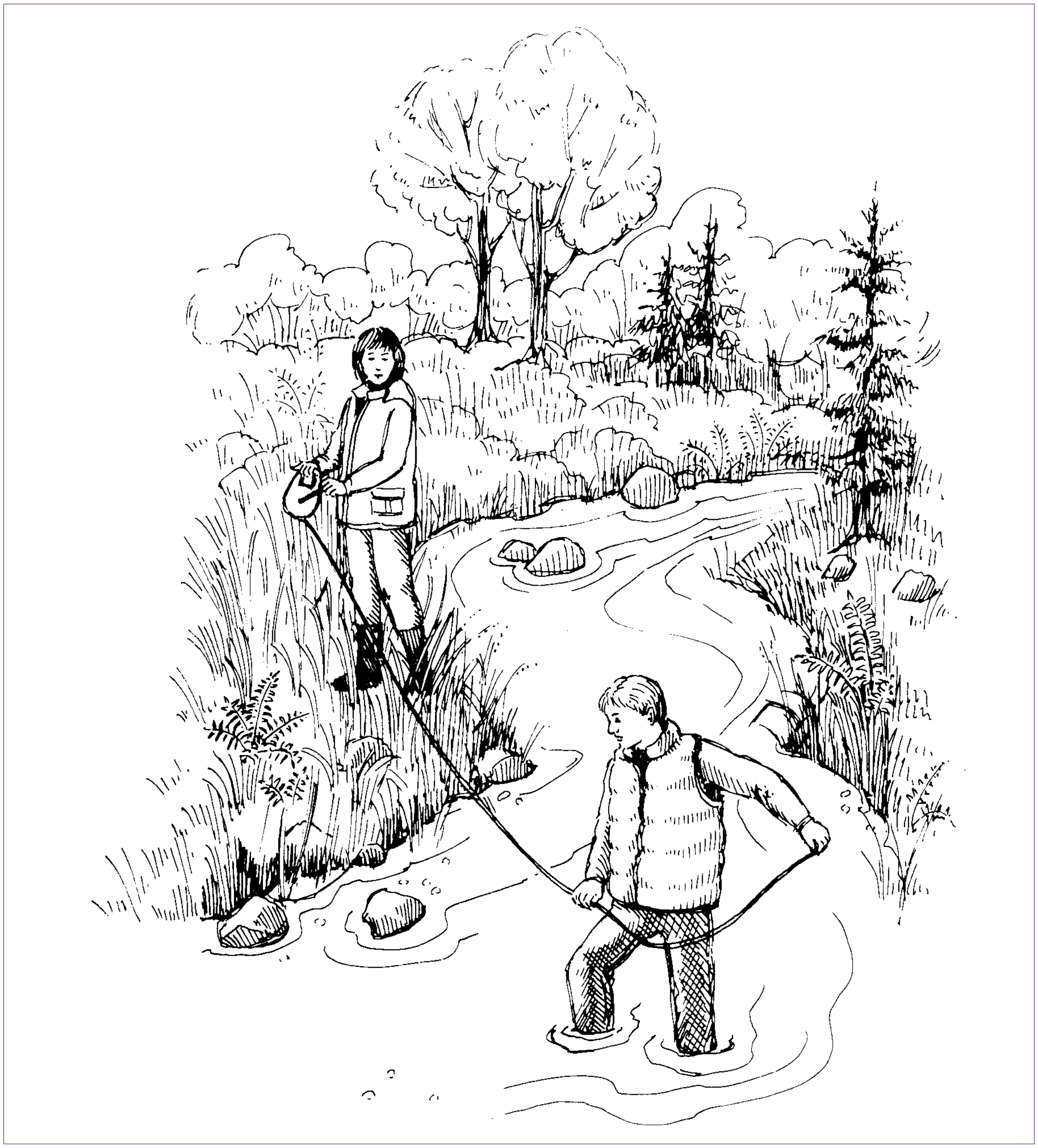
The **Stewardship** Series

The Streamkeepers Handbook



A Practical Guide To Stream And Wetland Care

Canada

Province of British Columbia

STREAMKEEPERS

Module 1
Introductory Stream Habitat Survey

Project Approval Required	Training	Time Commitment (per year)	Number of People	Time of Year
No	recommended	2 days or more	2 or more	High flow and low flow seasons

Fisheries and Oceans
Pêches et Océans

Canada

MODULE 1
Introductory 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) and Mel Kotyk (Environmental Protection Officer, District of North Vancouver) compiled the information for this module. The Langley Environmental Partners Society has field-tested this module extensively and provided considerable input into the revisions.

Project Activity and Purpose

You will collect information about your stream using available watershed maps and data from various sources. Then you will walk the stream to look for important unmapped features such as small tributaries and wetlands, habitat problems, and opportunities for habitat improvement. This introductory survey will help you focus your conservation and rehabilitation efforts. It also will help you decide where to establish monitoring sites for the more detailed assessments described in other modules.

Introduction

Stream ecosystems are complex interactions among plants, animals, and their physical environment. Human activities in watersheds make these systems even more complex. This module provides a starting point for studying your stream. It tells you how to find existing information, identify watershed boundaries, and then work on site to identify and map problem areas in your stream. Land and water use activities upstream and on surrounding slopes provide clues about problems you may discover in your stream.

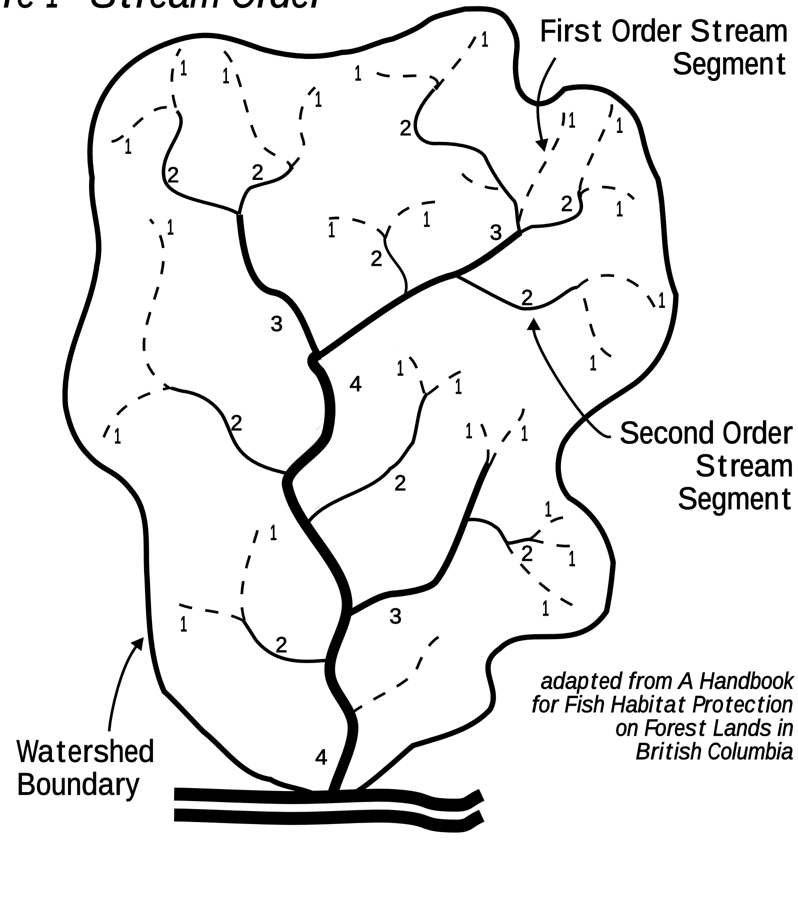
Maps and existing data provide useful background information. Information about many streams in the province is available in the Stream Inventory Summary System (SISS) database. The Department of Fisheries and Oceans (DFO) and Ministry of Environment, Lands, and Parks (WLAP) have data on physical characteristics and fish productivity in the SISS database.

A watershed consists of a network of tributaries or stream segments that feed into a main channel. Surveying an entire watershed may seem like an enormous task. One good way to organize information about a watershed is to break it into smaller stream segments. Your group can survey and monitor one segment in your watershed, and other groups can survey other segments.

One way to divide a watershed into smaller stream segments is to use the stream order system (Figure 1). Headwater tributaries are first order stream segments. When two segments of the same order merge, they form a higher order stream. Two first order streams merge into a second order stream segment; two second order streams merge into a third order stream segment, and so on. Large rivers often are sixth order or higher.

The order number for the main stream is related to the number and size of segments in the watershed. Natural geological processes and human disturbances such as construction of drainage canals and

Figure 1   Stream Order



channelization of large streams will alter the relationships between different segments.

Different segments of a stream and different streams can be compared using the stream order system. Stream order influences the physical and biological characteristics of a stream segment. For example, first order segments often are small and well-shaded, whereas downstream segments are larger, slower- flowing, and more exposed to the sun. Different species of plants and animals thrive in each of these environments.

Project Guidance and Approval

You need no formal project approval. Contact your Community Advisor, before you start the survey, for information on streams already surveyed. He or she can tell you how to gather existing data and share results with other interested groups and agencies. A Streamkeepers certification course offers training for this module.

Level of Effort

At least two people are required for a stream survey. One person monitors locations and takes measurements and the other records the information. It can take half a day to survey one stream segment and weeks to survey an entire watershed. If you decide to use several teams, make sure they are trained to use consistent methods.

Time of Year and Working Conditions

You can collect data at any time of year. However, the field survey is best done twice a year: during the high flow period (winter in coastal areas, spring freshet in interior areas) and during the late summer low flow period. Habitat problems are easiest to detect at these times of year.

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

2 copies of a 1:20,000 scale TRIM map (topographic)
1 copy of a 1:50,000 scale NTS map (topographic)

pencils	paper
clipboard	data sheet
first aid kit	hip chain
thermometer	waders or boots

tape measure (black numbers on yellow) for turbidity
camera (35 mm with wide angle lens is best)
wading staff (marked in cm)
map wheel or non-stretch string

optional:
compass
binoculars

Procedure - Before You Go to the Field

Step 1. REVIEW EXISTING DATA

Information about your stream or watershed may be available from various sources. Contact your Community Advisor or local DFO or WLAP office for access to the Stream Inventory Summary System (SISS) database. It contains detailed information about larger streams in the province, but often has little or no information about smaller streams and tributaries. The database describes stream names, locations, watershed codes, physical characteristics (gradient, flow), and fish productivity (species, escapement, life history timing, potential production). It also provides information on physical and water quality problems, obstructions to fish migration, enhancement or management activities, land use, water use, and previous studies.

Contact Water Survey of Canada (Environment Canada) for the water quality and stream flow data they have collected at established sampling stations on streams in the province. Municipal or regional district offices may have data on local streams. Long-term residents are good sources of historical information. Also check the Streamkeepers Database for data collected by other Streamkeeper groups in your area. The current address is in the Handbook.

Step 2. OBTAIN MAPS AND AERIAL PHOTOGRAPHS

Maps are useful for planning the survey and recording any new information you collect. Use a large scale topographic map, such as a 1:20,000 scale Terrain Resource Information Management (TRIM) map. Appendix 1 contains information on ordering the right TRIM map for your stream. Order two copies to use as working and good copies. If you are working on a large stream, order all the TRIM maps that cover the watershed. Also, order a 1:50,000 National Topographic Series (NTS) map to provide a bigger perspective of the land around the watershed. NTS maps are available at most map stores.

Aerial photos are taken at altitudes ranging from very low level (<1:11,000 scale) to high level (1:90,000 scale). When you order TRIM maps, you can order a set of aerial photos as well. The Stream Inventory Manual (Anon., 1994) provides advice on how to interpret aerial photos.

Step 3. ESTABLISH WATERSHED BOUNDARIES, WATERSHED CODES, AND STREAM ORDERS

Map the **watershed boundaries** using a 1:20,000 TRIM map and the following procedure taken from the Streamkeepers Field Guide (Adopt-a-Stream, 1994):

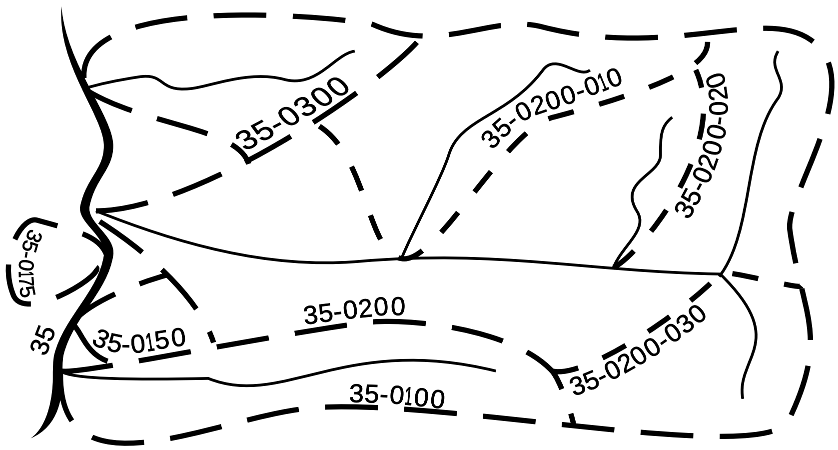
1. Locate the outlet point of your watershed. It will be the lowest elevation in your watershed and in most cases will be the mouth of your stream.
2. Trace the stream from its mouth to its tributaries. Using a pencil, make marks along the stream and its tributaries every inch (2.5 cm) or so, dividing them into one inch (2.5 cm) sections.
3. At each mark, draw a line perpendicular to the stream or tributary, running out in both directions.
4. Follow each line out from the stream or tributary until you reach a maximum elevation. Mark all these high elevation points with an "X."
5. Locate the beginning of each tributary, or the place where the stream's water originates. Extend a line out from each of these locations, in the direction opposite to the flow of water. Follow these lines until you reach a maximum elevation. Mark the high points with an "X."
6. Connect all the high points with a line following the highest elevations. The result of "connecting the dots" will be the boundaries of your watershed. Double check your boundaries to ensure accuracy, and then mark the boundaries with a pen or magic marker.

You can add other information to the map about land and water use in the watershed. If there is too much information to show on one map, use several maps or acetate overlays to present data separately on forestry activities, urban development zones, agricultural land, and so on. If you discover a problem during your stream survey, this information may help you find the cause.

Often, two streams in the province have the same name. The **watershed code** system was developed to avoid confusion. Watershed codes have been assigned for most streams and tributaries large enough to appear on a 1:50,000 NTS map. Codes are listed in the SISS catalogue, available at DFO offices, and the Watershed Code Dictionary, available at WLAP offices. Record the codes on the TRIM map next to your study stream and its tributaries and on the Data Sheet, Stream Location and Conditions Section. Other people will find the code useful when trying to locate your stream. If you do not find your stream in the SISS database, assign watershed codes following the procedure outlined in Appendix 2.

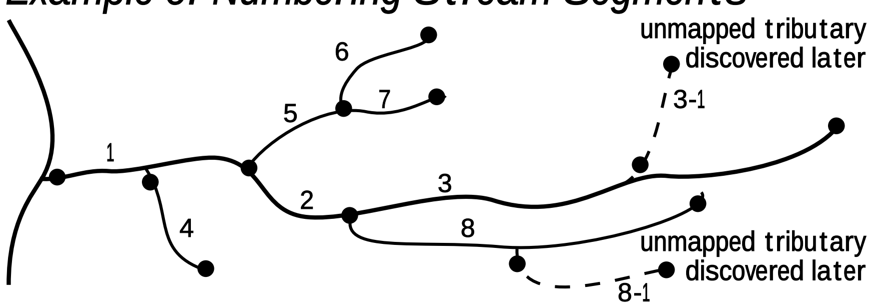
Figure 2
Watershed Code Example

source: Shera and Grant 1980



When you consider the stream network in terms of **stream order**, you can easily divide the stream into **segments** for further study (Figures 1 and 3). Use a 1:20,000 scale map to work out stream order. Map scale affects the ordering of the stream network, since the number of identifiable small tributaries changes with the map scale used. Colour code all the stream segments on your map. Use one colour for all first order segments, another for all second order segments, and so on. You can number these segments, to help you keep track of them and organize your data. Since there is no conventional system for keeping track of stream segments, we suggest the method shown in Figure 3. Number the mainstem segments first, from the mouth of the stream to its headwaters, then number the tributaries. Use the additional system (e.g., 3-1,8-1) when you add newly discovered tributaries to your map.

Figure 3
Example of Numbering Stream Segments



Procedure - Field Survey

Start your stream survey at the mouth of the stream, or the lower end of the segment you plan to survey. Survey each stream segment separately and use a new Stream Location and Conditions Data Sheet for each segment. Take along the field copy of the 1:20,000 TRIM map.

Step 4. COMPLETE THE STREAM LOCATION AND CONDITIONS DATA SHEET, THEN WALK THE STREAM

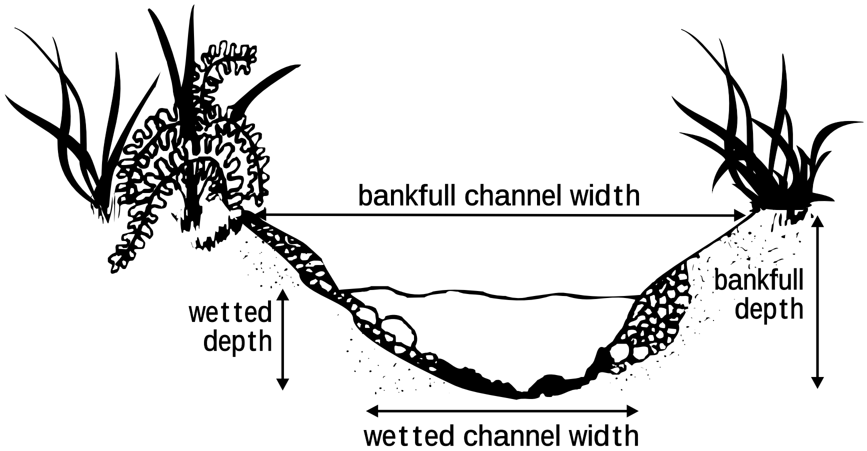
Before starting your walk, fill in the data sheet with the stream name, town, watershed code, stream segment number, stream length surveyed, people involved, and date. Record the relevant map sheet number, map type (e.g., TRIM), and map scale for the survey start and end points. Note the weather and stream conditions. You can use this information later when you interpret the results.

Clearly describe the downstream start point and upstream end point of the stream segment. Give precise directions to these points so that someone else can find them. Provide distances from known landmarks on the stream, such as bridge crossings. If you cannot survey the entire segment in one day, establish another start and end point within the segment.

Measure the channel dimensions at a riffle that typifies the average dimensions. The bankfull channel is the active stream channel, formed during annual floods (Figure 4). Its 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 of changing runoff patterns in the watershed. You may see permanent reminders left by receding flood waters. These mark the boundaries of the bankfull channel. Sometimes the boundaries 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 height of frequent inundation and are formed by sediment or lichen).

Figure 4
Bankfull and Wetted Channel Dimensions



Stretch a measuring tape across the channel at the top of the bankfull channel, making sure it is level and perpendicular to the stream flow. Measure the bankfull channel width, then the wetted channel width. Measure bankfull and wetted depth in the deepest part of the channel. Record the information on the Stream Location and Conditions data sheet. Measure air and water temperatures. Leave the thermometer for at least two minutes before taking the reading.

Measure water turbidity in a deep pool. Use a standard household tape measure (black numbers on yellow) and lower the tape into the water until you cannot see the number "one" at the end of the tape. Subtract 1 from the number showing at the water surface. Record this turbidity reading on the data sheet. If the water is clear to the bottom of the pool, record turbidity as "greater than ... depth."

As you walk upstream, use a **hip chain** to measure the exact location of stream features upstream of the stream segment start point. A hip chain is worn at the waist and is a plastic or leather case containing biodegradable thread. It measures long distances by feeding the thread through a calibrated counter. Attach the string to an object at the start point. Set the counter to zero and start walking. To get the most accurate measurement, walk the bank parallel to the centre-line of the stream. Avoid crossing from one bank to the other. When you wish to record the location of a particular feature, such as an outfall pipe, read the distance traveled off the counter. Attach the string again and reset the counter at landmarks along the stream, such as bridge crossings and tributary confluences. This helps avoid compounding small errors when measuring long distances.

Confirm the location of any details already included on the TRIM map. Look for features that are not on the map, including:

- unmapped tributaries, wetlands, swamps, backwaters
- intermittent channels, ditches
- unmapped landmarks, such as hydro or pipeline crossings
- stream banks with little or no native vegetation
- artificially stabilized stream banks (e.g., large rocks, timber, concrete)
- areas used for garbage disposal
- areas where livestock can enter the stream
- pipe outfalls
- barriers to fish migration
- eroding stream banks, collapsing banks, active slide areas
- water intake pipes and diversions (screens need openings less than 2.5 mm to be effective fish barriers)
- active discharges of pollutants

Describe any pollution or habitat problems in detail. Mention the extent, severity and source of discharges, the type and size of physical barriers, and details of bank degradation. Step 5 describes how to record this information. Appendix 3 describes these problems and their impacts more fully and tells you what type of information to collect for each type of feature.

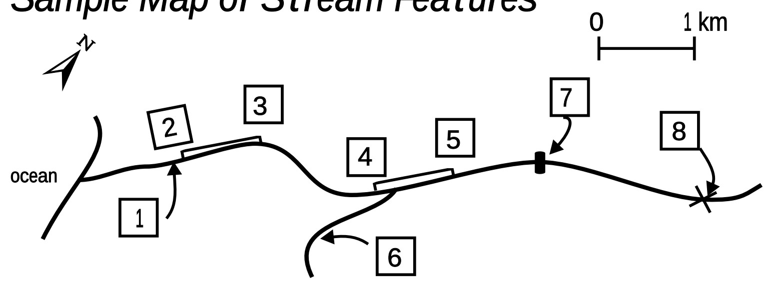
Step 5. COMPLETE THE FIELD DATA SHEET

To save work and keep your data sheets complete, record the general survey information at the top of the Stream Reconnaissance Field Data Sheet, then make photocopies. Use a fresh copy for each feature. As well as the field data sheet, there is a Stream Feature Checklist, to help you briefly describe the feature.

Assign a unique number to each feature you observe, starting with the most downstream feature (Figure 5). Use these numbers to label a feature, locate it on the map, then later retrieve the appropriate data sheet. Record the feature number and a brief description on the field data sheet. Record the location of the feature as metres upstream from the segment start point. If the feature extends along the length of a stream, record the location of the downstream end of the feature. Also, record the appropriate measurements as described in Appendix 3. Note the predominant land use on both sides of the stream near the feature. Add any comments on observable water quality problems, and recommended actions.

Photograph the feature with someone standing in the photo to provide scale. Include in the foreground a piece of paper showing stream name, feature, date, and location. Record the photo frame number on the field data sheet.

Sample Map of Stream Features



1 Cattle access

2 Downstream limit of no riparian vegetation

3 Upstream limit of no riparian vegetation

4 Downstream limit of eroding streambank

5 Upstream limit of eroding streambank

6 Unmapped tributary

7 Industrial discharge pipe

8 Fish Barrier

Step 6. TRANSCRIBE FIELD DATA AND ASSESS STREAM CONDITIONS

At home, copy the stream feature numbers from the field data sheets onto your good copy of the TRIM map. Use a map wheel or nonstretch string to transfer distances onto the map.

You, or other Streamkeeper groups in your watershed, can conduct long-term monitoring programs or carry out more detailed assessments of stream health at particular locations or reference sites. The completed introductory survey will give you a good idea of where to establish these sites. Modules 2, 3, and 4 describe in detail the procedures used to survey and assess habitat, water quality, and benthic invertebrates.

Collecting, Reporting and Evaluating Information

Send the data to the Streamkeepers Database. Streamkeepers throughout the province can share the data you provide. The map, data sheets, and notes on habitat problems establish a good record of the watershed. You can use this information to identify specific habitat problems and potential restoration projects. Presenting the data at local land use hearings may help protect sensitive stream environments from future development.

Survey data will help you interpret the results collected in other project modules. For example, water quality testing may show high turbidity and water temperatures at a reference site. Perhaps you can relate these findings to a section of eroding stream bank mapped in your introductory stream survey.

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.

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Adopt-A-Stream Foundation
P.O. Box 5558
Everett, WA 98206

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Water Division, EPA Region 10
1200 Sixth Avenue
Seattle, WA 98101

APPENDIX 1 Ordering TRIM Maps

APPENDIX 2 Watershed Code System

APPENDIX 3 Identifying and Descibing Unmapped Features

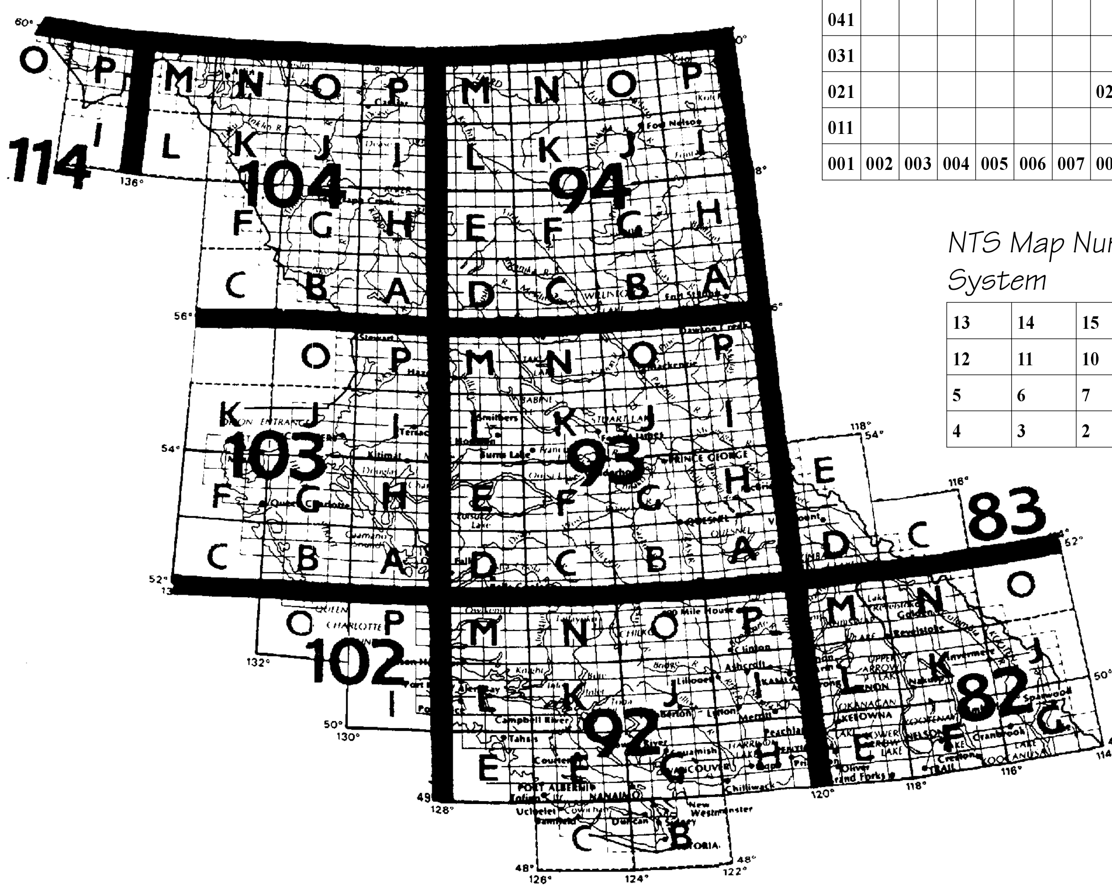
APPENDIX 1 Ordering TRIM Maps

Order a 1:50,000 National Topographic Series (NTS) map. Figure 6 is an index to these maps. Find the index number and letter corresponding to your area of interest. Each lettered box is divided into 16 smaller boxes representing the 1:50,000 scale maps available for that area. For example, if you are interested in the 1:50,000 NTS map for a stream in Prince George, you would order map number 93 G/15.

The same numbering system is used when ordering 1:20,000 scale Terrain Resource Inventory Maps (TRIM maps), but each lettered box is divided into 100 smaller boxes rather than 16. Figure 6 shows an example from area 82 F, in southeastern British Columbia. If you have difficulty determining which small box your stream is in, you can order a 17" by 22" index map for the letter block area. These provide much more detail about the terrain covered by each of the 100 smaller boxes within the letter box.

TRIM Maps are available from your local Government Agent. Call 1-800-663-7867 to find one in your area.

Figure 6 NTS Map



TRIM Map Numbering System

091	092	093	094	095	096	097	098	099	100
081									090
071									080
061									070
051									060
041									050
031									040
021							028		030
011									020
001	002	003	004	005	006	007	008	009	010

NTS Map Numbering System

13	14	15	16
12	11	10	9
5	6	7	8
4	3	2	1

APPENDIX 2 Watershed Code System

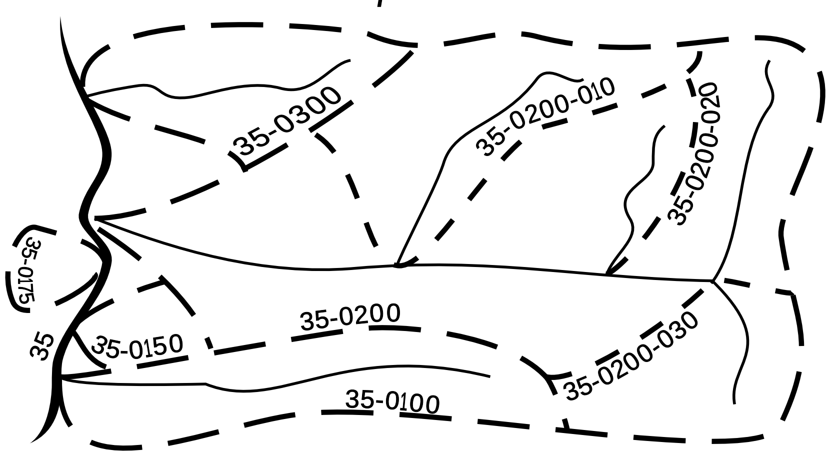
Often, two streams in the province have the same name. The provincial government developed the watershed code system to avoid confusion. Most streams large enough to appear on a 1:50,000 scale NTS map have been assigned watershed codes. The Stream Inventory Summary System (SISS) database and the Watershed Code Dictionary, available at DFO and WLAP offices, list watershed codes. Use the following procedure to assign a code if your stream does not have one.

The coding system uses a hierarchical approach to numbering large watersheds, sub-watersheds, and smaller tributary watersheds. Figure 7 shows the numbering system as it applies to hypothetical river 35, a major watershed. Sub-watersheds and tributaries are numbered sequentially in an upstream direction from the mouth of the main river.

Most watersheds have been assigned a 21-digit number, which is broken down into two, four, and three digit groups (Figure 7). The example is for major watershed 34, the Lower Kootenay River. Within the stream network, each group of digits refers to a successively smaller tributary watershed. An uncoded watershed lies within an already coded, larger watershed. You need to find out where it lies within the coding hierarchy before you can assign it a code. Uncoded watersheds are assigned codes by altering the underlined zeros in the example shown in Figure 8.

Figure 7
Watershed Code Example

source: Shera and Grant 1980



35-0175 and 35-0150 are previously uncoded sub-watersheds

Figure 8

The general format is

__ ____ ___ ___ ___ ___ ___

34	Lower Kootenay River
34-0700	Slocan River
34-0700-110	Little Slocan River
34-0700-110-030	Koch Creek
34-0700-110-030-040	Grissley Creek
34-0700-110-030-040-020	Greasybill Creek
34-0700-110-030-040-020-010	North Greasybill Creek

34 The two digit group designates a major watershed. All major watersheds in the province have an assigned code. Your stream flows within one of these watersheds.

0700 The four digit group refers to sub-watersheds. The largest sub-watersheds are assigned a number between 0100 and 9900, by 100's. For example, Figure 7 shows sub-watershed 35-0200 upstream of 35-0100 and downstream of 35-0300. All three tributaries enter watershed 35 directly. The number assigned does not reflect stream discharge or watershed size.

Between these sub-watersheds, up to 99 lesser sub-watersheds can be added, using the underlined positions of the four digit group shown in Figure 8. These numbers apply to other tributaries that enter the main river directly. Their assigned number reflects geographic and numerical location in relation to already numbered sub-watersheds. In Figure 7, sub-watershed 35-0150 enters watershed 35 about half way between sub-watersheds 35-0100 and 35-0200. Sub-watershed 35-0175 enters watershed 35 about three-quarters of the distance between sub-watersheds 35-0100 and 35-0200.

110 The first three digit group refers to a minor watershed within the sub-watershed. Again, up to 99 of the largest minor watersheds are assigned a number between 010 and 990, by 10's. In Figure 7, minor watershed 35-0200-020 enters sub-watershed 35-0200 upstream of 35-0200-010 and downstream of 35-0200-030.

Between each numbered minor watershed, there is room to add up to nine lesser minor watersheds. The underlined position shown in Figure 8 for the first three digit group is used. As with sub-watersheds, the last digit reflects relative position.

Within each minor watershed, up to four more levels of lesser watersheds within watersheds can be coded using three digit groups. The numbering system follows the same procedure used for minor and sub-watersheds. For example, 34-0700-110-030-040-020-010 refers to North Greasybill Creek, a very small intermittent tributary of Greasybill Creek.

When you walk the stream, you may find many features not previously recorded. This Appendix describes how to identify and map these features and impacts.

APPENDIX 3 *(revised March 2000)* Module 1

Identifying and Describing Features

Note whether feature is on the left or right bank (facing *downstream*)

Stream Feature Description Checklist

BANK EROSION
slumping bank, undercut, upslope slide, other
Measure length, height and slope.

GARBAGE
commercial/industrial source, residential/recreational source, other
Measure length, type and quantity.

SIDE CHANNEL
dry channel, flowing channel, other
Measure length, depth and width of wetted area. Take temperature readings.

LACK OF RIPARIAN VEGETATION
human induced, natural phenomenon, other
Measure length, width and slope.

WETLAND
bogs, marshes, swamp, pond, other
Measure length, depth and width. Take temperature readings.

WATER BODY
Tributary, wetland, ditch, other
Measure bankfull and wetted channel widths and depths, (Optional: compass bearing 10m upstream of confluence, and 25m or at major bends. Measure gradient.)
In water body - take temperature readings 2m upstream of confluence.
In main stem - take temperature readings 2m upstream and 2m downstream of confluence.

ENHANCEMENT
log/rock weir, fishway
Measure length and width, and height of structure to fish access, plunge pool depth.

ENHANCEMENT (con't)
riparian planting, woody debris placement, spawning gravel placement
Measure length and width
incubation box/hatchery
Measure length, width and height
constructed pond/side channel
Measure length, width and depth. Take temperature.
boulder cluster
Measure length and width and approximate size of boulders.

ARTIFICIAL MODIFICATION
dam
Measure length, width and height of structure, and depth of plunge pool.
dredging, channelization, retaining wall, instream crossing, fence
Measure length and width.
bridge
Measure length and width, height from substrate to bridge deck, depth of water.
culvert
Measure height/width or diameter - height from substrate to bottom of structure - if flowing, temperature in flow. In main stem - 2m upstream and 2m downstream.
rip-rap
Measure length, width, slope and approximate size of material.
other
Measure length, width and height

APPENDIX 3 *(revised March 2000)* Module 1

OBSTRUCTION

culvert

Measure height/width or diameter - height from substrate to bottom of structure, depth of water at base - if flowing, temperature in flow. In main stem - 2m upstream and 2m downstream.

log jam

Measure length, width and vertical height from substrate to top of jam.

dam

Measure length, width and vertical height from substrate to top, depth of water at base.

beaver dam

Measure length, width and vertical height from substrate to top, depth of water at base.

falls, cascade,canyon

Measure length, width and vertical height and slope, depth of water at base.

fence

Measure length, vertical height, height from substrate to bottom of fence, depth of water at base.

bridge

Measure length and width, height from substrate to bridge deck, depth of water.

DISCHARGE PIPE

septic effluent

Measure height/width/diameter. Height from substrate to bottom of pipe, depth of water.
DO NOT TOUCH!

industrial outfall

Measure height/width/diameter. Height from substrate to bottom of pipe, depth of water.
DO NOT TOUCH!

DISCHARGE PIPE (con't)

tile drain

Measure height/width/diameter. Height from substrate to bottom of pipe, depth of water. If discharging, take temperature in flow, then in main stem, 2m upstream and 2m downstream.

storm drain

Measure height/width/diameter. Height from substrate to bottom of pipe, depth of water. If discharging, take temperature in flow, then in main stem, 2m upstream and 2m downstream.

trench

Measure length/height/width.

If discharging, take temperature in flow, then in main stem, 2m upstream and 2m downstream.

LIVESTOCK ACCESS

streamside grazing

livestock crossing

Measure affected length and width of stream.

WATER WITHDRAWAL

screened intake

Measure length and width of intake and mesh size.

unscreened intake

Measure length and width of intake

When you walk the stream, you may find features not previously recorded. This Appendix describes how to identify and map these features.

Bank Erosion

Background: Eroded areas of the stream look raw. The soil has slipped down the bank, and either entered or threatens to enter the stream channel. Erosion occurs at several kinds of places, such as undercut banks (the current erodes the soil below the original top of the bank), slumping banks (the bank slumps into the stream), or oxbows (a stream bends sharply and current flows straight ahead into the bend).

Action: Measure the length, height and slope of affected stream bank. Note whether erosion affects the left or right bank (facing downstream). Describe the nature of the erosion (undercut or slumping bank, oxbow, etc.) in the comment section of the data sheet.

Garbage

Background: Consider the severity of the damage before identifying garbage as a feature. Only those areas that require a cleanup crew are considered a feature. Remove only human-made material. Leave all natural material in the stream.

Action: Describe the type, quantity, and location of garbage. Measure the length of bank affected and whether the left or right bank (facing downstream) is involved. Look for evidence of the source of the garbage, such as names and addresses on stationary or other items.

Side Channel

Background: Pay special attention to side channels, since they often are not mapped. They provide important fish and wildlife habitat, such as refuge during floods. A side channel is a lateral channel, with the flow running roughly parallel to the main channel. Water enters from the main channel, either seasonally or year-round. The substrate usually is much finer than in the main channel.

Action: Note the location, length, depth, and width of the side channel. Measure length and width of the side channel, and note whether it lies on the left or right bank (facing downstream). Also, note whether the side channel contains water now.

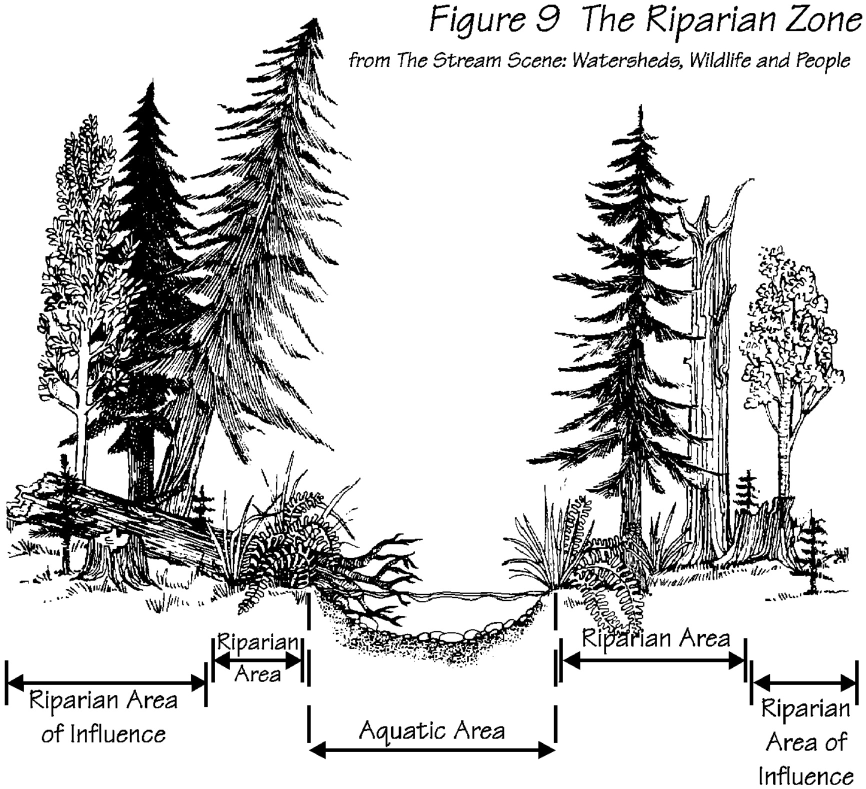
Lack of Riparian Vegetation

Background: Riparian vegetation is the natural ground cover, shrub layer, and tree canopy along the stream bank. Healthy streams have a variety of native species of shrubs and trees (Figure 9).

Action: Measure the length and width of affected stream bank lacking vegetation or landscaped with introduced species or lawns. Measure the slope of the bank lacking riparian vegetation, if appropriate. Note whether the left or right bank (facing downstream) is affected.

Figure 9 The Riparian Zone

from The Stream Scene: Watersheds, Wildlife and People



Wetland

Background: Wetlands are areas inundated with water for part or all of the year. They provide essential habitat for fish and wildlife and moderate the effects of extreme flood or drought conditions. Wetlands may be swamps (contain live or dead trees), bogs (contain mainly Sphagnum moss), ponds (have open areas of water), or marshes (contain mainly emergent vegetation such as reeds, rushes, cattails, and sedges).

Action: Identify the type of wetland. Note the approximate length, width, and depth of the wetland if the map does not show them. Note whether there is a seasonal or year-round connection between the wetland and the stream. Describe any encroachments (harmful disturbances) on the wetland.

Unmapped Waterbody

Background: Some tributaries, wetlands, and ditches may not have been mapped previously. These features are very important to include in the stream survey. You also can use this feature designation if the existing map shows only part of the tributary.

Action: Record the location of the tributary confluence with the mainstem, using the hip chain measurement. Measure both the mainstem and tributary water temperatures a few metres upstream of the confluence.

Optional Action for Unmapped Tributaries: Measure the bankfull and present channel width and depth of the tributary. Take a compass bearing. Have someone stand in the middle of the tributary 10 m upstream and take the bearing from the confluence point to him or her. If the person is out of sight at 10 m, take the reading where he or she disappears. Take a compass bearing every 25 m, or at major bends in the tributary. Measure stream gradient at the same places using a hand level or clinometer (see Module 2, page 14). Include a sketch of the unmapped tributary on the field map.

Action for Unmapped Wetlands: Identify the type of wetland. Accurately measure dimensions and depth of the wetlands. Note whether there is a seasonal or year-round connection between the wetland and the stream. Describe any encroachments (harmful disturbances) to the wetland.

Enhancement

Background: There may be projects along the stream designed to enhance fish resources and habitats. These include added large woody debris, incubation boxes or hatcheries, constructed side channels or ponds, log or rock weirs, riparian plantings, added spawning gravel, fishways, and added clusters of boulders.

Action: Record the type and approximate dimensions of the enhancement work.

Artificial Modification

Background: There may be dams, dredged areas, bridges, channelized areas (linear ditches or streams), culverts, rip rap, retaining walls, instream crossings and other artificial modifications on the stream.

Action: Record the type and dimensions of the modification. Record whether the right or left bank (facing downstream) is affected, where appropriate.

Obstruction

Background: There may be an obstruction on the stream that prevents fish passage for part or all of the year. Fish usually can pass over low falls and inclines up to 1 m high if there is a well-situated plunge pool at the base. The height of the jump should be less than 1.25 times the depth of the plunge pool, to allow fish passage. Other obstructions include culverts, log jams, dams, beaver dams, falls, fences, and bridges. Describe other kinds of obstructions in the comment section of the data sheet.

Action: Identify the type of obstruction. Measure its length, width, height, and slope (Figure 10). Measure the depth of the plunge pool at its base. Note whether the obstruction prevents fish passage under only certain conditions or year-round.

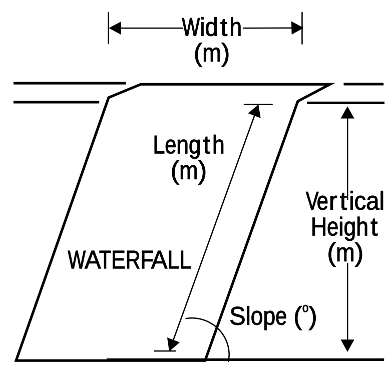


Figure 10
Estimating the Size of a Fish Barrier

Discharge pipe

Background: Pollution and sediment can enter the stream from definite or point sources. You may find septic effluent leaking out of a pipe from a septic tank system (it usually has an unpleasant odour). In agricultural areas you may find tile drainage (used to improve drainage on fields), or trenches (used to divert water or livestock manure to ditches and streams). In urban areas you may find storm drain outlets that direct storm water runoff to a stream. Industrial outfalls or pipes may drain effluent from an industrial site.

Action: Record dimensions of the pipe or trench and its elevation above the stream bed. Describe the pollutant smell, colour, appearance (oily film, sudsy, etc.) if the pipe is discharging actively. DO NOT TOUCH IT!!! Describe whether the pipe is on the left or right bank (facing downstream).

Livestock Access

Background: Livestock that have access to the stream can cause bank erosion, damage fish habitat, and contaminate the water. The most common situations are where livestock graze along unfenced parts of the stream and where livestock cross the stream at a trail crossing or watering ramp.

Action: Measure the affected length and width of the stream, and note whether the left or right bank (facing downstream) is affected. Estimate the number and type of livestock with access to the area.

Water Withdrawal

Background: There may be an intake pipe or diversion ditch that draws water from the stream for agricultural, industrial, or domestic purposes. The pipe or ditch may be screened or unscreened. Screened pipes with openings larger than 2.5 mm and unscreened pipes allow juvenile fish to pass through, resulting in fish mortalities.

Action: Record the dimensions of the intake structure, pipe, or diversion ditch. If possible, find out where the water goes (e.g., to irrigate a nearby field). Note whether the pipe is screened or unscreened. Measure the size of any mesh. Record whether the left or right bank (facing downstream) is affected.

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

Stream Location and Conditions

(use a new data sheet for each stream section surveyed) **Module 1**

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

Survey Start Point (when applicable)

Mapsheet number_______________ Type________________ Scale__________________			
Start Point Location (distance from known stream landmark, directions to start)			
Time:______ Weather	‘ clear ‘ overcast	‘ shower (1-2.5 cm in 24 hr) ‘ storm (>2.5 cm in 24 hr)	‘ snow ‘ rain on snow
Water turbidity (cm visibility) _________________________	Temperature ^oC (leave thermometer 2 min.) air ___________ water _______________		
Measurements taken every _____ m			
Bankfull Channel width __________(m)	Average depth _____________(m)		
Wetted Channel width __________(m)	Average depth _____________(m)		

Survey End Point (when applicable)

Mapsheet number_______________ Type________________ Scale__________________			
End Point Location (distance from known stream landmark)			
Time:______ Weather	‘ clear ‘ overcast	‘ shower (1-2.5 cm in 24 hr) ‘ storm (>2.5 cm in 24 hr)	‘ snow ‘ rain on snow
Water turbidity (cm visibility) _________________________	Temperature ^oC (leave thermometer 2 min.) air ___________ water _______________		
Measurements taken every _____ m			
Bankfull Channel width __________(m)	Average depth _____________(m)		
Wetted Channel width __________(m)	Average depth _____________(m)		

(Start Point) First and Last Measurements taken 0.1 m from streambank edge (End Point)

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 the data to the Streamkeepers Database

Stream Reconnaissance Field Data Sheet

. . . Additional Feature Information **Module 1**

Stream Name/Nearest Town:	Date
	Watershed code
Organization Name:	
Contact Name:	Phone #
Stream Segment #	
Stream Section #	

Feature Information

Feature #	Photo #	*m* upstream of last feature	Feature Description and Size (see App. 3)	Stream-bank (L or R)	Adjacent Land Use *	Actions/Comments/ Water Quality Concerns

* *Adjacent Land Use Codes:* **U***ndisturbed,* **A***griculture,* **F***orestry,* **R***esidential,* **P***arks,* **C***ommercial,* **I***ndustrial*

Note whether feature is on the left or right bank (facing *downstream*)

Page ____ of ____

send the data to the Streamkeepers Database

Stream Reconnaissance Field Data Sheet

Feature Information con't **Module 1**

Feature #	Photo #	*m* upstream of last feature	Feature Description and Size (see App. 3)	Stream-bank (L or R)	Adjacent Land Use *	Actions/Comments/ Water Quality Concerns

* *Adjacent Land Use Codes:* **U***ndisturbed,* **A***griculture,* **F***orestry,* **R***esidential,* **P***arks,* **C***ommercial,* **I***ndustrial*

General comments on this section of the stream

Page ____ of ____

APPENDIX 3 *(revised)* Module 1

Identifying and Describing Features

Note whether feature is on the left or right bank (facing *downstream*)

Stream Feature Description Checklist

BANK EROSION
slumping bank, undercut, upslope slide, other
- Measure length, height and slope.

GARBAGE
commercial/industrial source, residential/recreational source, other
- Measure length, type and quantity.

SIDE CHANNEL
dry channel, flowing channel, other
- Measure length, depth and width of wetted area. Take temperature readings.

LACK OF RIPARIAN VEGETATION
human induced, natural phenomenon, other
- Measure length, width and slope.

WETLAND
bogs, marshes, swamp, pond, other
- Measure length, depth and width. Take temperature readings.

WATER BODY
Tributary, wetland, ditch, other
- Measure bankfull and wetted channel widths and depths, (Optional: compass bearing 10m upstream of confluence, and 25m or at major bends. Measure gradient.)
- In water body - take temperature readings 2m upstream of confluence.
- In main stem - take temperature readings 2m upstream and 2m downstream of confluence.

ENHANCEMENT
log/rock weir, fishway
- Measure length and width, and height of structure to fish access, plunge pool depth.

ENHANCEMENT (con't)
riparian planting, woody debris placement, spawning gravel placement
- Measure length and width

incubation box/hatchery
- Measure length, width and height

constructed pond/side channel
- Measure length, width and depth. Take temperature.

boulder cluster
- Measure length and width and approximate size of boulders.

ARTIFICIAL MODIFICATION
dam
- Measure length, width and height of structure, and depth of plunge pool.

dredging, channelization, retaining wall, instream crossing, fence
- Measure length and width.

bridge
- Measure length and width, height from substrate to bridge deck, depth of water.

culvert
- Measure height/width or diameter - height from substrate to bottom of structure - if flowing, temperature in flow. In main stem - 2m upstream and 2m downstream.

rip-rap
- Measure length, width, slope and approximate size of material.

other
- Measure length, width and height

APPENDIX 3 *(revised)* Module 1

OBSTRUCTION

culvert

- Measure height/width or diameter - height from substrate to bottom of structure, depth of water at base - if flowing, temperature in flow. In main stem - 2m upstream and 2m downstream.

log jam

- Measure length, width and vertical height from substrate to top of jam.

dam

- Measure length, width and vertical height from substrate to top, depth of water at base.

beaver dam

- Measure length, width and vertical height from substrate to top, depth of water at base.

falls, cascade,canyon

- Measure length, width and vertical height and slope, depth of water at base.

fence

- Measure length, vertical height, height from substrate to bottom of fence, depth of water at base.

bridge

- Measure length and width, height from substrate to bridge deck, depth of water.

DISCHARGE PIPE

septic effluent

- Measure height/width/diameter. Height from substrate to bottom of pipe, depth of water.
- DO NOT TOUCH!

industrial outfall

- Measure height/width/diameter. Height from substrate to bottom of pipe, depth of water.
- DO NOT TOUCH!

DISCHARGE PIPE (con't)

tile drain

- Measure height/width/diameter. Height from substrate to bottom of pipe, depth of water. If discharging, take temperature in flow, then in main stem, 2m upstream and 2m downstream.

storm drain

- Measure height/width/diameter. Height from substrate to bottom of pipe, depth of water. If discharging, take temperature in flow, then in main stem, 2m upstream and 2m downstream.

trench

- Measure length/height/width.
- If discharging, take temperature in flow, then in main stem, 2m upstream and 2m downstream.

LIVESTOCK ACCESS

streamside grazing

livestock crossing

- Measure affected length and width of stream.

WATER WITHDRAWAL

screened intake

- Measure length and width of intake and mesh size.

unscreened intake

- Measure length and width of intake.