Biodiversity Strategy

For the Goulburn Broken Catchment, Victoria

2010 - 2015

Biodiversity Strategy Working group

Member	Skill / Role
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Foreword

The Goulburn Broken Catchment's 200,000 people enjoy widely varying landscapes and environments, from snow-covered alps to red gum floodplains, and from mixed cropping and grazing farms to irrigated orchards and dairy farms.

We acknowledge our 6,000 Indigenous Australians from the Taungurung and Yorta Yorta clans who are traditional owners of the land. We strongly respect their rich culture and intrinsic connection to the land and natural systems.

Biodiversity underpins the health of our intimately connected natural and managed systems, especially agriculture.

Many species of native flora and fauna have become extinct since European settlement and several are at the threshold of extinction because of historic activities such as large-scale clearing of native vegetation.

Biodiversity is under pressure from climate variability and change, and rapid changes in land and water use. After thirteen years of drought, the driest period on record, the message is clear: leadership is required to equip people, enterprises and environments to adapt to these changes.

The environment and people in the upper part of the catchment will continue to recover from the 2009 Black Saturday bushfires. Based on spatial data from the Department of Sustainability and Environment, over one-third (325,823ha) of the Goulburn Broken Catchment's woody native vegetation was burnt in the 2006 and 2009 bushfires.

The newly created River Red Gum National Parks in the lower part of the catchment presents a significant opportunity for improving biodiversity outcomes and for involving traditional owners in management.

Large changes to the 270,000 hectares of irrigation farm enterprises and rural communities have been underway for several years as a result of water reform and irrigation modernisation. The Victorian and Australian Governments have responded with a $2 billion investment to upgrade and rationalise irrigation water delivery systems and this is resulting in water savings for the benefit of irrigators and the environment. Murray-Darling Basin Authority's Basin Plan (being developed) will include sustainable diversion limits to protect river systems and will include the Barmah-Millewa Forest and the Lower Goulburn Floodplain as two of 18 key environmental icon sites.

This Biodiversity Strategy is the next step of the journey in improving the resilience of ecosystems so that they continue to provide habitat for flora and fauna and to provide the ecosystem services for more immediate human needs such as the filtering of water, the pollinating of crops and the provision of aesthetically pleasing places to live, work and play.

This Strategy follows implementation of Goulburn Broken CMA's Native Vegetation Management Strategy (developed in 2000) and From the Fringe to Mainstream – a Strategic Plan for Integrating Native Biodiversity (developed in 2004).

The Strategy provides a regional perspective for implementing Victoria's White Paper for Land and Biodiversity at a time of Climate Change (released December 2009). Geographic priorities identified in this Strategy complement the White Paper's Flagship areas and Biolink areas. The priorities and actions will inform the renewal of the Regional Catchment Strategy, which will be updated in 2011. The updated Regional Catchment Strategy will cover the new Natural Resource and Catchment Authority area, which presently includes the Goulburn Broken, North Central and North East Catchment Management Authority areas.

Thanks are due to the many organisations and people who helped develop the Strategy over the past two years.

We look forward to working with our many partners to implement the actions in this Strategy to help safeguard the future biodiversity in our catchment.

Peter F Ryan

Chair, Goulburn Broken Catchment Management Authority

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Executive Summary

This Strategy follows and builds upon the Goulburn Broken Catchment Management Authority's (Goulburn Broken CMA) *Native Vegetation Management Strategy* (developed in 2000 and incorporated into GBCMA 2003a) and *From the Fringe to Mainstream: a Strategic Plan for Integrating Native Biodiversity* (McLennan et al. 2004). It provides a regional perspective on the Victorian Government's Land and Biodiversity White Paper (DSE 2009a) and *Biodiversity is Everybody's Business, Victoria's Biodiversity Strategy Consultation Draft* (DSE 2010a). The Strategy will inform annual investment plans and the *Regional Catchment Strategy* update in 2011. This Strategy factors in reviews of previous strategies, a review of biodiversity targets, and a biodiversity risk assessment. It identifies priority geographic zones and strategic directions and actions for the next five years. It has been developed with extensive participation and consultation with key partners over the past two years.

Where are we at?

Biodiversity conservation is fast becoming a mainstream issue as critical ecosystem services, such as filtering water, become more appreciated and the threats to individual species and ecosystems become more widely understood.

Since about 1990, there has been a documented increase in uptake of environmental works by landholders. However, the Goulburn Broken CMA rated the condition of biodiversity as 'poor' in 1990 and again in 2009 (GBCMA 2009). Over 100 native vertebrate animals in the catchment are threatened with extinction (DSE 2007a).

Many species are at threshold levels of existence because of the legacy of past activities (especially large-scale clearing of native vegetation). Climate change and its interaction with other threats poses a significant risk to biodiversity, and ecosystems need to be assessed in terms of their ability to adapt or transform into new states. There is an ongoing need for targeted, active management of habitats to help build resilience.

Recent key drivers of biodiversity change include:

- climate change and variability (including associated drought, changes to pest plant and animal distribution and fire policy responses);
- changing land and water use and associated changes to demographics (collectively, rural landholders are large custodians of the catchment's biodiversity and the sector is undergoing rapid change);
- increased community and government commitment to biodiversity protection and improved mechanisms and approaches to achieve change (for on ground works to protect and restore biodiversity values on both private and public land); and
- emerging markets for carbon, water, energy and biodiversity, which will provide both opportunities and potential risks.

What are we aiming for?

The long-term vision developed for biodiversity in the Goulburn Broken Catchment is:

> *Healthy ecosystems supporting viable populations of flora and fauna.*

This complements the Goulburn Broken CMA's overarching vision for the catchment, which is: *Healthy, resilient and increasingly productive landscapes supporting vibrant communities.*

We aim to achieve the biodiversity vision by working towards the following three targets:

1. **Maintain extent and quality of all native habitat at 2005 levels in keeping with the goal of 'net gain' listed in Victoria's Biodiversity Strategy 1997.**
2. **Increase the extent of native vegetation in fragmented landscapes by 70,000 ha by 2030 to restore threatened Ecological Vegetation Classes (EVCs) and improve landscape connectivity.**
3. **Improve the quality of 90% of existing (2005) native vegetation by 10% by 2030.**

While these targets may be uncertain they provide a platform to monitor progress, evaluate programs, and identify knowledge gaps. They are reported against using data and assumptions, which are continually refined based on the best available information. Native vegetation targets act as a measurable surrogate for all of biodiversity. Targets for other elements of biodiversity (e.g. threatened species and soil biota) will be pursued as more information comes to hand to set meaningful and measurable targets. In the meantime these elements are addressed as actions within the Strategy.

Aquatic, riparian and wetland biodiversity is a strong focus of the Goulburn Broken CMA's Regional River Health Strategy and links between the Biodiversity and River Health programs of the Goulburn Broken CMA will continue to be strengthened. A regional *Invasive Plants and Animals Strategy* (to be released in 2010) will recognise threats to the region's key biodiversity assets.

As part of preparing this Strategy, the Goulburn Broken Catchment was divided into fourteen biogeographical zones based on distinguishing landscape and biodiversity features. These were prioritised for protection and restoration of biodiversity. Investment in landscape-scale change is best made in areas that have the greatest ability to respond quickly to changed management. Intact zones such as the South-Eastern Highlands, the Murray Corridor and the Goldfields provide substantial ecosystem services, while zones such as the Lower Goulburn and Broken Rivers, and the Longwood and Violet Town Plains have the potential to achieve large-scale restoration objectives. While the highly modified (relict) zones have degraded ecological processes at a landscape scale, significant discrete assets within these zones should not be dismissed.

Vision

Healthy ecosystems supporting viable populations of native flora and fauna

Ecological outcomes

• Protected and secured habitat • Landscape and habitat connectivity • Ecological processes, energy and gene flow • High quality habitat • Viability of threatened species • Representation of habitat types

Biodiversity target themes

• Native vegetation extent • Native vegetation quality • Threatened species

Strategic Directions

Adapting to change	Nurturing Partnerships	Investing more wisely	Building on our ecological infrastructure	Legitimising biodiversity conservation

Indicators of Strategic Directions

Adapting to change	Nurturing Partnerships	Investing more wisely	Building on our ecological infrastructure	Legitimising biodiversity conservation
20% increase in 2009-10 investment in biodiversity conservation	Roles and responsibilities defined and understood by key stakeholders	Strategy priorities, trade-offs, risks and synergy benefits are explicit in project design (templates)	90% of biodiversity management agreements between private landholders and the GB CMA are in identified high priority areas.	Government investment in biodiversity management through the GB CMA is clearly framed around supporting land managers to be active stewards of the environment
3 working examples of biodiverse carbon farming	5 cross-tenure projects (with biodiversity management agreements between public land managers, the GB CMA and other relevant parties)	80% of government investment in biodiversity aligns with regional priorities	Priorities are based on increasing ecosystem function and diversity under a changing climate	A much larger proportion of the Catchment's land use reflecting biodiversity conservation
Land use changes result in an improvement in biodiversity over a net 5000 ha	1000 new biodiversity projects/agreements between private land managers and the GB CMA	Strong links between this strategy, corporate plan and performance reporting	4 large-scale biolink projects underway in priority zones	Strengthened community support for biodiversity conservation as our natural life support system

Strategic Initiatives

Adapting to change	Nurturing Partnerships	Investing more wisely	Building on our ecological infrastructure	Legitimising biodiversity conservation
Identify, define and respond to socio-economic and policy drivers	Review existing partnerships	Translate policy and research to implementation	Develop/support scientifically sound biolink projects to improve landscape connectivity	Strengthen and communicate duty of care for biodiversity
Seize opportunities for climate change mitigation and adaptation	Identify and establish new partnerships, particularly with indigenous groups	Develop clear processes for biodiversity prioritisation at various scales	Accelerate stewardship approaches and extend to wetlands and waterways	Increase opportunities for landholders to act as biodiversity stewards
Provide tailored support to a changing social landscape	Develop large-scale, collaborative projects and networks		Integrate the management of surface and ground water for the benefit of ground water and aquatic-dependent ecosystems	Influence government planning and policy
	Integrate GB CMA programs / approaches		Develop strategies for ecosystems to transform and adapt to climate change	Promote an understanding of the fundamental reliance on biodiversity for quality of human life, economy and identity
	Initiate active engagement with public land managers regarding biodiversity monitoring, evaluation and reporting			
	Ensure biodiversity info is provided to fire fighting authorities prior / during wildfires			

Actions

See Section 5 of Strategy for detailed actions

Left-side labels:
- VISION — 20 - 50 yrs
- INDICATORS OF VISION ACHIEVEMENT
- STRATEGIC DIRECTIONS
- INDICATORS OF STRATEGIC DIRECTIONS
- STRATEGIC INITIATIVES — 5 - 6 yrs
- ACTIONS

How will we get there?

Key principles and factors that influenced the development of directions, initiatives and actions in the Strategy include:

- the environment must not be separated from people when decisions are made. Community capacity, engagement and recognition are crucial elements to achieving on-ground change;
- the achievement of biodiversity outcomes relies on strong partnerships with other programs and agencies, and with private and public land managers;
- biodiversity protection and restoration are priorities in areas that have the 'ecological infrastructure' (rivers, wetlands, creek systems, and healthy ecosystems) upon which to nurture and expand;
- it is usually more effective to build general resilience across ecosystems than to build resilience of specific species or single ecosystems to specific threats;
- links between Biodiversity and River Health programs will continue to be strengthened;
- climate change and its interaction with other threats poses a significant risk to biodiversity, and identification of refugia, including wetlands, across a range of areas is important;
- effective calls on allocating scarce funds are needed to get the balance right between saving species vulnerable to extinction and preventing more common species from becoming threatened; and
- targets and the evaluation of how we are progressing towards them are useful in adapting to change and new knowledge.

The diagram to the left represents the relationship between the vision and actions, with each of the five columns (directions) being addressed as sections within the Strategy. Actions will be included and expanded where necessary in annual investment plans.

Evaluation and improvement

Because the drivers of biodiversity change shift rapidly and the information-base for decision-making continually improves, implementation of this Biodiversity Strategy will be evaluated regularly so that new knowledge is included in implementation programs. There will be annual reviews of listed actions and we will continue to improve our understanding of the impact of actions on biodiversity condition change.

Introduction

1. Introduction

The Goulburn Broken Catchment Management Authority (Goulburn Broken CMA) is the peak Natural Resource Management (NRM) agency for the Goulburn Broken Catchment. Over the years it has prepared a number of strategies to guide investment and implementation of NRM programs, with the *Regional Catchment Strategy* (RCS) being the overarching document. The RCS is due to be reviewed and updated in 2011 for the new Natural Resources and Catchment Authority area covering the Goulburn Broken, North Central and North East catchments (as described in the Land and Biodiversity White Paper, DSE 2009a). In preparation for this, the Goulburn Broken CMA has undertaken reviews of relevant sub-strategies of the RCS, including the two key strategies relating to biodiversity:

1. *From the Fringe to Mainstream: a Strategic Plan for Integrating Native Biodiversity* 2004–2007; and

2. *Goulburn Broken Native Vegetation Management Strategy* [NVMS] (finalised in 2000 and included as Volume 1 of the Native Vegetation Plan, GBCMA 2003a).

Reviews of the previous two biodiversity-related strategies found that the majority of actions had been successfully completed and the need to establish future directions was identified. The review highlighted an urgent need for a single strategic document related to biodiversity.

Prior to completing the draft of this Strategy, the Victorian Government released its White Paper for Land and Biodiversity at a time of Climate Change (DSE 2009a). A renewed Victorian Biodiversity Strategy Consultation Draft was also released in May 2010 (DSE 2010a). While the full implications of these two documents were not known during the development of this Strategy, it was regarded that an updated strategic document for biodiversity in the Goulburn Broken Catchment was urgently required to guide implementation. There are many parallels between this Strategy and both the White Paper and the renewed Victorian Biodiversity Strategy Consultation Draft, and many of the actions within this Strategy were suggested for inclusion in the Victorian Biodiversity Strategy during its consultation period. Further synergies between this Strategy and the two key state government documents will require ongoing identification during implementation and annual reviews of this Strategy.

The development and release of this Strategy comes at a time of significant change both institutionally, and environmentally. We are only just starting to learn about the potential impacts of climate change on biodiversity and its interaction with existing threatening processes. The Strategy takes a forward looking approach accepting that our environment is changing and our decision-making needs to keep up. To address high levels of uncertainty however, the Strategy promotes a highly adaptive approach, spreading investment, building diversity of actions and working together with partners and land managers to find solutions within a broad framework.

1.1
Strategy purpose

This Strategy identifies biodiversity conservation priorities for the Goulburn Broken Catchment over the five-year period 2010–2015. It also updates the longer-term vision and targets.

The vision for biodiversity in the Goulburn Broken Catchment is:

> *Healthy ecosystems supporting viable populations of native flora and fauna.*

This complements the Goulburn Broken CMA's overarching vision for the catchment, which is: *Healthy, resilient and increasingly productive landscapes supporting vibrant communities.*

The purpose of this Strategy is to:

- provide a vision for biodiversity conservation in the catchment based on multi-agency involvement and collective agreement;
- promote the fundamental importance of biodiversity conservation in natural resource management[1];
- set clear priorities and practical directions for biodiversity conservation over the next five years, while acknowledging there are other external influences (to guide the work of the Goulburn Broken CMA and partner organisations);
- promote an integrated and coordinated approach to biodiversity conservation in the catchment;
- provide a reference point for engaging stakeholders;
- set future directions in a way that aligns with, or provides flexibility to meet government and other stakeholder priorities and engender confidence in our ability to do so; and
- attract increased investment into biodiversity conservation in the Goulburn Broken Catchment.

Scope of strategy

The Strategy describes the general direction for biodiversity conservation in the Goulburn Broken Catchment over the next five years (it is not a detailed action plan for the general community). The broad actions listed will be reviewed annually and used as a guide to formulate detailed tasks and investment plans. The actions from the Strategy will be implemented through effective partnerships with key stakeholders, including private landholders.

....

[1] *While the recent focus on biodiversity conservation for NRM programs is welcome, there is still a need to be proactive in ensuring that biodiversity is adequately integrated into broader political agendas such as sustainability (e.g. eco-living) and any national (and global) carbon-accounting scheme. In doing so, there is huge potential to greatly enhance the outcomes of such policies as well as achieve strong gains for biodiversity conservation. The Strategy therefore aims to identify opportunities to strengthen integration or synergies in whole-of-government programs.*

Native Vegetation Retention Planning Controls outside the scope of the Strategy

While regulation is one policy instrument relevant to the implementation of the Strategy, it is not addressed directly in the Strategy. Native Vegetation Retention Controls continue to be addressed in Volume 2 of the *Regional Native Vegetation Plan* (GBCMA 2003a), a sub-component of Victoria's *Native Vegetation Management Framework*, which is an 'incorporated' document embedded in the Victorian Planning Provisions under the *Planning and Environment Act 1987*. It is important that the strategic directions and investment priorities for biodiversity in the Goulburn Broken Catchment can be updated separate to any review of relevant legislation, and this Biodiversity Strategy enables this.

Land tenure

This Strategy provides a 'tenure-blind' vision for biodiversity in the catchment. It will be important during implementation to identify specific actions for the range of land managers, both private and public.

1.2
Whose strategy?

This Strategy has been developed under the guidance of a multi-agency Biodiversity Strategy Working Group, which has acted as a technical and community reference group. It is an inclusive strategy for those with a stake in biodiversity conservation in the Goulburn Broken Catchment, including the major organisations involved in planning and implementing biodiversity programs. The directions within the Strategy have also been developed based on formal reviews of the two previous strategies (GBCMA 2003a; McLennan et al. 2004), input from a range of Goulburn Broken CMA staff, Implementation Committees and Board, and consideration of emerging policy directions from other relevant planning processes.

While the vision and directions within this Strategy are shared among those with an interest in biodiversity, many of the actions are targeted at the Goulburn Broken CMA as a coordinating body for collaborative biodiversity planning and implementation. Annual implementation planning will identify responsible agents for actions (that are identified in Section 5). Partners have traditionally been strongly engaged during development and update of the Regional Catchment Strategy and its sub-strategies.

While the Strategy will have varying uses for different stakeholders (Table 1) it provides a regional vision that everyone can work towards. Other relevant national, state and regional strategies are acknowledged and are summarised in Appendix 1.

Stakeholder	Relevance of strategy
Broad community	Illustrates the vision for the Goulburn Broken Catchment's biodiversity, identifying priority zones and strategic actions. Does not provide specific actions or advice for on-ground management.
Private landholders	Provides guiding principles for biodiversity conservation and regional priorities, to which landholders can contribute.
Public land managers e.g., Parks Victoria	Provides a catchment-wide, tenure-blind view of biodiversity goals and opportunities for future collaboration between the key NRM organisations.
Department of Sustainability and Environment (DSE)	Communicates a shared view of priority biodiversity actions for the Goulburn Broken Catchment and opportunities for further regional collaboration and integration between the Goulburn Broken CMA and DSE.
Department of Primary Industries	Provides a vision and central focus for any staff that may be involved in delivering biodiversity and land management projects, to enable coordinated and informed sub-catchment and site planning, and implementation.
Local Government	Provides a catchment wide perspective on biodiversity priorities to enable effective collaboration with local government staff and councillors. Provides opportunities for alignment with local government strategic planning.
Statutory bodies/utilities	Provides guiding principles for biodiversity conservation and regional priorities to which utilities can contribute.
Goulburn Broken CMA	A key strategic document for biodiversity planning and implementation, particularly for the Biodiversity, Catchment Planning, River Health programs and Implementation Committees. It will be a key document for informing the development of the next Regional Catchment Strategy and is therefore highly relevant to the Goulburn Broken CMA Board.
Victorian Government (includes DSE - policy groups)	Provides a regional framework for implementing state-wide policies, strategic objectives and the Victorian Investment Framework, including translation of State priorities to the regional level and describes regional process issues (such as engagement) required.
Australian Government	Communicates regional priorities and alignment with nation-wide priorities.

Table 1: Strategy audience

1.3
Submissions and comments on the draft strategy

The consultation draft of this Strategy was released for stakeholder comment and made available on the Goulburn Broken CMA website between 7th May - 11th June 2010. Submissions/comments were received from the following individuals and organisations and have been considered in finalising the Strategy.

Allison McCallum, *Shire of Campaspe*

Gary Deayton, *Moira Shire Council*

Sharon Lewis; Abby Dobell; Jim Crosthwaite, *Department of Sustainability and Environment*

Broken Goulburn Implementation Committee

Ann Jelinek, *Ecoviews Pty Ltd*

Murray Chapman; Terry Court, *Goulburn Broken CMA Board*

Chris Solum, *Northern Victorian irrigation Renewal Project*

Michael Ryan, *VicForests*

Craig Tuhan, *Goulburn Murray Landcare Network Inc.*

Nick Roberts, *Victorian National Parks Association*

Kieran Lawton, *Wimmera CMA.*

Karen Alexander, *Victoria Naturally Alliance*

Rachael Spokes, *Goulburn Broken CMA* and Philip Thompson, *Greater Shepparton City Council*

Wayne Tennant, *Goulburn Broken CMA*

Key feedback themes

Key feedback themes are summarised below and have been addressed in this final strategy:

- need to highlight the relevance of the Strategy to private landholders;
- need to further promote the importance of private landholders;
- need to emphasise the importance of public land, but acknowledge that biodiversity conservation is just one of a number of values to be managed;
- need to acknowledge the active management, including environmental flows, that must accompany increases in reservation status in the River Red Gum areas of the catchment;
- confusion around targets, in particular how we measure progress towards them;
- concern by local government about over-reliance on planning tools to increase protection to a significant degree. Need to strengthen existing partnerships in particular local government;
- need to further acknowledge that while priority zones may receive more investment, specific high value assets within relictual landscapes are still important;
- need to emphasise the need for large-scale projects;
- need to mention emergence of new farming systems and how we can capitalise on these to achieve improved biodiversity outcomes;
- need to incorporate the importance of soil biodiversity;
- need to better recognise the need for improved management of riparian areas and frontages;
- address how Landcare and community group partnerships can be nurtured and implemented; and
- positive feedback: comprehensive, well-focussed, actions well-considered, significant evolution in catchment management design.

Part A

Where are we at?

2. Goulburn Broken Catchment's biodiversity

The Goulburn Broken Catchment boasts a wide diversity of landscapes and environments, including snow-covered alps at 1,800 m, moist montane and sclerophyll forests, granitic outcrops, gentle sloping plains, box woodlands and River Red Gum floodplains, mixed farms, irrigated pastures and orchards. Average rainfall varies substantially, from 1,600 mm in the high country of the south east to 400 mm in the north west.

These varied landscapes and environments are home to a great diversity of native plants and animals, several of which occur nowhere else in the world. They form a large part of the catchment's cultural and spiritual identity, especially for the catchment's Indigenous people. From National Parks to local creeks running through our townships, these environments and the biodiversity they support contribute to our health and wellbeing. (adapted from DSE 2009a)

The catchment crosses eight bioregions (mapping units for biodiversity planning) including the Victorian Riverina, Goldfields, Murray Fans, Northern Inland Slopes, Highlands – Northern Fall, Highlands – Southern Fall, Central Victorian Uplands and Victorian Alps.

> "Biodiversity, or biological diversity, is the variety of all life on earth including the different plants, animals and microorganisms, their genes, and their terrestrial, marine and freshwater ecosystems.
>
> Biodiversity and the ecosystems it supports are fundamental to life and to our lifestyles. They provide a diverse range of goods and services, the value of which is difficult to calculate in dollar terms." (DSE 2009a)

2.1
Condition of the catchment's biodiversity

The *Victorian Catchment Condition Report* (VCMC 2007) rated the Goulburn Broken Catchment's biodiversity as variable, from poor to good condition. The GBCMA (2009) rated the general condition of biodiversity as poor in 1990 and again in 2009. At a finer scale, some aspects of biodiversity are improving and some are declining (see Section 2.3 and GBCMA 2007). Many species of plants and animals in the catchment are threatened because of the legacy of past activities, especially clearing of vast tracts of native vegetation (about 10 per cent of native vegetation remains on private land and over 100 of the catchment's native vertebrate animals are threatened with extinction (see Table 2 and Appendix 2 [2007a]). Private landholders play a crucial role in protecting threatened biodiversity values.

Some species that occur only in remnant or relict landscapes (see Figure 1) are unlikely to survive in the long-term because of degraded ecological processes. Actions to restore ecological function to these landscapes have not been adequate or timely, especially given the looming impact of climate change.

An updated Biodiversity Risk Assessment (Brunt and Miles 2009) found that extreme threats to biodiversity include reduced habitat function, isolation and simplification, weed invasion and climate change (especially an increase in occurrence and severity of fire and changes in rainfall patterns and associated water availability for rivers, streams and wetlands). Saline water and high water tables are now deemed to be less threatening because of reduced rainfall. However, a swing back to higher rainfall, while unlikely, is possible and salinity could again pose a major threat to biodiversity, especially in the context of other multiple threats. See also Appendix 5.

Based on spatial data from the Department of Sustainability and Environment, over one-third (325,823ha) of the catchment's woody native vegetation was burnt in the 2006 and 2009 fires. However, long-term impacts on biodiversity, either negative or positive, are yet to be determined. The most recent bushfires that began on Black Saturday in February 2009 became Australia's worst natural disaster on record. Most of the bushfires were in the upper part of the Goulburn Broken Catchment and caused a tragic loss of human lives, loss of property and environmental disturbance. The 2009 fires burnt 190,000 hectares (eight per cent) of the entire Goulburn Broken Catchment, including 2,845 km of stream frontage and 212 km of native vegetation along major rivers.

Given the huge expense of restoring ecological function for some threatened species and ecosystems, effective calls on allocating scarce funds are needed to get the balance right between saving species vulnerable to extinction and preventing more common species from becoming threatened.

"*Indigenous Australians have contributed to the shape of the Australian landscape over many thousands of years, most notably through the use of fire as a tool. In the two hundred years since European settlement, the landscape in the area now known as Victoria has been transformed, often to the detriment of our ecosystems and biodiversity.*

...the benefits we have gained from...prosperity have come with an environmental cost. Two centuries of intensive use of Victoria's natural resources has altered the functioning of many of our ecosystems. Rapid population growth, increasing consumption and development have led to:

- *the loss, fragmentation and degradation of habitat*
- *the unsustainable use of many natural resources*
- *the introduction of invasive species*

- *marine and coastal pollution*
- *changes to the aquatic environment and water flows*
- *changes to natural fire regimes...*

Victoria has the highest proportion (48 per cent) of bioregions in Australia considered to be in poor landscape condition. The National Land and Water Resources Audit (2001) found that many Victorian ecosystems are under serious stress. The picture has not improved since the Audit. The Victorian Catchment Condition Report (VCMC 2007) found that most of Victoria's catchments were rated moderate to poor in a number of assessment categories, reflecting a general decline in condition of land, water and biodiversity since 2002. The Catchment Condition Report noted that in the forests and parks that make up the majority of our public land, biodiversity was in good condition. Elsewhere it was poor and declining. The Victorian State of the Environment (2008) report affirmed these trends.

Whole communities of plants and animals, including native grasslands, rainforests, woodlands and alpine bogs are at risk due to a variety of threatening processes." *(DSE 2009a)*
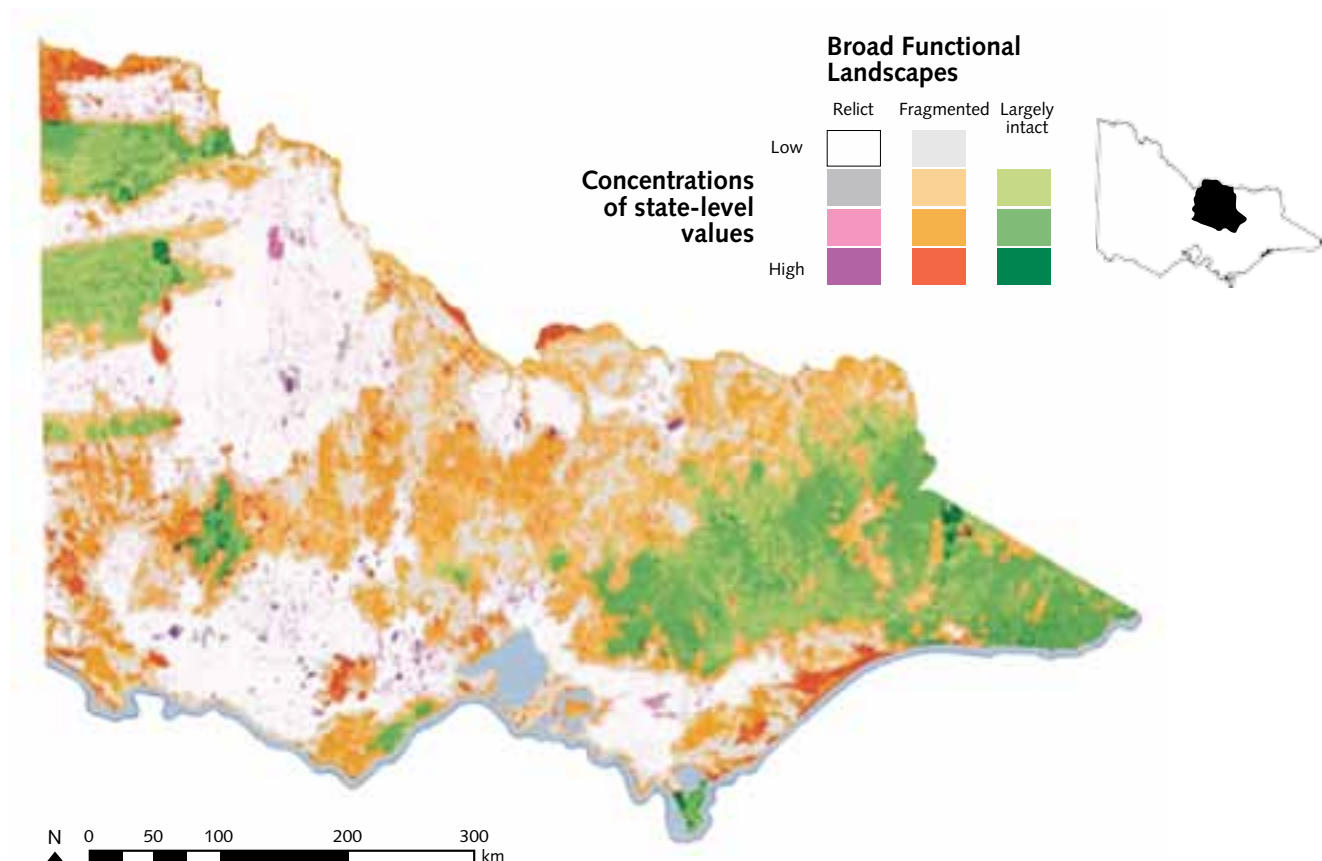

Figure 1: Biodiversity values and broad functional landscapes across Victoria (from DSE 2009a)

Biodiversity asset	Status
Native vegetation	Over 60% of the catchment has been cleared, mainly in bioregions most suited to intensive agriculture, such as the Victorian Riverina. Large-scale declines in extent may have stabilised (although post Black Saturday clearing needs to be assessed). However, incremental losses, particularly in vegetation quality, are still occurring. Losses are somewhat countered by large-scale revegetation, remnant protection and grazing management programs. There are 2,750 native species of which 357 (13%) are threatened (DSE 2007a) 64% of ecological vegetation classes are listed as Endangered or Vulnerable (DSE 2007d)
Wetlands	The majority of remaining wetlands are considered to be in poor to moderate condition and many of the plants and animals that depend upon them are threatened (DSE 2009a). The area of natural wetlands in the catchment has been reduced by approximately 30% since settlement (Wetland 1994 spatial layer, DSE). The shallow ephemeral wetlands have suffered the greatest decline in area including freshwater meadows (22% decline in area), shallow freshwater marshes (40% decline in area) and deep freshwater marshes (60% decline in area).
Rivers and streams	29% (720 km) of the catchment's 2,492 km of streams and waterways are rated as poor / very poor, 54% (1,337km) rated as moderate and 17% (435 km) rated as good / excellent. [NOTE: These statistics are based on the Index of Stream Condition in 2004 (DSE 2005) and do not include a full assessment of waterways across the catchment. A large proportion of the catchment has been affected by fires which will have impacted on the condition of waterways and water quality.]
Native fauna	493 species of vertebrate fauna of which 110 (22%) are threatened (DSE 2007a). There are an unknown (but very large) number of invertebrates. Many species exist in areas that are below minimum threshold habitat levels. Natural and/or human-induced events could cause their extinction within the catchment.
Soil biodiversity	Below-ground flora and fauna represents one of the most species-rich components of terrestrial ecosystems and there is a strong link between above ground and below ground biodiversity. Healthy remnants and biodiverse soils go hand in hand. However, we know very little of how best to manage for healthy and biodiverse soils.

Table 2: Summary of biodiversity statistics, Goulburn Broken Catchment

2.2
Drivers of change

Large changes in the condition of biodiversity since European settlement can be traced to a small number of causes at any one time. Some of these are listed in Table 3, compiled from sources such as Mansergh *et al.* (2006) and DSE (2004). A detailed timeline of changes in the Violet Town-Longwood region of the catchment can also be found in Race *et al.* (2009).

1820s	Aboriginal land management replaced with European land use and management
1836	Major Mitchell survey starting a land rush. Squatters take over crown land and grow sheep and cattle
1850s	Gold mining leads to increased population, clearing and waterway degradation
1860s	Rabbits and environmental weeds moving throughout Victoria
1860	Squatters land opened up for purchase (*Nicholson Land Act 1860*)
1870s	High wool prices leads to increases in flock sizes and area of land exploited
1903	Licences granted to graze crown frontages on waterways
1907	Forests Department established resulting in more controlled timber harvesting, declaration of reserves and collection of royalties
1929	Superphosphate introduced into the environment via government subsidies
1930s	Large scale clearing and ploughing leads to fragmented and relictual landscapes in high production areas. Murray river regulation begins and irrigation changes landscapes Salinity becomes an issue and drainage projects evoked
1940s	Soldier settlement –more farms developed in marginal land Large scale clearing encouraged by government and enabled through oil fuelled vehicles (bulldozers), chainsaws, pesticides and herbicides
1950	Myxomatosis introduced reducing impact of rabbits
1950s	Wool prices boom resulting in new land cleared and increased use of introduced pastures and fertilisers
1955	Lake Eildon completed to current size
1956	Legislation enacted to manage and protect Victoria's national parks (*National Parks Act 1956*)
1959	Game licences introduced resulting in protection of some wetlands
1960s	Pinus radiata forests planted Clearing continues but attitudes towards the Australian environment beginning to change
1970s	Land Conservation Council established to identify areas for nature reserves Lifestyle properties in the hills close to urban centres becomes popular
1980s	Revegetation on farms begins to reverse past trends of exploitation
1986	Landcare introduced in Victoria
1987	Clearing reduced through permit process (*Planning and Environment Act 1987*)
1990s	Recognition that public land areas (including riparian frontages) offer significant potential for biodiversity gains
1990	Government commitment to integrated catchment management
1992	Water rights capped and rights to water become tradeable
1997	Catchment Management Authorities formed under the *Catchment and Land Protection Act (1994)*
2000s	Longest dry period on record Fires in 2006 and 2009 burn half of the catchment's woody native vegetation
2000	Development of the Goulburn Broken Native Vegetation Management Strategy
2010	River Red Gum Forest Conservation Reserves increase from 5.7% to 14.2% of original extent 18% of State in conservation reserves (including terrestrial and marine reserves) Lake Mokoan decommissioned

Table 3: Key drivers and results of change to Goulburn Broken Catchment's biodiversity

The following recent drivers of biodiversity change are further explained in Sections 2.2.1 to 2.2.3:

- climate change (including associated drought, changing pest plant and animal distribution and fire policy responses);
- changing land and water use and associated changes to demographics (collectively, rural landholders are large custodians of the catchment's biodiversity and the sector is undergoing rapid change);
- increased commitment to biodiversity protection and improved mechanisms and approaches to achieve change (for on ground works to protect and restore biodiversity values on both private and public land); and
- emerging markets for carbon, water, energy and biodiversity, which will provide both opportunities and potential risks to biodiversity.

> *"Climate change, population growth and settlements, and consumption associated with economic growth are the overarching driving forces of environmental degradation."*
> *(Commissioner for Environmental Sustainability 2009)*

2.2.1
Climate change

> *"Climate change is the greatest social economic and environmental challenge of our time."*
> *(Intergovernmental Panel on Climate Change 2007).*

Climate change is seen as a critical element for consideration in biodiversity conservation and requires special attention in this Strategy. Natural systems are vulnerable to climate change, with a minimal coping range and adaptive capacity as a result of fragmentation and associated impacts (Pearman undated and see Appendix 3). Climate change in Victoria is likely to create lower annual rainfall but more rainfall events, fewer frosts, more days with high and extreme fire danger and more extreme weather events. Northern Victoria is likely to be warmer and drier. Amongst other changes, this is expected to impact on surface and groundwater flows, the composition, abundance and distribution of weed species and processes such as pollination. Such changes will influence the composition of ecosystems and the spatial distribution and abundance of species and communities. (Adapted from DSE 2009a)

It is very difficult to predict the impacts of climate change at the ecosystem level, but some general trends can be anticipated (see Appendix 3). Finer scale assessments will be needed to help understand the full impact of climate change on biodiversity, for example, on specific threatened species, wetlands, vegetation communities and remnant patches of habitat. The emphasis of future assessments needs to be on the interaction of climate change on existing threats to biodiversity.

Water flows in rivers and streams are lower than the worst case scenarios predicted as recently as 2004. Realised water savings from large-scale water efficiency projects have been countered by reduced rainfall and hence water availability. Water availability for irrigation has been well below average and water availability for rivers and wetlands has also been very low, placing aquatic environments and the species they support under severe pressure. Threatened native fish species have endured significant declines in abundance and/or range due to threatening processes, and although the Goulburn Broken CMA has committed significant resources to their recovery, predicted changes in rainfall, evaporation and air temperature as a result of climate change, pose a serious threat to their long-term viability (Kearns *et al.* 2009).

The catchment's longest dry period on record is now in its fourteenth year, indicating the likely situation under climate change. There are some cases of large-scale vegetation changes due to a reduced watering regime, such as giant rush colonisation of Barmah Lake, River Red Gum establishment in beds of now dry creeks and the death of River Red Gums on higher parts of the floodplain.

The long dry is resulting in significant changes to land and water use, which in turn is impacting on biodiversity. A fundamental change in climate would mean an increase in these changes into the future.

Community and institutional reactions to the bushfires of 2009 are influencing planning regulations, including where buildings are positioned in the landscape and clearing of native vegetation for fire protection purposes. A rational, science-based response is required. The 2009 Victorian Bushfires Royal Commission is due to report in 2010.

> *"Biodiversity is declining across the globe. In 2005, the United Nations Environment Program First Millennium Ecosystem Assessment report concluded that the world is either on the cusp of, or has already entered, a period of rapid mass extinction not seen since the demise of the dinosaurs. This sixth extinction phase is unlike all the others.*
>
> *The report found that humans have contributed to climate change and changes to ecosystems over the past 50 years in an unprecedented way. It concludes that nearly two thirds of the critical services nature provides to humans are in decline, and warns that we face even greater loss of biodiversity over the next 50 years.*
>
> *Recent research shows a marked collapse in bird numbers and breeding events due to the lack of water in the landscape. This is affecting food sources for many birds, such as species that rely on the nectar of flowering gums."* *(DSE 2009a)*

2.2.2
Changing land and water use and associated demographics

Collectively, rural landholders are custodians of much of the catchment's biodiversity, with the use of land and water being a significant determinant of what happens to biodiversity. Rapid changes in land and water use are having enormous implications for policy mechanisms and tools used to achieve biodiversity conservation outcomes.

Land and water use change is being driven by a range of forces, summarised below.

- Climate change (as discussed in previous section).
- Water security: the availability and security of supply and how it is shared amongst users is the subject of intense debate and substantial reform. This is dramatically affecting land use, land value and the structure of rural communities and industries. As land owners look for other avenues of income there is an opportunity for biodiversity conservation to become part of any new farm business.
- Industry and economic trends: the average age of landholders is rising because fewer family farms are handed down to younger generations, mainly because the young are out-migrating from farming areas (Argent & Walmsley 2008) and new residents are also older; new residents generally have higher incomes, higher levels of employment and were employed in urban-focused employment sectors. There are about 900 dairy farmers in the catchment and this number is declining by about eight per cent per year (severely reduced milk prices since late 2008 are likely to result in a more rapid exit of farmers and this will be exacerbated if conditions remain dry). The social adjustment for

Projections indicate that Victoria will grow by 2.3 million people in the next 30 years... ....including about 477,000 people in regional Victoria... ...will add to pressure on biodiversity in the urban fringe and regional centres. (DSE 2009a)

dairy farmers and flow on effects for the rest of the catchment are potentially massive (GBCMA 2009): a greater diversity of enterprises; increased interest in integrated farm forestry; technological developments; new or emerging markets and the increasing scale of farm businesses.

- Lifestylers: the proximity to Melbourne has attracted tree-changers and commuters to the south of the catchment, resulting in a significant increase in 'lifestylers' who have differing intentions for their land and capacity to manage it (Barr 2003). Landscape amenity was found to be a good predictor of rural area population change, especially in areas within commuting zones around major capital and regional cities (Argent et al. 2007).
- Recreation: the proximity to Melbourne is resulting in increasing use of the catchment for recreational purposes.
- Energy: changes associated with petrol price rises and the search for alternatives to oil and coal again may change agricultural practices and crops, rural and urban living preferences, and tourism.

2.2.3
Improved mechanisms for positive change

Two decades of integrated natural resource management have given the Goulburn Broken Catchment's communities significant experience and understanding of the mechanisms that will make a difference.

"...many landholders provide significant voluntary contributions to improving land and biodiversity. Victoria has strong community-based natural resource management and volunteer networks whose contribution to the environment cannot be underestimated. This 'social capital' gives us a strong foundation to continue to work together to restore our natural capital." (DSE 2009a)

The Goulburn Broken CMA believes that general landholder understanding of the needs of biodiversity has improved dramatically since about 1990 and there has been a parallel increase in uptake of environmental works on private land (see Figure 4).

Successful mechanisms for achieving biodiversity outcomes include Bush Returns (see Miles 2008) and other market-based incentives, the Drought Employment Program, Conservation Management Networks, Environmental Management Incentives (multiple-benefit approach), and Conservation Covenants.

The Lower Goulburn National Park and the Barmah National Park created in June 2010, will help to protect large areas of River Red Gum forests in conservation reserves from a range of threats. However, appropriate management including adequate environmental flows will be needed to complement the increased security status of these areas. There is ongoing

Community networks getting the job done
by Jim Castles, GB CMA

Works covering more than 115,000 hectares were undertaken through two conservation management networks (CMNs) in 2008-09.

CMNs are local partnerships between government agencies, community groups and individuals that cover public and private land.

The CMNs are proving a very successful model for linking high level policies to onground change because of the emphasis on understanding and integrating local needs.

The Broken Boosey CMN's achievements for the year include:

- 34 hectares of private and public land direct seeded;
- 40,000 hectares of private land and State Park baited for foxes by 50 landholders and Parks Victoria;
- 413 Squirrel Glider nest boxes built and installed by Drought Employment Program crew;
- 450 seedlings of threatened species of native vegetation propagated and planted;
- a biodiversity education calendar (6,000 copies);
- 15 biodiversity education days for schools; and
- a field day at Kinnaird's Wetland attended by 75 people.

The Broken Boosey CMN, which began in 2002, was one of four finalists in Parks Victoria's Environment and Sustainability Award as part of the Regional Achievement and Community Awards.

The Whroo Goldfields CMN has already achieved impressive results, despite only starting in 2008. Achievements for 2008-09 include:

- 24,000 hectares of private land baited for foxes by 46 landholders
- 50,000 hectares of public land baited by Parks Victoria, Puckapunyal Army Base and Department of Sustainability and Environment
- 346 Brush-tailed Phascogale nest boxes were built and installed by Drought Employment Program crew.

In addition, a bird identification booklet covering the two CMNs (Broken Boosey and Goldfields) was prepared and 4,000 copies were distributed.

Native animals are monitored annually and results help to inform landholders of the benefits of undertaking works and adjusting management.

Jaye Caldwell (DPI) with students from St Mary of the Angels Regional College at an Biodiversity Education Day. Photo: Lanie Pearce, Conservation Management Network member

Case study from 2008-09 (GBCMA 2009)

investment from the Australian Government to increase the size of the National Reserve System (e.g., through the Caring for Our Country program).

Major policies emerging from Victorian and Australian governments will impact significantly on biodiversity. The Goulburn Broken CMA works effectively to align regional long-term strategies and annual funding proposals with the directions of the State and the Commonwealth. Emerging markets for carbon also present opportunities for retaining and sequestering carbon while supporting biodiversity conservation. However, a National Emissions Trading Scheme and the opportunities and threats this may pose to biodiversity are yet to be fully understood.

At the end of 2009, the Victorian Government released a White Paper for Land and Biodiversity at a time of Climate Change: *Securing our Natural Future*, which is a 'long-term strategic framework to secure the health of Victoria's land, water and biodiversity in the face of ongoing pressures and a changing climate over the next fifty years' (DSE 2009a).

Goulburn Broken CMA's approach in recent years of protecting and restoring landscapes at large scales is consistent with the flagship and biolink approach described in the White Paper (DSE 2009a).

"There are three inter-related elements to the new framework for action: build resilience of Victoria's ecosystems; manage flagship areas to maintain vital ecosystem services; and improve connectivity within important landscapes identified as biolinks.

The Victorian Government is responsible for leading the development, communication and implementation of its vision for the environment. A business-as-usual approach to natural resource management will not keep pace with the mounting threats faced by Victoria's land, water and biodiversity assets. The challenge of adapting to climate change and the pressures of population growth increase the urgency of reforming natural resource management organisations and processes.

The reform agenda includes structural reform of NRM organisations, administrative and enabling reforms, improved investment frameworks, better knowledge management, and a modern legislative framework."
(DSE 2009a)

The Victorian Government is also renewing its *Biodiversity Strategy* (draft released for public comment on 5th May 2010, DSE 2010a).

The *Regional Catchment Strategy* will be updated in 2011, and will be broadened to match the new Natural Resource Catchment Authority (NRCA) area described in DSE (2009a), covering the former Goulburn Broken, North Central and North East Catchment Management Authority areas.

The Australian Government released *Australia's Biodiversity Conservation Consultation Draft* in 2009 (Commonwealth of Australia 2009) setting a national direction for biodiversity conservation over the next decade and asking all Australians to contribute.

Victorian and Australian governments guide a significant proportion of short and medium-term investment in environmental management through the *Victorian Investment Framework* and the *Caring for our Country* Business Plan.

The relationship of this Biodiversity Strategy with other regional strategies is shown in Figure 2 and described in detail in Appendix 1. Appendix 1 also includes a list of other relevant government policy and legislation.
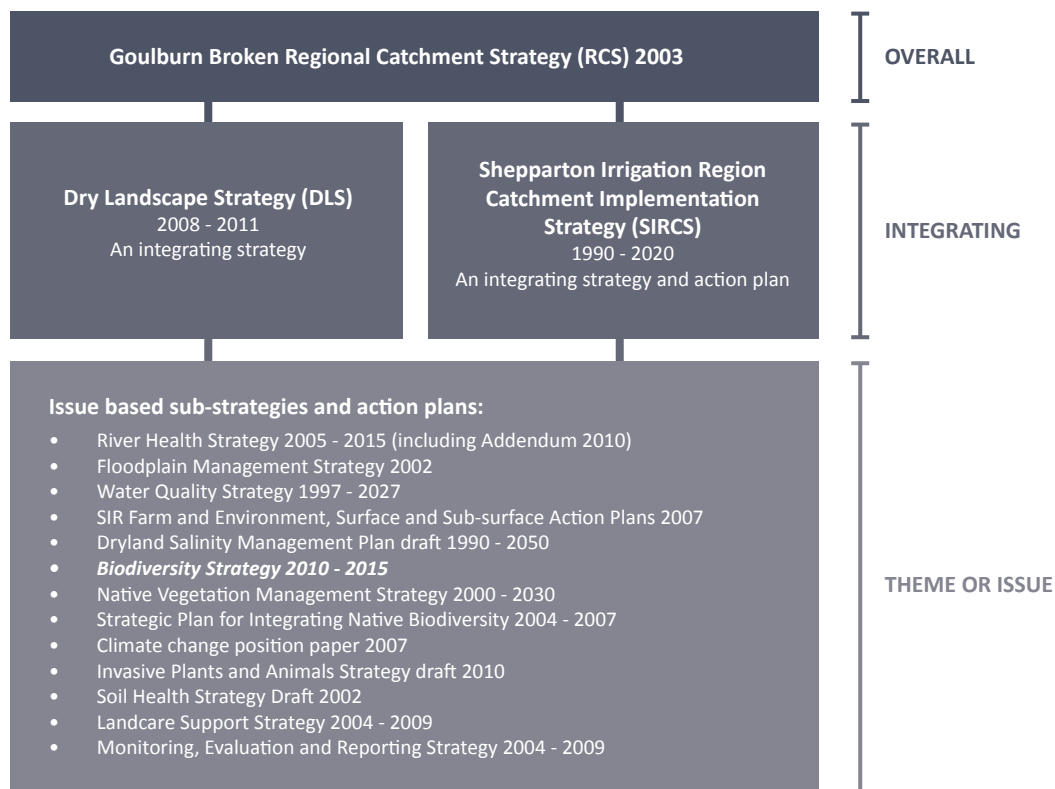
Goulburn Broken Regional Catchment Strategy (RCS) 2003	OVERALL
Dry Landscape Strategy (DLS) 2008 - 2011 An integrating strategy / **Shepparton Irrigation Region Catchment Implementation Strategy (SIRCS)** 1990 - 2020 An integrating strategy and action plan	INTEGRATING
Issue based sub-strategies and action plans: • River Health Strategy 2005 - 2015 (including Addendum 2010) • Floodplain Management Strategy 2002 • Water Quality Strategy 1997 - 2027 • SIR Farm and Environment, Surface and Sub-surface Action Plans 2007 • Dryland Salinity Management Plan draft 1990 - 2050 • *Biodiversity Strategy 2010 - 2015* • Native Vegetation Management Strategy 2000 - 2030 • Strategic Plan for Integrating Native Biodiversity 2004 - 2007 • Climate change position paper 2007 • Invasive Plants and Animals Strategy draft 2010 • Soil Health Strategy Draft 2002 • Landcare Support Strategy 2004 - 2009 • Monitoring, Evaluation and Reporting Strategy 2004 - 2009	THEME OR ISSUE

Figure 2: Goulburn Broken Regional Catchment Strategy and Sub-Strategies Structure

2.3
Progress in implementing long-term strategies

Our decisions for investing are based on the drivers of change, our understanding of progress including the scale of the challenge, and the resources available.

Government investment often dictates the levels of investment in each investment type (on-ground works; knowledge; planning and responding; and relationships, partnerships and community capacity) although the Goulburn Broken CMA attempts to ensure the balance of investment between the different types is appropriate for the issue. The emphasis on different types of action changes over time. For example, the emphasis in knowledge peaks at the start whereas the emphasis in on-ground works peaks after several years.

We are at a different stage in 'maturity' for different natural resource management issues. For example, investment in irrigation salinity began much earlier than investment in climate change adaptation. Biodiversity is somewhere between the two.

There has been an increase in positive action in recent decades following increased acceptance of the challenge to improve the condition of biodiversity.

The Goulburn Broken catchment community has been implementing long-term strategies that have addressed biodiversity conservation for over two decades. Strategies focused primarily on biodiversity are the Goulburn Broken Native Vegetation Management Strategy, NVMS (GBCMA 2003a), From the Fringe to the Mainstream: A Strategic Plan for Integrating Native Biodiversity (McLennan *et al.* 2004) and the Goulburn Broken Regional River Health Strategy 2005–15 (GBCMA 2002). Before 2000, two of the key documents that included biodiversity considerations were the Dryland Salinity Management Plan (1990) and the Shepparton Irrigation Region Land and Water Management Plan (1990).

The extent of native vegetation is a major medium-term (circa 20 years) indicator for achieving desired long-term biodiversity outcomes. Given a range of assumptions and best available information, it appears that an increase in the extent of native vegetation has occurred (see Figure 3). However, the graph highlights that a dramatic acceleration would be needed to achieve the projected 2030 target that was first developed by GBCMA (2003a) (see also section 3.2 on updated targets, and Appendix 6).

Progress against native vegetation extent target[i]
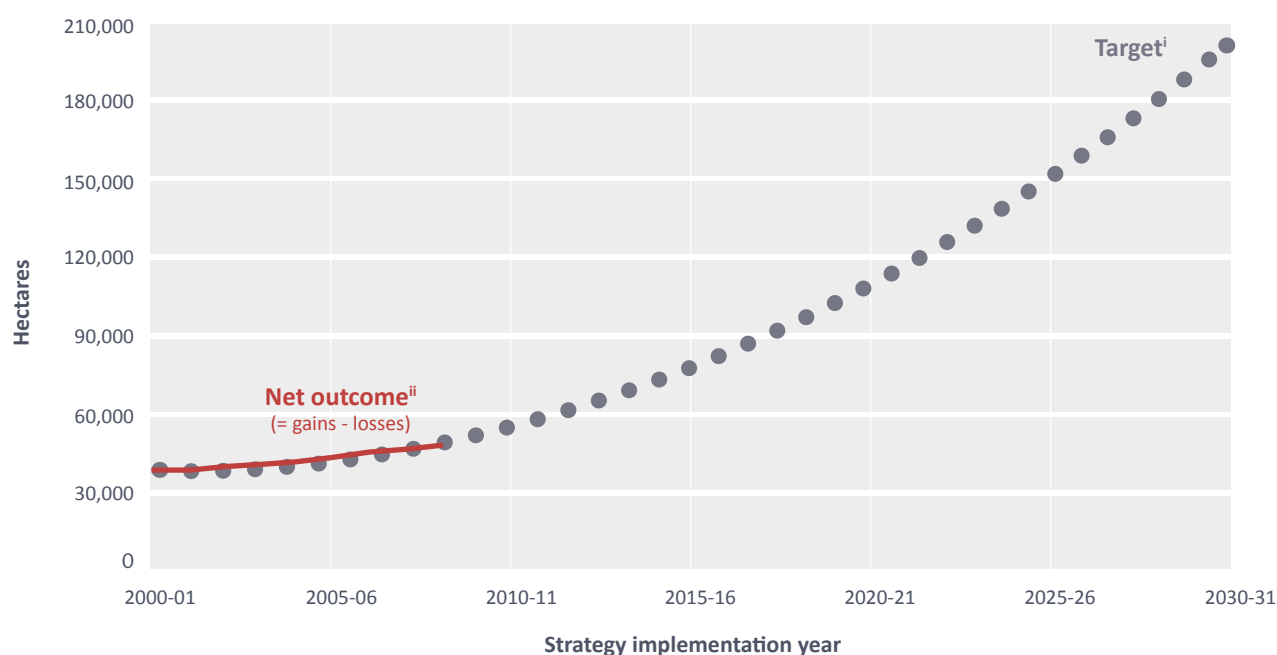
i. Resource condition target (GB CMA 2003a): 'Increase cover of all endangered and applicable vulnerable Ecological Vegetation Classes to at least 15 per cent of their pre-European vegetation cover by 2030'. This equates to an increase in vegetation extent of these vegetation classes to 200,000 hectares.

ii. Based on assumptions on gains in vegetation (such as revegetation and natural regeneration) and losses of vegetation (such as legal and illegal clearing). Vegetation burnt in the 2009 fires has not been included as a loss of extent, as it is assumed the area burnt will regenerate by 2030. Direct vegetation removal associated fire clearing is assumed as a loss in the net outcome. Detailed assumptions can be found at www.gbcma.vic.gov.au

Figure 3: Progress against native vegetation extent target as reported in GBCMA (2009). The graph provides a general depiction of progress given best available knowledge

A review of progress found that most tasks listed in the NVMS and the Strategic Plan for Integrating Native Biodiversity were completed on schedule and found that an urgent update of strategic direction was needed. Highlights of progress drawn from the reviews include:

- biodiversity is now a primary factor in natural resource management decision-making;
- recording and understanding progress has improved dramatically;
- a framework for identifying research priorities has been developed and is resulting in several collaborations with research institutions;
- voluntary and government investment in biodiversity has increased;
- levels of on-ground works have increased as more investment, new mechanisms (such as Bush Returns) and ideas for achieving change have emerged;
- the conservation management network model has been successful in addressing the interface of public and private land management;
- partnerships between agencies and between agencies and non-government organisations have been strengthened, especially between Goulburn Broken CMA, DPI, DSE, local government and Trust for Nature;
- Goulburn Broken CMA's River Health and Biodiversity programs are becoming closely aligned;
- information for prioritising and communicating biodiversity issues is more readily available;
- preliminary investigations have been undertaken into corporate and philanthropic investment in biodiversity as part of a whole-of-community approach ;
- local government has adopted biodiversity risk mitigation protocols across the catchment and rate rebates for conservation activities on private land are being delivered by some local governments;
- use of cost-effective direct seeding over tube-stock planting of native vegetation has increased significantly; and
- Indigenous cultural heritage needs are being closely aligned with aquatic biodiversity programs.
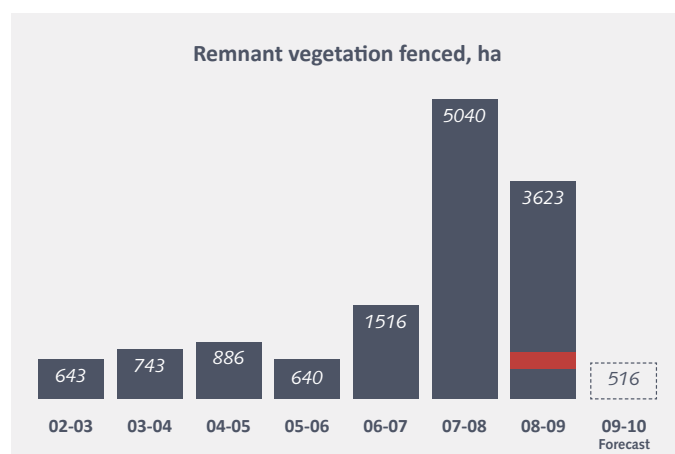
Improvements in management that are resulting in some improvements to the condition of biodiversity include:

- important sites covenanted or purchased (Trust for Nature, National Reserve System);
- increased natural regeneration of native vegetation through land use change;
- considerable revegetation, remnant protection and stewardship/management for natural regeneration through market-based approaches (Bush Returns, Green Graze, BushTender);
- large areas protected through incorporation into the national reserve system (Box-Ironbark woodlands and River Red Gum forests, including creation of the Lower Goulburn National Park and Barmah National Park in 2010);
- environmental water allocations delivered to important wetlands and floodplains (but more is needed);
- institutional relationships and mechanisms have strengthened, particularly with regard to environmental water allocations; and
- reduced legal and illegal vegetation clearance rates (although impacts of post Black Saturday bushfire clearing need to be assessed).
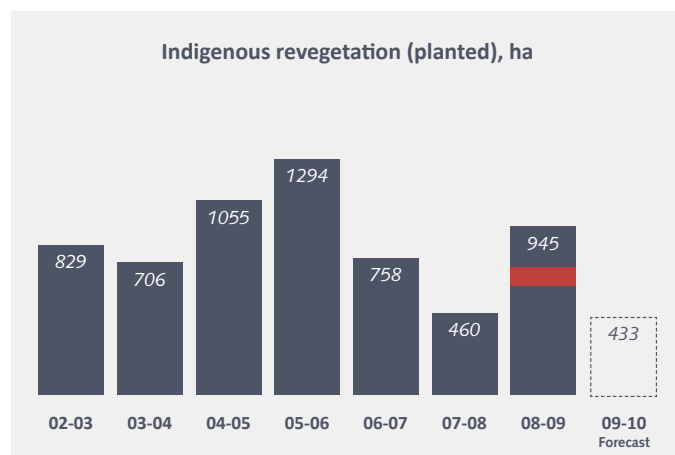
"The Local Government Biodiversity Risk Management Project is an example of a great partnership between local government and the GBCMA. While the project group was initiated to develop the Biodiversity Risk Management Protocols in 2006, the forum has continued, providing great support to local government in terms of sharing information about biodiversity and new programs and funding opportunities. The forum provides good networking opportunities across local governments as well as across government departments and agencies. The group's new project 'Backbone to Biolinks' is an example of a multi-institutional, multi-tenure project that has the opportunity to initiate landscape-scale change." Shire of Campaspe submission on the consultation draft of this strategy.

Most biodiversity outcomes are achieved through partnerships both within and external to the Goulburn Broken CMA. For example, the Drought Employment Program is a whole of CMA and community initiative which has provided a boost to on-ground biodiversity works, particularly fencing of waterways (see Figure 4).

Exceptional achievement due to Drought Employment Project (in 2006-07 to 2008-09)

Remnant vegetation fenced, ha

643	743	886	640	1516	5040	3623	516
02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10 Forecast

Achievement from many programs

Indigenous revegetation (planted), ha

829	706	1055	1294	758	460	945	433
02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10 Forecast

■ Target for 08-09

Figure 4: On-ground works achieved from complementary programs, 2002–03 to 2008–09 (from GBCMA 2009)

What are we aiming for?

3. Biodiversity outcomes

Biodiversity outcomes are achieved by minimising loss of biodiversity and maximising functionality of ecosystems. On that basis the two key objectives for biodiversity conservation as listed by DSE (2009b) are that:

1. *Species survive in the natural environment where possible, as does the genetic diversity that drives their evolutionary potential and their ability to cope with natural disturbances and future threats.*

2. *Native ecosystems retain as much of their natural function as possible, and where this is diminished, are able to recover to the extent that they meet species persistence and human needs goals.*

A vision provides a desired image for biodiversity in the long term. Ecological outcomes help to tease apart the vision. Finally, to help measure these outcomes, targets are used to quantify where possible, an end state for key elements of biodiversity. Together, outcomes and targets are indicators of progress towards the vision. See Table 4.

Hierarchy	Context	
Vision	Defines overarching, long-term outcome for biodiversity in the Goulburn Broken Catchment	Healthy ecosystems supporting viable populations of flora and fauna
Ecological outcomes	Assist in development and articulation of the vision. Based on expert and local knowledge, national and state biodiversity priorities (Miles 2009) and current literature on ecological processes (e.g. McGregor et al. 2008; Bennett *et al.* 2009). First developed for the Goulburn Broken Catchment in 2007 by Barlow *et al*.	• protected and secured habitat • landscape and habitat connectivity • ecological processes, energy and gene flow • high quality habitat • viability of threatened species; and • representation of habitat/increased extent of threatened EVCs to a viable level
Long-term biophysical targets	A way of defining/quantifying the type, amount and distribution of biodiversity assets that need to be conserved to achieve the vision	Key target themes which are quantifiable surrogates for ecological outcomes (e.g. ecosystem function and conservation of soil biota) and for reporting progress: • native vegetation extent • native vegetation quality • threatened species

Table 4: Strategic hierarchy for long-term biodiversity planning in the Goulburn Broken Catchment

3.1
Biodiversity Vision, 2050

> *Healthy ecosystems supporting viable populations of native flora and fauna*

This complements the Goulburn Broken CMA's overarching vision for the catchment, which is: *Healthy, resilient and increasingly productive landscapes supporting vibrant communities.*

The following description is based on what the land management and biodiversity outcomes would look like if the vision was fully realised in 2050.

Vision description

The community of the Goulburn Broken Catchment has been a proud participant in the international galvanising movement to abate global warming. The pathway to achieving this has changed the way we relate to the land, how we manage our natural resources, the scale at which we farm, and the development and trade of new commodities. Because of this, the catchment is nationally renowned for its grand mountain ranges, its expansive floodplains, the flocking of large populations of water birds to congregate in its ephemeral wetlands, the abundance of native fauna and seasonal wildflowers; all of which are intractably linked to our national icon – the mighty Murray River. As the Murray winds its way to demarcate the north of the catchment, it meets its largest tributary – the Goulburn River. As with all the rivers in the catchment, the natural flooding regime, the ecological needs of the surrounding floodplain, and the health of the river underpin the way we manage and relate to these national treasures. The health of the surrounding land, its capacity and its associated land use is highly productive and sustainable as a result.

The Goulburn Broken Catchment is renowned for its diversity of landscapes, from alpine environments, to granite ranges, rolling woodlands and vast plains. Within each of these landscapes ongoing land management promotes their unique natural features, where land managers are astute to the needs of the local flora and fauna and work within the limitations of the productive capacity of the land. The intrinsic environmental values are appreciated and the whole community is contributing to the cost of maintaining these values. Local communities are strong, resilient and vibrant, with local economies built on the features of the natural environment – tourism, local food production, community supported agriculture, biodiversity credits, and native vegetation carbon sequestration.

A significant portion of public land within the catchment is managed for conservation, with any products resulting from these lands carefully selected for their value-added potential (e.g. bush tucker, craft timber, medicines). Plantations that support a vibrant forestry industry are built on an integrated approach of meeting carbon-trading agreements and biodiversity credits.

With an engaged community fully aware of the inter-dependence of society and environment, the functioning of our natural ecosystems is highly valued and much better understood by the scientific and local community.

3.2
Long-term biodiversity targets

Given the complexities of natural ecosystems, it remains difficult to set catchment-scale targets with certainty that they will lead to achieving the biodiversity vision and underlying ecological outcomes. However, setting catchment-scale targets improves catchment-scale decision-making by helping to:

- quantify the current understanding of the type, amount and distribution of biodiversity assets that need to be conserved to achieve the vision;
- communicate the large scale of on-ground change needed. The target amount may not be precise, but the scale of the target is more certain, and more important;
- provide a reference point to aim towards. In doing so targets create a common sense of purpose and direction at all scales (from catchment to paddock);
- convey that individual actions have impacts at a catchment scale. For example, a two hectare revegetation project has positive impacts at the property scale while also contributing to the catchment scale targets and outcomes;
- develop key research questions. This research helps us to improve our understanding of the biodiversity outcomes that we are after, and the actions required to achieve these; and
- satisfy the needs of important external stakeholders (including government investors).

Some changes to the biodiversity targets first developed in 2000 and updated in 2003 (GBCMA 2003a; GBCMA 2003b) have been made to reflect improvements in knowledge (Appendix 6; Keogh *et al.* 2009). The revised biodiversity targets outlined below are specific, measurable, achievable, relevant and time-related. As with the 2003 targets, the revised targets are based on:

- a balance of what the science suggests is needed and what is deemed feasible given the degree of landscape modification and ongoing threatening processes; and
- what the community regard as being achievable given a reasonable level of public and private investment. This investment includes continued patterns and trends of significant private contributions in such forms as volunteer labour and an increasing willingness of the broader community to invest in private land conservation for the public good.

The targets have been developed as a surrogate for broader biodiversity outcomes that are difficult to measure; it is assumed that through achieving the targets, broader outcomes such as promoting ecological processes and conserving soil biodiversity will be achieved, and progress will be made towards achieving the vision. Targets for other elements of biodiversity, including threatened species and soil biota, will be pursued as more information becomes available and through actions within the Strategy. Targets may need to be adjusted over time to accommodate new information or changes emanating from relevant policy, such as Victoria's Land and Biodiversity White Paper.

Native vegetation targets

The native vegetation targets focus on the extent and quality of native vegetation. Ecological rationale has guided the amendment of the targets which were first developed in the *Native Vegetation Management Strategy 2000* (GBCMA 2003a). Based on this rationale, the amount, type and quality of native vegetation is assumed to be important in achieving the vision and the associated ecological outcomes. The spatial configuration is also assumed to be important, and the revised targets incorporate a more thorough consideration of strategic spatial distribution to allow landscape connectivity objectives to be better reflected. Previous targets had a strong focus on restoring threatened EVCs without much discrimination between landscape types. The approach aligns with the concept of regional-scale biolinks presented in DSE (2009a). Further information, including changes made to the previous targets and the approach used to develop the revised targets can be found in Appendix 6 and Keogh *et al*. (2009).

The revised native vegetation targets for this Strategy are:

> **Target 1:**
> **Maintain extent and quality of all native vegetation at 2005[2] levels.**
>
> **Target 2:**
> **Increase the extent of native vegetation in fragmented[3] landscapes by 70,000ha by 2030 in order to restore threatened EVCs and improve landscape connectivity (relative to 2005[2] levels).**
>
> **Target 3:**
> **Improve the quality of 90% of existing (2005)[2] native vegetation by 10% by 2030.**
>
> These targets are in-keeping with the goal of 'net gain' listed in Victoria's Biodiversity Strategy 1997 (DSE 1997).

The Goulburn Broken CMA is a partner in the Landscape Logic project, a multi-agency Commonwealth Environment Research Facilities research hub which is looking to test a number of the assumptions used by the Goulburn Broken CMA in measuring progress towards targets. One major sub-project analysed patterns and macro-drivers of change in woody vegetation extent since the 1940s. Preliminary results indicate that there has been a reverse in the decline of woody vegetation loss, owing far more to natural regeneration around remnant trees and reserves than to revegetation. Results from property-scale mapping also challenge previous work (Ambrosio et al. 2009) on the Goulburn Broken CMA's 'times 2' assumption. The new data suggest the 'times 2' assumption overestimates gains in extent of native vegetation through privately funded action.

See www.landscapelogic.org.au

Monitoring progress towards native vegetation targets

The Goulburn Broken CMA uses an equation, 'Outcomes = Outputs x Assumptions' to determine progress towards targets. In doing so, best available knowledge is used to inform our understanding of the changes in vegetation extent and condition in the catchment resulting from funded and unfunded activities. For example, we know how much revegetation is occurring through Goulburn Broken CMA funded projects (outputs) and make assumptions about how much revegetation is occurring outside of this funding (such as privately funded activities). Changes brought about through processes such as fire and direct removal of native vegetation are also considered. This approach to measuring progress enables areas of significant uncertainty (such as the impact of 2009 Black Saturday fires, and the appropriate measurement of vegetation quality change over time) to be identified for improvement through research. The Goulburn Broken CMA will continue to apply and refine this approach through the implementation of this Strategy and periodic reviews of outputs achieved and assumptions made. These are documented in a dynamic (annually updated) Biodiversity Monitoring Action Plan, available at www.gbcma.vic.gov.au.

DSE is developing sophisticated models of species distributions and habitat suitability. It is anticipated that these models will assist with target setting in the future. Further consideration of 'resilience thinking' (e.g. thresholds of potential concern relating to ecosystems and species) and classifications of function, structure and composition (Noss 1990) may also be helpful in guiding future targets.

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[2] *Targets are based on a subset of the latest native vegetation data from DSE (DSE 2007d). The subset does not include grassy vegetation extent. Further details are provided in Keogh et al. 2009, along with areas (ha) required to achieve targets per bioregion and EVC. Note – progress towards Target 2 is based on the area of native vegetation subject to a change in quality by at least 10%, as an accurate benchmark of vegetation quality upon which to consistently measure catchment-scale change is not currently available.*

[3] *Intact, Fragmented and Relict landscapes as modelled by DSE (DSE 2009c).*

Threatened species targets

A threatened species target was developed as a part of the Native Vegetation Management Strategy (GBCMA 2003a) in recognition of the potential impact of species extinction on biodiversity (see Appendix 6). However, during the review of targets (Keogh *et al*. 2009), the existing threatened species target was deemed to be of limited value as it was based on achieving changes in conservation status; and as many of the threatened species and communities have ranges outside of the Goulburn Broken Catchment, a change in conservation status is reliant on activities outside of the catchment. Taxonomic changes and time lags also confuse targets based on conservation status. DSE is aiming to develop a consistent, systems-based approach to threatened species reporting that will be used by a range of stakeholders such as CMAs and Parks Victoria. The Goulburn Broken CMA is exploring a revised target in collaboration with DSE (to be developed during the implementation of this Strategy). This is likely to be based on the status of populations and/or the level of threat to populations.

Links to other programs

River Health

Aquatic, riparian and wetland biodiversity are all important components of biodiversity. While being catered for to a certain degree in the Goulburn Broken CMA biodiversity targets, aquatic, riparian and wetland biodiversity are a strong focus of the Regional River Health Strategy and updated planning is currently in place. A key focus under this Strategy is to continue to strengthen the links between the Biodiversity and River Health programs of the Goulburn Broken CMA.

Pest Plants and Animals

The Goulburn Broken CMA and its partners recognise the importance of controlling pest plants and animals for biodiversity outcomes. While targets 1 and 3 in this Strategy consider weeds as a component of vegetation quality, no specific biodiversity targets were set for pest plants and animals for two reasons. Firstly, these targets would not be consistent with the assets-based nature of the biodiversity targets. Secondly, a Regional Invasive Plants and Animals Strategy (IPAS) is currently under development and is due for completion in 2010. The Goulburn Broken CMA's Biodiversity Program is involved in the development of the IPAS and will work with relevant staff to incorporate biodiversity outcomes (in asset protection objectives), and monitor progress towards the targets of relevance.

Community Capacity

Capacity building activities enable biophysical targets to be achieved. While no specific targets were set for these activities, community capacity and engagement indicators have been developed to complement biophysical indicators, helping to evaluate the outcomes of this Strategy. Relevant capacity building actions have also been included in Section 5 of the Strategy. The biophysical processes and capacity building activities will need to be monitored separately, but considered simultaneously when evaluated; we have learnt that the environment must not be separated from people when decisions are made.

4. Prioritising geographic areas

There is a need for increased transparency, accountability, efficiency and strategy for public investment in biodiversity conservation and restoration. While there is a sufficient array of tools, resources and decision frameworks available to decision makers (Wintle 2008), the challenge is deciding on the right tool for the situation and acknowledging that one size does not fit all.

The highly complex, interconnected nature of biodiversity poses many challenges for identifying specific priority assets. Taking a long-term strategic and ecosystems approach to prioritisation is required to work towards the vision. Information and tools developed by the state government help to achieve this, however, catchment and sub-catchment scale planning helps to identify biophysical and community issues at the right scale to enable projects within national and state priority areas to be achieved. These processes need to be dynamic to adapt to improved scientific information as it emerges, and involve those who are most familiar with the region and its assets.

Biodiversity assets can be categorised and prioritised at various scales. Table 5 shows how investment decisions are made at various levels. Australian and state government investment priorities clearly influence decision-making at the catchment scale. At the other end of the spectrum, Biodiversity Action Planning (BAP) prioritises site-scale assets (e.g. patches of native vegetation) using criteria based on the Native Vegetation Management Framework (Department of Natural Resources and Environment 2002) and focal species requirements (see Appendix 7). To further prioritise these assets, annual (BAP) implementation plans are developed to identify and target specific assets within known budget and operational constraints. Asset identification at this level is based on extension officers establishing local ecological objectives (in line with catchment-scale priorities) and assessing assets, threats and importantly, the feasibility of interventions (see Stothers 2009).

This implementation planning process is in its infancy, but provides a rapid and practical assessment by biodiversity extension staff to inform annual priorities. Incentive program matrices and metrics are also designed to direct funding to sites meeting priority criteria.

During the development of this Strategy, there was a focus on prioritising at a sub-catchment scale as this was identified as a gap, particularly for progressing large-scale projects. The catchment was divided into 14 geographic zones, each with their own ecological attributes and functional characteristics. Profiles of the 14 zones have been drafted (Miles and Stothers 2009) to identify key characteristics such as the proportion of native vegetation, ratio of public to private land, key assets, threats and opportunities. These profiles provide a preliminary overview of characteristics and ideas for further assessment and for seeking funding as opportunities arise and change over time. A summary of the zone characteristics is provided in Table 6.

Scale*	Key tools[4]	Description	Purpose
National	Legislation, *Caring for our Country* program priorities	Listed species and vegetation communities.	Communicates national biodiversity priorities.
State	Biodiversity assets surface[5] (Appendix 4). Note: the impending 'Natureprint' initiative of the *Victorian Biodiversity Strategy Consultation Draft* (DSE 2010a) will inform State and regional priorities in the future.	Models of native vegetation, wetlands and threatened species and assessments of regional and local landscape connectivity. Designed for use at a regional scale (1:500,000).	Spatially represents biodiversity values across relict, fragmented and largely intact landscapes.
	Land and Biodiversity White Paper Flagship and Biolink areas, also used in Victorian Investment Framework priorities.	Broad statewide flagship areas to be managed to maintain ecosystem services, and a system of biolinks to strengthen connectivity.	Communicates land and biodiversity priority areas across the state, including catchments.
	Legislation, Flora Information System, Fauna Information System.	Listed species and locations.	
Catchment	Broad biodiversity protection and restoration areas (see Figure 8A, Appendix 8).	Strategic focus areas for protection and restoration.	Broadly communicates where protection and restoration efforts will be focused.
Sub-catchment	**Geographic zones (see Figure 5).**	**Broad geographical units with similar ecological values that can be prioritised.**	**Informs catchment planning and investment, in particular the development of appropriate landscape-scale projects.**
	NRM Reporting Guidelines (from DSE) require Landscape Action Plans	Spatially-based sub-regional plans that articulate management activities to implement catchment strategies. Based on NRM Planning and Reporting Units.	To be confirmed with DSE.
Local area	Biodiversity Action Planning mapping (see Appendix 7)	Spatial representation of priorities based on bioregional conservation status, threatened species, size, etc.	Informs local and annual planning and targeted on-ground implementation by extension officers.
Site/patch	Vegetation quality assessment, management plans.	Identifies site value attributes and on-ground management needs, taking into account surrounding values and contribution towards broader objectives.	Targets specific ecological needs of sites.

* These various scales influence each other from above and below.

Table 5: Levels of decision making for identifying and prioritising biodiversity assets, highlighting the scale at which geographic zones are considered

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[4] Relevant policies and legislation are summarised in Appendix 1.

[5] A new spatial layer that will help guide prioritisation 'Derived from the combination of (A) a dataset reflecting concentrations of state-level biodiversity values – i.e. presence of Rare/Depleted Vegetation/Wetlands & Richness of rare or threatened species' habitat and (B) a dataset representing Broad Functional Landscapes – i.e. Landscape Fragmentation/Connectivity. Note: The fragmented landscape offers the most opportunities for building connectivity in the landscape.' (From Biodiversity Assets Surface Metadata, DSE March 2009)

The zones were assessed based on their existing biodiversity attributes and the potential to contribute to the vision and ecological outcomes described in Section 3 to identify broad zones of focus for the life of this Strategy. The method used is summarised in Appendix 8. Figure 5 shows the results of the assessment, including a comparison with state-wide priorities (DSE 2009a).

The zone assessment highlighted the most intact zones such as the South-Eastern Highlands, the Murray Corridor and the Goldfields as those with the highest scores for existing biodiversity values (native vegetation condition, soil health, species diversity etc) and reflect areas of priority for maintaining and improving biodiversity condition. A different set of priority zones were identified for restoration potential and priorities for increasing native vegetation extent and quality, namely the Lower Goulburn and Broken Rivers, and the Longwood and Violet Town Plains.

Overall, lower ranking zones generally reflect the more relict (highly modified) landscapes. Significant assets, including wetlands, exist within these zones, and should not be dismissed (see for example BAP Mapping in Appendix 7 or DSE's Biodiversity Assets Surface in Appendix 4). However, investment in landscape-scale change is best applied in less modified areas of the catchment where there is greater ability of systems to respond quickly (e.g. regenerate naturally) to changed management. Zones that have the ecological infrastructure (rivers, creek systems, wetlands and native vegetation) and space upon which to expand are a priority in terms of achieving both protection and restoration of biodiversity.

The zone assessment provided an inclusive, objective approach to prioritisation at a sub-catchment level. With the key steps now in place an opportunity exists to review and refine new information and alignment with government priorities over time and based on wider input. As this is applied, greater links between targets and zone prioritisation will also be valuable.

Zone (and functional landscape type)	General characteristics
South-Eastern Highlands (Largely Intact)	• large proportion of native vegetation, significant contribution to ecosystem services • land tenure security • alps bioregion and vegetation, threatened species habitat • nationally significant wetlands • already heavily vegetated, so quality target applies more than extent target
Goldfields (Fragmented)	• large core areas of native vegetation • land tenure security • substantial time lag before sufficient habitat is available e.g., large, hollow-bearing trees
Murray Corridor (Fragmented)	• land tenure security, improved protection of River Red Gum Forests following VEAC investigation • nationally significant wetlands, Barmah Wetland (RAMSAR listed) • large-scale connectivity (along waterways) • concentration of cultural sites • modified flooding regimes
Lower Goulburn and Broken Rivers (Fragmented)	• large Goulburn River floodplain • high regeneration potential • moderate to high vegetation condition • native pastures • concentration of cultural sites • nationally significant wetlands • modified flooding regimes
Broken Boosey Nine Mile Creek System (Fragmented)	• creek systems provide good connectivity • mix of land tenures • nationally significant wetlands • concentration of cultural sites • unique vegetation associations • modified flooding regimes
Strathbogie Tablelands (Fragmented)	• significant area for peatlands and spring soaks • high vegetation condition (localised), broadly moderate • distinctive vegetation associations • wildlife refuge
Warby Ranges and Foothills (Fragmented /Relict)	• includes diversity of landscapes from foothills to Winton Wetlands where biodiversity restoration potential is high after decommissioning of Lake Mokoan • some large areas of native vegetation such as the Warby Ranges • threatened species (e.g., Warby Gum, Carpet Python)
Longwood and Violet Town Plains (Fragmented)	• many of the areas within the Northern Inland Slopes (Box-Ironbark) provide high regeneration potential • large area of native pastures • highly cleared in some areas, competing productive land use in southern end of zone • east-west running creeks (e.g., Sevens and Pranjip), connecting Strathbogies to Goulburn River
Corop (Largely Relict)	• nationally significant wetlands • highly modified surrounds • modified flooding regimes
Upper Goulburn River (Fragmented)	• highly regulated stretch of the Goulburn River • important riparian vegetation • presence of large trees • adjoining network of wetlands in various states of condition
Yarck/Mansfield (Fragmented)	• large areas of hill country with native grasses and nationally significant woodlands – ability (for native vegetation) to respond quickly/positively with improved grazing management
Piper (Fragmented)	• some large patches of native vegetation such as Cobaw Ranges, Tallarook State Forest and Mt Piper • highly cleared and modified surrounds
Dookie (Largely Relict)	• some areas of nationally significant remnant vegetation such as the Dookie Bushland Reserve • highly modified agricultural (cropping) landscape
Northern Relictual Landscapes (Fragmented /Relict)	• small patches of threatened vegetation • nationally significant wetlands • highly modified, with a high proportion of irrigation and dryland cropping • numerous populations of threatened taxa

Table 6: Summary of biogeographical zone characteristics

Priorities for protecting ecosystem services

			Score
VERY HIGH	10	South-Eastern Highlands	80
	4	Goldfields	70
	7	Murray Corridor	70
	6	Lower Goulburn & Broken Rivers	65
HIGH	1	Broken Boosey Nine Mile Creek System	62
	11	Strathbogie Tablelands	61
	13	Warby Ranges & Foothills	55
MEDIUM	5	Longwood & Violet Town Plains	52
	2	Corop	51
	12	Upper Goulburn River	48
LOW	14	Yarck / Mansfield	42
	9	Piper	38
	3	Dookie	36
	8	Northern Relictual Landscapes	26
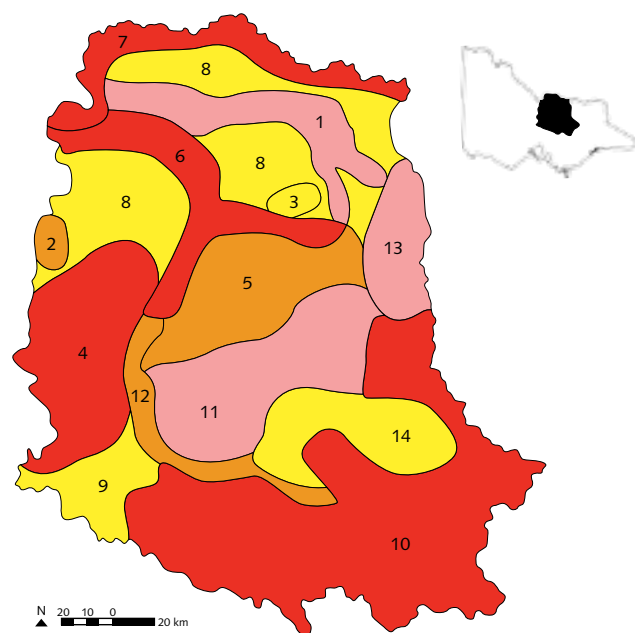
Priorities for restoration and improving connectivity

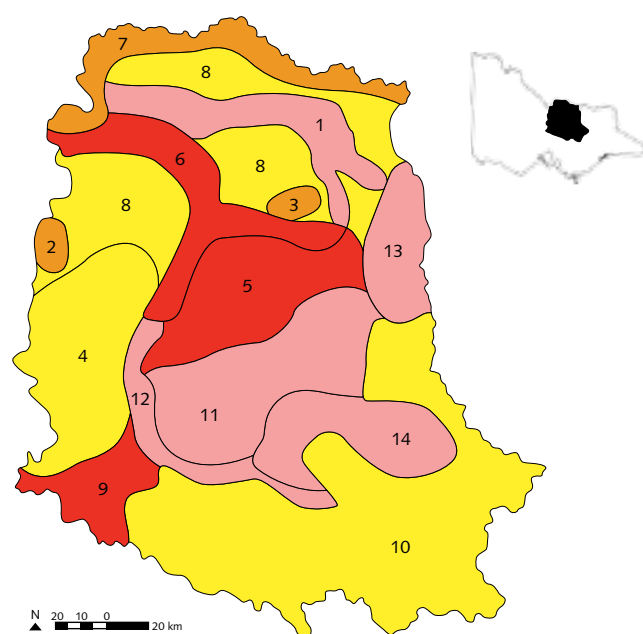|			Score
VERY HIGH	6	Lower Goulburn & Broken Rivers	66
	5	Longwood & Violet Town Plains	65
	9	Piper	63
HIGH	1	Broken Boosey Nine Mile Creek System	62
	14	Yarck / Mansfield	62
	12	Upper Goulburn River	62
	11	Strathbogie Tablelands	61
	13	Warby Ranges & Foothills	60
MEDIUM	3	Dookie	55
	7	Murray Corridor	48
	2	Corop	46
LOW	4	Goldfields	42
	8	Northern Relictual Landscapes	38
	10	South-Eastern Highlands	33

Figure 5: Priority zones in the Goulburn Broken Catchment showing the relationship to state level priorities

Relationship with priority flagship areas at a state level
'Assets within flagship areas are managed to maintain ecosystem services' (DSE 2009a)
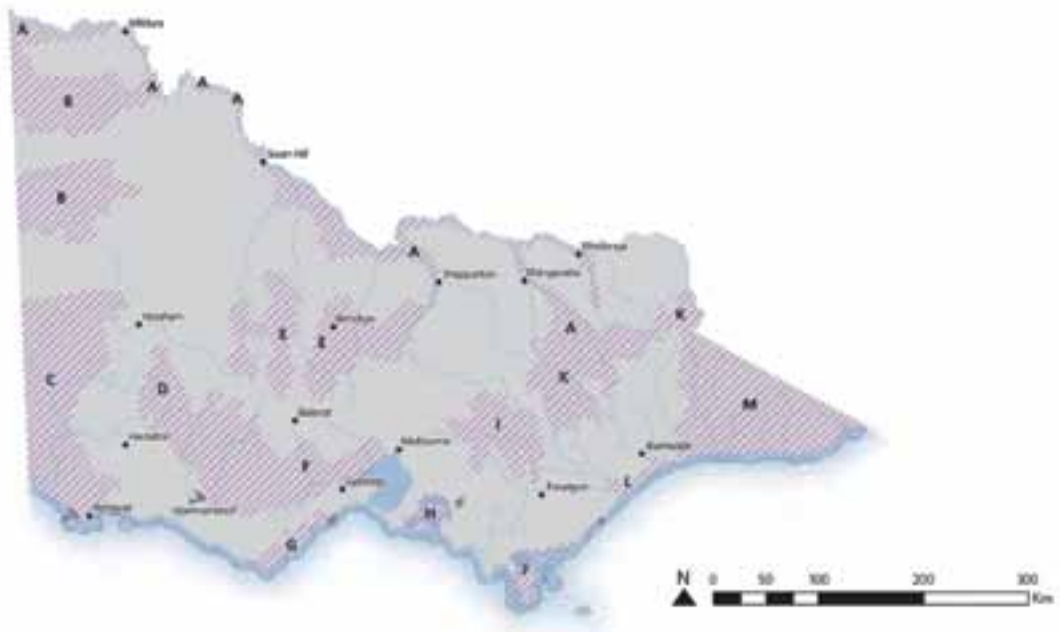
Relationship with priority biolink areas at a state level
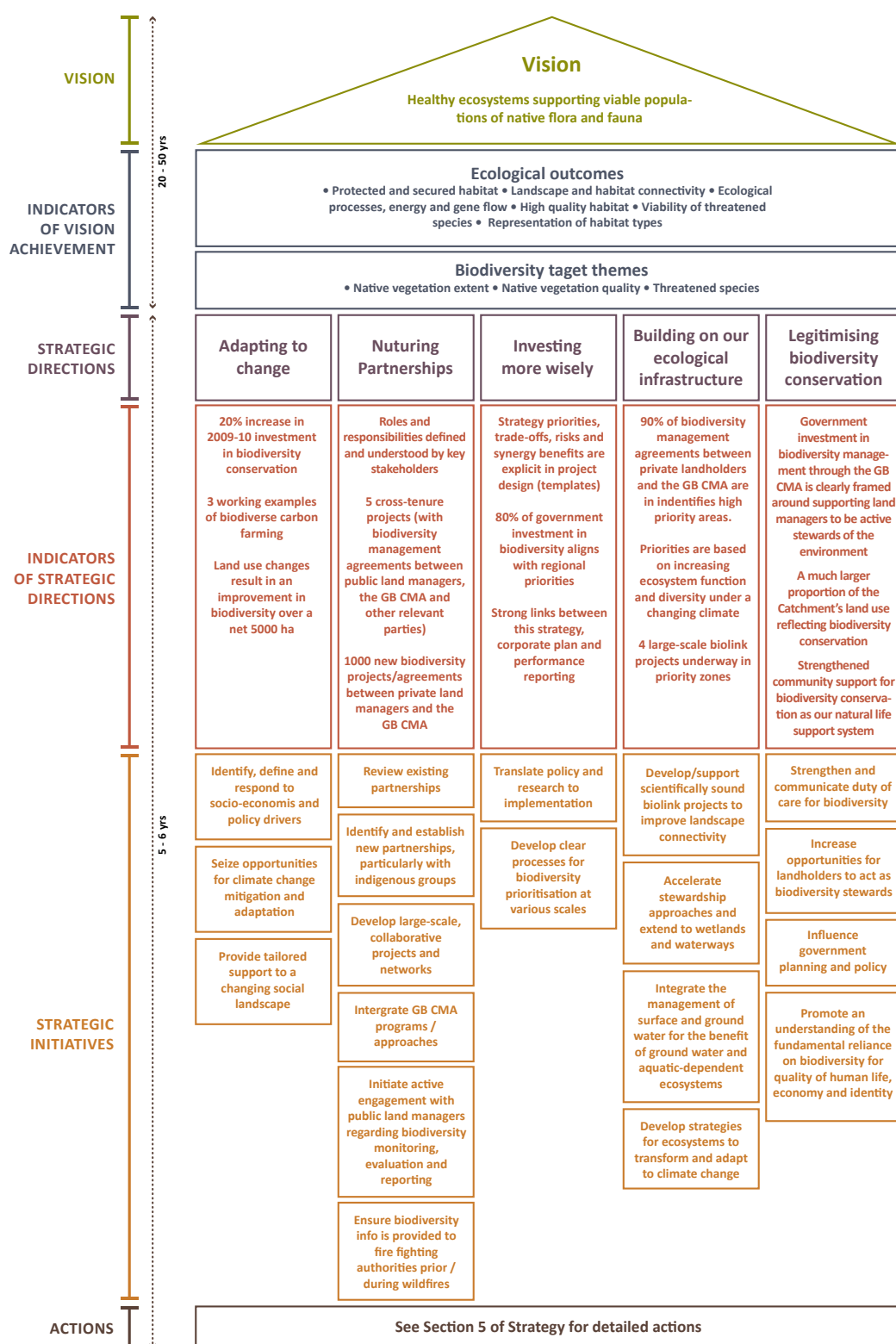*'A system of biolinks strengthens connectivity across Victoria' (DSE 2009a)*

Part C
How will we get there?

5. Strategic directions, initiatives and actions

Figure 6: The strategy framework: logic between vision and actions

Strategic directions, initiatives and actions have been developed to provide a focus for working towards Part B of this Strategy. The Goulburn Broken CMA will work with partners to implement this Strategy, including annual implementation planning that identifies specific tasks, timelines, responsibilities and priorities. Actions will be flagged to prospective investors as opportunities arise and details on timelines, costs and responsibilities will be provided when project proposals are formalised. It should be noted that the completion of actions will be subject to funding.

Strategic directions and actions are highly connected and many are interdependent. Some actions could quite easily sit under multiple directions. The order of the directions and actions is arbitrary.

The following five **strategic directions** highlight the key focus areas for Part C of the Strategy.

1. **Adapting to change**
2. **Nurturing partnerships**
3. **Investing more wisely**
4. **Building on our ecological infrastructure**
5. **Legitimising biodiversity conservation**

5.1
Adapting to change

Natural resource management policy and socio-economic drivers are changing rapidly, presenting significant threats and opportunities for biodiversity. We must be proactive to influence the consequences of change and ensure that biodiversity conservation is a primary consideration in decision-making. We also need to be aware of and actively pursue opportunities for attracting contributors and investors to help address increasing threats to biodiversity.

An explicit focus on biodiversity and the national reserve system from the Australian Government is evident through its 2009–10 *Caring for our Country* Business Plan. The Goulburn Broken CMA is adapting to this focus by strengthening partnerships with several land managers that have common biodiversity objectives. The Northern Rivers Natural Resource and Catchment Authority (NRCA) that will be formed in 2011 needs to ensure that biodiversity conservation is a primary objective in the updated *Regional Catchment Strategy,* which will cover the three former CMA areas, including the Goulburn Broken Catchment. Policy developments and carbon markets present potential opportunities for widespread carbon farming and revegetation that can be harnessed to have substantial biodiversity benefits. A rigorous risk management approach will be required to ensure counter productive biodiversity

outcomes are avoided such as plantation monocultures through the emerging carbon market and a potential *Carbon Pollution Reduction Scheme*.

The Goulburn Broken CMA will continue to proactively seek opportunities through any potential Carbon Pollution Reduction Scheme and voluntary carbon markets to promote investment in positive NRM outcomes through bio-sequestration activities. It will be important to work collaboratively with partner organisations, researchers, carbon brokers and landholders to provide guidance on required standards to achieve biodiversity conservation outcomes.

Major socio-economic trends in south-east Australia are providing increased opportunities for biodiversity at a large scale. While some land is being more intensively managed for irrigated and dryland agriculture, vast tracts are being less intensively managed. 'Lifestylers', including retirees, now own and manage more land for biodiversity conservation purposes (often areas that were previously managed for agriculture).

We will continue to align with policy directions via the *Victorian White Paper for Land and Biodiversity at a time of Climate Change*, the renewed *Victorian Biodiversity Strategy* and the *Victorian Strategy for Healthy Rivers, Estuaries and Wetlands.*

Key Indicators of success for Strategic Direction 1 (Adapting to change)

» **30% increase on 2009–10 investment into (terrestrial and aquatic) biodiversity conservation through external funding sources;**
» **three working examples of carbon farming that incorporate needs of biodiversity; and**
» **land use changes result in an improvement in biodiversity over a net 10,000 ha (some areas will continue to decline).**

Adapting to change: Strategic initiatives and Actions
1.1 Identify and explicitly define socio-economic and policy drivers that are or will significantly impact (positive and negative) on biodiversity and develop processes to ensure that we adapt and attract investment that results in sound biodiversity outcomes.
1.1.1 Annually identify national and state government priorities and develop an approach to align with these as appropriate.
1.1.2 Ensure biodiversity conservation is an overarching outcome of the next Regional Catchment Strategy and programs of the Northern Rivers Natural Resource and Catchment Authority (to be formed in 2011).
1.1.3 Identify and pursue companies looking for 'green' branding as a source of potential funding for biodiversity management.
1.2 Seize opportunities for climate change mitigation and adaptation by encouraging biodiverse carbon farming into the catchment, while taking an active risk management approach to address carbon capture schemes that promote monocultures instead of biodiverse revegetation (including natural regeneration).
1.2.1 Work collaboratively with carbon brokers to initiate large-scale, biodiverse revegetation projects.
1.2.2 Work with partner organisations to lobby government to influence carbon accounting (e.g., what gets recognised in a potential Carbon Pollution Reduction Scheme) to encourage biodiversity outcomes from biosequestration activities.
1.3 Provide tailored support to new landholders based on the changing social landscape to integrate biodiversity conservation into future land use and management.
1.3.1 Ensure biodiversity is well integrated into information packages and programs developed for new landholders.
1.3.2 Identify areas being converted/retired from irrigation to dryland farming and opportunities for enhancing biodiversity outcomes through land use change (link with 'New Dryland' program spanning North Central and Goulburn Broken catchments).
1.3.3 Increase the use of labour support for high priority sites (use learnings from Drought Employment Crews).
1.3.4 Identify and support commercial agricultural land uses that improve biodiversity.

5.2
Nurturing partnerships

The fate of biodiversity will be determined by a myriad of land managers. The Goulburn Broken CMA has therefore had a strong emphasis over the last decade on partnerships with land managers and those who influence them to achieve biodiversity outcomes.

Our partnerships and partnership approaches need to be continually reviewed so that crucial partners who can have maximum effect in implementing this Strategy are identified. This will include a clear understanding of the roles, responsibilities and capacity of stakeholders. While partnerships with private landholders (including Landcare) will remain paramount, stronger collaborations with public land managers and Indigenous groups will assist with an increased focus on large-scale, cross-tenure projects

National and regional parks created following the Victorian Environmental Assessment Council's (VEAC) River Red Gum Forests Investigation will result in co-management between Parks Victoria and the traditional owners, the Yorta Yorta Nation. This co-management arrangement is a first for Victoria and presents exciting opportunities for a better understanding of traditional land management. In addition, the *Aboriginal Heritage Act 2006* has established Registered Aboriginal Parties within the Goulburn Broken Catchment (Taungurung Clans Aboriginal Corporation and Yorta Yorta Nation Aboriginal Corporation), giving traditional owners a formal role in management of cultural heritage on country. A key objective of the legislation is to promote the management of Aboriginal Cultural Heritage as an integral part of natural resource management.

There is much to be learnt from the Conservation Management Network (CMN) model, which is centred on partnerships across different land tenures and provides a solution to problems of managing the interface of public and private land. The CMN approach originated from the VEAC Box-Ironbark Investigation, and a similar model is appropriate to address cross-tenure collaboration issues arising from the River Red Gum Investigation.

Cross-program partnerships within the Goulburn Broken CMA could also be reviewed and strengthened to streamline planning and implementation.

Key Indicators of success for Strategic Direction 2 (Nurturing partnerships)

» **roles and responsibilities defined and understood by key stakeholders;**
» **five cross-tenure projects (with biodiversity management agreements between public land managers, Goulburn Broken CMA and other relevant parties); and**
» **1,000 new biodiversity projects/management agreements between private land managers and the Goulburn Broken CMA.**

Nurturing partnerships: Strategic initiatives and Actions
2.1 Review existing partnerships in place to deliver biodiversity outcomes.
2.1.1   Produce a report identifying and analysing current partnerships and recommendations to improve as appropriate.
2.1.2   Review opportunities for stakeholder participation in the Biodiversity Strategy Working Group (to address planning, funding and monitoring, evaluation and reporting issues).
2.1.3   Reinvigorate a biodiversity practitioner's forum to allow sharing of information and ideas, particularly at the implementation level. In addition, support and strengthen biodiversity forums and partnerships that are driven by local government.
2.1.4   Investigate potential alignment of the Shepparton Irrigation Region and Dryland Environmental Incentive programs, standards and other processes.
2.2 Identify new and strengthen existing partnerships, in particular with Indigenous groups.
2.2.1   Initiate practitioner training in Indigenous understanding of biodiversity and processes to ensure ongoing input from the Indigenous community.
2.2.2   Pursue Indigenous Lands Trust funding for land acquisition where relevant.
2.2.3   Identify and showcase examples of effective co-management with Aboriginal communities.
2.2.4   Support / recommend the development of a Memorandum of Understanding between the Goulburn Broken CMA and the relevant Registered Aboriginal Parties to clarify working relationships, as part of developing the updated Regional Catchment Strategy.
2.2.5   Develop where appropriate Cultural Heritage Agreements with Registered Aboriginal Parties, other partners, and stakeholders (including private landholders), to facilitate the long term protection of Cultural and Natural Heritage.
2.2.6   Seek support from Parks Victoria to have areas adjoining National and Regional Parks (and other reserves) added to the Reserve System where they are identified by Traditional Owners and the Goulburn Broken CMA as having high cultural and natural values.
2.2.7   Identify opportunities for (and needs of) philanthropic and private industry sponsorship.
2.3 Develop large-scale, multi-institutional, multi-tenure projects, as opportunities arise or as needed.
2.3.1   Extend the successful CMN model that addresses the public:private land interface and support the continuation of the existing Broken Boosey and Whroo Goldfields CMNs. See Context Pty Ltd (2008) and Castles (2009).
2.3.2   Collaborate with Parks Victoria and other land managers (including freehold) to capitalise on improved land security and management outcomes arising from the VEAC recommendations for the River Red Gum area.
2.3.3   Identify and support private land managers who manage large areas of habitat as part of a movement away from servicing small sites.
2.4 Investigate restructure of Goulburn Broken CMA programs or approaches to ensure integrated planning and implementation for terrestrial and aquatic biodiversity.
2.5 Establish an approach to ensure active engagement with public land managers to improve whole-of-catchment implementation efforts and reporting on biodiversity outcomes.
2.6 Ensure information about high priority biodiversity assets is considered by fire fighting authorities prior to and during wildfires.

5.3
Investing more wisely

While increased investment in biodiversity conservation is a performance indicator of this Strategy (see strategy purpose and strategic direction 1), it is even more important to invest the limited funds wisely. Within this approach, there is a rationale for prioritising geographic areas so that the greatest biodiversity benefits will be generated from investment (see Section 4). An adaptive management framework is being pursued with research partners to understand the crucial determinants and measurements of change in biodiversity values.

As well as having a good sense of geographic priorities, it is critical to understand which mechanisms appeal to land managers. The landscape has been shaped by a few drivers of change historically, such as booming wool prices in the 1950s, (Race *et al.* 2009 and see Table 3), and we must remain alert to what is driving change now so that we can respond by adapting mechanisms appropriately.

We are building greater clarity of the trade-offs and risks of investment decisions so that better overall outcomes are generated.

Recent suggestions from both the Victorian and Australian governments (e.g. Victorian Government's Land and Biodiversity White Paper and the Australian Government's Caring for our Country Business Plan) indicate that an emphasis on threatened species at the expense of broader ecosystems might be counterproductive to overall biodiversity condition given existing funding limitations (see also Appendix 9).

Some biodiversity projects in the Goulburn Broken Catchment use 'focal' species such as the Superb Parrot or Carpet Python to achieve broader biodiversity benefits while others, addressing specific actions for threatened species, have a single species focus (e.g. Barred galaxias). It is timely to review single species programs, particularly those with poor prognoses under climate change, by comparing benefits and costs of these programs with those that have a broader biodiversity focus.

The Goulburn Broken CMA's River Health program has started investigating how to improve investment choices and a similar project is being developed between the Goulburn Broken CMA, the University of Melbourne and DSE to review the prioritisation of threatened species investment.

The way we invest in biodiversity (including native vegetation and threatened species) needs to be consistent with knowledge of the likely impacts of climate change. Steffen *et al.* (2009, p.13) stress that we must undertake a vastly enhanced conservation effort: *"Management approaches that seek to maintain current spatial arrangements of species will be very difficult to implement under a changing climate – and could well be counterproductive. Management objectives will need to be reoriented from preserving all species in their current locations to maintaining the provision of ecosystem services through a diversity of well-functioning ecosystems."* This is the single most important adaptation strategy.

Ensuring translation between policy and implementation is crucial, as are well-formed research priorities. Increasing the use of risk assessments at all scales (e.g., species, sites, ecosystems) will help to assess the vulnerability of biodiversity and help shape appropriate management options and investment choices. The public and private benefits of investment also need to be determined to ensure that the right policy instruments are being applied, for example, under what circumstances should financial incentives be provided compared with extension, regulation or technology innovation?

Current approaches to translate national, state and regional strategies into action include the development of Goulburn Broken CMA's annual priorities document, which is used to communicate investment priorities to the community and facilitate collaboration between potential partners.

Key Indicators of success for Strategic Direction 3 (Investing more wisely)

» **strategy priorities, trade-offs, risks and synergy benefits are explicit in project design;**
» **80% of government investment in biodiversity aligns with regional priorities; and**
» **strong link between this Strategy, Goulburn Broken CMA's Corporate Plan and performance reporting.**

Investing more wisely: Strategic initiatives and Actions

3.1 Develop processes to ensure that the most recent policy, monitoring results and research are translated/incorporated into planning and implementation.

3.1.1 Consistent with Goulburn Broken CMA's evaluation and improvement framework (Section 6), annually review progress towards implementing this Biodiversity Strategy in the context of new and emerging issues, prior to updating processes for investment planning, ensuring alignment with government funding priorities.

3.1.2 Review results and recommendations from the Landscape Logic research project, and other relevant research and development projects, and incorporate into programs where relevant.

3.1.3 Continue to annually update the Goulburn Broken CMA's Biodiversity Monitoring Action Plan (method for documenting and improving [through appropriate research] certainty of assumptions around progress towards biodiversity targets) and extend this model to other programs such as the Goulburn Broken CMA's River Health program.

3.1.4 Continue work with universities and other agencies to understand ecological processes and develop indicators for measuring change over time (to be incorporated into the monitoring framework in the future).

3.1.5 Clearly define and seek agreement of roles for reporting on biodiversity outcomes, including at national, state, catchment and local levels.

3.1.6 Identify opportunities for communicating the contributions of community activities such as CMNs to broader ecological objectives.

3.1.7 Increase the use of approaches that aim to measure/predict biodiversity outcomes to guide investment choices, and develop standard metrics where possible.

3.1.8 Review Whole Farm Planning processes to ensure biodiversity is adequately addressed.

3.1.9 Review relevant incentive/grant programs to ensure alignment with this Strategy.

3.2 Develop clear processes for biodiversity prioritisation at various scales, particularly the landscape scale.

3.2.1 Develop landscape-scale implementation plans, building on existing resources such as this Strategy, BAP and implementation planning commenced by DPI's Sustainable Landscapes in the Dryland area during 2008–09. As part of this, investigate the use of Landscape Action Plans proposed in DSE (2009a) along with other implementation planning processes and tools that will aid in project planning, e.g. for biolinks.

3.2.2 Undertake specific risk assessments for specific biodiversity assets to determine priorities for investment or disinvestment.

3.2.3 Ensure regional involvement in state and national prioritisation processes for biodiversity, e.g., continue involvement in piloting a threatened species prioritisation process in the Goulburn Broken Catchment.

3.2.4 Prioritise investment and actions for threatened species that incorporate thinking around the viability of the species, the biological, social and/or economic value, and the broader benefits of the actions (e.g., to other species and ecosystem function).

3.2.5 Undertake periodic reviews of incentive programs against areas of risk identified in Vegetation Incentives Analysis (VIA) (Stothers et al. 2008) to ensure ongoing refinement, and align and monitor funding allocations for existing vegetation incentive schemes based on the recommendations from the VIA and ongoing analyses.

3.2.6 Under future climate change scenarios review revegetation techniques and species selection in line with adaptation strategies (e.g., greater promotion of natural regeneration and direct seeding).

3.2.7 Apply the public:private benefits framework to projects to ensure that public funding reflects the level of public benefit.

3.2.8 Further investigate application of, and contribute to the refinement of a range of prioritisation tools as needed, e.g., the Investment Framework for Environmental Resources (INFFER).

5.4
Building on our ecological infrastructure

The Land and Biodiversity White Paper (DSE 2009a) highlights the role of existing assets such as public land, riparian lands and rural landscapes in building healthy and resilient ecosystems. 'Resilience' is the capacity of a system to absorb disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks (Walker et al. 2004). Ecosystem resilience needs to be considered alongside a complex, evolving, integrated socio-ecological system in which humans are a part of nature (Wolfenden et al. 2007).

Much of the catchment is highly modified from its natural state and is rapidly changing. Some ecosystems will not be able to adapt quickly enough to the compounding threat of a rapidly changing climate. To reduce the predicted wave of species extinctions over the coming decades (Steffen et al. 2009; Mac Nally et al. 2009), we need to build on carefully chosen parts of our natural infrastructure to provide species and ecosystems with what they need to adapt and survive.

The natural infrastructure we aim to establish needs to be resistant to future shocks or capable of changing into a different form that is still desirable. Building our knowledge in this area will be vital as the ability of our systems' adaptive capacity is currently poorly known.

It is suggested it is no longer feasible, particularly in the face of climate change, to attempt to maintain all species in their present locations and all ecosystems in their present composition (Steffen et al. 2009). We need a diversity of ecosystems that provide a diversity of functions, for a wide range of species. A pre-European settlement 'natural state' of our ecosystems may no longer be an appropriate or achievable benchmark.

Central to giving ecosystems the best possible chance to adapt and evolve is to enhance resilience by building connections across fragmented and intact ecosystems, enhancing the national reserve system, protecting key refuge areas, implementing more effective control of invasive species and developing appropriate fire

management regimes, all of which are integrated with enhancing social capacity. Effective large-scale, cross-tenure projects enable essential connections between ecosystems to happen at a large scale. The wet areas of the catchment (rivers, streams and wetlands) are a central starting point for building biolinks across priority areas of the catchment. The Murray-Darling Basin Authority Basin Plan is developing sustainable diversion limits to protect river systems and aquatic dependent ecosystems and has identified the Barmah-Millewa Forest and the Lower Goulburn Floodplain as two of 18 key environmental indicator sites. This may present an opportunity to protect aquatic dependent environmental values through the delivery of improved environmental flow regimes.

Relictual (highly altered) landscapes in the Goulburn Broken Catchment are not a high priority for investment in landscape restoration (although highly targeted actions may still be applicable).

There are significant time lags between habitat restoration and use by some species. Nevertheless, we know enough to act now to protect existing biodiversity and to restore function.

The Conservation Management Networks within the catchment provide a good model for making timely judgements and getting on with the job, while the science and prioritisation processes are refined.

The risk assessment process undertaken as part of this Strategy's development highlighted the need to accelerate management approaches already in place to address threatening processes other than climate change.

Improved security and management arrangements for River Red Gum areas in much of the catchment (as a result of the creation of national and regional parks in 2010 and the return to wetlands of Lake Mokoan) present opportunities for building ecological infrastructure. There are also opportunities to improve management of river frontages for environmental gains.

The Goulburn Broken CMA's Biodiversity and River Health Programs are actively involved in a number of statewide initiatives to set standards for riparian management, develop programs for the enhancement of public land protection and priortise waterways recognising biodiversity assets in the terrestrial and aquatic environments. The outcomes of these initiatives will be integrated into local programs as appropriate. Increased investment will be sought for the management of riparian areas, which has become the foundation of landscape approaches.

Greater levels of biodiversity stewardship by land managers are needed to achieve the vision of this Strategy, which means that government investment into biodiversity conservation on both private and public land will need to increased and supplemented.

Key Indicators of success for Strategic Direction 4 (Building on our ecological infrastructure)

» **90% of biodiversity land management agreements between private land managers and the Goulburn Broken CMA are in identified high priority areas;**
» **priorities are based on increasing ecosystem function and diversity under a changing climate; and**
» **four large-scale biolink projects underway in priority zones.**

Building on our ecological infrastructure: Strategic initiatives and Actions
4.1 Develop or support scientifically sound biolink projects to improve landscape connectivity and climate change adaptation.
4.1.1   Develop map of 'resilience' for the catchment (e.g. based on key indicators such as regeneration potential/success), to enable better targeting of implementation programs.   4.1.2   Identify and manage key areas likely to provide refuge in the face of climate change, including the prioritisation of wetlands for environmental watering.
4.2 Accelerate stewardship programs such as Bush Returns and Green Graze, which target large-scale landscape protection and restoration in priority areas, and expand such approaches to waterways and wetlands.   4.2.1   Review and revise incentive programs across the catchment to ensure a more targeted and stewardship-focused approach.
4.3 Work with Goulburn Murray Water and DSE to integrate the management of surface and ground water for the benefit of groundwater dependent ecosystems and aquatic species and communities.   4.3.1   Support the development of local or regional implementation rules (science-based approaches) regarding water extraction.   4.3.2   Account for capacity of groundwater systems prior to issuing new licences and cap under sustainable limits.
4.4 Identify and maintain well-functioning ecosystems and develop strategies for ecosystems to adapt (and transform if necessary) to mounting pressures such as climate change.
4.4.1   Develop a list of ecosystems we have now and can work on, including benefits and disbenefits of targeting these areas.   4.4.2   Develop sound monitoring approaches and experiments to inform adaptive management and the choice between maintaining the existing suite of ecosystems or facilitating transformation into new ecosystems.   4.4.3   Continually refine appropriate targets for biodiversity, including the consideration of managing for different ecological states in different ecosystems (are pre European benchmarks still appropriate?). This includes establishing benchmarks for soil ecosystems.

5.5
Legitimising biodiversity conservation

Biodiversity underpins the processes that make all life possible. The importance of biodiversity to human welfare needs to be understood by the community to ensure appropriate (and increased) investment by government and the community.

Although the connection between land use and natural systems is not always immediate, all human land uses ultimately rely on natural systems and the biodiversity they support.

Agricultural systems can be obviously and immediately connected to biodiversity,for example, pollination of crops by insects or year-round ground cover and summer feed for stock provided by well-managed native pastures. There may be more remote connections as well, such as the provision of water via rainfall that falls hundreds of kilometres away and filters through landscapes.

Biodiversity conservation is often thought to be at the opposite end of the spectrum to agriculture and this dichotomy is not useful. Farmers rely on natural systems and natural systems need active stewards. Management of native vegetation is not the only way of addressing this potential dichotomy. For private landholders, the soil and its biodiversity is where they can play a crucial role in supporting healthy and functioning ecosystems. Increasingly there are examples of research and land management approaches where both biodiversity and production benefits are being realised (Crosthwaite *et al.* 2009). This information needs to be more widely disseminated and understood to affect greater levels of change to benefit both biodiversity and production, particularly in grazing systems. The need to integrate biodiversity and production is becoming recognised by landholders who are adopting different practices and by agencies that are trialling new extension and incentive programs such as the Goulburn Broken CMA's 'Land Class Fencing Incentive' and 'Green Graze'. Expansion of such programs would result in substantial environmental gains across large areas and at a low cost to the government and community. New types of farming systems that emerge e.g., from the carbon market, will present potential opportunities that may enhance biodiversity. However, the risks of new approaches also need to be considered to ensure that we adapt and attract investment into public benefit biodiversity outcomes.

Reactions to the 2009 bushfires in the Goulburn Broken Catchment appeared to have entrenched an either/or attitude to native vegetation and people, although this needs further testing. Extra efforts will be needed to ensure that planning and fire management integrates ecosystem needs with those of people appropriately.

Improved policy and planning mechanisms are needed to better protect biodiversity values and allow for long-term biodiversity planning. The free market often fails where the connection between agriculture and biodiversity is not immediate as the farmer has little incentive to conserve natural values. However, significant government/community investment is justified because of the large public benefits of biodiversity and the overall net economic benefit of its conservation (Lockwood *et al.* 1999).

Better defining land managers' duty of care based on contemporary community expectations will be crucial in establishing obligations and incentives for supporting land managers to improve biodiversity management.

Key Indicators of success for Strategic Direction 5 (Legitimising biodiversity conservation)

» **government investment in biodiversity management through the Goulburn Broken CMA is clearly framed around supporting land managers to be active stewards of the environment;**
» **a much larger proportion of the catchment's land use reflecting biodiversity conservation*; and**
» **strengthened community support for biodiversity conservation as our natural life support system*.**
   * measures to be determined

Legitimising biodiversity conservation: Strategic initiatives and Actions

5.1 Strengthen and communicate duty of care for biodiversity conservation.

5.1.1 Compile a list of current expectations of duty of care, or minimum standards with respect to biodiversity management (particularly hill country and riparian zones), linking with Victoria's Land and Biodiversity White Paper process for developing a duty of care approach as it emerges.

5.1.2 Summarise the existing restrictions on land managers' rights to help identify the distinction between statutory obligations, duty of care and public/private benefit.

5.1.3 Investigate potential application/trial of the Duty of Care Framework developed by Gill Earl (Charles Sturt University), in collaboration with private and public land managers.

5.1.4 Prioritise riparian zones and river frontages recognising biodiversity values, and promote and encourage improved management of these areas in line with the intent of Victoria's Land and Biodiversity White Paper.

5.2 Increase opportunities for landholders to act as biodiversity stewards through appropriate mechanisms and support.

5.2.1 Promote and showcase land management methods and philosophies that demonstrate a whole-of-farm approach where both biodiversity and production benefits can be realised.

5.2.2 Provide and communicate a range of mechanisms/tools to achieve biodiversity outcomes, considering the varied demographic, knowledge and expectations of landholders, as well as emerging soil and carbon management approaches that complement biodiversity outcomes.

5.2.3 Implement a second stage of the Goulburn Broken CMA's Green Graze program (whole-of-farm grazing management tender program) and apply learnings from the Green Graze Pilot (Moll et al. 2007) more widely.

5.3 Influence government planning and policy.

5.3.1 Assist local government to develop and apply appropriate planning tools for all council plans and strategies (e.g. Municipal Strategic Statement review, policies, & overlays) to increase the protection and reduce risks to biodiversity (e.g., matching land use intensity to land characteristics).

5.3.2 Influence forest management including timber harvesting to achieve improved biodiversity outcomes, when opportunities arise such as during reviews of relevant state legislation and policy. Work with local forest planners

5.3.3 Identify potential negative impact programs, and apply/encourage risk management processes for addressing impacts, building on lessons from the Biodiversity Risk Management Protocols project implemented within the Goulburn Broken CMA and local government.

5.4 Promote an understanding of the fundamental reliance on biodiversity for quality of human life, economy and identity.

5.4.1 Better promote the priorities of this Strategy, through the development of a communication plan, and tailored documents and approaches to demonstrate what private and public land managers can do to contribute (including training in identification and recording of flora and fauna, and application of current recommended practices).

5.4.2 Develop a targeted education campaign to improve community attitudes towards natural values post Black Saturday fires in 2009 (including an acknowledgement of changed fire regimes and proposed solutions to managing that change).

5.4.3 Identify the best methods of addressing the threats of cultivation, cropping and pasture management and reduced habitat function where these are impacting on high priority biodiversity assets (the risk assessment undertaken as part of this Strategy's development identified that an education campaign would be one key approach to address these specific threats).

6. Evaluation and improvement

The key to successful adaptive management systems is for information to clearly feedback into decision-making processes. Decisions in natural resource management have vastly different timeframes, from daily operational decisions of the government agency extension officer to the three to six yearly strategic decisions of the Goulburn Broken CMA Board.

6.1
General Goulburn Broken CMA monitoring, evaluation and reporting framework

The Goulburn Broken CMA recognises the need for Monitoring, Evaluation and Reporting to improve the way we manage biodiversity conservation through the use of public funds. The Goulburn Broke CMA's Monitoring, Evaluation and Reporting Strategy (GBCMA 2004) highlights the importance of developing a common language and standardised information between different disciplines so that integrated decision-making can be improved.

Decision makers need to know annually whether funded actions were achieved. It is also critical for decision makers to compare progress in implementing actions listed in strategies with the change in condition of the asset of interest. This comparison can

alert us to under or over achievement and force us to consider questions such as:

- Was the original strategy appropriate?
- Have circumstances (such as new knowledge or different weather patterns) changed sufficiently to warrant a revised strategy?
- Does the investment mix need to be modified?

Data are organised to inform three critical and connected levels of analysis, as shown in Table 7.

Analysis level	Analysis terminology	Typical questions used to assist analysis	Examples of evidence to inform analysis
1	Annual performance	How did we go this year against what we said we would do?	Outputs achieved and funds spent against targets set in the Corporate Plan
2	Long-term strategy implementation progress	How have we gone against what we said we would do when we wrote the Strategy?	Outputs and assumptions of their impact listed in strategies
3	Catchment condition change	What shape is the asset we are managing in now?	Resource condition; trends; tipping points; indicators of resilience, adaptation and transformation responses

Table 7: Three levels for analysing progress

This Biodiversity Strategy focuses on the Goulburn Broken CMA's three to six year and annual planning cycles, as shown in the following flowchart (Figure 7), which is generic for all major issues of concern to the Goulburn Broken CMA. Each step in the cycle requires different levels of information, as shown in Table 8.
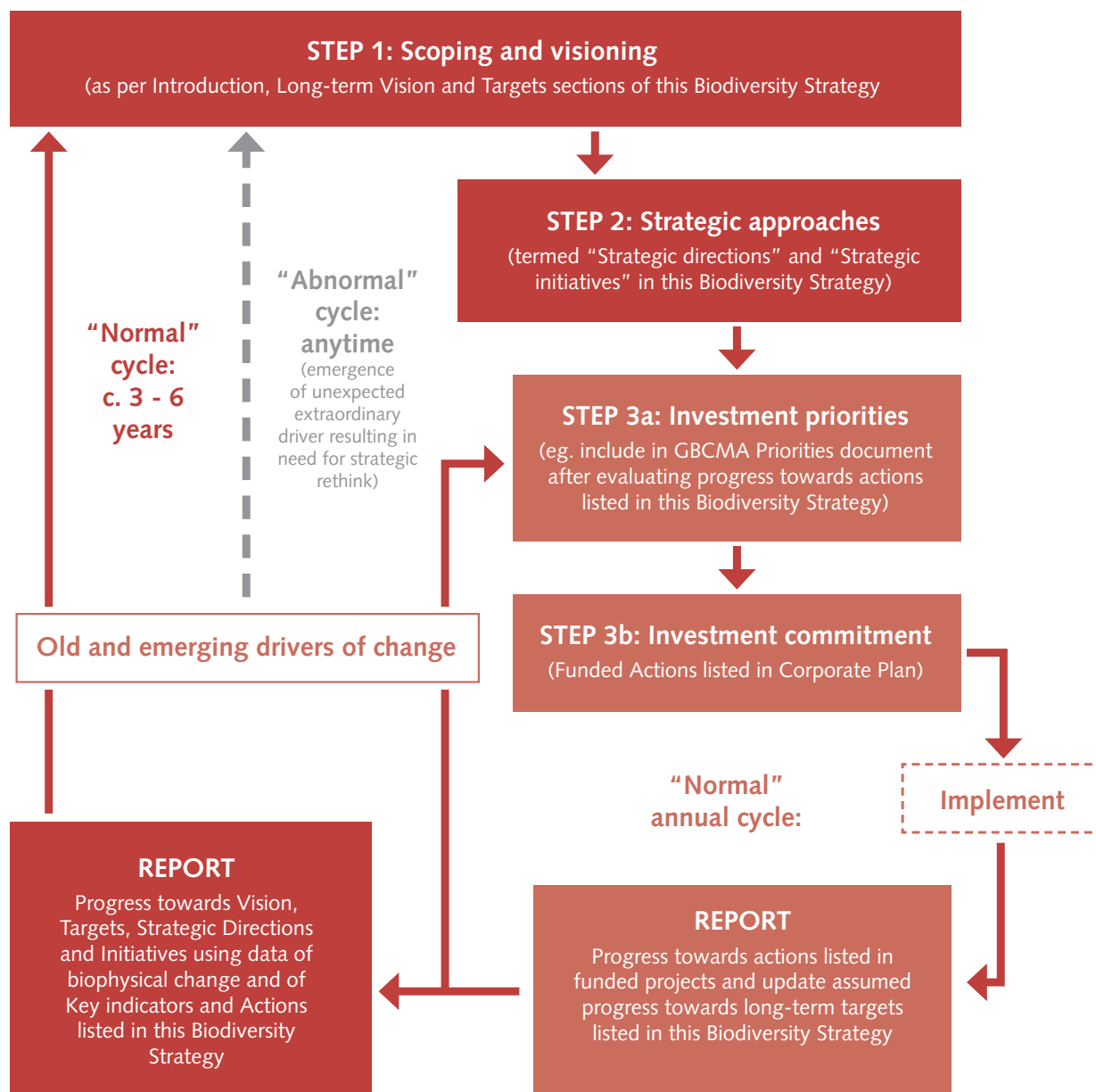
STEP 1: Scoping and visioning
(as per Introduction, Long-term Vision and Targets sections of this Biodiversity Strategy

STEP 2: Strategic approaches
(termed "Strategic directions" and "Strategic initiatives" in this Biodiversity Strategy)

"Normal" cycle: c. 3 - 6 years

"Abnormal" cycle: anytime
(emergence of unexpected extraordinary driver resulting in need for strategic rethink)

STEP 3a: Investment priorities
(eg. include in GBCMA Priorities document after evaluating progress towards actions listed in this Biodiversity Strategy)

Old and emerging drivers of change

STEP 3b: Investment commitment
(Funded Actions listed in Corporate Plan)

"Normal" annual cycle:

Implement

REPORT
Progress towards Vision, Targets, Strategic Directions and Initiatives using data of biophysical change and of Key indicators and Actions listed in this Biodiversity Strategy

REPORT
Progress towards actions listed in funded projects and update assumed progress towards long-term targets listed in this Biodiversity Strategy

Figure 7: Goulburn Broken CMA planning cycles showing how it is applied to this Biodiversity Strategy

Planning step	Information needed in report(s)*	Primary information user	Decisions documented in plan	Recurrence • report • plan
1. Scoping and visioning	Old and emerging drivers of change • community priorities • government priorities • prevailing circumstances (weather etc) Resource condition • values • threats Information from other planning steps e.g. progress towards targets from intervention	CMA Board	Regional community's NRM vision • strategic priorities • resource condition targets (where possible) • broad delivery arrangements	Six-yearly (approx.) • report: catchment condition (reported in Annual Report)*** • plan: RCS
2. Strategic approaches**	Information from other planning steps Assumptions linking works outputs to outcomes Expected costs and benefits of various actions	Prepared by Board for CMA Implementation Committees*****	Resource condition targets Preferred actions • works • non-works Cost-share	Six-yearly (approx.) • report: catchment condition (reported in Annual Report) • plan: sub-strategies**
3a. Investment priorities	Information from other planning steps Progress toward resource condition targets from intervention Historical investment pattern with analysis****	Implementation Committees Prospective service providers (land managers)	General priorities • estimated or relative investment levels in each investment area (dryland salinity, native vegetation, etc)**** Specific priorities • type of works • location of works • type of non-works action	Annual • plan: priorities document (investment guide for potential service providers - landholder groups etc)
3b. Investment commitment	Funding Outputs (works) Key Performance Indicators (non-works, including statutory requirements)	Board (exception only) Implementation Committees*****	Funding targets Outputs targets Key Performance Indicators Delivery arrangements	Annual • report: Annual Report • plan: Corporate Plan

* Information can be derived from formal monitoring and evaluation exercises, commissioned background 'issues' or 'discussion' papers, or from ad hoc sources such as unexpected government initiatives and anecdotal evidence on community perceptions. Much of the information contained in reports for both timeframes should be common, allowing aggregation across years.

** Strategic approaches are prepared with varying degrees of effort and formality, from 'full-blown' strategies that have undergone extensive consultation to desk-top reviews by individual officers. It is appropriate for this effort and formality to vary. These strategic approaches should be consistent with the regional community's NRM vision.

*** Timeframe should vary from issue to issue and catchment to catchment. Plans and reports should be included on the Goulburn Broken CMA website as they are produced or updated i.e., do not have to wait for six years and do it all at once.

**** Likely to be a year or two away from providing this information.

***** This table was prepared prior to a change in the Charter for Implementation Committees in the Goulburn Broken CMA in 2010. Their information needs may have changed.

Source: Derived from a discussion paper by McLennan and McFarlane (2006)

Table 8: Information for decisions at different steps of Goulburn Broken CMA planning cycles

6.2
Biodiversity evaluation and improvement processes

Annual performance, long-term strategy implementation progress and catchment condition are reported in the Goulburn Broken CMA's Annual Report.

Annual assessments of progress in implementing actions listed in the previous section of this Biodiversity Strategy will be critical in identifying priorities for each year.

A detailed Biodiversity Monitoring Action Plan (first developed in 2005 and updated annually) describes the process for measuring progress towards long-term biodiversity targets. It identifies

critical gaps in knowledge, many of which have become a focus of collaborative research projects such as: Landscape Logic (www.landscapelogic.org.au); a project to identify voluntary contributions to native vegetation (Ambrosio et al. 2009); and an analysis of data on actions undertaken to inform annual performance and long-term progress.

The Goulburn Broken CMA is aligning its reporting with the 2009-10 Annual Report Guidelines for CMAs and the Victorian Catchment Management Council (DSE 2010b).

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Page 38:	Echidna: Paul O'Connor (BBCMN Calendar 2010 – check Jim), Regenerating tree: Tony Kubeil, Nest box installation: Jim Castles
Page 40 :	Sedge: Carla Miles. Emperor Gum Moth: Di Huber. Tree Ferns: Tony Kubeil.

Appendix 1

Relationship of this Strategy with other key strategies

Victorian Biodiversity Strategy Renewal

The *Victorian Biodiversity Strategy* (VBS) is being renewed (DSE 2010a) and will help to operationalise the state's Land and Biodiversity White Paper (DSE 2009a). It is intended that the VBS will provide a state-wide view of priorities and highlight a collaborative approach to biodiversity conservation across the state, including the identification of specific tasks and partnerships.

Goulburn Broken Regional Catchment Strategy 1997 and 2003

The Goulburn Broken CMA's Regional Catchment Strategy (RCS) is a blueprint for catchment management, documenting the overarching vision, values, principles, approaches and targets for all NRM issues. This Biodiversity Strategy is one of many sub-strategies that helps to translate the RCS into on-ground action and in this case will feedback into the review of the RCS in 2011.

Dryland Landscape Strategy 2009–2011 (DLS)

The DLS is an integrating strategy across all NRM issues in the Dryland region of the catchment, and emphasises issues that are pertinent to achieving better integration. It needs other single issue or sub-strategies to feed into it and provide greater detail. As with this Biodiversity Strategy the development of the DLS was driven from within the catchment.

Shepparton Irrigation Region Catchment Implementation Strategy 1990–2020 (SIRCIS)

The SIRCIS is an integrating strategy across relevant NRM issues in the Shepparton Irrigation Region. Unlike the DLS it also provides a detailed action plan. Some of the actions from the Biodiversity Strategy will be picked up in the SIRCIS.

Goulburn Broken Regional River Health Strategy 2005–2015 (RRHS)

The RRHS provides a strategic framework for the protection and enhancement of water quality and priority aquatic assets including rivers, wetlands, floodplains and associated biota. Priorities are based on a range of environmental, social and economic criteria established in guidelines developed by DSE and used by all CMAs. The Strategy covers detailed actions and implementation planning (including the identification of specific geographic priority locations) as well as the high level framework. It is a 10-year strategy and a mid-term review is currently underway.

A second generation Victorian River Health Strategy is being developed and will be delivered in 2011 as the Victorian Strategy for Healthy Rivers, Estuaries and Wetlands (VSHREW). As part of this process reviews of RRHS's have been undertaken and new guidelines will be prepared to assist the CMAs in developing their second generation RRHSs, to be completed by 2012. In the interim, the priority management actions outlined in the original RRHSs have been reviewed to ensure they deliver optimal investment and river health outcomes in their regions. Additionally, changes in the regional environment (e.g., drought, bushfire, floods etc.) and the completion of new policies or major projects affecting river health (e.g., Our Water Our Future, regional Sustainable Water Strategies, Northern Victoria Irrigation Renewal Project) may have altered priorities in some areas. Accordingly a short-term, contemporary addendum to the RRHS has been developed to ensure there is adequate direction of investment until 2012 when the second generation RRHSs are finalised.

There is no current wetland strategy for the Goulburn Broken Catchment, however, wetlands will be included in the review of the RRHS, guided by the Victorian Strategy for Healthy Rivers, Estuaries and Wetlands (in prep.).

Historically, aquatic and terrestrial biodiversity have been dealt with separately through the CMA's River Health and Biodiversity programs. Where appropriate, this Biodiversity Strategy aims to integrate and complement aquatic and terrestrial planning and implementation (e.g., through the risk assessment, and identification of priority zones). Some institutional barriers such as state funding processes make this process challenging in the short term. It is envisaged that this Strategy will be an interim step towards a fully integrated aquatic and terrestrial biodiversity strategy.

Other strategies

There are obviously other relevant strategies (e.g. Northern Sustainable Water Strategy 2009, Australia's Biodiversity Conservation Strategy 2010–2020 Consultation Draft, Victorian Climate Change White Paper 2010 and Victoria's Land and Biodiversity White Paper 2009 [referred to in body of this Strategy]). However, only a snapshot of strategies has been provided above. (See Figure 2 in the body of the Strategy for a list of other strategies).

Indigenous Co-operative Management Agreements

In accordance with the Yorta Yorta Co-operative Management Agreement, the Goulburn Broken CMA has consulted with the Yorta Yorta Joint Body in developing this Strategy. The Yorta Yorta Co-operative Management Agreement was signed by the Victorian State Government and the Yorta Yorta Nation Aboriginal Corporation in June 2004. It formalises the right of the Yorta Yorta people to have a role in natural resource management decision-making in specific areas of Crown land within Yorta Yorta Country. The Yorta Yorta Joint Body acts as the vehicle for the facilitation of the co-operative management arrangement. A Cooperative Management Agreement is not yet in place for the Taungurung Clans Aboriginal Corporation, however a Memorandum of Understanding between the Corporation and the Goulburn Broken CMA is in development.

Related policies and legislation (adapted from DSE 2009b)

The legislative and policy context for this Strategy is summarised in the following table.

State of Victoria
Growing Victoria together 2: Protecting the environment for future generations.   White Paper on Land and Biodiversity at a time of Climate Change.   Our Water Our Future policy.   Future Farm Strategy.   Native Vegetation Management Framework.   Victoria's Biodiversity Strategy 2010-1015 Consultation Draft.

National and international
Australia's Biodiversity Conservation Strategy   A consultation draft for public comment was released in March 2009. The draft sets forth a vision for biodiversity: 'Australia's biodiversity is healthy, resilient to climate change and valued for its essential contribution to our existence'. It includes six priorities for change: 1. Building ecosystem resilience   2. Mainstreaming biodiversity   3. Knowledge for all   4. Getting results   5. Involving Indigenous peoples   6. Measuring success   United Nations Convention on Biological Diversity.   Convention on International Trade in Endangered Species (CITES).   Convention on Migratory Species (CMS or Bonn Convention).   Japan-Australia Migratory Birds & China-Australia Migratory Birds Agreement, Republic of Korea-Australia Migratory Birds Agreement.   Ramsar Convention on Wetlands of International Importance.   East Asian Australasian Flyway Site Network.

Related legislation
Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act) (Commonwealth).   *Flora and Fauna Guarantee Act 1998.*   *Catchment and Land Protection Act 1994.*   *Wildlife Act 1975.*   *Coastal Act 1995.*   *Environmental Protection Act 1970.*   *National Parks Act 1975.*   *Planning and Environment Act 1987* (and the Victorian Planning Provisions).   *Water Act 1989.*   *Victorian Environment Assessment Council Act 2001.*

Table 1A: National and state legislative and policy context

Appendix 2

Summary of flora and fauna status in the Goulburn Broken Catchment

Threat Category[1]	Monocotyledons	Dicotyledons	Conifers	Ferns and allies	Mosses and Liverworts	Total
Presumed extinct in Victoria	1	0	0	0	0	1
Endangered in Victoria	14	31	0	0	0	45
Vulnerable in Victoria	24	51	0	1	1	77
Rare in Victoria	42	129	0	8	7	186
Poorly known in Victoria	17	25	0	2	4	48
Total threatened	98	236	0	11	12	357
No. of native species in catchment	609	1803	5	86	247	2,750
% native species threatened	16%	13%	0	12%	5%	13%
No. of introduced species in catchment	231	531	7	0	1	770

Sources: DSE 2007a and Flora Information System

Table 2A: Number of taxa by class and Victorian Conservation Status Category of flora in the Goulburn Broken Catchment

Threat Category[1]	Birds	Mammals	Reptiles	Amphibians	Fish	Total
Regionally Extinct	0	2	0	0	1	3
Critically endangered	5	2	0	3	3	13
Endangered	13	3	4	2	3	25
Vulnerable	23	4	1	1	2	31
Data deficient	0	2	2	1	2	7
Near threatened	25	4	2	0	0	31
Total threatened	66	17	9	7	11	110
No. of native species in catchment	298	70	72	31	22	493
% native species threatened	22%	24%	13%	23%	50%	22%
No. of introduced species in catchment	13	14	0	0	8	35

Sources: DSE 2007a and Victoria Fauna Database

Table 2B: Number of taxa by class and Victorian Conservation Status Category of fauna in the Goulburn Broken Catchment

Explanation of flora and fauna listings

Species in Victoria can be 'listed' at two levels. The Advisory List of vertebrate taxa that are considered threatened, poorly known, near threatened or extinct in Victoria is maintained by the Department of Sustainability and Environment. Together with the range of programs and other resources available, lists of this type serve to increase community awareness of threatened species and may encourage community members to become involved in activities to protect threatened species, thereby reducing the risk of their conservation status worsening. (DSE 2007a)

This advisory list is not the same as the statutory list of threatened taxa established under the Victorian Flora and Fauna Guarantee Act 1988 (FFG Act). There are no legal requirements or consequences that flow from inclusion of a species in this advisory list. However, some of the species in this advisory list are also listed as threatened under the FFG Act. The FFG Act Threatened List only includes items that have been nominated, assessed by the Scientific Advisory Committee and approved for listing by the responsible Minister. (DSE 2007a)

There are also species on this list that are listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

Within the Goulburn Broken Catchment, the EPBC-listed Ecological Communities include:

- Alpine Sphagnum Bogs and Associated Fens (endangered – listed January 2009).
- White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grasslands or Box Gum Grassy Woodlands and Derived Grasslands [Short Name] (critically endangered – listed May 2006).
- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions (endangered - listed July 2000).
- Grey Box (Eucalyptus microcarpa) Grassy Woodlands and derived grasslands of South-Eastern Australia (listed April 2010).

Summary of the Bioregional Status of Ecological Vegetation Classes (EVCs) in the Goulburn Broken Catchment.

Status		Criteria
Presumed Extinct	X	Probably no longer present in the bioregion (the accuracy of this resumption is limited by the use of remotely - sensed 1:100 000 scale woody vegetation cover mapping to determine depletion - grassland, open woodland and wetland types are particularly affected).
Endangered (End)	E	Contracted to less than 10% of former range; or Less than 10% pre-European extent remains; or Combination of depletion, degradation, current threats and rarity is comparable overall to the above: • 10 to 30% pre-European extent remains and severely degraded over a majority of this area; or • naturally restricted EVC reduced to 30% or less of former range and moderately degraded over a majority of this area; or • Rare EVC cleared and/or moderately degraded over a majority of former area.
Vulnerable (Vul)	V	10 to 30% pre-European extent remains; or Combination of depletion, degradation, current threats and rarity is comparable overall to the above: • greater than 30% and up to 50% pre-European extent remains and moderately degraded over a majority of this area; or • greater than 50% pre-European extent remains and severely degraded over a majority of this area; or • naturally restricted EVC where greater than 30% pre-European extent remains and moderately degraded over a majority of this area; or • Rare EVC cleared and/or moderately degraded over a minority of former area.
Depleted (Depl)	D	Greater than 30% and up to 50% pre-European extent remains; or Combination of depletion, degradation and current threats is comparable overall to the above and: • greater than 50% pre-European extent remains and moderately degraded over a majority of this area.
Rare	R	Rare EVC (as defined by geographic occurrence) but neither depleted, degraded nor currently threatened to an extent that would qualify as Endangered, Vulnerable or Depleted.
Least Concern (LC)	LC	Greater than 50% pre-European extent remains and subject to little to no degradation over a majority of this area.

Table 2C: Legend for Bioregional Conservation Status of Ecological Vegetation Classes (EVC)

Legend

— Priority reaches
■ GBCMA Bioregion
■ Central Victorian Uplands (CVU)
■ Goldfields (GO)
■ Highlands - Northern Fall (HN)
■ Murray Fans (MF)
■ Northern Inland Slopers (NIS)
■ Victorian Alps (VA)
■ Victorian Riverina (VR)
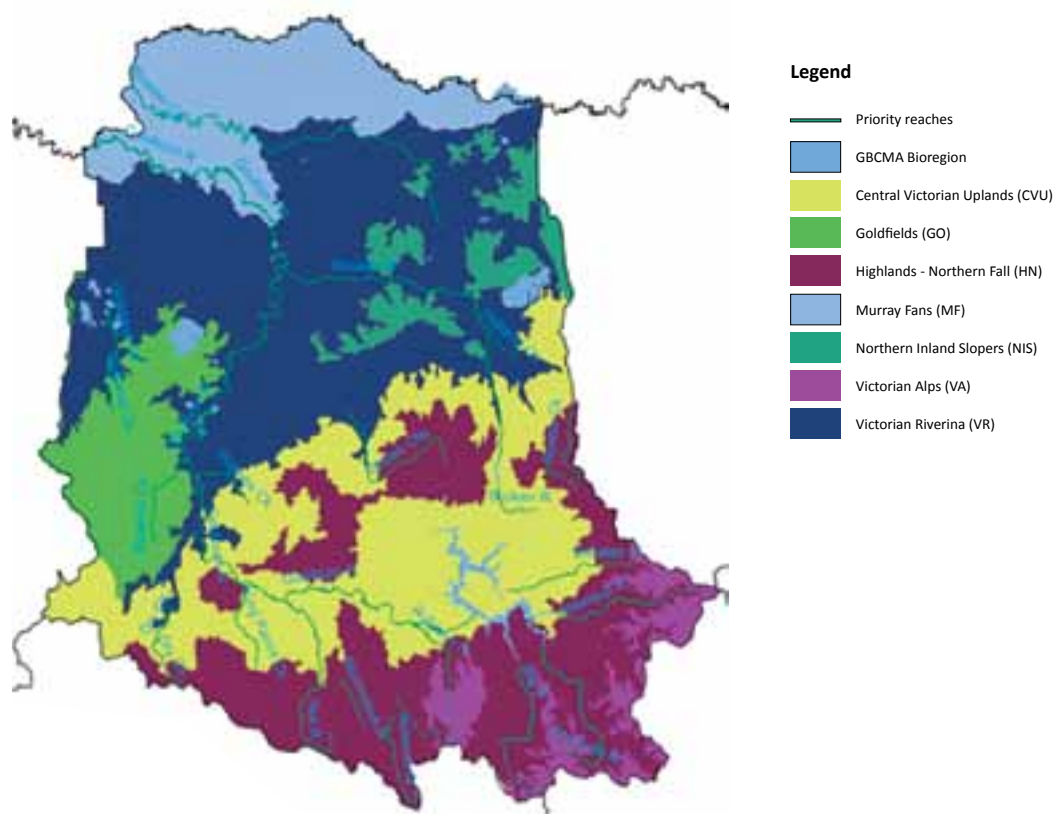
Figure 2A: Bioregions within the Goulburn Broken Catchment, Victoria

| Bioregion | Ecological Vegetation Classes | | Pre-European | Existing (as at 2005) | | | |
	Conservation Status	No of EVCs	Vegetation Cover (ha)	Vegetation Cover (ha)	% of pre-European EVC cover remaining	% of remaining cover on Private land	% of remaining cover on Public land
Murray Fans	Endangered	31	169,904	43,620	26%	85	15
	Vulnerable	31	59,602	33,361	56%	58	42
	Depleted	46	32,922	31,767	96%	4	96
	Least Concern	2	761	757	99%	0	100
TOTAL		**112**	**263,189**	**109,505**	**42%**	**53%**	**47%**
Victorian Riverina	Endangered	39	709,669	128,621	18%	88	12
	Vulnerable	29	36,604	21,302	58%	48	52
	Depleted	5	1,070	763	71%	26	74
	Least Concern	1	212	75	35%	77	23
TOTAL		**76**	**747,555**	**150,761**	**22%**	**82%**	**18%**
Northern Inland Slopes	Endangered	21	58,397	9,338	16%	92	8
	Vulnerable	5	24,996	8,651	35%	86	14
	Depleted	1	342	280	82%	21	79
	Least Concern	3	7,626	5,920	78%	36	64
TOTAL		**30**	**91,361**	**24,189**	**26%**	**75%**	**25%**
Goldfields	Endangered	24	19,256	9,885	51%	38	62
	Vulnerable	8	39,609	17,302	44%	87	13
	Depleted	9	99,507	83,290	84%	32	68
	Least Concern	2	10,131	8,315	82%	36	64
TOTAL		**43**	**168,503**	**118,792**	**70%**	**41%**	**59%**
Central Victorian Uplands	Endangered	23	183,025	44,006	24%	86	14
	Vulnerable	12	160,075	45,803	29%	91	9
	Depleted	9	157,055	94,444	60%	66	34
	Least Concern	4	20,145	12,492	62%	53	47
	Rare	1	103	92	89%	99	1
TOTAL		**49**	**520,403**	**196,837**	**38%**	**75%**	**25%**
Highlands – Northern Fall	Endangered	6	4,071	3,126	77%	13	87
	Vulnerable	7	10,714	4,329	40%	66	34
	Depleted	5	6,062	3,686	61%	54	46
	Least Concern	15	491,967	405,073	82%	16	84
	Rare	3	847	767	91%	10	90
TOTAL		**36**	**512,814**	**416,214**	**81%**	**17%**	**83%**
Highlands – Southern Fall	Least Concern	9	719	707	98%	4	96
TOTAL		**9**	**719**	**707**	**98%**	**4%**	**96%**
Victorian Alps	Endangered	3	2,574	2,574	100%	0	100
	Vulnerable	2	17	17	100%	0	100
	Least Concern	13	85,660	85,638	100%	0	100
	Rare	6	1,005	1,003	100%	0	100
TOTAL		**24**	**89,256**	**89,232**	**3%**	**0%**	**100%**
GRAND TOTAL		**379**	**2,395,299**	**1,106,237**	**46%**	**42%**	**58%**

Table 2D: EVC coverage, pre-European settlement and 2005 (Sources: DSE 2007b; DSE 2007c)

Note – data in the above table excludes areas mapped as water bodies (fresh and human-made) and sandy beaches. A list of individual EVCs for the Goulburn Broken Catchment can be found at www.gbcma.vic.gov.au.

Appendix 3
Climate change impacts on biodiversity

Natural ecosystems and climate change

Natural ecosystems have a lower coping capacity relative to other elements likely to be affected by climate change (Figure 3A).

At carbon levels of 450 parts per million by volume (ppmv), significant loss of species is possible throughout this century, perhaps 10 per cent or more by 2100. Climate change is likely to lead to a substantial reshaping of natural ecosystems and loss of resilience and viability in some cases. Factors such as a higher frequency and intensity of bushfires across the nation have the potential to adversely impact on ecosystems. Such changes will affect the provision of ecosystem services (e.g., timber, aesthetics, water harvesting, soil protection, and tourism). Australian ecosystems identified at greatest risk from climate change include the Great Barrier Reef, the southwest of Western Australia, the Murray–Darling Basin, eastern Australian alpine systems, eastern Queensland, Kakadu, the Queensland wet tropics and the sub-Antarctic islands. These risks will require significant adaptive responses, e.g. from the conventional ski industries and the managers of the most important ecotourism icons across the nation. There will be great challenges for the provision and suitability of national reserves and of corridors for migration of species, and for the preservation of species endangered by climate change (adapted from Pearman undated).

At carbon levels of 750 ppmv, there will be significant loss of human life from bushfires, heatwaves, invasive diseases, loss of capacity to supply hydroelectricity and water for power-plant cooling. Higher temperatures and low water availability will result in massive loss of species in the Australian and global contexts. Most ecosystems and ecosystem services will be at risk of complete breakdown. Most alpine ecosystems will have disappeared well before 2100. Australia's ability to meet its food demands would be stretched (adapted from Pearman undated). Table 3A summarizes the risks to natural ecosystems with various degrees of future warming.
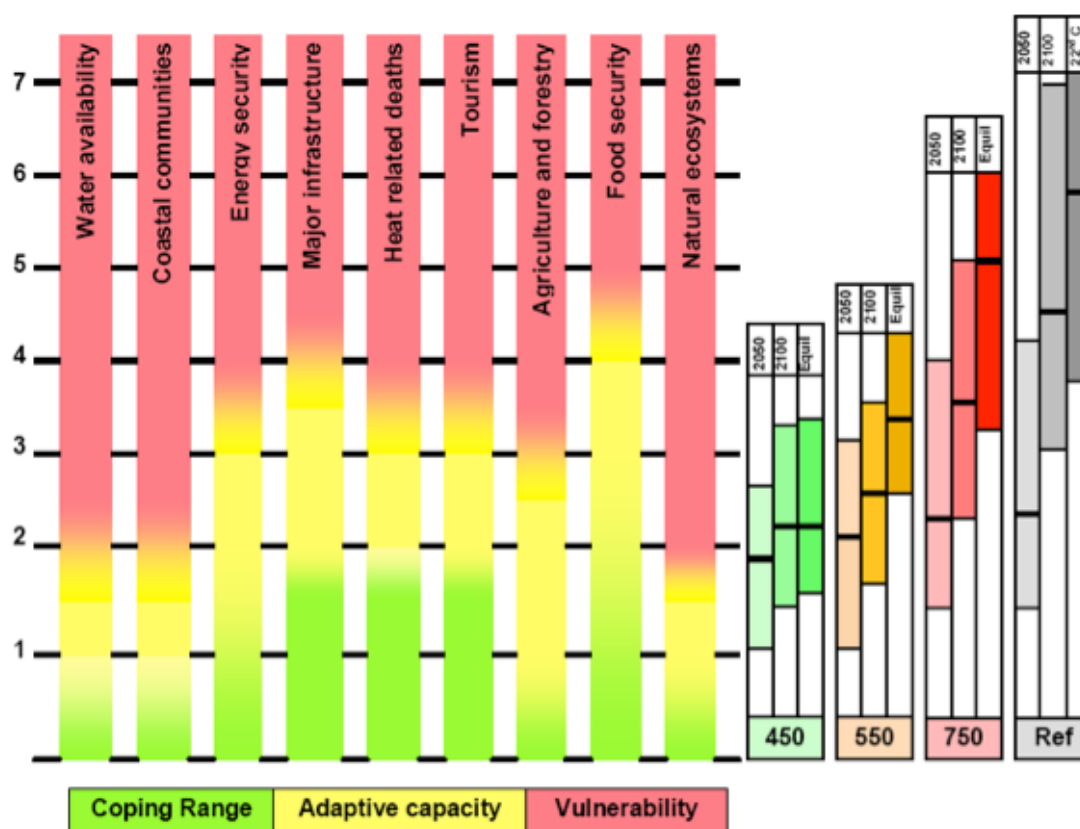
Source: Pearman (undated).

Figure 3A: Coping capacity associated with levels of warming in Australia

450 ppmv (~2 oC)	Significant loss of species and resilience. At high risk are the Great Barrier Reef, SW Western Australia, the Murray–Darling Basin, Alpine systems, Eastern Queensland, Kakadu, Queensland wet tropics and sub-Antarctic Islands. Natural coping capacity exceeded.
550 ppmv (~3 oC)	30% of all species at risk of extinction. Total realignment of ecosystems across Australia, with risks to ecosystem services. Total loss of alpine environments, major incursions of pests, weeds and diseases. Adaptive capacity exceeded.
750 ppmv (~4-5 oC)	Massive loss of species in Australia and globally, with little chance of any ecosystem maintaining resilience, and loss of ecosystem services. Alpine environments disappear well before the end of the century. Loss of ecosystem integrity. Adaptive capacity exceeded.
Reference Case (>5 oC)	Major loss of complete ecosystems and serious resilience and structural problems for remaining assemblages of species. Adaptive capacity exceeded.

Table 3A: Risks to Australian natural ecosystems with various degrees of future warming (ppmv = parts per million by volume) (adapted from Pearman undated)

Effects of increased CO2 concentrations

Increased CO2 concentration will act on species directly (via physiology) and indirectly (via climate changes) (first tier). Individual species might respond in four ways (second tier), resulting in changes in species interactions (third tier). These changes might then lead either to extinctions or to further shifts in ranges (fourth tier), ultimately leading to changes in the structure and composition of communities.
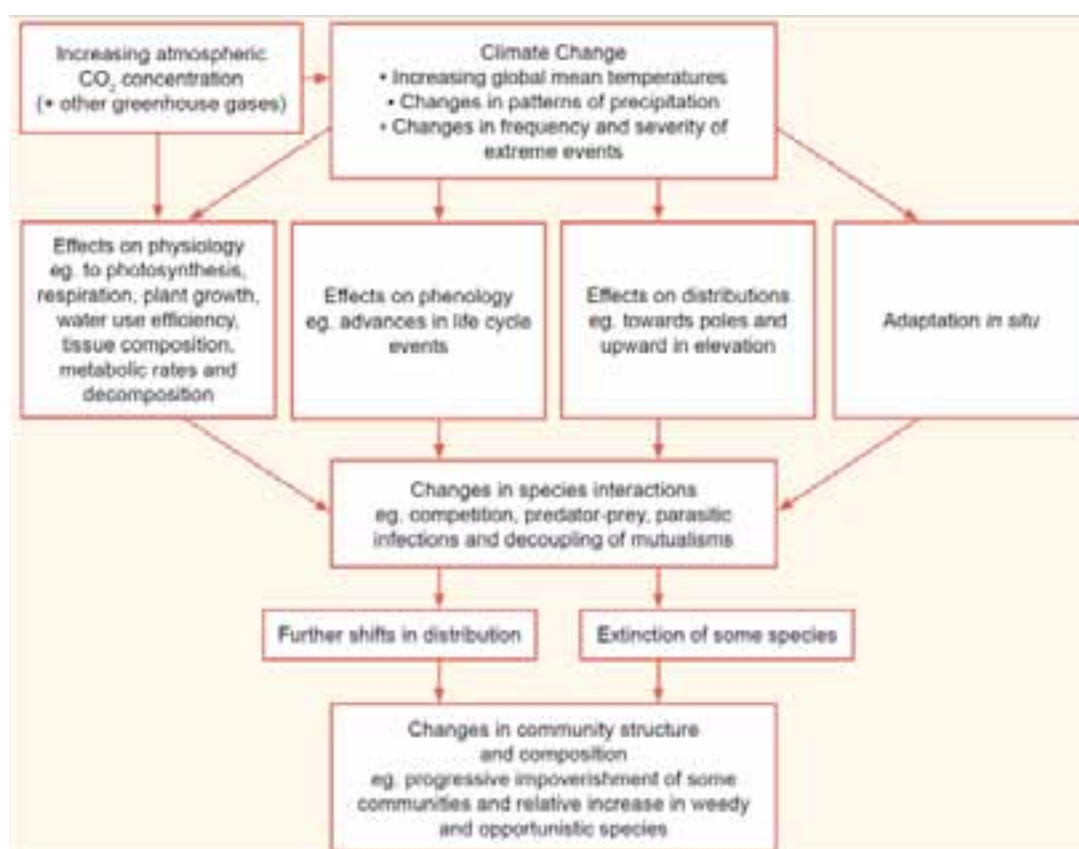
Source: Steffen et al. 2009 p.8
Figure 3B: Example of the potential pathways of community change flowing on from individual responses to climate change.

Appendix 4

Victorian biodiversity assets

Figures 4A and 4B represent the level of fragmentation and connectivity at a landscape level, coupled with the concentration of state-level biodiversity values, including the presence of rare/depleted vegetation and richness of rare or threatened species habitat.
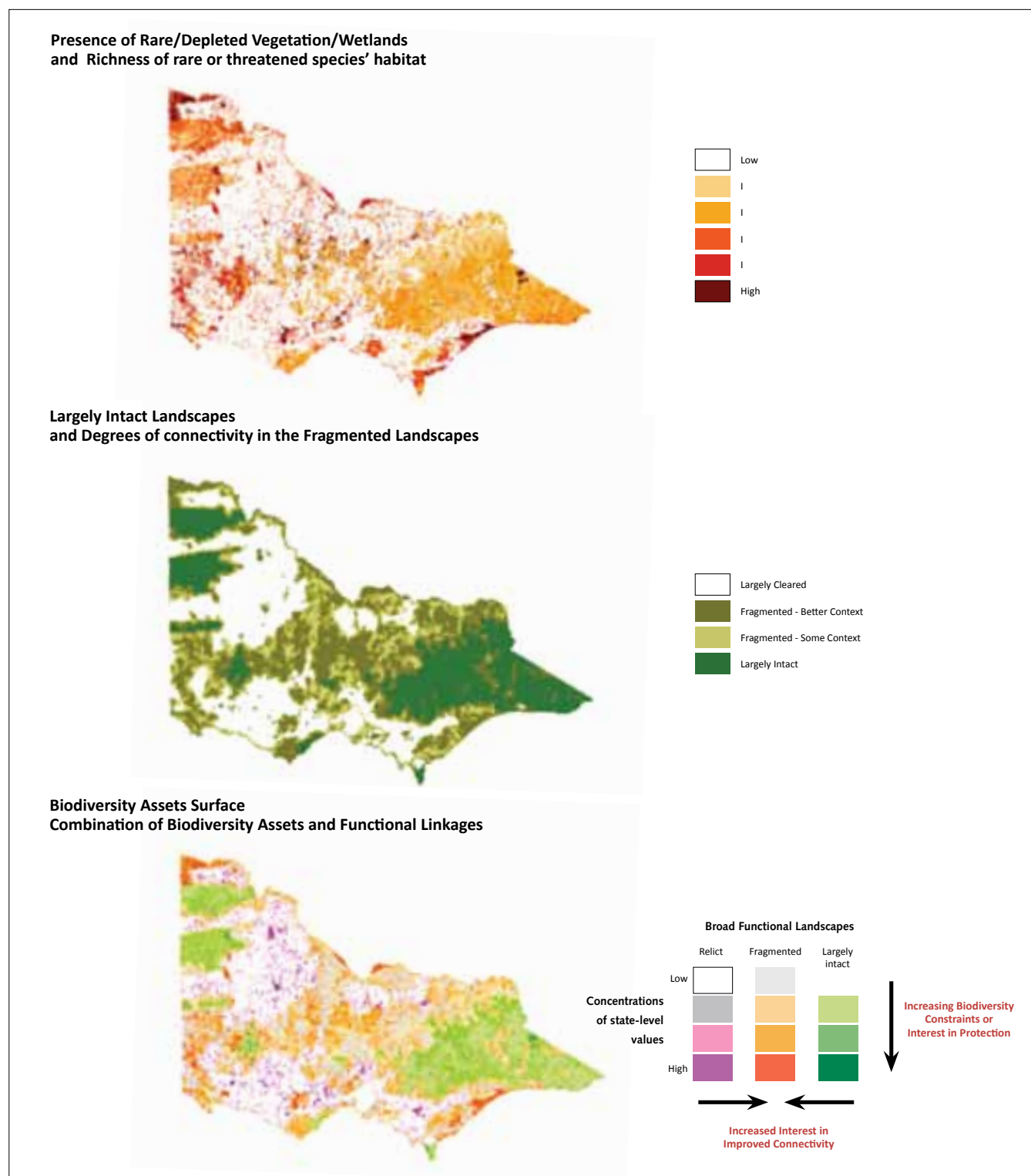
Figure 4A: Biodiversity assets across Victoria (DSE 2009c)

Figure 4B: Biodiversity assets surface across the Goulburn Broken Catchment (DSE 2009c)

Appendix 5

Summary of biodiversity and climate change risk assessment

A background paper is also available (Brunt and Miles 2009)

Method

The Standards Australia (2004) methodology for risk management was used to undertake a biodiversity risk assessment as part of the development of this updated strategy, with reference to Commonwealth of Australia (2006) and CSIRO (2006). In an effort to provide a direct link to priority setting and investment, a risk register was developed to outline and assess the activities currently in place, or are required to reduce the risk rating of various threats. The register can be updated at any time and used during the next level of planning (during implementation of this Strategy).

The Goulburn Broken CMA's climate change policy aims to ensure that adaptation strategies are built into the Authority's existing strategies at the time of their development or review. The assessment therefore factored in climate change threats in this Strategy more fully than in the 2004 risk assessment (McLennan *et al.* 2007) . An assessment of climate change impacts on water quality, quantity and river condition was undertaken by the Goulburn Broken CMA in Jan/Feb 2008 (GBCMA 2008). The need for further analysis of climate change impacts on rivers, streams and wetlands has also been identified by the Goulburn Broken CMA's River Health team and is likely to be addressed as part of the next River Health Strategy. The Australian Government has recently supported risk assessments as a process for developing adaptation strategies for some municipalities in the Goulburn Broken Catchment.

Controls (actions) to reduce risks, both current and future, were developed and assessed (e.g., feasibility) for extreme risks (determined through a matrix where likelihood is 'likely'/'almost certain' and consequence is 'major'/'catastrophic'). Controls listed for 'extreme' threats across all assets were also assessed for their ability to address threats identified as 'very high', recognising where further controls may need to be considered.

Threats rated as 'extreme' across the broad assets are shown in Table 5B. Assets and threats with a high number of extremes are shaded in grey.

Further/new controls assessed as feasible for addressing extreme threats are summarised in Table 5A. These have been incorporated as actions in Section 5 of the Strategy.

Further controls required	Threats addressed	Assets
Education campaign on the impacts of the activity on the asset	Cultivation, cropping and pasture management	Native Vegetation Flora and Fauna
More widespread stewardship programs such as Bush Returns	Reduced habitat function Dieback Lack of regeneration Isolation and simplification Weed invasion	Native Vegetation Wetlands Rivers and Streams Flora and Fauna
Reinvigorate Green Graze	Lack of Regeneration	Native Vegetation Flora and Fauna
Specifically address pollinator needs in management plans for sites	Isolation and simplification	Native Vegetation
Be more targeted with incentive programs to focus on specific ecological needs	Isolation and simplification Reduced habitat function	Native Vegetation Wetlands Rivers and Streams Flora and Fauna
Information and education prior to and during a fire event on the location of priority sites	Fire management	Wetlands
Further Wetland incentives and Stewardship programs	Landforming and drainage	Wetlands
Wetland planning overlays and better enforcement of legislation	Landforming and drainage	Wetlands
Produce better information and mapping about wetland locations	Landforming and drainage	Wetlands
Specifically address pollinator needs in management plans	Isolation and simplification Reduced habitat function	Wetlands Rivers and Streams Flora and Fauna
Education campaign	Reduced Habitat Function	Flora and Fauna
Matching landuse intensity to land characteristics and enacting this through local government overlays	Cultivation, cropping and pasture management	Soil Biota

Table 5A: Summary of further actions identified for the Goulburn Broken Catchment

Threat	Native Vegetation	Wetlands	Rivers & Streams	Flora / Fauna	Threatened species	Soil biota	No. Assets affected by threat
Clearing (direct removal of native veg)			E			E	2
Cultivation, cropping and pasture management	E			E		E	3
Stock grazing		E					1
Introduction of weeds	E		E	E			3
Introduction of pest animals			E				1
Transportation of pathogens			E			E	2
Poaching and hunting of native spp			E				1
Fish stocking of introduced, translocation spp			E				1
Irrigation (current practice)			E				1
Reduced habitat function (due to size, quality or fragmentation)	E	E	E	E	E		5
Dieback	E			E			2
Lack of regeneration	E	E	E	E	E		5
Isolation and simplification (includes lack of pollinators and species population size, isolation or genetic decline)	E	E	E	E	E	E	6
Weed invasion	E	E	E	E	E		5
Pest animals			E		E		2
Fire	E			E			2
On-stream barriers (includes culverts & regulators)		E					1
On-stream storages (flow regulation)		E	E				2
On-stream storages (water harvesting)			E				1
Infrastructure - waterways and floodplain development - including levees		E	E				2
Infrastructure - road and rail						E	1
Fire Management (suppressions and regime)		E					1
Landforming and drainage		E					1
Irrigation (in new areas)	E	E	E	E			4
Changed flow pattern and water availability		E	E				2
Drought		E					1
Groundwater extraction			E				1
Mining						E	1
Soil sodicity						E	1
Climate change (CC) in general	E	E	E	E	E	E	6
Total threats per asset (including specific CC threats)	**10**	**14**	**19**	**10**	**6**	**8**	
CC - Increase in intensity and occurrence of drought	E	E	E		E		4
CC - Eutrophication - increases in loads of nutrients to water bodies							0
CC - Increased occurrence and severity of fire	E	E	E	E		E	5
CC - Increased fire prevention activities	E	E					2
CC - Increased fire recovery activities	E			E		E	3
CC - Changed flood regime - fewer more severe floods			E				1
CC - Increase in stream salinity		E	E				2
CC - Change in land use leading to land use intensification						E	1
CC - Changes to pest distribution and species (including pathogens, viruses and ppa)		E	E			E	3
CC - Increase in mosquito borne diseases leading to drainage of wetlands			E				1
CC - Overall increase in temperature		E					1
CC - Temperature increase in spring/summer							0
CC - Reduced environmental flows			E				1
CC - Change in snow regime	E	E		E	E		4
CC - Increase in summer storms (wind storms, lightning, rainfall)							0
CC - Change in rainfall patterns	E	E	E	E	E		5
CC - Increases in summer rainfall							0
CC - Decreased frost days							0
CC - Reduced runoff	E	E	E	E			4
CC - Reduced rainfall in winter	E	E	E	E			4
CC - Change to phenology (timing of events)	E	E		E			3
CC - Change in political focus (biodiversity becomes less important)							0
CC - Climate refugees - causing population increase							0
CC - Climate refugees - causing population decrease							0
Sub total (CC threats)	**9**	**11**	**10**	**7**	**3**	**4**	
Total threats per asset	**19**	**25**	**29**	**17**	**9**	**12**	

Table 5B: Summary of extreme (E) risks across broad biodiversity assets in the Goulburn Broken Catchment

Note re Table 5B– threats in italics are 'induced threats'. Standard text generally refers to land and water use practices, including in new areas. Those threats in red are 'natural' processes now potentially more serious because the environment has been modified (including flood, fire, native species grazing, native fauna species becoming invasive, wind damage, earthquake and drought). The yellow section highlights climate change threats. Assets and threats with a high number of extreme risks are shaded in grey.

Appendix 6

Targets revision and background

Targets are set and periodically revised within boundaries defined by an understanding of the benefits of target-setting (listed in section 3.2) and our ability to measure change.

Revised targets (2009)	Level of change	Summary of Changes*	Previous targets (GBCMA 2003a; GBCMA 2003b)
Target 1: **Maintain extent and quality of all native vegetation at 2005 levels.**	Minor	The term 'quality' was added to make it more explicit that we are interested in maintaining both extent and quality of native vegetation. '1999 levels' were changed to '2005 levels' to reflect the datasets used to determine native vegetation extent and quality (DSE 2007d; DSE 2007e). The text referring to net gain is relevant to all targets. Therefore, this text was added as a footnote to all targets, and removed from Target 1.	Maintain extent of all native vegetation types at 1999 levels in keeping with the goal of 'net gain' listed in Victoria's Biodiversity Strategy 1997.
Target 2: **Increase the extent of native vegetation in fragmented landscapes by 70,000 ha by 2030 in order to restore threatened EVCs and improve landscape connectivity.**	Moderate	Priorities for increasing extent were developed (also see Table 6B), which are: • increasing extent of Endangered and Vulnerable EVCs; • increasing connectivity; and • focusing on fragmented landscapes. Spatial models were developed to provide scenarios of increasing the extent of Endangered and Vulnerable EVCs to 15% in line with the above mentioned priorities (see inserted map). The models were developed using the updated native vegetation extent dataset (DSE 2007d) the Goulburn Broken Landscape Context Model, and Biodiversity Assets Surface (DSE 2009c). The updated native vegetation extent dataset has provided a higher estimate of the extent of native vegetation in the Goulburn Broken Catchment than previous datasets, and as a result, the increase in area required to achieve the 15% target has reduced. Additionally, not all EVCs could reach the 15% target while meeting the above priorities, and therefore the revised target reflects an increase of EVCs to 15% only where it was possible within the other priorities (achieving connectivity in fragmented landscapes). Based on the original (2003) target, an increase in extent of 162,000 ha was required to meet the target. With the changes made to Target 2, an increase of 70,000 ha is required to meet the target (see Figure A). This is despite both targets being centred around increasing vegetation types to 15% of their pre-European cover, and largely reflects differences in the understanding of existing vegetation extent (which is based on spatial datasets) and improved knowledge of the desired spatial distribution of this increase. The difference between the 2003 and revised (2009) target highlights the uncertainty and complexity around setting targets. However, targets remain an important part of strategic planning and implementation as they highlight the uncertainty and knowledge gaps that need to be addressed to improve decision making, and provide a reference point to aim and measure progress towards. A 100 year target was also developed to better reflect and spatially represent the long-term vision and ecological needs. The target was to: Increase the extent of native vegetation by 230,000 ha by 2110. This target is not included in the Strategy as it is not considered to be at an appropriate scale and timeframe. Spatial models of this target were also developed.	Increase the cover of all endangered and applicable vulnerable EVCs to at least 15% of their pre European vegetation cover by 2030. *Green areas: focus for improving quality of native vegetation* *Purple areas: focus for increasing the extent of native vegetation, Goulburn Broken Catchment.*
Target 3: **Improve the quality of 90% of existing (2005) native vegetation by 10% by 2030**	Minor	'2003' changed to '2005' to reflect updated data used. To assist with the review of Target 3, the components of vegetation quality were defined. Quality broadly includes the structure and composition of habitat including components such as the presence of large trees, the diversity and abundance of life forms (e.g. trees, shrubs, grasses, lichens), and the presence of fallen timber. The review highlighted that there is significant work to be undertaken to improve our understanding of the desired increase in vegetation quality. At this stage, the interpretation and measurement of a 10% increase in quality remains an area for further refinement. While the target may considered ambitious, no major changes were made to the target in the absence of better information.	Improve the quality of 90% of existing (2003) native vegetation by 10% by 2030.
Threatened Species and Communities Target	Probably Major	In development with DSE. Not included in this Strategy.	Increase 2002 conservation status of 80% threatened flora and 60% threatened fauna by 2030.

See Keogh et al. (2009) for further information.

Table 6A: Summary of changes to biodiversity targets.

Relevant target theme	Premise	Rationale
Native Vegetation Extent	Restoring threatened EVCs will ensure a range of habitat types to support the vision.	As in most parts of the world, the most cleared vegetation types in the Goulburn Broken Catchment are those found in the more productive areas. Usually, different faunal assemblages associate with different vegetation types (Bennett et al. 1991, Morrison et al. 1992; Lindenmayer and Fischer 2006). Therefore, the almost total loss of specific vegetation types has significant impacts on biodiversity as these areas represent a different set of species to the more intact/less productive parts of the catchment. It is not the intention of the targets to maintain all species in their present locations and all ecosystems in their present composition (See Steffen et al. 2009). Rather, they are trying to ensure the availability of a range of habitat types across the catchment. It is recognised that habitat is not always synonymous with native vegetation as what constitutes suitable habitat is species-specific. However, clearing of native vegetation leads to the loss of habitat for the majority of flora and fauna species, particularly those of conservation concern. Numerous studies have found that loss of native vegetation results in reduced species richness (e.g., Reid 2000; Fahrig 2003; Radford et al. 2005).
	Increasing vegetation extent in areas that improve landscape connectivity will promote healthy ecosystems and viable populations of flora and fauna.	Lindenmayer and Fischer (2006) describe 3 interrelated types of connectivity. 1. Landscape Connectivity: the connectedness of vegetation cover within a given landscape (human perspective). 2. Ecological Connectivity: the connectedness of ecological processes at multiple scales (ecosystem perspective). 3. Habitat Connectivity: the connectedness of habitat patches for a given species (single species perspective). As the extent target is at a catchment scale, the target relates to improving landscape connectivity. Landscapes that retain more connections between patches of otherwise isolated patches of vegetation are more likely to maintain populations of species that inhabited the original landscape (Lindenmayer and Fischer 2006). A lack of landscape connectivity may result in areas of vegetation remaining unoccupied for suites of species. It may also result in reduced ecological connectivity leading to a range of cascading effects such as altering the structure of food webs or disrupting ecological processes such as decomposition of wastes, seed dispersal or pollination (Lindenmayer and Fischer 2006). Improving landscape connectivity is seen as a key method to ensure that natural environments are able to retain their biodiversity values and critical ecological functions in the face of growing pressures including climate change. It is also a key method in enabling species to self adapt.
	Focusing on increasing extent in fragmented landscapes will result in better outcomes for biodiversity than in relict landscapes (and intact areas cannot contribute significantly to an increase in vegetation extent).	Intact and fragmented landscapes have greater area of existing vegetation/habitat upon which to improve connectivity and habitat quality. Reid (2000) and Radford et al. (2005) found that the greater the extent of vegetation in the landscape, the greater the species richness of birds. It is therefore assumed that intact and fragmented areas have greatest potential for recoverability/improvement, as they have retained a better diversity and abundance of species on which to improve. Remaining habitat in relict landscapes is assumed to be highly vulnerable with limited capacity to adapt or cope with climate change and other threats, and is unlikely to result in good return on investment in the long term (except for specific, identified assets).
Native Vegetation Quality	Improving the quality of habitat components (i.e. getting habitat components such as fallen timber, closer to EVC benchmark levels) is assumed to benefit most species and ecosystem function.	Access to suitable habitat is essential for the survival and successful reproduction of all species (Lindenmayer and Fischer 2006). Habitat quality can be measured using methods such as Habitat Hectares (DSE 2004), which assess components such as mature trees, understorey, logs, leaf litter, native species diversity, and weed cover. These components provide different habitat resources for different species. For example, logs and leaf litter on the ground are habitat for insects and microflora that in turn provide important food and nutrients for other native flora and fauna. Mature trees provide food and shelter for native fauna. Therefore, an increase in the quality and availability of these components is assumed to be of benefit to native flora and fauna.
Threatened Species	Conserving plants and animals is an important component of achieving the vision.	Diversity of species is important in maintaining ecosystem function. Species provide genetic and other resources that are of inestimable economic value (e.g. tourism, forestry and agriculture), provide indirect benefits to humanity through 'ecosystem services' that are essential to our survival, and are of scientific interest and aesthetic importance. The importance of conserving threatened species is also reflected in relevant legislation including the *Flora and Fauna Guarantee Act 1988* and the *Environmental Protection and Biodiversity Conservation Act 1999*.

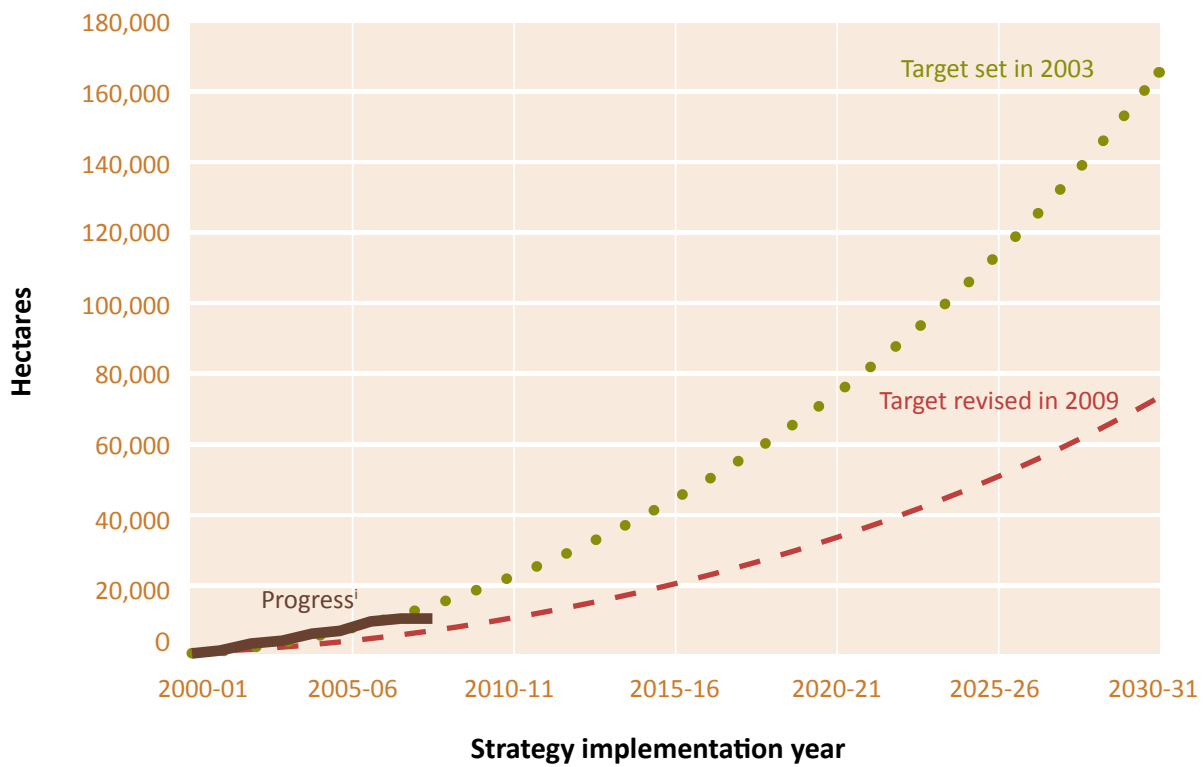**Table 6B:** Premise and rationale behind revised biodiversity targets

Figure 6A: Graph highlighting the difference between the 2003 and revised (2009) native vegetation extent targets and progress towards these

i Based on assumptions on gains in vegetation (such as revegetation and natural regeneration) and losses of vegetation (such as legal and illegal clearing). Vegetation burnt in the 2009 fires has not been included as a loss of extent, as it is assumed the area burnt will regenerate by 2030. Direct vegetation removal associated with post fire clearing is assumed as a loss in the net outcome. Detailed assumptions can be found at www.gbcma.vic.gov.au.

Appendix 7

Prioritised Biodiversity Action Planning sites

Biodiversity Assets   **BAP Sites**

Legend

● Major Towns
— Major Road
— Minor Road
— Major Rivers
▨ Lakes

BAP Sites:

▨ Low
▨ Medium
▨ High
▨ Very High
▨ GBCMA

Map Scale 1:1.22 24e+006
Produced by Vanessa Keogh
Produced on 20 Aug 2007
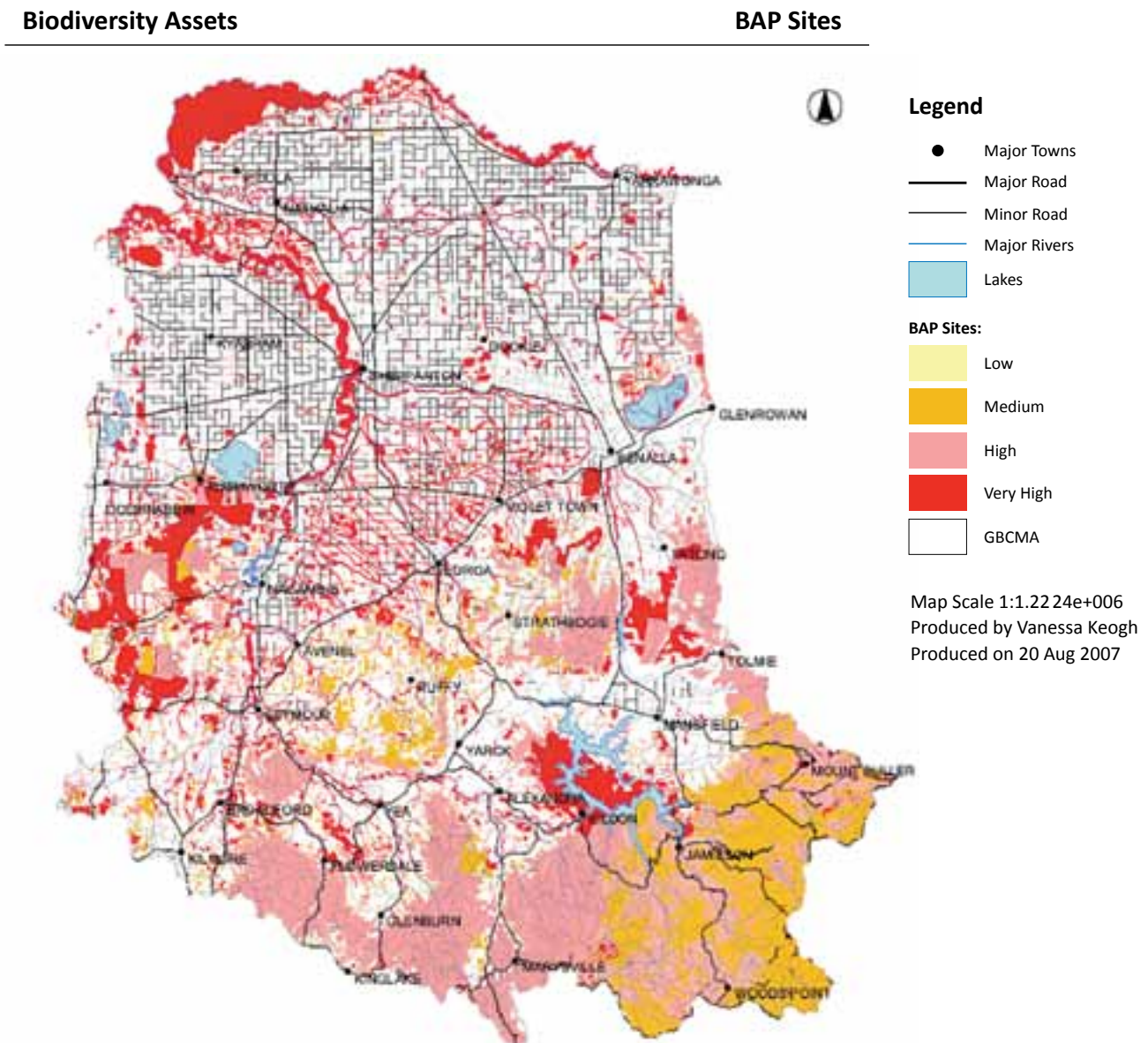
Figure 7A: Prioritised Biodiversity Action Planning sites (Very high to low)

Grey-crowned Babbler *(Pomatostomus temporalis)* (e)

Minimum patch size (threshold)	> 2ha, > 1km continuous roadside
Critical distance between patches	< 500m from known site
Dispersal threshold	< 2km, very few records > 10km
Ecological Vegetation Class	Woodlands
Some other requirements (general)	Mature trees, shrubs (>6m), linkages

Bush Stone-curlew *(Burhinus grallarius)* (e)

Minimum patch size (threshold)	> 1ha, >40m wide
Critical distance between patches	< 1km
Dispersal threshold	< 2km from known site
Ecological Vegetation Class	Creeklines, Woodlands
Some other requirements (general)	Ground timber, fox control

Superb Parrot *(Polytelis swainsonii)* (e)

Minimum patch size (threshold)	Larger the better
Critical distance between patches	Varies for breeding / non breeding
Dispersal threshold	Varies for breeding / non breeding
Ecological Vegetation Class	Woodlands, forests (River Red Gum)
Some other requirements (general)	Hollows, shrubs, corridors, dead trees

Brown Treecreeper *(Climacteris picumnus)* (k)

Minimum patch size (threshold)	> 30ha
Critical distance between patches	< 500m from known site
Dispersal threshold	< 1km
Ecological Vegetation Class	Woodlands, edges, forest clearings
Some other requirements (general)	Mature trees, fallen timber*, linkages

Tree Goanna *(Varanus varius)* (v)

Minimum patch size (threshold)	> 2km roadside / streamside patches
Critical distance between patches	< 2km
Dispersal threshold	< 2km
Ecological Vegetation Class	Most except wetlands
Some other requirements (general)	Mature trees, fox control, logs

Brolga *(Grus rubicunda)* (v)

Minimum patch size (threshold)	> 50ha or clusters of wetlands
Critical distance between patches	Varies
Dispersal threshold	Varies
Ecological Vegetation Class	Wetland (ephemeral, 20-30cm depth)
Some other requirements (general)	Fox control, Canegrass, Eleocharis spp

Squirrel Glider *(Petaurus norfolcensis)* (e)

Minimum patch size (threshold)	> 0.5ha, > 1km length
Critical distance between patches	< 50 meters
Dispersal threshold	< 1km
Ecological Vegetation Class	Woodlands, Forests
Some other requirements (general)	Mature trees, Hollow-dependant#

Victorian threatened status definitions: (e) = endangered, (v) = vulnerable, (k) = poorly known.

Habitat Requirement Source: Variety of Sources (GBCMA *in prep.***) and DSE 2005a.**

* Habitat requirements include fallen timber at > 40 tonne/hectare (MacNally 2006).
# Tree-hollows (with tight-fitting entrance hole) are essential to Squirrel Gliders for breeding and den sites.

Photo Credits: Grey crowned Babbler (Graeme Chapman), Bush Stone-curlew (Ian McCann), Tree Goanna (Peter Robertson) and Squirrel Glider (John Seebeck) (NRE 2002f); Superb Parrot and Brown Treecreeper (Dr. Neville. R. Bartlett 2006); and Brolga (Paul O'Connor 1992).

Table 7A: Focal species and their habitat requirements - Barmah Landscape Zone

Appendix 8
Summary of methodology for assessing the 14 geographic zones

Geographic zones were identified for an assessment of their existing biodiversity attributes and the potential to contribute to ecological objectives. This process was based on a rational thinking process by Barwick (pers comm.).

A scoring system using local/expert knowledge[6] was used to assess zones according to the:

1. existing biodiversity attributes (maintenance values);
2. potential of the zones to contribute to ecological objectives (taking into account level of resilience and feasibility given surrounding land use and other threats); and
3. both 1+2.

The biodiversity values and objectives were determined during a vision setting/mapping exercise for biodiversity in the Goulburn Broken Catchment (Barlow et al. 2007; Figure 8A below). Objectives were developed as part of this process and were ranked/weighted according to their importance in achieving the vision. These objectives and weightings were transferred to the assessment of biogeographical zones. Each zone was rated from 1 (poor) to 5 (excellent) and then multiplied by the weightings (raw data in Miles and Stothers 2009). Zones with the top three scores were rated as very high, the next three high, the following three medium and the remainder low priority.

Biodiversity attributes (maintenance values)	Ecological objective	Weighting
Native habitat (existing/protected/secured)	Increase native habitat protection and security	5
Connectivity	Improve landscape and habitat connectivity	5
Ecological processes	Provide for ecological processes, energy and gene flow	3
Vegetation/habitat Condition	Improve the condition of native habitat	3
Threatened species	Improve the viability of threatened species	1
Threatened EVCs	Increase the extent of threatened EVCs to a viable level	1

Table 8A: Biodiversity values and objectives and associated weightings.

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[6] Sub-group of the Biodiversity Strategy Working Group

Legend

- • Locations
- Major Rivers
- Plantations
- GBCMA

Major Roads

Biodiversity Assets

Potential biolinks (opportunities for landscape restoration)

Broad biodiversity assets (focus for protection and management)

Public Land

0 10 20 30 40 Km

Due to scale, numerous smaller and dispersed assets are not shown, especially remnants on the plains   31 Aug 2007
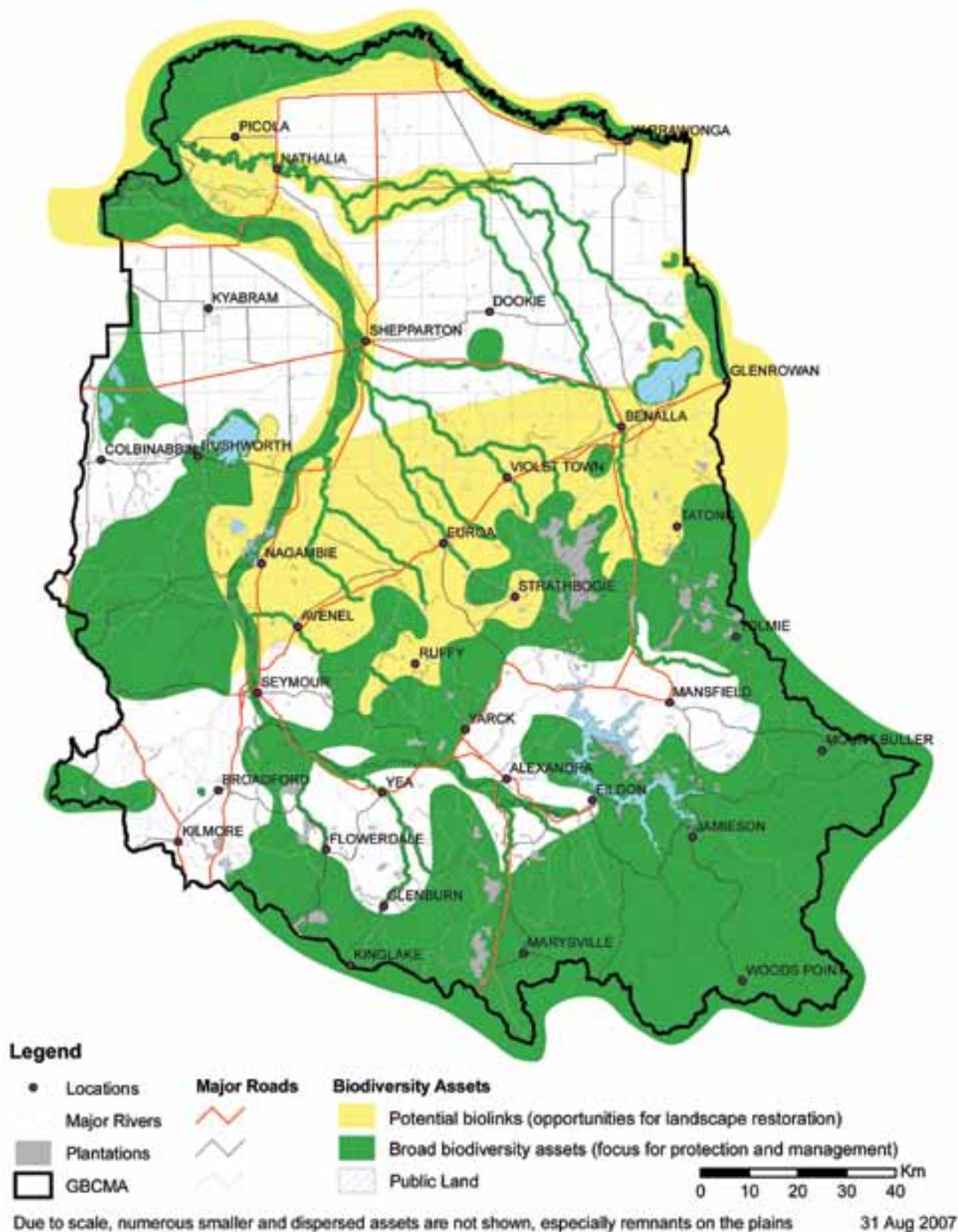
Figure 8A: Catchment-scale overview of focus areas for biodiversity protection and restoration (from the vision setting exercise in 2007)

Appendix 9
Triage approach to threatened species management?

Decision-making processes for investing in different biodiversity objectives often depend on government priorities. There is significant investment in threatened species through Goulburn Broken CMA's River Health and Biodiversity programs. However, the rationale for deciding the proportion of funding allocated to individual species conservation versus broader ecosystem health is not clear. The tension between investing in these different objectives was raised in the Victorian Government's Land and Biodiversity Green Paper: '...increase the resilience of critical habitats to restore broad ecosystem function, rather than focusing on conserving individual species' (DSE 2008). While threatened species conservation was identified as an objective in the Goulburn Broken biodiversity vision setting exercise that commenced in 2007, it was ranked lowest against all other objectives that targeted a more systems approach to biodiversity conservation (see Barlow et al. 2007).

All species maintain a right to existence. They also provide genetic and other resources that are of inestimable economic value (e.g., tourism, forestry and agriculture), provide indirect benefits to humanity through 'ecosystem services' that are essential to our survival, and are of scientific interest and aesthetic importance.

Funding for conservation will always be inadequate given the size of the problem. Given this, and in the face of climate change, it is clear that we cannot save everything. This makes prioritisation of investment in threatened species conservation vital to optimise the return on investment and reduce loss of biodiversity as much as possible. At present, investment in threatened species is skewed towards species most at risk of extinction. That is, Critically Endangered species are more likely to receive funding than a species that is classified as Declining. An alternative approach is the 'triage approach' (Possingham 2001). This approach tries to minimise the total loss of species over a long time frame rather than trying to save everything. In this approach, species are placed in three categories:

1. threatened Species that are likely to become extinct even with huge expenditure;

2. threatened Species that can be recovered quickly for a reasonable level of expenditure and in a relatively short timeframe; and

3. species that are threatened but are currently a long way from extinction.

The advocates of ecological triage argue that most funding should go to species in the second category, the ones that can be secured quickly at low cost. The highly endangered species for which recovery actions are uncertain and expensive are left to fend for themselves. They may recover without assistance, they may become extinct, or a cheap and efficient means of ensuring recovery may be discovered. Either way, the cost of saving them is too high and the chances of success are too low.

A 'triage approach' aims to add rigour to the decision-making process and reduce overall loss of biodiversity.

See also Bottrill et al. 2008 and Moran et al. 2008.