Wimmera Catchment Management Authority

Waterways for Life.

MacKenzie River Waterway Action Plan

December 2004

Prepared by
Earth Tech Engineering Pty Ltd
ABN 61 089 482 888
Horsaham Office, 62 Darlot Street
Horsham VIC 3400
Tel +61 3 **5382 2228**

MacKenzie River

Waterway Action Plan

Document History:

ISSUE DATE	REVISION NUMBER	AUTHOR	CHECKED	APPROVED
20/8/2004	0	James Lander Paul Atherton		
27/08/04	1	Paul Atherton Heinz DeChelard		
29/08/2004	2	Paul Atherton		
01/10/2004	3	Heinz de Chelard	Rob Ferguson 4/10/04	
11/10/2004			Ross Hardie	
02/12/2004	4	Heinz de Chelard		
06/12/2004	5		Michael Bain	

EARTH TECH

Natural Resources Group

Earth Tech Engineering Pty Ltd
ABN 61 089 482 888
Head Office 71 Queens Road
Melbourne VIC 3004
Tel +61 3 8517 9200

Contents

List of Figures

List of Tables

List of Appendix

Glossary

Term	Definition
aggradation	Deposition of material which raises the level of the stream bed.
armouring	A stable layer of the largest available sediment size from which finer particles have been removed by stream flow. The armoured surface acts to protect the streambed or bars from erosion.
bedrock	Exposed rock within the streambed. Cohesive rock prevents incision of the channel.
bench	Bank-attached, flat and narrow surface, deposit of fine grained sediment occurring at elevations between the stream bed and the floodplain. Generally will have more established vegetation on it than bars within the channel bed.
degradation	Erosive removal of materials from the stream bed, other geomorphic units or the floodplain, lowering their surface elevation.
confluence	The junction of two streams.
dynamic equilibrium	The condition of a stream that is experiencing an overall balance between erosion and input of sediment. Dynamic equilibrium recognises that significant changes may occur rapidly in response to events such as flooding, resulting in short term change. Material may be passing through the stream bed for example, but the elevation of the bed remains relatively unchanged through time..
easting and northing coordinate system	A means of locating a position based on the Australian Map Grid (AMG) system. Used in conjunction with Global Positioning System (GPS) devices.
erosion	The group of natural processes, including weathering, dissolution, abrasion, corrosion, and transportation, by which material is worn away from the earth's surface.
alluvial fan	A low spreading (often triangular in planform shape) deposit of sediment coming off a hillside. The upslope (head) of the fan is steeper than the wider base of the fan.
fluvial-geomorphology	The study of the evolution and configuration of landforms as produced by the action of a river or stream.
geomorphology	The study of the evolution and configuration of landforms (see also fluvial-geomorphology).

Term	Definition
headcut	Vertical, or near vertical drop in channel elevation greater than 300mm
hydraulics	The physical science and technology of the static and dynamic behaviour of fluids. The state of forces of water in a stream at any given time.
hydrology	The scientific study of the properties, distribution and effects of water on the Earth's surface, in the soil and underlying rocks and in the atmosphere. The long term changes in stream flow, including periods of flood and drought.
incision	Lowering or downward cutting of the channel level through water erosion
left bank	The streambank on a persons left hand side when facing downstream
nick point	Vertical, or near vertical drop in channel elevation less than 300mm (see also head cut)
planform	The form or shape of a stream as viewed directly from above (such as can be seen in aerial photographs).
reach	The basic stream management unit. Defined as a length of stream with similar characteristics.
right bank	The streambank on a persons right hand side when facing downstream
riparian	From the Latin word for riverbank. Pertaining to riverbanks. Riparian vegetation refers to the vegetation along streambanks.
riverine	Relating to or resembling a river.
sinuosity	Ratio of the length of the channel between two points to the straight line distance between those two points.
streampower	The ability of a stream to do work. Calculated as shear stress times flow velocity.
sodic soils	Soils with high concentration of sodium ions such that the structure of the soil is affected. Sodic soils are highly dispersible on contact with fresh water.
valley fill	Sediment accumulated within the floor of a valley.

Abbreviations

ASL	Above Sea Level
DSE	Department of Sustainability & Environment
EVC	Ecological Vegetation Class
ISC	Index of Stream Condition
LWD	Large Woody Debris
NRM	Natural Resource Management
RHA	Rapid Habitat Assessment
WAP	Waterway Action Plan
Wimmera CMA	Wimmera Catchment Management Authority

Executive Summary

In 2003 the Wimmera Catchment Management Authority (Wimmera CMA) undertook a geomorphic categorisation and stream condition assessment of the Wimmera River catchment. The study identified the MacKenzie River as a rare stream type in south eastern Australia that required management in order to maintain its diverse and unique geomorphic and values. As such the Wimmera CMA has developed a Waterway Action Plan (WAP) for MacKenzie River. The objectives of the plan are to:

1. Protect and enhance the high values of the MacKenzie River;
2. Confirm values and threats identified from existing reports and community consultation;
3. Develop appropriate management actions on a reach by reach basis, in conjunction with the catchment community.

The MacKenzie River is a tributary of the Wimmera River that originates from the northern Grampians ranges in western Victoria and joins the Wimmera River approximately 5km downstream of Horsham. The upper catchment forms part of the Grampians National Park and is highly valued for its conservation and recreational values. It also forms the catchment for Lake Wartook – Horsham's urban water supply. Downstream of the National Park grazing and cropping are the predominant land uses. Within this middle and lower catchment area Crown Frontage exists for almost the entire length of the MacKenzie River. The riparian vegetation in these sections ranges in condition from good to excellent. This tract of vegetation is broad (up to 200m wide) and ecologically diverse. Consequently the river is a significant recreational and ecological resource for the local community and the region.

The MacKenzie River and its tributaries are rich in native fish species. A significant population of platypus exists in many areas, however they are currently threatened by predation during dry periods. Therefore, the maintenance of deep pools within the river system is a key element in their long term survival.

The MacKenzie River catchment is also the site of important Aboriginal and European heritage values. The area is significant in its role in the dreaming stories of the local aboriginal communities, with the MacKenzie River forming a key element of the Blackfish Dreaming. Associated with this are significant archaeological sites throughout the catchment.

The largest impacts upon the ecological values of the MacKenzie River are the unseasonal variation of flow caused by the use of the main river stem for the Wimmera Stock and Domestic Water Supply System and Horsham's urban water supply. Within the Grampians National Park the river flows for most of the time, maintained by controlled releases from Lake Wartook for Horsham's urban water supply and from small streams and aquifer recharge. In the mid-sections, flows vary according to supply demands within the Wimmera Stock and domestic water supply system, whilst in the lower sections flow is frequently very low or non existant. The geomorphology of the river is changing as a result of the altered flow regime. Action to preserve the unique geomorphic values of the system is therefore required.

Priorities for management actions to preserve and enhance the values of the MacKenzie River were determined by compiling data from a document review, field

inspections. This data was then used in a risk assessment process to determine action priorities in the form of a Waterway Action Plan. The major action recommended for the MacKenzie River in this Waterway Action Plan is the return of water to the system in a way that mimics the natural hydrologic regime. Another recommendation from the report is the urgent need to control weeds within the riparian zone of some reaches of the river. However, as the riparian zone is predominantly Crown Land, responsibility for its management rests with the Department of Sustainability and Environment. Other issues such as the unauthorised riding of motor bikes in the riparian zone, illegal firewood collection and rubbish dumping are all threats to the MacKenzie River that will require a coordinated approach from management agencies.

1 Introduction

In 2003 the Wimmera Catchment Management Authority (Wimmera CMA) undertook a geomorphic categorisation and stream condition assessment of the Wimmera River catchment. Located to the south east of Horsham in western Victoria (Figure 1), the MacKenzie River was identified in the study as a rare stream type in south eastern Australia. It is therefore recognised that to preserve the river and its diverse and unique geomorphic, ecological and recreational values, ongoing action is required. This report by Earth Tech Engineering Pty Ltd (Earth Tech) documents the analysis and outcomes of a Waterway Action Plan (WAP) for MacKenzie River. The WAP has been developed to guide management and facilitate the implementation of waterway management works. The WAP includes:

1. The development of objectives for MacKenzie River in accordance with state and regional priorities for management (*Catchment Values Threats and Management Objectives*, section 3);
2. The current geomorphologic and ecological conditions of MacKenzie River;
3. Assessment of values and threats to the creek, as perceived by stakeholders including the MacKenzie River catchment community;
4. An assessment of risks to waterway health within the MacKenzie River catchment, and;
5. A determination of waterway health targets for MacKenzie River, incorporating a detailed action plan to achieve these targets.

Figure 1. The location of the MacKenzie River catchment within the WCMA boundary.

1.1 Scope

The scope for this project is set out in the Wimmera CMA Project Brief and comprises the following project tasks:

- A review of the relevant state and regional strategies;
- Development of a subcatchment management plan detailing the risks and opportunities within the subcatchment, and prioritised management actions;
- Detailed maps showing the location of proposed management actions;
- Identification of bed and bank instabilities;
- Location of pest plant and animal species that may pose a threat to waterway health at a reach scale;
- Extent and condition of riparian vegetation and fencing at a reach scale;
- Identification of high value assets and the risks and opportunities associated with these assets;
- An indicative budget to undertake management actions;
- Development of WAPs with a “Landscape” or whole of catchment approach to natural resource management (NRM);
- The WAPs are developed with consideration for other NRM programs and projects planned or underway within the catchment.
- Development of WAPs with a holistic catchment-wide NRM approach, and in consideration of other programs planned or underway within the catchment. These projects and activities include works currently planned or being undertaken by Landcare Groups or as part of the piping of the Wimmera Mallee Domestic and Stock Supply System.

The background review and field assessments identified many issues that have an impact upon waterway health, however management of a number of these issues is achieved within other works programs, strategies and plans developed by various management organisations and individual landowners. These issues along with their associated management programs are detailed in the Table 1.

Table 1. Waterway and land management programs relevant to the MacKenzie River catchment.

Issues identified in Waterway Action Plan	Responding Strategy / Plan / Activity
Bank erosion Stream bed instability In stream Water Quality In stream habitat Riparian zone revegetation	***Mackenzie River Waterway Action Plan***
Exotic pest plants	***Wimmera Weed Action Plan***
Whole farm and pasture management	***Whole Farm planning***
Rabbits	***Wimmera Rabbit Management Action Plan***
Other exotic pest animals	***Victorian pest management framework***
Native pest animals	***Dept. Sustainability & Environment***
Native Vegetation Management	***Victorian Biodiversity Strategy*** ***Shire Planning schemes***

The Wimmera Catchment Management Authority (Wimmera CMA) plans to undertake a stream management works program along the MacKenzie River, which has been identified as a high priority for management. It is recognised that MacKenzie River is also named MacKenzie Creek, MacKenzie River or MacKenzie Creek in local maps, which can cause confusion. As such, this Waterway Action Plan (WAP) will use the term MacKenzie River to describe the stream from its origins above Lake Wartook to its confluence with the Wimmera River. The WAP, being prepared by Earth Tech Engineering, is to help guide the most appropriate management and facilitate the implementation of waterway management works where required. The development of local community support, the investigation of reach wide issues and the subsequent provision of a technical and financial basis for the works are important aspects of Waterway Action Plans. The WAP will also consider the hydrological, physiological and ecological interactions of the MacKenzie River with Burnt and Bungalally Creeks.

This report includes

1. a discussionA review of regional and local objectives of the Wimmera CMA via objectives referenced in relevant regional strategies and investigations. These objectives are to be observed throughout the development of the Waterway Action Plan

2. A summary of catchment conditions, sourced from reports and investigations into waterway health within the Wimmera CMA region, and
3. A summary of values and issues raised at meetings with stakeholders and the MacKenzie River catchment community.

2 Methodology

The Waterway Action Plan for the MacKenzie River was compiled using the following methodology:

2.1 Background Document Review

A desktop review of existing reports, investigations into waterway health issues and associated available data was undertaken. The aim was to provide:

1. A comprehensive list of waterway health issues. This list provided the basis for data collection during fieldwork and subsequent remedial action development;
2. A comprehensive list of stakeholders to be consulted during the development of the plan and the preparation of a stakeholder consultation plan. This plan was used to obtain stakeholder input on issues and concerns about the condition of MacKenzie River and works planned for the catchment.

2.2 Engagement of Stakeholders and the Community

Public notices were placed in local newspapers and a letter drop was made to all roadside mailboxes within the catchment. This was undertaken at project inception to inform the community of the commencement of the project, identify opportunities for community involvement and advise people of the dates and venues for information sessions

2.3 Field Assessments

A specialist team including a geomorphologist, waterway engineer and vegetation specialist undertook field assessments. The inspections were conducted in the presence of Wimmera CMA waterways staff and the landholder where possible. This approach permitted a continuous exchange of information by which all parties could learn from each other.

Information collected during the field inspections included:

- Past and present geomorphic condition;
- Contemporary vegetation condition and extent;
- Habitat quality, and;
- Fencing, revegetation and engineering works required.

The methodology applied to assess this information is elaborated upon in the following paragraphs.

Stream health

Stream health in Victoria is assessed using the Department of Sustainability and Environment's (DSE) Index of Stream Condition (ISC). ISC assessments have not been undertaken on the MacKenzie River as part of this plan. ISC assessments for the MacKenzie River, conducted in 1999, rate highly factors such as the condition of

the streamside zone, water quality and aquatic life. However **a very low score for hydrology results in overall ratings of poor or medium.**

Contemporary Vegetation Condition and Extent

The field condition and extent of contemporary vegetation, including native, exotic and weed species, was assessed by a vegetation specialist. Vegetation was then described in terms of the pre-1750's Ecological Vegetation Class (EVC) for the relevant bio-region. These classes are further defined in terms of their Bio-regional Conservation Status and may be described as listed in table 2.

Table 2. Summary of EVC Bioregional Conservation Status Definitions.

Symbol	Conservation Status	Brief Definition
X	Presumed Extinct	Probably no longer present in the bioregion (or, if present, below the resolution of available mapping)
E	Endangered	<10% of pre-European extent remains (or a combination of depletion, loss of quality, current threats and rarity that gives a comparable status)
V	Vulnerable	10 - 30% of pre-European extent remains (or a combination of depletion, decreased quality, on-going threats and rarity that gives a comparable status)
D	Depleted	>30% and up to 50% of pre-European extent remains (or a combination of depletion, loss of quality, on-going threats and rarity that gives a comparable status)
R	Rare	Rare as defined by geographic occurrence (total range generally <10 000ha, or pre-European extent in Victorian Bioregion <1000ha or patch size generally <100ha) but neither depleted, degraded nor currently threatened to an extent that would qualify as endangered, vulnerable or depleted
LC	Least Concern	>50% or pre-European extent exists and subject to little to no degradation over a majority of this area.

Source: Ecological Vegetation Class - Bioregional Conservation Status, Depletion & Tenure Area Statement on CD provided to consultants at the Native Vegetation Framework Training, September 2003.

Issues relating to the quality of vegetation, threats and opportunities are noted for each reach within the MacKenzie River catchment. Species lists are provided in Appendix B.

Habitat quality

An assessment of habitat quality has been provided to enhance the value of the vegetation information collected. Note that sub-reach delineation was not determined prior to the commencement of the field inspection stage as this refinement was to be based on the geomorphic information derived from the field inspections. As a result, it was not possible to collect habitat quality information for all of the reaches.

Habitat quality in the MacKenzie River riparian zone was determined using the Rapid Habitat Assessment (RHA) method developed by DSE. This method is a modified version of the Habitat Hectares Method used in more comprehensive surveys. The RHA gives an estimate of vegetation / habitat quality using the following criteria:

- Retention of large old trees
- Retention of canopy cover
- Retention of the cover of, and diversity within, understorey life forms
- Presence of appropriate recruitment
- Absence of weeds
- Litter
- Logs (in woodlands and forests)

At a particular site, native vegetation is assessed by comparing it to a benchmark which represents the average characteristics of a mature, long undisturbed stand of the same type of vegetation. The RHA therefore provides a 'snap-shot' of current habitat quality. Once current condition is established, sites may be ranked according to condition, enabling goals, minimum standards and management priorities to be formulated.

Habitat quality assessments vary throughout the MacKenzie River catchment and as such the results are provided on a reach by reach basis in the Sub-Reach section of this report. Field notes for the assessment undertaken in each reach are provided in Appendix D.

Risk assessment & priority setting for management actions

The risk assessment process assembled the information gathered during the document review, stakeholder consultation and field assessments. Each assessment considered the values and threats to the values at the inspection sites.

The first component of the analysis identified standardised environmental values in each reach and threats to these values (Appendix D). All values were assigned a rating from Very Good (5) through to Very Poor (1).

Environmental values were determined via information gathered in the literature review and from field observations. Social and economic values were assigned a subjective rating from Very Good (5) through to Very Poor (1) based on background document review and stakeholder and community consultation.

Threats have been given a similar rating from Very High (5) through to Very Low (1). Social threats and economic threats have been determined from consultation with stakeholders. Environmental threats have been determined from information gathered in the literature review and from field observations.

In order to determine the level of "Risk", the impact of a "Threat" on a "Value" is determined by multiplying the "Value x Threat", then multiplying this rating by standardised Likelihood and Trajectory.

"Likelihood and "Trajectory" are defined as follows:

Likelihood – i.e. what is the likelihood of this threat impacting on this value;

5-almost certain

4-quite possible

3-unusual but possible

2-remotely possible

1-practically impossible

Trajectory – i.e. what is the timescale created by this impact;

5-rapid

3-slow

1-stable

Trajectory provides a time scale when prioritising risk. Trajectory also varies between reaches and has therefore been identified for every risk in every reach.

The risk to a value was determined by the resultant score from the multiplication of Value x threat x Likelihood x Trajectory. The risk rating was assigned according to the following method:

Low	<80
Medium	< 200
High	< 400
Very High	> 400

Priorities for management actions were determined by the risk rating. High priority actions correspond with very high and high risk ratings. Similarly, medium and low priority actions correspond with medium and low risk ratings respectively.

3 Management Objectives, Condition and Values

The regional strategies, policies and actions which are relevant to the Wimmera River Catchment are:

- Victorian River Health Strategy (2002)
- Draft Wimmera Waterway Management Strategy (2002)
- Wimmera Water Quality Strategy (2002)
- Wimmera River Geomorphic Investigation (2001)
- Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment (2003)

3.1 Review of State and Regional Strategies

The Victorian River Health Strategy

"The objective of the Victorian River Health Strategy (VRHS) is to achieve healthy rivers, streams and floodplains which meet the environmental, economic, recreational and cultural needs of current and future generations" (DNRE, 2002). To achieve this objective, a management approach based on 4 key elements will be used :

- Protecting rivers that are of the highest community value from any decline in condition;
- Maintaining the condition of ecologically healthy rivers;
- Achieving an 'overall improvement' in the environmental condition of the remainder of the State's rivers, and;
- Preventing damage from future management activities.

Implementation of this management approach will be by:

- Providing special protection for rivers of very high value;
- Establishing regional five and 10 year targets for river protection and restoration through community-driven regional planning processes; and
- Establishing policies for specific management activities aimed at preventing damage to river health from future management activities.

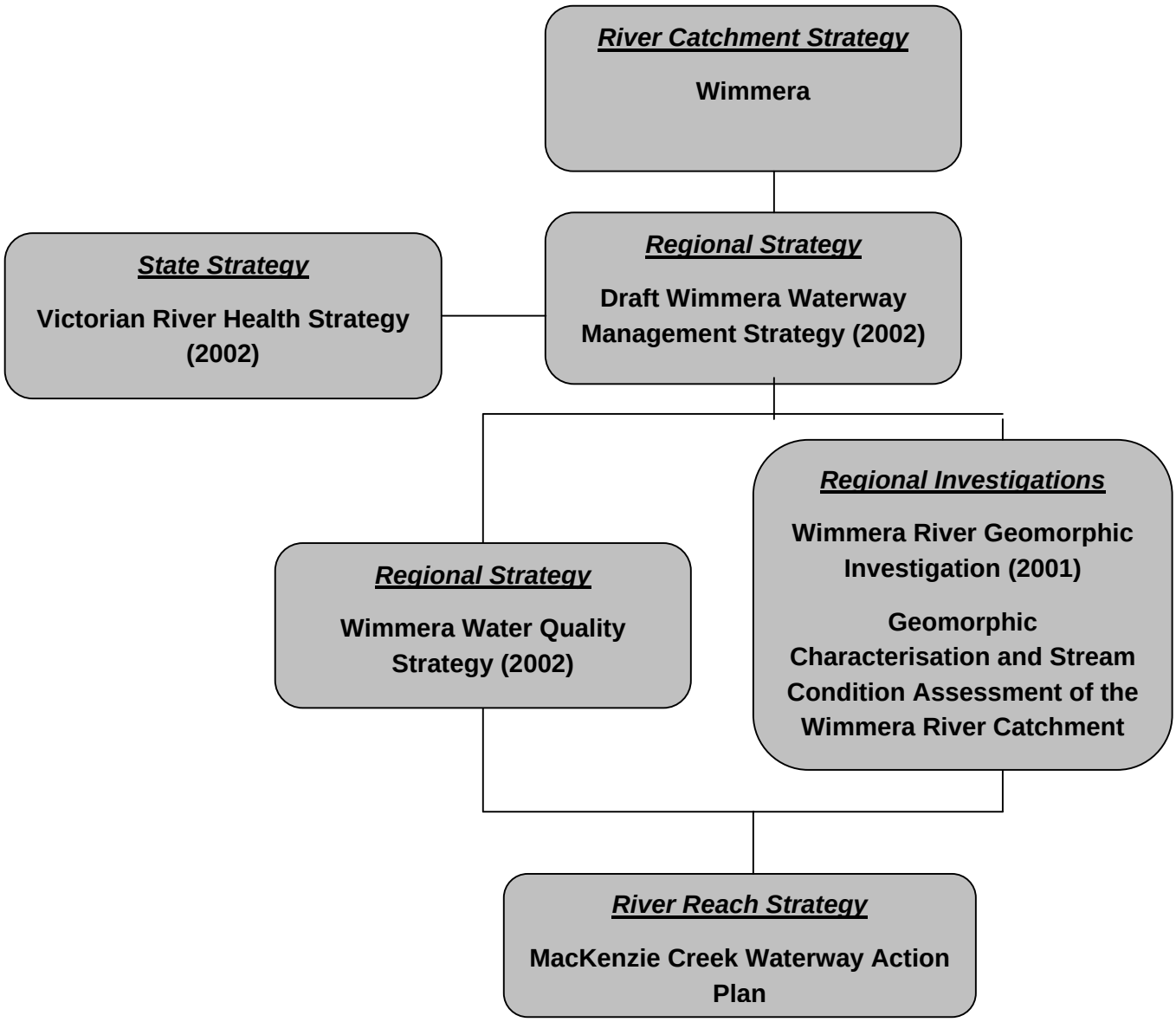


Figure 1a - Relationships between reports used to compile the MacKenzie River Waterway Action Plan

The Wimmera Waterway Management Strategy

The Wimmera Waterway Management Strategy (WWMS) aims to, *"protect and enhance the region's waterways through fair and sustainable management, taking account of environmental, economic, cultural and social objectives".*

The 2003 Wimmera Regional Catchment Strategy identifies changed channel form as a significant waterway issue and identifies resource condition targets and actions to achieve these.

Key Resource Condition Targets in the Wimmera RCS are:

- R9 – All stream reaches identified as being of high value and in good condition in the Draft Wimmera Waterway Management Strategy be protected by 2020.
- R10 – Improvement in the 'stability condition' of high value streams rated as moderate by the Draft Wimmera Waterway Management Strategy protected or returned to good condition by 2020.

Key Management Action Targets in the Wimmera RCS are:

- WR37 – Undertake works in priority areas to restore and protect in-stream habitat.
- WR50 – Implement priority actions to protect and manage stream forms.
- WR51 – Assist with gully stabilisation where there is a direct impact on the waterway.

A series of programs, which are consistent with the Wimmera Regional Catchment Strategy, are detailed in the WWMS. Of particular relevance to this Waterway Action Plan are:

- Program 1. Asset Management

Aim: To manage structural waterway assets so as to improve the health of the waterways;

- Program 2. Waterway Repair and Maintenance

Aim: To preserve, maintain and/or rehabilitate the environmental, economic and social values of waterways;

- Program 3. Riparian Management

Aim: To improve waterway health through the sustainable management of riparian zones

- Program 4. Catchment Management

Aim: To assist in addressing land management issues that have negative impacts on waterway values.

- Program 5. Flow regimes

Aim: To improve the health of aquatic and riparian ecosystems though provision of appropriate flow regimes, and

- Program 8. Water Quality and Urban Stormwater Management

Aim: To improve the quality of water in the region's waterways and wetlands

The WWMS divided the Wimmera CMA region into 12 Waterway Management Units (WMU). The WMUs are shown in Figure 2. This report aims to confirm and elaborate on the findings of the WWMS in relation to MacKenzie River, which is wholly contained within Waterway Management Unit 7.

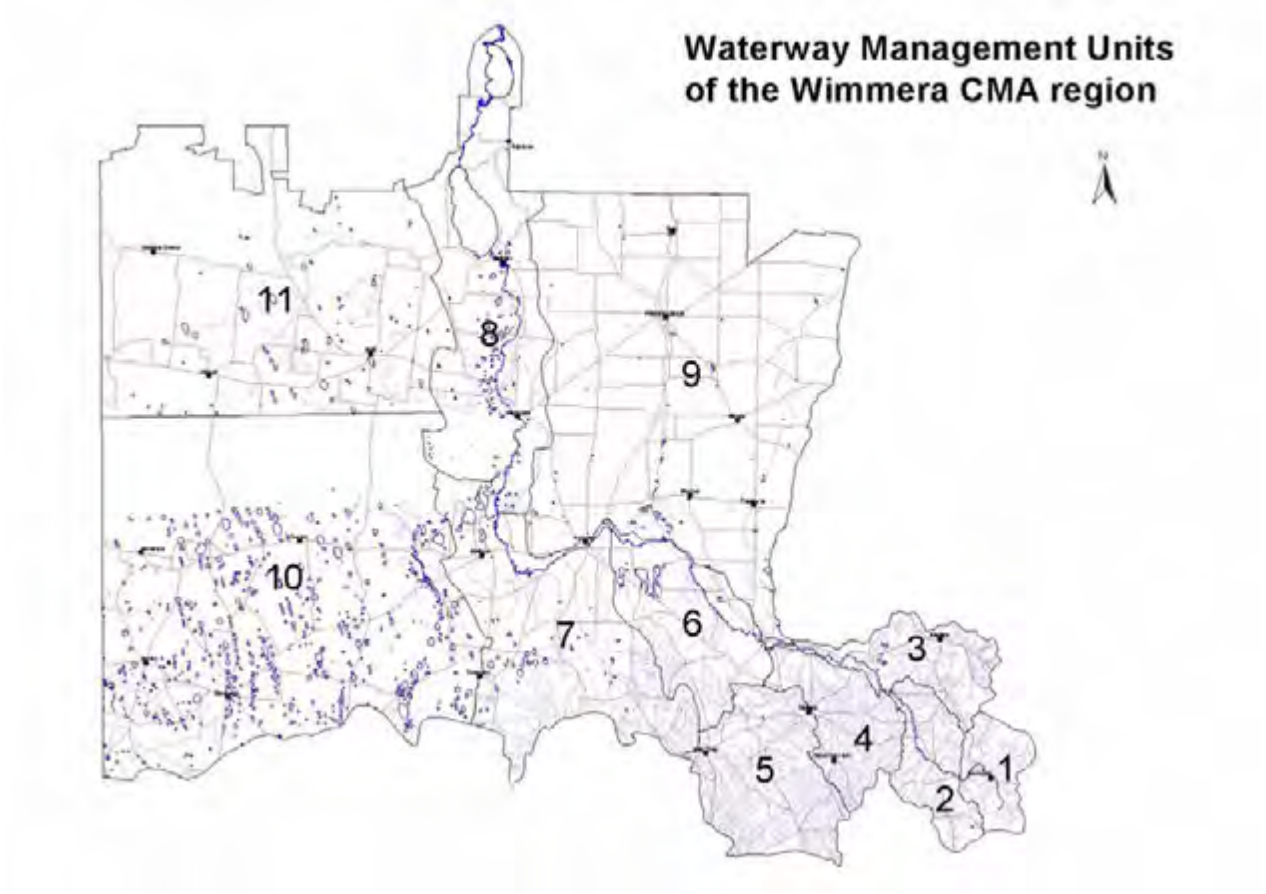


Figure 1b – Waterway Management Units of the Wimmera CMA Region

The Wimmera Water Quality Strategy

"The aim of the Wimmera Water Quality Strategy is to improve the quality of the Region's water that will result in environmental, social and economic benefits to the Region". Implementing the strategy could reduce total phosphorous levels in the Wimmera River by up to 42 tonnes per year (WCMA 2002b).

The strategy is to be applied through a number of Programs. Of these, Program 7; Catchment and River Health Management, is most relevant to this report. Its objective is to, "ensure that catchment and river health management in the region will result in improved water quality". This is to be achieved through:

- Waterway repair and maintenance;
- Flow regimes;
- Riparian management; and
- Catchment management.

The Wimmera River Geomorphic Investigation

The Wimmera River Geomorphic Investigation (WRGI) comprised a review and analysis of sediment processes within the Wimmera catchment, with a focus primarily on the Wimmera River. This report recommends that the following priorities, based on the principles of best practice catchment management, be applied:

- Preserve areas with near pristine values;
- Restore areas of high value;
- Rehabilitate areas that place other values at risk or provide good opportunity for restoring values; and

Maintain degraded areas to prevent values declining to unacceptable levels.

The Wimmera River Geomorphic Categorisation and Stream Condition Assessment

The Wimmera River Geomorphic Characterisation and Stream Condition Assessment built on previous findings from the Wimmera River Geomorphic Investigation. It identified the stream types throughout the Wimmera River Catchment and provided information to assist in determining management regimes for stream types based on the geomorphic characteristics and condition of the stream. The project identified reference sites for stream types and benchmarked stream condition at those sites. The reference sites are then able to provide a template for rehabilitation of similar stream types elsewhere throughout the catchment.

The report recommended five actions be implemented:

- Protection of Rare Stream Types
- Protection of Streams in Good Condition
- Protection of Stream System Function and Diversity
- Protection of Heritage Rivers
- Defining Template Reaches using Representative Rivers as a Basis

The MacKenzie River was named as a rare stream type, and as such, requires responsible and effective management that considers;

- Restoring flows which mimic natural flow regimes
- A detailed assessment to identify any specific risks due to sediment input and/or channel incision
- A monitoring system should be developed to assess changes in the waterway condition and identify risks within the system

3.2 MacKenzie River Condition

The Wimmera River Geomorphic Investigation

The Wimmera River Geomorphic Investigation (WRGI) comprised a review and analysis of sediment processes within the Wimmera catchment, with a focus primarily on the Wimmera River. This report recommends that the following

priorities, based on the principles of best practice catchment management, be applied:

- Preserve areas with near pristine values;
- Restore areas of high value;
- Rehabilitate areas that place other values at risk or provide good opportunity for restoring values; and

Maintain degraded areas to prevent values declining to unacceptable levels.The MacKenzie River is a tributary of the Wimmera River, which joins the main trunk downstream of Horsham. Its headwaters begin in the northern reaches of the Grampians National Park, where the stream drains into Lake Wartook. The MacKenzie River is an important water catchment system, and as such, has been significantly affected by inter-basin water transfers. Lake Wartook is capable of storing 29,360ML, much of which is used for urban water supply in Horsham and irrigation supply for the surrounding area. From Lake Wartook, the MacKenzie River flows over the MacKenzie Falls and then through undulating uplands to the Dad and Dave Weir, where a significant portion of flow is diverted to the Mt Zero Water Treatment Plant via the Mt Zero offtake channel. Water that progresses further downstream beyond the Dad and Dave Weir is usually transferred to Distribution Heads (a modified swamp), down Burnt Creek and then off to Taylors Lake, west of Horsham and stored for irrigation supply. Currently, there are no controlled releases of water from Distribution Heads down the MacKenzie River. As such, the only flows that are experienced between Distribution Heads and the Wimmera River are natural runoff events from storms or periods of prolonged rainfall.

The discontinuous nature of the channel system of the MacKenzie River means that very little, if any flow and/or sediment actually makes it to the main channel of the Wimmera River. Whilst this may limit the amount of water that contributes to the Wimmera River, it also limits the quantity of sediment that may be deposited in the many deep pools that exist downstream of the Horsham Weir. As the MacKenzie River approaches the Wimmera River it cuts almost perpendicular the east-west sand dune ridges of the Lowan formation, intercepting easily mobilised sands. These sands appear to be stored within the dense, intact riparian vegetation corridor that covers the lower MacKenzie channel belt. Within the channel belt, the river takes the form of multiple discontinuous channels. The lower MacKenzie River has the potential to be very sensitive to change. Land use or riparian vegetation alterations may pose a high risk of mobilising large quantities of sand (ID&A, 2001).

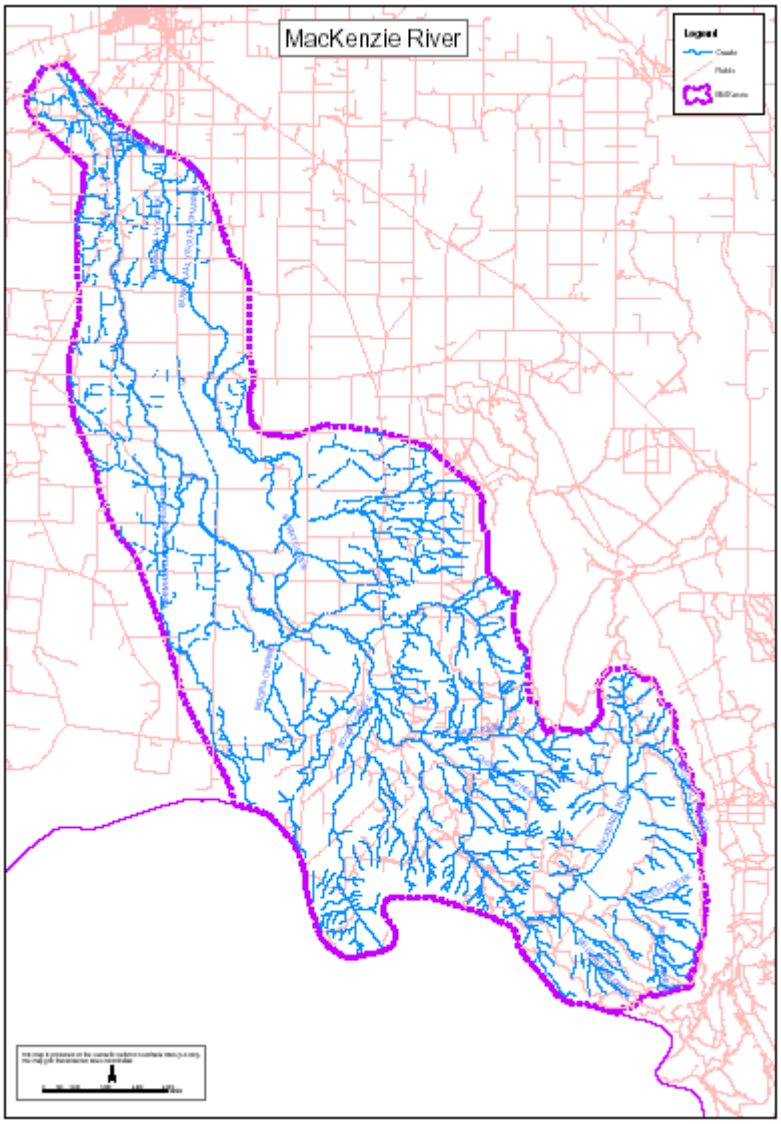


Figure 1c – Location Map of MacKenzie River

Issues identified from stakeholder consultation meeting – Wimmera CMA Offices (23/6/2004)

The issues to arise from the stakeholder meeting for the Mackenzie River included;

- *Use of recreational vehicles in the bed of the lower MacKenzie River*
- Prescribed fuel reduction burning and possible increases in sediment yields in the upper reaches of the catchment above Wartook Dam
- *Silt run off from unsealed roads, particularly in the National Park*
- *Leaching of chemicals and waste from the old Wartook Tip*
- *Regulations regarding native fauna management – kangaroo populations are reported to be in excess of 1000/km^2*
- Water allocation and the attempt to mimic natural flows for the mid-lower MacKenzie River

- *Availability of licences to graze crown land adjacent to the River*
- *Continual flooding causing dieback of tree populations*
- *Population pressures at Wartook/Laharum*
- Leaching/transportation of chemicals and fertilisers from paddocks to waterway
- Significant populations of native fish, platypus and freshwater crayfish that need to be protected
- *Distribution of weeds*
- *Area is rich in Aboriginal heritage*

Issues identified from the community consultation meeting – Laharum Hall (23/6/2004)

The issues to arise from the community consultation meeting included;

- *Increasing levels of development around Laharum*
- Significant populations of Blackfish, Pigmy Perch and Platypus between Distribution Heads to upstream of Dad and Dave Weir that needed protection – some populations have been noted down the WMW distribution channels
- *Non-native fauna species, in particular goats and carp*
- Non-native flora species, in particular Cane Grass, Cape Tulip, Bridal Creeper, Blackberries and Pattersons Curse
- Salt scalding and seepages from WMW distribution channels and surrounding bedrock
- *Encroachment of native vegetation in the channel zone which can lead to increased flood levels and occurrences*
- *Systematic removal of vegetation from the channel zone*
- *Protection of existing wetlands*
- *Spraying of herbicides in the WMW channels*
- *Erosion of banks and sedimentation in pools*
- Motorbike access in the bed of the channel in the mid-lower reaches causing bank instability and loss of habitat
- Lack of natural flow downstream of Distribution Heads (apart from high rainfall events)

Physical form

"In the lower Mackenzie River, the channels consist of scour pools (often associated with channel bends) separated by runs. The channels seem to be fairly stable, showing no signs of lateral movement. However, there are common scours in the floodplain, which may link up with the current channels in floods allowing the river to evolve. Recognition needs to be made by the WMCA and community that from this reach downstream, the Wimmera is bounded and often composed of sandy sediments derived from Aeolian and marine surficial geology of the area. Hence, the river will contain sandy geomorphic units" (Earth Tech 2003).

"In the middle to lower reaches of the MacKenzie River, the channel is typified as a low sinuosity channel with minor point bar and bench development on some of the meander bends. The banks and floodplain are thickly vegetated with shrubs. The middle to upper reaches of the MacKenzie River, the channel is classified as a meandering stream that is partly confined by the foothills of the Grampians. Minor scouring is noted on the outer parts of some of the meander bends. These bends are also usually associated with fallen trees that may have been undermined. Located in the upper part of the catchment, downstream of the MacKenzie Falls is the MacKenzie Gorge. It is highly stable with cobbles and boulders to country rock making up the bed and banks of the river. Above the Mackenzie falls, the stream is classified as partly confined on an upland plateau. The stream seems in good geomorphic condition, apart from the changed natural flows due to water being released or withheld in the Wartook Reservoir upstream" (Earth Tech 2003).

"The sand bedded lower MacKenzie River still has an intact channel system. The system shows no evidence of instability, or excessive incision and erosion. Similar systems have been identified in the Mt Lofty Ranges of South Australia. The two systems contain similar geomorphic forms and riparian vegetation. The major issues perceived include the environmental flow requirements of tributaries with the impact of storages and diversion on downstream values and fish passages. The protection of existing high value reaches such as the lower MacKenzie River, the reaches adjacent to the National Park and the provision of flow and habitat for platypus in the area are a high priority" (WCMA 2002a).

Preliminary site inspections have found bedrock in the banks and the base of the channel in the lower MacKenzie River near the MacKenzie Creek Bushland Reserve. At present, it is not known if the bedrock is a limiting factor in the potential for the channel to alter its alignment. It is noted, however, that there are deep scour holes (that are presently dry) in the vicinity of the bedrock. These scour holes are deemed to be important habitats for fish populations, and as such, should be preserved and enhanced where possible.

"In the summary of waterway conditions and issues, the MacKenzie River catchment was considered to have excellent stability and good to excellent ecological condition. Issues regarding to stream erosion and stream sedimentation were both rated as low for the entire system. Concerns about flow regime were rated as high for 2 of the 6 sub-reaches of the catchment, whilst the other 4 sub-reaches were rated as medium, however, issues regarding in-stream habitat loss were rated as low for 4 of the 6 sub-catchments with one catchment rated as medium and the other as high. Issues regarding barriers to fish passage were rated as high for three of the sub-catchments whilst the other three were not rated. Pestilent plants, losses of stream vegetation and frontage management were all considered to be low issues for concern within the Mackenzie Catchment". The Wimmera CMA program for remedial structural measures to address key waterway management issues

considers the primary management response for the MacKenzie River catchment is fencing, revegetation and pestilent plant control. However, due to the inherent geomorphic stability exhibited, funding for this project is not considered to be of high priority in terms of other issues that need addressing elsewhere in the greater Wimmera catchment" (WCMA 2002a).

"The ISC Streamside Zone Sub-index scores for the lower MacKenzie River sites were all 7/10 or 8/10, indicating that the riparian zone is in good to very good condition. The ISC Physical Form Sub-index scores were between 6/10 and 8/10. Hydrology of the lower Mackenzie is seriously affected by water being extracted in some sections and other sections being used for water transfer" (Earth Tech 2003).

"Between Lake Wartook and the Mt Zero offtake, the in-stream habitat is diverse and flows perennial. These reach characteristics are reflected in diverse and abundant fish species. There has been some erosion of stream banks, however, bank erosion is restricted to a few bank segments on high and steep bends where the otherwise dense riparian vegetation is limited. Input of sediments derived from streambanks coupled with a reduction in the magnitude, frequency and duration of high flow events has resulted in sedimentation of pools and smothering of benthic habitats. The complexity(structure) and diversity (types) of in-stream habitat play an important role in determining diversity of fish assemblages and the sedimentation of in-stream habitats represents a significant risk to aquatic fauna" (SKM 2003).

Current Flow Regime

Between Lake Wartook and Distribution Heads

"Downstream of the Dad and Dave Weir (Mt Zero offtake), water is released from the Wartook Reservoir on an essentially continuous basis for the Horsham urban water supply. Releases are in the order of 30ML/day in summer and 10-15ML/day in the colder months as demand reduces. The Mt Zero channel has a capacity of 30ML/day, so nearly all Wartook releases can be diverted. The only flows purposely allowed to pass the Mt Zero offtake are discharges to maintain flood reserve, and are sent to Pine and Taylors Lakes via Distribution Heads and then down Burnt Creek. Flood reserves are operated from June to October according to a target curve. No purposeful flow is currently released down the MacKenzie River downstream of Distribution Heads. The result of the system operations in this reach is that there are numerous reaches with different flow regimes. Immediately downstream of Lake Wartook to the Mt Zero channel, the flow regime is more stable and can be higher in summer when releases are made from Horsham's water supply. The Mt Zero channel has the capacity to harvest the typical summer release, however, a flow of 5-7ML/day passes the offtake in most years. This means that the reach between Wartook and Distribution Heads essentially flows perennially" (SKM 2003).

Flow Recommendations

Environmental flow recommendations have been made for the MacKenzie River between Lake Wartook and Distribution Heads. They are designed to mimic natural flow conditions, preserve permanent pools which are important habitats within the reach, provide longitudinal connectivity between such pools, act as a trigger for biological responses and remove build-ups of debris and sediment in the channel. Table 2a shows the environmental flow recommendations for this reach of the MacKenzie River.

Season	Magnitude	Frequency	Duration
Summer	0 ML/day	Maximum 5 days annually	Maximum 7 days each
	2 ML/day	Annual	When not cease to flow
	>5 ML/day	5 Annually	5 days
Winter	Minimum flow 27 ML/day	Daily	July-November
	>75 ML/day	Minimum 3 annually	Minimum 7 days
Annual	1,700 ML/day	1 in 4-5 years	Minimum 1 day

Table 2a – Flow Recommendations for MacKenzie River between Wartook and Distribution Heads

Downstream of Distribution Heads to the Wimmera River

MacKenzie Creek does not currently receive any prescribed flow downstream of Distribution Heads. As such, the number of cease to flow events that occur annually has decreased, but their duration has significantly increased. This has the potential to affect ecological functions and interactions within the system. Flow does occur naturally in the system, however, this only happens after intense storms and prolonged rainfall events.

Flow recommendations

Environmental flow recommendations have been made for the MacKenzie River between Distribution Heads and the Wimmera RIver. They are designed to mimic natural flow conditions, preserve permanent pools which are important habitats within the reach, provide longitudinal connectivity between such pools, act as a trigger for biological responses and remove build-ups of debris and sediment in the channel. Table 2b shows the environmental flow recommendations for this reach of the MacKenzie River.

Season	Magnitude	Frequency	Duration
Summer	0 ML/day	Maximum 5 days annually	Maximum 7 days each
	2 ML/day	Annual	When not cease to flow
	>5 ML/day	5 Annually	7 days
Winter	Minimum flow 37 ML/day	Daily	July-November
	>75 ML/day	Minimum 3 annually	Minimum 7 days
Annual	1,700 ML/day	1 in 4-5 years	Minimum 1 day

Table 2b - Flow Recommendations between Distribution Heads and the Wimmera River

Management

"The lower Mackenzie is categorised as a discontinuous anabranching chain of ponds. This section of waterway has intact geomorphic form, is rare as a stream category within the Wimmera River catchment and is unusual in southeast Australia. It is therefore important that this type of landscape association be recognised and preserved for ecological, cultural and aesthetic values" (Earth Tech 2003).

"The lower Mackenzie has limited flows downstream from Distribution Heads, where water is diverted into the Wimmera Mallee Stock and Domestic Supply System. The hydrology and ecology of the lower MacKenzie River has been severely affected by water harvesting. The condition of this reach of river should be a focus for management and a management plan should be developed. This plan should consider:

- *Restoring flows which mimic natural flow regimes*
- *A detailed assessment to identify any specific risks due to sediment input and/or channel incision*
- *A monitoring program should be developed to assess changes in the waterway condition and identify risks within the system.*

The identification of specific threats should then also be treated and managed. An important part of the management program should also be to educate the local landholders and the public about the system" (ID&A 2001).

"The partial or complete drying up of water within the channel does not imply that water is not present. Groundwater inflow is sufficient to maintain a series of large pools along the stream channel. Anderson and Morison (1989) suggested that a sustaining environmental flow in the MacKenzie River be set at 3-5 ML/day (in practice, it has been found that 5ML/day from Distribution Heads will not sustain a

continuous flow in the MacKenzie River during the months of January/February)" (WCMA 2002a).

"Most of the drainage network in the tributary system is stable. A large portion of the upper MacKenzie River flows through the Grampians National Park, and as such, has very few pressures associated with grazing or degradation of riparian vegetation that are experienced elsewhere in the catchment. The mid to lower MacKenzie River has a discontinuous channel form (chain of ponds) channel network that continues to remain in its near-original state. There is very little, if any lateral migration of the channel, despite the channel flowing through sand dunes. This stability is attributed to the dense and well-established riparian vegetation still present in the system. During the hotter months of summer, when evaporation rates are high to very high, the ponds may be devoid of water, however, sub-surface flows may still be able to recharge the pools" (WCMA 2002a).

3.3 Values and Issues of MacKenzie River

A meeting for relevant stakeholders in the MacKenzie River Catchment was held at the Wimmera CMA offices on June 23rd, 2004. The issues raised at this meeting were;

- *Use of recreational vehicles in the bed of the lower MacKenzie River*
- Prescribed fuel reduction burning and possible increases in sediment yields in the upper reaches of the catchment above Wartook Dam
- *Silt run off from unsealed roads, particularly in the National Park*
- *Leaching of chemicals and waste from the old Wartook Tip*
- *Regulations regarding native fauna management – kangaroo populations are reported to be in excess of 1000/km^2*
- Water allocation and the attempt to mimic natural flows for the mid-lower MacKenzie River
- *Availability of licences to graze crown land adjacent to the River*
- *Continual flooding causing dieback of tree populations*
- *Population pressures at Wartook/Laharum*
- Leaching/transportation of chemicals and fertilisers from paddocks to waterway
- Significant populations of native fish, platypus and freshwater crayfish that need to be protected
- *Distribution of weeds*
- *Area is rich in Aboriginal heritage*

A community consultation meeting was also held for the MacKenzie River Catchment at the Laharum Hall on June 23rd, 2004. The issues raised at this meeting were;

- *Increasing levels of development around Laharum*

- Significant populations of Blackfish, Pigmy Perch and Platypus between Distribution Heads to upstream of Dad and Dave Weir that needed protection – some populations have been noted down the WMW distribution channels

- *Non-native fauna species, in particular goats and carp*

- Non-native flora species, in particular Cane Grass, Cape Tulip, Bridal Creeper, Blackberries and Pattersons Curse

- Salt scalding and seepages from WMW distribution channels and surrounding bedrock

- *Encroachment of native vegetation in the channel zone which can lead to increased flood levels and occurrences*

- *Systematic removal of vegetation from the channel zone*

- *Protection of existing wetlands*

- *Spraying of herbicides in the WMW channels*

- *Erosion of banks and sedimentation in pools*

- Motorbike access in the bed of the channel in the mid-lower reaches causing bank instability and loss of habitat

- Lack of natural flow downstream of Distribution Heads (apart from high rainfall events)

4 Waterway Action Plan Objectives

In accordance with State and Regional plans and strategies, the objectives of the MacKenzie River Waterway Action Plan are;

4. To protect the health and vitality of the MacKenzie River.

This will involve

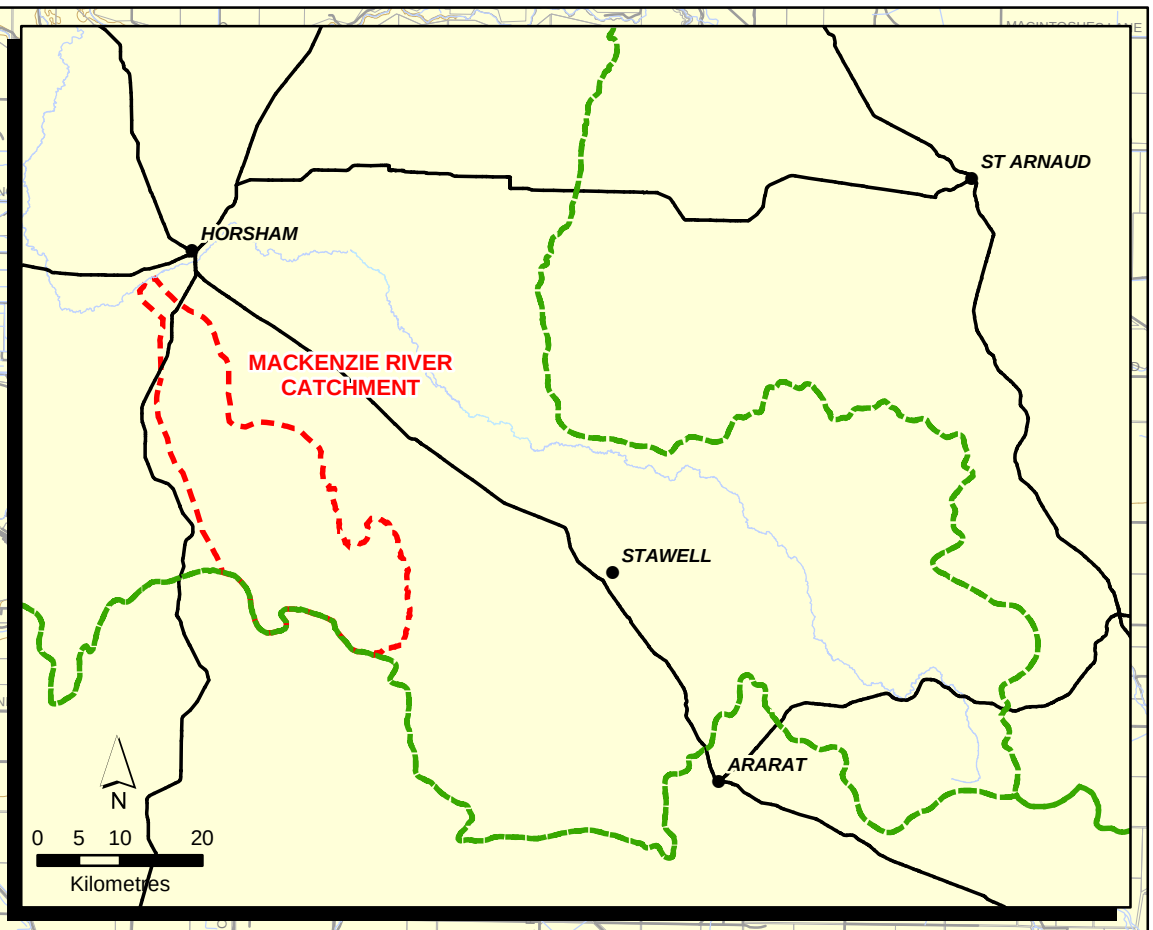
- understanding the nature of channel adjustments (or lack there of) that may have occurred in the past
- determining the location of current issues concerning stream health
- identifying the type and location of potential issues that may arise in the future assessing the potential for sediment to be mobilised and subsequently transported into the Wimmera River
- maintaining an ecologically healthy riparian corridor

5. To confirm values and threats identified through existing reports and community consultation and devise appropriate management actions to enhance stream health for the catchment.

6. To develop appropriate management actions on a reach by reach basis, in conjunction with the catchment community.

Figure 2. MacKenzie River Locality Map.

Location of MacKenzie River



HORSHAM
Wimmera River
WARTOOK
Distribution Heads
Dad and Dave Weir
WARTOOK RESERVOIR

Legend

- Catchment Boundary
- CMA Boundary
- Grampians National Park
- Waterways
- Channels
- MacKenzie River

N

0 1.5 3 6

Kilometres

Wimmera Catchment Management Authority

Waterways for Life.

Earth Tech

063_M009

5 MacKenzie River Catchment

5.1 Catchment description

The MacKenzie River is a tributary of the Wimmera River that originates from the northern Grampians in western Victoria and joins the Wimmera River approximately 5km downstream of Horsham. The catchment lies to the south of Horsham and covers an area of approximately 597km^2 (Figure 2).

The upper catchment lies within the Grampians National Park and is highly valued for its nature conservation and recreational values. Downstream of the National Park, grazing and cropping are the predominant land uses. Within this middle and lower catchment area Crown Frontage exists on both sides of the MacKenzie River for almost its entire length. The riparian vegetation is broad (up to 200m wide) and ecologically diverse along the entire waterway ranges, with a condition ranging from good to excellent.

Hydrology

Prior to European settlement the entire length of the MacKenzie River and its tributaries experienced a regime in which the majority of the flow occurred in the high rainfall Winter months. Summer often saw the channel experiencing very low or zero flow, with deep pools providing the only respite for aquatic plant and animal species.

The contemporary MacKenzie River is a key component of the water supply and distribution network for Horsham and surrounding districts. Responsibility for distributing water within the system falls to Grampians Wimmera Mallee Water who carry out inter-basin water transfers using the upper reaches of the river as a conduit. The result is a river system in which the upper reaches experience high flow conditions for the majority of the year, while the lower reaches receive little or no flow at any time.

Located within the headwaters of the catchment, Lake Wartook is the primary source of water to the MacKenzie River system. Downstream of Lake Watertook the river flows over MacKenzie Falls and through undulating uplands to the “Dad and Dave” weir, on the Grampians National Park boundary. As a consequence of controlled releases from the lake this reach experiences a constant base flow throughout the year. At the weir, a significant portion of flow is diverted to the Mt Zero Water Treatment Plant via the Mt Zero offtake channel for Horsham’s urban water supply. Water in the MacKenzie River continues downstream to Distribution Heads where it may be diverted via Burnt Creek to Taylors Lake for GWMW Stock and Domestic system. This diversion occurs annually between April and November, and in dry years may continue through to January. Outside of these periods there is no flow below Dave and Dad weir other than that resulting from local runoff.

Due to on-going drought conditions from 1998-2004, there has been no controlled release of water from Distribution Heads downstream in the MacKenzie River. As such, the only flows experienced between Distribution Heads and the Wimmera River are natural runoff events from storms or periods of prolonged rainfall.

Geomorphology

Despite the significant hydrologic changes there has been little geomorphic change in the MacKenzie River since European settlement. A reduction in flow could be expected to result in channel infilling due to insufficient flow to maintain scour pools. This absence of infilling is likely to have been the result of limited sediment input from the catchment headwaters in the Grampians. Where geomorphic changes have occurred these are in the form of vegetation encroachment on the channel. This has acted to stabilise the channel bed and banks further limiting sediment generation within the catchment.

Along the majority of its length the river riparian corridor supports a single channel. However in some sections the channel splits into a series of channels or anabranches, as can be seen in Figure 2. In the upper MacKenzie River between the Mt Zero offtake and Distribution Heads, and in some sections of Burnt Creek, the channel is poorly defined as the river flows through a number of wetlands. Due to the widespread draining of wetlands in the region these areas are considered to be of high value and are therefore a priority for protection.

Geology

The steep slopes of the northern tip of the Grampians Range are dominated by the Grampians Group of resistant quartz-rich sandstones and red siltstones (Earth Tech 2003). These rocks derive from sediment deposited on the sea floor around 420 million years ago. Material derived from the bedrock hill slopes (colluvium) forms an apron below the steep sandstone slopes, with a prominent break in slope at its base. This break of slope is also the boundary for the Grampians National Park. Along the main trunk of the river around two kilometres west of Wartook Reservoir, granodiorite is found. This then weathers to produce sandy soils and lower gradient slopes than the Grampian Group sandstones.

Approximately 2km upstream of Distribution Heads, the geology and consequently the topography change. Down-slope of the apron of colluvium, there exists Parilla and Dorodong Sands which were laid down under shallow seas between two and five million years ago. These sands are now very stable and well vegetated with native tree and grass species. Undulating plains form on these deposits. The flat plains to the northwest are formed on the younger Shepparton Formation.

Sediments deposited by the MacKenzie River within the last few thousand years occur in a zone less than one kilometre wide. In places deposits of the Parilla Sand form low hills on either side of the channel. This has acted to restrict the channel to a zone less than 300m wide. As a result the channel zone is now dominated by a number of wetlands and much of the adjacent land in this low lying zone is prone to inundation.

Vegetation

A good cover of riparian vegetation extends along the length of the MacKenzie River from its head waters in the Grampians to the confluence with the Wimmera River. For much of its length this vegetation ranges in condition from good to excellent. One hundred to two hundred metres wide, this tract of vegetation is ecologically diverse, featuring 16 different Ecological Vegetation Classes (EVCs). Several rare or threatened species were identified, and these include Grampian's Scent Bark (*Eucalyptus sabulosa*), Mossy Woodruff (*Asperula minor*), Wetlands Blown Grass (*Agrostis avenacea* var. *perennis*), Pale Flax Lily (*Dianella* sp *nova* ff *longifolia*), Broom Bitter Pea (*Davesia genistifolia*), Dark Wire Grass (*Aristida calycina*) and Leafy Wallaby Grass (*Austrodanthonia bipartita*).

At the time of field investigations a number of specimens of an unidentified *Calistemon* species were also recorded. These specimens are similar to the Lemon Bottlebrush (*Callistemon pallidus*) and have since been confirmed as a new species. Classification is currently being undertaken by the National Herbarium, Botanic Gardens, Melbourne.

Further inspections by Neil Marriot reveal that the majority of these plants are in a highly stressed state due to a lack of water (Marriot pers com). It is therefore urgently recommended that an environmental flow be provided during the Spring / Summer of 2004 to save what is likely to be an endangered species.

A limited number of sites having poor or no ground cover exist along the river. These appear to have been disturbed by either stock grazing or timber collection/removal for firewood (primarily near main roads).

Within the Wimmera community there is a desire to create links between core habitat areas such the Grampians, the Little Desert and the Big Desert National Parks. Wherever possible these links will utilise roadsides, existing remnants and waterways. The MacKenzie River currently provides an important component of this habitat corridor and other core habitat within the Wimmera region.

Aquatic Species

The MacKenzie River catchment has a rich diversity of native fish. Protected species such as the Southern Pigmy Perch, Blackfish, Mountain Galaxias and Flathead Gudgeon are all found within the catchment. The river also contains introduced fish such as carp, mosquito fish, redfin and trout. The latter two species are highly regarded and attract recreational anglers to the river. A significant population of platypus within the river system are the subject of an ongoing monitoring program Pressure from predation during dry periods is a major threat to these populations and as such the maintenance of pools are a key element in their long term survival.

Heritage

The MacKenzie River contains significant Aboriginal and European heritage values. The river has a significant role in the dreaming stories of the local indigenous people. Traditional stories often refer to the land, or to a specific stretch of country where the incidents it narrates were believed to have taken place. Stories are told of mythic or 'Dreaming' people in human, animal or other form moving across the country leaving signs of themselves or their spiritual presence at particular sites. The MacKenzie River is a key element of the Blackfish Dreaming story of the local Aboriginal communities. There are also significant archaeological sites along the length of the river, with Zumsteins, in the upper catchment having significance as a site of European historical interest.

Weeds

The occurrence of woody weeds is low in the riparian zone of the MacKenzie River. However, other exotic species such as Phalaris (*Phalaris aquatica*), Perrenial Veldt Grass (*Erhartia calycina*) and Bridal Creeper (*Asparagus asparagoides*) are found in abundance. Declared Noxious Weeds identified include; One Leaf Cape Tulip (*Homeria flaccida*) and Blackberry (*Rubus fruticosus* agg). Isolated pockets of Watsonia are also present.

6 Management Reaches

For ease of management and in order to refine the assessment process and works program, the MacKenzie River and its tributaries were divided into four reaches. The location and extent of each reach is shown on Figure 3.

Table 3: Reach delineation of MacKenzie River

Reaches	Location
Reach 1	Headwaters of the MacKenzie River to Dad and Dave Weir (edge of the Grampians National Park). Includes tributaries that flow from the Asses Ears.
Reach 2	Dad and Dave Weir (edge of the National Park) to Distribution Heads. Includes adjoining tributaries.
Reach 3	MacKenzie River downstream of Distribution Heads and Bungallaly Creek downstream of the Bungallaly South irrigation channel. Incudes adjoining tributaries.
Reach 4	Burnt Creek downstream of Distribution Heads to Bungallaly Creek. Bungallaly Creek to the Bungallaly South irrigation channel. Includes adjoining tributaries.

Reach conditions, values and management actions are described in terms of geomorphology, vegetation, habitat quality, threats and risks, and management actions. A description of the geology of each reach is not included as this subject has been previously addressed.

Figure 3. MacKenzie River Reach Map

MacKenzie River Waterway Action Plan

Wimmera Catchment Management Authority

Waterways for Life.

Legend

- Waterways
- Channels
- MacKenzie Catchment
- Grampians National Park
- Cadastre

MacKenzie Reaches

- Reach 1
- Reach 2
- Reach 3
- Reach 4

HORSHAM
BAILLIE STREET
REMLAW ROAD
RUDOLPHS ROAD
WIMMERA HIGHWAY
NATIMUK ROAD
BARNES BOULEVARD
WIMMERA RIVER
CURRAN ROAD
GOLF COURSE ROAD
CAMERON ROAD
OSBORNE ROAD
RIVERSIDE EAST ROAD
BROWNS ROAD
MILLS ROAD
DRUNG-JUNG ROAD
MCINTYRES ROAD
WEST ROAD
SCHOOL ROAD
NORTH ROAD
EAST ROAD
PINE LAKE ROAD
DOMASCHENZ ROAD
SCHNEIDERS ROAD
FUZZONS ROAD
THREE BRIDGES ROAD
HOLES ROAD
OLD HAMILTON ROAD
WARDS ROAD
MACKIES ROAD
WESTERN HIGHWAY
CARMICHAELS ROAD
WALSHS ROAD
CURRAN ROAD
HARDINGHAMS ROAD
BARKERS ROAD
CLYNES ROAD
BALLYGLUNIN NORTH ROAD
FISHERS ROAD
ST HELENS ROAD
REYNOLDS ROAD
PEUCKERS ROAD
ONE TREE ROAD
GATES ROAD
PLUSH HANNANS ROAD
EXELLS ROAD
LAHARUM ROAD
TAYLORS ROAD
BALLYGLUNIN SOUTH ROAD
WATSONS ROAD
HORSHA
BOTHES ROAD
PENNYS ROAD
EAGLES ROAD
TYERS ROAD
BUTLERS ROAD
MCKENZIES ROAD
MACKENZIES ROAD
GREEN LAKE ROAD
ARNOTTS ROAD
ROSS R
RIFLE BUTTS ROAD
HENTY HIGHWAY
NIXONS ROAD
ZIPPELS ROAD
COOMBES ROAD
OLD WARTOOK ROAD
WONWONDAH-DADSWELL BRIDGE
TOOLONDO ROAD
NORTH-EAST WONWONDAH ROAD
CURTIS ROAD
DUNNS ROAD
WINFIELDS ROAD
FLATROCK ROAD
RESERVOIR ROAD
CRUTES SOUTH ROAD
GOLTON SOUTH ROAD
JUBILEE LANE
RYANS ROAD
HICKEYS ROAD
POHLNERS ROAD
GRAMPIANS TOURIST ROAD
KIEFELS ROAD
HEARDS ROAD
TULLEYS LANE
MCINNES ROAD
OLIVE PLANTATION ROAD
MILLAR ROAD
STAEHRS ROAD
HOWARDS ROAD
HAMMONDS WOOLSHED ROAD
DONALD SWAMP ROAD
MOTAVISHS ROAD
CRUTES ROAD
ROSES GAP ROAD
OBIERNES ROAD
BARKERS LANE
CARTER ROAD
CAMERONS ROAD
MT ZERO ROAD
CLARKES LANE
LANGES ROAD
KNONAGLES ROAD
SMITHS ROAD
RED ROCK ROAD
BYRNES ROAD
GRAHAMS BRIDGE ROAD
GRIMBLE-GEUE ROAD
Distribution Heads
MAGGIES LANE
CREASEYS ROAD
ROBERTS ROAD
BRIMACOMBES ROAD
AUGHEYS ROAD
LONGPOINT FIRELINE
FIREBREAK
CAMPBELLS LANE
BRIMPAEN-LAHARUM ROAD
SLATERS ROAD
SCHMIDTS ROAD
OSULLIVANS ROAD
OLD ADELAIDE ROAD
WARTOOK
SNELLS ROAD
Boggy Creek
GLENISLA-ROSEBROOK ROAD
Dad and Dave Weir
WARTOOK RESERVOIR
MT DIFFICULT ROAD
MT VICTORY ROAD
ASSES EARS ROAD
SMITH ROAD
ROSE CREEK ROAD
SMITHS ROAD

N

0 1.5 3 6

Kilometres

This map is produced on the Geodetic Datum of Australia 1994 (GDA94). The map grid therefore has MGA coordinates.

Earth Tech

063_M010

6.1 Waterway Management Targets

While the overall environmental health of the MacKenzie River catchment is good, there is potential for improvement. ISC assessments previously conducted along the MacKenzie River presented with high scores for all indices except hydrology (www.vicwaterdata.net). The implementation of a flow regime that mimics naturally occurring flows through the MacKenzie River system will increase this value and further improve the ecological health of the catchment.

In order for the management actions proposed in the MacKenzie River Waterway Action Plan to contribute to the achievement of Statewide River Health Targets (see Table 3), the following waterway management targets for the MacKenzie River have been developed.

Reach 1:

- Maintain current ISC scores. It may be possible to increase these from Marginal to Good with measured Water Quality results as opposed to estimated results from the 1999 survey. It will be difficult to alter ratings unless hydrologic regimes are modified to mimic natural flows.
- Protect and maintain the condition of the MacKenzie River. (High value Gorge and Partly Confined1 stream types. Earth Tech 2003)

Reach 2:

- Increase ISC values from 26-34 (Marginal) to 35-41 (Good). It will be difficult to alter ratings unless hydrologic regimes are modified to mimic natural flows.
- Protect and maintain condition of Boggy Creek (a tributary with its confluence with the MacKenzie River located downstream of the township of Wartook). *(High value Confined stream type. Earth Tech 2003).* Potential ecologically healthy stream type
- Enhance condition of MacKenzie River. (High value Partly Confined 2 stream type. Earth Tech 2003)

Reach 3

- Increase ISC scores from Marginal to Good. It will be difficult to alter ratings unless hydrologic regimes are modified to mimic natural flows. *(High value Discontinuous Anabranching Chain of Ponds stream type. Earth Tech 2003)*.

Reach 4

- In the absence of ISC assessments benchmark the reach and aim for an ISC value score of 35 (Good). One ISC assessment was conducted on Burnt Creek at CFA map reference 313E, in 2002. Physical Form Sub-Index score of 6 and a Streamside Zone Sub-Index score of 6 give this location an ISC rating of 'Very Poor'. Aim to increase the ISC rating to 'Good' in this reach.

These targets are aimed at preserving the high value of the MacKenzie River and contributing to the achievement of Statewide River Health Targets outlined in Table 4.

Table 4. Statewide River Health Targets relevant to the MacKenzie River.

By 2011

- 95% of all highland and upland and 60% of all lowland monitoring sites will meet SEPP environmental quality objectives.
- 1000 high value public assets provided with appropriate level of protection.

By 2021:

- One major representative river reach in ecologically healthy condition in each major river class.
- An increase of 3000km in the length of rivers in excellent or good condition.

6.2 Reach 1: Headwaters of the MacKenzie River to Dad and Dave Weir

4.2.1 Geomorphology

The MacKenzie River within the Grampians National Park is in excellent physical condition. Due to their position in the steep upper catchment the valley floors are narrow and therefore floodplains are also narrow or non-existent. Channels primarily cut through colluvial (hill slope) material display very little erosion. Riparian vegetation extends to the edge of the channel providing plentiful habitat in the form of Large Woody Debris. Water quality is high due to the location of the upper catchments within the Grampians National Park.

Prior to the construction of the Lake Wartook dam the river is likely to have experienced cease to flow periods during the Summer months. Downstream of Lake Wartook stream flows are regulated so that water is flowing in the channel throughout the year. Between Lake Wartook and the MacKenzie Falls there is a single well defined channel largely controlled by the bedrock of the valley margins and associated colluvial material. This channel meanders through isolated pockets of floodplain where the riparian vegetation extends to the waters edge and is in excellent physical condition. Downstream of MacKenzie Falls to Dad and Dave Weir, the streambed gradient begins to decrease, the valley becomes wider and small floodplains have formed adjacent to the channel.

4.2.2 Vegetation

Existing Ecological Vegetation Class (EVC) mapping shows that the vegetation in this reach includes Riparian Scrub Complex, Riparian Forest, Riparian Scrub, Sedgy Riparian Woodland, Damp Sands Herb Rich Woodland, Alluvial Terraces Herb Rich Woodland and Shrubby Woodland.

Index of Stream Condition (ISC) assessments were performed in this Management Unit during 1999, 2002 and 2004. Results from 2002 indicate that, at the site sampled, stream condition was good. Physical form and streamside zone both rated highly (8/10). Hydrology in this reach rated 2/10 – very low.

Results from the recently completed 2004 assessments are due to be released in October 2004.

4.2.3 Habitat

Due to the reach incorporating the northern section of the Grampians National Park, habitat values are high. Habitat assessments were not conducted within Reach 1.

4.2.4 Reach 1: Threats and Risks

Threat	Risk
Increased potential for hill slope and bank erosion caused by high-intensity controlled burns/bushfires reducing ground cover. Deposition of sandy sediment within stream lines will reduce in-stream geomorphic variability by filling scour holes, thus decreasing habitat diversity.	High
Sediment runoff from unsealed tracks entering drainage lines and degrading pre-existing habitats. Road-side drains in some part of the National Parks are choked with sand, which is being transported towards natural stream lines.	Low
Altered flow regimes affecting breeding cycles amongst native fish and macro invertebrate species.	High
Contamination of water quality from inadequate amenities at heavily used tourist destinations within the National Park.	Moderate
Contamination of soil and groundwater from leaching chemicals within the disused Asses Ears landfill.	Moderate

6.3 Reach 2: Dad and Dave Weir to Distribution Heads.

4.3.1 Geomorphology

Downstream of Dad and Dave Weir the MacKenzie River traverses through the undulating hill slopes and plains of the mid-catchment. Here the river alternates between a well defined channel that is between three and five metres wide and one to two metres deep, to having no clearly defined channel. Wetlands are common in these areas.

At the time of the field inspections, flow releases from Lake Wartook for the stock and domestic dam filling season prevented access to the channel zone in a number of locations. Of the sites that were accessible the streambed and banks were stable due to the presence of cohesive silty-clays held in place by the intact riparian vegetation. Exclusion of stock from the majority of the streamside zone plays an important role in the low level of bank erosion.

Figure 4. An example of the intact riparian vegetation along the streambanks of Reach 2 (August 2004).

4.3.2 Vegetation

Ecological Vegetation Class (EVC) mapping shows that the vegetation in this reach includes Shrubby Woodland, Damp Sands Herb Rich Woodland, Alluvial Terraces Herb Rich Woodland, Plains Grassy Woodland, Riparian Scrub, Plains Sedgy Woodland, Heathy Woodland and Shallow Freshwater Marsh types. Occasional cleared / severely disturbed' areas are present within this reach.

Index of Stream Condition (ISC) assessments were performed in this reach during 1999, 2002 and 2004. Results from 2002 indicate that on average the total condition for the river in this reach was 'low'. Streamside zone rated 6/10, whilst hydrology rated a very low 2/10..

Several rare plant species are present in this reach. Examples are; Grampian's Scent Bark (*Eucalyptus sabulosa*), Mossy Woodruff (*Asperula minor*) and Wetlands Blown Grass (*Agrostis avenacea* var. *perennis*). Refer to Appendix B for site specific species listings.

Native vegetation species diversity is high in this reach. At all sites ground cover diversity is rich and includes numerous orchids, lilies and herbs. Vegetation structure is generally intact. In some cases, heathland Melaleuca and Leptospermum species not characteristic of the plains vegetation are present.

The number and density of weeds increases further downstream in the catchment. Species such as Phalaris (*Phalaris aquatica*) and Perrenial Veldt Grass (*Erhartia calycina*) are abundant. Listed noxious weeds include One Leaf Cape Tulip (*Homeria flaccida*) and Blackberry (*Rubus fruticosus* agg).

4.3.3 Habitat

Five habitat assessments were completed in this reach. The results of the habitat quality assessments are presented in the table below.

Table 5. Habitat quality assessment scores for Reach 2.

Veg Site	Preliminary Score	Habitat Quality
1	18/20	High
2	15.5/20	High
3	17.5/20	High
4	11.5/20	Medium
5	13/20 High	High
	Av 15.1/20	High

Habitat quality is generally high in Reach 2. An intact riparian vegetation corridor exists along the majority of this reach. As a result, values were high for large trees, canopy cover, understorey, litter, logs and patch size. Sites close to the Grampians National Park had high core area scores as they were less than one kilometre from a native vegetation block with an area larger than 50 hectares.

Significant populations of Blackfish, Pigmy Perch and Platypus exist between Distribution Heads and the National Park upstream of the Dad and Dave Weir. The intact condition of the riparian vegetation and intrinsic habitat values within the reach provide ideal conditions for aquatic life. Landholder input also suggests that some plant and animal species have colonised the GWMW channels. Habitat values within such locations are however considered quite poor, as the channels are regularly cleared to prevent the build up of debris and provide a hydraulically clean conduit.

4.3.4 Development and Tourism

The availability of water in the channel for large parts of the year through controlled releases, the extent and density of native fauna, the location in relation to the Grampians and the topography of the landscape combine to provide the ideal setting for tourism development in the local area. A number of existing properties have been subdivided to facilitate this. Plans also exist to develop tourist eco-lodges alongside the river. Traditionally this land was used for grazing, and large portions of the reach are still dominated by this activity. However, in the last 10 years a significant number of tourist facilities have been established in the area.

4.3.5 Infrastructure

Reach 2 has been the site of significant water infrastructure development. Grampians Wimmera Mallee Water use the MacKenzie River for water transfer to private properties and major storages that are part of the stock and domestic supply system. To facilitate this a number of weirs, earth channels dams and diversions as well as monitoring/gauging sites have been constructed.

4.3.6 Reach 2: Threats and Risks

Threat	Risk
Altered flow regimes affect breeding cycles amongst native aquatic species. Altered flow regimes also affect connectivity between pools, limiting the passage of fish and invertebrate species through the reach. It is also recognised that altered flow regimes impact upon native vegetation that requires regular and intermittent periods of wetting and drying. Consequently, this provides ideal conditions for the growth of non-native vegetative species.	High
Saline groundwater forced toward the surface due to a natural geologic constriction, decreasing farm productivity and threatening ecosystem health.	Moderate
Spread of non-native vegetation, reducing native species diversity within the riparian zone.	Moderate
Impact of non-native fauna damaging both the terrestrial and aquatic habitats of native species.	Moderate
Vegetation encroachment reduces the capacity of the channel, thereby causing the channel to flood more regularly under low or moderate flow events.	High
Urban development and subdivision of land decreasing visual amenity in the area. This type of development also threatens healthy ecosystem functioning and has the potential to degrade water quality.	High

6.4 Reach 3: MacKenzie River Downstream of Distribution Heads and Bungallaly Creek Downstream of the Bungallaly South Channel

4.4.1 Geomorphology

Reach 3 is located between Distribution Heads and the confluence of the MacKenzie River with the Wimmera River. It also includes the Bungalally Creek below the Bungalally South Irrigation channel. The bed and banks within this reach are stable and very well vegetated, however the hydrology of this reach has been substantially altered through water diversions. The altered hydrology has resulted in vegetation encroachment in the bed and on the banks throughout much of the reach. This is causing the drainage network to shutdown as accumulating sediment is no longer transported through the reach. As a result, scour holes in the streambed are filling with sandy sediment. Additionally, vegetation debris is accumulating in the channel bed and forming small dams during minor flow events.

A range of channel forms occur within Reach 3. There are numerous locations where the channel is well defined with dimensions ranging from 2-5m wide and 1-3m deep. In places there can be up to a metre of vertical relief on the channel bed over ten or less horizontal metres. This channel bed relief is due to scour around bedrock in the streambed and banks. This produces good habitat diversity and availability, but requires a moderate flow event to connect all the pools.

In other locations the channel in this reach is poorly defined. This contrasts with areas where the channel takes on multiple flow paths. In these situations the primary channel is usually around five metres wide and up to 2-3m deep, whereas the secondary channels are 2-3m wide and around one metre deep. Minor channels tend to have a greater LWD and minor woody debris load. This pattern of discontinuous anabranching channels is a rare stream type in southern Australia, with the Mt Lofty Ranges in South Australia being the only other location where this stream morhpology has been preserved.

Figure 5. Photo left shows the confluence of the MacKenzie River and the Wimmera River. Photo right shows a section of well defined channel in Reach 3 (August 2004).

4.4.2 Vegetation

Ecological Vegetation Class (EVC) mapping shows that the vegetation in this Reach includes Shrubby Woodland, Shallow Freshwater Marsh, Plains Grassy Woodland, Plains Riparian Shrubby Woodland, Sand Ridge Woodland / Damp Sands Herb Rich Woodland Mosaic, Plains Woodland, Shallow Sands Woodland, Blackbox Chenopod Woodland and Alluvial Terraces Herb Rich Woodland. Within the area adjacent to the riparian zone, the once extensive cover of Plains Woodland has been cleared since European settlement.

Index of Stream Condition (ISC) assessments were performed in this Reach during 1999 and 2004. Results from 1999 indicate that on average, the total condition for the river in the lower catchment was 'marginal'. Physical form and streamside zone both rated 8/10, water quality 8/10 and aquatic life 9/10. Hydrology in this reach rated a lowly 2/10.

Several rare species were identified in this Reach including Grassland Pale Flax Lily (*Dianella* sp *nova* ff *longifolia*), Dark Wire Grass (*Aristida calycina*) and Leafy Wallaby Grass (*Austrodanthonia bipartita*). Refer to Appendix B for site specific species listings.

Native species diversity is high in Reach 3. In particular, the ground layer is rich and includes rare grasses and herbs. At several sites a mix of heathland, grassy woodland and grassland species was identified. Stands of Oyster Bay Pine (*Callitris rhomboidea*), were found on the plains (normally a foothill species), while Buloke (*Allocasuarina leuhmannii*), and Totem Poles (*Melaleuca decussata*) were also recorded at some sites. The overstorey layer tends to be composed of Red Gum (*Eucalyptus camaldulensis*) and in some cases Grey Box (*Eucalyptus microcarpa*) further away from the waterway. Midstorey species include various Wattles (*Acacia* sp.), Banksias (*Banksia marginata*), Totem Poles (*Melaleuca decussata*) and Tea Trees (*Leptospermum* sp.).

Weed density increases toward the downstream end of the reach with species such as Phalaris (*Phalaris aquatica*) and particularly Perrenial Veldt Grass (*Erhartia calycina*) found in abundance. A Weed of National Significance, Bridal Creeper (*Asparagus asparagoides*), was also present in this reach. Watsonia (*Watsonia bulbillifera*), an invasive bulb species, was present at site 11.

4.4.3 Habitat

Four habitat assessments were completed in this Reach. The results of the habitat quality assessments are presented below.

Table 6. Habitat quality assessments for Reach 3.

Veg Site	Preliminary Score	Habitat Quality
7	16/20	High
9	10/20	Medium
10	16/20	High
11	14/20	High
	Av 14/20	

Habitat quality is generally high in Reach 3. An intact riparian vegetation corridor is present along the majority of the reach. As a result, metrics such as large trees, canopy cover, understorey, litter, logs and patch size scored well in the habitat quality assessment. Core area scores were reduced in comparison with Reach 2

because sites were further away from the Grampians which constitutes the nearest native vegetation block lager than 50 hectares.

Poor connectivity between pools, imposed by irregular flows, means that aquatic species diversity is poor throughout most of the reach. However, after periods of increased rainfall when hydraulic connectivity between the pools is improved, native fish species are commonly found throughout the reach. Towards the junction of the MacKenzie and Wimmera Rivers, platypus sightings used to be common. A combination of no flow releases within the channel and the recent drought has greatly diminished the number and extent of pools, forcing platypus to seek alternative habitats.

The intact condition of the riparian vegetation and intrinsic habitat values within the reach provide ideal habitat for aquatic life. Following a flow event it is common for significant populations of Blackfish and Pigmy Perch to be found. During the field inspections numerous yabby holes were also found in the mid to lower sections of the reach. Local land owners have indicated that these holes are still active, even after the prolonged drought conditions that have continued for the past six years.

4.4.4 Threats and Risks

Threat	Risk
Altered flow regimes affect breeding cycles of native aquatic species. Altered flow regimes also affect connectivity between pools, limiting passage through the system for fish and invertebrate species. It is also recognised that this impacts upon native vegetation that requires regular and intermittent periods of wetting and drying. Consequently, these conditions are ideal for the growth of non-native vegetative species.	High
Spread of non-native vegetation, reducing native species diversity within the riparian zone.	Moderate
Impact of non-native fauna damaging both the terrestrial and aquatic habitats of native species.	Moderate
Vegetation encroachment reduces the channel's capacity, causing the channel to flood more regularly under low or moderate flow events.	High
Motorbike and recreational vehicle access within the channel/riparian zone. This problem is isolated to the lower MacKenzie River below Distribution Heads, and is exacerbated by the scarcity of water in the channel. Where vegetation encroachment and debris has limited access to the channel vehicles are driving up the banks, destroying vegetation and causing erosion in the process.	Low
Rubbish dumping and removal of timber for firewood degrade habitat availability within the reach.	Low

6.5 Reach 4: Burnt Creek to Bungallaly Creek. Bungallaly Creek to the Bungallaly South Irrigation Channel

4.5.1 Geomorphology

Reach 4 includes Burnt Creek from Distribution Heads to Bungalally Creek, extending along Bungalally Creek to the confluence with the Bungalally South Channel. With the exception of the temporary Grampians Wimmera Mallee Water diversion channel at Boggy Corner, bed and bank stability within the reach is high. This bank stability is largely dictated by the intact condition of the riparian vegetation, reasonably low channel gradient and the exclusion of stock from most of the stream-side zone. The channel is usually present in a zone 100-200 m wide, and is inset 1-3 m below the level of adjacent Shepparton Formation surface or Parilla Sand dunes. As such, the channel for most of the reach is well defined, typically 5-10m wide and approximately 1-1.5m deep. There are remnant wetlands present that can extend across most of the width of the inset channel zone. Where wetlands are present, channel dimensions typically decrease and the in-stream vegetation slows the velocity of the water causing it to pond and dissipate over the low -lying land within the riparian zone. Sites such as these should be protected, as they are representative of the channel form prior to European settlement.

Figure 6. Photo right shows the channel and streamside zone at the Distribution Heads. Photo right shows a GWMW channel immediately upstream from Boggy Corner on Burnt Creek (August 2004).

4.5.2 Vegetation

Extant Ecological Vegetation Class (EVC) mapping shows that the vegetation in this reach is mostly Plains Riparian Shrubby Woodland. Within the area adjacent to the riparian zone, extensive cover of Plains Woodland has been cleared since European settlement.

Index of Stream Condition (ISC) assessments were not performed in this Reach during 1999 or 2004.

Two rare species were identified within the reach, Broom Bitter Pea (*Davesia genistifolia*) and several specimens of a previously unidentified *Calistemon* species were recorded at site 8. These specimens show affinities with Lemon Bottlebrush (*Callistemon pallidus*) and are currently being classified by the National Herbarium, Botanic Gardens, Melbourne. Refer Appendix B for site specific species listings. Native vegetative species diversity is high in this reach. In particular, the ground layer is diverse and includes rare grasses and herbs.

Weed abundance was higher at site 8 compared with site 6. Both have been invaded by Perennial Veldt Grass (*Erhartia calycina*). A weed of National Significance, Bridal Creeper (*Asparagus asparagoides*), was also present throughout the reach.

4.5.3 Habitat

The results of the habitat quality assessments completed in this reach are presented in the table below.

Table 7. Habitat quality assessments for Reach 4.

Veg Site	Preliminary Score	Habitat Quality
6	13/20	High
8	15/20	High
	Av 14/20	

Habitat quality is high in Reach 4, with an intact riparian vegetation corridor present along most of the Reach. As a result, metrics such as large trees, canopy cover, understorey, litter, logs and patch size scored well in the habitat quality assessment. Core area scores were reduced in comparison with Reach 3 because sites are a significant distance from the Grampians National Park, which constitutes the closest native vegetation block larger than 50 hectares.

Two rare plant species were identified within the reach, Broom Bitter Pea (*Davesia genistifolia*) and several specimens of a previously unidentified *Calistemon* species were recorded at site 8. These specimens show affinities with Lemon Bottlebrush (*Callistemon pallidus*) and are currently being classified by the National Herbarium, Botanic Gardens, Melbourne.

Significant populations of Blackfish, Pigmy Perch and Platypus exist in the upper sections of Burnt Creek The intact condition of the riparian vegetation and intrinsic habitat values within the reach provide ideal habitat for aquatic life. Landholder input also suggests that some populations of fish have colonised the GWMW channels. Habitat values within such locations are considered to be poor as the channels are regularly cleared to prevent the build up of debris which could damage the channel.

4.5.4 Infrastructure

There has been significant infrastructure development in Reach 3. Grampians Wimmera Mallee Water use Burnt Creek to transfer water to private properties and major storages that are part of the stock and domestic supply system. A significant volume of the water that flows along Burnt Creek is diverted to Pine Lake and Taylors Lake via the Rocklands Channel. Examples of the existing infrastructure used to facilitate water transfers include weirs, earth channels dams and diversions as well as monitoring/gauging sites. The reliance of many towns for water supplied by the GWMW system means that the maintenance of the existing infrastructure is essential.

4.5.5 Reach 4: Threats and Risks

Threat	Risk
Altered flow regimes affect the breeding cycles of native aquatic species. Altered flow regimes also affect connectivity between pools, limiting passage through the system for fish and invertebrate species. These altered flow regimes also impact upon native vegetation that requires regular and intermittent periods of wetting and drying.	High

Consequently this provides ideal conditions for the growth of non-native vegetative plant species.	
Spread of non-native vegetation, reducing native species diversity within the riparian zone.	Moderate
Impact of non-native fauna damaging both the terrestrial and aquatic habitats of native species.	Moderate
Vegetation encroachment reduces the capacity of the channel, causing the channel to flood more regularly under low or moderate flow events.	High
Erosion and subsequent sedimentation resulting from the failed GWMW diversion channel at Boggy Corner.	High
Rubbish dumping and removal of timber for firewood degrading visual amenity and habitat availability within the reach.	Low

7 Works Program and Cost Estimate for Implementation of Management Actions

Note:

- Cost for works have not been provided as none of the actions listed involve on-ground works. Site locations for specific actions are shown in this section.
- Length and locations of fencing requirements to prevent stock access are unknown as weather and river flow conditions at the time of fieldwork prevented the collection of this data.

Action Number	Management Action	Priority
	Reach 1	
1.1	Restore flow regimes to mimic natural hydrologic variability through the reach.	High
1.2	Upgrade of existing waste water management systems at MacKenzie Falls. (in progress)	Low
1.4	Test for contaminated water leaching from the abandoned Asses Ears Landfill.	Low
	Reach 2	
2.1	Fence off riparian zone to protect native vegetation from grazing.	Medium
2.2	Weed control, including targeted attack on Spiny Rush, Bridal Creeper, One leaf cape tulip and blackberry	Medium
2.3	Manage salt affected land with appropriate perennial pasture and tree species.	Low
2.4	Implement flow regimes, as per environmental flow recommendations, to mimic natural hydraulic variability, within the reach	High

	Reach 3	
3.1	Implement environmental flow recommendations to mimic natural hydraulic variability within the reach.	Very High
3.2	Fence off riparian zone to protect native vegetation from grazing	Medium
3.3	Weed control including targeted attack on Watsonia and Bridal Creeper	Medium
3.4	Establish a 'community watch' program to monitor the dumping of rubbish and collection of fire wood. This would aid rangers/officers working in the field.	Low
	Reach 4	
4.1	Implement environmental flow recommendations to mimic natural hydraulic variability within the reach.	High
4.2	Weed control, including targeted attack on Bridal Creeper.	Medium
4.3	Fence off riparian zone to protect native vegetation from grazing.	Medium
4.4	Control extent and spread of sediment further downstream that has resulted from localised erosion of the GWMW diversion channel at Boggy Creek.	Low

8 Wimmera CMA 04/05 Incentive Rates

Wimmera CMA offers landholders incentive rates to undertake fencing and revegetation of streamside areas. The rates presented below represent the full incentive that will be paid and have been calculated to consider the full cost of the works. For example, the price of $1.00 for a plant, includes the purchase of the plant, plant establishment costs such as weed control, deep ripping and tree guards. As these costs have been considered in the incentive rates, additional funding is not available for these activities.

Activity	Priority	WCMA cost share	Criteria		Incentive	Unit
Waterways Fencing	VH	90%	Frontage >20m & Very High, High or medium conservation significance		Contact Glenn Dixon, WCMA, regarding waterway works prior to inspecting proposed projects. 5382 1544	
	H	80%	Frontage >20m, low conservation significance			
	M	60%	Frontage 10 - 20m			
	L	40%	Frontage <10m			
Off stream watering	VH	50%	Solar pump. 50% of total project cost. Maximum grant $3000			
	H	50%	Dam. 50%of construction cost. Maximum grant $1000			
Remnant Vegetation Fencing	VH	100%	Very high, high or medium conservation significance, with Trust for Nature Conservation covenant in place		$ 3.55	m
	H	75%	High to Very High Conservation significance		$ 2.65	m
	M	65%	Medium to Low conservation significance		$ 2.30	m
Land class fencing	M	60%	Fencing land class 4 & 5		$ 2.15	m
Revegetation fencing	VH	80%	Very High Conservation significance potential	PMP*	$ 2.85	m
		70%		No PMP	$ 2.50	m
	H	70%	High Conservation significance potential	PMP	$ 2.50	m
		60%		No PMP	$ 2.15	m
	M	55%	Medium Conservation significance potential	PMP	$ 1.95	m
		45%		No PMP	$ 1.60	m
	L	35%	Low Conservation significance potential	PMP	$ 1.25	m
		25%		No PMP	$ 0.90	m
Revegetation	H	80%	Plants: 80% of cost of plants, guards and follow up weed control for 12 months.		$ 1.00	each
	H	80%	Direct Seeding: 80% of cost of seed and follow up weed control for 12 months.		$ 160	km
Erosion control works	VH	80%	Works are part of an existing Property Management Plan / whole farm plan		Up to 80% of cost of Priority works	
	H	60%	No Property Management Plan / Whole Farm Plan completed		Up to 60% of cost of Priority works	
Saline Pasture	M	20%			$48	Ha
Saltbush	M	65%	Costing includes cost of plants and mounding.		$0.25	each
Fencing to protect salinity management works#	VH	80%	Works in “Implementation” priority GFS	PMP	$ 2.85	m
		70%		No PMP	$ 2.50	m
	H	70%	Works in “Research and development” priority GFS	PMP	$ 2.50	m
		60%		No PMP	$ 2.15	m
	M	55%	Works in “Co-investment” priority GFS	PMP	$ 1.95	m
		45%		No PMP	$ 1.60	m
	L	35%	Discharge Fencing	PMP	$ 1.25	m
		25%		No PMP	$ 0.90	m

* To be eligible for higher rates, inspecting officer must sight completed Property Management Plan or Whole Farm Plan

Higher incentive rates may be available for salinity works if they have conservation outcomes. In such cases rates for revegetation may be applied.

9 References

DNRE (Department of Natural Resources & Environment), 2002. *Draft Victorian River Health Strategy*, Catchment & Water division DNRE, Melbourne Australia.

Earth Tech. 2003, *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment.* Earth Tech Victoria.

ID&A, 2001**. *Wimmera River Geomorphic Investigation*, ID&A, Melbourne Australia.**

WCMA (Wimmera Catchment Management Authority), 2002a. *Wimmera Waterway Management Strategy*, WCMA, Horsham Victoria.

WCMA (Wimmera Catchment Management Authority), 2002b. *Wimmera Water Quality Strategy*, WCMA Horsham Victoria.

Appendix A

Vegetation Species Lists for MacKenzie River

Reach 2.

Vegetation Quality Assessment Site 1.

Private Property at end of Samuels Dve, Wartook

Species name	***Common Name***
Native Vegetation	
Acacia mearnsii	Black Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia retinodes	Wirilda
Acaena echinate	Sheep's Burr
Agrostis avenacea	Common Blown-grass
Amyema pendula	Drooping Mistletoe
Arthropodium strictum	Chocolate-lily
Astroloma conostephioides	Flame Heath
Astroloma humifusum	Cranberry Heath
Austrodanthonia geniculata	Kneed Wallaby-grass
Austrodanthonia setacea var. setacea	Bristly Wallaby-grass
Austrostipa mollis	Supple Spear-grass
Banksia marginata	Silver Banksia
Brachyloma daphnoides	Daphne Heath
Carex appressa	Tall Sedge
Chamaescilla corymbose	Blue Stars
Chorizandra enodis	Black Bristle Rush
Crassula sieberiana	Sieber Crassula
Dianella revoluta s.l	Black-anther Flax-lily
Dillwynia glaberrima	Smooth Parrot-pea
Drosera whittakeri	Scented Sundew
Elymus scaber	Common Wheat-grass
Eucalyptus camaldulensis	River Red-gum
Eucalyptus ovata	Swamp Gum
r *Eucalyptus sabulosa*	Grampians Scent-bark
Exocarpus cupressiformis	Native Cherry
Ficinia nodosa (syn Isolepis nodosa)	Knobby Club-rush
Geranium retrorsum	Grassland Cranesbill
Gonocarpus tetragynus	Common Raspwort
Hibbertia fasciculata var. prostrata	Bundled Guinea-flower
Hibbertia riparia sl	Erect Guinea-flower
Hydrocotyle laxiflora	Stinking Pennywort
Hypericum gramineum	Small St John's Wort
Juncus pallidus	Pale Rush
Lagenifera gracilis	Slender Lagenifera

Species name	***Common Name***
Lepidosperma carphoides	Black Rapier-sedge
Leptospermum continentale	Prickly Tea-tree
Leptospermum obovatum	River Tea-tree
Lomandra filiformis	Wattle Mat-rush
Lomandra longifolia	Spiny-headed Mat-rush
Lythrum hyssopifolia	Small Loosestrife
Microlaena stipoides	Weeping Grass
Microtis unifolia	Common Onion-orchid
Oxalis perennans	Grassland Wood-sorrel
Pimelea humilis	Common Rice-flower
Poa labillardieri	Common Tussock-grass
Poranthera microphylla	Small Poranthera
Pseudognaphalium luteoalbum	Cudweed
Pteridium esculentum	Austral Bracken
Ptilotus macrocephalus	Feather Heads
Rumex brownii	Slender Swamp Dock
Schoenus apogon	Common Bog-rush
Senecio hispidula var dissectus	Rough Fireweed
Senecio quadridentatus	Cotton Fireweed
Solenogyne dominii	Smooth Solenogyne
Thelymitra pauciflora	Slender Sun-orchid
Thysanotus patersonii	Twining Fringe-lily
Wahlenbergia stricta	Tall Bluebell

Weeds		Declared Noxious Weed
**Aira cupaniana*	Small Hair-grass	NA
**Avena fatua*	Wild Oat	NA
**Briza maxima*	Large Quaking-grass	NA
**Briza minor*	Lesser Quaking-grass	NA
**Hypochaeris radicata*	Cat's-ear	NA
**Vulpia myuros*	Rat's-tail Fescue	NA

Reach 2.

Vegetation Quality Assessment Site 2.

Private Property at end of Samuels Dve, Wartook

Species name	***Common Name***
Native Vegetation	
Agrostis avenacea	Common Blown-grass
Austrodanthonia geniculata	Kneed Wallaby-grass
Baumea articulata	Jointed Twig-sedge
Brachyscome cardiocarpa	Swamp Daisy
Chorizandra enodis	Black Bristle Rush
Eryngium ovinum	Blue Devil
Eryngium vesiculosum	Prickfoot
Eucalyptus camaldulensis	River Red-gum
Eucalyptus ovata	Swamp Gum
Hydrocotyle callicarpa	Annual Pennywort
Juncus sp-tall	Rush
Juncus sp –low	Rush
Leptospermum continentale	Prickly Tea-tree
Leptospermum lanigerum	Woolly Tea-tree
Poa labillardieri	Common Tussock-grass
Melaleuca gibbosa	Slender Honey-myrtle
Pseudognaphalium luteoalbum	Cudweed
Restio tetraphyllus	Tassel Cord-rush
Schoenus apogon	Common Bog-rush

Weeds		Declared Noxious Weed
**Cotula coronopifolia*	Water Buttons	NA
**Hypochaeris radicata*	Cat's-ear	NA
**Juncus acutus*	Spiny Rush	Regionally Controlled Weed
**Freesia sp*	Freesia	NA
**Holcus lanatus*	Yorkshire Fog-grass	NA
**Plantago coronopus*	Buck's-horn Plantain	NA
**Vulpia myuros*	Rat's-tail Fescue	NA

Reach 2.

Vegetation Quality Assessment Site 3.

Rosebrook, Wartook

Species name	***Common Name***
Native Vegetation	
Acacia retinodes	Wirilda
r *Asperula minima*	Mossy Woodruff
Astroloma humifusum	Cranberry Heath
Austrodanthonia geniculata	Kneed Wallaby-grass
Austrostipa mollis	Supple Spear-grass
Banksia marginata	Silver Banksia
Brachyloma daphnoides	Daphne Heath
Carex apressa	Tall Sedge
Crassula decumbens	Spreading Crassula
Crassula sieberiana	Sieber Crassula
Dianella revoluta s.s	Black-anther Flax-lily
Eucalyptus camaldulensis	River Red-gum
Eucalyptus melliodora	Yellow Box
Eucalyptus ovata	Swamp Gum
r *Eucalyptus sabulosa*	Grampians Scent-bark
Hibbertia riparia sl	Erect Guinea-flower
Hydrocotyle laxiflora	Stinking Pennywort
Juncus sp.	Rush
Leptospermum continentale	Prickly Tea-tree
Leptospermum obovatum	River Tea-tree
Microlaena stipoides	Weeping Grass
Pterostylis nutans	Nodding Greenhood
Restio tetraphyllus	Tassel Cord-rush
Senecio hispidula	Rough Fireweed
Thysanotus patersonii	Twining Fringe-lily
Triglochin procera	Water Ribbons
Villarsia reniformis	Running Marsh Flower

Species name	***Common Name***	Declared Noxious Weed
Weeds		**Declared Noxious Weed**
**Arctotheca calendula*	Cape Weed	NA
**Asparagus asparagoides*	Bridal Creeper	Not listed but highly invasive weed
**Briza maxima*	Large Quaking-grass	NA
**Cotula coronopifolia*	Water Buttons	NA
**Holcus lanatus*	Yorkshire Fog Grass	NA
**Hypochoeris radicata*	Cat's-ear	NA
**Romulea rosea*	Onion Grass	NA
**Vulpia myuros*	Rat's-tail Fescue	NA

Reach 2.

Vegetation Quality Assessment Site 4.

Tatlock's Bridge, Wartook

Species name	*Common Name*
Native Vegetation	
Acacia mearnsii	Black Wattle
Acacia retinodes	Wirilda
Acaena echinata	Sheep's Burr
k *Agrostis avenacea var. perennis*	Wetland Blown-grass
Arthropodium strictum	Chocolate-lily
Astroloma humifusum	Cranberry Heath
Austrodanthonia geniculata	Kneed Wallaby-grass
Austrodanthonia racemosa var. racemosa	Stiped Wallaby-grass
Austrodanthonia cespitosa	Common Wallaby-grass
Austrodanthonia setacea var. setacea	Bristly Wallaby-grass
Austrostipa mollis	Supple Spear-grass
Banksia marginata	Silver Banksia
Carex appressa	Tall Sedge
Cassytha pubescens	Downy Dodder-laurel
Crassula decumbens	Spreading Crassula
Eucalyptus camaldulensis	River Red-gum
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Eucalyptus ovata	Swamp Gum
Geranium retrorsum	Grassland Cranesbill
Gonocarpus tetragynus	Common Raspwort
Goodenia ovata	Swamp Goodenia
Hydrocotyle callicarpa	Small Pennywort
Hydrocotyle foveolata	Yellow Pennywort
Hydrocotyle laxiflora	Stinking Pennywort
Juncus sp.	Rush
Lepidosperma sp aff congestum	Clustered Sword-sedge
Leptospermum lanigerum	Woolly Tea-tree
Leptospermum obovatum	River Tea-tree
Lomandra filiformis ssp coriacea	Wattle Mat-rush
Oxalis perennans	Grassland Wood-sorrel
Poa labillardieri	Common Tussock-grass
Restio tetraphyllus	Tassel Cord-rush
Rumex brownii	Slender Swamp Dock
Schoenus apogon	Common Bog-rush
Tricoryne elatior	Yellow Rush-lily
Thysanotus patersonii	Twining Fringe-lily

Species name	*Common Name*
Triglochin procera	Water Ribbons

Species name	*Common Name*	Declared Noxious Weed
Weeds		**Declared Noxious Weed**
**Acetosella vulgaris*	Sheep Sorrell	NA
**Arctotheca calendula*	Cape Weed	NA
**Avena fatua*	Wild Oat	NA
**Brassica x napus*	Rape (Canola)	NA
**Briza maxima*	Large Quaking-grass	NA
**Bromus diandrus*	Great Brome	NA
**Bromus hordeaceus*	Soft Brome	NA
**Cirsium vulgare*	Scotch (Spear) Thistle	NA
**Lagurus ovata*		
**Holcus lanatus*	Yorkshire Fog Grass	NA
***Homeria flaccida*	**One-leaf Cape Tulip**	**Regionally Prohibited**
**Hypochaeris radicata*	Cat's-ear	NA
**Oxalis pes-caprae*	Soursob	NA
**Oxalis purpurea*	Large-flower Wood-sorrel	NA
**Poa bulbosa*	Bulbous Meadow-grass	NA
**Romulea rosea*	Onion Grass	NA
***Rubus fruticosa spp agg*	**Blackberry**	**Regionally Controlled**
**Rumex sp.*	Dock	NA
**Sonchus asper s.l.*	Rough Sow-thistle	NA
**Trifolium angustifolium*	Narrow-leaf clover	NA
**Trifolium arvense*	Hare's-foot Clover	NA
**Trifolium campestre var. campestre*	Hop Clover	NA
**Vulpia myuros*	Rat's-tail Fescue	NA

Reach 3.

Vegetation Quality Assessment Site 5.

Distribution Heads, Laharum

Species name	***Common Name***
Native Vegetation	
Acacia mearnsii	Black Wattle
Acacia retinodes	Wirilda
Acaena echinata	Sheep's Burr
Austrodanthonia caespitosa	Common Wallaby-grass
Carex appressa	Tall Sedge
Dichelachne crinita	Long-hair Plume-grass
Eleocharis sphacelata	Tall Spike-sedge
Elymus scabrus	Common Wheat-grass
Eucalyptus camaldulensis	River Red-gum
Exocarpus cupressoides	Cherry Ballart
Exocarpus strictus	Dwarf Cherry
Gahnia sieberiana	Red-fruit Saw-sedge
Geranium retrorsum	Grassland Cranesbill
Gonocarpus tetragynus	Common Raspwort
Goodenia ovata	Swamp Goodenia
Hydrocotyle laxiflora	Stinking Pennywort
Juncus pallidus	Pale Rush
Juncus sp.	Rush
Lepidosperma congestum	Clustered Sword-sedge
Leptospermum continentale	Prickly Tea-tree
Leptospermum obovatum	River Tea-tree
Lythrum hyssopifolia	Small Loosestrife
Microlaena stipoides	Weeping Grass
Myriophyllum sp	Water Milfoil
Oxalis perennans	Grassland Wood-sorrel
Persicaria decipiens	Slender Knotweed
Poa labillardieri	Common Tussock-grass
Pterostylis nutans	Nodding Greenhood
Restio tetraphyllus	Tassel Cord-rush
Rumex brownii	Slender Swamp Dock
Senecio hispidula var dissecta	Rough Fireweed
Senecio quadridentatus	Cotton Fireweed
Thelymitra pauciflora	Slender Sun-orchid
Triglochin procera	Water Ribbons
Villarsia reniformis	Running Marsh-flower

Species name	***Common Name***	Declared Noxious

		Weed
Weeds		**Declared Noxious Weed**
**Acetosella vulgaris*	Sheep Sorrell	NA
**Arctotheca calendula*	Cape Weed	NA
**Avena fatua*	Wild Oat	NA
**Brassica x napus*	Rape (Canola)	NA
**Briza maxima*	Large Quaking-grass	NA
**Bromus diandrus*	Great Brome	NA
**Bromus hordeaceus*	Soft Brome	NA
**Cirsium vulgare*	Scotch (Spear) Thistle	NA
**Lagurus ovata*		
**Holcus lanatus*	Yorkshire Fog Grass	NA
****Homeria flaccida***	**One-leaf Cape Tulip**	**Regionally Prohibited**
**Hypochaeris radicata*	Cat's-ear	NA
**Oxalis pes-caprae*	Soursob	NA
**Oxalis purpurea*	Large-flower Wood-sorrel	NA
**Poa bulbosa*	Bulbous Meadow-grass	NA
**Romulea rosea*	Onion Grass	NA
****Rubus fruticosa spp agg***	**Blackberry**	**Regionally Controlled**
**Rumex sp.*	Dock	NA
**Sonchus asper s.l.*	Rough Sow-thistle	NA
**Trifolium angustifolium*	Narrow-leaf clover	NA
**Trifolium arvense*	Hare's-foot Clover	NA
**Trifolium campestre var. campestre*	Hop Clover	NA
**Vulpia myuros*	Rat's-tail Fescue	NA

Reach 3

Vegetation Quality Assessment Site 8.

N.E. Wonwondah Rd, Laharum

Species name	*Common Name*
Native Vegetation	
Acaena echinata	Sheep's Burr
Arthropodium fimbriatum	Nodding Chocolate-lily
Arthropodium strictum	Chocolate-lily
Austrodanthonia geniculata	Kneed Wallaby-grass
Austrostipa mollis	Supple Spear-grass
Austrostipa scabra	Rough Spear-grass
Austrostipa sp.	Spear-grass
Callistemon sp aff pallidus	Bottlebrush
Callistemon rugulosus	Scarlet Bottlebrush
Chamaescilla corymbosa	Blue Stars
Cheilanthes sieberi	Narrow Rock-fern
Chorizandra enodis	Black Bristle Rush
Crassula colorata	Dense Crassula
Crassula decumbens	Spreading Crassula
Cyperus lucidus	Leafy Flat-sedge
Dianella revoluta s.l	Black-anther Flax-lily
r *Daviesia genistifolia*	Broom Bitter-pea
Dillwynia glaberrima	Smooth Parrot-pea
Drosera whittakeri ssp aberrans	Scented Sundew
Elymus scabrus	Common Wheat-grass
Eucalyptus camaldulensis	River Red-gum
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Geranium retrorsum	Grassland Cranesbill
Gonocarpus tetragynus	Common Raspwort
Hibbertia riparia	Erect Guinea-flower
Juncus sp.	Rush
Lomandra filiformis ssp coriacea	Wattle Mat-rush
Lomandra micrantha ssp micrantha	Small Flowered Mat Rush
Lomandra nana	Dwarf Mat-rush
Neurachne alopecuroidea	Fox-tail Mulga Grass
Oxalis perennans	Grassland Wood-sorrel
Pelargonium rodneyanum	Magenta Stork's-bill
Pultenaea laxiflora	Loose-flower Bush-pea
Rumex brownii	Slender Swamp Dock
Thysanotus patersonii	Twining Fringe-lily
Veronica calycina	Hairy Speedwell
Vittadinia sp.	New Holland Daisy

Species name	*Common Name*	Declared Noxious Weed

Weeds		
**Agave americana*	American Aloe	NA
**Asparagus asparagoides*	Bridal Creeper	Not listed but highly invasive weed
**Avena fatua*	Wild Oats	NA
**Briza maxima*	Quaking Grass	NA
**Bromus hordeaceus*	Soft Brome	NA
**Ehrharta calycina*	Perennial Veldt Grass	NA
**Hypochaeris radicata*	Cat's-ear	NA
**Lagurus ovatus*	Hare's Tail	NA

Reach 3.

Vegetation Quality Assessment Site 9. MacKenzie Crossing, MacKenzie Ck.

NATIVE VEGETATION	
Acacia acinacea	Gold-dust Wattle
Acacia implexa	Lightwood
Acacia retinodes	Wirilda
Acaena echinata	Sheep's Burr
Acaena ovina	
Agrostis avenacea	Common Blown-grass
Allocasuarina luehmannii	Buloke
Amyema pendula	Drooping Mistletoe
r *Aristida calycina*	**Dark Wire-grass**
Arthropodium fimbriatum	Nodding Chocolate-lily
Arthropodium strictum	Chocolate-lily
r *Austrodanthonia bipartita*	Leafy Wallaby Grass
Austrodanthonia setacea	Bristly Wallaby-grass
Austrodanthonia sp.	Wallaby-grass
Austrostipa mollis	Supple Spear-grass
Austrostipa scabra	Rough Spear-grass
Austrostipa sp.	Spear-grass
Banksia marginata	Silver Banksia
Callitris gracilis	Slender Cypress-pine
Calytrix tetragona	Common Fringe-myrtle
Carex appressa	Tall Sedge
Chamaescilla corymbosa	Blue Stars
Crassula decumbens	Spreading Crassula
Crassula helmsii	Swamp Crassula
Cyperus sp	Flat-sedge
Dianella revoluta s.l	Black-anther Flax-lily
Dodonaea viscosa ssp .cuneata	Wedge-leaf Hop-bush
Einadia nutans	Nodding Saltbush
Elymus scabrus	Common Wheat-grass
Eucalyptus camaldulensis	River Red-gum
Eucalyptus microcarpa	Grey Box
Eutaxia microphylla s.s	Common Eutaxia
Exocarpus cupressiformis	Native Cherry
Geranium retrorsum	Grassland Cranesbill
Goodenia ovata	Hop Goodenia
Hydrocotyle laxiflora	Stinking Pennywort
Juncus sp.	Rush
Lepidosperma congestum	Clustered Sword-sedge
Melaleuca decussata	Totem Poles
Oxalis perennans	Grassland Wood-sorrel
Pseudognaphalium luteoalbum	Cudweed
Ranunculus sessiliflorus	Annual Buttercup
Triglochin sp	Arrow-grass
Vittadinia cuneata	Fuzzy New Holland Daisy

Species name	***Common Name***	Declared Noxious

		Weed
WEEDS		**Declared Noxious Weed**
****Asparagus asparagoides***	**Bridal Creeper**	Not listed but highly invasive weed
**Avena fatua*	Wild Oat	NA
**Briza maxima*	Large Quaking-grass	NA
**Carthamus lanatus*	Saffron Thistle	NA
****Ehrharta calycina***	**Perennial Veldt Grass**	NA
**Hypochaeris radicata*	Cat's-ear	NA
**Romulea rosea*	Onion Grass	NA
**Trifolium angustifolium*	Narrow-leaf clover	NA

Reach 4.

Vegetation Quality Assessment Site 6.

Boggy Corner, Laharum

Species name	*Common Name*
Native Vegetation	
Acacia retinodes	Wirilda
Acaena echinata	Sheep's Burr
Arthropodium strictum	Chocolate-lily
Austrodanthonia duttoniana	Brown-back Wallaby-grass
Baumea articulata	Jointed Twig-sedge
Calocephalus citreus	Lemon Beauty-heads
Carex appressa	Tall Sedge
Centipeda sp	Sneezeweed
Chamaescilla corymbosa	Blue Stars
Chorizandra enodis	Black Bristle Rush
Cyperus lucidus	Leafy Flat-sedge
Deyeuxia quadriseta	Reed Bent-grass
Dianella revoluta s.l	Black-anther Flax-lily
Dichelachne crinita	Long-hair Plume-grass
Eleocharis sphacelata	Tall Spike-sedge
Elymus scabrus	Common Wheat-grass
Eragrostis brownii	Common Love-grass
Eryngium ovinum	Blue Devil
Eryngium vesiculosum	Prickfoot
Eucalyptus camaldulensis	River Red-gum
Eucalyptus microcarpa	Grey Box
Eucalyptus viminalis ssp. cygnetensis	Rough-barked Manna Gum
Eutaxia microphylla s.s	Common Eutaxia
Gonocarpus tetragynus	Common Raspwort
Goodenia humilis	Swamp Goodenia
Homopholis proluta	Rigid Panic
Juncus holoschoenus	Joint-leaf Rush
Juncus sp.	Rush
Lepidosperma carphoides	Black Rapier-sedge
Lepidosperma congestum	Clustered Sword-sedge
Leptorhynchos squamatus	Scaly Buttons
Leptospermum obovatum	River Tea-tree
Lythrum hyssopifolia	Small Loosestrife
Oxalis perennans	Grassland Wood-sorrel
Persicaria decipiens	Slender Knotweed
Poa labillardieri	Common Tussock-grass
Poa sieberiana	Grey Tussock-grass

Species name	***Common Name***
Pterostylis nutans	Nodding Greenhood
Ranunculus lappaceus	Australian Buttercup
Restio tetraphyllus	Tassel Cord-rush
Rumex brownii	Slender Swamp Dock
Schoenus apogon	Common Bog-rush
Solenogyne dominii	Smooth Solenogyne
Typha domingensis	Cumbungi
Triglochin procera	Water Ribbons

Weeds		**Declared Noxious Weed**
**Bromus hordeaceus*	Soft Brome	NA
**Cirsium vulgare*	Scotch (Spear) Thistle	NA
**Dittrichia graveolens*	Stinkwort	NA
**Ehrharta calycina*	Perennial Veldt Grass	NA
**Holcus lanatus*	Yorkshire Fog Grass	NA
**Hypochaeris radicata*	Cat's-ear	NA
**Phalaris aquatica*	Canary Grass	NA
**Picris echioides*	Ox-tongue Daisy	NA
**Romulea rosea*	Onion Grass	NA
**Vulpia myuros*	Rat's-tail Fescue	NA
**Watsonia bulbillifera*	Watsonia	Not listed but high priority for management

Reach 4.

Vegetation Quality Assessment Site 7.

Graham's Bridge Rd, Laharum

Species name	***Common Name***
Native Vegetation	
Acacia acinacea	Gold-dust Wattle
Acacia implexa	Lightwood
Acacia retinodes	Wirilda
Acaena echinata	Sheep's Burr
Allocasuarina luehmannii	Buloke
Arthropodium fimbriatum	Nodding Chocolate-lily
Arthropodium strictum	Chocolate-lily
Astroloma humifusum	Cranberry Heath
Austrodanthonia geniculata	Kneed Wallaby-grass
Austrostipa mollis	Supple Spear-grass
Austrostipa scabra	Rough Spear-grass
Bursaria spinosa	Sweet Bursaria
Callitris rhomboidea	Oyster Bay Pine
Calytrix tetragona	Common Fringe-myrtle
Carex inversa	Common Sedge
Chamaescilla corymbosa	Blue Stars
Cheilanthes sieberi	Narrow Rock-fern
Chorizandra enodis	Black Bristle Rush
Crassula colorata	Dense Crassula
Crassula decumbens	Spreading Crassula
Cyperus lucidus	Leafy Flat-sedge
r *Dianella sp nova ff longifolia*	Grassland Pale Flax-lily
Dianella revoluta s.l	Black-anther Flax-lily
Dillwynia glaberrima	Smooth Parrot-pea
Dillwynia hispida	Red Parrot-pea
Drosera whittakeri ssp aberrans	Scented Sundew
Elymus scabrus	Common Wheat-grass
Eucalyptus camaldulensis	River Red-gum
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Geranium retrorsum	Grassland Cranesbill
Gonocarpus tetragynus	Common Raspwort
Goodenia blackiana	Black's Goodenia
Goodenia pinnatifida	Cut-leaf Goodenia

Species	***Common Name***
Hydrocotyle callicarpa	Small Pennywort
Hydrocotyle laxiflora	Stinking Pennywort
Lagenifera gracilis	Slender Lagenifera
Lepidosperma carphoides	Black Rapier-sedge
Leptospermum obovatum	River Tea-tree
Lomandra filiformis ssp coriacea	Wattle Mat-rush
Lomandra micrantha ssp micrantha	Small Flowered Mat Rush
Lomandra nana	Dwarf Mat-rush
Neurachne alopecuroidea	Fox-tail Mulga Grass
Oxalis perennans	Grassland Wood-sorrel
Pelargonium rodneyanum	Magenta Stork's-bill
Poa labillardieri	Common Tussock-grass
Poa sieberiana	Grey Tussock-grass
Poranthera microphylla	Small Poranthera
Pterostylis nana	Dwarf Greenhood
Wahlenbergia stricta	Tall Bluebell

Weeds		**Declared Noxious Weed**
**Avena fatua*	Wild Oats	NA
**Briza maxima*	Quaking Grass	NA
**Bromus hordeaceus*	Soft Brome	NA
**Ehrharta calycina*	Perennial Veldt Grass	NA
**Hypochaeris radicata*	Cat’s-ear	NA
**Phalaris aquatica*	Canary Grass	NA
**Romulea rosea*	Onion Grass	NA
**Vulpia myuros*	Rat’s-tail Fescue	NA

Appendix B

Habitat Quality Field Assessments for MacKenzie River

SITE RECORD SHEET

Work Sheet 1

Refer Map.
Off Sunnels Rd

Sketch map of paddock (not to scale). Show and number all native vegetation sites to be assessed. (Note: a separate site record sheet is to be prepared for each numbered site).

Property Name: Development Site - Swamp

Paddock Name or Number: n/a

Vegetation Site Number (as per sketch map): M1

Assessor: JS + HdC

Date: 28 Jul 2004

Work Sheet 2

EVC GROUP Refer to Victorian Resources Online www.dse.vic.gov.au: Woodland

Work Sheet 3

GENERALISED CONSERVATION STATUS
Refer to EVC Group table. The Generalised Conservation Status is listed for each of the 21 EVC Groups

Endangered
Vulnerable
Rare
Depleted
Least concern

n/a

Work Sheet 4

MEASUREMENT OF HABITAT QUALITY (total) as determined on reverse: 18

Work Sheet 5

GENERALISED CONSERVATION SIGNIFICANCE

5B GENERALISED CONSERVATION STATUS	5A EVC GROUP TYPE: Forests, woodlands or mallee	Grasslands or wetlands	Scrub, shrublands or heathlands	5C MEASUREMENT OF HABITAT QUALITY	5D
Endangered	8 +	6 +	7 +	Very high	
	< 8	< 6	< 7	High	
Vulnerable	10 +	8 +	8.5 +	Very high	
	6 – 10	5 – 8	5 – 8.5	High	
	< 6	< 5	< 5	Medium	
Rare	12 +	9.5 +	10 +	Very high	
	6 – 12	5 – 9.5	5 – 10	High	
	< 6	< 5	< 5	Medium	
Depleted	12 +	9.5 +	10 +	High	
	6 – 12	5 – 9.5	5 – 10	Medium	
	< 6	< 5	< 5	Low	
Least concern	12 +	9.5 +	10 +	Medium	
	< 12	< 9.5	< 10	Low	

Work Sheet 6

PERFORMANCE STANDARDS

Current extent on farm

Future quality & quantity on farm

Work Sheet 7

TARGET AND MANAGEMENT ACTIONS

	Benchmark/ observations	Quality Measurement		Measurement
LARGE TREES (only apply to Woodlands and Forests)	Enter the number of trees over 60 cms diameter (or 190cms circumference) at breast height in 0.25ha (50mx50m) x4 (ie # per ha)	*No large trees*	0	2
		Woodlands: up to 7/ha *Forests:* up to 12/ha	1	
		Woodlands: more than 7/ha *Forests:* more than 12/ha	2	
CANOPY COVER (only apply to sites with large trees)	Enter the canopy cover of large trees 50+% in Rainforests 10-20% in Woodlands 20-50% in Dry Forests 50% in Wet Forests 50% in Scrubs 20% in Shrublands	Less than 25% of benchmark	0	0
		25-50% of benchmark	0.5	
		More than 50% of benchmark	1	
UNDERSTOREY	Cover of native species: 90-100% in Woodlands, Forests and Grasslands Number of native species: 25-35 species in *Woodlands, Forests, Shrublands, Grasslands*	***Cover minimal*** Less than 10%	0	5
		Cover low 10-25%	1	
		Cover reduced 25%-75% ***Low species number*** Less than 12	2	
		Cover reduced 25% - 75% ***High species number*** More than 12	4	
		Cover intact More than 75% ***High species number*** More than 12	5	
WEEDINESS	Enter the % weed cover on the site	More than 50% weed cover	0	3
		25 – 50% weed cover	1	
		5 – 25% weed cover	2	
		Less than 5% weed cover	3	
RECRUITMENT (only apply to non-flowering growth less than 4 years old)	*Woodlands, Forests, Shrublands, Scrubs and Heathlands:* % of woody species *Grasslands:* Diversity of herbs within inter-tussock spaces	Less than 25% of woody species present *Grasslands:* **few or absent** small herbs	0	1
		25-75% of woody species present *Grasslands:* **some** small herbs	1	
		More than 75% of woody species of present *Grasslands:* **diverse** number of small herbs	2	
ORGANIC LITTER	Enter the % cover of organic litter on the site	**Less than:** 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands*. 5% cover in *Grasslands*	0	1
		More than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	1	
LOGS (only apply to Woodlands and Forests)	Length of fallen trees/ branches >10cm dia.	**Less than:** 50m/ha in *Woodlands* 75 m/ha in *Forests*	0	1
		More than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	1	
SIZE		Less than 2 ha	0	2
		2 – 10 ha	1	
		More than 10 ha	2	
NEIGHBOURHOOD	% area covered by native vegetation within 1 km radius	Less than 10% cover	0	2
		10 – 50% cover	1	
		More than 50% cover	2	
Distance to nearest CORE AREA	Core area is a block of native vegetation greater than 50 ha	1 km from native vegetation block bigger than 50 ha	0	1
		Less than 1 km from a native vegetation block bigger than 50 ha	1	
		4A Measurement of Habitat Quality (total)		18

SITE RECORD SHEET

Work Sheet 1

Refer Map.

Sketch map of paddock (not to scale). Show and number all native vegetation sites' to be assessed. (*Note:* a separate site record sheet is to be prepared for each numbered site).

Property Name: –

Paddock Name or Number: n/a

Vegetation Site Number (as per sketch map): M2

Assessor: JS + HdC

Date: 28 Jul 2004

Work Sheet 2

EVC GROUP Refer to Victorian Resources Online www.dse.vic.gov.au: Woodland

Work Sheet 3

GENERALISED CONSERVATION STATUS
Refer to EVC Group table. The Generalised Conservation Status is listed for each of the 21 EVC Groups

Endangered
Vulnerable
Rare
Depleted
Least concern

n/a

Work Sheet 4

MEASUREMENT OF HABITAT QUALITY (total) as determined on reverse: 15.5

Work Sheet 5

GENERALISED CONSERVATION SIGNIFICANCE

GENERALISED CONSERVATION STATUS (5B)	5A EVC GROUP TYPE: Forests, woodlands or mallee	Grasslands or wetlands	Scrub, shrublands or heathlands	5C MEASUREMENT OF HABITAT QUALITY	5D
Endangered	8 +	6 +	7 +	Very high	
	< 8	< 6	< 7	High	
Vulnerable	10 +	8 +	8.5 +	Very high	
	6 – 10	5 – 8	5 – 8.5	High	
	< 6	< 5	< 5	Medium	
Rare	12 +	9.5 +	10 +	Very high	
	6 – 12	5 – 9.5	5 – 10	High	
	< 6	< 5	< 5	Medium	
Depleted	12 +	9.5 +	10 +	High	
	6 – 12	5 – 9.5	5 – 10	Medium	
	< 6	< 5	< 5	Low	
Least concern	12 +	9.5 +	10 +	Medium	
	< 12	< 9.5	< 10	Low	

Work Sheet 6

PERFORMANCE STANDARDS

Current extent on farm: n/a

Future quality & quantity on farm: n/a

Work Sheet 7

TARGET AND MANAGEMENT ACTIONS: n/a

	Benchmark/ observations	Quality Measurement		Measurement
LARGE TREES (only apply to Woodlands and Forests)	Enter the number of trees over 60 cms diameter (or 190cms circumference) at breast height in 0.25ha (50mx50m) ____ x4 (ie # per ha)	*No large trees*	0	1
		Woodlands: up to 7/ha *Forests:* up to 12/ha	1	
		Woodlands: more than 7/ha *Forests:* more than 12/ha	2	
CANOPY COVER (only apply to sites with large trees)	Enter the canopy cover of large trees 50+% in Rainforests 10-20% in Woodlands 20-50% in Dry Forests 50% in Wet Forests 50% in Scrubs 20% in Shrublands	Less than 25% of benchmark	0	0.5
		25-50% of benchmark	0.5	
		More than 50% of benchmark	1	
UNDERSTOREY	**Cover** of native species. 90-100% in Woodlands, Forests and Grasslands **Number** of native species: 25-35 species in *Woodlands, Forests, Shrublands, Grasslands.*	***Cover minimal*** Less than 10%	0	4
		Cover low 10-25%	1	
		Cover reduced 25%-75% ***Low species number*** Less than 12	3	
		Cover reduced 25% - 75% ***High species number*** More than 12	4	
		Cover intact More than 75% ***High species number*** More than 12	5	
WEEDINESS	Enter the % weed cover on the site ____	More than 50% weed cover	0	2
		25 – 50% weed cover	1	
		5 – 25% weed cover	2	
		Less than 5% weed cover	3	
RECRUITMENT (only apply to non-flowering growth less than 4 years old)	*Woodlands, Forests, Shrublands, Scrubs and Heathlands:* % of woody species *Grasslands:* Diversity of herbs within inter-tussock spaces	Less than 25% of woody species present *Grasslands:* **few or absent** small herbs	0	1
		25-75% of woody species present *Grasslands:* **some** small herbs	1	
		More than 75% of woody species of present *Grasslands:* **diverse** number of small herbs	2	
ORGANIC LITTER	Enter the % cover of organic litter on the site ____	**Less than:** 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands.* 5% cover in *Grasslands*	0	1
		More than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands.* 5% cover in *Grasslands*	1	
LOGS (only apply to Woodlands and Forests)	Length of fallen trees/ branches >10cm dia.	**Less than:** 50m/ha in *Woodlands* 75 m/ha in *Forests*	0	1
		More than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	1	
SIZE		Less than 2 ha	0	2
		2 – 10 ha	1	
		More than 10 ha	2	
NEIGHBOURHOOD	% area covered by native vegetation within 1 km radius	Less than 10% cover	0	2
		10 – 50% cover	1	
		More than 50% cover	2	
Distance to nearest **CORE AREA**	Core area is a block of native vegetation greater than 50 ha	1 km from native vegetation block bigger than 50 ha	0	1
		Less than 1 km from a native vegetation block bigger than 50 ha	1	
		4A Measurement of Habitat Quality (total)		15-5

SITE RECORD SHEET

Work Sheet 1

Refer Map.

Photos 6033
6034

Sketch map of paddock (not to scale). Show and number all native 'vegetation sites' to be assessed. (Note: a separate site record sheet is to be prepared for each numbered site).

Property Name: –

Paddock Name or Number: n/a

Vegetation Site Number (as per sketch map): M3

Assessor: JS + HdC

Date: 28 Jul 2004

Work Sheet 2

EVC GROUP Refer to Victorian Resources Online www.dse.vic.gov.au: Woodland

Work Sheet 3

GENERALISED CONSERVATION STATUS
Refer to EVC Group table. The Generalised Conservation Status is listed for each of the 21 EVC Groups

Endangered
Vulnerable
Rare
Depleted
Least concern

n/a

Work Sheet 4

MEASUREMENT OF HABITAT QUALITY (total) as determined on reverse: 17.5

Work Sheet 5

GENERALISED CONSERVATION SIGNIFICANCE

GENERALISED CONSERVATION STATUS (5B)	EVC GROUP TYPE (5A): Forests, woodlands or mallee	Grasslands or wetlands	Scrub, shrublands or heathlands	MEASUREMENT OF HABITAT QUALITY (5C)	(5D)
Endangered	8 +	6 +	7 +	Very high	
	< 8	< 6	< 7	High	
Vulnerable	10 +	8 +	8.5 +	Very high	
	6 – 10	5 – 8	5 – 8.5	High	
	< 6	< 5	< 5	Medium	
Rare	12 +	9.5 +	10 +	Very high	
	6 – 12	5 – 9.5	5 – 10	High	
	< 6	< 5	< 5	Medium	
Depleted	12 +	9.5 +	10 +	High	
	6 – 12	5 – 9.5	5 – 10	Medium	
	< 6	< 5	< 5	Low	
Least concern	12 +	9.5 +	10 +	Medium	
	< 12	< 9.5	< 10	Low	

Work Sheet 6

PERFORMANCE STANDARDS

Current extent on farm: n/a

Future quality & quantity on farm: n/a

Work Sheet 7

TARGET AND MANAGEMENT ACTIONS: n/a

	Benchmark/ observations	Quality Measurement		Measurement
LARGE TREES (only apply to Woodlands and Forests)	Enter the number of trees over 60 cms diameter (or 190cms circumference) at breast height in 0.25ha (50mx50m) [ ] x4 (ie # per ha)	*No large trees*	0	2
		Woodlands: up to 7/ha *Forests:* up to 12/ha	1	
		Woodlands: more than 7/ha *Forests:* more than 12/ha	2	
CANOPY COVER (only apply to sites with large trees)	Enter the canopy cover of large trees 50+% in Rainforests; 10-20% in Woodlands; 20-50% in Dry Forests; 50% in Wet Forests; 50% in Scrubs; 20% in Shrublands [ ]	Less than 25% of benchmark	0	0.5
		25-50% of benchmark	0.5	
		More than 50% of benchmark	1	
UNDERSTOREY	Cover of native species: 90-100% in Woodlands, Forests and Grasslands. Number of native species: 25-35 species in *Woodlands, Forests, Shrublands, Grasslands.*	***Cover minimal*** Less than 10%	0	5
		Cover low 10-25%	1	
		Cover reduced 25%-75% ***Low species number*** Less than 12	2	
		Cover reduced 25% - 75% ***High species number*** More than 12	4	
		Cover intact More than 75% ***High species number*** More than 12	5	
WEEDINESS	Enter the % weed cover on the site [ ]	More than 50% weed cover	0	2
		25 – 50% weed cover	1	
		5 – 25% weed cover	2	
		Less than 5% weed cover	3	
RECRUITMENT (only apply to non-flowering growth less than 4 years old)	*Woodlands, Forests, Shrublands, Scrubs and Heathlands:* % of woody species. *Grasslands:* Diversity of herbs within inter-tussock spaces	Less than 25% of woody species present *Grasslands:* **few or absent** small herbs	0	1
		25-75% of woody species present *Grasslands:* **some** small herbs	1	
		More than 75% of woody species of present *Grasslands:* **diverse** number of small herbs	2	
ORGANIC LITTER	Enter the % cover of organic litter on the site [ ]	**Less than:** 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands.* 5% cover in *Grasslands*	0	1
		More than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands.* 5% cover in *Grasslands*	1	
LOGS (only apply to Woodlands and Forests)	Length of fallen trees/ branches >10cm dia.	**Less than:** 50m/ha in *Woodlands* 75 m/ha in *Forests*	0	1
		More than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	1	
SIZE		Less than 2 ha	0	2
		2 – 10 ha	1	
		More than 10 ha	2	
NEIGHBOURHOOD	% area covered by native vegetation within 1 km radius	Less than 10% cover	0	2
		10 – 50% cover	1	
		More than 50% cover	2	
Distance to nearest CORE AREA	Core area is a block of native vegetation greater than 50 ha	1 km from native vegetation block bigger than 50 ha	0	1
		Less than 1 km from a native vegetation block bigger than 50 ha	1	
		4A Measurement of Habitat Quality (total)		17.5

SITE RECORD SHEET

Work Sheet 1

Refer Map.

Photos 6029
6030
6031
6032

Sketch map of paddock (not to scale). Show and number all native 'vegetation sites' to be assessed. (Note: a separate site record sheet is to be prepared for each numbered site).

Property Name: Tatlocks Bridge

Paddock Name or Number: n/a

Vegetation Site Number (as per sketch map): M 4

Assessor: JS + HdC

Date: 28 Jul 2004

Work Sheet 2

EVC GROUP Refer to Victorian Resources Online www.dse.vic.gov.au: Woodland

Work Sheet 3

GENERALISED CONSERVATION STATUS
Refer to EVC Group table. The Generalised Conservation Status is listed for each of the 21 EVC Groups

Endangered
Vulnerable
Rare
Depleted
Least concern

n/a

Work Sheet 4

MEASUREMENT OF HABITAT QUALITY (total) as determined on reverse: 11.5

Work Sheet 5

GENERALISED CONSERVATION SIGNIFICANCE

5B GENERALISED CONSERVATION STATUS	5A EVC GROUP TYPE: Forests, woodlands or mallee	Grasslands or wetlands	Scrub, shrublands or heathlands	5C MEASUREMENT OF HABITAT QUALITY	5D
Endangered	8 +	6 +	7 +	Very high	
	< 8	< 6	< 7	High	
Vulnerable	10 +	8 +	8.5 +	Very high	
	6 – 10	5 – 9	5 – 8.5	High	
	< 6	< 5	< 5	Medium	
Rare	12 +	9.5 +	10 +	Very high	
	6 – 12	5 – 9.5	5 – 10	High	
	< 6	< 5	< 5	Medium	
Depleted	12 +	9.5 +	10 +	High	
	6 – 12	5 – 9.5	5 – 10	Medium	
	< 6	< 5	< 5	Low	
Least concern	12 +	9.5 +	10 +	Medium	
	< 12	< 9.5	< 10	Low	

Work Sheet 6

PERFORMANCE STANDARDS

Current extent on farm: n/a

Future quality & quantity on farm: n/a

Work Sheet 7

TARGET AND MANAGEMENT ACTIONS: n/a

	Benchmark/ observations	Quality Measurement		Measurement
LARGE TREES (only apply to Woodlands and Forests)	Enter the number of trees over 60 cms diameter (or 190cms circumference) at breast height in 0.25ha (50mx50m) x4 (ie # per ha)	*No large trees*	0	2
		Woodlands: up to 7/ha *Forests:* up to 12/ha	1	
		Woodlands: more than 7/ha *Forests:* more than 12/ha	2	
CANOPY COVER (only apply to sites with large trees)	Enter the canopy cover of large trees: 50+% in Rainforests 10-20% in Woodlands 20-50% in Wet Forests 50% in Scrubs 20% in Shrublands	Less than 25% of benchmark	0	0.5
		25-50% of benchmark	0.5	
		More than 50% of benchmark	1	
UNDERSTOREY	Cover of native species: 90-100% in Woodlands, Forests and Grasslands Number of native species: 25-35 species in *Woodlands, Forests, Shrublands, Grasslands.*	*Cover minimal* Less than 10%	0	4
		Cover low 10-25%	1	
		Cover reduced *Low species number* 25%-75% Less than 12	2	
		Cover reduced *High species number* 25% - 75% More than 12	4	
		Cover intact *High species number* More than 75% More than 12	5	
WEEDINESS	Enter the % weed cover on the site	More than 50% weed cover	0	1
		25 – 50% weed cover	1	
		5 – 25% weed cover	2	
		Less than 5% weed cover	3	
RECRUITMENT (only apply to non-flowering growth less than 4 years old)	*Woodlands, Forests, Shrublands, Scrubs and Heathlands:* % of woody species Grasslands: Diversity of herbs within inter-tussock spaces	Less than 25% of woody species present *Grasslands:* **few or absent** small herbs	0	0
		25-75% of woody species present *Grasslands:* **some** small herbs	1	
		More than 75% of woody species of present *Grasslands:* **diverse** number of small herbs	2	
ORGANIC LITTER	Enter the % cover of organic litter on the site	**Less than:** 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	0	0
		More than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	1	
LOGS (only apply to Woodlands and Forests)	Length of fallen trees/ branches >10cm dia.	**Less than:** 50m/ha in *Woodlands* 75 m/ha in *Forests*	0	1
		More than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	1	
SIZE		Less than 2 ha	0	2
		2 – 10 ha	1	
		More than 10 ha	2	
NEIGHBOURHOOD	% area covered by native vegetation within 1 km radius	Less than 10% cover	0	1
		10 – 50% cover	1	
		More than 50% cover	2	
Distance to nearest CORE AREA	Core area is a block of native vegetation greater than 50 ha	1 km from native vegetation block bigger than 50 ha	0	0
		Less than 1 km from a native vegetation block bigger than 50 ha	1	
		4A Measurement of Habitat Quality (total)		11.5

SITE RECORD SHEET

Work Sheet 1

Refer Map.

Photos 6024
6025
6026
6027

Sketch map of paddock (not to scale). Show and number all native vegetation sites' to be assessed. (Note: a separate site record sheet is to be prepared for each numbered site).

Property Name: Old Swamp (WMW channel)

Paddock Name or Number: n/a

Vegetation Site Number (as per sketch map): M5

Assessor: JS + Hdc

Date: 28 June 2024.

Work Sheet 2

EVC GROUP Refer to Victorian Resources Online www.dse.vic.gov.au: Woodland

Work Sheet 3

GENERALISED CONSERVATION STATUS
Refer to EVC Group table. The Generalised Conservation Status is listed for each of the 21 EVC Groups

Endangered
Vulnerable
Rare
Depleted
Least concern

n/a

Work Sheet 4

MEASUREMENT OF HABITAT QUALITY (total) as determined on reverse: 13

Work Sheet 5

GENERALISED CONSERVATION SIGNIFICANCE

GENERALISED CONSERVATION STATUS (5B)	EVC GROUP TYPE (5A): Forests, woodlands or mallee	Grasslands or wetlands	Scrub, shrublands or heathlands	MEASUREMENT OF HABITAT QUALITY (5C)	GENERALISED CONSERVATION SIGNIFICANCE (5D)
Endangered	8 +	6 +	7 +		Very high
	< 8	< 6	< 7		High
Vulnerable	10 +	8 +	8.5 +		Very high
	6 – 10	5 – 8	5 – 8.5		High
	< 6	< 5	< 5		Medium
Rare	12 +	9.5 +	10 +		Very high
	6 – 12	5 – 9.5	5 – 10		High
	< 6	< 5	< 5		Medium
Depleted	12 +	9.5 +	10 +		High
	6 – 12	5 – 9.5	5 – 10		Medium
	< 6	< 5	< 5		Low
Least concern	12 +	9.5 +	10 +		Medium
	< 12	< 9.5	< 10		Low

Work Sheet 6

PERFORMANCE STANDARDS

Current extent on farm: n/a

Future quality & quantity on farm: n/a

Work Sheet 7

TARGET AND MANAGEMENT ACTIONS: n/a

	Benchmark/ observations	Quality Measurement		Measurement
LARGE TREES (only apply to Woodlands and Forests)	Enter the number of trees over 60 cms diameter (or 190cms circumference) at breast height in 0.25ha (50mx50m) x4 (ie # per ha)	*No large trees*	0	2
		Woodlands: up to 7/ha *Forests:* up to 12/ha	1	
		Woodlands: more than 7/ha *Forests:* more than 12/ha	2	
CANOPY COVER (only apply to sites with large trees)	Enter the canopy cover of large trees 50+% in Rainforests 10-20% in Woodlands 20-50% in Dry Forests 50% in Wet Forests 50% in Scrubs 20% in Shrublands	Less than 25% of benchmark	0	1
		25-50% of benchmark	0.5	
		More than 50% of benchmark	1	
UNDERSTOREY	Cover of native species: 90-100% in Woodlands, Forests and Grasslands Number of native species: 25-35 species in *Woodlands, Forests, Shrublands, Grasslands.*	***Cover minimal*** Less than 10%	0	4
		Cover low 10-25%	1	
		Cover reduced 25%-75% ***Low species number*** Less than 12	2	
		Cover reduced 25% - 75% ***High species number*** More than 12	4	
		Cover intact More than 75% ***High species number*** More than 12	8	
WEEDINESS	Enter the % weed cover on the site	More than 50% weed cover	0	1
		25 – 50% weed cover	1	
		5 – 25% weed cover	2	
		Less than 5% weed cover	3	
RECRUITMENT (only apply to non-flowering growth less than 4 years old)	*Woodlands, Forests, Shrublands, Scrubs and Heathlands:* % of woody species *Grasslands:* Diversity of herbs within inter-tussock spaces	Less than 25% of woody species present *Grasslands:* few or absent small herbs	0	1
		25-75% of woody species present *Grasslands:* some small herbs	1	
		More than 75% of woody species of present *Grasslands:* diverse number of small herbs	2	
ORGANIC LITTER	Enter the % cover of organic litter on the site	**Less than:** 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	0	0
		More than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	1	
LOGS (only apply to Woodlands and Forests)	Length of fallen trees/ branches >10cm dia.	**Less than:** 50m/ha in *Woodlands* 75 m/ha in *Forests*	0	1
		More than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	1	
SIZE		Less than 2 ha	0	2
		2 – 10 ha	1	
		More than 10 ha	2	
NEIGHBOURHOOD	% area covered by native vegetation within 1 km radius	Less than 10% cover	0	1
		10 – 50% cover	1	
		More than 50% cover	2	
Distance to nearest CORE AREA	Core area is a block of native vegetation greater than 50 ha	1 km from native vegetation block bigger than 50 ha	0	0
		Less than 1 km from a native vegetation block bigger than 50 ha	1	
	4A	**Measurement of Habitat Quality (total)**		13

SITE RECORD SHEET

Work Sheet 1

Refer Map.

Sketch map of paddock (not to scale). Show and number all native 'vegetation sites' to be assessed. (Note: a separate site record sheet is to be prepared for each numbered site).

Property Name: Boggy Corner

Paddock Name or Number: n/a

Vegetation Site Number (as per sketch map): M6

Assessor: JS + HdC

Date: 28 Jul 2004

Work Sheet 2

EVC GROUP Refer to Victorian Resources Online www.dse.vic.gov.au: Woodland

Work Sheet 3

GENERALISED CONSERVATION STATUS
Refer to EVC Group table. The Generalised Conservation Status is listed for each of the 21 EVC Groups

Endangered
Vulnerable
Rare
Depleted
Least concern

n/a

Work Sheet 4

MEASUREMENT OF HABITAT QUALITY (total) as determined on reverse: 13

Work Sheet 5

GENERALISED CONSERVATION SIGNIFICANCE

5B GENERALISED CONSERVATION STATUS	5A EVC GROUP TYPE: Forests, woodlands or mallee	Grasslands or wetlands	Scrub, shrublands or heathlands	5C MEASUREMENT OF HABITAT QUALITY	5D
Endangered	8 +	6 +	7 +	Very high	
	< 8	< 6	< 7	High	
Vulnerable	10 +	8 +	8.5 +	Very high	
	6 – 10	5 – 8	5 – 8.5	High	
	< 6	< 5	< 5	Medium	
Rare	12 +	9.5 +	10 +	Very high	
	6 – 12	5 – 9.5	5 – 10	High	
	< 6	< 5	< 5	Medium	
Depleted	12 +	9.5 +	10 +	High	
	6 - 12	5 – 9.5	5 – 10	Medium	
	< 6	< 5	< 5	Low	
Least concern	12 +	9.5 +	10 +	Medium	
	< 12	< 9.5	< 10	Low	

Work Sheet 6

PERFORMANCE STANDARDS

Current extent on farm: n/a

Future quality & quantity on farm: n/a

Work Sheet 7

TARGET AND MANAGEMENT ACTIONS: n/a

	Benchmark/ observations	Quality Measurement		Measurement
LARGE TREES (only apply to Woodlands and Forests)	Enter the number of trees over 60 cms diameter (or 190cms circumference) at breast height in 0.25ha (50mx50m) x4 (ie # per ha)	*No large trees*	0	1
		Woodlands: up to 7/ha *Forests:* up to 12/ha	1	
		Woodlands: more than 7/ha *Forests:* more than 12/ha	2	
CANOPY COVER (only apply to sites with large trees)	Enter the canopy cover of large trees 50+% in Rainforests 10-20% in Woodlands 20-50% in Dry Forests 50% in Wet Forests 50% in Scrubs 20% in Shrublands	Less than 25% of benchmark	0	0
		25-50% of benchmark	0.5	
		More than 50% of benchmark	1	
UNDERSTOREY	**Cover** of native species: 90-100% in Woodlands, Forests and Grasslands **Number** of native species: 25-35 species in *Woodlands, Forests, Shrublands, Grasslands*	***Cover minimal*** Less than 10%	0	4
		Cover low 10-25%	2	
		Cover reduced ***Low species number*** 25%-75% Less than 12	3	
		Cover reduced ***High species number*** 25% - 75% More than 12	4	
		Cover intact ***High species number*** More than 75% More than 12	5	
WEEDINESS	Enter the % weed cover on the site	More than 50% weed cover	0	2
		25 – 50% weed cover	1	
		5 – 25% weed cover	2	
		Less than 5% weed cover	3	
RECRUITMENT (only apply to non-flowering growth less than 4 years old)	*Woodlands, Forests, Shrublands, Scrubs and Heathlands:* % of woody species *Grasslands:* Diversity of herbs within inter-tussock spaces	Less than 25% of woody species present *Grasslands:* **few or absent** small herbs	0	2
		25-75% of woody species present *Grasslands:* **some** small herbs	1	
		More than 75% of woody species of present *Grasslands:* **diverse** number of small herbs	2	
ORGANIC LITTER	Enter the % cover of organic litter on the site	**Less than:** 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	0	1
		More than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	1	
LOGS (only apply to Woodlands and Forests)	Length of fallen trees/ branches >10cm dia.	**Less than:** 50m/ha in *Woodlands* 75 m/ha in *Forests*	0	1
		More than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	1	
SIZE		Less than 2 ha	0	2
		2 – 10 ha	1	
		More than 10 ha	2	
NEIGHBOURHOOD	% area covered by native vegetation within 1 km radius	Less than 10% cover	0	0
		10 – 50% cover	1	
		More than 50% cover	2	
Distance to nearest **CORE AREA**	Core area is a block of native vegetation greater than 50 ha	1 km from native vegetation block bigger than 50 ha	0	0
		Less than 1 km from a native vegetation block bigger than 50 ha	1	
		4A Measurement of Habitat Quality (total)		13

SITE RECORD SHEET

Work Sheet 1

Refer Map

Sketch map of paddock (not to scale). Show and number all native vegetation sites' to be assessed. (Note: a separate site record sheet is to be prepared for each numbered site).

Property Name

–

Paddock Name or Number

n/a

Vegetation Site Number (as per sketch map)

M7

Assessor

JS + NM

Date

20 Jul 2004

Work Sheet 2

EVC GROUP Refer to Victorian Resources Online www.dse.vic.gov.au

Woodland

Work Sheet 3

GENERALISED CONSERVATION STATUS
Refer to EVC Group table. The Generalised Conservation Status is listed for each of the 21 EVC Groups

Endangered
Vulnerable
Rare
Depleted
Least concern

n/a

Work Sheet 4

MEASUREMENT OF HABITAT QUALITY (total)
as determined on reverse

16

Work Sheet 5

GENERALISED CONSERVATION SIGNIFICANCE

5B GENERALISED CONSERVATION STATUS	5A EVC GROUP TYPE: Forests, woodlands or mallee	Grasslands or wetlands	Scrub, shrublands or heathlands	5C MEASUREMENT OF HABITAT QUALITY	5D
Endangered	8 +	6 +	7 +	Very high	
	< 8	< 6	< 7	High	
Vulnerable	10 +	8 +	8.5 +	Very high	
	6 – 10	5 – 8	5 – 8.5	High	
	< 6	< 5	< 5	Medium	
Rare	12 +	9.5 +	10 +	Very high	
	6 – 12	5 – 9.5	5 - 10	High	
	< 6	< 5	< 5	Medium	
Depleted	12 +	9.5 +	10 +	High	
	6 - 12	5 – 9.5	5 - 10	Medium	
	< 6	< 5	< 5	Low	
Least concern	12 +	9.5 +	10 +	Medium	
	< 12	< 9.5	< 10	Low	

Work Sheet 6

PERFORMANCE STANDARDS

Current extent on farm: n/a

Future quality & quantity on farm: n/a

Work Sheet 7

TARGET AND MANAGEMENT ACTIONS

n/a

	Benchmark/ observations	Quality Measurement		Measurement
LARGE TREES (only apply to Woodlands and Forests)	Enter the number of trees over 60 cms diameter (or 190cms circumference) at breast height in 0.25ha (50mx50m) [ ] x4 (ie # per ha)	*No large trees*	0	2
		Woodlands: up to 7/ha *Forests:* up to 12/ha	1	
		Woodlands: more than 7/ha *Forests:* more than 12/ha	2	
CANOPY COVER (only apply to sites with large trees)	Enter the canopy cover of large trees 50+% in Rainforests 10-20% in Woodlands 20-60% in Dry Forests 50% in Scrubs 20% in Shrublands	Less than 25% of benchmark	0	1
		25-50% of benchmark	0.5	
		More than 50% of benchmark	1	
UNDERSTOREY	Cover of native species. 90-100% in Woodlands, Forests and Grasslands Number of native species: 25-35 species in *Woodlands, Forests, Shrublands, Grasslands*	*Cover minimal* Less than 10%	0	5
		Cover low 10-25%	2	
		Cover reduced 25%-75% *Low species number* Less than 12	3	
		Cover reduced 25% - 75% *High species number* More than 12	4	
		Cover intact More than 75% *High species number* More than 12	5	
WEEDINESS	Enter the % weed cover on the site [ ]	More than 50% weed cover	0	2
		25 – 50% weed cover	1	
		5 – 25% weed cover	2	
		Less than 5% weed cover	3	
RECRUITMENT (only apply to non-flowering growth less than 4 years old)	*Woodlands, Forests, Shrublands, Scrubs and Heathlands:* % of woody species *Grasslands:* Diversity of herbs within inter-tussock spaces	Less than 25% of woody species present *Grasslands:* **few or absent** small herbs	0	1
		25-75% of woody species present *Grasslands:* **some** small herbs	1	
		More than 75% of woody species of present *Grasslands:* **diverse** number of small herbs	2	
ORGANIC LITTER	Enter the % cover of organic litter on the site [ ]	**Less than:** 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	0	1
		More than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	1	
LOGS (only apply to Woodlands and Forests)	Length of fallen trees/ branches >10cm dia.	**Less than:** 50m/ha in *Woodlands* 75 m/ha in *Forests*	0	1
		More than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	1	
SIZE		Less than 2 ha	0	2
		2 – 10 ha	1	
		More than 10 ha	2	
NEIGHBOURHOOD	% area covered by native vegetation within 1 km radius	Less than 10% cover	0	1
		10 – 50% cover	1	
		More than 50% cover	2	
Distance to nearest CORE AREA	Core area is a block of native vegetation greater than 50 ha	1 km from native vegetation block bigger than 50 ha	0	0
		Less than 1 km from a native vegetation block bigger than 50 ha	1	
		4A **Measurement of Habitat Quality (total)**		16

SITE RECORD SHEET

Work Sheet 1

Refer Map.

Sketch map of paddock (not to scale). Show and number all native vegetation sites to be assessed. (Note: a separate site record sheet is to be prepared for each numbered site).

Property Name

–

Paddock Name or Number

n/a

Vegetation Site Number (as per sketch map)

MS

Assessor

JS + NM

Date 20 Jul 2004

Work Sheet 2 EVC GROUP Refer to Victorian Resources Online www.dse.vic.gov.au: Woodland

Work Sheet 3 GENERALISED CONSERVATION STATUS
Refer to EVC Group table. The Generalised Conservation Status is listed for each of the 21 EVC Groups
Endangered
Vulnerable
Rare
Depleted
Least concern: n/a

Work Sheet 4 MEASUREMENT OF HABITAT QUALITY (total) as determined on reverse: 15

Work Sheet 5 GENERALISED CONSERVATION SIGNIFICANCE

5B GENERALISED CONSERVATION STATUS	5A EVC GROUP TYPE: Forests, woodlands or mallee	Grasslands or wetlands	Scrub, shrublands or heathlands	5C MEASUREMENT OF HABITAT QUALITY	5D
Endangered	8 +	6 +	7 +	Very high	
	< 8	< 6	< 7	High	
Vulnerable	10 +	8 +	8.5 +	Very high	
	6 – 10	5 – 8	5 – 8.5	High	
	< 6	< 5	< 5	Medium	
Rare	12 +	9.5 +	10 +	Very high	
	6 – 12	5 – 9.5	5 – 10	High	
	< 6	< 5	< 5	Medium	
Depleted	12 +	9.5 +	10 +	High	
	6 – 12	5 – 9.5	5 – 10	Medium	
	< 6	< 5	< 5	Low	
Least concern	12 +	9.5 +	10 +	Medium	
	< 12	< 9.5	< 10	Low	

Work Sheet 6 PERFORMANCE STANDARDS

Current extent on farm: n/a

Future quality & quantity on farm: n/a

Work Sheet 7 TARGET AND MANAGEMENT ACTIONS: n/a

	Benchmark/ observations	Quality Measurement		Measurement
LARGE TREES (only apply to Woodlands and Forests)	Enter the number of trees over 60 cms diameter (or 190cms circumference) at breast height in 0.25ha (50mx50m) x4 (ie # per ha)	*No large trees*	0	2
		Woodlands: up to 7/ha *Forests:* up to 12/ha	1	
		Woodlands: more than 7/ha *Forests:* more than 12/ha	2	
CANOPY COVER (only apply to sites with large trees)	Enter the canopy cover of large trees 50+% in Rainforests 10-20% in Woodlands 20-50% in Dry Forests 50% in Wet Forests 50% in Scrubs 20% in Shrublands	Less than 25% of benchmark	0	1
		25-50% of benchmark	0.5	
		More than 50% of benchmark	1	
UNDERSTOREY	Cover of native species: 90-100% in Woodlands, Forests and Grasslands Number of native species: 25-35 species in *Woodlands, Forests, Shrublands, Grasslands*	*Cover minimal* Less than 10%	0	5
		Cover low 10-25%	1	
		Cover reduced 25%-75% *Low species number* Less than 12	2	
		Cover reduced 25% - 75% *High species number* More than 12	4	
		Cover intact More than 75% *High species number* More than 12	5	
WEEDINESS	Enter the % weed cover on the site	More than 50% weed cover	0	1
		25 – 50% weed cover	1	
		5 – 25% weed cover	2	
		Less than 5% weed cover	3	
RECRUITMENT (only apply to non-flowering growth less than 4 years old)	*Woodlands, Forests, Shrublands, Scrubs and Heathlands:* % of woody species *Grasslands:* Diversity of herbs within inter-tussock spaces	Less than 25% of woody species present *Grasslands:* few or absent small herbs	0	1
		25-75% of woody species present *Grasslands:* some small herbs	1	
		More than 75% of woody species of present *Grasslands:* diverse number of small herbs	2	
ORGANIC LITTER	Enter the % cover of organic litter on the site	Less than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	0	1
		More than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	1	
LOGS (only apply to Woodlands and Forests)	Length of fallen trees/ branches >10cm dia.	Less than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	0	1
		More than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	1	
SIZE		Less than 2 ha	0	2
		2 – 10 ha	1	
		More than 10 ha	2	
NEIGHBOURHOOD	% area covered by native vegetation within 1 km radius	Less than 10% cover	0	1
		10 – 50% cover	1	
		More than 50% cover	2	
Distance to nearest CORE AREA	Core area is a block of native vegetation greater than 50 ha	1 km from native vegetation block bigger than 50 ha	0	0
		Less than 1 km from a native vegetation block bigger than 50 ha	1	
		4A Measurement of Habitat Quality (total)		15

SITE RECORD SHEET

Work Sheet 1

Refer Map.

Photos 6015
6016
6017
6018
6019

Sketch map of paddock (not to scale). Show and number all native 'vegetation sites' to be assessed. (*Note:* a separate site record sheet is to be prepared for each numbered site).

Property Name

-

Paddock Name or Number

n/a

Vegetation Site Number (as per sketch map)

M9

Assessor

JS + HdC

Date 28 Jul 2004

Work Sheet 2

EVC GROUP Refer to Victorian Resources Online www.dse.vic.gov.au — Woodland

Work Sheet 3

GENERALISED CONSERVATION STATUS
Refer to EVC Group table. The Generalised Conservation Status is listed for each of the 21 EVC Groups

Endangered
Vulnerable
Rare
Depleted
Least concern

n/a

Work Sheet 4

MEASUREMENT OF HABITAT QUALITY (total)
as determined on reverse

Work Sheet 5

GENERALISED CONSERVATION SIGNIFICANCE

5B GENERALISED CONSERVATION STATUS	5A EVC GROUP TYPE: Forests, woodlands or mallee	Grasslands or wetlands	Scrub, shrublands or heathlands	5C MEASUREMENT OF HABITAT QUALITY	5D
Endangered	8 +	6 +	7 +	Very high	
	< 8	< 6	< 7	High	
Vulnerable	10 +	8 +	8.5 +	Very high	
	6 – 10	5 – 8	5 – 8.5	High	
	< 6	< 5	< 5	Medium	
Rare	12 +	9.5 +	10 +	Very high	
	6 – 12	5 – 9.5	5 – 10	High	
	< 6	< 5	< 5	Medium	
Depleted	12 +	9.5 +	10 +	High	
	6 - 12	5 – 9.5	5 - 10	Medium	
	< 6	< 5	< 5	Low	
Least concern	12 +	9.5 +	10 +	Medium	
	< 12	< 9.5	< 10	Low	

Work Sheet 6

PERFORMANCE STANDARDS

Current extent on farm: n/a

Future quality & quantity on farm: n/a

Work Sheet 7

TARGET AND MANAGEMENT ACTIONS

n/a

	Benchmark/ observations	Quality Measurement		Measurement
LARGE TREES (only apply to Woodlands and Forests)	Enter the number of trees over 60 cms diameter (or 190cms circumference) at breast height in 0.25ha (50mx50m) x4 (ie # per ha)	*No large trees*	0	1
		Woodlands: up to 7/ha *Forests:* up to 12/ha	1	
		Woodlands: more than 7/ha *Forests:* more than 12/ha	2	
CANOPY COVER (only apply to sites with large trees)	Enter the canopy cover of large trees 50+% in Rainforests 10-20% in Woodlands 20-50% in Dry Forests 50% in Wet Forests 50% in Scrubs 20% in Shrublands	Less than 25% of benchmark	0	0
		25-50% of benchmark	0.5	
		More than 50% of benchmark	1	
UNDERSTOREY	Cover of native species: 90-100% in Woodlands, Forests and Grasslands Number of native species: 25-35 species in *Woodlands, Forests, Shrublands, Grasslands*	***Cover minimal*** Less than 10%	0	3
		Cover low 10-25%	1	
		Cover reduced ***Low species number*** 25%-75% Less than 12	2	
		Cover reduced ***High species number*** 25% - 75% More than 12	4	
		Cover intact ***High species number*** More than 75% More than 12	5	
WEEDINESS	Enter the % weed cover on the site	More than 50% weed cover	0	0
		25 – 50% weed cover	1	
		5 – 25% weed cover	2	
		Less than 5% weed cover	3	
RECRUITMENT (only apply to non-flowering growth less than 4 years old)	*Woodlands, Forests, Shrublands, Scrubs and Heathlands:* % of woody species *Grasslands:* Diversity of herbs within inter-tussock spaces	Less than 25% of woody species present *Grasslands:* **few or absent** small herbs	0	2
		25-75% of woody species present *Grasslands:* **some** small herbs	1	
		More than 75% of woody species of present *Grasslands:* **diverse** number of small herbs	2	
ORGANIC LITTER	Enter the % cover of organic litter on the site	**Less than:** 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	0	0
		More than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	1	
LOGS (only apply to Woodlands and Forests)	Length of fallen trees/ branches >10cm dia.	**Less than:** 50m/ha in *Woodlands* 75 m/ha in *Forests*	0	1
		More than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	1	
SIZE		Less than 2 ha	0	2
		2 – 10 ha	1	
		More than 10 ha	2	
NEIGHBOURHOOD	% area **covered** by native vegetation within 1 km radius	Less than 10% cover	0	1
		10 – 50% cover	1	
		More than 50% cover	2	
Distance to nearest **CORE AREA**	Core area is a block of native vegetation greater than 50 ha	1 km from native vegetation block bigger than 50 ha	0	0
		Less than 1 km from a native vegetation block bigger than 50 ha	1	
		4A Measurement of Habitat Quality (total)		10

SITE RECORD SHEET

Work Sheet 1

Refer Map.

Photos 6011
6012
6013
6014

Sketch map of paddock (not to scale). Show and number all native vegetation sites' to be assessed. (Note: a separate site record sheet is to be prepared for each numbered site).

Property Name Quarry / Bushland Reserve

Paddock Name or Number n/a

Vegetation Site Number (as per sketch map) M 10

Assessor JS + HdC

Date 27 Jul 2004

Work Sheet 2

EVC GROUP Refer to Victorian Resources Online www.dse.vic.gov.au — Woodland

Work Sheet 3

GENERALISED CONSERVATION STATUS
Refer to EVC Group table. The Generalised Conservation Status is listed for each of the 21 EVC Groups

Endangered
Vulnerable
Rare
Depleted
Least concern

n/a

Work Sheet 4

MEASUREMENT OF HABITAT QUALITY (total) as determined on reverse — 16

Work Sheet 5

GENERALISED CONSERVATION SIGNIFICANCE

5A EVC GROUP TYPE

5B GENERALISED CONSERVATION STATUS	Forests, woodlands or mallee	Grasslands or wetlands	Scrub, scrublands or heathlands	5C MEASUREMENT OF HABITAT QUALITY	5D
Endangered	8 +	8 +	7 +	Very high	
	< 8	< 8	< 7	High	
Vulnerable	10 +	8 +	8.5 +	Very high	
	6 – 10	5 – 8	5 – 8.5	High	
	< 6	< 5	< 5	Medium	
Rare	12 +	9.5 +	10 +	Very high	
	6 – 12	5 – 9.5	5 – 10	High	
	< 6	< 5	< 5	Medium	
Depleted	12 +	9.5 +	10 +	High	
	6 – 12	5 – 9.5	5 – 10	Medium	
	< 6	< 5	< 5	Low	
Least concern	12 +	9.5 +	10 +	Medium	
	< 12	< 9.5	< 10	Low	

Work Sheet 6

PERFORMANCE STANDARDS

Current extent on farm: n/a

Future quality & quantity on farm: n/a

Work Sheet 7

TARGET AND MANAGEMENT ACTIONS

n/a

	Benchmark/ observations	Quality Measurement		Measurement
LARGE TREES (only apply to Woodlands and Forests)	Enter the number of trees over 60 cms diameter (or 190cms circumference) at breast height in 0.25ha (50mx50m) x4 (ie # per ha)	*No large trees*	0	2
		Woodlands: up to 7/ha *Forests:* up to 12/ha	1	
		Woodlands: more than 7/ha *Forests:* more than 12/ha	2	
CANOPY COVER (only apply to sites with large trees)	Enter the canopy cover of large trees 50+% in Rainforests 10-20% in Woodlands 20-50% in Wet Forests 50% in Scrubs 20% in Shrublands	Less than 25% of benchmark	0	1
		25-50% of benchmark	0.5	
		More than 50% of benchmark	1	
UNDERSTOREY	Cover of native species: 90-100% in Woodlands, Forests and Grasslands Number of native species: 25-35 species in *Woodlands, Forests, Shrublands, Grasslands.*	*Cover minimal* Less than 10%	0	5
		Cover low 10-25%	2	
		Cover reduced *Low species number* 25%-75% Less than 12	3	
		Cover reduced *High species number* 25% - 75% More than 12	4	
		Cover intact *High species number* More than 75% More than 12	5	
WEEDINESS	Enter the % weed cover on the site	More than 50% weed cover	0	2
		25 – 50% weed cover	1	
		5 – 25% weed cover	2	
		Less than 5% weed cover	3	
RECRUITMENT (only apply to non-flowering growth less than 4 years old)	*Woodlands, Forests, Shrublands:* Scrubs and *Heathlands:* % of woody species Grasslands: Diversity of herbs within inter-tussock spaces	Less than 25% of woody species present *Grasslands:* few or absent small herbs	0	2
		25-75% of woody species present *Grasslands:* some small herbs	1	
		More than 75% of woody species of present *Grasslands:* diverse number of small herbs	2	
ORGANIC LITTER	Enter the % cover of organic litter on the site	Less than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	0	1
		More than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	1	
LOGS (only apply to Woodlands and Forests)	Length of fallen trees/ branches >10cm dia	Less than: 50m/ha in Woodlands 75 m/ha in *Forests*	0	1
		More than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	1	
SIZE		Less than 2 ha	0	2
		2 – 10 ha	1	
		More than 10 ha	2	
NEIGHBOURHOOD	% area covered by native vegetation within 1 km radius	Less than 10% cover	0	0
		10 – 50% cover	1	
		More than 50% cover	2	
Distance to nearest CORE AREA	Core area is a block of native vegetation greater then 50 ha	1 km from native vegetation block bigger than 50 ha	0	0
		Less than 1 km from a native vegetation block bigger than 50 ha	1	
		4A Measurement of Habitat Quality (total)		16

SITE RECORD SHEET

Work Sheet 1

Refer Map.

Photos 6007
6008
6009
6010

Sketch map of paddock (not to scale). Show and number all native vegetation sites to be assessed. (Note: a separate site record sheet is to be prepared for each numbered site).

Property Name: Mouth of Mackenzie River

Paddock Name or Number: –

Vegetation Site Number (as per sketch map): M 11

Assessor: JS + HdC

Date: 28 Jul 2004

Work Sheet 2

EVC GROUP Refer to Victorian Resources Online www.dse.vic.gov.au: Woodland

Work Sheet 3

GENERALISED CONSERVATION STATUS
Refer to EVC Group table. The Generalised Conservation Status is listed for each of the 21 EVC Groups

Endangered
Vulnerable
Rare
Depleted
Least concern

n/a

Work Sheet 4

MEASUREMENT OF HABITAT QUALITY (total) as determined on reverse: 14

Work Sheet 5

GENERALISED CONSERVATION SIGNIFICANCE

GENERALISED CONSERVATION STATUS (5B)	EVC GROUP TYPE (5A): Forests, woodlands or mallee	Grasslands or wetlands	Scrub, scrublands or heathlands	MEASUREMENT OF HABITAT QUALITY (5C)	(5D)
Endangered	8 +	6 +	7 +	Very high	
	< 8	< 6	< 7	High	
Vulnerable	10 +	8 +	8.5 +	Very high	
	6 – 10	5 – 8	5 – 8.5	High	
	< 6	< 5	< 5	Medium	
Rare	12 +	9.5 +	10 +	Very high	
	6 – 12	5 – 9.5	5 – 10	High	
	< 6	< 5	< 5	Medium	
Depleted	12 +	9.5 +	10 +	High	
	6 - 12	5 – 9.5	5 – 10	Medium	
	< 6	< 5	< 5	Low	
Least concern	12 +	9.5 +	10 +	Medium	
	< 12	< 9.5	< 10	Low	

Work Sheet 6

PERFORMANCE STANDARDS

Current extent on farm: n/a

Future quality & quantity on farm: n/a

Work Sheet 7

TARGET AND MANAGEMENT ACTIONS: n/a

	Benchmark/ observations	Quality Measurement		Measurement
LARGE TREES (only apply to Woodlands and Forests)	Enter the number of trees over 60 cms diameter (or 190cms circumference) at breast height in 0.25ha (50mx50m) x4 (ie # per ha)	*No large trees*	0	2
		Woodlands: up to 7/ha *Forests:* up to 12/ha	1	
		Woodlands: more than 7/ha *Forests:* more than 12/ha	2	
CANOPY COVER (only apply to sites with large trees)	Enter the canopy cover of large trees 50+% in Rainforests 10-20% in Woodlands 20-50% in Dry Forests 50% in Wet Forests 50% in Scrubs 20% in Shrublands	Less than 25% of benchmark	0	1
		25-50% of benchmark	0.5	
		More than 50% of benchmark	1	
UNDERSTOREY	Cover of native species: 90-100% in Woodlands, Forests and Grasslands Number of native species: 25-35 species in *Woodlands, Forests, Shrublands, Grasslands*	*Cover minimal* Less than 10%	0	4
		Cover low 10-25%	2	
		Cover reduced 25%-75% *Low species number* Less than 12	3	
		Cover reduced 25% - 75% *High species number* More than 12	4	
		Cover intact More than 75% *High species number* More than 12	5	
WEEDINESS	Enter the % weed cover on the site	More than 50% weed cover	0	1
		25 – 50% weed cover	1	
		5 – 25% weed cover	2	
		Less than 5% weed cover	3	
RECRUITMENT (only apply to non-flowering growth less than 4 years old)	*Woodlands, Forests, Shrublands, Scrubs and Heathlands:* % of woody species *Grasslands:* Diversity of herbs within inter-tussock spaces	Less than 25% of woody species present *Grasslands:* few or absent small herbs	0	1
		25-75% of woody species present *Grasslands:* some small herbs	1	
		More than 75% of woody species of present *Grasslands:* diverse number of small herbs	2	
ORGANIC LITTER	Enter the % cover of organic litter on the site	Less than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	0	1
		More than: 30% cover in *Rainforests* 20% cover in *Forests* 10% cover in *Woodlands* and *Shrublands* 5% cover in *Grasslands*	1	
LOGS (only apply to Woodlands and Forests)	Length of fallen trees/ branches >10cm dia.	Less than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	0	1
		More than: 50m/ha in *Woodlands* 75 m/ha in *Forests*	1	
SIZE		Less than 2 ha	0	2
		2 – 10 ha	1	
		More than 10 ha	2	
NEIGHBOURHOOD	% area covered by native vegetation within 1 km radius	Less than 10% cover	0	1
		10 – 50% cover	1	
		More than 50% cover	2	
Distance to nearest CORE AREA	Core area is a block of native vegetation greater than 50 ha	1 km from native vegetation block bigger than 50 ha	0	0
		Less than 1 km from a native vegetation block bigger than 50 ha	1	
		4A Measurement of Habitat Quality (total)		14

Appendix C

Risk Assessment for the MacKenzie River

RISK WORKBOOK

MacKenzie River Reach 1

LEGEND	3		
Likelihood →	3	3 ←	Trajectory
Score/Result →	27	low ←	Risk Rating

		VALUES		Threats: Bank Erosion				Bed Instability				Water Quality				Altered Hydrology			
				3				1				1				5			
ENVIRONMENTAL		Geomorphic Diversity	5	2	3			1	1			1	1			4	3		
				90	low			5	low			5	low			300	HIGH		
		LWD Large Woody Debris	5	1	3			3	1			2	1			3	3		
				45	low			15	low			10	low			225	HIGH		
		Native Fish	4	3	3			3	1			3	2			4	5		
				108	medium			12	low			24	low			400	HIGH		
		Native Fauna	4	3	3			3	1			3	1			3	3		
				108	medium			12	low			12	low			180	medium		
		Significant Flora	5	3	3			2	3			3	2			2	3		
				135	medium			30	low			30	low			150	medium		
		Wetlands	0	3	1			3	1			3	2			4	3		
				0	NA			0	NA			0	NA			0	NA		
		Width of Native Veg	5	2	3			3	1			1	1			2	3		
				90	low			15	low			5	low			150	medium		
SOCIAL		Aesthetic Aust Native	5	1	1			2	3			2	1			1	1		
				15	low			30	low			10	low			25	low		
		Amenity	5	1	1			2	1			2	1			1	1		
				15	low			10	low			10	low			25	low		
		Fishing	4	1	1			1	1			3	1			3	1		
				12	low			4	low			12	low			60	low		
		Heritage	3	1	1			3	3			2	1			1	1		
				9	low			27	low			6	low			15	low		
		Passive Recreation	5	2	1			2	1			2	1			3	1		
				30	low			10	low			10	low			75	low		
		Sense of Place	5	3	1			2	1			2	1			1	1		
				45	low			10	low			10	low			25	low		
ECONOMIC		Access	5	1	3			2	3			1	1			2	1		
				45	low			30	low			5	low			50	low		
		Cultivation	0	3	1			2	1			2	1			2	1		
				0	NA			0	NA			0	NA			0	NA		
		Grazing	0	0	0			0	0			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Horticulture	0	0	0			0	0			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Intrastructure	1	3	3			3	3			3	1			3	1		
				27	low			9	low			3	low			15	low		
		Bank Protection	0	3	3			3	3			1	1			3	3		
				0	NA			0	NA			0	NA			0	NA		
		Rural Land Value	5	0	0			0	0			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Water Supply	5	1	1			3	3			4	1			1	1		
				15	low			5	low			20	low			25	low		

		VALUES		Threats: Loss of Terrestrial Veg				Loss of Instream Habitat				Stock Access				Cultivation			
				1				1				1				1			
ENVIRONMENTAL		Geomorphic Diversity	5	1	1			1	1			0	0			0	0		
				5	low			5	low			0	NA			0	NA		
		LWD Large Woody Debris	5	4	5			5	3			0	0			0	0		
				100	low			75	low			0	NA			0	NA		
		Native Fish	4	3	3			5	5			0	0			0	0		
				36	low			100	low			0	NA			0	NA		
		Native Fauna	4	3	3			3	3			0	0			0	0		
				36	low			36	low			0	NA			0	NA		
		Significant Flora	5	4	3			3	1			0	0			0	0		
				60	low			15	low			0	NA			0	NA		
		Wetlands	0	4	3			4	3			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Width of Native Veg	5	4	3			4	1			0	0			0	0		
				60	low			20	low			0	NA			0	NA		
SOCIAL		Aesthetic Aust Native	5	4	5			3	1			0	0			0	0		
				100	low			15	low			0	NA			0	NA		
		Amenity	5	4	3			3	3			0	0			0	0		
				60	low			45	low			0	NA			0	NA		
		Fishing	4	3	3			5	3			0	0			0	0		
				36	low			60	low			0	NA			0	NA		
		Heritage	3	3	3			2	1			0	0			0	0		
				27	low			6	low			0	NA			0	NA		
		Passive Recreation	5	3	3			2	1			0	0			0	0		
				45	low			10	low			0	NA			0	NA		
		Sense of Place	5	4	3			3	1			0	0			0	0		
				60	low			15	low			0	NA			0	NA		
ECONOMIC		Access	5	2	1			2	1			3	3			3	1		
				10	low			10	low			45	low			15	low		
		Cultivation	0	2	1			3	1			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Grazing	0	0	0			0	0			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Horticulture	0	0	0			0	0			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Intrastructure	1	3	3			3	3			0	0			0	0		
				3	low			9	low			0	NA			0	NA		
		Bank Protection	0	2	1			3	1			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Rural Land Value	5	0	0			0	0			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Water Supply	5	3	1			3	1			0	0			0	0		
				15	low			15	low			0	NA			0	NA		

		VALUES		Threats: Horticulture				Other Access				Exotic Vegetation				Exotic Fauna			
				1				2				3				2			
ENVIRONMENTAL		Geomorphic Diversity	5	0	0			3	1			2	3			0	0		
				0	NA			30	low			90	low			0	NA		
		LWD Large Woody Debris	5	0	0			2	1			1	1			0	0		
				0	NA			20	low			15	low			0	NA		
		Native Fish	4	0	0			2	1			1	1			3	2		
				0	NA			16	low			12	low			48	low		
		Native Fauna	4	0	0			3	1			2	1			1	1		
				0	NA			24	low			24	low			8	low		
		Significant Flora	5	0	0			3	3			2	3			3	3		
				0	NA			90	low			90	low			90	low		
		Wetlands	0	0	0			2	1			2	3			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Width of Native Veg	5	0	0			3	1			2	3			2	2		
				0	NA			30	low			90	low			40	low		
SOCIAL		Aesthetic Aust Native	5	0	0			3	1			2	2			2	2		
				0	NA			30	low			60	low			40	low		
		Amenity	5	0	0			3	3			2	2			1	1		
				0	NA			90	low			60	low			10	low		
		Fishing	4	0	0			3	1			2	2			1	1		
				0	NA			24	low			48	low			8	low		
		Heritage	3	0	0			3	3			2	2			1	1		
				0	NA			54	low			36	low			6	low		
		Passive Recreation	5	0	0			2	1			2	2			0	0		
				0	NA			20	low			60	low			0	NA		
		Sense of Place	5	0	0			2	1			2	2			2	1		
				0	NA			20	low			60	low			20	low		
ECONOMIC		Access	5	3	5			2	1			2	1			0	0		
				75	low			20	low			30	low			0	NA		
		Cultivation	0	0	0			2	1			3	1			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Grazing	0	0	0			0	0			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Horticulture	0	0	0			0	0			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Intrastructure	1	0	0			3	3			1	1			0	0		
				0	NA			18	low			3	low			0	NA		
		Bank Protection	0	0	0			2	1			3	3			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Rural Land Value	5	0	0			0	0			0	0			0	0		
				0	NA			0	NA			0	NA			0	NA		
		Water Supply	5	0	0			2	1			1	1			1	1		
				0	NA			20	low			15	low			10	low		

Values
5 Very Good
4 Good
3 Satisfactory
2 Poor
1 Very Poor

Threats
5 Very High
4 High
3 Moderate
2 Low
1 Very Low

Likelihood
5 almost certain
4 quite possible
3 unusual but possible
2 remotely possible
1 practically impossible

Trajectory	
5	*rapid*
3	*slow*
1	*stable*

Score	
Low	<80
Medium	< 200
High	< 400
Very High	> 400

RISK WORKBOOK

MacKenzie River Reach 2

LEGEND	3		
Likelihood →	3	3 ←	Trajectory
Score/Result →	27	low ←	Risk Rating

			Threats																							
			Bank Erosion		Bed Instability		Water Quality		Altered Hydrology		Loss of Terrestrial Veg		Loss of Instream Habitat		Stock Access		Cultivation		Horticulture		Other Access		Exotic Vegetation		Exotic Fauna	
	VALUES		1		1		1		5		1		1		1		1		1		2		3		2	
ENVIRONMENTAL	Geomorphic Diversity	5	1	1	1	1	1	1	4	3	1	1	1	1	5	5	0	0	0	0	3	1	2	3	0	0
			5	low	5	low	5	low	300	HIGH	5	low	5	low	125	medium	0	NA	0	NA	30	low	90	low	0	NA
	LWD Large Woody Debris	5	1	3	3	1	2	1	3	3	4	5	5	3	5	5	0	0	0	0	2	1	1	1	0	0
			15	low	15	low	10	low	225	HIGH	100	low	75	low	125	medium	0	NA	0	NA	20	low	15	low	0	NA
	Native Fish	4	3	3	3	1	3	2	4	5	3	3	5	5	5	5	0	0	0	0	2	1	1	1	3	2
			36	low	12	low	24	low	400	HIGH	36	low	100	low	100	low	0	NA	0	NA	16	low	12	low	48	low
	Native Fauna	4	3	3	3	1	3	1	3	3	3	3	3	3	4	5	0	0	0	0	3	1	2	1	1	1
			36	low	12	low	12	low	180	medium	36	low	36	low	80	low	0	NA	0	NA	24	low	24	low	8	low
	Significant Flora	5	3	3	2	3	3	2	3	3	4	3	3	1	5	5	0	0	0	0	3	3	2	3	3	3
			45	low	30	low	30	low	225	HIGH	60	low	15	low	125	medium	0	NA	0	NA	90	low	90	low	90	low
	Wetlands	0	3	1	3	1	3	2	4	3	4	3	4	3	0	0	0	0	0	0	2	1	2	3	0	0
			0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
	Width of Native Veg	5	2	3	3	1	1	1	2	3	4	3	4	1	5	5	0	0	0	0	3	1	2	3	2	2
			30	low	15	low	5	low	150	medium	60	low	20	low	125	medium	0	NA	0	NA	30	low	90	low	40	low
SOCIAL	Aesthetic Aust Native	5	3	3	2	3	2	1	1	1	4	5	3	1	5	5	0	0	0	0	3	1	2	2	2	2
			45	low	30	low	10	low	25	low	100	low	15	low	125	medium	0	NA	0	NA	30	low	60	low	40	low
	Amenity	5	3	1	2	1	2	1	1	1	4	3	3	3	5	5	0	0	0	0	3	3	2	2	1	1
			15	low	10	low	10	low	25	low	60	low	45	low	125	medium	0	NA	0	NA	90	low	60	low	10	low
	Fishing	4	1	1	1	1	4	3	3	1	3	3	5	3	5	5	0	0	0	0	3	1	2	2	1	1
			4	low	4	low	48	low	60	low	36	low	60	low	100	low	0	NA	0	NA	24	low	48	low	8	low
	Heritage	3	4	5	3	3	2	1	1	1	3	3	2	1	5	5	0	0	0	0	3	3	2	2	1	1
			60	low	27	low	6	low	15	low	27	low	6	low	75	low	0	NA	0	NA	54	low	36	low	6	low
	Passive Recreation	5	2	1	2	1	2	1	3	1	3	3	2	1	5	5	0	0	0	0	2	1	2	2	0	0
			10	low	10	low	10	low	75	low	45	low	10	low	125	medium	0	NA	0	NA	20	low	60	low	0	NA
	Sense of Place	5	3	1	2	1	2	1	1	1	4	3	3	1	0	0	0	0	0	0	2	1	2	2	2	1
			15	low	10	low	10	low	25	low	60	low	15	low	0	NA	0	NA	0	NA	20	low	60	low	20	low
ECONOMIC			3	3	2	3	1	1	2	1	2	1	2	1	3	3	3	1	3	5	2	1	2	3	0	0
	Access	5	45	low	30	low	5	low	50	low	10	low	10	low	45	low	15	low	75	low	20	low	90	low	0	NA
			3	1	2	1	2	1	2	1	2	1	3	1	0	0	0	0	0	0	2	1	3	1	0	0
	Cultivation	0	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Grazing	0	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Horticulture	0	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
			3	3	3	3	3	1	3	1	3	1	3	3	0	0	0	0	0	0	3	3	1	1	0	0
	Intrastructure	1	9	low	9	low	3	low	15	low	3	low	9	low	0	NA	0	NA	0	NA	18	low	3	low	0	NA
			3	3	3	3	1	1	3	3	2	1	3	1	5	5	0	0	0	0	2	1	3	3	0	0
	Bank Protection	0	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural Land Value	5	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
			1	1	1	1	4	1	1	1	3	1	3	1	0	0	0	0	0	0	2	1	1	1	1	1
	Water Supply	5	5	low	5	low	20	low	25	low	15	low	15	low	0	NA	0	NA	0	NA	20	low	15	low	10	low

Values
5 Very Good
4 Good
3 Satisfactory
2 Poor
1 Very Poor

Threats
5 Very High
4 High
3 Moderate
2 Low
1 Very Low

Likelihood
5 almost certain
4 quite possible
3 unusual but possible
2 remotely possible
1 practically impossible

Trajectory	
5	*rapid*
3	*slow*
1	*stable*

Score	
Low	<80
Medium	< 200
High	< 400
Very High	> 400

RISK WORKBOOK

MacKenzie River Reach 3

LEGEND	3		
Likelihood →	3	3 ←	Trajectory
Score/Result →	27	low ←	Risk Rating

	VALUES		Threats		Bank Erosion		Bed Instability		Water Quality		Altered Hydrology		Loss of Terrestrial Veg		Loss of Instream Habitat		Stock Access		Cultivation		Horticulture		Other Access		Exotic Vegetation		Exotic Fauna	
					1		1		1		5		1		1		1		1		1		2		3		2	
ENVIRONMENTAL	Geomorphic Diversity	5			1	1	1	1	1	1	4	5	1	1	1	1	5	5	0	0	0	0	3	1	2	3	0	0
					5	low	5	low	5	low	500	VERY HIGH	5	low	5	low	125	medium	0	NA	0	NA	30	low	90	low	0	NA
	LWD Large Woody Debris	5			1	3	3	1	2	1	3	3	4	5	5	3	5	5	0	0	0	0	2	1	1	1	0	0
					15	low	15	low	10	low	225	HIGH	100	low	75	low	125	medium	0	NA	0	NA	20	low	15	low	0	NA
	Native Fish	4			3	3	3	1	3	2	4	5	3	3	5	5	5	5	0	0	0	0	2	1	1	1	3	2
					36	low	12	low	24	low	400	HIGH	36	low	100	low	100	low	0	NA	0	NA	16	low	12	low	48	low
	Native Fauna	4			3	3	3	1	3	1	3	3	3	3	3	3	5	5	0	0	0	0	3	1	2	1	1	1
					36	low	12	low	12	low	180	medium	36	low	36	low	100	low	0	NA	0	NA	24	low	24	low	8	low
	Significant Flora	5			3	3	2	3	3	2	3	3	4	3	3	1	5	5	0	0	0	0	3	3	2	3	3	3
					45	low	30	low	30	low	225	HIGH	60	low	15	low	125	medium	0	NA	0	NA	90	low	90	low	90	low
	Wetlands	0			3	1	3	1	3	2	4	3	4	3	4	3	0	0	0	0	0	0	2	1	2	3	0	0
					0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
	Width of Native Veg	5			2	3	3	1	1	1	2	3	4	3	4	1	5	5	0	0	0	0	3	1	2	3	2	2
					30	low	15	low	5	low	150	medium	60	low	20	low	125	medium	0	NA	0	NA	30	low	90	low	40	low
SOCIAL	Aesthetic Aust Native	5			3	3	2	3	2	1	1	1	4	5	3	1	0	0	0	0	0	0	3	1	2	2	2	2
					45	low	30	low	10	low	25	low	100	low	15	low	0	NA	0	NA	0	NA	30	low	60	low	40	low
	Amenity	5			3	1	2	1	2	1	1	1	4	3	3	3	5	5	0	0	0	0	3	3	2	2	1	1
					15	low	10	low	10	low	25	low	60	low	45	low	125	medium	0	NA	0	NA	90	low	60	low	10	low
	Fishing	4			1	1	1	1	3	1	3	1	3	3	5	3	5	5	0	0	0	0	3	1	2	2	1	1
					4	low	4	low	12	low	60	low	36	low	60	low	100	low	0	NA	0	NA	24	low	48	low	8	low
	Heritage	3			4	5	3	3	2	1	1	1	3	3	2	1	5	5	0	0	0	0	3	3	2	2	1	1
					60	low	27	low	6	low	15	low	27	low	6	low	75	low	0	NA	0	NA	54	low	36	low	6	low
	Passive Recreation	5			2	1	2	1	2	1	3	1	3	3	2	1	5	5	0	0	0	0	2	1	2	2	0	0
					10	low	10	low	10	low	75	low	45	low	10	low	125	medium	0	NA	0	NA	20	low	60	low	0	NA
	Sense of Place	5			3	1	2	1	2	1	1	1	4	3	3	1	0	0	0	0	0	0	2	1	2	2	2	1
					15	low	10	low	10	low	25	low	60	low	15	low	0	NA	0	NA	0	NA	20	low	60	low	20	low
ECONOMIC					3	3	2	3	1	1	2	1	2	1	2	1	3	3	3	1	3	5	2	1	3	3	0	0
	Access	5			45	low	30	low	5	low	50	low	10	low	10	low	45	low	15	low	75	low	20	low	135	medium	0	NA
					3	1	2	1	2	1	2	1	2	1	3	1	0	0	0	0	0	0	2	1	3	1	0	0
	Cultivation	4			12	low	8	low	8	low	40	low	8	low	12	low	0	NA	0	NA	0	NA	16	low	36	low	0	NA
					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Grazing	0			0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Horticulture	0			0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
					3	3	3	3	3	1	3	1	3	1	3	3	0	0	0	0	0	0	3	3	1	1	0	0
	Intrastructure	1			9	low	9	low	3	low	15	low	3	low	9	low	0	NA	0	NA	0	NA	18	low	3	low	0	NA
					3	3	3	3	1	1	3	3	2	1	3	1	0	0	0	0	0	0	2	1	3	3	0	0
	Bank Protection	4			36	low	36	low	4	low	180	medium	8	low	12	low	0	NA	0	NA	0	NA	16	low	108	medium	0	NA
	Rural Land Value				2	3	2	1	3	3	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		5			30	low	10	low	45	low	150	medium	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
	Water Supply	5			1	1	1	1	4	1	1	1	3	1	3	1	0	0	0	0	0	0	2	1	1	1	1	1
					5	low	5	low	20	low	25	low	15	low	15	low	0	NA	0	NA	0	NA	20	low	15	low	10	low

Values
5 Very Good
4 Good
3 Satisfactory
2 Poor
1 Very Poor

Threats
5 Very High
4 High
3 Moderate
2 Low
1 Very Low

Likelihood
5 almost certain
4 quite possible
3 unusual but possible
2 remotely possible
1 practically impossible

Trajectory	
5	*rapid*
3	*slow*
1	*stable*

Score	
Low	<80
Medium	< 200
High	< 400
Very High	> 400

RISK WORKBOOK

MacKenzie River Reach 4			
LEGEND	3		
Likelihood	3	3	Trajectory
Score/Result	27	low	Risk Rating

	VALUES		Threats		Bank Erosion		Bed Instability		Water Quality		Altered Hydrology		Loss of Terrestrial Veg		Loss of Instream Habitat		Stock Access		Cultivation		Horticulture		Other Access		Exotic Vegetation		Exotic Fauna	
					1		1		1		5		1		1		1		1		1		2		3		2	
ENVIRONMENTAL	Geomorphic Diversity	5			5	3	1	1	1	1	4	3	1	1	1	1	5	5	0	0	0	0	3	1	2	3	0	0
					75	low	5	low	5	low	300	HIGH	5	low	5	low	125	medium	0	NA	0	NA	30	low	90	low	0	NA
	LWD Large Woody Debris	5			5	3	3	1	2	1	3	3	4	5	5	3	0	0	0	0	0	0	2	1	1	1	0	0
					75	low	15	low	10	low	225	HIGH	100	low	75	low	0	NA	0	NA	0	NA	20	low	15	low	0	NA
	Native Fish	4			5	3	3	1	3	2	4	5	3	3	5	5	4	5	0	0	0	0	2	1	1	1	3	2
					60	low	12	low	24	low	400	HIGH	36	low	100	low	80	low	0	NA	0	NA	16	low	12	low	48	low
	Native Fauna	4			3	3	3	1	3	1	3	3	3	3	3	3	5	5	0	0	0	0	3	1	2	1	1	1
					36	low	12	low	12	low	180	medium	36	low	36	low	100	low	0	NA	0	NA	24	low	24	low	8	low
	Significant Flora	5			3	3	2	3	3	2	3	3	4	3	3	1	5	5	0	0	0	0	3	3	2	3	3	3
					45	low	30	low	30	low	225	HIGH	60	low	15	low	125	medium	0	NA	0	NA	90	low	90	low	90	low
	Wetlands	0			3	1	3	1	3	2	4	3	4	3	4	3	0	0	0	0	0	0	2	1	2	3	0	0
					0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
	Width of Native Veg	5			2	3	3	1	1	1	2	3	4	3	4	1	5	5	0	0	0	0	3	1	2	3	2	2
					30	low	15	low	5	low	150	medium	60	low	20	low	125	medium	0	NA	0	NA	30	low	90	low	40	low
SOCIAL	Aesthetic Aust Native	5			3	3	2	3	2	1	1	1	4	5	3	1	0	0	0	0	0	0	3	1	2	2	2	2
					45	low	30	low	10	low	25	low	100	low	15	low	0	NA	0	NA	0	NA	30	low	60	low	40	low
	Amenity	5			5	1	2	1	2	1	1	1	4	3	3	3	0	0	0	0	0	0	3	3	2	2	1	1
					25	low	10	low	10	low	25	low	60	low	45	low	0	NA	0	NA	0	NA	90	low	60	low	10	low
	Fishing	4			5	1	1	1	3	1	3	1	3	3	5	3	0	0	0	0	0	0	3	1	2	2	1	1
					20	low	4	low	12	low	60	low	36	low	60	low	0	NA	0	NA	0	NA	24	low	48	low	8	low
	Heritage	3			5	5	3	3	2	1	1	1	3	3	2	1	0	0	0	0	0	0	3	3	2	2	1	1
					75	low	27	low	6	low	15	low	27	low	6	low	0	NA	0	NA	0	NA	54	low	36	low	6	low
	Passive Recreation	5			2	1	2	1	2	1	3	1	3	3	2	1	0	0	0	0	0	0	2	1	2	2	0	0
					10	low	10	low	10	low	75	low	45	low	10	low	0	NA	0	NA	0	NA	20	low	60	low	0	NA
	Sense of Place	5			3	1	2	1	2	1	1	1	4	3	3	1	0	0	0	0	0	0	2	1	2	2	2	1
					15	low	10	low	10	low	25	low	60	low	15	low	0	NA	0	NA	0	NA	20	low	60	low	20	low
ECONOMIC	Access	5			3	3	2	3	1	1	2	1	2	1	2	1	3	3	3	1	3	5	2	1	3	3	0	0
					45	low	30	low	5	low	50	low	10	low	10	low	45	low	15	low	75	low	20	low	135	medium	0	NA
	Cultivation	3			3	1	2	1	2	1	2	1	2	1	3	1	0	0	0	0	0	0	2	1	3	1	0	0
					9	low	6	low	6	low	30	low	6	low	9	low	0	NA	0	NA	0	NA	12	low	27	low	0	NA
	Grazing	3			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
					0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
	Horticulture	1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
					0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
	Intrastructure	3			3	3	3	3	3	1	3	1	3	1	3	3	0	0	0	0	0	0	3	3	1	1	0	0
					27	low	27	low	9	low	45	low	9	low	27	low	0	NA	0	NA	0	NA	54	low	9	low	0	NA
	Bank Protection	0			3	3	3	3	1	1	3	3	2	1	3	1	0	0	0	0	0	0	2	1	3	3	0	0
					0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
	Rural Land Value	5			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
					0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
	Water Supply	1			1	1	1	1	4	1	1	1	3	1	3	1	0	0	0	0	0	0	2	1	1	1	1	1
					1	low	1	low	4	low	5	low	3	low	3	low	0	NA	0	NA	0	NA	4	low	3	low	2	low

Values
5 Very Good
4 Good
3 Satisfactory
2 Poor
1 Very Poor

Threats
5 Very High
4 High
3 Moderate
2 Low
1 Very Low

Likelihood
5 almost certain
4 quite possible
3 unusual but possible
2 remotely possible
1 practically impossible

Trajectory	
5	*rapid*
3	*slow*
1	*stable*

Score	
Low	<80
Medium	< 200
High	< 400
Very High	> 400

Appendix D

Works Program Locality Map

MacKenzie River Waterway Action Plan

Catchment Boundary
Cadastre
Channels

MacKenzie Reaches
Reach 1
Reach 2
Reach 3
Reach 4

Action High Priority
Action Medium Priority
Action Low Priority

N

0 0.5 1 2
Kilometres

Wimmera Catchment Management Authority
Waterways for Life.
Earth Tech

WIMMERA RIVER

Action 3.3
Weed control.

Action 4.2
Weed control

Protect unique waterholes.

Action 3.3
Weed control.

Action 3.3
Weed control.

Action 4.2
Weed control.

Action 4.4
Control sediment transport.

Action 3.3
Weed control.

Action 2.2
Weed control

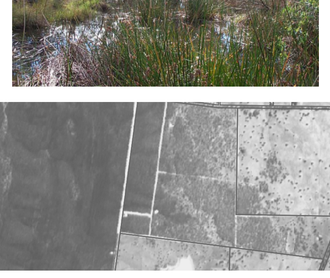
Distribution Heads

Action 2.2
Weed control

Action 2.2
Weed control

Dad and Dave Weir

WARTOOK RESERVOIR



Drawing No. S9904063_011