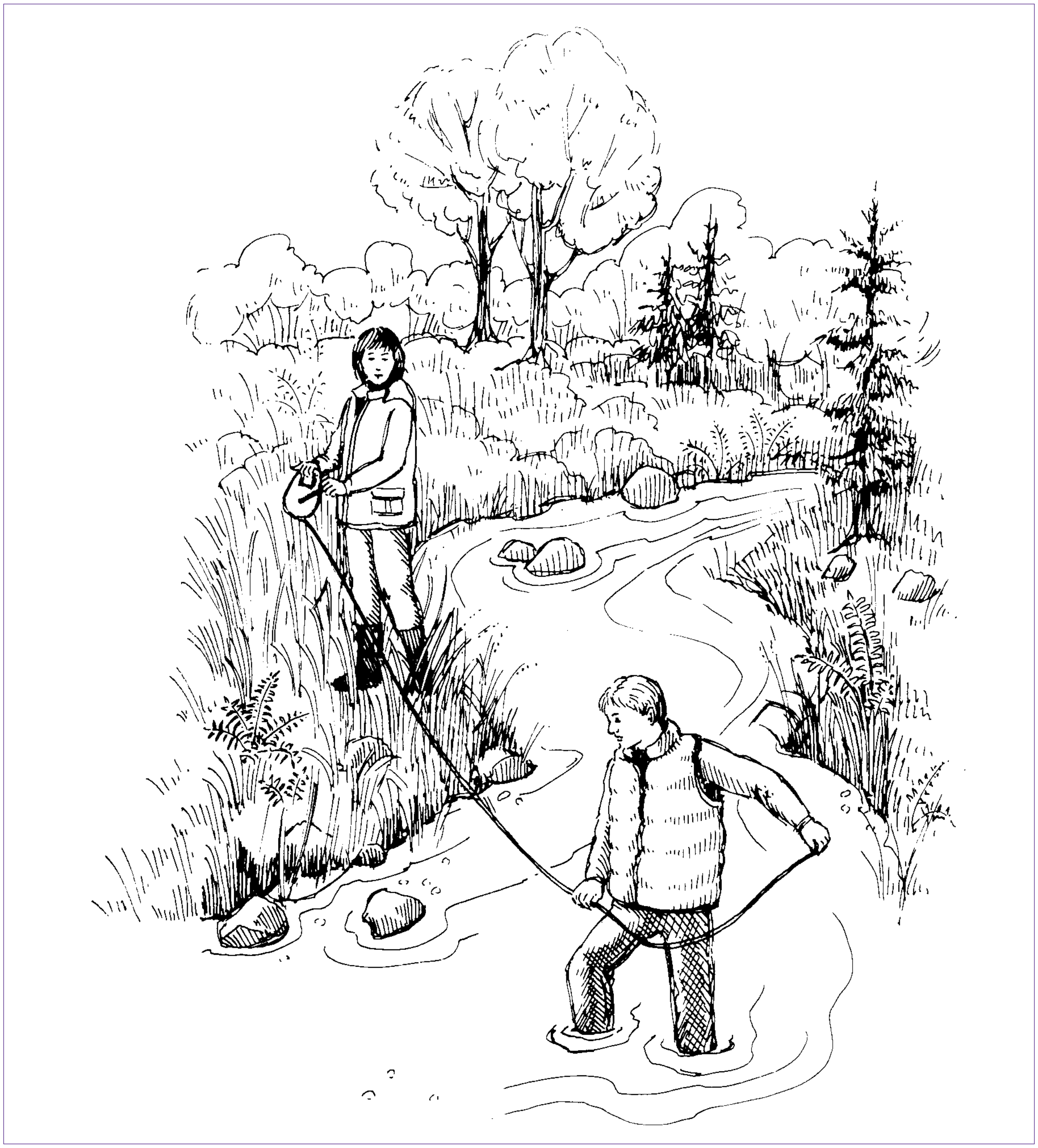
The **Stewardship** Series

The Streamkeepers Handbook



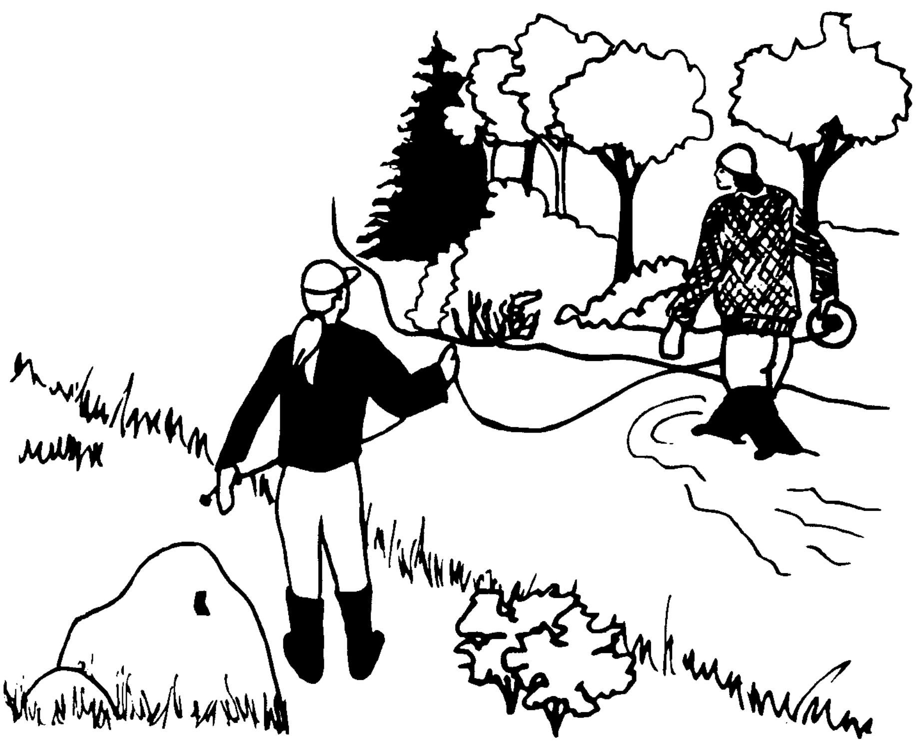
A Practical Guide To Stream And Wetland Care

Canada

Province of British Columbia

STREAMKEEPERS

Module 2
Advanced Stream Habitat Survey



Project Approval Required	Training	Time Commitment (per year)	Number of People	Time of Year
no	recommended	half day per site	2 or more	late summer, early fall

Fisheries and Oceans   Pêches et Océans

Canada

MODULE 2
Advanced Stream Habitat Survey

Welcome to the Streamkeepers Program! The Department of Fisheries and Oceans Community Involvement Program provides these Streamkeepers training modules. These modules encourage “hands on” environmental activities in watersheds in British Columbia. Volunteer groups, schools, and individuals are using this material to monitor and restore local waterways. Your local Fisheries and Oceans Community Advisor can provide more information.

Acknowledgments

Gary Taccogna (Community Involvement Program, Department of Fisheries and Oceans) compiled the information for this module.

Project Activity and Purpose

This advanced survey adds details about stream conditions and habitat to information already collected in the Introductory Survey (Module 1). You will choose one or more reference sites on your stream. At each site you will establish a benchmark, conduct cross-sectional and longitudinal surveys, measure stream discharge, and assess habitat quality.

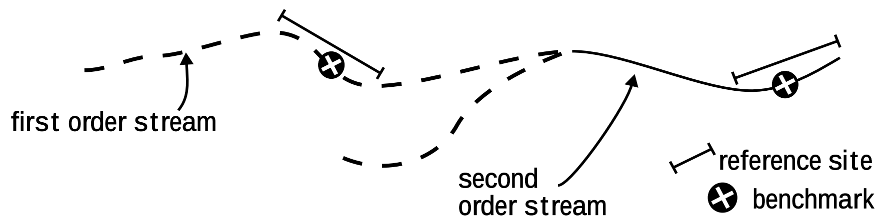
You can use this data to detect changes in stream conditions over the long term or to document the impacts of a suspected habitat problem. In the first case, you will return to a site periodically to document changes in stream conditions over many years. In the second, you will survey sites upstream and downstream of an impact, usually on the same day. If you rehabilitate an area, you will want to survey it in subsequent years to assess the effectiveness of your improvements.

Introduction

The survey methods show you how to collect consistent data so you can compare sites or streams with confidence, even when different people or organizations have collected the information. Your first step is to decide whether you wish to monitor long-term changes or document impacts of habitat problems.

The second step is to define your study area or areas. Select a short section of stream (a reference site) that represents habitat in that stretch of stream (stream segment). Identify the reference site with a benchmark, a metal tag that enables you or others to find the exact location again. Figure 1 shows a reference site and benchmark on first and second order segments of a stream.

Figure 1
Reference Site and
Benchmark on Stream Segments



You can establish several reference sites on a stream, each representing particular types of habitat and stream conditions in the watershed. Consider ease of access when you select the reference site(s). If you are interested in a second order stream, for example, you can establish sites on the first order headwater segments as well as on the second order segment. If you wish to measure the impact of a problem you can collect data at reference sites upstream (control site), in the vicinity (impact site) of the problem, and perhaps further downstream (recovery site). Do all the surveys on the same day. If this is not practical, survey over a few days, as long as stream flow conditions remain constant.

Once you have established a reference site, you can collect detailed information about the physical habitat (this module), water quality (Module 3), benthic invertebrates (Module 4), or fish (Module 11).

Monitoring many sites can be time consuming for one group, but a network of groups in one watershed can share the work. Each group can be responsible for one or two sites. If more than one group is involved, make sure everyone uses consistent methods and timing. The data need to be reliable and comparable to be useful.

Many methods described here were developed for use on streams. They may not work as easily for large or deep rivers. Ask your Community Advisor for advice if you need to modify the methods.

Project Guidance and Approval

You need no formal approval, but you should advise your Community Advisor. He or she can help coordinate equipment, training, and site selection. The methods used are technical in nature. They may seem complicated at first, but are not difficult to learn. A Streamkeepers certification course is available.

Level of Effort

The first time you survey a reference site you may take at least half a day on a small stream, and longer on a larger stream. Subsequent surveys of the same site take less time because you have marked the benchmark already. You can modify the procedure by simply establishing a benchmark and compiling a photographic record of the site. This takes much less time, but still provides useful information about habitat quality.

Time of Year And Working Conditions

Conduct the advanced survey during late summer or early autumn, if possible. Stream flows are lower at these times, making it easier to work in the stream channel. It also is a good time of year to assess vegetation on the banks. If you repeat the survey annually, return at the same time of year, when flow and weather conditions are similar.

Safety

PERSONAL SAFETY

Concern for personal safety is essential when working outdoors. Always tell someone where you are going and when you will return. Work in pairs, never alone. Carry emergency phone numbers for police and ambulance.

Do not attempt to wade fast water or water deeper than your knees. Watch out for slippery stream beds, undercut banks, waterfalls, and fast flowing areas. Log jams can be unstable, so take care to walk around them.

Get permission to cross or use private property. Beware of domestic animals and wildlife.

Warn everyone, especially children, about urban hazards such as syringes, needles, broken glass, and condoms.Remove them with tongs and place them in a special hazardous materials bucket, or flag them with bright tape. Avoid foul smelling areas, spills of unknown substances, or containers of hazardous or unidentified materials.

Contact emergency response agencies or municipal crews to remove these materials.

HEALTH

Do not drink stream water. Although it may look pristine, it can harbour bacteria or parasites that will make you sick. Do not expose cuts and wounds to stream water. Know the symptoms and treatment for hypothermia.

EQUIPMENT

Carry a first aid kit. When working in isolated areas, carry a survival kit containing at least a lighter, fire starter, candle, and flares. Take a cellular phone if you have one.

CLOTHING

Dress for the weather and stream conditions. Wear highly visible clothing. Wear waders with felts when walking in the stream.

Materials And Equipment

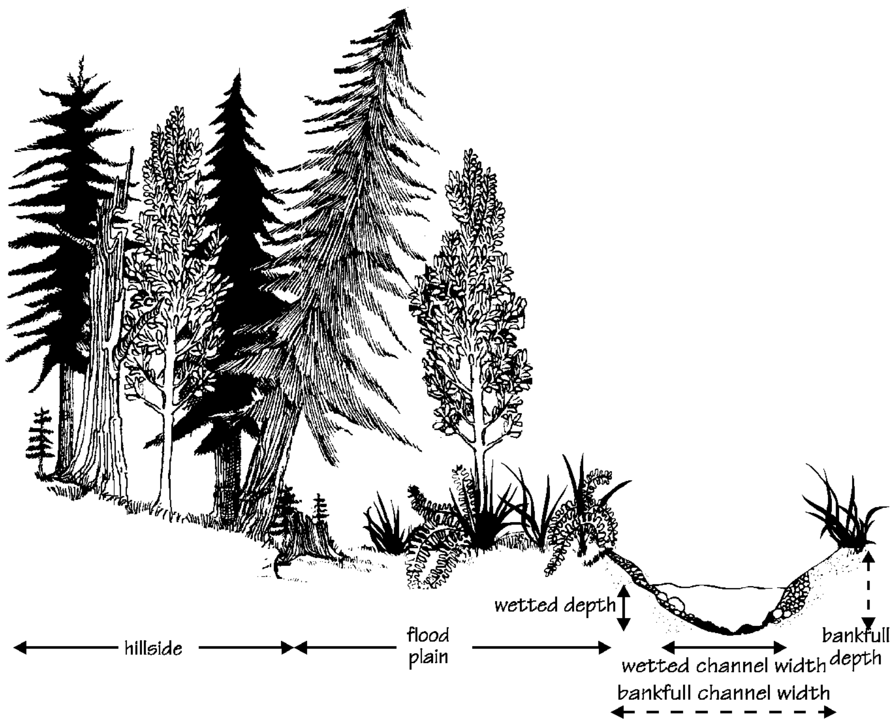
clinometer
survey staff
flagging tape
hip chain
data sheets
felt pen, pencils
hammer
rebar rods (60 cm or longer)
stopwatch
metre stick
fibreglass tape measure
metric ruler
thermometer
clipboard and paper
calculator
nails, rock nails
orange
first aid kit
metal tags (buy from survey equipment supplier
camera, extra rolls of film (35 mm camera with 28 to 35 mm wide angle lens and polarizing filter is best)
stepladder (optional - for taking stream channel photos)

Procedure

Step 1. ESTABLISH A BENCHMARK

Once you select a location for a reference site, establish a benchmark so the site can be found for future surveys. A benchmark is a tagged feature on the stream bank that permanently identifies the reference site. It should be near the midpoint of the length of stream you will survey. The reference site is a length of stream at least twelve times the bankfull channel width. The bankfull channel is the active stream channel to the edge of well-established perennial vegetation (Figure 2). For example, if the bankfull channel width is 2.5 m, the boundaries of the site are about 15 m upstream and 15 m downstream of the benchmark.

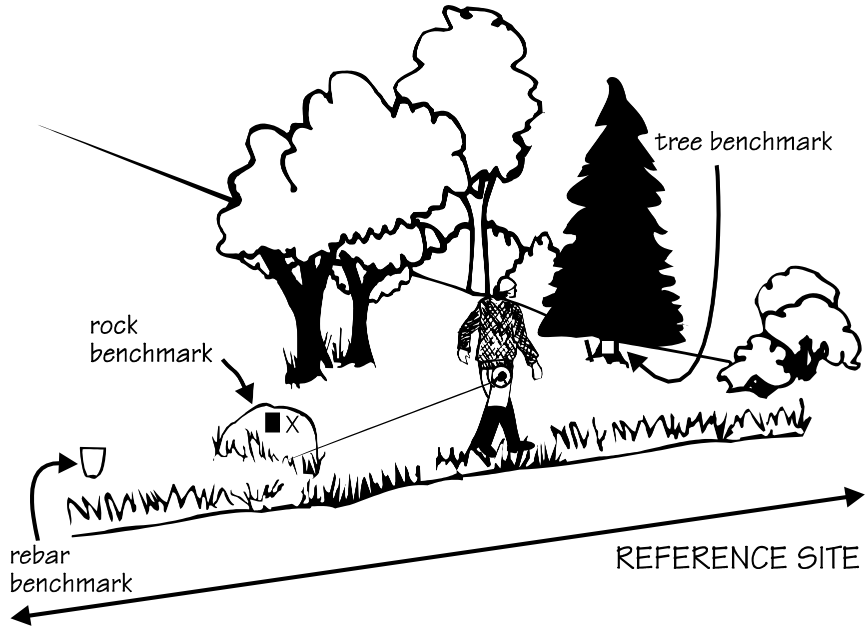
Figure 2
Cross Section of a Stream



Measure the bankfull channel width at a few places in the reference site. Locate the benchmark at a place where the bankfull channel width and general stream conditions appear typical of average conditions for the site. Choose the location for the benchmark carefully; you will make several measurements there. Select a straight length of stream with a single channel, where you can see clear indications of the boundaries of the bankfull channel. The site you choose on the stream should not have a braided channel, multiple channels, large boulders, large logs, or engineered structures that alter the form of the channel at the benchmark. You will measure stream discharge at the benchmark, so choose a riffle area with a relatively smooth stream bottom and uniform depth.

Permanently mark the benchmark using one of the following methods (Figure 3). Nail a metal survey tag into a healthy, firmly-rooted tree of at least 30 cm diameter, preferably a conifer such as cedar, Douglas fir, or pine. Pound a steel rebar rod into the ground and attach a metal tag. Affix a metal tag to a large boulder or bedrock canyon wall using masonry or rock nails.

Figure 3
Examples of Benchmark Locations



Fill in the Locations and Conditions section of the data sheet. Include accurate directions to the stream area and benchmark.

Locate the marker on the bank where it will not be washed away, but will be visible from the channel. Unfortunately, obvious markers may be vandalized. Attach a second marker on the opposite side of the channel, so there is an additional benchmark in case the first one is lost. Attach the second marker directly across the channel from the first, at the same elevation. This way, you can use the two markers as the endpoints for the cross-section survey.

Record the location of the benchmark on the Field Data Sheet, Step 1.

Step 2. CONDUCT A CROSS-SECTIONAL SURVEY

In this step, measure the bankfull and wetted width and depth of the stream channel, as shown in Figure 2. The channel is formed at the bankfull stage, during annual floods. Although you should never measure a stream at the flooding stage, you may observe permanent reminders left by receding flood waters. These mark the boundaries of the bankfull channel. Sometimes the indicators are hard to find. Look for:

the edge of the active stream channel and the beginning of the flood plain

the start of well-established perennial vegetation such as trees, shrubs, and ferns

a change in the bank slope from vertical to more horizontal

a change in bank material from coarse gravel to fine sand or soil

the highest stain lines (these mark the lines of frequent inundation and are formed by sediment or lichen).

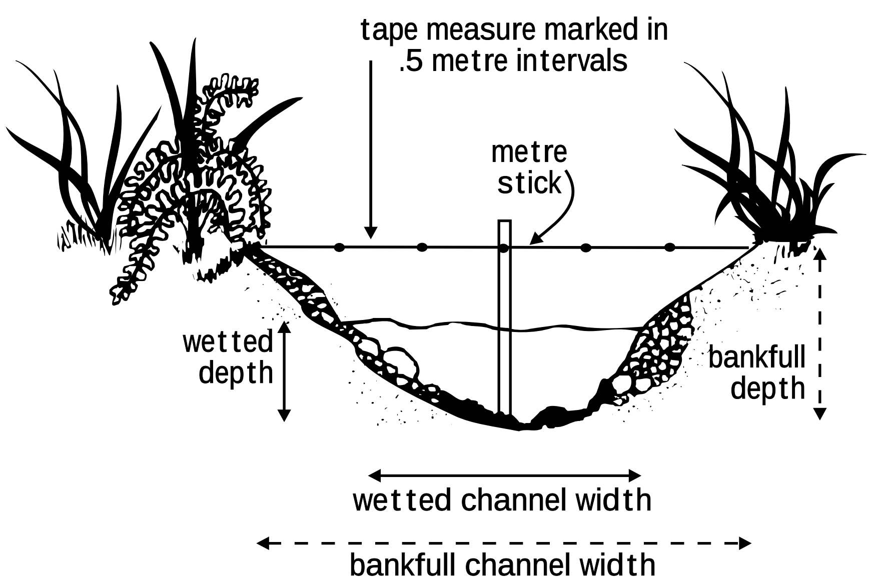
The bankfull channel width and depth reflect the total discharge or volume of water during annual flood events. A change in the bankfull channel dimensions may be a warning sign that natural runoff patterns are changing in the watershed.

Do the cross-sectional survey using the permanent benchmarks as endpoints. If this is not possible, use the same criteria as in Step 1 to choose a cross-sectional survey site.

Stretch a measuring tape between the two markers, so it is at the same elevation as the top of the bankfull channel. Make sure the tape is level and is perpendicular to the stream flow. Measure the bankfull width. Measure the bankfull depth, the depth from the tape measure to the bottom, to either dry land or stream bottom (Figure 4). Measure the depth at regular intervals across the stream (every 0.5 m in streams less than 5 m wide, every 1 m in streams 5 to 15 m wide, and every 2 m in streams 15 to 25 m wide). Also, take initial and final measurements 0.1 m away from each endpoint.

Record all the information on the Field Data Sheet, Step 2. Calculate the average depth to the nearest 0.1 m.

Figure 4
Bankfull and Wetted Channel Measurements



While you still have the tape in place, measure and record the width of the wetted channel. Measure the wetted depth at the same places you measured bankfull depth, except, of course, where there is no water. You will use this information to calculate stream flow and discharge in Step 3. On the Field Data Sheet, draw a sketch of the stream channel cross-section showing the bankfull channel and the wetted channel depths and widths.

Photos

Take three photos while the tape is in place. A wide angle lens is very useful. Record the film type, lens focal length, and camera type in your field notes. You can reduce glare from the water surface by taking the photos with the camera pointed down at the water surface or by using a polarizing filter. A stepladder is helpful, as long as you do not have to carry it far. Have someone stand in the photos holding a paper or small chalkboard stating the name of the creek, date, site number, and orientation in relation to stream flow. Take photos looking upstream and downstream of the cross-section, with the tape measure in place. Also, take a photo of the cross-sectional view along the tape, with the benchmark in the background.

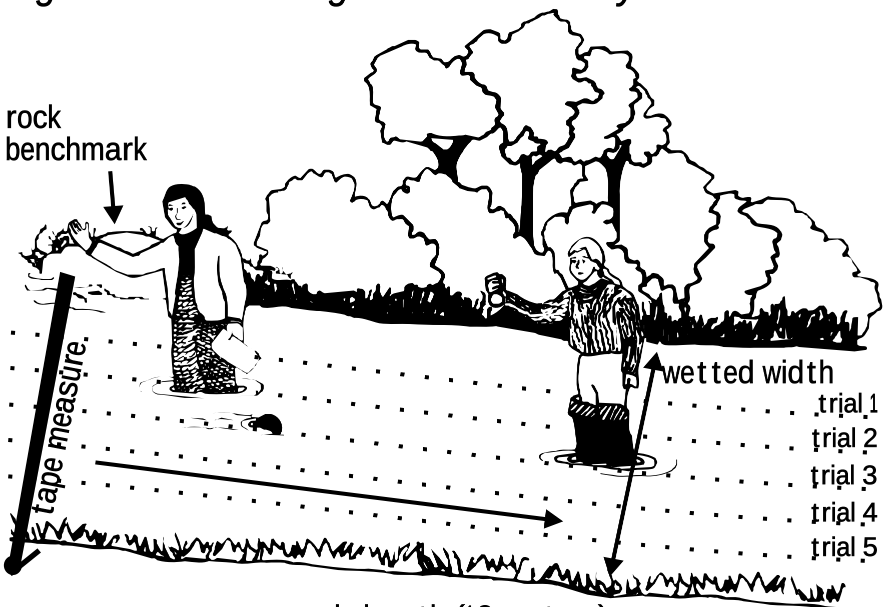
Step 3. MEASURE STREAM DISCHARGE

Stream discharge is calculated by multiplying stream velocity by wetted channel cross-sectional area. Measure velocity in a riffle area, preferably where you did the cross-section profile, because you already have the measurements of the wetted channel profile. If you must choose a new location, measure the depths and widths as for Step 2, wetted channel dimensions. Record the cross-sectional area information on the Field Data Sheet, Step 3.

Calculate the stream cross-sectional area (m2) from your plot of wetted channel dimensions. Multiply width by average depth and enter the value for total cross-sectional area on the Data Sheet, Step 3.

Visually divide the stream width into five sections: one midstream, two near shore, and two half way to the middle (Figure 5). Have someone stand 10 m downstream of you. Stand midstream and drop an orange or tennis ball into the water beside you. Use a stopwatch to record the time it takes the orange to float 10 m downstream. Repeat the process in the other four sections of the stream. Record the individual times for the five trials and calculate the average. Divide the distance (10 m) by the average time in seconds, to get the average stream velocity in m/sec. Record the result on the Field Data Sheet, Step 3.

Figure 5 Measuring Stream Velocity



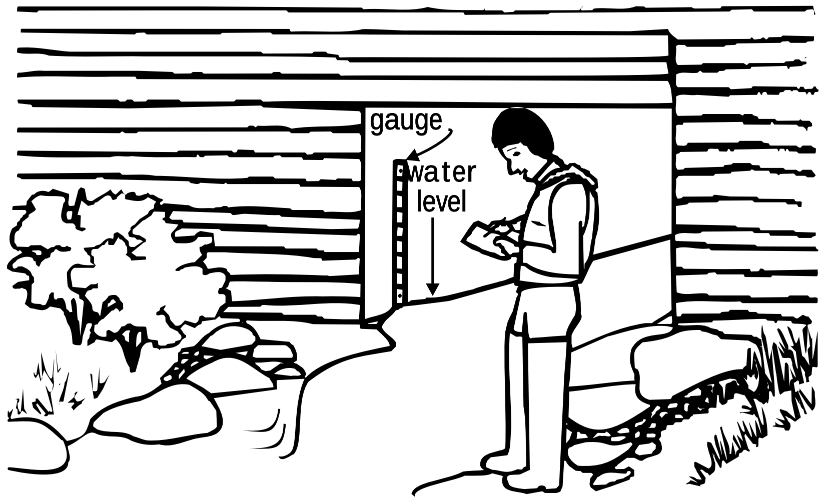
To calculate total stream discharge in m3/sec, multiply the average water velocity (m/sec) by cross-sectional area (m2) and by a correction factor of 0.8. This factor converts your velocity measurement from surface velocity to average velocity. Water flows faster at the surface than deeper in the water column. Average velocity occurs just below the mid-depth. Record the stream discharge on the Field Data Sheet, Step 3.

average velocity (m/sec)	X	cross-sectional area (m2)	X 0.8	=	discharge (m3/sec)

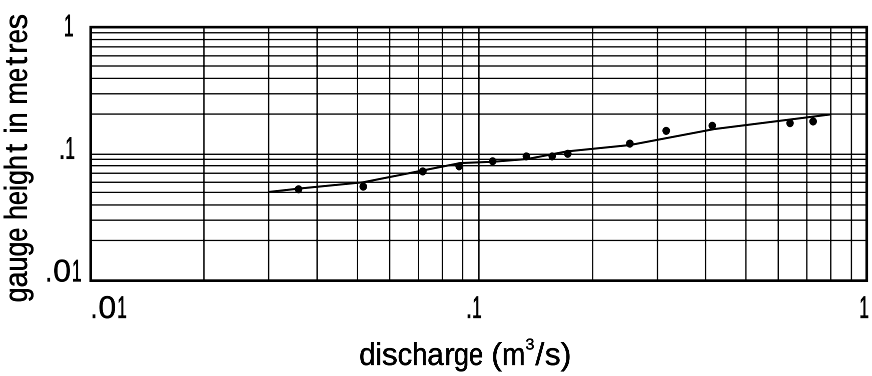
Staff gauge

There may be a staff gauge already installed somewhere on the stream, or you may wish to install one at a culvert or bridge abutment if you plan to monitor stream discharge frequently. The staff gauge is a painted scale (marked in metres and centimetres) used to show the water depth (Figure 6). An engineered area of the stream, such as a bridge crossing, box culvert or flood control area, may have a gauge. Gauge readings and stream discharge rates are measured over a wide range of stream flows, then plotted on logarithmic graph paper to produce a rating curve (Figure 6). Once the rating curve has been determined, you can read the staff gauge height, then estimate the stream discharge from the rating curve.

Figure 6 Staff Gauge at a Box Culvert



Staff Gauge:
Example of Rating Curve on Logarithmic Paper
from Stream Channel Reference Sites: An Illustrated Guide to Field Technique



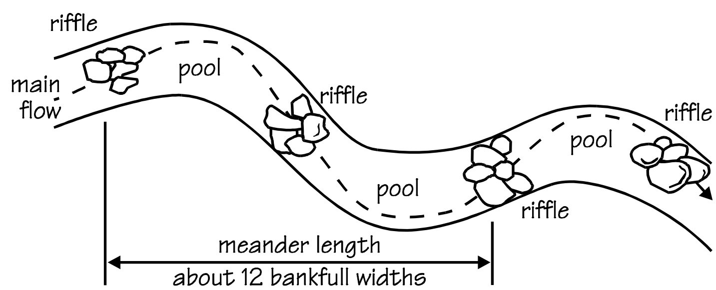
Step 4. LONGITUDINAL SURVEY

In this step you collect information about habitat quality over the entire length of the reference site. The length of the reference site should be at least twelve times the bankfull channel width. On average, a pool-riffle sequence is repeated every six times the bankfull width and a full S-shaped meander is repeated every twelve times the bankfull width (Figure 7a).The benchmark should be near the midpoint of the longitudinal survey.

There are two parts to the longitudinal survey. In the first, you define upstream and down- stream boundaries of the site and divide the site into distinct habitat units. Each stream consists of a repeating pattern of pool and riffle habitat units. Pools have deeper water, lower velocity and water surface gradient, and little or no surface turbulence. Riffles have shallower water, higher velocity and water surface gradient, and some surface turbulence.

In the second part of your survey, you measure or observe nine important habitat characteristics over the length of the reference site. You will use this information in Step 5 to rate the habitat quality at the reference site.

Figure 7a
The Natural Meander Pattern of a Stream
adapted from Stream Analysis and Fish Habitat Design, 1994



STEP 4.1. Mark the Upstream and Downstream Boundaries, Define Habitat Units

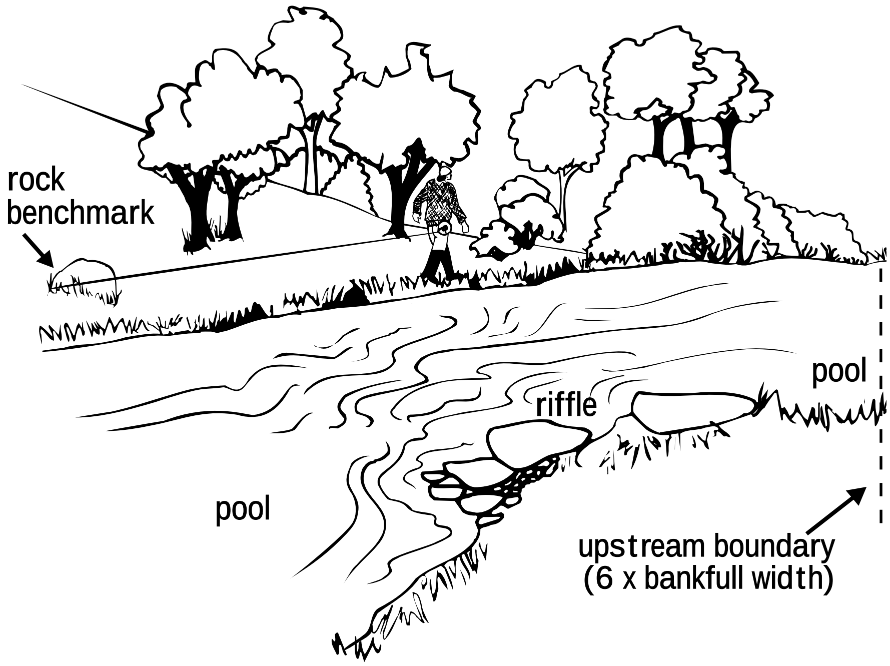
Using a hipchain, walk downstream from the benchmark a distance of about six times the bankfull channel width. Mark the downstream end of the closest pool or riffle habitat unit with a piece of flagging tape. Make sure you can see the marker from mid-channel.

Start walking upstream. Mark the upstream end of the last habitat unit with flagging tape. This mark also is the down- stream end of the next habitat unit. Continue upstream, marking the boundaries of the alternating pool and riffle habitats. Stop when you reach a distance of about six times the bankfull width upstream of the benchmark (Figure 7b).

On the Field Data Sheet, Step 4.1, record the total distances to the upstream and downstream boundaries of the reference site, relative to the benchmark. Record the distance to the boundary of each habitat unit.

Facing downstream, take photos of each habitat unit, starting at the upstream end of the reference site. Take photos from a high point to reduce glare from the water surface, using a polarizing filter or a stepladder if you brought one. Include in the first photo a piece of paper or chalkboard noting location, date, habitat unit type, distance upstream of the benchmark, and camera frame number. Include in each photo the upstream habitat unit marker in the foreground, and the

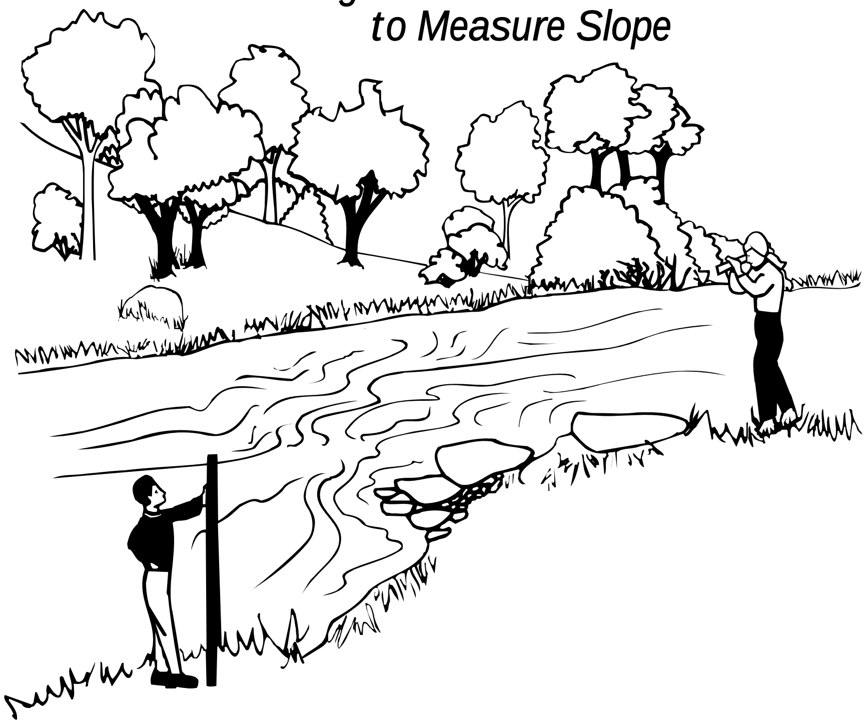
Figure 7b
Alternating Pool and Riffle Habitats in the Reference Site



downstream marker with someone standing beside it for scale. Take two photos if the habitat unit is too long to fit into one photo.

You need to know the stream slope to do the stream habitat assessment in Step 5. Measure the slope or drop in elevation for each habitat unit when you photograph it. Use a clinometer and a survey staff to record the elevation drop at the water surface between the upstream and downstream markers of each habitat unit (Figure 8). You can use a two to three metre long stick and flagging tape as a survey staff. Stand beside the upright staff, with your boot beside the base of the staff. Tie a piece of flagging tape at your eye level. Send your partner to the downstream end of the habitat unit with the staff. Get your partner to position the staff with its base at the same elevation as the water surface. Stand at the upstream marker with your feet at the same elevation as the water surface. Hold the clinometer in front of one eye so you can see the scale through the optics. Use your other eye to aim the clinometer at the staff downstream. Line up the hairline on the clinometer scale with the flagging tape on the staff. Read the percent slope from the clinometer scale (Figure 9). Ignore the scale that gives the reading in degrees. Record the slope in percent on the Field Data Sheet, Step 4.1.

Figure 8
Positions While Using the Clinometer to Measure Slope



STEP 4.2 Measure or Observe Habitat Characteristics

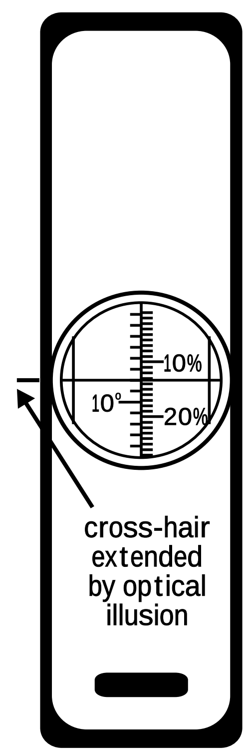
The nine characteristics listed below help describe the quality of stream habitat and capacity for biological productivity. Your measurements or observations should reflect average stream conditions over the entire length of the reference site. The characteristics are considered primary, secondary, or tertiary, based on their significance to habitat quality. Composition of streambed material, embeddedness of substrate, and instream cover are most important in defining habitat quality and types of plant and animal life in the stream. Characteristics of secondary importance include the percent pool habitat, off-channel habitat, and bank stability. Tertiary characteristics include stream bank vegetation, amount of overhead canopy, and size of riparian zone.

PRIMARY CHARACTERISTICS

4.2.1 Streambed Material

Different kinds of streambed material influence plant and animal life in a stream. Substrate sizes range from "fines" like silt, sand, and clay, to large boulders and bedrock (Table 2). Although variety in substrate size is desirable, a streambed comprised primarily of fine sediment is less stable than one comprised primarily of boulder, cobble, and gravel. Large substrates also provide better quality fish and aquatic invertebrate habitat.

Figure 9
Clinometer Scale



Select a representative pool and riffle unit within the reference site. Measure twenty-five particles in each habitat unit using the following procedure:

a) Toss a pebble along the stream bank and begin a transect where the pebble comes to rest. Take one step from the bank into the stream. Without looking at the stream bottom, reach down to the toe of your boot and pick up the first particle touched by the tip of your finger.

b) Measure the length, width, and depth of the particle in cm, using a ruler or metre stick (Figure 10). Call out the three dimensions to the person recording data, who can record it on a piece of paper. Work out the average diameter of the particle by adding the three numbers and dividing by three. For large boulders embedded in the stream, measure the shorter of the two exposed dimensions and record that as the average particle diameter.

Figure 10
Example of Average Size Measurement

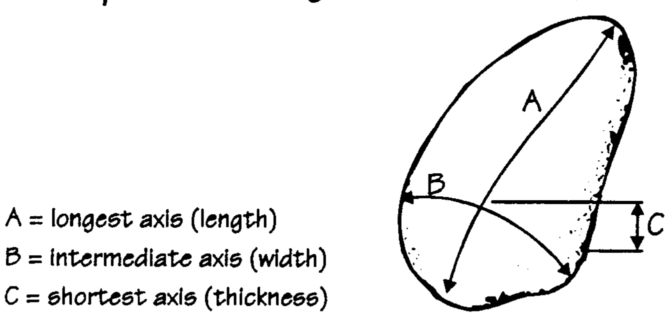


Table 2
Size Categories of Streambed Material

bedrock	solid slab of rock
boulder	>25 cm diameter
cobble	5 - 25 cm diameter
gravel	0.2 - 5 cm diameter
fines	<0.2 cm diameter

c) Take another step across the channel in the direction of the opposite bank and repeat the process. If you reach the opposite bank before you have measured twenty-five particles, toss a pebble along the bank again and begin another transect across the channel.

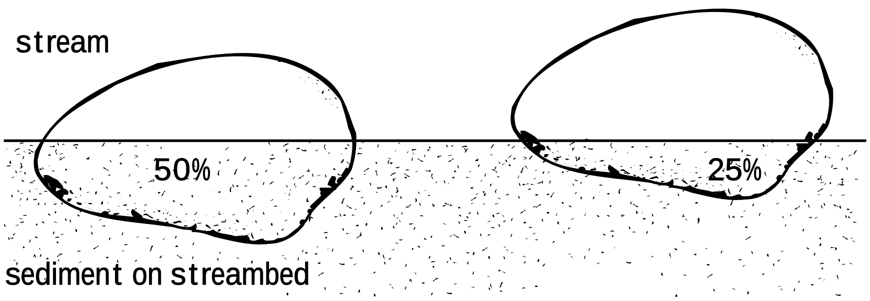
d) Repeat the process in the other habitat unit. Combine the results from the pool and riffle samples. Count the number of particles from your sample that fall into each substrate class listed in Table 1. Convert the data to percentages and record the results for each substrate class in the Field Data Sheet, Step 4.2.1.

4.2.2. Embeddedness

Fine sediments often bury, or embed, some gravel and cobble substrate. Fines accumulate naturally in pools, where gradient and water velocity are reduced. In undisturbed streams, fines do not accumulate significantly in riffles, so large amounts of fines on riffle substrates may indicate erosion problems in the watershed. Embedded riffle substrates provide less desirable habitat for invertebrates, and reduce habitat quality, stream productivity, and fish spawning habitat.

Wade into the middle of a riffle in the reference site. Pick up several pieces of gravel and cobble. Estimate the percentage of rock surface area buried in fines (Figure 11). Often a stain line indicates the level of burial. Repeat this in a few locations in the riffle and record the estimated percent embeddedness on the Field Data Sheet, Step 4.2.2.

Figure 11
Estimating Embeddedness of Gravel and Cobble



4.2.3. Instream Cover

Stable logs, stumps and undercut banks with large protruding root masses provide important habitat for fish and other animals. They provide shelter, cover from predators, and refuge during floods and droughts.

Walk the entire length of the reference site. Count the number of pieces of large woody debris (LWD) at least 1 m long and 0.1 m in diameter that seem unlikely to wash away. Check both stream banks and count the number of stable undercut banks with roots protruding into the channel.

Record the number of pieces of LWD on the Field Data Sheet, Step 4.2.3. Divide the number of pieces of LWD by the length of the survey site expressed in channel widths (the length of the reference site divided by the bankfull channel width, usually about 12). Record this value as well. Repeat the procedure for rooted cutbanks.

SECONDARY CHARACTERISTICS

4.2.4. Percent Pool Habitat

Percent pool habitat refers to the proportion of pool habitat at your reference site. Pools are areas of low energy and riffles are areas of high energy. Pool and riffle habitats alternate in stream channels. Both habitat types are important to stream organisms. Pools provide a refuge in flood conditions and may be the only habitat available during drought conditions. Many factors influence the relative abundance of pools and riffles.

Calculate the total length of pool habitat from the measurements obtained in Part 4.1. Record this value on the Field Data Sheet, Step 4.2.4. Divide the total length of pool habitat by the total length of the reference site. Multiply by 100 to obtain the percent pool habitat. Record the percent on the Field Data Sheet, Step 4.2.4.

Calculate the average slope for the entire reference site from the slope data collected in Step 4.1. This is the average of the individual values. Record the average percent slope on the Field Data Sheet, Step 4.2.4.

4.2.5. Off-channel Habitat

Side channels, ponds, wetlands, and secondary overflow channels next to the main channel provide off-channel habitat. These areas are isolated and protected from main channel floods. They may join the main stream channel occasionally or throughout the year. Off-channel habitat provides seasonal breeding and rearing areas and protection from flood flows for many animal species. Some are easy to see and others are less obvious.

Carefully search both banks of the reference site for small channels that lead away from the main stream. Record the number of side channels and backwater ponds on the Field Data Sheet, Step 4.2.5. Describe their approximate size, shape, and potential as a refuge from floods. Decide whether they are seasonal or year-round. Take photos if you wish.

4.2.6. Bank Stability

This refers to bank areas between the annual high water and low water marks. Examine the banks for signs of existing or potential sloughing to assess bank stability. Streams with unstable banks often have unstable stream beds and poor instream habitat as well. Steep banks and banks with damaged or no vegetation often are unstable. Soil can slide into the channel from unstable areas further up the bank. Artificially stabilized stream banks indicate erosion problems.

Count the number of places on both banks where you see active erosion (sloughing soil, raw appearance), artificial bank stabilization, or signs of landslides into the channel. Use a hip chain or measuring tape to measure the length of stream bank affected by each impact.

Record the individual and total values on the Field Data Sheet, Step 4.2.6.

TERTIARY CHARACTERISTICS

4.2.7. Bank Vegetation

Perennial vegetation at the edge of the bankfull channel includes trees, shrubs, and grasses. Stream bank vegetation contributes to a healthy stream habitat. It binds the soil with root networks, moderates temperature fluctuations, absorbs pollutants from runoff, and provides a source of food and large woody debris. Removing bank vegetation degrades stream habitat significantly.

Measure the lengths of stream bank where there is no vegetation at the edge of the bankfull channel, using a hip chain. Record the values for both the left and right banks on the Field Data Sheet, Step 4.2.7.

4.2.8. Overhead Canopy

Tree and shrub branches overhanging the stream form an overhead canopy. This canopy provides food, shade, and cover for animals in the stream below. The extent of the canopy is estimated as a percentage of bankfull channel area. For example, when the branches on opposite banks meet or overlap at the centre of the channel, 100% cover occurs.

You can estimate overhead cover from a recent large-scale aerial photograph. If you have no aerial photo, use a tape to measure the average distance that branches extend over the top of the stream at your reference site. Take measurements from the right and left banks at a few locations. Calculate the average value for left and right banks, add them, and divide by the bankfull channel width. Multiply this value by 100 and record this percent value on the Field Data Sheet, Step 4.2.8.

4.2.9. Riparian Zone

The riparian zone is the vegetated area between the stream bank and the upland slope at the edge of the flood plain. Stream bank vegetation needs to be wide enough to provide a buffer from land use impacts near the stream. A good quality buffer zone has several species of coniferous and deciduous trees and shrubs. It is wide enough to protect the entire flood plain up to the base of adjacent slopes.

Note the relative abundance of coniferous and deciduous trees, shrubs, and grasses in the riparian zone on the Field Data Sheet, Step 4.2.9. You can estimate the width of the riparian buffer zone from a recent aerial photograph. See Module 1 for more information about aerial photos. If you do not have an aerial photo, find a high point overlooking the reference site. Estimate the average width of the riparian zone, in terms of the number of bankfull channel widths. Record the value on the Field Data Sheet, Step 4.2.9. For example, if the buffer zone on both sides of the stream is about twice as wide as the average bankfull channel width, record two channel widths on the form.

Step 5. CONDUCT A HABITAT ASSESSMENT

The final step in the advanced survey is to rate habitat quality at the reference site. Base these scores on average conditions over the length of the reference site. The habitat assessment is adapted from methods used by the U.S. Environmental Protection Agency (Plafkin, 1989), Washington State Department of Natural Resources (Anonymous, 1993), and the University of Idaho Water Resource Institute (Rabe, 1992).

The scores for the nine characteristics described in Step 4.2 are weighted to reflect their significance to the biological productivity of the stream. Primary characteristics (1-3), related to streambed composition and instream cover, are ranked between 0 and 20 points. Secondary characteristics (4-6), related to channel structure and stability, are ranked between 0 and 15 points. Tertiary characteristics (7-9), related to streamside vegetation, are ranked between 0 and 10 points.

Assign a score for each of the nine characteristics surveyed in Step 4.2 using the scoring table in the Interpretation Sheet, Step 5. Add the values to get the total score for your reference site.

Collecting, Reporting, and Evaluating Information

Send copies of the data to the Streamkeepers Database. The current address is in the Handbook. If the total score for your reference site is in the marginal or poor category, check the individual scores to identify particular problems at the site. This will help you choose a focus for your initial restoration efforts. You may wish to confirm poor results by doing water quality or stream invertebrate surveys at the site (Modules 3 and 4).

Public Relations

You can clean up streams, monitor their condition, and undertake enhancement projects, but you need the support of your community for these projects to succeed. Talk about your project with others whenever and wherever you can, including at schools and public meetings. Place signs at visible projects. Contact newspapers, radio stations and television stations. Module 10 contains specific information about increasing community awareness and working with the media.

References

Anon. 1993. *Standard Methodology for Conducting Watershed Analysis.* Section for Fish Habitat. Washington Forest Practices Board. Wash. State Dept. of Natural Resources, Olympia, WA.

Anon. 1994. *Stream Inventory Manual (*Draft Version). Prepared for Fisheries Branch, B. C. Ministry of Water, Land and Air Protection, Lands, and Parks and Department of Fisheries and Oceans, Canada.

Harrelson, C., C. Rawlins, and J. Potyondy. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Technique.* Gen. Tech. Rep. RM-245. Fort Collins CO, US Dept. Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 pp.

Newbury, R. W. and M. N. Gaboury. 1994. *Stream Analysis and Fish Habitat Design*. Published by Newbury Hydraulics Ltd., Gibsons, B.C. 256 pp.

Plafkin, J. et al. 1989. *Rapid Bioassessment Protocols for Use in Streams and Rivers*. U.S. Environmental Protection Agency/444/4-89-001. Washington, DC.

Rabe, F.W. 1992. *Streamwalk II: Learning How to Monitor our Streams.* Idaho Water Resources Research Institute, Univ. of Idaho. 61 pp.

Schuett-Hames, D., A. Pleus, L. Bullchild, and S. Hall. 1994. *Timber-Fish-Wildlife Ambient Monitoring Program Manual.* Northwest Indian Fisheries Commission, Washington State.

send the data to: Streamkeepers Database, Department of Fisheries and Oceans,
Suite 400, 555 W. Hastings Street, Station 321, Vancouver, B.C. V6B 5G3
or fax to (604) 666-0292

Advanced Stream Habitat Survey Field Data Sheet

(use a new data sheet for each reference site surveyed) **Module 2**

Stream Name/Nearest Town:		Date
		Watershed code
Organization Name:		
Contact Name:		Phone #
Crew Names:		Stream Segment #
		Stream Section #
		Length Surveyed

Upstream End Point

Mapsheet number_______________ Type________________ Scale__________________

Location (distance from known stream landmark, directions to benchmark)

Time:______ Weather ‘ clear ‘ shower (1-2.5 cm in 24 hr) ‘ snow
‘ overcast ‘ storm (<2.5 cm in 24 hr) ‘ rain on snow

Water turbidity (cm visibility) _________________________ Temperature ^{o}C (leave thermometer 2 min.) air ___________ water _______________

Measurements taken every _____ m

Bankfull Channel width __________(m) Average depth _____________(m)

Wetted Channel width __________(m) Average depth _____________(m)

Downstream End Point

Mapsheet number_______________ Type________________ Scale__________________

Location (distance from known stream landmark, directions to benchmark)

Time:______ Weather ‘ clear ‘ shower (1-2.5 cm in 24 hr) ‘ snow
‘ overcast ‘ storm (<2.5 cm in 24 hr) ‘ rain on snow

Water turbidity (cm visibility) _________________________ Temperature ^{o}C (leave thermometer 2 min.) air ___________ water _______________

Measurements taken every _____ m

Bankfull Channel width __________(m) Average depth _____________(m)

Wetted Channel width __________(m) Average depth _____________(m)

(Upstream) First and Last Measurements taken .1 m from streambank edge (Downstream)

Left Bank								**Right Bank**
Wetted Depth								Wetted Depth
Bankfull Depth								Bankfull Depth

Left Bank								**Right Bank**
Wetted Depth								Wetted Depth
Bankfull Depth								Bankfull Depth

Take measurements every 0.5m in streams less than 5m wide, every 1m in streams 5 to 15m

Page ___ of ___

send this data to the Streamkeepers Database

Advanced Stream Habitat Survey Field Data Sheet

(use a new data sheet for each reference site surveyed) **Module 2**

Stream Name	Date
Organization Name	Stream Segment # Section #
	Map Sheet #

STEP 1. BENCHMARK LOCATION

Directions to benchmark

STEP 2. CROSS-SECTIONAL SURVEY

Location relative to benchmark	Photos taken: (yes or no)
Bankfull channel width (m)	Average bankfull depth (m)
Wetted channel width (m)	Average wetted depth (m)
Measurements taken every _____ metres Cross-sectional plot	

Left Bank									**Right Bank**
Wetted Depth									Wetted Depth
Bankfull Depth									Bankfull Depth

STEP 3. STREAM DISCHARGE

Cross-sectional area of wetted stream (m^2) __________ x ____________ = ___________(m^2)
wetted width **average wetted depth**

Average Time (sec)
[_____ + _____ + _____ + _____ + _____] = ______ ÷ 5 = ______________
trial 1 **trial 2** **trial 3** **trial 4** **trial 5** **total trials** **Average Time (sec)**

Average Velocity (m/sec) _________ ÷ ______________ = ______________________
length (m) **average time (sec)** **Average Velocity (m/sec)**

Average Stream Discharge (m^3/sec) ____________ x _____________ x ___0.8____ = __________
cross sectional area (m^2) **average velocity (m/sec)** **correction factor** **Discharge (m^3/sec)**

send the data to the Streamkeepers Database

Advanced Stream Habitat Survey Field Data Sheet

(use a new data sheet for each reference site surveyed) **Module 2**

Stream Name	Date
Organization Name	Stream Seg # Section#
	Map Sheet #

STEP 4.1 LONGITUDINAL SURVEY, MEASUREMENTS

	Photos (yes, no)
Length of survey site (minimum 12 times the bankfull width) Minimum _____ (m) Actual______(m)	
Upstream survey boundary (m upstream of benchmark) Minimum _____ (m) Actual _____ (m)	
Downstream boundary (m downstream of benchmark) Minimum _____ (m) Actual _____ (m)	

* distance **upstream** (Up) of benchmark

habitat unit type (pool or riffle)	bottom of habitat unit*	top of habitat unit*	length of habitat unit (m)	% slope	Photo Frame #
	Up	Up			
	Up	Up			
	Up	Up			
	Up	Up			
	Up	Up			
	Up	Up			
	Up	Up			

* distance **downstream** (Dn) of benchmark in metres

habitat unit type (pool or riffle)	top of habitat unit*	bottom of habitat unit*	length of habitat unit (m)	% slope	Photo Frame #
	Dn	Dn			
	Dn	Dn			
	Dn	Dn			
	Dn	Dn			
	Dn	Dn			
	Dn	Dn			
	Dn	Dn			

send the data to the Streamkeepers Database

Advanced Stream Habitat Survey Field Data Sheet

(use a new data sheet for each reference site surveyed) **Module 2: (con't)**

Stream Name	Date
Stream segment and section #'s	

STEP 4.2 LONGITUDINAL SURVEY, HABITAT QUALITY

1. Streambed material Collect 25 samples 1 8 15 22 2 9 16 23 3 10 17 24 4 11 18 25 5 12 19 6 13 20 7 14 21	% fines (<0-2cm) - ladybug size and smaller % gravel(0.2-5 cm) - ladybug to tennis ball % cobble (5·25cm) - tennis ball to basketball % boulder (>25cm) – bigger then a basketball with definable edges % bedrock - slab of rock	*Fines* = ______% *Gravel* = ______% ***Cobble*** = ______% ***Boulder*** = ______% *Bedrock* = ______% ***Cobble + Boulder*** *Total* = ______%
2. % embeddedness - cover of gravel and cobble by fine sediment		_________%
3. Instream cover LWD ___________________________ Rooted cutbank	______ # pieces LWD + ______ # rooted cutbanks = ______ ÷ ______ = __________ total cover (length of reference site ÷bankfull width) instream cover	

4. Percent pool habitat survey site slope total length of reference site (m)	total length of pools (m) % pool habitat

5. Off channel habitat (if present, describe habitat type, size, and whether it is seasonal or year-round)	description	PRESENT ABSENT
6. Bank stability (left or right bank facing downstream) # active bank erosion bank stabilization # slides reaching the channel	*# of sites and length of bank affected (m)* LEFT BANK RIGHT BANK _________ _________ _________ _________ _________ _________	
7. Length of bank with no vegetation (m)	LEFT BANK _____________	RIGHT BANK ___________
8. Overhead canopy	% bankfull channel covered by overhanging branches	
9. Riparian zone type and amount of vegetation	# of channel widths coniferous trees deciduous trees shrubs grasses	_____________________ none ❑ few ❑ many ❑ none ❑ few ❑ many ❑ none ❑ few ❑ many ❑ none ❑ few ❑ many ❑
Adjacent land use and impacts		

send the data to the Streamkeepers Database

Advanced Stream Habitat Survey Field Data Sheet
(use a new data sheet for each reference site surveyed) **Module 2 (con't)**

Stream Name	Date
Stream segment and section #'s	

STEP 5 HABITAT ASSESSMENT ***(the score in bold, estimate a value within the range listed)***

Characteristic	Results	Good	Acceptable	Marginal	Poor	Score
1: Streambed material: **% boulder and cobble**		**15 - 20** 50%	**10 - 15** 30-50%	**5 - 10** 10-30%	**0 - 5** <10%	
2: Embeddedness:		**15 - 20** 25–0%	**10 - 15** 50-25%	**5 - 10** 75-50%	**0 - 5** >75%	
3: Instream cover:		**15 - 20** >3	**10 - 15** 2 to 3	**5 - 10** 1 to 2	**0 - 5** <1	
4: % Pool Habitat **<2% stream slope** **2-5% stream slope** **>5% stream slope**		**11 - 15** >60% pool >50% pool >40% pool	**7 - 11** 50-60% 40-50% 30-40%	**3 - 7** 40-50% 30-40% 20-30%	**0 - 3** <40% <30% <20%	
5: Off-channel habitat: ponds, side channels with protection from flood flows		**11 - 15** year round, good protection	**7 - 11** seasonal, good protection	**3 - 7** seasonal, minimal protection	**0 - 3** little or none, no protection	
6: Bank stability **stability**		**11 - 15** stable	**7 - 11** moderately stable	**3 - 7** moderately unstable	**0 - 3** unstable	
evidence of erosion or bank failure ***(see note 1)***		none	some	some	lots	
7. Bank vegetation: % stream bank covered by vegetation		**8 - 10** >90%	**5 - 8** 70-90%	**2 - 5** 50-70%	**0 - 2** and <50%	
8. Overhead canopy: % bankfull channel overhung by trees and shrubs		**8 - 10** >30%	**5 - 8** 20-30%	**2 - 5** 10-20%	**0 - 2** 0-10%	
9. Riparian zone: **# bankfull channels wide**		**8 - 10** 2 or more	**5 - 8** 1 to 2	**2 - 5** <1	**0 - 2** 0	
trees and shrubs		abundant on whole floodplain	good species mix	common, few species	sparse or absent	
TOTAL SCORE		**102 - 135**	**66 - 102**	**30 - 66**	**0 - 30**	

Note 1: The evidence of erosion or bank failure changes from **Good** (intact banks) to **Acceptable** (healed or banks stabilized) to **Marginal** (active erosion or extensive bank stabilization) to **Poor** (many actively eroding areas or upslope slides reaching channel).