WATER PROGRAMS DIVISION

Standard Operating Procedure for the Collection of Physical Habitat Data in Streams

Revised and Adopted January 2024 (Previous Revision March 2016)

FINAL

OKLAHOMA WATER RESOURCES BOARD
WATER DIVISION
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STANDARD OPERATING PROCEDURE FOR THE COLLECTION OF PHYSICAL HABITAT DATA IN STREAMS
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1.0 General Information

An evaluation of habitat quality is critical to any assessment of ecological integrity. The habitat assessment measures the quality of the instream habitat and riparian zone area that influences the structure and function of the lotic aquatic community. Habitat directly influences the biotic community and can be used to discern the source of impairment. The habitat parameters evaluated during this process are related to the overall aquatic life use and are potential sources of limitations to the aquatic biota. Habitat, as structured by instream and surrounding topographical features is a major determinant of the aquatic community potential. Both the quality and quantity of available habitat affect the structure and composition of resident biological communities.

The habitat assessment procedures follow a modified version of the EPA Rapid Bioassessment Protocol V (EPA 1999), the National Rivers and Streams Assessment Field Protocols (USEPA, 2008, 2013, 2018), and other supplementary documents. The habitat assessment was designed to assess the physical habitat available to support the biological community. The assessment is based on particular parameters grouped into three principal categories. The first group represents parameters on the microscale habitat, for example bottom substrate, cover, and stream flow. The second group of parameters is designed to assess the macroscale habitat such as channel morphology, sediment deposition, and sinuosity. The third grouping evaluates the riparian and bank structure; for example, bank stability, vegetation types, and streamside cover (groundcover, canopy cover, edge of water instream habitat). A quantitative value or weight is assigned to each parameter so that biologically significant factors can be emphasized. These weighting values are then adjusted based on the quality of the parameter. Scores are then assigned as an evaluation of instream and riparian conditions. Measurements/scoring for each parameter are made on various intervals set at 4x, 2x, 0.4 times average wetted width, or reach length.

2.0 Definitions/Terms

- Team Leader—crew member of physical habitat collection team who provides support, expertise, and opinions; gives instruction and has final say on how work will be done.
- Team Member—crew member of physical habitat collection team who provides support, expertise, and opinions; follows the instructions of the team leader
- Left and Right Bank—bank is determined by looking downstream with right bank to right and left bank to left

3.0 Safety

Upon reaching the sampling location, site safety determinations should be made before proceeding with the physical habitat assessment. Please refer to the OWRB safety manual for instructions.

4.0 Quality of the Measurement

4.1 Training

Principle investigators for the OWRB are required to have degrees and/or experience with biological or other applicable sciences. Principle investigators are defined as crew leaders, and this designation may be made upon the leader of a multi- or a one-person crew. Training is required for all SOPs dealing with water quality and quantity collections and measurements as well as habitat assessments and biological collections. Investigators must be familiar with OWRB SOP document, and all training will follow the methods outlined in that document. Extra training will be provided when new SOPs are developed. Training of field crews will be done through dry run exercises in the laboratory to familiarize field crews with sample collection, sample preservation, instrument operation, calibration, and maintenance. In addition, when new personnel are hired or new methods developed, qualified staff will train on sample collection, measurement, and field analysis methods through side-by-side field trips. These trips will familiarize staff with SOP requirements. For physical habitat field training will take place prior to staff being released to collect habitat data that will be used for assessments. When training is considered adequate, a qualified staff member (physical habitat crew leader) will check field staff for adherence to SOPs. Prior to collecting data, all staff should familiarize themselves with this SOP, OWRB Technical Report 99-3, and the National Rivers and Streams Assessment Field Protocols (USEPA, 2008, 2013, 2018).

4.2 Kinds of Quality Assurance Samples

4.2.1 Replicate Collections

Replicate habitat collections will be made when replicate fish collections are done. The scope and number of replicates will be determined by the project Quality Assurance Project Plan.

4.2.2 Certification of Personnel for Habitat Measurements

For habitat assessments, field QA sessions are conducted annually and will include a side-by-side measurement of all metrics with all qualified personnel. Calculating a mean score for all team leaders creates a data standard for the assessment. Team leaders and other staff are then compared to the mean and a percent difference is calculated for each metric. An acceptable percent difference is ½ of the scoring category range. Remedial training will be performed when an investigator falls outside of the acceptable percent difference. For NRSA study years all OWRB crew leaders must watch the training videos and attend the in-person NRSA training for all parameters including the physical habitat portion.

5.0 Personnel and Equipment

5.1 Personnel

Habitat measurement crews will consist of a team leader and one or two team members. The team leader is someone with one or more seasons of collection experience who has passed the annual QA described above and has attended all necessary trainings. Collection experience in other programs may be substituted for that with the OWRB. The team leader will have the final say on all crew activities. A team member is someone trained by the habitat crew leader on habitat measurement protocols. Team members will be expected to participate in the decision-making and follow the team leader's direction.

5.2 Equipment

All equipment should be consistently calibrated, cleaned, and treated with care. Training on the proper operation of each piece of equipment will be done by a team leader before use is allowed.

- **Auto Level and Tripod—**Used to measure slope.
- **Stadia Rod—**used to measure height, depth, width, slope, and bank angle. The rod should be calibrated to the nearest centimeter and made of a durable material (pvc usually).
- **Rangefinder—**Used to measure transects and widths. It should not be used for widths less than or equal to five meters. Widths less than or equal to five meters will be measured manually using the calibrated stadia rod or a tag line (NRSA method).
- **GPS Unit—**used to mark beginning and ending point of a reach as well as midstream and bank transects on larger rivers (boatables). Will also be used on larger rivers to set points for thalweg measurement profiles as needed.
- **Clinometer—**Used to measure bank angle and height and may be used to measure slope.
- **Convex Spherical Densiometer—**used to measure canopy (cover) density with a value of 0 (no coverage) to 17 (full coverage).
- **Compass—**used to measure bearing.

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6.0 Measurement of Habitat Data

The stream habitat assessment follows a modified version of the EPA Rapid Bioassessment Protocol V (EPA 1999), OWRB Technical Report 99-3, and the National Rivers and Streams Assessment Field Protocols (USEPA, 2008, 2013, 2018). The habitat assessment was designed to assess the physical habitat available to support a biological community and is based on parameters as they are observed in the field. A quantitative or qualitative value is recorded for each parameter at set intervals (4x, 2x, and 0.4x of average wetted width) along the stream reach depending on the type of parameter. The information is weighted and complied to generate an overall habitat score.

Over the following pages are the various metadata and metrics that need to be accounted for in the assessment. The following paragraphs are divided into certain groups to allow for better explanation.

Because interpretation of the assessment parameters can be subjective from site to site and ecoregion to ecoregion, it is imperative that the field personnel be properly trained in quantitative evaluation and go through annual re-certification. OWRB staff must record all measurement data needed for scoring and in the correct units and significant digits required.

6.1 Designation of Reach Length (All Biological Sampling Activities)

Before sampling begins, a waterbody should be classified based on size and accessibility. Average wetted width (AWW), crew leader experience, and fish gear needed to make the collection will be used to determine reach length and whether a site is wadeable or boatable. First, a total possible reach length will be established by using either detailed aerial photos or direct measurements at the site (during field scouting). A total of five representative widths are used to obtain the AWW and should represent the diversity of the site. It is important to measure areas of varying width including bends, large shallow runs, and riffles. Areas directly around a bridge should be avoided. After the AWW is calculated, the reach length is set at 40x wetted width. Second, fish gear accessibility is determined. If a reach is continuously wetted and greater than 50% of contiguous length can be safely and efficiently fished using a seine or tote barge/backpack electrofishing equipment, the site is classified as wadeable. Conversely, if a reach is continuously wetted and greater than 50% of contiguous length requires at least a 16-foot electrofishing boat to be efficiently fished and can be safely and efficiently accessed, the site is classified as boatable. Based on this information, the following rules should be used to determine reach length.

1. All sites will have a minimum reach length of 150 meters, regardless of wadeability.
2. Wadeable sites can be fished efficiently and effectively with pram or seine over greater than 50% of contiguous wetted length. Maximum reach length will be 2000 meters (non NRSA study years), regardless of calculated reach length.
3. Boatable sites can be fished efficiently and effectively with a boat over greater than 50% of contiguous wetted length. Maximum reach length will be 4000 meters, regardless of calculated reach length.
4. The reach length minimum and maximums can be adjusted under extremely unique circumstances, but only after prior consultation with the Monitoring Coordinator and Biological Team Leader and approval.

6.2 Wadeable Habitat Introduction

Following is a simplistic explanation of each set of measurements made. Please refer to the more detailed protocols for more in-depth explanation. For all forms, please place site number, transect or sub-reach, and date. For NRSA study years all data are to be recorded in full and reviewed for completeness and accuracy. Once electronic data forms are completed, they are to be e-mailed to the EPA (NARSFieldData@epa.gov)

via the IPAD. See Figure 2 below for a visual wadeable habitat assessment reach layout.

6.2.1 Channel/Riparian Transect and Mid-Section Cross-Section Forms

The NRSA App forms should be completed in full for each transect. In addition to these forms, the Oklahoma RBP Habitat form (in the Survey 123 App) will be filled out completely as well for each transect and midpoint. The measurements are made at the 2x AWW level and characterize the depths, substrates, fish cover, bank measurements, canopy cover, riparian area, human influence, thalweg profile, and large woody debris.

6.2.1.1 Substrate Cross-Sectional Information

Cross-section measurements include distance from left bank (100th of a meter), depth (centimeter), size classification code, and as embeddedness percentage. Each measurement type is divided into 5 subcolumns (Left, Left Center, Center, Right Center, and Right).

- "Left" is depth at the left bank where water meets un-wetted bank.
- "Left Center" is depth of water midway between the center of the stream and the left bank. May be measured on dry land.
- "Center" is depth of water at the midway point between left and right bank and may be measured on dry land.
- "Right Center" is depth of water midway between the center of the stream and the right bank and may be measured on dry land.
- "Right" is depth at the right bank where water meets un-wetted bank.

The substrate measurement characterizes the physical benthic material of the streambed and is collected in several ways. First, the dominant substrate immediately below the stadia rod at the 5 increments described above is recorded using the substrate codes on the form.

Embeddedness (EMB) is the degree to which boulders, cobble and gravel have been surrounded by fine sediment and indicates suitability of the stream substrate as habitat. If there is no fine material surrounding the cobble and gravel, and there is at least some free space under the rocks, that is 0 percent embedded. If the free space under the rocks is filled but the sides are untouched, count that as 5 percent embedded. As the level of fines (fine sediment) increases up the substrate sides, estimate the percentage of the total height of the cobble (rock that is tennis ball to basketball size) that is covered. This is the embeddedness estimate. Often an "embeddedness line" is quite distinct if rocks are inspected out of the water. At least five rocks from bank to bank should be used in the estimate. Embeddedness should be determined for substrates at the five cross-section measurements. Please, note that some substrates are automatically classified as 0% embedded (bedrock and hardpan clay) or 100% embedded (sand and silt).

6.2.1.2 Bank Measurements

Bank measurements are made at a 2x interval for bank angle and undercut distance (meters) for both banks. Wetted width, in-channel bar-width, and bankfull widths are measured across the transect to the nearest tenth of a meter. Similarly, incised heights are measured to the nearest tenth of a meter at the lowest point off the channel.

6.2.1.3 Canopy Cover Measurements

The spherical densiometer is used to measure canopy cover (shading of the stream) for each transect (NRSA and modified RBP habitat) and midpoint (modified RBP habitat). The number of points intersected along a grid of 17 squares is counted at six locations including the left and right banks (one foot off of the water at the water's edge facing riparian) as well as in the center of the stream at points facing upstream, downstream, left (facing downstream left if left) and right (facing downstream right is right).

6.2.1.4 Fish Cover Area

These are gross quantifications made across the sub-reach for each transect. For boulders include cobble and gravel in the estimate (modified RBP only). Fish cover area for wadeable sites is measured across the channel five meters up and five meters down of the transect line (there are 11 habitat transects named A thru K).

6.2.1.5 Visual Riparian Estimates

This section includes three different kinds of visual estimations. First, riparian vegetation cover is estimated in three cover classes (ground, understory, and canopy) over a 10X10-meter riparian plot set on both banks (left and right). Secondly, human influence is classified into four categories including (0)not present, (P)=>10 meters from plot, (C)within 10 meters of the plot, and (B)on the bank.

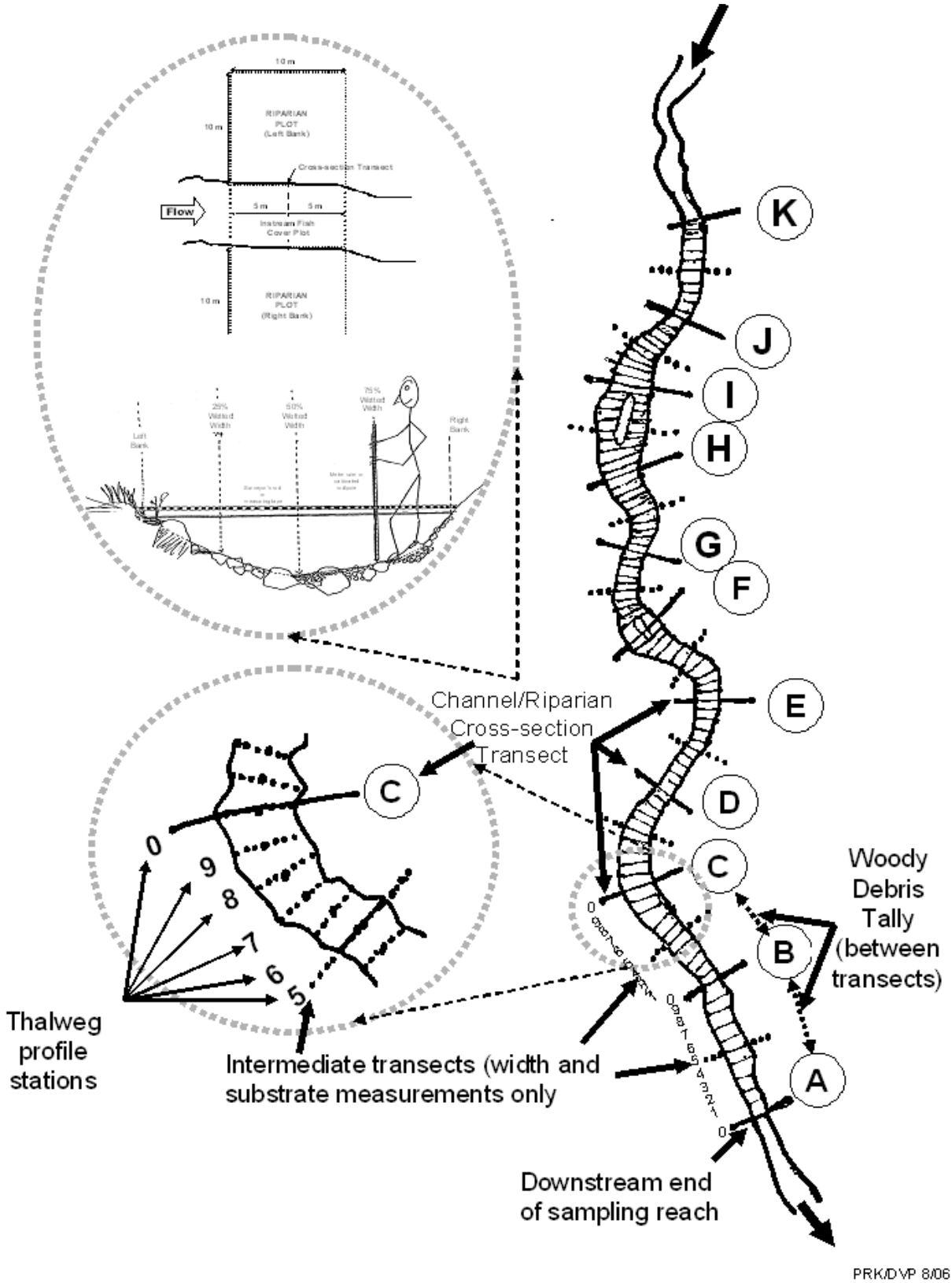

Figure 2. Illustration of sample reach layout and plot for Wadeable Habitat (USEPA 2008, 2013, 2018).

Lastly, at each transect and midpoint (4x wetted width); several measurements will be taken that are needed for the RBP habitat methodology. Measurements should be made on both the left and right bank and include. Following is the step-by-step process for completing the RBP Habitat Assessment. Numbers correspond to boxes on the RBP sheet.

11. **Distance**. **The distance from the start points as measured by the hip chain**. A stream must be assessed a minimum of 150 meters. Parameters 12 through 37 should all be measured at the start point and recorded to the right of the start (0) point. Generally, we assess streams in conjunction with a bioassessment. For this purpose, **parameters 12-37 will be measured and recorded every 10 meters along the stream**. Instruction for their measurement follows.

12. **Depth**. Depth of water is measured in meters to the nearest 0.1 meter. **The left bank of the stream is that on your left as you face downstream**. The left □ (L□) is the depth of water midway between the center of the stream and the left bank. Center (C) is the depth of water in the center of the streambed. Right □ (R□) is the depth of water midway between the center of the stream and the right bank.

13. **Width WTR & Width BNK** are the width of the water in meters to the nearest 0.1 m, and the width of the lower bank in meters to the nearest 1 m. The lower bank extends from the water's edge at summer low flow to the top of the normal high-water line. The normal high-water line is usually marked by the beginning of well-established perennial vegetation. Below this line will be gravel and bare soil. There may be a sparse covering of annual vegetation below this line. The lower bank width is the distance between the tops of the left and right lower banks.

14. **Substrate**. This is an estimate of the substrate of the stream at the point where measurements are taken from the edge of the water on one side to the edge on the other side. The total of all substrate components should add up to 100 percent. The categories include the following:

a. **S.& C** Loose silt and clay.
b. **SND** Sand or rock particles; 0.1 to 2mm.
c. **GVL** Gravel; rocks from 2 mm to 50 mm.
d. **CBL** Cobble; rocks from 50 mm to 250 mm.
e. **BLD** Boulder; rocks > 250mm.
f. **BRK** Bedrock or hardpan clay.
g. **POM** Particulate organic matter--rotten leaves and fragments of stick and logs.
h. **HPC** Hardpan clay

15. **Habitat Type**. 0 Check the box that is most applicable to the habitat type present at the station. A **riffle** has surface which is definitely broken and usually makes a sound. A **pool** has a smooth surface, no or very little current and can be deep or shallow. A **run** has an obvious current, may be deep or shallow and often has a

surface which may be slightly broken, but doesn't make any noise. Check **dry** if the stream has no water in it at the point being measured.

If there are two obvious habitat types at the cross section you are measuring, check both boxes. An example is when a backwater pool is encountered beside a run or riffle.

16. Instream Cover Area. This category attempts to quantify the amount of cover present for fish in the section of stream from the previous station to the present one. For example, if the section was 20 meters long and averaged 6 meters wide, its area would be $120m^2$. A submerged log about 3 meters long by 0.5 meters wide would offer $1.5m^2$ cover, and you would note that the LWD (large woody debris) category offered 1.5/120 or 1.3 percent cover. Water willow, an emergent aquatic macrophyte, might be growing in shallow water along the edge of the stream. If both edges had a zone about 1 meter wide where it grows, there would be (1 meter) (20 meters) (2 sides)=$40m^2$ of EAV (emergent aquatic vegetation in the $120m^2$ section of stream and you would check 40/120 or 33 percent in the EAV column. **Note that the totals of the "percent cover" columns for each row will rarely add up to 100 percent and may often be 0 percent**.

The categories are:

a. **UCB** Undercut banks
b. **LWD** Large woody debris--woody debris in the water > 10 cm. in diameter.
c. **SWD** Small woody debris-- woody debris in the water <= 10 cm. in diameter.
d. **RTS** Roots--these are submerged root wads of trees. If single or occasional roots are encountered, count them in one of the woody debris categories.
e. **BRL** Bedrock ledges--underwater bedrock ledges not forming part of an undercut bank.
f. **SAV** Submerged aquatic vegetation.
g. **EAV** Emergent aquatic vegetation.
h. **TV** Terrestrial vegetation which is currently underwater. An example would be tree branches or grass leaves that are actually hanging down into the stream.
I. **CBG** Cobble, Boulder and Growth. This is an estimate of the percent coverage of cobble and boulder in the 20-meter section. It may not be the same number as the percent composition of cobble and boulder in the cross section where you estimated substrate since they represent different areas.

17. **EMB - Embeddedness**. This quantifies the amount of silt, clay and sand which has been **DEPOSITED**. If there is no fine material surrounding the cobble and gravel, and there is at least some free space under the rocks, that is 0 percent embedded. If the free space under the rocks is filled but the sides are untouched, count that as 5 percent embedded. As the level of fines increases up the side of the cobble, the estimated percentage is that of the total height of the cobbles that are covered. This is your embeddedness estimate. You can often see this line quite distinctly if you lift the rocks out of the water.

18. **CAN - Percent Canopy Cover**. At each measuring station, estimate the percent canopy cover in the previous segment. It can range from 0 to 100 percent, but if you can see any sky directly overhead, that part is not covered, and your estimates should be less than 100 percent.

19. **PTB - Point Bar**. If a recently formed point bar is present, that is, it has no or little vegetation on it, put a check in this box for yes. If no point bar is present leave the box empty.

20. **D&S - Deposition and Scouring**. If there is evidence of scouring (smooth, clean bedrock or
hardpan clay) or deposition (loose, shifting bottoms of fine sand or silt or filled in pools) in the previous segment surveyed, check this box.

21. **BVC - Bank Vegetative Cover**. Record an estimate of the total area on both banks that is protected from erosion by well established **perennial** vegetation. Soil doesn't have to be covered as long as it's stable. If banks are covered with rip-rap or large gravel, they can still be stable. Remember to note this in the Comments section.

22. **DV - Dominant Vegetation**. Place an S (shrub), T (tree), or G (grasses and forbs) in the box indicating which type of vegetation is most dominant **ON THE BANKS** in terms of percent of ground protected. For our purposes, shrubs are any woody plant whose trunk and branches are <= 10 cm in diameter. If the vegetation is mixed but each of the three groups contribute at least 20% of the total put an M in the box.

23. At each measurement point **record the average % of stream bank that is actively eroding** for both the left bank and the right bank of the stream segment you just walked. Measure from the edge of the lower bank to the edge of the upper bank. [The upper bank is usually the edge of the flood plain.]

    REMEMBER THAT THE LEFT BANK IS THE BANK TOWARDS THE LEFT AS YOU FACE DOWNSTREAM so if you are walking upstream the left bank will be the one on your right side.

24. Record the **average height of the eroding banks** on each side of the stream segment you just walked. Measure from the lower edge of the bank to the upper edge of the bank.

25. Record the average % slope of the banks in degrees (left and right bank angles). Measure from the lower edge of the bank to the upper edge of the bank. OWRB staff now use clinometers placed on stadia rods to measure bank angles since the introduction of this piece of equipment after the 2008-09 NRSA Study.

26. Record the **typical substrate of each bank**, use the same substrate abbreviations (SA (sand), CB (cobble), GF (fine gravel), GC (course gravel), etc.) that are used in the NRSA App.

27. Record the **average width of the riparian vegetation** for each side of the segment you just walked. The riparian zone for our purposes extends from the top of the upper bank outwards from the stream. (Remember that you have already described the size and vegetative state of the banks in columns 21, 22, 24, & 25.) For our purposes, the riparian zone ends where the unmanaged (i.e. not plowed or mowed) portion of land ends. Riparian vegetation is typically bottomland hardwood forest when in a natural state, but mixtures of trees and herbaceous plants are frequently encountered. These will grade from a fairly dense forest with sparse grasses to land that is mostly pasture with a few scattered trees.

If WOODY SHRUB AND SAPLING GROWTH CAN BE CONTROLLED USING A 6' BRUSHHOG AND A MEDIUM SIZE TRACTOR IN BETWEEN THE LARGER TREES, THE LAND WILL BE LABELED PASTURE AND MAY OR MAY NOT BE INCLUDED IN THE RIPARIAN ZONE. IF THE LARGE TREES ARE SO DENSE THAT A TRACTOR AND MOWER OF THIS SIZE CAN'T BE USED FOR BRUSH CONTROL, THE LAND SHOULD BE LABELED AS FOREST AND INCLUDED IN THE RIPARIAN ZONE. Remember that the riparian zone stops where pasture or crop management begins.

28. As stated earlier, natural riparian vegetation is typically bottomland hardwood forest, but when disturbances have been or are present there will be varying amounts of herbaceous plants and bare soil also. In these two columns you are asked to decide whether the majority of the land in the riparian zone on either side of the stream is grassland or forest. USE THE CRITERIA FROM CATEGORY 27 FOR THIS DETERMINATION. You are also called upon to decide how much bare soil is exposed. In grassy areas, this is a straightforward determination and is done by estimating the average % of bare soil you see as you walk the ten meter riparian zone in question. Forest, while not expected to have grasses & forbs covering the ground, is expected to have a layer of spongy duff composed of organic matter in various states of decay covering the soil. This layer is usually covered by a layer of recently fallen leaves or annual herbaceous vegetation that haven't yet started to decay, so you will have to move

these leaves or vegetation out of the way to determine if the duff layer is present. Soil not covered by duff should be counted as bare. Estimate the % bare soil exposed in the forest as you walk the area in question.

THE RIPARIAN ZONE ON BOTH SIDES OF THE STREAM SHOULD BE PLACED IN ONE OF THE FOLLOWING CATEGORIES. Write "W" after the condition class if at least five meters of riparian area depth appear to be wetland based on the presence of standing water or saturated soil after at least a week of dry conditions, or dominance by sedges, rushes, button bush or willow.

1A	STABLE FOREST	<1% bare soil exposed
1B	MODERATELY USED FOREST	1-10% of surface is bare soil
1C	HEAVILY USED FOREST	>10% of surface is bare soil
2A	GOOD CONDITION GRASSLAND	<1% bare soil exposed
2B	FAIR CONDITION GRASSLAND	1-5% bare soil exposed
2C	POOR CONDITION GRASSLAND	>5 <20% bare soil exposed
2D	BAD CONDITION GRASSLAND	>20% bare soil exposed

29. Cattle excluded from the stream. Put a check mark in the box if this statement is true for the last ten meters.

30. % of land trampled. This is an estimate of land where livestock trampling is evident within one meter either way of the transect. In other words, you are looking at a two-meter-wide strip that runs from the top of the right upper bank across the stream to the top of the left upper bank.

31. # cow pies. This is the number of cow pies in the two meter wide transect of column 30.

32. # trails. This is the number of livestock trails on both banks that reach the stream over the entire ten meter transect. A single trail that crosses the stream and goes up the other side counts as two trails.

33. Class of cow trails. Each cow trail should be placed in one of the following classes and the class of each trail recorded in this column.

1. < .75m wide
2. □ .75 < 1.5m wide
3. □ 1.5 < 2.5m wide
4. □ 2.5m wide

There should be as many numbers listed here as there were cow trails in column 38. Separate each number by a comma. **As of 2023 RBP habitat data collection cattle trails, cow pies, and percent trample are now recorded via a comment section in the survey 123 App.**

34. If a road is contributing excess sediment to the stream, or a pipe is discharging to the stream or there is a dump present or any other thing which you deem significant is present, record it in the comment block (section) in the survey 123 App and NRSA App. All comments pertaining to habitat, riparian, and human disturbances should be placed in the comments section of both Habitat Apps.

6.2.2 Thalweg Profile and Woody Debris Form

A thalweg profile will be taken between each transect (NRSA App only). Measurements include depth of thalweg (deepest and most flowing point of channel) in centimeters. Additionally, presence will be noted of mid-channel and point bars, soft/small sediment (fines including gravel), side channels, and backwaters. Lastly, at each measurement point a channel unit code (RI (riffle), GL (glide/run), PO (pool), DR (dry), etc.) should be determined.

Throughout the sub-reach, the woody debris will be classified and tallied as well. Pieces are first classified into one of 24 size categories based on large end diameter and length, and then classified as all/part of the bankfull channel or above bankfull channel. Minimum size is 0.1-meter large end diameter and 1.5 meters in length.

6.2.3 Slope and Bearing Form (NRSA wadeable sites only)

Slope and bearing is calculated on all wadeable NRSA waterbodies. The method is described in detail in the NRSA Field Protocols (USEPA, 2008, 2013, 2018). Various methods may be used for direct site measurements. However, the transit method is preferred (auto levels and stadia rod) because it is much more accurate and typically not difficult to accomplish. The levels must be calibrated by EPA prior to field use by crews before each sampling season.

Reach-Wide Forms 6.2.4

Various forms will be completed that characterize the entire reach. The Channel Constraint Form classifies channel pattern, channel constraint, and constraining feature. The Torrent evidence accounts for any recent events that may have had dramatic influence on channel characteristics. The site assessment form classifies watershed activities and disturbances, dominant land use type, accounts for the presence of beavers, invasive species, and allows the sampling team to make a subjective determination of how pristine and appealing the site is. Additionally, comments should be made about the site that do not easily fit into any of the completed forms. Photo-documentation is another very important part of physical habitat data collection and all photos taken at each sampled site are cataloged and stored on the OWRB network under the site name, site ID, and date the photos were taken. Eventually the OWRB plans to have these site photos also stored in the Ambient Water Quality Monitoring System (AWQMS) along with the habitat data.

6.3 NRSA Boatable Habitat Introduction

The following is a simplistic explanation of each set of measurements made at boatable river sites. Please refer to the more detailed protocols presented in the NRSA field operations manuals for more in-depth explanation (USEPA 2008, 2013, 2018). All field forms in the NRSA App are to be filled out completely by OWRB streams sampling staff. Survey 123 Habitat data are not collected for boatable habitat sites. All boatable habitat data collection will take place via IPADS in the NRSA App.

6.3.1 Channel/Riparian Transect Forms

These habitat forms should be completed in their entirety. The measurements are made at 4x wetted width and characterize the littoral/shoreline depths, substrates, channel, bank characteristics, fish cover, woody debris, bank angles, riparian area, and human influence. Unless otherwise noted, all measurements are made with a 10x20-meter plot around the transect on a particular bank. The sample reach layout for boatable habitat is illustrated in Figure 1.

For each transect, several accounting measurements will need to be taken. Transect GPS measurements will be taken at the mid-channel (Midstream) and shoreline areas (Bank). The intended transect spacing and the actual transect spacing will be recorded also. The channel will be classified into one of four constraint categories—constrained, in broad valley but constrained by incision, narrow valley but not very constrained, and un-constrained. Also, note the distance from water's edge to riparian vegetation as well as the ability to readily see over the bank from water's edge.

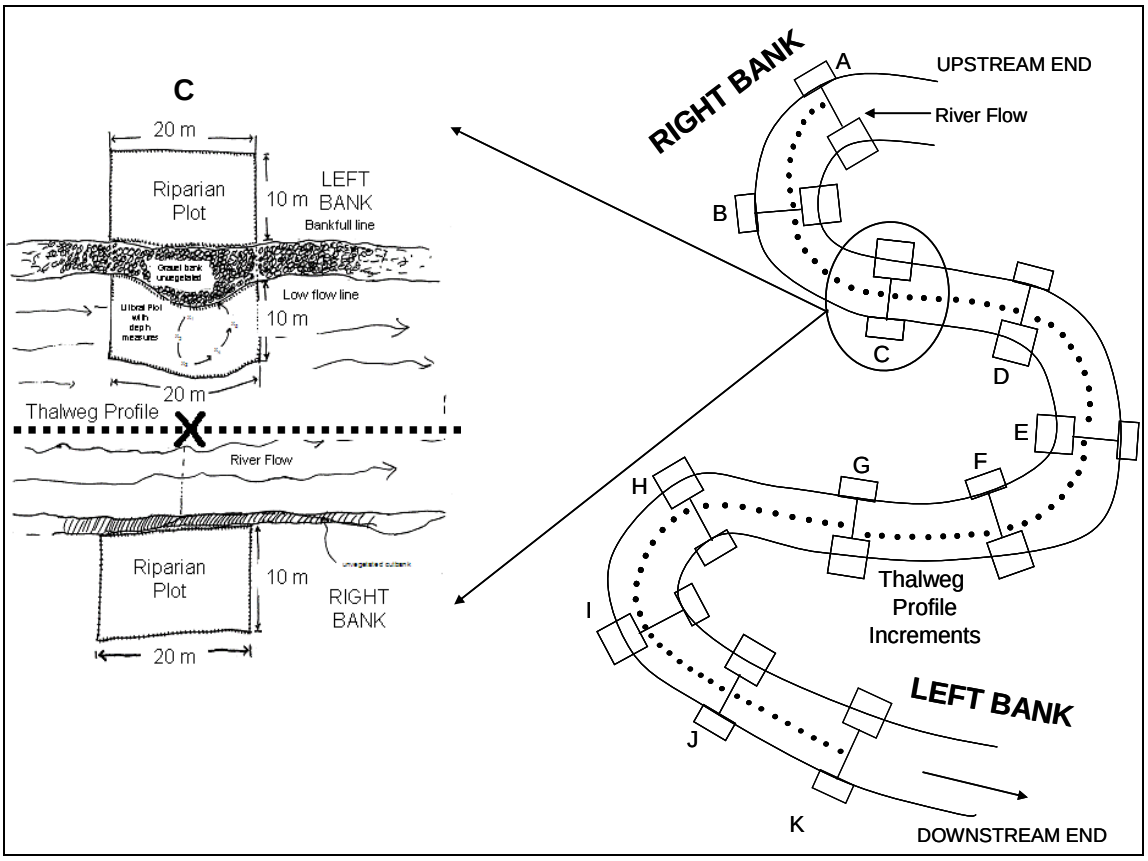

Figure 1. Illustration of sample reach layout and plot for Boatable Habitat.

6.3.1.1 Substrate, Bank and Depth Characteristics

The NRSA habitat assessment also quantifies the substrate, depths, and bank characteristics. First, the littoral substrates are classified on both the shore and the bottom. Both the dominant and secondary substrates are classified either through judgment or observation (visual or with stadia rod). Second, depth is measured at five points within the 10x20 meter plot around the boat. To ensure consistency of measurement, these measurements should be made at five points around the boat. With the boat perpendicular to the shore, measurements should be at just off shore at both the left and right gunwales, left and right of stern, and aft of stern behind and away from the motor. Third, bank characteristics will be measured to the nearest centimeter including wetted, bar, and bankfull widths as well as bankfull and incised heights. When determining heights, the near (work) bank will be compared to the far bank, and the lowest height will be recorded. Also, bank angle will be determined only at the near bank using a gross estimation (pictured on the form) and classified as flat, gradual, steep, and near vertical/undercut.

6.3.1.2 Canopy Cover Measurements

The spherical densiometer is used to measure canopy in the 10x20 meter littoral habitat plot by taking this measurement at the front of the boat by kneeling (about a foot off the boat). The number of points intersected along a grid of 17 squares is counted at four

bank points including (facing) upstream, downstream, and towards both the left and right banks.

6.3.1.3 Fish Cover

These are gross quantifications made within the littoral plot for each transect pertaining to nine different categories (types of fish cover) for fish cover that will each be placed in one of five categories of prevalence (percentage of occurrence). For example, determinations are made for fish cover types such as filamentous algae, macrophytes, Big woody debris, brush/small woody debris, live trees/roots, etc. The percentage groups are as follows: 0 (0%) Absent, 1 (<10%) Sparse, 2 (10-40%) Moderate, 3 (40-75%) Heavy, and 4 (>75%) Very Heavy.

6.3.1.4 Visual Riparian Estimates

This section includes three different kinds of visual estimations. First, riparian vegetation cover is estimated in three cover classes (ground cover, understory, and canopy) over a 10X20 meter riparian plot on both banks. Secondly, human influence is classified into four categories including 0- not present, P->10 meters from plot, C- within 10 meters of plot, and B-on the bank. For both sets of measurements, the far bank can be visualized and estimated from the near bank.

6.3.2 Large Woody Debris

Each piece of large woody debris is tallied for the entire 10x20 meter plot. For each group, pieces are first classified into one of four size categories based on large end diameter and length, and then classified as “all/part in wetted channel” or “dry but all/part in bankfull channel”. Minimum size is 0.3-meter large end diameter and 5-meters in length. There is also a populate blank boxes with zeros button that assists in this data collection group.

6.3.3 Thalweg Profile

A thalweg profile will be taken between each transect at 0.4x wetted width. At each point, depth will be measured to the nearest tenth of a meter (or foot) using either a stadia rod (pole) or sonar. Also, presence will be noted for snags (dead wood in the wetted channel) visible from the thalweg. Lastly, at each measurement point, substrate should be classified, and a channel habitat code should be determined as well. Lastly, off channels should be noted here as well.

6.3.4 Slope and Bearing Form (NRSA wadeable sites only)

Slope and bearing is calculated on all wadeable waterbodies (streams). The method for slope and bearing is described in detail in the NRSA Field Protocols (USEPA, 2008, 2013, 2018). Various methods may be used for direct site measurements. However, the transit method is preferred (auto levels and stadia rod) because it is much more accurate and typically not difficult to accomplish.

At boatable sites, direct field measurements will not be necessary for slope and bearing determinations.

6.3.5 Reach-Wide Forms

Various forms will be completed that characterize the entire reach. The Channel Constraint Form classifies channel pattern, channel constraint, and constraining feature. The Torrent evidence accounts for any recent events that may have had dramatic influence on channel characteristics. The site assessment form classifies watershed activities and disturbances, dominant land use type, accounts for the presence of beavers, invasive species, and allows the sampling team to make a subjective determination of how pristine and appealing the site is. Additionally, comments should be made about the site that do not easily fit into any of the completed forms. Photo-documentation is another very important part of physical habitat data collection and all photos taken at each sampled site are cataloged and stored on the OWRB network under the site name, site ID, and date the photos were taken. Eventually the OWRB plans to have these site photos also stored in the Ambient Water Quality Monitoring System (AWQMS) along with the habitat data.

7.0 Forms

7.1 Field Forms

Field forms are documents used to annotate and record information that is gathered at the project site. They are a data sheet and should be treated as such. Therefore, they should be complete. Field forms should be initialed and dated by the collecting personnel and data entry personnel. As of 2024, the verification form in the NRSA App satisfies this data section for collecting site metadata such as collector's names, collection date, site accessibility comments, site ID, site name, reach length, site verification, etc. The verification form should always be filled out completely during each physical habitat assessment.

8.0 Data Storage

The data from the physical habitat field forms (OWRB modified RBP survey 123 data and NRSA App data) will be stored electronically on the OWRB Water Quality Database known as the Ambient Water Quality Monitoring System (AWQMS) and the provided electronic Json files (from NRSA App) and survey 123 App data along with the OWRB Excel spreadsheet with automated habitat calculations will be stored on the OWRB network (I drive). OWRB modified RBP habitat data including metrics and scoring will be housed within the AWQMS. Each physical habitat data sample should be maintained electronically in the OWRB database (AWQMS) and on the OWRB network under a unique sample ID number (4 million number system).

9.0 References

United States Environmental Protection Agency. 1999. Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers, 2nd Edition. EPA 841-B-99-002. Office of Water, Washington, D.C.

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Oklahoma Conservation Commission, Water Quality Division. 2001. Standard Operating Procedures Habitat Assessment. Oklahoma City, OK.

Oklahoma Water Resources Board. 1999. Technical Report 99-3: Standard Operating Procedures for Stream Assessments and Biological Collections Related to Biological Criteria and Development. Oklahoma City, OK.

Oklahoma Water Resources Board. 2005. Standard Operating Procedures for the Measurement of Stream Discharge. Oklahoma City, OK.