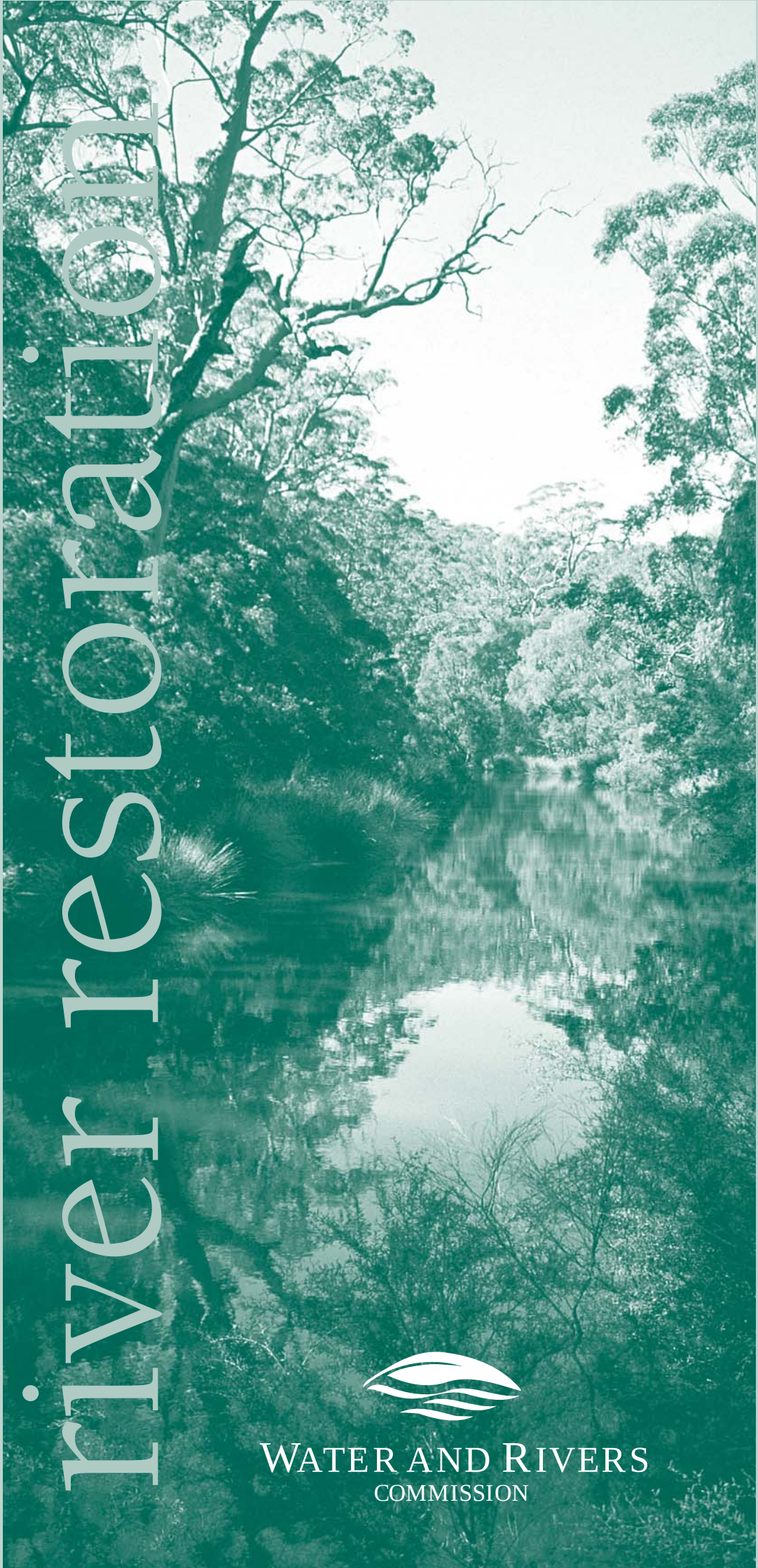

Planning and Management

Foreshore condition assessment in farming areas of south-west Western Australia

WATER AND RIVERS COMMISSION

August 1999
Report No. RR 3

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PLANNING & MANAGEMENT

Foreshore condition assessment in farming areas of south-west Western Australia

Prepared by
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jointly funded by

Natural Heritage Trust

WATER AND RIVERS COMMISSION

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Foreword

Many Western Australian rivers are becoming degraded as a result of human activity within and along waterways and through the off-site effects of catchment land uses. The erosion of foreshores and invasion of weeds and feral animals are some of the more pressing problems. Water quality in our rivers is declining with many carrying excessive loads of nutrients and sediment and in some cases contaminated with synthetic chemicals and other pollutants. Many rivers in the south-west region are also becoming increasingly saline.

The Water and Rivers Commission is responsible for coordinating the management of the state's waterways. Given that Western Australia has some 208 major rivers with a combined length of over 25 000 km, management can only be achieved through the development of partnerships between business, landowners, community groups, local governments and the Western Australian and Commonwealth Governments.

The Water and Rivers Commission is the lead agency for the Waterways WA Program which is aimed at the protection and enhancement of Western Australia's waterways through support for on-ground action. One of these support functions is the development of river restoration literature that will assist Local Government, community groups and landholders to restore, protect and manage waterways.

This document is part of an ongoing series of river restoration literature aimed at providing a guide to the nature, rehabilitation and long-term management of waterways in Western Australia. It is intended that the series will undergo continuous development and review. As part of this process any feedback on the series is welcomed and may be directed to the Catchment and Waterways Management Branch of the Water and Rivers Commission.

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1. Introduction

Streamline degradation in south-west Australia is widespread. The need to protect and rehabilitate streamlines is recognised by the landcare community but there are the problems of what to do, where to begin and limited resources. This highlights the need for a rapid and inexpensive streamline assessment system which can be used by members of the local community, supported by state government agencies or other professionals.

To make the most effective use of resources in river protection (fencing) and rehabilitation (vegetation regeneration), information is required on river foreshore condition and fencing status. This enables priorities to be set for long term work. Areas which are degraded quickly and which will be more expensive to repair in the future can be prioritised for work, while those degrading more slowly can be left for a while. The most degraded areas can be targeted for rehabilitation and the relatively pristine areas, which have aesthetic and conservation values, can be secured for the future by appropriate management.

Providing resources for individuals to carry out broad scale surveys can be expensive and logistically difficult to achieve, depending on the form and location of the streamlines to be surveyed. An alternative method of conducting extensive streamline surveys of foreshore condition is to obtain the assistance of land owners and local community groups. Volunteers can be trained to recognise degrees of foreshore degradation and record their assessment of foreshore condition on standardised forms. They can assess as much or as little of the their local areas as they wish. The resulting data can be gathered together to produce a record of foreshore condition over large areas. This provides baseline data on which to base long term monitoring and management.

To enable community groups and individuals to conduct foreshore surveys to collect this type of information, a foreshore assessment form was developed. This form will ensure that future assessments will record data in a consistent manner. Any number of people can conduct surveys over a period of time and the recorded information can be collated to provide a summary of the foreshore condition over a full stream length and across time.

To assist in achieving this goal Pen and Scott (1995) developed a stream foreshore assessment system for farming areas in south-west Australia and it is this methodology that is summarised here. The foreshore condition assessment method was developed through extensive observation of river system degradation throughout south-west Australia. Habitat assessment sections were adapted from a method used to assess the environmental condition of all streams in Victoria (Ladson *et al, 1996*) while sections on channel form assessment were taken from a method developed in Canada by Newbury and Gaboury (1993).

2. Survey Method

Aerial photographs, vegetation maps and satellite images provide broadscale information on the riparian zone such as the presence of remnant vegetation but they do not give an accurate picture of foreshore health on a local scale. Assessment of foreshore condition and degradation, such as weed invasion, understorey decline and superficial erosion, as well as other information including fencing status and livestock access, can only be obtained by extensive streamline surveys carried out from the ground.

Ideally, the foreshore areas should be traversed prior to the survey to gain familiarity with the area and to assess the range of condition and general accessibility. The site is then divided into relatively homogeneous sections delineated on the basis of vegetation structure or landuse. A survey form should be completed for each of these sections.

In areas with dense foreshore vegetation on both banks of the river, each side should be surveyed separately with survey forms completed for each side. On highly degraded rivers where the foreshore along both banks is easily observed from one side, and the vegetation and disturbance factors are similar, a single survey form may be used.

The object of the assessment is to collect detailed information on the condition of stream foreshores that will be used to obtain a broad picture of the condition of your river or creek system. This will enable you to identify areas of degradation and to target land care works and assistance where they will do the most good.

Some general definitions that may be useful when discussing your foreshores are given below. It should be noted, however that all of these elements may not be present in all streams.

Low flow channel - the channel in which the water is contained during periods of low flow, when the stream is not in flood. The low flow channel is where the stream carries water most of the time.

Dominant (or bank full channel) - this is the channel that is formed by seasonal peak flows, which occurs on average every 1 - 2 years. It is during these peak flows that the stream has the power to do the most work and to erode and transport material.

Floodway - during high rainfall run-off events or flood, the stream spills over the main channel into the broader valley. The floodway forms the main flow path for these waters and is where the water is flowing strongly during these times of high flow. The floodway is where the flooded stream has the energy to erode and transport material and is therefore an area of main interest for management. In the South West, because the floodways are mostly dry or only moist throughout the year, they are often colonised by dense wetland vegetation which stabilises the soil and largely prevents erosion.

Flood fringe -the area of the floodplain where the water is merely spilling over from the floodway or is moving slowly over adjacent land.

Broad floodplain - the area that includes the stream channel, the floodway and the flood fringe. It is the portion of the river valley that is covered with water when the main channel ‘overflows’ in time of flood or major stream flows.

Verge or buffer - the narrow buffer of upland at the top of the main river valley, perhaps to a nearby fenceline or roadway.

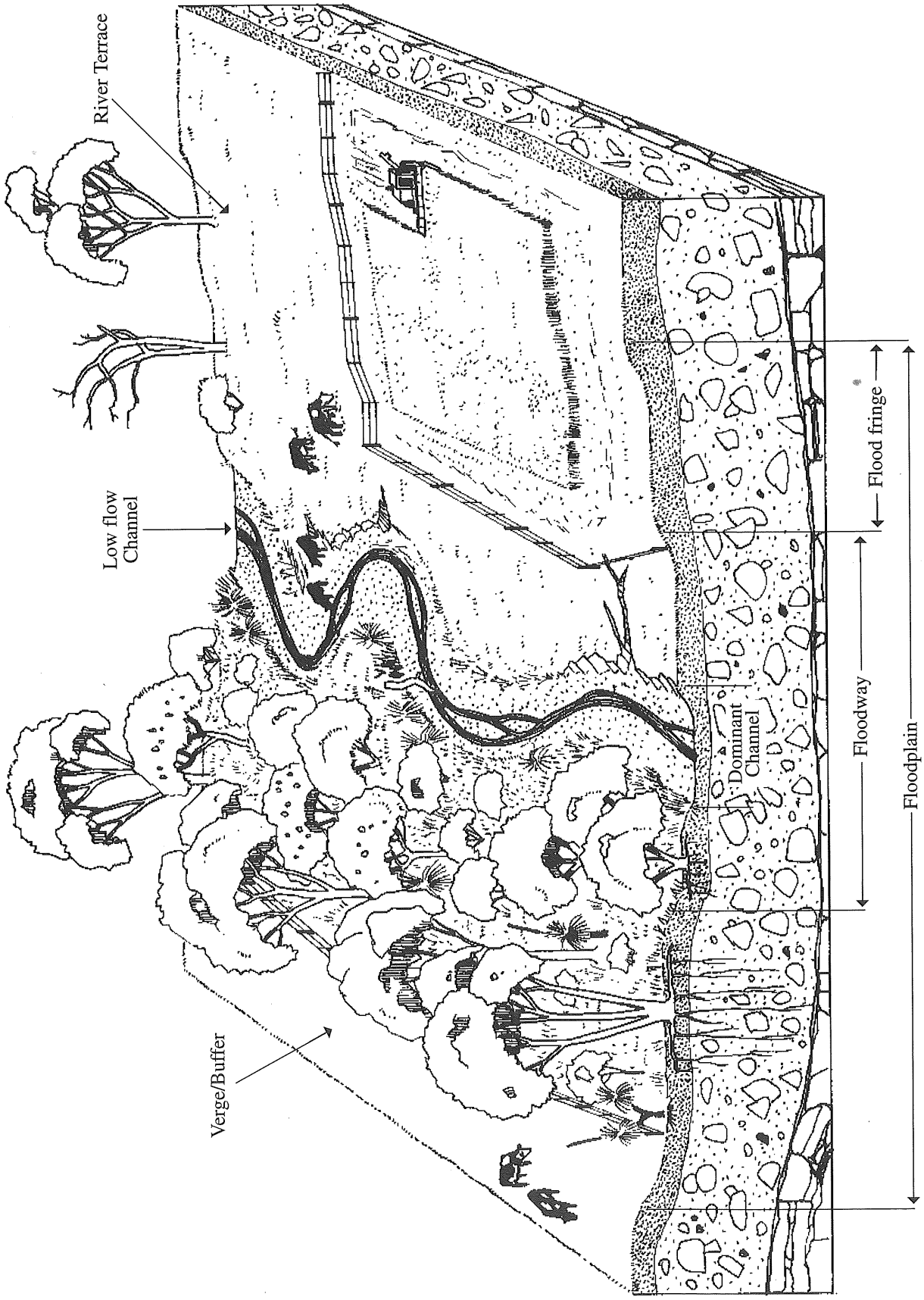


Figure 1. The immediate river valley and the terms used to describe its form.

3. Elements of the foreshore condition assessment system

The foreshore condition assessment has been developed from observations of river system degradation throughout south-west Australia. The system follows the general process of remnant bush degradation, with the added complication of erosion as stream banks become exposed.

The system has been designed to allow for a varied level of assessment. It consists of a number of stages or grades, A, B, C and D, beginning at pristine and running through to completely degraded. To perform more detailed surveys each grade has three sub-levels that are easy to recognise (section 3.2).

3.1 Foreshore condition - basic assessment

The basic survey is used when assessing long river sections or for a basic survey at paddock level. In the basic survey, you grade the foreshore into one of four categories, A, B, C and D. Just tick the appropriate box on the survey form. These grades are simple to recognise and are illustrated in Figure 2 and on the paddock scale survey form (section 4).

A grade is where the foreshore has healthy native bush, similar to that which you would see in most nature reserves, state forests and national parks.

B grade is where the bush along the stream has been invaded by weeds, mainly grasses, and looks like typical roadside bush. For example, in winter, soft light green leaved grasses are usually seen, along with flatweeds and maybe more substantial weeds such as Watsonia and bridal creeper. In summer or autumn, dry, yellowing dead grasses or their remnant seed heads are seen amongst the bush.

C grade is where the foreshore supports only trees over weeds or pasture, or just plain pasture, and bank erosion and subsidence may be occurring, but only in a few spots.

D grade is where the stream is little more than an eroding ditch or a weed infested drain. Here, think of the typical drains you have seen, either just after having been cleaned out with a backhoe or in need of a clean out.

If the condition of the foreshore varies, tick the box on the survey form that you think best represents the general overall condition.

3.2 Detailed assessment of foreshore condition

If you are interested, and have the confidence, you can assess foreshore in more detail. Each grade has three sub-categories. They are reasonably simple to recognise.

A1. Pristine

The river embankments and floodway are entirely vegetated with native species, and there is no evidence of human presence or livestock damage.

A2. Near pristine

Native vegetation dominates. Some introduced weeds may be present in the understorey, but not to the extent that they displace native species. Otherwise there is no evidence of human impact. (A river valley in this condition is as good as will be found today)

A3. Slightly disturbed

Native vegetation dominates, but there are some areas of human disturbance where soil may be exposed and weeds are relatively dense (such as along tracks). The native vegetation would quickly recolonise the disturbed areas if human activity declined.

B1. Degraded - weed infested

Weeds have become a significant component of the understorey vegetation. Although native species are dominant, a few have been replaced by weeds.

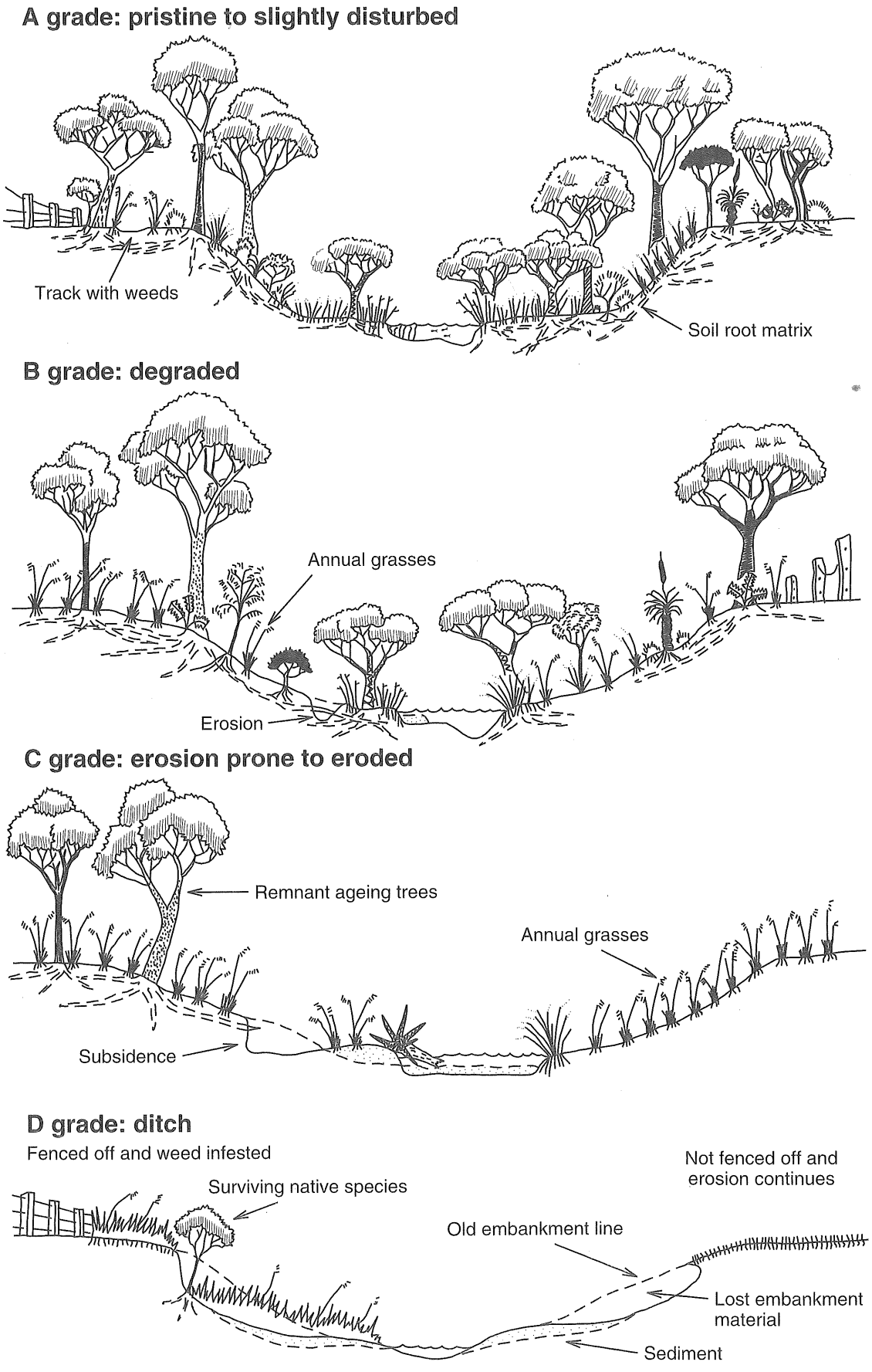


Figure 2: The four grades of River foreshore condition following the general process of river degradation from pristine (A) to ditch (D).

B2. Degraded - heavily weed infested

In the understorey, weeds are about as abundant as native species. The regeneration of some tree and large shrub species may have declined.

B3. Degraded - weed dominated

Weeds dominate the understorey, but many native species remain. Some trees and large shrub species may have declined or disappeared altogether.

C1. Erosion prone

Trees remain, and possibly some large shrubs or tree grasses, but the understorey consists entirely of weeds, mainly annual grasses. The trees are generally resilient or long lived species but there is little or no evidence of regeneration. The shallow-rooted weedy understorey provides no support to the soil, and only a small increase in physical disturbance will expose the soil and make the river embankments and floodway vulnerable to erosion.

C2. Soil exposed

Older trees remain, but the ground is virtually bare. Annual grasses and other weeds have been removed by livestock trampling or grazing, or through over use by humans. Low-level soil erosion has begun, by the action of either wind or water.

C3. Eroded

Soil is washed away from between tree roots, trees are being undermined and unsupported embankments are subsiding into the river valley.

D1. Ditch - eroding

There is not enough fringing vegetation to control erosion Some trees and shrubs remain and act to retard erosion in certain spots, but are doomed to be undermined eventually.

D2. Ditch - freely eroding

No significant fringing vegetation remains and erosion is completely out of control. Undermined and subsided embankments are common, and large sediment plumes are visible along the river channel.

D3. Drain - weed dominated

The highly eroded river valley has been fenced off, preventing control of weeds by stock. Perennial (long-lived) weeds have become established. The river has become a simple drain, similar or identical to a typical major urban drain.

Sometimes when assessing the condition of a foreshore you may think it is too variable to tick any one box and you may wish to express the full range of condition. This can be done. For example, you may think that the condition ranges between A3 and B2. If so, simply tick both boxes. On the other hand, you may think that while it is mainly B1, it ranges between A3 and B2. In this case tick A3 and B2, and tick B1 twice. Similarly, if you think it ranges between A3 and B2, but is mostly B2, tick A3 once and B2 twice.

The survey forms are also designed to allow for the collection of other information relating to soils, bank stability and environmental health that you may find useful when planning management works. The collection of this information is optional and is discussed further is Section 4.

3.3 Fencing status

This will provide information on whether the stream is fenced off or not and whether stock have access to the land.

Fenced off - tick yes only if the the fence is in good order and is actually functioning as a fence.

Stock access - tick yes if it appears that stock have had access to the river/creek recently, even if the streamline is fenced off.

Crossing point - tick yes if there is a livestock or vehicle crossing point across the stream.

3.4 Additional information

As well as general stream condition there are other factors that you can assess which will provide valuable information to assist with planning your management options. These factors will help you to prioritise works and to identify areas that may be prone to degradation.

3.4.1 Bank steepness

Steep banks are more prone to erosion and collapse than more moderately sloped ones. Combined with soil cohesion information, this will highlight points of high erosion hazards. Tick the box which best represents the foreshore being surveyed.

3.4.2 General Soil Cohesion

The degree of cohesiveness of the stream embankment determines how vulnerable it is to erosion and subsidence once the supporting vegetation has been lost. Rocky embankments are extremely cohesive and the erosion of surface sediment is limited. Clayey soils are reasonably cohesive and only erode slowly, although loose surface sediment is quickly lost. Non-cohesive embankments of sand, loam or dispersive clays are the most prone to erosion and collapse. Tick the box which best represents the foreshore being surveyed.

3.4.3 Major Erosion/siltation

Any point of erosion that produces more than a trailer load worth of sediment can be considered 'major'. Erosion types include simple cutting into the stream bank, undercutting of stream banks, firebreak or track washouts, and subsidence. Also indicate if there are large heaps of sediment, usually seen as white sand. Use the comments to give additional information such as the extent of the erosion or whether sediment is filling a river pool. This information will be used to identify "black spot" areas. Tick the appropriate boxes.

3.4.4 Vegetation health

Use this section to give a general description of the health and vigour of the vegetation. This information is needed to identify sections of foreshore that may become unsupported by trees in the near future. Be sure to note the presence or absence of regenerating trees. The mature trees may be dead or sick looking, but if young ones are present, they may replace the old ones. Alternatively, adult trees may be healthy but no regeneration is occurring. Tick the appropriate boxes.

3.5 Stream health assessment - living streams survey

The living streams survey provides an indication of stream health based on an assessment of the quality and diversity of habitats. The following factors are used as assessment parameters to help identify the health of the habitat around the stream you are monitoring (see sections below for an explanation of these):

- Floodway bank and vegetation
- Verge vegetation
- Stream cover
- Bank stability and erosion
- Habitat diversity
- Surrounding land use

Plants provide habitat for birds, frogs, possums, and many other organisms which live in and around streams. The completeness of this zone is important for the existence and health of all types of creatures ranging from mosquito larvae through to large birds and mammals. Leaf litter from overhanging trees, and fallen branches provide a food and shelter for fish, crayfish and other aquatic life. Shade provided by overhanging vegetation influences stream temperatures and light. Rivers and streams which are dominate by introduced plants (exotics), such as willow trees, cannot supply a year round shelter and food supply which is so important for our aquatic life.

Each of the assessment parameters is ranked from excellent through to very poor. A numerical score has also been given to each ranking and the score system has been calculated to give more weighting to conditions which are more important to stream health, such as shade and the presence of areas of permanent water, which are very important to aquatic life in a region characterised by long hot dry summers. Add up the total value of all the boxes you have ticked on your record sheet under stream environmental health rating. This will give you a total score, which you can evaluate against the table below to give you an overall rating of stream health.

Score	Rating
40-55	**Excellent**
30-39	**Good**
20-29	**Moderate**
10-19	**Poor**
0-9	**Very poor**

Plate 1: A grade foreshore on a river in karri forest. Note that the vegetation looks a little untidy after winter floods. (Photo by Darryl Moss).

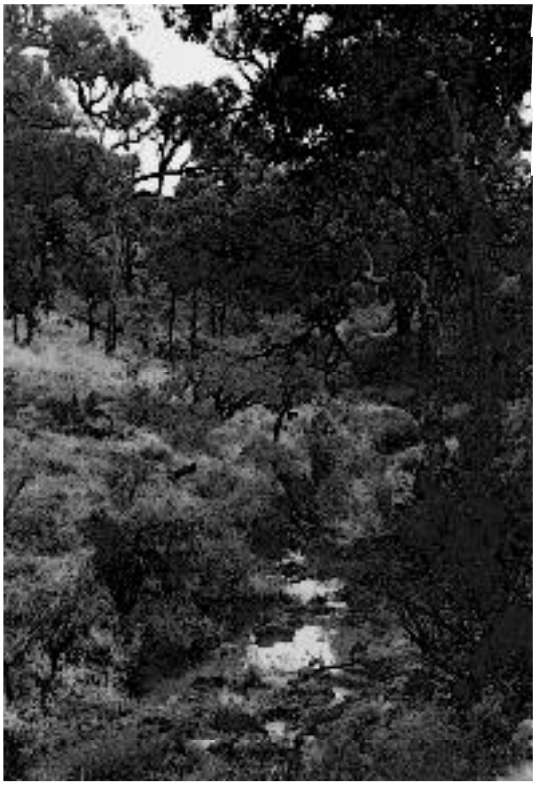


Plate 2: B grade foreshore on a narrow rocky creek. The native vegetation appears dark green while the annual weeds are summer yellow. In detail the foreshore ranges from B2 to B3. (Photo by Peter Williams).

Plate 3: C grade foreshore. Gum trees over pasture grasses. Note the absence of tree regeneration. The foreshore is classic C1. (Photo by Margaret Scott).

Plate 4: D grade foreshore. No fringing vegetation remains to control erosion. The detailed assessment is D2, as there is virtually no vegetation. (Photo by Luke Pen).

Plate 5: D grade foreshore. the stream banks are completely infested with weeds (D3). The stream is simply a drain and may become clogged with weeds at times. (Photo by Margaret Scott).

Plate 6: A1-2 grade foreshore. Native species dominate and protect the foreshore. A close inspection of the foreshore would probably show up some weeds in the understorey, in which case the foreshore would be A2. (Photo by Luke Pen).

Plate 7: A3 grade foreshore on right, where a small clearing has been made by people visiting the river side. (Photo by Luke Pen).

Plate 8: B1 grade foreshore and floodways. the dark vegetation is salt-water paperbark and samphire, reflecting a saline river environment. The tinges of green and yellow are annual weeds. (Photo by Luke Pen).

Plate 9: B2 grade embankment. The tussocks under the trees are a native sedge while the light green amongst them are annual introduced grasses. the tall shrubs are native. (Photo by Luke Pen).

Plate 10: B3 grade foreshore in the foreshore on the right. The native tussock sedges have been eaten down by livestock over the summer, and the light green annuals can be seen coming up between the tussocks. (Photo by Luke Pen).

Plate 11: C1 grade foreshore on both sides of the river. Some tall weeds and regenerating paperbarks can be seen on the left. The bare ground on the left could rate this foreshore C1 to C2 (exposed soil), but C1 mostly if you look upstream. (Photo by Darryl Moss).

Plate 12: C2 grade foreshore on right bank in foreground. the full right bank in view would be C1-2, C1 mostly. (Photo by Darryl Moss).

Plate 13: C3 grade foreshore on the other side of the river. It is a section of localised undercutting. (Photo by Luke Pen).

Plate 14: D1 grade foreshore. Subsidence and undercutting are commonplace, but vegetation still supports some sections of foreshore (i.e. shrub in right foreground, steep grassed embankment on left foreshore, small tree in right middleground and upstream. (Photo by Peter Williams).

Plate 15: D2 grade foreshore. Virtually no vegetation remains to control erosion and this creek is now eating into the paddock. Note the broad area of ripping on the left in preparation for tree planting. (Photo by Luke Pen).

Plate 16: D3 grade foreshores. This river diversion is totally dominated by weeds. Note that undercutting is still occurring (right foreground) despite the abundance of weed growth. (Photo by Peter Williams).

3.5.1 Floodway and bank vegetation

This vegetation grows in the floodway (Fig. 1) or on the banks and is the major natural source of nutrients and carbon for the stream ecosystem. The canopy is the tree cover that overhangs the stream. Plant roots stabilise the floodway and banks against erosion and subsidence. Stems and foliage dissipate the energy of floodwaters, reducing erosion and promoting sedimentation.

3.5.2 Verge vegetation

The stream verge extends from the top of the embankment to a paddock fence, backyard fence or road, and is usually about 10-50 m wide. Sometimes the verge is part of streamside parkland. Verge vegetation provides habitat next to water, increases the value of the riparian zone as an ecological corridor and stabilises the stream banks by anchoring them with tree roots to adjacent land.

3.5.3 Stream cover

Fish and other aquatic organisms require snags, leaf litter and rocks to shelter from predators and fast flowing water, to reproduce, establish territories, and for navigation. Aquatic plants are also very important for fish and other creatures in the stream. They have a direct effect on the available oxygen in the water, which in turn can affect the type of fish and other animals found. Protruding snags and rocks provide roosting and preening sites for birds and help to oxygenate water in fast flowing sections. Overhanging and emergent vegetation provides shade to which many aquatic animals retreat during the hot days of summer and autumn. Insects blown from flowers and leaves are a very important source of food for fish and other animals.

3.5.4 Bank stability and erosion

Banks sometimes naturally erode on bends (meanders). However, when vegetation is cleared for agricultural activities and urban development, the stream banks can become unstable, resulting in extensive erosion along the floodway and the build-up of sediment that is then slowly washed downstream. Erosion and bank collapse can also be caused by increased runoff from impervious surfaces (e.g. car parks), from pipes and drains, and by straightening or channelling the stream.

3.5.5 Habitat diversity: cascades, runs riffles, pools and meanders.

Different habitat types in streams include cascades, rapids, riffles, waterfalls (which are quite rare), runs, meanders, pools and floodplains. Stream sections that have a range of habitat types can support a greater variety of species.

Rapids occur where rocks and snags protrude through rapidly flowing water. Areas where water flows quickly over stones and rocks, or between tree stems, are known as riffles. Areas where the water surface is essentially flat, are known as runs. Rapids and riffles aerate water and provide habitat for invertebrates. It is common for the stream floodway, including rapids and riffles, to be heavily vegetated.

The vegetated floodways are usually broken by deep pools which provide habitat for fish, turtles, marron and other animals. Pools are often the only parts of streams to retain water over summer, providing an essential drought refuge.

Long broad sections of vegetated or clear floodway are typical of the lower reaches of our larger south-west rivers. They provide different types of habitats because the cutting action of water at bends creates deeper areas and variable water speed. Seasonal floodwaters adjacent to the stream may provide important breeding and feeding habitat for aquatic life.

3.5.6 Surrounding land use

The surrounding land use activities will contribute greatly to the ecological value of the stream. An area of national park or remnant bush contribute to, and benefit from, a wider biological diversity than can be found in either the stream or bushland alone. A stream in an agricultural setting will have elevated sediment and nutrient levels, while a stream in an urban or industrial area will be more vulnerable to weed invasion and pollution. Native animals living in urban and semi-rural areas benefit from a stream environment or from the remnant bush along its flanks.

Table 1. Living streams survey: information to determine stream health ratings

	Floodway and Bank Vegetation	Verge Vegetation	Stream Cover	Bank Stability and Erosion	Habitat Diversity
Excellent	• Healthy undisturbed native vegetation. • No weeds. **(15 points)**	• Healthy undisturbed native vegetation. • Verges more than 20 metres wide. **(8 points)**	• Abundant cover: shade, overhanging vegetation. • Snags, leaf litter, rocks and/or aquatic vegetation in stream. **(8 points)**	• No erosion or subsidence or sediment deposits. • Dense vegetation cover on banks and verge. • No disturbance. **(8 points)**	• Three or more habitat type. • Some permanent water. **(6 points)**
Good	• Mainly healthy undisturbed native vegetation. • Some weeds. • No recent disturbances. **(12 points)**	• Mainly healthy undisturbed native vegetation. • Verges less than 20 metres wide. **(6 points)**	• Abundant shade and overhanging vegetation. • Some cover in the stream. **(6 points)**	• No significant erosion, subsidence or sediment deposits in floodway or on lower banks. • May be some soil exposure and vegetation thinning on upper bank and verge. **(6 points)**	• Two habitat type. • Some permanent water. **(4 points)**
Moderate	• Good vegetation cover, but a mixture of native and exotic species. • Localised clearing. • Little recent disturbance. **(6 points)**	• Good vegetation cover, but mixture of exotic and native species. • Verges 20 m wide or more. **(4 points)**	• Some permanent shade and overhanging vegetation. • Some instream cover. **(4 points)**	• Good vegetation cover. • Only localised erosion, bank collapse and sediment heaps. • Verges may have sparse vegetation cover. **(4 points)**	• Mainly one habitat type with permanent water, or a range of habitats with no permanent water. **(2 points)**
Poor	• Mainly exotic ground cover. • Obvious site disturbance. **(3 points)**	• Narrow verges only (< 20 m wide). • Mainly exotic vegetation. **(2 points)**	• Channel mainly clear. • Little permanent shade or instream cover. **(2 points)**	• Extensive active erosion and sediment heaps. • Bare banks and verges common. • Banks may be collapsing. **(2 points)**	• Mainly one habitat type with no permanent water. **(1 points)**
Very Poor	• Mostly bare ground or exotic ground cover (i.e. pasture gardens or weeds but no trees). **(0 points)**	• Mostly bare ground or exotic ground cover (i.e. pasture gardens or weeds but no trees). **(0 points)**	• Virtually no shade or instream cover. **(0 points)**	• Almost continuous erosion. • Over 50% of banks collapsing. • Sediment heaps line or fill much of the floodway. • Little or no vegetation cover. **(0 points)**	• Stream channellised. • No pools, riffles or meanders. • The stream forms a continuous channel. **(0 points)**

4. Performing foreshore surveys at the paddock scale

4.1 Introduction

This "Paddock Scale" form is to be used to assess the condition of the stream foreshore on a block of land used for farming. Each form is to be used to assess foreshore of a length of stream (river, creek, brook, etc) running beside, or through, a single paddock (or block, depending on the detail required). One paddock, one form. If you have a number of paddocks with stream foreshore, a corresponding number of forms will be used.

The basis for assessing one paddock at a time is that each paddock has its own individual character depending on how it has been used and how old it is. The foreshore condition of sections of streamline will tend to reflect the age and land use history of their respective associated paddocks.

The form may look a bit complicated but really it is quite simple to use and if you are not confident, only part of it need be filled in to complete a basic survey.

Each box on the form indicates a separate section to be filled out and simple instructions for each are given below.

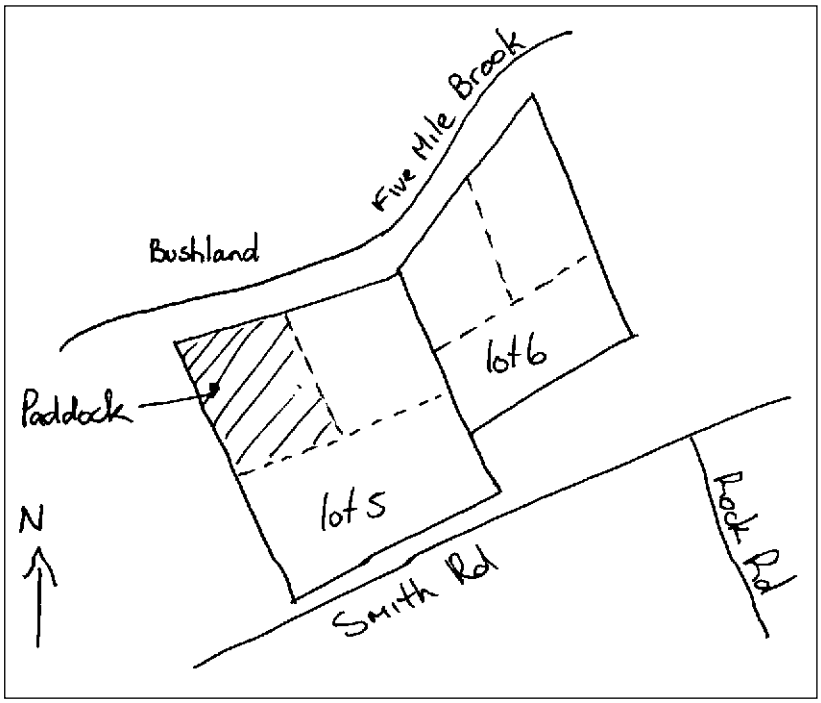


Figure 3: Example of site diagram for paddock scale surveys.

4.2 Filling out the form

Paddock scale surveys : quick reference guide to filling out assessment forms	
General Details	Answer as many questions in this section as possible. ESSENTIAL INFORMATION: Your name, date of survey, the farm name, the nearest road intersection to the farm and the location number or lot number* of the property on which the survey was carried out (if known). Please indicate whether the survey was conducted with the assent of the property owner. OPTIONAL INFORMATION: Your contact address and phone number, the farm name and address. ** The location or lot numbers will help to locate the property, if not already known, on 1:50,000 topographic/cadastral maps from the Department of Land Administration.*
Foreshore assessed	Indicate whether one or both sides of the stream are being assessed. Generally, if the stream is at the boundary of the paddock, assess only the adjacent side. If it passes through the paddock assess both sides, using only one form.
Site diagram	Draw a sketch of the farm property, shading in the area where the paddock is located, indicating the general location of the stream. Include any other information which will be useful, such as roads, other streams, prominent features, lot numbers, etc. If you are doing more than one paddock, a single sketch will do. Just number the paddocks on the first sketch and refer to it on subsequent forms.
Foreshore condition	*Basic survey* In the basic survey, you grade the foreshore into one of four categories, A, B, C and D. *Detailed Survey* For more detailed surveys grade the foreshore using the sub-categories (A1,A2,.....D2,D3).
Fenced off	Indicate whether the stream is fenced off from livestock. Tick yes only if the fence is in good order and is actually functioning as a fence.
Stock access	Tick the yes box if it appears that stock have had access to the river/creek recently, even if the streamline is fenced off.
Crossing point	Indicate whether there is a livestock or vehicle crossing point across the stream.
Comments	Any general comments or specific points regarding fences or livestock or vehicle access should be noted here.
ADDITIONAL INFORMATION	*The following sections provides some useful additional information to help gain an overall picture of the vulnerability and health of the river system. Fill out one or more of the boxes as appropriate.*
Bank steepness	Tick the box which best represents the foreshore being surveyed.
General soil cohesion	Tick the box which best represents the foreshore being surveyed.
Major erosion/siltation	Tick the appropriate boxes (you may tick several boxes).
Vegetation health	Tick the appropriate boxes (you may tick several boxes).
Comments	Any general comments, special notes or specific points regarding the above sections should be included here.
Overall stream health rating	Assess each of the given parameters using Table 1. Add all of the scores together to environmental rating obtain the total score. Use this score to calculate the *stream health rating.*

Foreshore Condition Assessment Form:
for paddock scale surveys

General details

Name: _____
Address : _____

_____

Ph no.:_____
Date: _____
Farm name: _____
Farm address: _____

_____

Nearest road intersection _____

_____

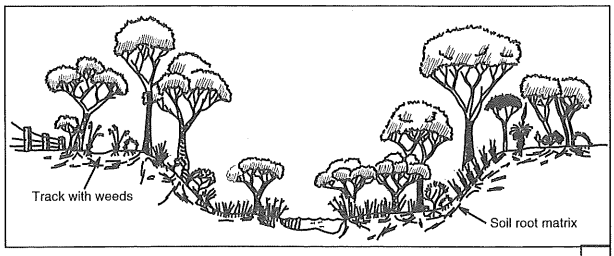
Catchment _____
Stream name: _____
Location: _____
Lot no.: _____
Owner/manager assent obtained
Yes ☐ No ☐

Foreshore assessed
One side ☐ Both sides ☐

Site diagram

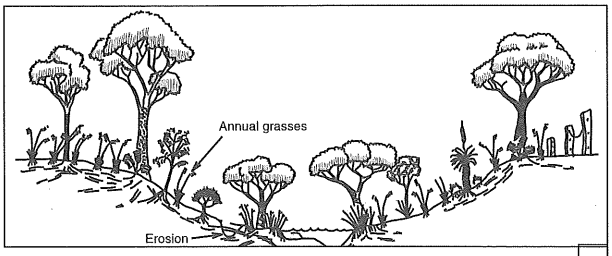
Foreshore Condition

A. PRISTINE - FEW WEEDS ☐



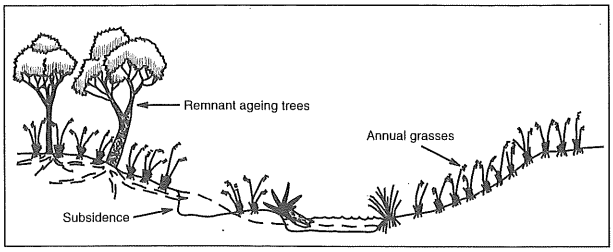
A1 Pristine: no weeds ☐
A2 Near pristine: some weeds ☐
A3 Slightly disturbed: local weed infestations ☐

B. DEGRADED - WEED INFESTED ☐



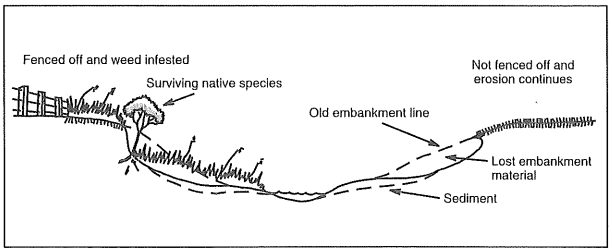
B1 Weed infested: understorey mainly natives ☐
B2 Heavily weed infested: natives = weeds ☐
B3 Degraded: understorey weed dominated ☐

C. ERODING OR EROSION PRONE ☐



C1 Erosion prone: understorey weeds only ☐
C2 Surface erosion: soil exposed ☐
C3 Erosion and subsistence present ☐

D. DITCH OR DRAIN ☐



D1 Eroding: extensive erosion and siltation ☐
D2 Freely eroding (ditch): erosion / siltation out of control ☐
D3 Weed infested (drain): highly eroded ☐

Fencing Status

Fenced off: Yes ☐ No ☐

Stock access to foreshore: Yes ☐ No ☐

Crossing point present: Yes ☐ No ☐

Comments:

Additional Information

General bank steepness

☐ > 60˚  Very Steep

☐ > 45-60˚  Steep

☐ > 10-45˚  Moderate

☐ > 0-10˚  Slight

Major erosion/siltation

☐ None

☐ Points of cutting/undercutting

☐ Major undercutting

☐ Firebreak/track washouts

☐ Bank subsidence

☐ Large deposits

Vegetation health

☐ Looks healthy

☐ Some sick trees

☐ Many sick and/or dying trees

☐ Many dead trees

☐ Mainly long dead trees

Tree seedlings and saplings present

Yes ☐ No ☐

General soil cohesion

☐ Excellent - rock, stone ☐ Good - clay, clayey loam ☐ Poor - sand, loose loam

Comments:

Overall stream environmental rating

Rating	Floodway & Bank vegetation	Verge vegetation	Stream cover	Bank stability & sediment	Habitat diversity
Excellent	(15)	(8)	(8)	(8)	(6)
Good	(12)	(6)	(6)	(6)	(4)
Moderate	(6)	(4)	(4)	(4)	(2)
Poor	(3)	(2)	(2)	(2)	(1)
Very poor	(0)	(0)	(0)	(0)	(0)

Surrounding landuse:

☐ Conservation reserve (8) ☐ Rural residential (4) ☐ Agriculture (2)

☐ Remnant bush (6) ☐ Urban (2) ☐ Commercial/industrial (1)

TOTAL SCORE = **ENVIRONMENTAL RATING =**

Score	40-55	30-39	20-29	10-19	0-9
Rating	**Excellent**	**Good**	**Moderate**	**Poor**	**Very poor**

5. Performing foreshore surveys at a large scale

5.1 Introduction

Paddock scale surveys are fine if you wish to survey a single paddock or a farm having a few paddocks with streamlines. But once you have gained some experience and confidence, using a single form for each paddock or block of land will seem time consuming and cumbersome. If you wish to survey a large area or long section of stream, use the "Long River Section" survey form.

On this form you will enter the same information as for the paddock scale survey but you will have to remember the different categories of information and the abbreviations used to express them. An abbreviation list is provided below. Refer to section 3 if you require more detail on any of the categories.

5.2 Filling out the survey form

5.2.1 Index diagram

From a 1:50,000 map showing properties (CALM maps and the 1:50,000 cadastral/topographical series from DOLA convey this information), obtain a copy of the section of river or creek you are interested in surveying. For each block of land having a unique land use history draw and number these on the map copy. In most cases these will correspond to paddocks, but may also be road reserves, shire reserves, A class reserves, Crown land, etc. This is your index diagram.

Enter these numbers across the top of the survey form table opposite "Section", in the same order you intend to survey them. There is space for 15 separate sections. If you have more than 15 sections, continue on another sheet. The survey information for each section of foreshore can be entered below the respective numbers. When you have completed the survey attach your index diagram to the survey form or forms.

5.2.2 Abbreviations

The table below provides a summary of the abbreviations to be used when filling out the long section survey form.

Yes can be indicated by a "Y" or a "tick" as preferred.

No can be indicated by a "N" or by leaving the box blank.

Not applicable is indicated by "NA".

Large scale surveys : guide to filling out assessment forms	
Foreshore assessed	Indicate with a tick whether one or both sides of stream are being assessed.
Foreshore condition	Enter A, B, C or D as appropriate.
General	Enter A1, A2, etc as appropriate.
Best	Enter the best condition that can be found in the section, A1, A2, etc.
Poorest	Enter the poorest condition that can be found in the section, B2, B3 etc. *Note: The object of the above information is to record the general condition and range of condition.*
Fenced off	Enter Y or N.
Stock access	Enter Y or N.
Soil cohesion	Enter the appropriate adhesion level as abbreviation below: E = Excellent G = good P = poor
Erosion/siltation	Enter Y or N as appropriate in the first row and then tick or not as appropriate.
Bank steepness	Enter the appropriate condition as abbreviation below: VS = very steep, greater than 60˚ S = steep, between 45˚ and 60˚ MS = moderate slope, between 10˚ and 45˚ SS = slight slope, less than 10˚
Vegetation health	Tick as appropriate.

Foreshore Condition Assessment Form:

for Long River Section Surveys

General details

Recorder's Name: Contact Number: Date:

River/Creek: Catchment:

Nearest Road Intersection:

Index diagram ref No:

Foreshore assessed (facing upstream): left ☐ right ☐ both ☐

Section															
Foreshore condition (A, B...)															
General (A1, A2...)															
Best															
Poorest															
Fenced off (Y/N)															
Stock access (Y/N)															
Soil cohesion (E/G/P)															
Erosion/siltation (Y/N)															
Cutting/undercutting															
Major undercutting															
Firebreak washouts															
Bank subsidence															
Large sediment deposits															
Bank steepness (VS/S/MS/SS)															
Vegetation health															
Looks healthy															
Some sick trees															
Many sick and/or dying trees															
Many dead trees															
Long dead trees															
Tree seedlings/saplings present															

Comments:

6. References

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Appendix 1

Examples of paddock scale and long river section surveys

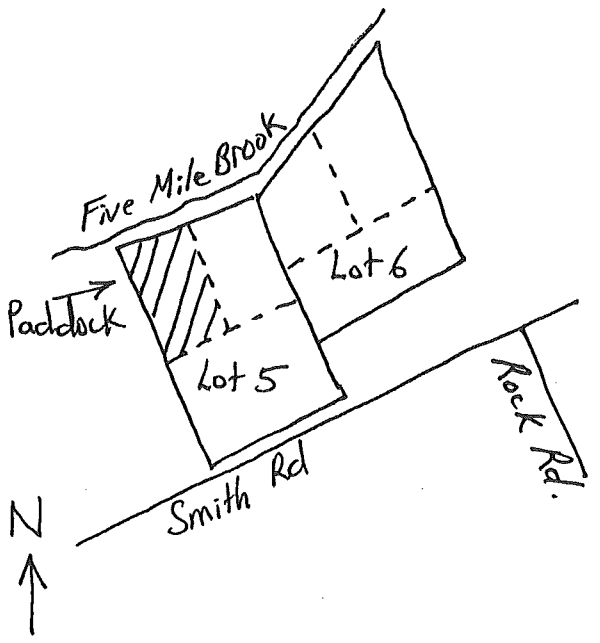
RIVER FORESHORE ASSESSMENT FORM

FOR PADDOCK SCALE SURVEYS

General details
Name: Bob Smith
Address: Lot 5, Smith Rd Colchester
Ph. no: NA
Date: 26.8.1994
Farm name: Bob's Farm
Farm address: As above
Nearest road intersection: Smith and Rock Rd.
Catchment: Blackwood
Stream name: Five Mile Brook
Location no.: ?
Lot no.: 5
Owner/manager assent obtained:
Yes ☑ No ☐

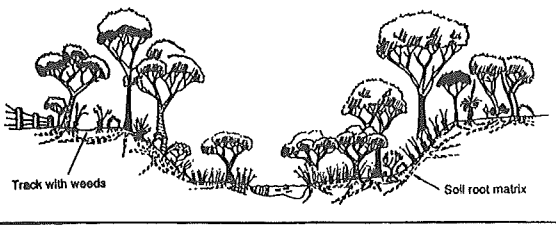
Foreshore assessed:
One side ☑ Both sides ☐

Site diagram



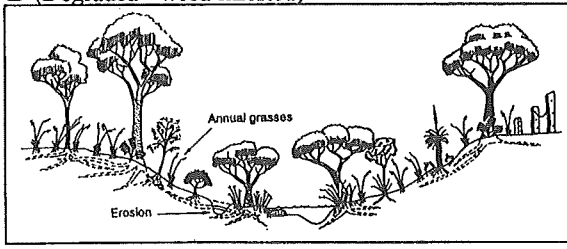
FORESHORE CONDITION

A (Pristine - near pristine) ☐



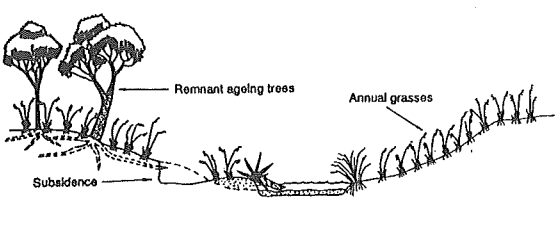
A1. Pristine: no weeds..... ☐
A2. Near pristine: some weeds..... ☐
A3. Local weed infestations..... ☑

B (Degraded - weed infested) ☐



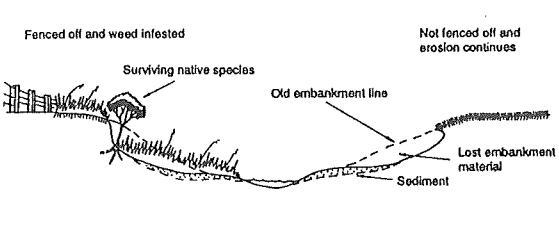
B1. Understorey mainly natives..... ☐
B2. Understorey: natives=weeds..... ☑
B3. Understorey: mainly weeds..... ☐

C (Eroding or erosion prone) ☐



C1. Understorey: weeds only, no erosion ☐
C2. Surface erosion, exposed soil..... ☐
C3. Erosion and subsidence present..... ☐

D (Ditch or drain) ☐



D1. Extensive erosion and siltation - out of control (ditch)..... ☐
D2. Weed infested (drain)..... ☐

FENCING STATUS

Fenced off: Yes ☑ No ☐

Stock access to foreshore: Yes ☐ No ☑

Comments: Old fence, will need work in next year or two.

OPTIONAL SECTION

General soil cohesion

- ☐ Excellent - rock, stone
- ☐ Good - clay, clayey loam
- ☑ Poor - sand, loose loam

General bank steepness

- ☐ >60° — Very steep
- ☑ 45-60° — Steep
- ☐ 10-45° — Moderate slope
- ☐ 0-10° — Slight slope

Major erosion/siltation

- ☑ None
- ☐ Points of cutting/undercutting
- ☐ Major undercutting
- ☐ Firebreak/track washouts
- ☐ Bank subsidence
- ☐ Large sediment deposits

Comments: The river seems in good shape, but lots of weeds.

Vegetation health

- ☑ Looks healthy
- ☐ Some sick trees
- ☐ Many sick and/or dying trees
- ☐ Many dead trees
- ☐ Mainly long dead trees

Tree seedlings and saplings present: Yes ☑ No ☐

Overall stream environmental rating ☑ Not done.

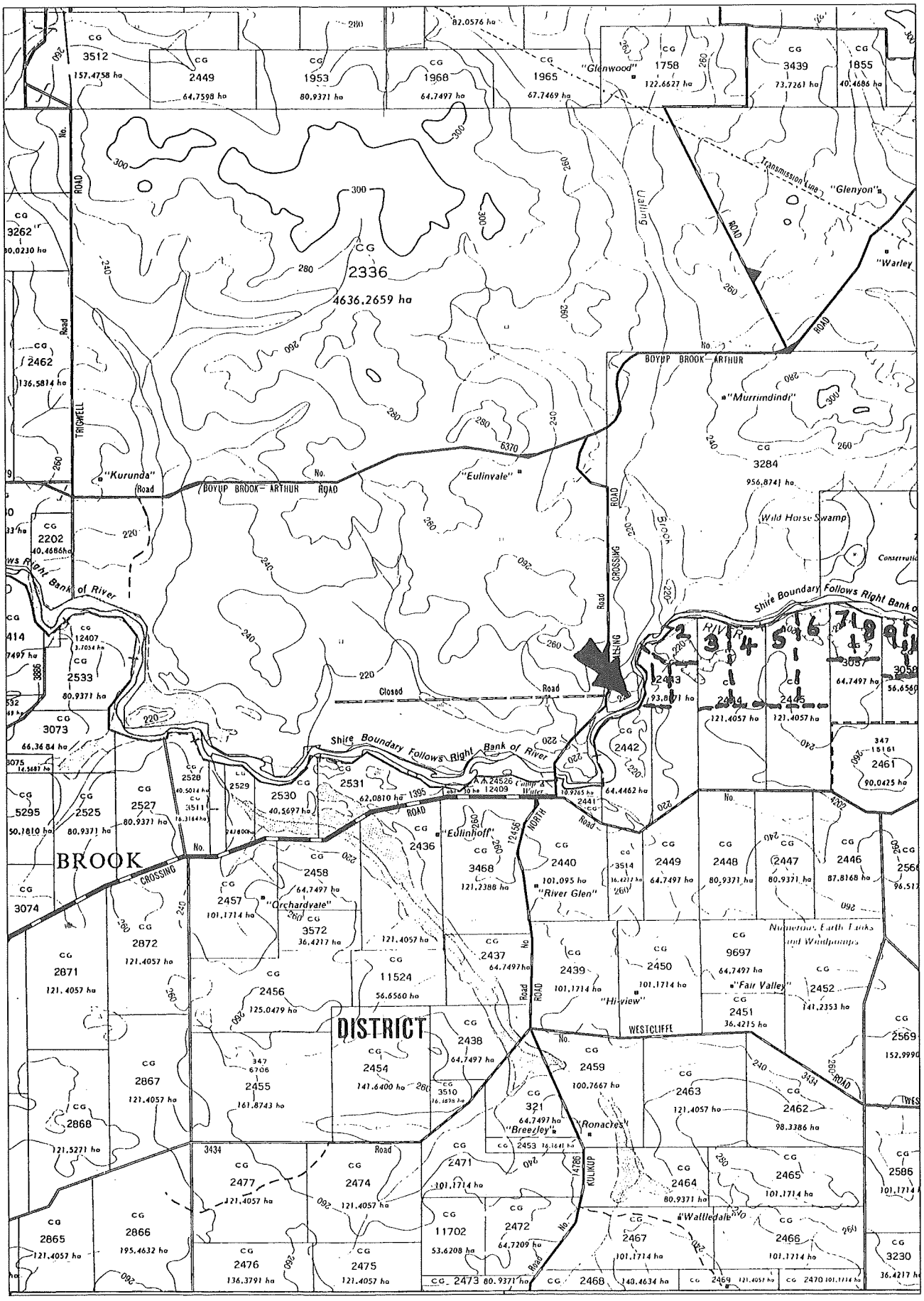
Rating	Floodway & bank vegetation	Verge vegetation	Stream cover	Bank stability & sediment	Habitat diversity
Excellent	(15)	(8)	(8)	(8)	(6)
Good	(12)	(6)	(6)	(6)	(4)
Moderate	(6)	(4)	(4)	(4)	(2)
Poor	(3)	(2)	(2)	(2)	(1)
Very poor	(0)	(0)	(0)	(0)	(0)

Surrounding landuse: Conservation reserve (8) Remnant bush (6) Rural residential (4) Agricultural (2) Urban (2) Commercial/industrial (1)

Total score = ☐

40-55 Excellent 10-19 Poor
30-39 Good 0-9 Very poor
20-29 Moderate

Environmental rating = ...


"Glenwood"
"Glenyon"
"Warley"
"Murrimdindi"
"Eulinvale"
"Kurunda"
BOYUP BROOK–ARTHUR ROAD
Wild Horse Swamp
Shire Boundary Follows Right Bank of River
Closed Road
"Edinhoff"
"River Glen"
"Orchardvale"
"Hi-view"
"Fair Valley"
"Breejley"
"Ronaces"
"Walledale"
BROOK
DISTRICT
WESTCLIFFE
CROSSING
TRIGWELL
KULKUP
2336
4636.2659 ha

RIVER FORESHORE ASSESSMENT FORM

LONG SURVEY

General details

Name: Susan Parks Date: 7.7.94 Phone no.: NA

Address: Old Rd, Boyer Brook

River/Creek: Blackwood R. Catchment: Blackwood

Location: Blackwood R. South Bank. Loc 2443-45, 3057-58. See Map

Foreshore assessment: One side ☑ Both sides ☐

SECTION	1	2	3	4	5	6	7	8	9	10
Foreshore condition	A	A	A	B	C	C	C	B	B	B
General	A3	A2	A3	B1	C2	C3	C2	B1	B1	B2
Best	A3	A2	A2	B1	C2	C3	C2	B1	B1	B2
Poorest	B1	A2	A3	B1	C3	C3	C2	B2	B2	B3
Fenced off (Y/N)	Y	Y	Y	Y	N	N	Y	Y	Y	N
Stock access (Y/N)	N	N	N	N	Y	Y	N	N	N	Y
Soil cohesion (E/G/P)	P	P	P	P	P	P	P	P	P	P
Erosion/siltation (Y/N)					Y	Y	Y			
Cutting/undercutting					✓	✓	✓			
Major undercutting					✓	✓				
Firebreak washouts										
Bank subsidence						✓				
Large sediment deposits		✓	✓	✓						
Bank steepness	MS	MS	MS	MS	MS	MS	MS	MS	MS	MS
Vegetation health										
Looks healthy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Some sick trees										
Many sick and/or dying trees										
Many dead trees										
Long dead trees										
Tree seedlings /saplings present	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Comments: Talked to the owner of Sections 5, 6 & 7. He said damage was done in a big flood a few years ago. Planned to put up fence next year.

Appendix 2

Condition mapping symbols

Weeds

Symbol	Common name	Scientific name
⋈	Weed wattles	*Acacia spp.*
|||||||	Giant reed	*Arundo donax*
♧	Canna lily	*Canna spp.*
*	Pampas grass	*Cortaderia selloana*
◑	Perennial veldtgrass	*Ehrharta calycina*
⊕	African lovegrass	*Eragrostis curvula*
C	Coral tree	*Erythrina x sykesii*
⊤	Edible fig tree	*Ficus spp.*
Z	Cotton bush	*Gomphocarpus fruticosus*
△	One leaf cape tulip	*Homeria flaccida*
◔	Morning glory	*Ipomoea spp.*
⊠		*Juncus microcephalus*
#	Lantana	*Lantana camara*
◥	Bridal creeper	*Myrsiphyllum asparagoides*
∿	Paspalum	*Paspalum spp.*
♦	Castor oil bush	*Ricinus communis*
#	Blackberry	*Rubus fruticosus*
⊤	Willow	*Salix spp.*
●	Japanese pepper	*Schinus terebinthifolia*
S	Deadly nightshade	*Solanum nigrum*
∞	Nasturtium	*Tropeolum spp.*
★	Bulrush	*Typha orientalis*
⊢	Vetch	*Vicia sativa*
≤	Watsonia	*Watsonia bulbillifera*
⊗	Arum lily	*Zantedeschia aethiopica*

Native Species

Symbol	Common name	Scientific name
Al	Swamp peppermint	*Agonis linearifolia*
As	Coojong	*Acacia saligna*
Ba	Slender banksia	*Banksia attenuata*
Bj	Bare twigrush	*Baumea juncea*
Ca	Tall sedge	*Carex appressa*
Cc	Marri	*Corymbia calophylla*
Er	Flooded gum	*Eucalyptus rudis*
Hc	Native wisteria	*Hardenbergia comptoniana*
Jp	Pale rush	*Juncus pallidus*
Js	Green stinkwood	*Jacksonia sternbergiana*
Kp	Running postman	*Kennedia prostrata*
Ll	Pithy sword-sedge	*Lepidosperma longitudinale*
Lt	Angle sword-sedge	*Lepidosperma tetraquetrum*
Mr	Swamp paperbark	*Melaleuca rhaphiophylla*
Ol	Narrow-leaved Oxylobium	*Oxylobium lineare*
Pe	Bracken fern	*Pteridium esculentum*
Vj	Swishbush	*Viminaria juncea*

Cadastral and Streetsmart data supplied by the Dept. of Land Administration (1998)

Map Legend