Waterways Unit
Department of Natural Resources and Environment
(Victoria)

AN INDEX OF STREAM CONDITION: FIELD MANUAL

April 1999

An index of stream condition: Field manual (April 1999)

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This manual is based on and supercedes the ISC *User's Manual* (ID&A Pty. Ltd. and CEAH, 1997).

Acknowledgements are provided in the accompanying *Reference Manual (second edition).*

Other publications in this series:

- Ladson, A.R., and White, L.J., 1999, *An index of stream condition: Reference manual (second edition),* Department of Natural Resources and Environment, Melbourne, April 1999.
- White, L.J., and Ladson, A.R., 1999, *An index of stream condition: Manual for catchment manager's,* Department of Natural Resources and Environment, Melbourne, April 1999.
- White, L.J., and Ladson, A.R., 1999, *An index of stream condition: User's manual (second edition),* Department of Natural Resources and Environment, Melbourne (in press - due for release in August 1999).

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1. INTRODUCTION

The target audience for this *Field manual* is field data collectors during the 1999 Victoria-wide application of the Index of Stream Condition (ISC). Each Catchment Management Authority (CMA) will select its field data collectors. If you have been selected to collect ISC field data, you will:

- have an important role in the statewide ISC application;
- attend a training course conducted by the Department of Natural Resources and Environment (NRE) on how to collect field data; and
- implement the methodology described in this *Field manual* to correctly and rapidly collect field data.

Field data collectors could be CMA field or office staff, Waterwatch co-ordinators, community representatives, tertiary students, consultants or others. This *Field manual* and the associated training course have been developed to cater for this range of knowledge and experience.

It is assumed that you (the field data collector) have had little exposure to the ISC prior to now. Therefore, in this *Field manual*, you are provided with

- a brief overview of the ISC (section 1.1);
- some preliminary information on field data collection (section 1.2);
- the details of how to collect field data (chapter 2); and
- some aids to assist you during field data collection (the appendices).

This *Field manual* will be discussed in detail during a training course on field data collection conducted by NRE. Positions on this training course will be offered to each CMA. The training course will include demonstrations of how to assess each indicator. You will have the opportunity to collect field data during the training course.

1.1 Overview of the ISC

ISC results will be used:

- for benchmarking stream condition, aiding objective setting and decision making by catchment managers, and judging the long-run effectiveness of waterway management programs; and
- by natural resource managers at local (e.g. CMA implementation groups, Landcare groups), regional (e.g. CMAs), statewide and national levels.

The ISC is a tool for catchment managers, and is intended to be an appropriate balance of cost, speed, accuracy, sensitivity and scientific rigour. The ISC is broad scaled: it will be assessed about every 5 years for reaches typically 10 - 30 km long. It has been developed primarily for rural streams. The ISC will be used to assess the condition of about 910 reaches of streams across Victoria in 1999.

In the ISC there are 5 groups of related indicators (‘sub-indices’) calculated from dimensionless values (‘ratings’) for 19 indicators. These sub-indices are the: Hydrology Sub-index, Physical Form Sub-index, Streamside Zone Sub-index, Water Quality Sub-index and Aquatic Life Sub-index. Each sub-index is scored out of 10. The sub-index and indicator names are given in table 1.1. The primary format for reporting ISC results is a bar chart (see figure 1.1).

Table 1.1 - ISC sub-indices and indicator names (the method to collect data to assess the indicators denoted by * are described in this *Field manual*).

Sub-index	Indicators within sub-index
Hydrology	Amended Annual Proportional Flow Deviation
	Daily flow variation due to change of catchment permeability
	Daily flow variation due to peaking hydro electricity stations
Physical Form	Bank stability*
	Bed stability*
	Impact of artificial barriers on fish migration
	Instream physical habitat*
Streamside Zone	Width of streamside zone*
	Longitudinal continuity*
	Structural intactness*
	Cover of exotic vegetation*
	Regeneration of indigenous woody vegetation*
	Billabong condition
Water Quality	Total phosphorus
	Turbidity
	Electrical conductivity
	Alkalinity / acidity
Aquatic Life	SIGNAL
	AUSRIVAS

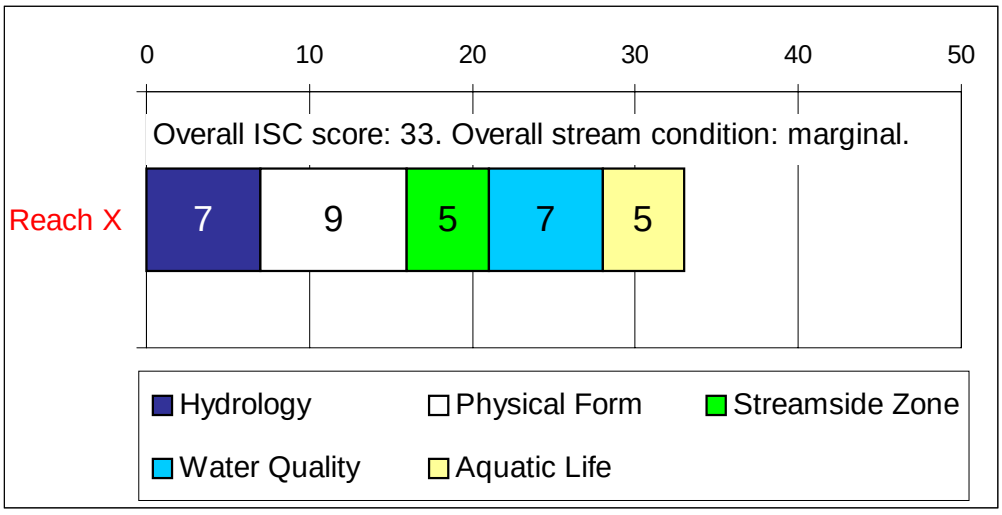


Figure 1.1 - The ISC bar chart

To evaluate 11 of the 19 indicators of the ISC for a reach, recent, suitable and available data will be used from existing programs (e.g. the Victorian Water Quality Monitoring Network, First National Assessment of River Health). For these 11 indicators, if adequate data is available from existing programs, CMAs will require no further data collection. Procedures to access and process this existing data will be included in the *User's manual (second edition),* and is beyond the scope of this *Field manual.*

For the remaining 8 indicators (which are in the Physical Form and Streamside Zone sub-indices - and denoted by * in table 1.1), each CMA will need to undertake its own field data collection program. **The purpose of this *Field manual* is to detail how the field data collection program is to be undertaken**. Indicator ratings generally range from 4 (excellent condition) to 0 (highly disturbed condition) – this manual provides guidance on how you would select the appropriate category.

1.2 Preliminary information on field data collection

The purpose of this *Field manual* is to provide you with all of the information necessary to collect field data to assess the 8 indicators denoted by * in table 1.1 quickly and rapidly. You will take this manual into the field. If you require more information on the ISC, it is available by talking with the CMA's Waterway co-ordinator, or in the accompanying *Reference manual, User's manual (second edition)* or *Manual for catchment manager's.*

The rest of this chapter provides essential background information on:

- some key definitions; and
- the sections of the ISC quality assurance and control program relevant to field data collection.

Before collecting field data, each CMA should develop and implement appropriate occupational, health and safety (OH&S) policies to address any potential hazards.

1.2.1 Some key definitions you need to know

Some definitions that you (as a field data collector) need to know are given below and illustrated on figures 1.2 and 1.3.

- **Reach:** a section of stream typically 10 - 30 km long (minimum length: 5 km, maximum length for lowland streams: 40 km) which is relatively homogeneous with regard to the Hydrology, Physical Form, Water Quality and Aquatic Life sub-indices of the ISC. (There often is so much variability in the streamside zone, even within a few hundred metres, that it is often not possible to pick reaches 10 - 30 km long with a near homogeneous Streamside Zone Sub-index score.) In upland areas, small similar streams are often grouped and treated as one reach. An ISC bar chart (figure 1.1) will be determined for each reach.
- **Measuring site:** a 430 m long section of stream at which field data is collected. Some indicators are assessed over the whole measuring site. Other indicators are assessed at 3 transects within a measuring site.
- **Transect:** a 30 m long section of stream at which some field data is collected. Transect boundaries are perpendicular to the stream. The distance from the centre of a transect to the centre of an adjacent transect within a measuring site is 200 m along the stream bank.

You will be told what indicators are collected over the whole measuring site, and what indicators are collected at transects, within the measuring site in chapter 2 of this *Field manual*.

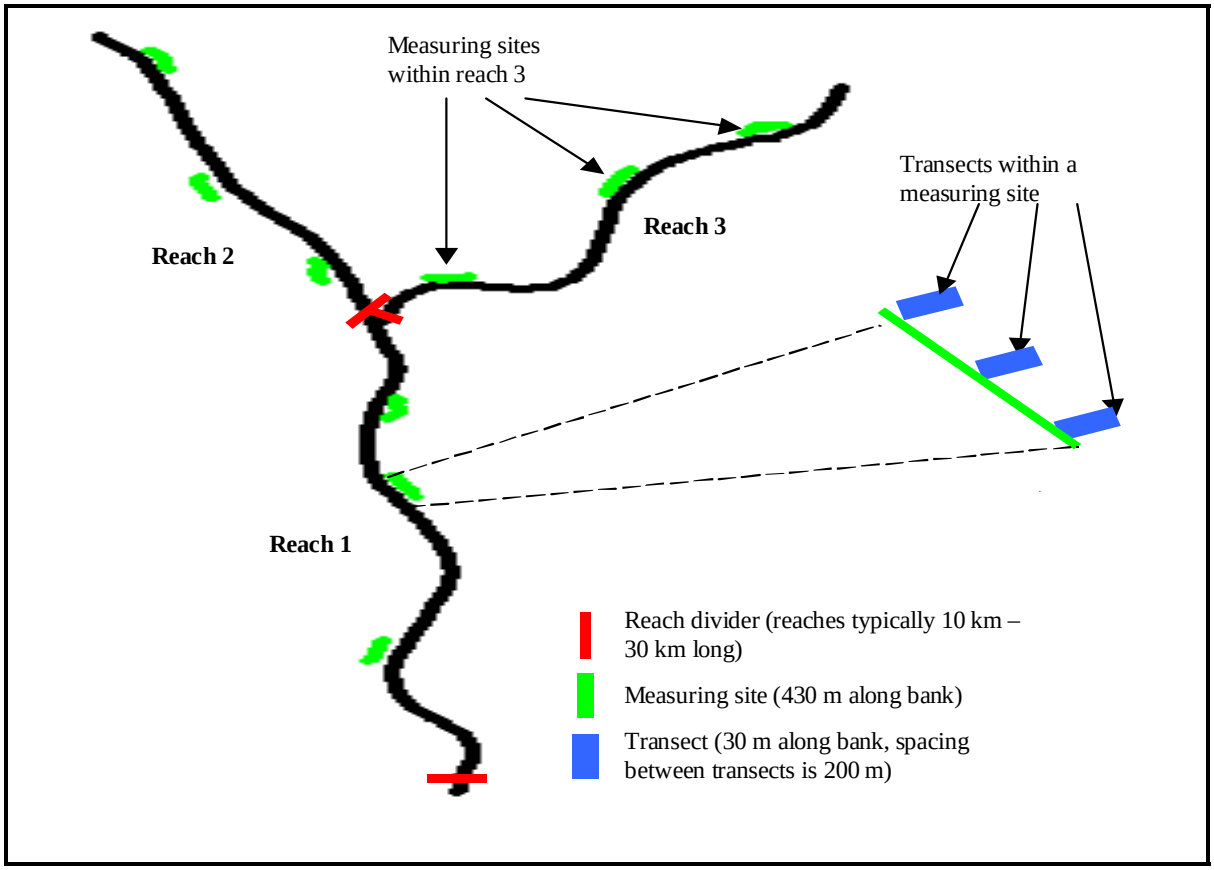


Figure 1.2 - Schematic showing definitions of reach / measuring site / transect

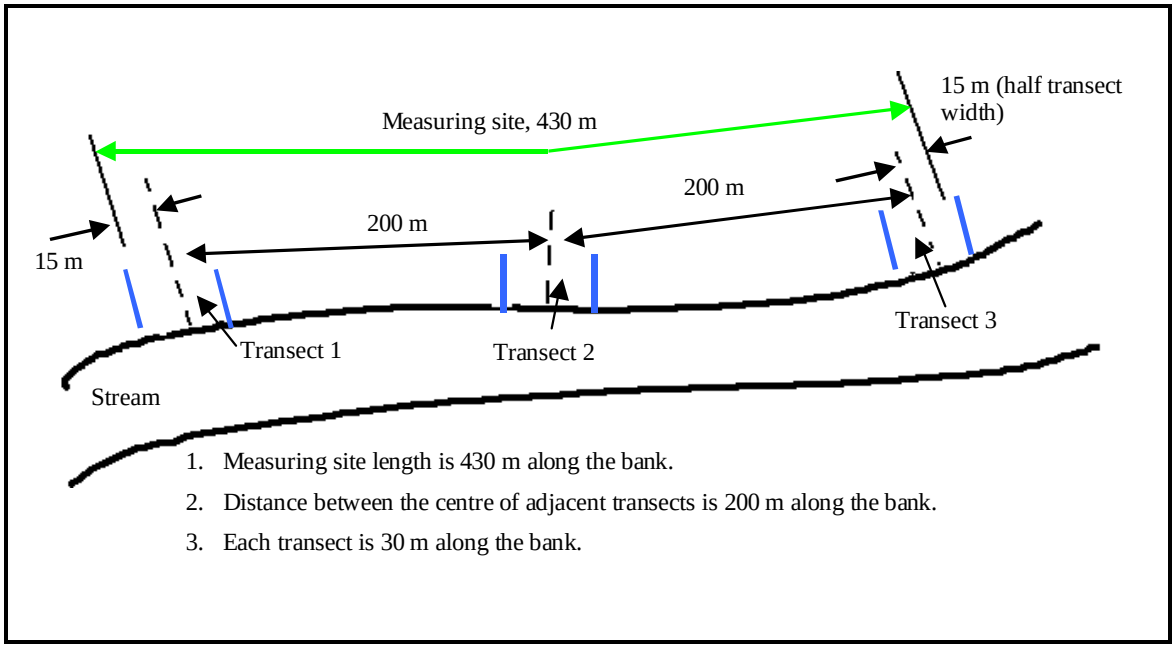


Figure 1.3 - Schematic showing length of a measuring site and each transect

Other definitions that you need to know for field data collection follow.

- **Bank:** the relatively steep part of a stream channel, being above the usual water level.
- **Bar:** a relatively flat, temporary, local feature, typically on the inside of a meander bend where sediment is deposited. Vegetation that grows on a bar is usually stripped during large floods.
- **Continuous vegetation:** in the longitudinal continuity indicator, continuous vegetation has greater than 5 m width of streamside vegetation lateral to the stream with greater than 20% cover.
- **Cover of woody vegetation:** the total projected area from any living woody vegetation onto a horizontal plane. For example, if the projected area by the tree layer was 50% and the projected area of the shrub layer was 20% but was all under the tree layer, then the cover of woody vegetation is 50%. In contrast, if the projected area of tree layer was 50% and the projected area of the shrub layer was 20% but was not underneath the tree layer, then the cover of woody vegetation is 70%.
- **Erosion resistant soils:** (bank stability indicator): soils that do not erode readily either due to large sediment size or high cohesive clay content. Stream banks with high cohesive clay content are capable of standing near vertically, and generally do not slump or rill much.
- **Gap:** (longitudinal continuity indicator). if the woody vegetation is either less than 20% cover and/or less than a width of 5 m for greater than 10 m along the bank, then there is a gap in woody vegetation. Gaps are recorded on the section for the longitudinal continuity indicator on the 'Field data sheet - Measuring site' (copies of the field data sheets are given in figures 2.2 – 2.5, and will be provided at the training course).
- **Ground layer:** plants without woody (brown) stems (e.g. sedges, reeds, and grasses).
- **Large woody debris / snag:** dead or living part of tree (ie. branch or root system) that has a maximum diameter at least 0.1 m, is greater than 1 m in length and is at least partially immersed in a stream.
- **Lowland reaches:** are low in gradient, and the flow velocity is on average low. Lowland streams often have depositional features. Some lowland streams are tidal. Lowland streams typically meander across broad (greater than 1 km wide) alluvial or coastal floodplains.
- **Regeneration:** immature woody plants that are under 1 m high.
- **Shrub layer:** woody (brown stemmed) plants less than 5 m tall, frequently with many stems arising at or near the base (e.g. a eucalyptus tree 3 m tall, blackberry 1 m tall).
- **Tree layer:** woody plants greater than 5 m tall, usually with a single stem (e.g. a eucalyptus tree 30 m tall, a willow tree 5.5 m tall).
- **Upland reaches:** have moderate or high gradient. Upland streams tend to be either cascading or have pools and riffles. The bed sediment in upland streams is usually coarser than sand. There is usually little deposition of fine sediment in upland reaches. There are normally erosional features upland streams.
- **Verge:** the area commencing at the top of the bank and extending to a clear land-use change (e.g. farmland, road reserve).
- **>:** greater than.
- **<:** less than.

A more detailed glossary of terms used in the ISC is provided in both the *Reference Manual* and *User's manual (second edition).*

1.2.2 Why it is critical that you collect accurate field data

Collecting accurate field data is critical!! If the data that is used to evaluate the ISC is incorrect, then it is likely that natural resource managers will make incorrect decisions, and hence scarce funding may be wasted. **Please make a big effort to do a great job!!** Some good practice during field data collection is highlighted in box 1.1.

Box 1.1 - Good practice during field data collection

Good practice during field data collection includes you:

- obtaining and using the skills to measure an indicator through training and thorough reading of this *Field manual*;
- going to the right location of a measuring site;
- inspecting each measuring site and transect adequately;
- correctly measuring distance, and in particular measuring parallel to the stream when assessing the longitudinal continuity indicator;
- when assessing indicators, referring frequently to the reference photographs and schematics in this *Field manual*;
- ensuring that you agree with other members of your data collection team on each indicator rating;
- crossing the correct checkboxes for each indicator;
- crossing only one checkbox, so that each indicator rating selected is clear;
- asking the CMA Waterway co-ordinator if you have any questions;
- using the guidelines for taking photographs in box 2.18;
- leaving gates how you found them;
- liaising with adjacent landholders; and
- implementing OH&S policies of the CMA.

To ensure that ISC results will be satisfactory for their intended use, an ISC 'Quality assurance and control plan' has been developed. It will be included in the forthcoming *User's manual (second edition)*. It includes some measures to assist you to collect accurate data, including those listed in box 1.2.

Please report any difficulties in collecting ISC field data on the form titled 'Report on difficulties when applying the ISC, and remedial actions taken' - which is included in appendix 4 of this *Field manual*. Ensure that a copy of each completed form is forwarded to NRE on conclusion of field data collection.

During field data collection, do not hesitate to contact your CMA's Waterway co-ordinator or Paul Wilson from NRE (03 9412 4324) if you would like to discuss a data quality issue.

Details on how you are to collect field data are provided in chapter 2.

Box 1.2 - Selected elements of the 'ISC quality assurance and control plan' that are relevant during field data collection

Training

- The importance of data quality will be emphasised repeatedly during the ISC training course on field data collection.
- A reminder of the importance of data quality will be placed on field data sheets.

Data collection

- The CMA Waterway co-ordinator will be responsible for arranging the collection of ISC data to a quality satisfactory to the CMA and NRE. Unless otherwise agreed by the CMA and NRE, at least one person who has attended an official ISC training course will be included on all teams that collect field data.
- The CMA will allow field data collectors adequate time to collect data, and provide the equipment listed in box 2.1 of this *Field manual*.
- During an ISC application, NRE will provide 'over the phone' technical support to CMA Waterway co-ordinators (with responses to 90% of queries being provided within 2 days if a field trip of NRE staff is not necessary. Call Paul Wilson on (03) 9412 4324).
- NRE will conduct a field audit of at least 2 randomly selected measuring sites in all CMA districts - and provide feedback to the relevant CMA Waterway co-ordinator.
- Space will be provided on the field data sheets for recording other pertinent information to be drawn to the attention of CMA (see the 'other observations' boxes on the field data sheets, which are provided in figures 2.1 - 2.4).

Reporting

- NRE will provide an award of excellence to the CMA that provides the highest quality ISC outputs at the end of the statewide application. The criteria for the award will be discussed with the Waterway Management Group (which is the Waterway co-ordinators from each CMA), and are likely to include implementation of the good practice shown in box 1.1. NRE will select the winner.

Data storage

- The CMA will ensure that copies of all ISC data are stored in at least two different buildings.

2. DETAILS OF FIELD DATA COLLECTION

When undertaking field data collection, your primary tasks at each measuring site are:
- to fill in 'field data sheets' that will allow the subsequent assessment of the 8 indicators denoted by * in table 1.1; and
- to take 2 photographs.

In this chapter, you are provided with details of:
- tasks to do well in advance of field data collection (section 2.1);
- tasks to do immediately prior to visiting a measuring site (section 2.2);
- tasks to do when at a measuring site (section 2.3);
- tasks to do after visiting a measuring site (section 2.4).

2.1 Tasks to do well in advance of field data collection

The tasks that will have been undertaken by the CMA Waterway co-ordinator and NRE well in advance of field data collection include:
- selecting 'homogeneous' reaches, and randomly selecting measuring sites within each reach. Details on how to do this will be in the forthcoming *User's manual (second edition)*. In 'modified' catchments there will be 3 measuring sites per reach, in unmodified catchments there will be 1 measuring site per reach. You will be told whether each reach is lowland or upland;
- selecting field data collection teams. Each team would typically comprise of two people. Criteria for selection of teams will include participation in an ISC training course (compulsory for at least one member of each team), and may also include your interest in broad stream management issues, availability, ability to work in teams, and attention to detail including neatness of handwriting and accuracy of recording;
- advising field data collectors of any particular river management issues to be observed at measuring sites and recorded on field data sheets (e.g. look out for a particular invasive weed); and
- arranging funding (if necessary) for the purchase or hire of any equipment in box 2.1 that is currently unavailable.

2.2 Tasks to do immediately prior to visiting a measuring site

The CMA Waterway co-ordinator will provide you with a map and/or list of measuring sites at which field data is to be collected. The CMA Waterway co-ordinator has reviewed the location of these measuring sites and decided that they all should be accessible. If it turns out that a measuring site actually is inaccessible (say it would take over two hours longer to access the measuring site than an alternative measuring site in the vicinity) then you should discuss this situation with the CMA Waterway co-ordinator. It is acceptable as a **last resort** to collect data at an alternative measuring site that is approved by the CMA Waterway co-ordinator. The location of the alternative measuring site is to be recorded on the field data sheet after using the GPS, and reported to the CMA and NRE on the form titled 'Report on difficulties when applying the ISC, and remedial actions taken'. This form is provided in appendix 4 of this *Field manual* and is also part of the 'ISC quality assurance and control', in the forthcoming *User's manual (second edition).*

Before visiting a measuring site you should have:

- ensured that the contents of this *Field manual* are fresh in your mind;
- worked out which measuring sites will be visited in a day (typically 4 - 7 measuring sites);
- worked out the quickest route to each measuring site (in same cases, it may be quicker to wade across a stream to access the far bank than to drive a long distance);
- contacted adjacent landholders (in some instances, an office worker could telephone these landholders or send a standard letter); and
- ensured that you have all necessary equipment (see box 2.1).

Box 2.1 - List of items for field data collection

Essential items for field data collection are:

- this *Field manual*;
- field data sheets (one set of 2 sheets per measuring site);
- a suitable 4 wheel drive vehicle;
- a suitable digital camera or a 35 mm SLR camera with a 28 mm focal length lens, and adequate appropriate print film (e.g. 400 ASA);
- a Global positioning system (GPS) unit;
- a 50 m tape measure;
- a calculator (which may be used when converting paces to metres whilst assessing the longitudinal continuity indicator);
- suitable pencils (probably HB, B or 2B grade);
- an eraser and a sharpener;
- a waterproof clipboard;
- personal protective clothing and other equipment (e.g. first aid kit, mobile phone) as governed by the CMA's OH&S policies; and
- spare batteries.

Other items that may be useful are:

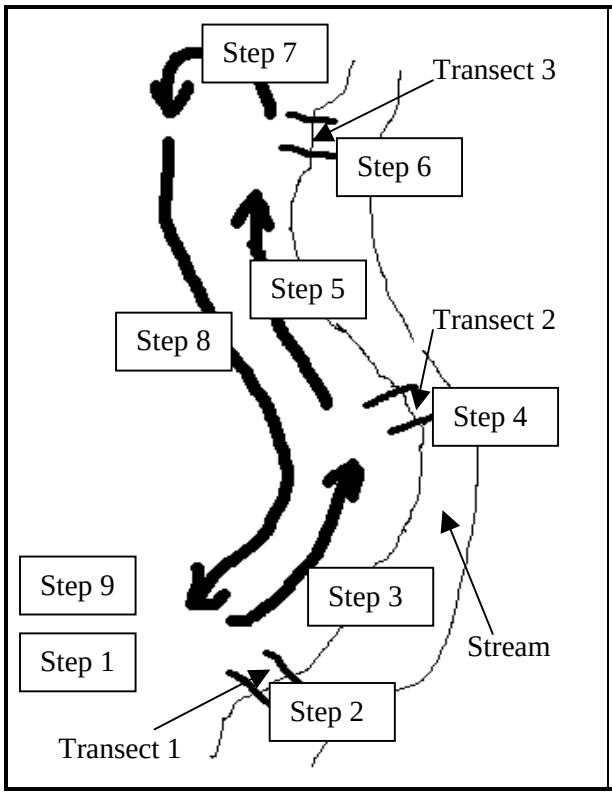
- a measuring wheel (for measuring distances along a stream bank);
- notebook computer with a power source; and
- waders or small boat (if it would save to access a measuring site by crossing a stream).

2.3 Tasks to do when at a measuring site

The procedure for collecting field data at a measuring site is a nine step process (see figure 2.1). Applying the ISC is expected to take between 45 minutes and an hour per measuring site.

When collecting field data you will fill in four field data sheets:
- one for the whole measuring site ('Field data sheet - Measuring site'), and
- one for each of 3 transects ('Field data sheet - Transect 1', 'Field data sheet - Transect 2' and 'Field data sheet - Transect 3' respectively).

A blank of each field data sheet is provided in figures 2.2 - 2.5.



Step 1.	Fill in preliminary data
Step 2.	Assess transect 1
Step 3.	Inspect between transect 1 and transect 2
Step 4.	Assess transect 2
Step 5.	Inspect between transect 2 and transect 3
Step 6.	Assess transect 3
Step 7.	Assess some measuring site indicators
Step 8.	Assess longitudinal continuity
Step 9.	Make other observations, take photographs and undertake final checks

Figure 2.1 - Typical steps at each measuring site when filling in field data sheets

Field data collectors may choose to swap the sequence of implementation of steps 7 & 8.

As a general point, it will be difficult for you to inspect the measuring site and measure distance simultaneously. It is best to collect field data in pairs. You could measure distance along the bank in one direction (e.g. downstream), and your partner could measure distance for the return leg (e.g. upstream). This will give you both an opportunity to inspect the measuring site and form your own view on the correct rating for each indicator assessed over the whole measuring site.

Details on how to undertake each of the nine steps follow the field data sheets (figures 2.2 - 2.5).

Figure 2.2 - Blank of 'Field data sheet - Measuring site' (filled in during steps 1, 7, 8 & 9, checked during step 9)

Figure 2.3 - Blank of 'Field data sheet - Transect 1' (filled in during step 2, checked during step 9)

Figure 2.4 - Blank of 'Field data sheet - Transect 2' (filled in during steps 1 and 4, checked during step 9)

Figure 2.5 - Blank of 'Field data sheet - Transect 3' (filled in during step 6, checked during step 9)

Step 1 - Fill in preliminary data

You will be entering preliminary data onto 'Field data sheet - Measuring site' and 'Field data sheet - Transect 2' in the sections shown in box 2.2. The reason that some of the preliminary reach information is to be entered on both sheets is in case the two pages of a field data sheet set become separated (either in the field or in the office).

Box 2.2 - Where to enter preliminary data on the field data sheets

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Field data sheet – Measuring site

Stream			Reach number	
Measuring site number			Date	
Measuring site location	Start	E		N
	End	E		N
Data collectors names				
Photographs	Roll / disk		Photos.	

***** - refer to reference photos in *Field manual* **^** - refer to schematics in *Field manual*

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Field data sheet – Transect 2

Stream			Reach number	
Measuring site number			Date	
Bank[@]	Right		Left	

Quality counts–collect accurate data

@ - looking downstream ***** - refer to reference photos in *Field Manual* **^** - refer to schematics in *Field Manual*

Regarding this preliminary information, please note the following:

- The reach number will be provided by the CMA Waterway co-ordinator.
- The 'measuring site number' for the first measuring site in each reach will be '1'. If the reach is modified and hence there will be 3 measuring sites within the reach, the subsequent measuring sites will be numbers '2' and '3'.
- Record the location of the start of the measuring site (ie. adjacent to the stream) by using the GPS unit. Remember to record the location of the far end of the measuring site before leaving the measuring site (there is a reminder to do this in step 7).
- There is a right bank / left bank box on each of the transect field data sheets because although all transects will usually be on the one bank, there may be some cases when it is necessary to collect field data from both banks.

Step 2 - Assess transect 1

At transect 1, you will fill in the 'Field data sheet - Transect 1' sheet.

A transect is a section of stream 30 m long. Transect 1 could be located at any point along a stream providing it (or any transect subsequently selected) is not within 50 m of a public road bridge. On a meandering stream, transect 1 could be located on the inside of a bend of the stream, on the outside of a bend, or on a straight. Transects 2 and 3 could both be located either upstream or downstream of transect 1. The centre to centre distance between transects is 200 m (see figure 1.3).

When assessing the indicators at a transect, ensure that you inspect the transect adequately. This would usually involve making observations while you:

- walked from the higher ground near the top of the bank to the water's edge near one boundary of the transect; then
- walked along the water's edge; and then
- walked back up to the higher ground near the other boundary of the transect.

The sequence that you will enter data onto the 'Field data sheet - Transect 1' (see figure 2.3) would normally be:

I. bank stability;

II. width of streamside zone;

III. structural intactness;

IV. cover of exotic vegetation;

V. regeneration of indigenous woody vegetation; and

VI. livestock access.

Details of how to enter this data follows.

I. Bank stability

After assessing this indicator, you will cross a box in the part of 'Field data sheet - Transect 1' shown in box 2.3.

Box 2.3 - Where to enter data for the bank stability indicator

I. Bank stability*

Stable (4)	
Limited erosion (3)	
Moderate erosion (2)	
Extensive erosion (1)	
Extreme instability (0)	

You assess the bank stability indicator by:

i. comparing the condition of the bank for the transect to the relevant reference photographs and descriptions in appendix 1; and

ii. selecting an indicator rating and crossing the appropriate box on the 'Field data sheet - Transect 1'.

Example

Imagine that for 10 m of transect 1, the bank condition looks like the left photograph in figure 2.6, and for the remainder of the transect (ie. 20 metres) the measuring site looks like the right photograph in figure 2.6.

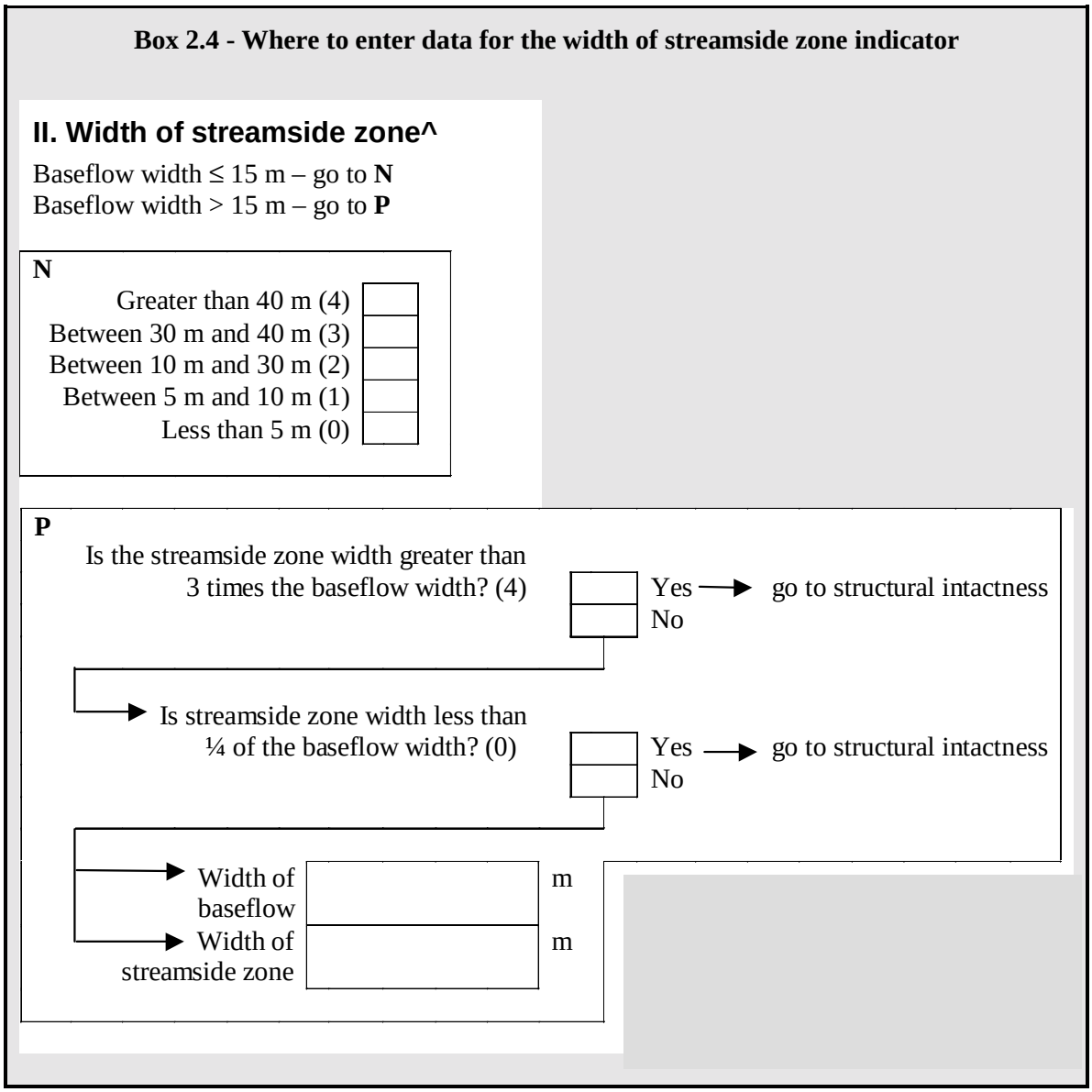
Figure 2.6 - Photographs of stream banks referred to in example of assessment of bank stability indicator

After looking at the reference photographs and descriptions given in appendix 1, you and your partner decide that 10 m of the bank could be categorised as being stable (ie. a rating of 4), and 20 m of the bank could be categorised as having moderate erosion (ie. a rating of 2). Overall, you and your field data collection partner agree that a rating of 3 is appropriate for the bank stability indicator for transect 1.

II. Width of streamside zone

As shown in box 2.4, after assessing the width of streamside zone indicator, you will enter data in either 'N' or 'P' of 'Field data sheet - Transect 1'.

Box 2.4 - Where to enter data for the width of streamside zone indicator



You assess the width of streamside zone indicator by:

i. measuring or accurately estimating the width of the stream at baseflow at the transect.

ii. selecting whether you will enter data in N or P. If the width of the stream at baseflow is clearly less than or equal to 15 m, enter data in N, or if clearly larger than 15 m, enter data in P. If it is not clear whether to fill in N or P, you are to measure the width of the stream at baseflow and then decide.

iii. reading what data is required in N or P. Whichever is selected, it is not necessary to measure the width of streamside zone over the transect as it will be clear what width range should be selected on the 'Field data sheet – Transect 1'. (The examples in appendix 3 illustrate some different scenarios of the width of streamside zone, including the treatment of instream bars.

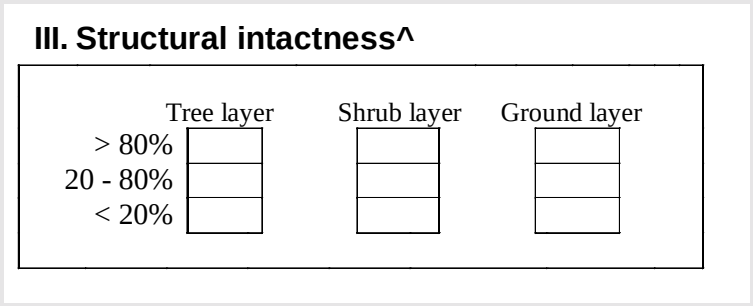
The primary determinant of the width of the streamside zone is a clear change in land-use. If a clear change of land-use is not present, the boundary for the width of streamside zone indicator is where the cover of woody vegetation becomes less than 20%.)

iv. crossing or filling in the appropriate boxes on the 'Field data sheet - Transect 1'.

III. Structural intactness

After assessing this indicator, you will cross 3 boxes in the part of the 'Field data sheet - Transect 1' shown in box 2.5. One box will be crossed for each of the three layers of vegetation: tree layer, shrub layer and ground layer.

Box 2.5 - Where to enter data for the structural intactness indicator



You assess the structural intactness indicator by:

i. inspecting the vegetation at the transect. Refer to the examples in appendix 3 to determine over what distance to measure this indicator if there is not a clear change in land-use to define the boundary of the streamside zone.

ii. categorising the vegetation into 3 layers: tree layer, shrub layer and ground layer, not distinguishing between indigenous and exotic taxa.

iii. assessing the extent to which the vegetation in these three layers is:
- greater than 80% cover;
- between 20% and 80% cover; or
- less than 20% cover.

To help determine the percentage cover of vegetation, you can use the schematics in appendix 2.

iv. crossing the appropriate box on the 'Field data sheet - Transect 1' for each of the 3 layers of vegetation.

Note: the data that you enter will later be compared against the "natural" (pre-European) density of each vegetation layer. If the current vegetation community is the same structurally to the natural vegetation community, then the structural intactness indicator rating will be 4.

An example follows discussion on the cover of exotic vegetation indicator.

IV. Cover of exotic vegetation

After assessing this indicator, you will cross 3 boxes in the part of the 'Field data sheet - Transect 1' shown in box 2.6. One box will be crossed for each of the three layers of vegetation: tree layer, shrub layer and ground layer.

Box 2.6 - Where to enter data for cover of exotic vegetation indicator

IV. Cover of exotic vegetation^

	Tree layer	Shrub layer	Ground layer
0% (4)			
1 - 10% (3)			
11 - 40% (2)			
40 - 60% (1)			
> 60% (0)			

You assess the cover of exotic vegetation indicator by:

i. inspecting the vegetation at the transect. If there is not a clear change in land-use to define the boundary of the streamside zone, refer to the examples in appendix 3 to determine over what distance to measure this indicator.

ii. segregating the vegetation into tree layer, shrub layer and ground layer. (Remember the distinction between tree layer and shrub layer is on height: woody vegetation greater than 5 m high is defined as tree layer, woody vegetation less than 5 m high is defined as shrub layer.)

iii. identifying which taxa are indigenous and which are exotic in each layer. (Note - most pasture grasses are exotic.) You may need a weed guide for reference when undertaking this task. Weed guides include:
   - Lamp, C., and Collet, F., 1989, A field guide to weeds in Australia (3rd edition), Inkarta Press.
   - Parsons, W.T., and Cuthbertson, E.G., 1992, Noxious weeds of Australia, Inkarta Press.

iv. working out the percentage cover of stream bank of exotic vegetation for each layer, and cross the appropriate boxes on the 'Field data sheet - Transect 1'.

An example of the filling in of this part of the 'Field data sheet – Transect 1' is given on the following page.

Example

Imagine that the cover of vegetation over a transect is:

- 30% cover of willow that is greater than 5 m tall (exotic - tree layer);
- 15% cover of mature silver wattle that is greater than 5 m tall (indigenous- tree layer); and
- 85% cover is blue perriwinkle (exotic - ground layer).

The data to assess the structural intactness indicator that would be entered on the field data sheet as given in box 2.7.

Box 2.7 - Example of data for assessment of the structural intactness indicator

III. Structural intactness^

	Tree layer	Shrub layer	Ground layer
> 80%			X
20 - 80%	X		
< 20%		X	

The data to assess the cover of exotic vegetation indicator that would be entered on the field data sheet as given in box 2.8.

Box 2.8 - Example of data for the assessment of the cover of exotic vegetation indicator

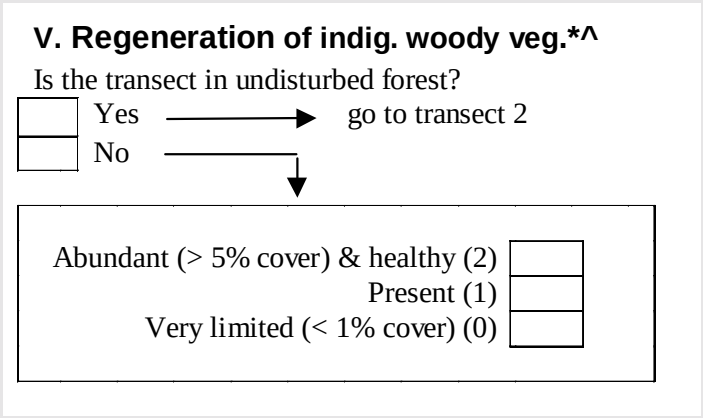
IV. Cover of exotic vegetation^

	Tree layer	Shrub layer	Ground layer
0% (4)		X	
1 - 10% (3)			
11 - 40% (2)	X		
40 - 60% (1)			
> 60% (0)			X

V. Regeneration of indigenous woody vegetation

For the regeneration of indigenous woody vegetation indicator, the part of the 'Field data sheet - Transect 1' to be filled in is given in box 2.9.

Box 2.9 - Where to enter data for regeneration of indigenous woody vegetation indicator



The transect may be in undisturbed forest (and hence regeneration of indigenous woody vegetation would be occurring at a natural rate) if there is no evidence of:

- clearing at any time;
- weeds;
- stock access at any time; or
- other disturbances to the streamside zone (e.g. campsites).

If you decide that the transect is in undisturbed forest, cross the 'yes' box and progress to step 3 (inspect between transect 1 and transect 2).

If the transect is not in undisturbed forest, you assess the regeneration of indigenous woody vegetation indicator by:

i. comparing the regeneration of indigenous woody vegetation for the measuring site to the reference photographs and descriptions in appendix 1, and the schematics for 1% and 5% cover of vegetation in appendix 2. If there is not a clear change in land-use to define the boundary of the streamside zone, refer to the examples in appendix 3 to determine over what distance to measure this indicator. Regeneration is defined as being immature woody plants under a metre high. Take care in determining the difference between indigenous and exotic vegetation.

ii. crossing the appropriate box or boxes on the 'Field data sheet - Transect 1'.

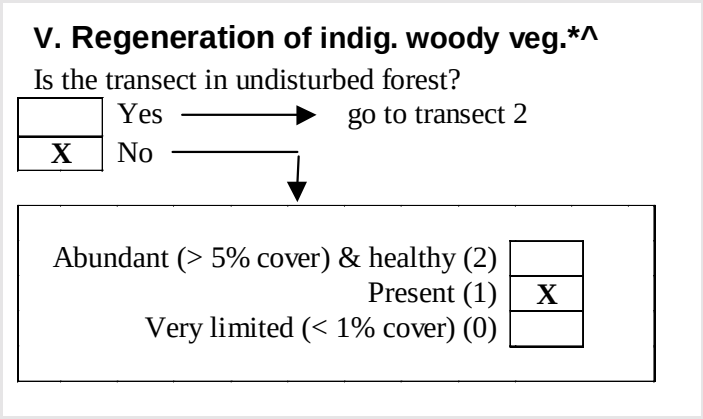
Example

Imagine a measuring site with:

- greater than 20% cover of 1.2 m high immature gum trees (native);
- greater than 40% cover of 0.5 m high blackberries (exotic), and
- about 2% cover of 0.3 m high immature black wattles (native).

This transect is not in undisturbed forest. When assessing this indicator in the field, you would ignore the immature gum trees (as they are greater than 1 m high) and ignore the blackberries (as they are exotic). You would enter the data onto the 'Field data sheet - Measuring site' as shown in box 2.10.

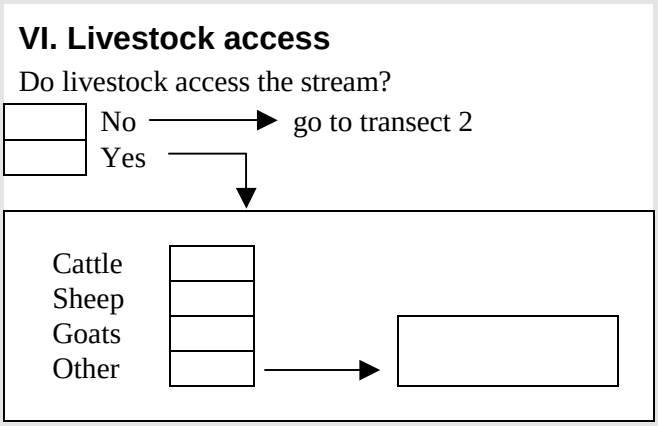
Box 2.10 - Example of data for the assessment of the regeneration of indigenous woody vegetation indicator



VI. Livestock access

Please fill in the section of the 'Field data sheet - Transect 1' reproduced in box 2.11 to inform the CMA whether stock are currently accessing the stream at the transect.

Box 2.11 - Where to enter data on livestock access



You will provide this data by:

i. inspecting the transect. Look for livestock that are currently on the bank or evidence of their presence in the recent past (e.g. well worn tracks, droppings, open gates, gaps in fences).

ii. crossing and/or filling the appropriate box(es) on the 'Field data sheet - Transect 1'.

Step 3: Inspect between transect 1 and transect 2

Walk 200 m to the next transect. If you are working in pairs, one could be measuring distance whilst the other is:

- making observations that will subsequently be used to fill in the 'Field data sheet - Measuring site' (refer to figure 2.2 to learn what to look out for); and
- thinking where photographs would be taken to best characterise the measuring site.

Step 4: Assess transect 2

Fill in 'Field data sheet - Transect 2' by going through the same process as at transect 1.

Step 5: Inspect between transect 2 and transect 3

Repeat the process undertaken whilst walking from transect 1 to transect 2.

Step 6: Assess transect 3

Fill in 'Field data sheet - Transect 3' by going through the same process as at transect 1.

Step 7: Assess some measuring site indicators

You should now have just completed assessing transect 3.

Using the GPS, record the location of the end of the measuring site on the 'Field data sheet - Measuring site'.

You and/or your partner would have made observations over the whole measuring site whilst walking between transects 1 and 2 (step 3), and transects 2 and 3 (step 5). Use these observations to fill in the entire 'Field data sheet - Measuring site', except for the longitudinal continuity indicator (see step 8) and the other observations box (see step 9).

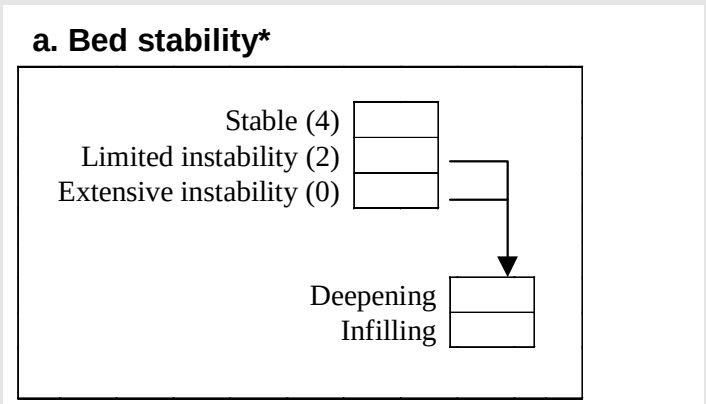
The sequence that you will enter data onto the 'Field data sheet - Measuring site' would normally be:

a. bed stability;
b. instream physical habitat;
c. miscellaneous questions;
d. longitudinal continuity; and
e. other observations.

a. Bed stability

After assessing the bed stability indicator, you will cross a box corresponding to an indicator rating on the relevant part of the 'Field data sheet - Measuring site' - as shown in box 2.12. You will cross two boxes if you have observed evidence of either infilling or deepening.

Box 2.12 - Where to enter data for the bed stability indicator



You assess the bed stability indicator by:

i. inspecting the stream bed over the whole measuring site.

ii. comparing the condition of the stream bed for the **whole measuring site** (430 m in length) to reference photographs and descriptions in appendix 1. Is this whole 430 m length of stream stable, or is there limited or extensive bed instability for the whole measuring site? (Note: this indicator is for **large** scale rather than localised degradation or aggradation. For example, 'normal' sediment accumulation on a bar the inside of a bend is irrelevant when assessing this indicator.)

iii. selecting a rating on the 'Field data sheet - Measuring site', and crossing the appropriate box. If there is some bed instability, also mark on the sheet whether you think the stream bed is deepening or infilling.

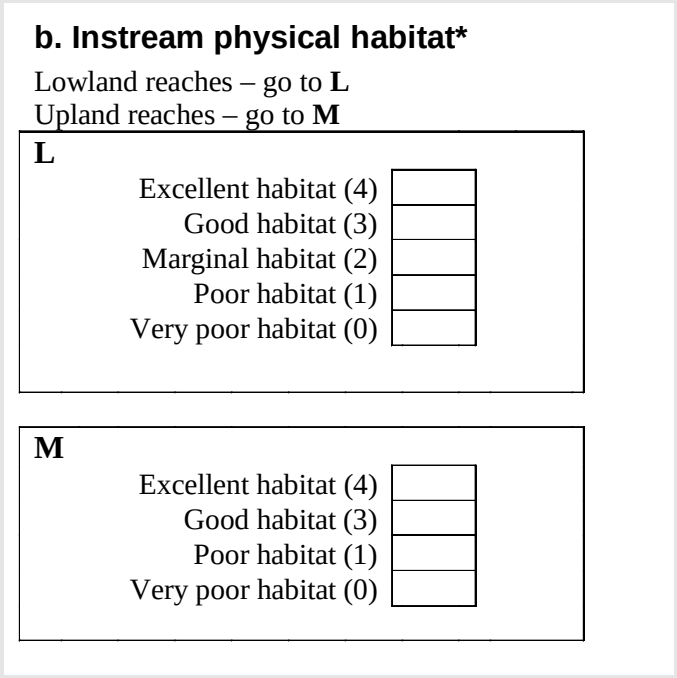
Note: It is more difficult to assess the bed stability indicator for lowland streams (where it is often not possible to see the stream bed) than for upland streams. Generally, most lowland reaches in Victoria will have a bed stability rating either of 4 or 2. Perhaps the only lowland reaches that would have a bed stability indicator of 0 would be:

- some East Gippsland lowland streams following the June and September 1998 floods (deepening); or
- some lowland streams with sand slugs that almost fill the channel (e.g. reaches of the Glenelg River).

b. Instream physical habitat

The relevant part of the 'Field data sheet - Measuring site' is given in box 2.13. After assessing this indicator, you will cross a box in either 'L' if the reach is upland, or 'M' if the reach is lowland.

Box 2.13 - Where to enter data for the instream physical habitat indicator



For lowland reaches (L), you will assess the instream physical habitat indicator by:

i. inspecting for the presence of in-stream large woody debris (LWD) over the whole measuring site, taking note of:
   - density of in-stream LWD (including totally submerged LWD);
   - location of LWD (ie. if near the edges, or is there also some in the middle of the stream); and
   - the origin of the LWD taxa (ie. whether the taxa is indigenous or exotic. Willows and poplars, for example, are exotic taxa.).

   Be sure to look into the water - don't just focus on snags that are emergent.

ii. comparing the LWD to reference photographs and descriptions in appendix 1.

iii. deciding which rating is appropriate on the 'Field data sheet - Measuring site', and crossing the appropriate box.

For upland reaches (M), you will assess the instream physical habitat indicator by:

i. inspecting for the presence of in-stream habitat, taking note of:
   - extent of in-stream debris (including totally submerged debris) - and whether it is likely to be immobile or transient;
   - sediment size: is it fine and mobile or larger and likely to be immobile;
   - stable undercut banks; and
   - other stable habitat.

ii. comparing your observations with the reference photographs and descriptions in appendix 1.

iii. deciding which rating is appropriate on the ‘Field data sheet - Measuring site’, and crossing the appropriate box.

c. Miscellaneous questions

Please answer the miscellaneous questions shown in box 2.14 on the ‘Field data sheet - Measuring site’.

Box 2.14 - Where to enter responses to the miscellaneous questions

c. Miscellaneous questions

Is the stream channel basaltic?	Yes	☐
	No	☐
Is the quantity of cover of woody vegetation ‘natural’?	Yes	☐
	No	☐
	Unsure	☐
Has the reach been desnagged?	Yes	☐
	No	☐
	Unsure	☐

When providing this information, please note the following:

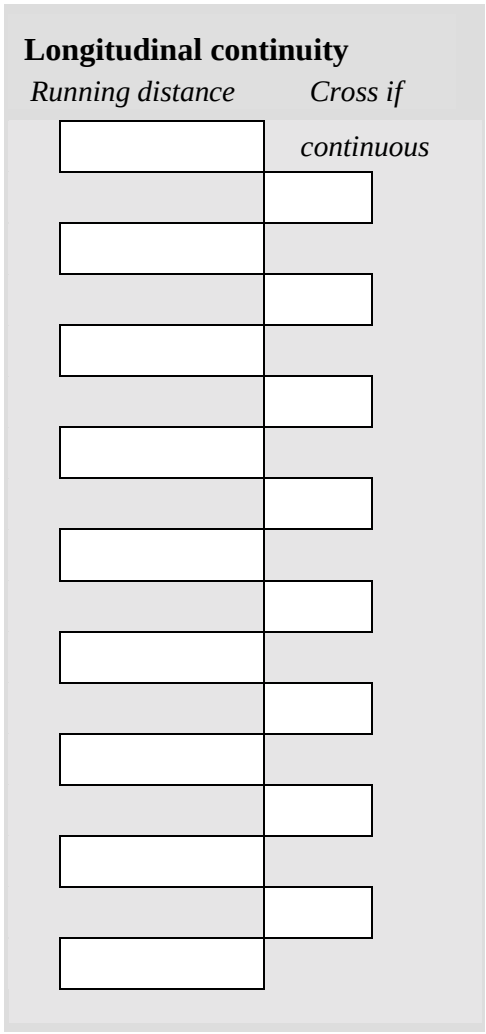
- Most basaltic stream channels in Victoria are in the west of the state.
- If a stream is through pasture and there is no fence to exclude stock then it is unlikely that the quantity of cover of woody vegetation is “natural”.
- If there is exotic woody vegetation in the streamside zone, then it is unlikely that the quantity of cover of woody vegetation is “natural”.
- If you are not sure of the answers to the latter two questions, then cross the ‘unsure’ box.

Step 8: Assess longitudinal continuity

d. Longitudinal continuity

For the longitudinal continuity indicator, the relevant part of the 'Field data sheet - Measuring site' is given in box 2.15. An example of how you will fill it in follows, and further examples are in appendix 5. (From experience, most field data collectors find this indicator the hardest to understand initially - so please ask questions if you are unsure.)

Box 2.15 - Where to enter data for the longitudinal continuity indicator



You make measurements to assess the longitudinal continuity indicator whilst returning from transect 3 to transect 1 over the 430 m measuring site. You record onto the 'Field data sheet - Measuring site' a running distance in the left column, and a cross in the right column if the vegetation is continuous. The running distance can start at either end of the measuring site, but it is normally easiest to start measuring at the far end of transect 3. A measuring wheel is to be used if available and the measuring

site conditions permit. Otherwise, distance can be measured by careful pacing. If pacing is to be used, you should accurately determine how many paces per 20 m (do not assume 1 pace = 1 metre).

You assess the longitudinal continuity indicator by:

i. pacing along the bank in pairs (normally one person will be measuring distance, the other will be deciding if the vegetation is continuous or not);
ii. marking on 'Field data sheet - Measuring site' the running distance at which the width of streamside woody vegetation (perpendicular to the direction of flow, with cover of woody vegetation layer greater than 20%) changes from less than 5 m to greater than 5 m (or vice versa) over a distance along the bank for a distance greater than 10 m; and
iii. if the vegetation is continuous (ie. greater than 5 m width), put a cross in the right hand column.

Example

For example, imagine that there is over 20% cover of woody vegetation to a width of:
- 10 m for the first 120 m along a bank,
- 3 m for the next 230 m; and
- 20 m for the next 80 m.

The data in box 2.16 would be entered on the 'Field data sheet - Measuring site'.

Box 2.16 - Example of the assessment of the longitudinal continuity indicator

Longitudinal continuity

Running distance	*Cross if continuous*
0	
	X
120	
350	
	X
430	

Further examples on the assessment of the longitudinal continuity indicator are in appendix 5.

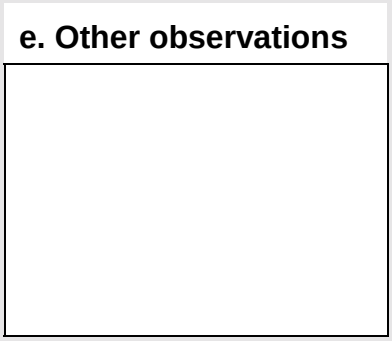
Step 9: Make other observations, take photographs and undertake final checks

Step 9 is the final tasks before you leave a measuring site.

e. Other observations

Please note any other observations at a measuring site that you want to bring to the attention of the CMA in the section of the 'Field data sheet - Measuring site' shown in box 2.17.

Box 2.17 - Where to enter other observations



Photographs

During the 1999 statewide ISC application, two photographs will be taken per measuring site. Guidelines for taking photographs are given in box 2.18.

Box 2.18 - Guidelines for taking photographs

To standardise the photography as far as possible:

- use either a suitable digital camera or a 35 mm SLR camera with a 28 mm focal length and 400 ASA - this film speed has been chosen as it is possible to take clear photographs with lower light than most films;
- consider the composition of the photograph and ensure that it is representative of the measuring site (for example, photographs of streams with sparse remnant vegetation can possibly be made to look well forested or desolate depending on the camera angle);
- the width of water should generally be 20 - 50% of the photograph;
- restrict the amount of sky to approximately 25%;
- use a camera which automatically inscribes time and date on the photograph if possible; and
- check the prints with the recorded data immediately after the film has been processed.

Final checks

Before leaving the measuring site, check that:

- all data have been entered onto the field data sheets. **This is important!!!** If one person filled in the field data sheets, the other should check these sheets before leaving site;
- photographs and film number have been entered onto the 'Field data sheet - Measuring site';
- all equipment has been returned to the vehicle; and
- all gates are left as they were found.

2.4. Tasks to do after visiting from a measuring site

When you return from collecting field data, be sure to ensure that all of the data is secure:

- make copies of field data sheets;
- download and back up images from a digital camera, or arrange for films to be processed with 'double prints'; and
- if data is directly entered into a notebook computer on site (which is not recommended in general), download the data.

Then, undertake tasks to prepare for any future field data collection (contacting adjacent landholders etc).