WATER QUALITY PROGRAMS DIVISION

Standard Operating Procedure for the Collection of Habitat Data in Streams

Revised and Adopted November 2005

Draft Copy

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STANDARD OPERATING PROCEDURE FOR THE COLLECTION OF HABITAT DATA IN STREAMS[1]
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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 in stream and riparian zone habitat 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 in stream 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 procedure follow a modified version of the EPA Rapid Bioassessment Protocol V (EPA 1999) supplemented by other 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 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, and streamside cover. 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 in-stream and riparian conditions. Habitat assessments are conducted on a 400 m reach of stream. Measurements/scoring for each parameter are made on 20 m intervals.

2.0 Definitions/Terms

- Team Leader—crew member of fish collection team who provides support, expertise, and opinions; gives instruction and has final say on how work will be done; must score a 95% on critical fish identification
- Team Member—crew member of fish 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

[1] Much of this SOP is adopted from two documents: 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 Conservation Commission (2001), Standard Operating Procedure for Macroinvertebrate Collection, Subsampling, and Picking. Oklahoma City, OK.

Upon reaching the sampling location, site safety determinations should be made before proceeding. 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. In-house training will be conducted for the use of all meters and digital titrators used for water quality or quantity measurements. 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. When training is considered adequate, a qualified staff member will check field staff for adherence to SOPs. Prior to collecting macroinvertebrates, subsampling, and picking, all staff should familiarize themselves with this SOP and OWRB Technical Report 99-3 Standard Operating Procedures for Stream Assessments and Biological Collections Related to Biological Criteria and Development.

4.2 Kinds of Quality Assurance Samples

4.2.1 Replicate Collections

Replicate habitat collections will be made when replicate fish collections are done and may include replicates for various habitat or stream order. 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 be 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.

5.0 Personnel and Equipment

5.1 Personnel

Habitat measurement crews may consist of one to two people. The team will consist of a team leader and possibly one team member. The team leader is someone with one or more seasons of collection experience who has passed the annual QA described

above. 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 on habitat measurement protocols. Team members will be expected to participate in the decision-making and follow the team leaders direction.

5.2 Equipment and Supplies

5.2.1 Wading Rod

The wading is used to measure both depth and sometimes width. The rod should be calibrated to tenths of a foot and made of a durable material.

5.2.2 Hip Chain

The hip chain is used to measure of transects. It is simply a box with a spool of string and a counter. Chain should be tied off and should not be allowed to drag in the water. **Always remove string from waterbody before leaving**.

5.2.3 Rangefinder

The rangefinder is used to measure transects and width. It should not be used for widths less than or equal to 10 meters. Training on the proper operation of the rangefinder will be done by a team leader before use is allowed.

5.2.4 GPS Unit

The GPS unit is used to mark beginning and ending point of reach.

6.0 Measurement of Habitat Data

The stream habitat assessment follows a modified version of the EPA Rapid Bioassessment Protocol V (EPA 1999) and is outlined in OWRB Technical Report 99-3. The habitat assessment was designed to assess the physical habitat available to support a biological community and is based on particular parameters as they are observed in the field. A quantitative or qualitative value is recorded for each parameter at 20 set intervals along the stream segment (e.g., every 20 meters over a 400 meter reach). The information is weighted and complied to generate an overall 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 certification. Record all measurement data in meters. This includes height of eroded bank, width of riparian zone, depth of pools, size of cobbles or boulders, width of stream and anything else you measure **except flow**. All measurements used to calculate instantaneous discharge are in feet.

6.11 Metadata

1. **Stream/Project—**List the stream sampled and the project that it is for. If the county map, soil map, or other map has a different name, the USGS 7-1/2' map takes precedence. If a stream is unnamed on the USGS map, but named on another map, use that name, but write the name of the map in parentheses beside the stream name.

2. **Investigators**—Crew leader should be denoted. All personnel need to be listed.

3. **Direction—**Circle the appropriate word. If going upstream from the start point, circle upstream.

4. **Date/Time—**List the MM/DD/YY and Time (milt).

5. **WB Number/HUC**—List the 12-digit waterbody identification number and 11-digit Hydrologic Unit Code (HUC).

6. **Flow—**Enter the flow in CFS. Measurements should be made at a flow under base flow conditions or as close as possible. Never measure within a week of a significant rain event (>0.5 in). Flow can be taken from a number of different sources but must be concurrent with the habitat assessment. The sources include:
   - Instantaneous measurement—Taken at the time of measurement using the document “Standard Operating Procedure for the Measurement of Stream Discharge” as a guide.
   - Rated flow from a non-recording gage or data collection platform (DCP)—If the OWRB or other agency maintains a current stage/discharge rating at the site, the rated discharge may be used. The stage must be recorded in parentheses. If the gage is non-recording, stage must be measured from the gage at the time of measurement. If stage is measured through a DCP, stage may be taken from the recorded record.
   - Rated flow from nearby location—If a gage is located near to the site, it may be used under the following conditions. The gage must be on the same waterbody. no major hydrologic influences including but not limited to major tributaries (>5% of flow), lakes, ponds, drainage ditches, culverts, or water withdraws may be present between the habitat site and the gage. Best judgment should be used in determining if the nearby gage may be used and proper documentation should accompany the habitat assessment. Furthermore, beware that groundwater interactions have a major influence on surface water and that a major losing or gaining section of the stream may be located between the two sites.
   - Rated flow from bracketed nearby locations—If gages are located upstream and downstream of the site, these may also be used. Follow the advice giving in the above paragraph and document decision.

7. **Start Point—**Provide a GPS lat/long and a brief written description of the starting point (first observation).

8. **End Point—**Provide a GPS lat/long and a brief written description of the ending point (last observation).

9. **Legal Description/County—**Provide a legal to the nearest 1/8 section and the county name. If reach crosses county line, provide both.

10. **Channel sinuosity—**Channel Sinuosity is the ratio of in-stream channel length divided by the valley length. This can be assessed in the field or from aerial photographs. USGS topographic maps should not be used.

11. **Distance—**Is the distance between transects. A stream must be assessed a minimum reach of 400 meters with 20 equidistant transects per reach. Measurements begin at the first transect (e.g., 20 meters on a 400 meter reach) with transect-wide measurements looking back over one interval, or in this case to the start point. Each transect will proceed in the same way until transect 20 (e.g., 400 meters) is reached. Occasionally stream reaches will exceed the 400-meter minimum. This is at the discretion of the team leader, and reasoning should be well documented.

6.12 Metrics Measured at the Transect

Each of these measurements are quantitative and are made on the transect.

12. **Depth**—The column "DEPTH" is divided into 3 subcolumns (L1/4, C, R1/4). In general, the depth of water is measured in meters to the nearest 0.1 m. Divide the stream into 3 segments: left ¼, right ¼, and center with the left bank of the stream is on left hand side while looking downstream.
    - The left 1/4 (**L1/4**) is the depth of water midway between the center of the stream and the left bank.
    - Center (**C**)
    - Right 1/4 (**R1/4**) is the depth of water midway between the center of the stream and the right bank.

13. **Width WTR & Width BNK—** The column "WIDTH" is divided into 2 subcolumns (WTR and BNK). The width measurement takes into account the width of the wetted surface or water, and the width of the lower bank to the nearest 1 m.
    - **WTR** refers to the total width from water's edge to water's edge measuring perpendicular across the wetted area.
    - **BNK** refers to the lower bank as it 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 width is measured from the top of the lower left lower bank to the top of the right lower bank.

14. **Substrate**—The substrate measurement characterizes the physical benthic material and is an estimate of the substrate of the stream at the point where measurements are taken. It is measured along the transect from one edge of water to the other. Record each type as a percent of the total with all substrate components adding up to 100 percent. The categories include the following:
    - **S & C**—Loose silt and clay.
    - **SND**—Sand or rock particles; 0.1 to 2mm.
    - **GVL**—Gravel; rocks from 2 mm to 50 mm.
    - **CBL**—Cobble; rocks from 50 mm to 250 mm.
    - **BLD**—Boulder; rocks > 250mm.
    - **BRK**—Bedrock or hardpan clay.
    - **POM**—Particulate organic matter--rotten leaves/fragments of stick and logs.
    - **HPC**—Hardpan clay

15. **Habitat Type**—The HABITAT TYPE column is subdivided into 4 additional columns (RIF, PL, RUN, or DRY). Check the cell that is most applicable to the habitat type present at the station. If there are two obvious habitat types at the cross section being measured, check both boxes. An example is when a backwater pool is encountered beside a run or riffle.
    - A riffle (**RIF**) is defined as any sudden downward change in the level of the streambed such that the surface of the water become disrupted by small waves and usually makes a sound.
    - A pool (**PL**) has a smooth surface with no or very little current and can be deep or shallow.
    - A run (**RUN**) has an obvious current, may be deep or shallow and often has a surface that may be slightly broken, but does not make any noise.
    - Check dry (**DRY**) if the stream has no water in it at the point being measured.

17. **Embeddedness (EMB)—**The degree to which boulders, cobble and gravel have been surrounded by fine sediment indicates suitability of the stream substrate as habitat. Embeddedness is evaluated by visual observation of the degree to which larger particles have been surrounded by sediment. This quantifies the amount of silt, clay, and sand that has been deposited in riffles and medium-fast runs. 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 rises up the cobble sides, estimate the percentage of the total height of the cobbles that is covered. This is your embeddedness estimate. You can often see this “embeddedness line” quite distinctly if you lift the rocks out of the water. At least 5 rocks from bank to bank should be used in the estimate.

6.13 Metrics Measured at the Transect

Each of these measurements are estimates and are made transect wide.

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 (where walked from) 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 (round all numbers to the nearest 0.5%). 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:
    - **UCB**—Undercut banks
    - **LWD**—Large woody debris—woody debris in the water > 10 cm. in diameter.
    - **SWD**—Small woody debris—woody debris in the water <= 10 cm. diameter.
    - **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.
    - **BRL**—Bedrock ledges—Underwater bedrock ledges not forming part of an undercut bank.
    - **SAV**—Submerged aquatic vegetation.
    - **EAV**—Emergent aquatic vegetation.
    - **TV**—Terrestrial vegetation that is currently underwater. An example would be tree branches or grass leaves that are actually hanging down into the stream.
    - **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.

18. **Percent Canopy Cover (CAN)—**At each measuring station, estimate the percent canopy cover in the previous segment. It is the percent estimated at high noon. It can range from 0 to 100 percent, but if can see sky directly overhead, that part is not covered and estimates should be less than 100 %.

19. **Point Bar (PTB)—**If a recently formed point bar is present, that is, it has no or little vegetation, put a check in this box.

20. **Deposition and Scouring (D&S)—**These parameters relate to the destruction of in-stream habitat. Characteristics to observe are scoured substrate and degree of siltation in pools and riffles. If there is evidence of scouring (smooth, clean bedrock or hardpan play) or deposition (loose, shifting bottoms of fine sand or silt or filled in pools) in the previous segment surveyed, check this box.

21. **Bank Vegetative Cover (BVC)—**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 is stable. If banks are covered with riprap or large gravel, they can still be stable. Remember to note this in the "Comments" section.

22. **Dominant Vegetation (DV)—**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 at least 2 of the three groups contribute at least 20% of the total put an M in the box.

23. **Percent Eroded Banks (% ERODED BK)—**The column is divided into 2 subcolumns (LEFT and RIGHT). Record the average % of streambank that is actively eroding for both the left bank and the right bank of the stream segment. 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.

24. **Average Height of the Eroding Banks (HT. ERODED BK)—**The column is divided into 2 subcolumns (LEFT and RIGHT). Record the average height of the eroding banks on either side of the stream segment just walked. Measure from the lower edge of the bank to the upper edge of the bank.

25. **Average Slope (SLOPE BK)—**The column is divided into 2 subcolumns (LEFT and RIGHT). Record the average slope of the banks in degrees (e.g., vertical bank would be 90 degrees). Measure from the edge of the lower bank to the edge of the upper bank.

26. **Bank Substrate (SUBSTRATE BK)—**Record the typical substrate(s) of each bank using the same substrate abbreviations that are used in the stream assessment form.

27. Riparian Zone Width (RIP. WIDTH)—The column is divided into 2 subcolumns (LEFT and RIGHT). Record the average width of the riparian vegetation for each side of the segment just walked. The riparian zone for Oklahoma's RBP purposes extends from the top of the upper bank outwards from the stream, and the riparian zone ends where the unmanaged (i.e. not plowed or mowed) portion of land ends (where pasture or crop management begins). Riparian vegetation is typically bottomland hardwood forest when in a natural state, but mixtures of trees and herbaceous plants are frequently encountered. These will vary from a fairly dense forest with sparse grasses to land that is mostly pasture with a few scattered trees. For consistency, forest and pasture have been defined below:

- Pasture—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.
- Forest—If the large trees are so dense that a tractor and mower of this size cannot 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. Riparian Condition (RIP. COND.)—The column is divided into 2 subcolumns (LEFT and RIGHT). 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. For this column the decision must be made as to whether the majority of the land in the riparian zone, on either side of the stream, is pasture (grassland) or forest. Refer to the definitions presented din the Riparian Width section. In addition to the habitat type, there is a determination of how much soil is exposed. In grassy areas, this is a straightforward determination and is done by estimating the average % of bare soil observed within the 20-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 an accumulation of recently fallen leaves or annual herbaceous vegetation that have not started to decay. The top layer of leaves and/or vegetation will have to be moved 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 forest while walking the area in question. The riparian zone on both sides of the stream should be placed in <u>one</u> of the following categories.

- 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
- W (Wetland)—at least 5 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

34. **Comments—**This category is used to document other things within the transect. Examples of items that may be documented included a road contributing excess sediment to the stream, a pipe discharging to the stream, a dump present. Document any other thing that is present which you deem significant. General reach wide comments are to be made in the comments section at the bottom of pages 1 and 2.

6.14 Cattle (Presence of Livestock or Other Animals)

This category attempts to identify the impact that livestock (e.g., cattle) or other animals (e.g., feral hogs) may be having on the banks or instream habitat. This category is divided into five subcolumns.

29. **Cattle Excluded (EXCL)—**Put a check mark in the box if this statement is true for the last 20 meters.
30. **Percent of Land Trampled (%TRAM)—**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 2 meter wide strip that runs from the top of the upper right bank across the stream to the top of the upper left bank.

31. **Number of Cow Pies (# CP)—**This is the number of cow pies in the 2 meters wide transect of column 30.

32. **Number of Trails (TRAILS)—**This is the number of livestock trails on both banks that reach the stream over the entire 20-meter transect. A single trail that crosses the stream and goes up the other side counts as two trails.

33. **Class of Cow Trails (TRAILS)—**Each cow trail should be placed in one of the following classes and the class of each trail recorded in this column. There should be as many numbers listed here as were total cow trails in column 32. Separate each number by a comma.
    - Class 1— <0.75m wide
    - Class 2— 0.75 < 1.5m wide
    - Class 3— 1.5 < 2.5m wide
    - Class 4— >2.5m wide

7.0 Forms

7.1 Field Notes

Field notes 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 written, legible, and complete. To avoid confusion and loss of data, a new sheet should be used at each new project site. Field notes should be initialed and dated by the collecting personnel and data entry personnel. For guidance on proper

procedure to complete the field notes, refer to your supervisor and or FTE. Field notes can be found at S:\Monitoring\STREAMS\forms\.

8.0 Data Storage

All completed paper copies of forms and data sheets should be maintained with the appropriate station notebook. The data from the field notes and laboratory data sheets should be either entered into or uploaded to the Water Quality Biological Database and a provided electronic spreadsheet with automated habitat calculations. Each sample should be maintained electronically in the database under a unique sample number.

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.

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.