MT PANORAMA PRECINCT

Fauna Management Strategy

SUMMARY DOCUMENT

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This report has been prepared for:

BATHURST REGIONAL COUNCIL

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A copy of the full Mount Panorama Fauna Management Strategy is available from the Environment, Planning & Building Services Department, Civic Centre, 158 Russell Street Bathurst or online via www.bathurst.nsw.gov.au/environment.

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Executive Summary

The purpose of this Management Plan is to ensure the survival of sustainable populations of native species and the maintenance of ecological processes within the Mount Panorama precinct while also allowing for the continuation of various residential, sporting (including motor sports), tourism and agricultural activities. The Mount Panorama precinct is 2.5km south of the Bathurst CBD. Bathurst Regional Council is a primary landholder in this precinct and is generally responsible for the management of fauna and native ecological communities. Mount Panorama is an important feature in the landscape and economy of the Bathurst region. The need for a Fauna Management Strategy to guide the adaptive management of these species has been identified.

A primary concern for Council in the management of the large species of native fauna in the Mount Panorama precinct relates to the potential for collisions between fauna and private and motor racing vehicles while also ensuring that existing land uses of both private landholders and Council land can be maintained. The plan is focussed on seven native mammal species, Eastern Grey Kangaroo, Common Wallaroo, Red-necked Wallaby, Swamp Wallaby, Common Wombat, Koala and Emu, and the three feral species European Rabbit, Red Fox and feral cat. The conservation of the two Endangered Ecological Communities *White Box – Yellow Box – Blakeley's Red Gum Woodland* and *Tablelands Basalt Forest* is also a consideration in this plan.

The Management Plan is divided into two sections: the first part provides the background including the issues and principles which are fundamental to the formulation of a Fauna Management Strategy, a description of the Mount Panorama precinct and the target species and a summary of the supporting information and data that has been produced and underpins the Fauna Management Strategy. The second part of the Management Plan is the Fauna Management Strategy. The detailed supporting documents are attached to the Management Plan.

A detailed review of the knowledge relating to macropods and other large fauna in the Mount Panorama precinct was carried out as the initial stage of the development of the Management Strategy. This included a review of the known ecology and breeding biology of the target species and knowledge of the species within the Bathurst region. The Mount Panorama precinct is important in the extensively cleared landscape of the central west as it provides remnant vegetation for refuge and breeding habitat for a broad diversity of native species. Fourteen species listed as threatened under NSW legislation are known to occur there.

Potential methods for assessing the abundance and density of the target fauna species and vegetation condition across the precinct are summarised from the literature and from NSW government protocols. This provides the basis for the methods selected for surveys of the fauna and vegetation condition in the precinct. Through the use of rigorous and repeatable survey procedures a benchmark density and carrying capacity is established which can then be used to monitor change

through time. Strategies for faunal management must be developed from an appropriate definition of the problem being addressed and the determination of an ecological carrying capacity is fundamental to this. A range of approaches needs to be considered in the development of the strategy and the accepted methods for controlling or reducing populations of kangaroos and pest species are reviewed.

A detailed assessment of the distribution and abundance of the target species of fauna within the precinct was carried out. This included the development of an appropriate scientifically rigorous survey methodology to provide an index of abundance which would also be appropriate for the conduct of repeated population surveys, assessment of local and regional dynamics and recommendations for the ongoing adaptive management strategy. Two surveys have been conducted, in March and August 2011, using a variable strip width strip transect method. Two observers walked predetermined transects and counted all target animals and transects were mapped from a GPS trace. All transects were surveyed in the early morning and late afternoon. The Mount Panorama precinct was stratified into six sub-areas and transects located within each of these. A broader study area was also defined and surveyed using a driven transect and a helicopter survey from the precinct to Rockley Mount was carried out in August 2011.

Eastern Grey Kangaroo were significantly more abundant than all other target species with an overall density index of 2.2/ha (March) and 2.0/ha (August) but there was not an even distribution of this species across the precinct. The highest index of density was in the area between the racing circuit and College Road (6/ha in August) while inside the circuit the density is higher at the top of the Mount and around the orchards and vineyards. This variation in distribution was confirmed by the driven transects and the helicopter survey which both recorded higher numbers on the eastern side of the precinct, north of the Waste Management Centre. The lowest densities were recorded within the area just west and south west of the circuit. Movement of the Eastern Grey Kangaroos was generally into more open grassy woodland to graze in the late afternoon, returning to the more dense wooded areas (including orchards) to rest during the day. Individuals were most habituated to human presence inside the track and along College Road.

The Common Wallaroo was the most abundant of the three other macropod species in the precinct while Red-necked Wallabies and Swamp Wallabies were generally uncommon. These three species mostly occurred towards the top of the Mount inside the track. No Common Wombats or Koalas were observed and a solitary Emu and two pairs of Red Kangaroos were present in the vicinity of the Waste Management Centre. These two species are likely to be surviving from those released from the Sir Joseph Banks Nature Reserve when it was closed. Rabbits and foxes were abundant across the precinct but only one feral cat was recorded. Accurate estimation of numbers of these species is difficult due to their cryptic behaviours, especially foxes and cats but they are both likely to be abundant.

On the basis of a carrying capacity of about 3 DSE for the Mount Panorama area and an equivalence of two kangaroos for one DSE, the Eastern Grey Kangaroo carrying capacity is at least six per hectare. Although this density was recorded east of the

circuit the concurrent vegetation condition assessment found no evidence of overgrazing, indicating that the ecological carrying capacity of the Mount Panorama precinct has not been reached with the current macropod densities.

The vegetation condition assessment was carried out concurrently with the fauna surveys. Thirty plots of 0.1ha scattered across the precinct were assessed. Groundcover density was moderate to very dense reflecting the preceding good seasons and is dominated by perennial native grasses. In the more degraded areas weed species including Phalaris, Paspalidium and saffron thistle were dominant and vegetation structure was homogenised. The noxious weed serrated tussock is also relatively common including in less disturbed woodlands of high conservation value. Regeneration of native grasses was generally good where they are dominant. Green grass, the preferred food of Eastern Grey Kangaroos and Common Wallaroos, was readily available including in August after the severe winter frosts. There was no evidence of shrub or tree browsing and evidence of chewed grass was minor.

The two Endangered Ecological Communities cover most of the Mount Panorama precinct and natural regeneration within these woodlands is low overall. The upper storey is generally in good health but there is a lack of structural integrity due to past clearing and low regeneration. Exotic shrubs (dominated by hawthorn and noxious species including blackberry) are common to abundant in the Box-Gum Woodlands. The grazing by the resident kangaroos and wallabies does not appear to have impacted on the condition of the Woodland EECs.

Stakeholder engagement has been an important aspect of the development of this Management Plan. An initial consultation forum was held to gauge stakeholder issues and concerns and was followed by another forum after the completion of the knowledge review and March survey to enable community input into the development of the goals and objectives for the Management Strategy. A survey of landholders within and adjacent to the precinct was also carried out with 23 of the 53 landholders providing a response to the questionnaire. This provided valuable information relating to distribution and abundance of kangaroos, and the change in numbers through time.

The plan includes the legislative, policy and ethical requirements for management of native and feral fauna in NSW. Animal welfare considerations are fundamental to the implementation of the Management Strategy and the codes of practice developed by the Department of Primary Industry in NSW and the Commonwealth Government must be followed. The management of high numbers of native species including the Eastern Grey Kangaroo and control of the damaging impact of feral species will both be most effectively carried out through co-operative partnerships between all stakeholders and land managers as stated in the NSW Biodiversity Strategy (Objective 10). There is also an obligation on land managers to control pest species declared under the provisions of the *Rural Lands Protection Act* 1998. The European Rabbit is a declared pest species.

The Management Strategy

Vision

To sustainably manage large native fauna within the Mount Panorama precinct while also reducing the potential for conflict between native wildlife and community or landholder activities.

There are four distinct aspects to the issue of fauna management and realisation of this vision in the Mount Panorama precinct and these are reflected in the goals of the Management Strategy. The objectives and actions of the Fauna Management Strategy are based around these goals. The goals are:

1. Develop and implement a management strategy that will effectively minimise the risk of a collision between race participants and macropods.
2. Manage and minimise the social and economic impacts of macropods on landholders and sporting and recreational activities within the Mount Panorama precinct.
3. Develop and implement a management strategy that will maintain sustainable populations of native fauna, flora and Endangered Ecological Communities within the Mount Panorama precinct.
4. Maintain a resilient landscape, sustainable populations of native fauna and healthy Endangered Ecological Communities by reducing the impact of feral animal species.

In terms of the potential conflict between native fauna and motor sports, the results of the surveys indicate that the abundance of Eastern Grey Kangaroos and Common Wallaroos has not been the critical factor causing incidents on the race track. It is more likely to be the result of auditory confusion by individuals that are not accustomed to race events. The intense noise produced by the race cars, flyovers and helicopters and the large number of race goers will affect the ability of a kangaroo to detect a real threat to its safety and cause a panic response. To the west and south-west of the track the kangaroos observed were frequently in smaller groups which are generally more flighty, they don't have the safety of the mob to rely on. The daily cycle of movements, feeding from a couple of hours before dark, through the night and a couple of hours after dawn and resting during the day, also reinforces the conclusion that the race track incidents are panicked individuals responding to a perceived threat, not a result of increased densities.

Conversely the higher abundance of Eastern Grey Kangaroos is perceived as a problem for the landholders on the eastern side of the precinct as a result of damage caused to property and a fear of attack by large bucks. This can potentially be addressed by reduction in numbers through a culling programme which can be applied for through the Office of Environment and Heritage. There are detailed requirements that must be met if this approach is adopted including the humane treatment of pouch young and young-at-heel. The age of greatest welfare concern for young Eastern Grey Kangaroos has been determined to be at 8-12 months of age. It is recommended that this impact be minimised by the application for permits within a specified season which is from March to July, early in the breeding season of this species. Ways in which people can avoid conflict with and potential injury from kangaroos are also provided.

Overgrazing by any herbivore population has the potential to cause extensive landscape damage including degradation of the two endangered Ecological Communities. The concurrent assessment of vegetation condition across the precinct has not found evidence of overgrazing by macropods despite some areas being around the conservatively estimated carrying capacity of six Eastern Grey Kangaroos per hectare. The greatest threats facing the integrity of this ecological community are currently the presence of weed species and erosion gullies and a strategy to control noxious weeds and exotic shrubs and thistles is an important first step in the maintenance and management of the Endangered Ecological Communities on Mount Panorama.

Control of feral vertebrate species is important in the maintenance of resilient native fauna populations within the Mount Panorama precinct. Given that the European Rabbit is a declared pest under the *RLP Act* 1998 it is the responsibility of the land owners, both public and private to implement control measures. Foxes and wild cats are not declared pests but predation by these species is listed as a Key Threatening Process under both NSW and Commonwealth legislation. Control of these species is, however, extremely difficult and most effectively carried out through co-operative programmes including all land managers.

A conceptual model indicating the interrelationships between the critical elements of the Mount Panorama Fauna Management Strategy and the actions required has been developed. This model demonstrates that the presence of the Eastern Grey Kangaroo is the key element linking these four goals and this is controlled by natural forces (drought or predation) or by human intervention. Effective management requires monitoring and control of a range of interacting factors which are included in the conceptual model.

Ten objectives based on the goals, the conceptual model and the results of the assessments of the Mount Panorama precinct have been determined, and actions for each objective specified. This includes a focus on continuing engagement with the community and landholders within the precinct in the implementation, evaluation and adaptation of this management strategy through time. Integral to this is the implementation of an effective monitoring programme which is outlined in the strategy.

Figure 1.1: The extent of Crown land (yellow) and land managed by Bathurst Regional Council (orange) within the Mount Panorama precinct. The previous 'Sir Joseph Banks Nature Reserve' is now held by the Bathurst Local Aboriginal Land Council (blue).

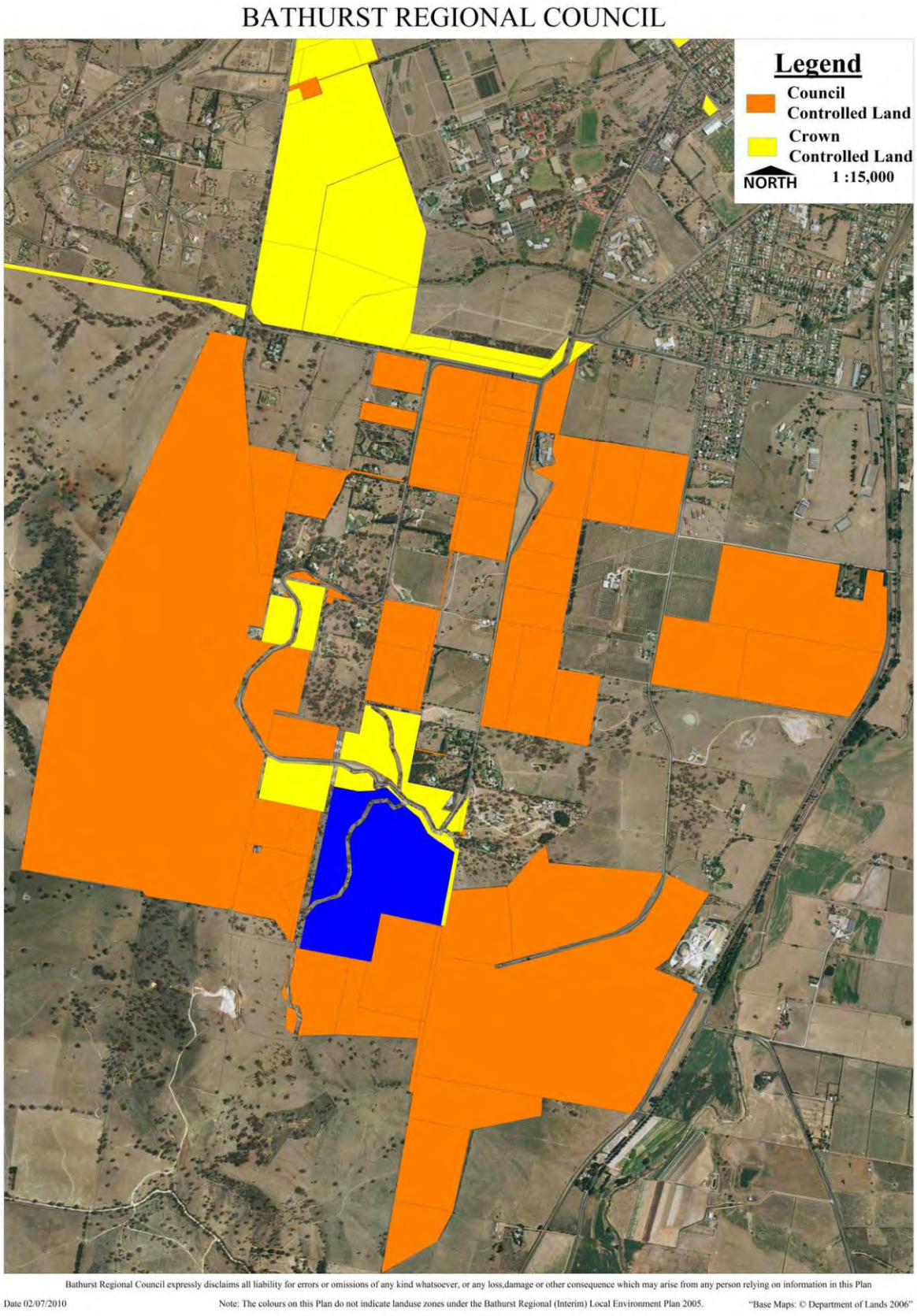
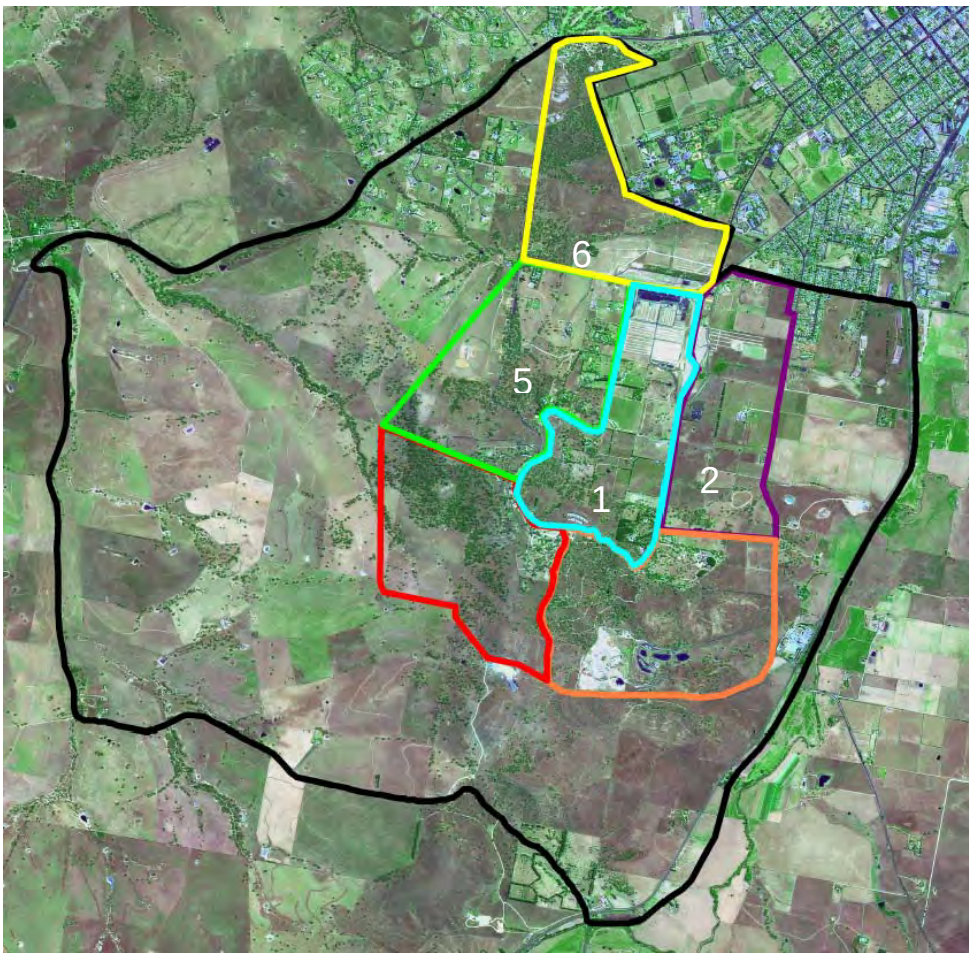


Figure 1.2:

The Mount Panorama precinct and the extended study area incorporated into this assessment. The extended study area is delineated by the black line and the precinct by the internal coloured lines. The six sub-areas used in the field assessment are numbered and delineated by the coloured lines (see also Attachment: Volume 2).



1. Part 2: The Fauna Management Strategy

1.1. Vision and Goals

1.1.1. Vision

To sustainably manage large native fauna within the Mount Panorama precinct while also reducing the potential for conflict between native wildlife and community or landholder activities.

1.1.2. Goals

1. Develop and implement a management strategy that will effectively minimise the risk of a collision between race participants and macropods.
2. Manage and minimise the social and economic impacts of macropods on landholders and sporting and recreational activities within the Mount Panorama precinct.
3. Develop and implement a management strategy that will maintain sustainable populations of native fauna, flora and Endangered Ecological Communities within the Mount Panorama precinct.
4. Maintain a resilient landscape, sustainable populations of native fauna and healthy Endangered Ecological Communities by reducing the impact of feral animal species.

1.2. Key findings to underpin the management strategy

As outlined in section 1.1.2 there are four distinct aspects to the issue of fauna management in the Mount Panorama precinct. The results of the knowledge review and the field assessments for this study address these aspects (Attachments: Volumes 1, 2, 3) and are discussed below.

1.2.1. The potential for conflict between native fauna and motor sports

A key requirement of this management strategy is to reduce the potential for a collision between macropods and racing vehicles on Mount Panorama. In discussion with BRC and through the stakeholder engagement it was clear that there is a very low tolerance of macropods hopping onto the track during race events. One fatal accident would not be acceptable and has the potential to jeopardise the Bathurst 1000 event which is so important to the economy and image of Bathurst. Equally, the use of culling of kangaroos on Mount Panorama to address this issue is likely to cause a repeat of the local, national and international outcry that occurred in 2009 and tarnish the image of the city of Bathurst. It is important that a range of strategies be assessed on the basis of the data obtained.

Within the last ten years Bathurst Regional Council has undertaken a number of measures to reduce the potential for a collision on the Mount Panorama circuit. This has included an assessment of high risk areas, installation of fencing, closing of gates, herding of animals away from the track and the installation of electronic devices to deter kangaroos in addition to the culling of 140 adult Eastern Grey Kangaroos just prior to the 2009 Bathurst 1000.

Records of macropod incidents during the Bathurst 1000 are limited to the four which occurred in 2004, 2005, 2007 and 2010 (Figure 2.1). In 2004 and 2005 the kangaroos moved onto the track from outside the circuit and in 2007 and 2010 it is difficult to tell where they entered the track but they exited to the outside of the track. Three of these incidents were Eastern Grey Kangaroos and the fourth was a

Common Wallaroo. The usual response to danger by the smaller Red-necked Wallabies and Swamp Wallabies suggests that they are unlikely to try to jump the fences during race events.

Kangaroos inside the circuit in 2011 are reported to have been relatively quiet with minimal disruption and movements reported by staff reflect the routine movements of these animals recorded during the surveys in both March and August 2011. The response of kangaroos to the jet flyover and at other times on the V8 race day was to move down into the gully and then into feeding areas later in the day. Additional fencing was installed in 2011 between 196 Mountain Straight and the neighbours to the east, an area where the residents have seen kangaroos move onto the circuit.

Key findings of the survey of large native fauna in March and August 2011 are:

1. The density index determined for Eastern Grey Kangaroos across the whole precinct was not significantly different between the two surveys in 2011 (2.0/ha in March, 2.2/ha in August), the population appeared to be relatively stable. Although it is difficult to compare the 2011 survey results with previous surveys, there does not appear to be any evidence of the number of kangaroos continuing to rise at present.
2. Movement between Boundary Road Reserve and the remainder of the precinct appears to be limited. If the transect counts from Sub-area 6 are removed from the remainder of the precinct, the density index is almost the same for both the March (2.2/ha) and August (2.3/ha) surveys.
3. The density of Eastern Grey Kangaroos is higher on the eastern and southern sides of the circuit (as determined from both walked and helicopter transects) and inside the southern end of the circuit. It is lower on the south-west and western sides (Figure 2.2). Three of the four known incidents have occurred adjacent to transect 5.2 which has the lowest density of all transects.
4. The habituation of Eastern Grey Kangaroos to humans was much greater inside and east of the circuit and in Sub-area 6 (BRR & CSU), while those to the west and south west were more flighty and nervous of humans.
5. There were no mass movements by macropods across the track either from inside to outside or outside to inside. There is evidence of some regular movements, however, with well worn paths near Forest Elbow and across Barry Gurdon Drive below the top of the mountain camping area where the 2007 incident occurred.
6. Other species: While the number of Common Wallaroo, Red-necked Wallaby and Swamp Wallaby were higher in August than in March 2011, the overall abundance of these species is relatively low.

Figure 2.1: Location of recent kangaroo incidents during the Bathurst 1000 (prepared by Joel Little BRC).

1. 2004 (EGK) From around the driveway of 196 Mountain Straight heading to the south
2. 2005 (EGK) Appeared at The Cutting, headed east to break in wall
3. 2007 (EGK) Appeared near entrance to picnic area opposite McPhillamy Park and headed SE into the Park.
4. 2010 (CW) Exited from break in wall at The Cutting, headed SW before jumping the wall

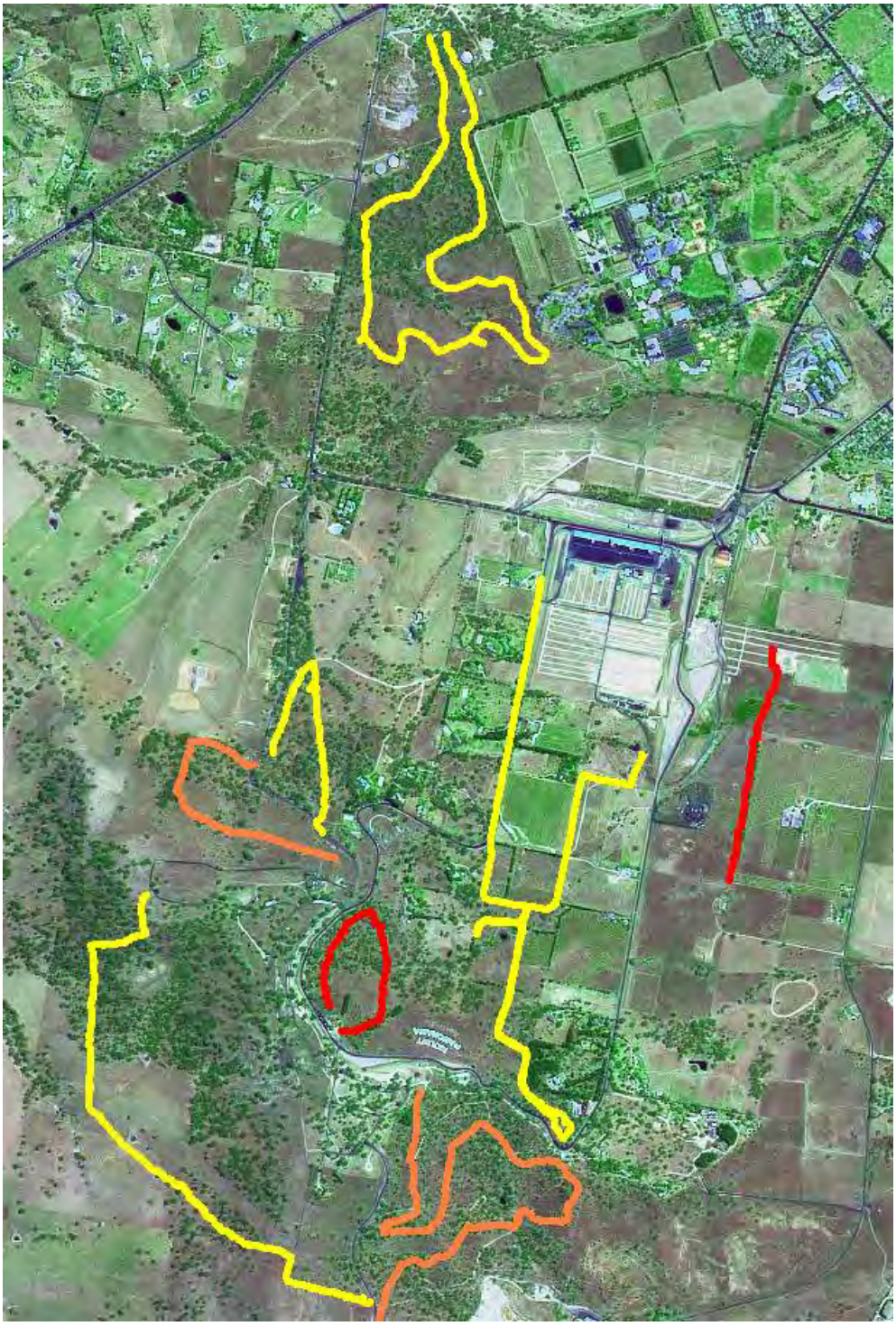


Figure 2.2: Relative densities of Eastern Grey Kangaroos for each of the survey transects. This is based on the mean of the results of the two surveys.
Key: Yellow – low (< 2/ha)
Orange – medium (2-3/ha)
Red – high (> 3/ha)

The finding that most incidents have occurred where the density of eastern grey kangaroos is generally low (Figures 2.1 and 2.2) suggests that high abundance of macropods within the Mount Panorama precinct has not been the critical factor causing incidents on the race track. It is more likely to be the result of auditory confusion by individuals that are not accustomed to race events. The intense noise produced by the race cars, flyovers and helicopters and the large numbers of race goers will affect the ability of a kangaroo to detect a real threat to its safety and cause a panic response. To the west and south-west of the track the kangaroos observed were frequently in smaller groups which are generally more flighty, they don't have the safety of the mob to rely on. The daily cycle of movements, feeding from a couple of hours before dark, through the night and a couple of hours after dawn and resting during the day, also reinforces the conclusion that the race track incidents are panicked individuals responding to a perceived threat, not a result of increased densities.

These findings are supported by recent results from radio-tracking of Eastern Grey Kangaroos by Dr D. Fletcher (ACT Government) in the ACT[1]. This research has demonstrated that individuals of this species become 'street smart' by detecting the direction of sounds along roads, and while they move freely around the less busy suburban streets they actively avoid the more busy main roads and highways. Effective detection of sounds is a critical factor in the behavioural response. Panic has also been identified as the most frequent cause for 'kangaroo attack' incidents in the ACT[2].

Given this, the most effective management strategies to reduce the risk of an incident are an extension of those already being used. Closing of gates and increased temporary fencing to the west and south-west of the circuit are the most important. The most effective location for additional fencing may not need to be adjacent to the track. Given that auditory confusion is the likely proximal cause of the panic response, the use of electronic devices designed to deter kangaroos through high frequency signals is unlikely to have any benefit. Habitat modification may also be useful and could include planting of trees and shrubs to provide additional shelter belts for the kangaroos. This would need to be appropriate to the Endangered Ecological Communities where it occurs.

1.2.2. The impact of a high density of kangaroos on the local residents and landowners

It became clear during stakeholder engagement that Eastern Grey Kangaroos in the Mount Panorama precinct are also causing concern and damage to the landholders within the precinct. The results of the fauna survey can also be used to address this issue.

The abundance of Eastern Grey Kangaroos is highest on the eastern side of the precinct. This is demonstrated by the density index of 4/ha and 6/ha recorded in Sub-

[1] Preliminary results of this research have recently been shown on ABC TV by the documentary 'Kangaroo Mob' produced by 360 Degree Films.
[2] See above documentary.

area 2 and 3/ha in March in Sub-area 3 (old nature reserve); high numbers counted during the driven survey in Sub-area 3 (particularly west of College Road); and the number of large red spots (high counts) on helicopter transects 1, 2 and 3 (see Attachment: Volume 2 (section 4.2.5)). Inside the track a high density index was recorded for transect 1.2 (3.3/ha and 3/ha) at the top of the Mount and although the overall index for transect 1.1 is lower, most observations were within the properties and more wooded areas to the south or higher parts of Sub-area 1. It appears from the helicopter survey that the Mount Panorama precinct and adjacent areas (see Figures 4.7 and 4.8, Attachment: Volume 2) retain the highest density of Eastern Grey Kangaroos between Mount Panorama and Rockley Mount. Juveniles, especially males are likely to disperse away from this population once independent.

The survey results were also reflected in the responses to the landholder survey with highest numbers indicated by the respondents being inside the race track, along College Road to the Waste Management Centre, east of College Road and around the WMC. In these parts of the precinct a number of respondents commented that kangaroos cause a lot of damage to property, fences and productivity and around the orchards appear threatening and out of control. Abundance is universally seen to have increased with long term residents indicating that they were very rare 40 years ago inside the track and 10 years ago there were none along College Road where they are now 'exploding'. There is a general perception that this is a result of the release of kangaroos on the closure of the nature reserve.

The Section 120 (*National Parks and Wildlife Act 1979*) general license to harm protected fauna allows for the removal of wildlife if damage to property can be demonstrated. The conditions of an s120 license require that:

1. The occupier of the land hold a current Occupier's license issued under s121 of the *NPW Act* ;
2. The number of fauna which can be harmed by the licensee must not exceed the number indicated on the Occupier's license relating to the property on which they are harmed;
3. The licensee shall promptly alleviate the suffering of any injured fauna, and shall comply with the *PoCtA Act 1979;*
4. The maximum number and species of the fauna to be taken/harmed is specified on the Occupier's license (s121);
5. Animals shot under these licenses are to be tagged and left in situ and unused tags to be returned to the National Parks and Wildlife Service;
6. The nominated trapper/shooter must be licensed;
7. All macropods taken under the license must be shot according to the 'Code of practice for the Humane Shooting of Kangaroos'
8. Returns specifying the compliance with the license and its conditions must be returned to the NPWS.
9. Taking of more that the specified number of animals stated on the license renders the offender liable to prosecution. The specified number does not include pouch young.

Commercial kangaroo harvesting can also be carried out in the Bathurst region. For this there is no requirement for evidence of damage to be provided but the license

can only be issued in accordance with the NSW Commercial Harvest Management Plan 2012-2017 and within the commercial kangaroo harvest management zones. The harvest plan is based on a population census using standardised calibrated protocols. Rather than the shot kangaroo being left in situ as is required for an s120 license, a commercial license allows for the sale of the carcass under strict conditions.

The fate of orphaned pouch young or young-at-heel (dependant young that have left the pouch) resulting from a culling operation is an important welfare issue. The pouch young that may be orphaned or killed as a result of the culling of adult kangaroos are not counted as part of the licensed quota but are required to be killed humanely in accordance with the Code of Practice. This was questioned by the Australian Society for Kangaroos after the Mount Panorama cull in 2009 and the complaint investigated by NPWS, the licensing authority. It was found that the Bathurst Regional Council and its contractor had carried out the cull in accordance with the license conditions and the National Code of Practice.

Detailed assessment of the development of pouch young for the ACT Kangaroo Management Plan (2010) concluded that the age of welfare concern for pouch young and young-at–heel is from 8-12 months of age. The seasonality of breeding by Eastern Grey Kangaroos allows for the specification of a shooting season for the reduction of kangaroo numbers. As a consequence the ACT Management Plan recommends that any culling of kangaroos should occur within a specified season which is early in the life of a pouch young and prior to the development of body functions including the ability to perceive pain. Body functions such as thermoregulation and kidney function and development of the nervous system are rudimentary or not evident in tiny naked pouch young. In the ACT the shooting season is restricted to March to July and while this is not mandated by NSW licenses it would be an appropriate requirement in the Mount Panorama precinct.

Shooting is the most humane and target specific technique currently available for the removal of a portion of an existing population of macropods (see Attachment: Volume 1 (Appendix 3)). However, if the use of high powered rifles is considered inappropriate in urban and peri-urban areas where human safety is a concern, capture by darting followed by lethal injection may be more appropriate. This approach has mostly been used for enclosed populations such as the Belconnen Naval Transmitting Site in the ACT but has been little used for the reduction of population density of free-ranging populations. A protocol has been developed for this by Roberts *et al*. (2010).

Translocation, the deliberate movement of wild adult animals from one part of their range to another, has been used for the resolution of human-animal conflicts or conservation of rare species. This approach has not been widely used for the reduction of populations causing damage due to difficulties in fulfilling the basic requirements for ethics approval. With habitat, behavioural and genetic considerations to be met, kangaroos cannot be simply trapped and relocated elsewhere (see Attachment: Volume 1 (section 5.6.1)). Research has shown that fertility control can be achieved with Eastern Grey Kangaroos but again this is only

likely to be successful in enclosed populations which have already been reduced in number by other methods.

The damage and fear caused by the high abundance of Eastern Grey Kangaroos in parts of the Mount Panorama precinct will be most effectively resolved through a combined approach developed through co-operation of all the relevant landholders affected and education. A brochure called "*Living with Kangaroos"* available from the Office of Environment and Heritage (OEH) (Appendix 1) explains the most effective ways for people to avoid conflict with kangaroos and injury. While the risk of being attacked by a kangaroo is very low (less than five people per year are treated for kangaroo-related injuries) the greatest risk occurs where the natural habitat and feeding patterns have been altered. This can include circumstances that have enabled a build up in kangaroo numbers, where individual kangaroos have lost their instinctive fear of humans or where a kangaroo that is accustomed to people becomes aggressive. The advice from the OEH is to avoid the risks but if a person feels threatened they should move away while keeping head and arms low and if attacked, the best response is to drop to the ground and curl into a ball with hands protecting the face and throat; if possible move behind some form of cover. For further details see Appendix 1.

1.2.3. The potential for an overabundance of large fauna to affect the resilience of the local landscape and the Endangered Ecological Communities.

Overgrazing by any herbivore population has the potential to cause extensive landscape damage, including erosion, loss of nutrients and degradation of vegetation communities. An important element of the vegetation of the Mount Panorama precinct is the presence of two Endangered Ecological Communities (EECs). On Mount Panorama the grazing pressure includes grazing by kangaroos, rabbits and stock agisted periodically in lands managed by BRC. Very little grazing damage was recorded during the vegetation condition surveys but where it was observed it was considered to have been from grazing by rabbits (Attachment: Volume 3). The grazing pressure from stock has not been determined as the grazing intensity in unknown.

The impact of kangaroo grazing pressure on ecosystem function within native grasslands and grassy woodlands has been little studied and there is little guidance as to the appropriate densities for the maintenance of ecosystem condition (ACT Govt 2010). In the ACT Kangaroo Management Plan (ACT Govt 2010), a mean kangaroo density of 1.5/ha or less was deemed appropriate for the maintenance of the integrity of lowland grassy ecosystems. If carrying capacity by macropods is exceeded, in addition to pressures from rabbits and stock, significant land degradation, degradation of EECs and an economic impact on private landholders could occur.

A conservative estimate of the ecological carrying capacity of the precinct has been calculated at six Eastern Grey Kangaroos per hectare (see Attachment: Volume 2 (section 4.2.3). The highest density index calculated for the precinct from these

surveys is 6/ha in Sub-area 2 in the August survey. The concurrent assessment of vegetation condition across the precinct found no evidence of overgrazing of the EEC by kangaroos and wallabies suggesting that the actual numbers of kangaroos have not yet reached this critical level. It is also important to include the fact that parts of the precinct have been grazed historically by domestic stock and some areas continue to be grazed. Calculation of the ecological carrying capacity of the precinct has not included the additional grazing by domestic stock which will need to be incorporated when monitoring the condition of the vegetation.

At the time of the surveys groundcover density was moderately dense to dense across all sites and this was lower in the woodland areas. The structural integrity of the groundcover was mostly good with high structural diversity including the presence of new leaf growth. Vertical and horizontal structure was provided by moribund leaves and stems of tussock grasses and some patchiness in plant formation present. Some areas are highly degraded and dominated by exotic grasses such as phalaris and paspalidium while the resilience of groundcover vegetation to disturbance is relatively high where the species composition is dominated by native or exotic perennial grasses (Attachment: Volume 3). Overall, species composition reflects prior landuse disturbances, grazing by domestic stock and rabbit damage. Overgrazing by kangaroos has been recorded for the old nature reserve when the kangaroo population was enclosed (D. Goldney *pers. comm*.). Groundcover should not be allowed to fall below 70% if the health of the EECs is to be maintained (McIlroy 2002a).

The Box-Gum Woodland EEC and its derived grassland covers a large proportion of the Mount Panorama precinct. There are also smaller areas of Tablelands Basalt Forest EEC and highly disturbed communities including the orchards, vineyards, old picture theatre site and gardens. In some remnant woodland patches such as the old nature reserve, Boundary Road Reserve and the south-west of the precinct there is high natural regeneration of tree species but overall tree and shrub regeneration is low. Shrub species are generally dominated by exotic species such as hawthorn and prunus and the noxious weeds blackberry, boxthorn and sweet briar and these are probably curtailing the regeneration of native shrub species (see Attachment 3 for more detail).

Proliferation of exotic plant species represents the greatest threat to the Box-Gum Woodland EEC within the precinct. This includes species in both the shrub and ground cover vegetation layers. In addition to the noxious shrub species noted above there are substantial areas of the noxious serrated tussock which has further compromised the ecological integrity of the EECs and their carrying capacity. Some grassland areas are densely covered by large swathes of saffron thistle which can form the dominant groundcover species.

A strategy to control noxious weeds, other exotic shrubs and thistles is an important first step in the maintenance and management of the EECs on Mount Panorama. Currently the grazing pressure from native vertebrates is not impacting on the integrity of these communities and weed control is likely to enhance the regeneration of the native grasses preferred by Eastern Grey Kangaroos and Common Wallaroos.

1.2.4. The statutory requirement to control feral vertebrate species

Observations of rabbits and foxes (both of animals and of sign) during the surveys indicated that there are significant numbers of both these species within the precinct. This is supported by the landholder surveys in which rabbits were perceived as being out of control and creating significant damage and foxes were generally thought be common, especially in the woodpile near the orchards in Sub-area 2. While a few landholders had implemented some control measures, it was broadly assumed that control of these species was the responsibility of Bathurst Council and the LHPA.

One cat was observed during the survey and feral cats are not perceived as being common by landholders. Because of their cryptic behaviour their numbers are likely to be substantially higher than observed or perceived. While the predation by feral cats is listed under the *TSC Act* 1995 as a Key Threatening Process, a threat abatement plan has not been developed by the OEH. Both the estimation of feral cat abundance and control measures are extremely difficult to determine, especially in the peri-urban context of the Mount Panorama precinct.

Given that the wild rabbit is a declared pest under the *RLP Act 1998* it is the responsibility of the owner and occupier of the land, both private and public to implement control measures. This includes the BRC. There are a range of measures recommended by the LHPA for rabbit control and these are listed in Attachment: Volume 1 (section 5.6.2). Foxes and wild cats are not declared pests but are listed as nuisance species. Simple control measures and cooperative management programs can dramatically reduce the impact of these species on both agricultural production and native wildlife.

The complex interaction between predators and prey availability can affect the population density of a number of species in the local environment. While rabbit numbers are high both cats and foxes are likely to preferentially prey on that species. Control of rabbits without fox control may lead to higher predation of small kangaroos, particularly the newly emerging pouch young, with the net result being the reduction in kangaroo population size. The preferred strategy for addressing the issues of foxes within the Mount Panorama precinct could be one of two approaches:

1. Routine, regular fox control through a cooperative programme which engages all landholders, or
2. No fox control in order to retain a predator within the ecosystem of Mount Panorama. This has the potential to contain numbers of Eastern Grey Kangaroos once rabbit numbers have been reduced. The impact of this approach on other native species is unknown however there are few species within the precinct that are likely to be impacted by this approach. As this approach has not been trialled elsewhere a concurrent monitoring of small native vertebrates is essential.

1.3. Adaptive Management Strategy

1.3.1. Influence Model

The development of a conceptual model is a critical element in the risk management cycle for an adaptive management strategy (see Attachment: Volume 1 Figure 5.2). This assists in the definition of the scope of the required management and provides a feedback between the predicted relationships and results of the monitoring protocols (Burgman 2005). A conceptual influence model indicating the interrelationships between the critical elements of the Mount Panorama Fauna Management Strategy and the actions required is provided in Figure 2.3. This model clearly incorporates the three key separate but interlinked elements of:

1. Race Impact (minimisation of the risk of a collision on the racing circuit);
2. Landholder Impact (management and minimisation of the social and economic impacts) and
3. Environmental Impact (maintenance or improvement of the environmental values of the Mount Panorama precinct).

This underpins the objectives and actions developed for this strategy, and demonstrates that the distribution and abundance of Eastern Grey Kangaroos is the element linking these three key issues. Macropod abundance is controlled either naturally (drought and predation) or by human intervention (Figure 2.3). Adaptive management actions need to be implemented if macropod abundance changes and creates an unacceptable impact on any one of these three key issues.

Management of the three key issues requires monitoring and control of a range of interacting factors which are included in the conceptual model (Figure 2.3) and are outlined below.

Maintenance or improvement of the environmental values: This can be divided into two elements, the protection of the two EECs and provision of conditions for the maintenance of sustainable populations of native fauna.

Protection of the two EECs: While the total grazing pressure from domestic stock, macropods and feral rabbits has the potential to cause degradation of the EECs, weed control and erosion control appear to be the most critical issues for maintaining and eventually improving the integrity of these ecological communities. This is outside the terms of reference of this fauna management strategy. It requires the development of a specific EEC management plan which addresses these two issues and incorporates the carrying capacity assessment determined through this fauna management strategy.

Maintenance of sustainable fauna populations: Habitat condition should be maintained by ensuring that the total grazing pressure within the Mount Panorama precinct is kept below a level equivalent to 3 DSE (including both domestic stock and kangaroos) and does not lead to loss of ground cover below about 70%. This can be assessed through the vegetation monitoring programme.

Minimisation of the risk of a collision on the racing circuit: Minimisation of this risk requires continuing monitoring of kangaroo movements and behavioural patterns and includes the establishment of a protocol for the systematic reporting of any incidents within the precinct and the incorporation of this information in the management strategy. The faunal assessment for the development of this management strategy was designed to determine the abundance and distribution of large fauna within the precinct rather than to provide a comprehensive analysis of kangaroo behaviour and its potential to impact on the use of the racing circuit. A comprehensive understanding of kangaroo movements and behaviour requires the compilation of observations through a longer time period. This might be most effectively addressed by supporting a research project addressing the behaviour and movements of Eastern Grey Kangaroos within the precinct. It requires with a longer time frame (three years) than the surveys for this Management Plan and should involve radio-tracking. This could be carried out as PhD research or a consultancy. The latter is likely to be more expensive.

Management and minimisation of the social and economic impacts: This includes the impacts of both kangaroos and feral pests.

Kangaroo density: High kangaroo densities can impact on the economic and social well being of landholders within the Mount Panorama precinct. This has already been clearly indicated through the landholder survey in which property damage was reported and the large numbers of Eastern Grey Kangaroos are threatening to some residents. Regular and ongoing consultation between all landholders and land managers (including BRC) and the National Parks and Wildlife rangers is required to assess the co-operative management of kangaroo numbers. This could include application for s120 and s121 licenses if property damage is occurring. Electric fencing (e.g. 'Westonfence' Appendix 2) has also been found to be very effective in directing the movements of Grey Kangaroos in property management without impacting on the kangaroo population.

Feral pests: Control of European Rabbits is a legislative requirement for all landholders. Within the precinct this will be most effectively carried out through a co-operative baiting programme coordinated by BRC as the largest landholder within the precinct. This will benefit the environmental values of the precinct by reducing grazing pressure, especially within the Box-Gum Woodland EEC. The Red Fox was not recorded as a high priority issue for landholders who responded to the survey however fox control may be beneficial for the sustainability of native fauna populations, especially once their prey sources have been reduced through rabbit control. Foxes may also provide some control over kangaroo densities by preying on juveniles. As for rabbits, co-operative fox control programmes between landholders will be most effective.

The first two stages of the adaptive management cycle (see Attachment: Volume 1 Figure 5.1), '**plan'** and '**act'** are provided in this report with actions for implementation

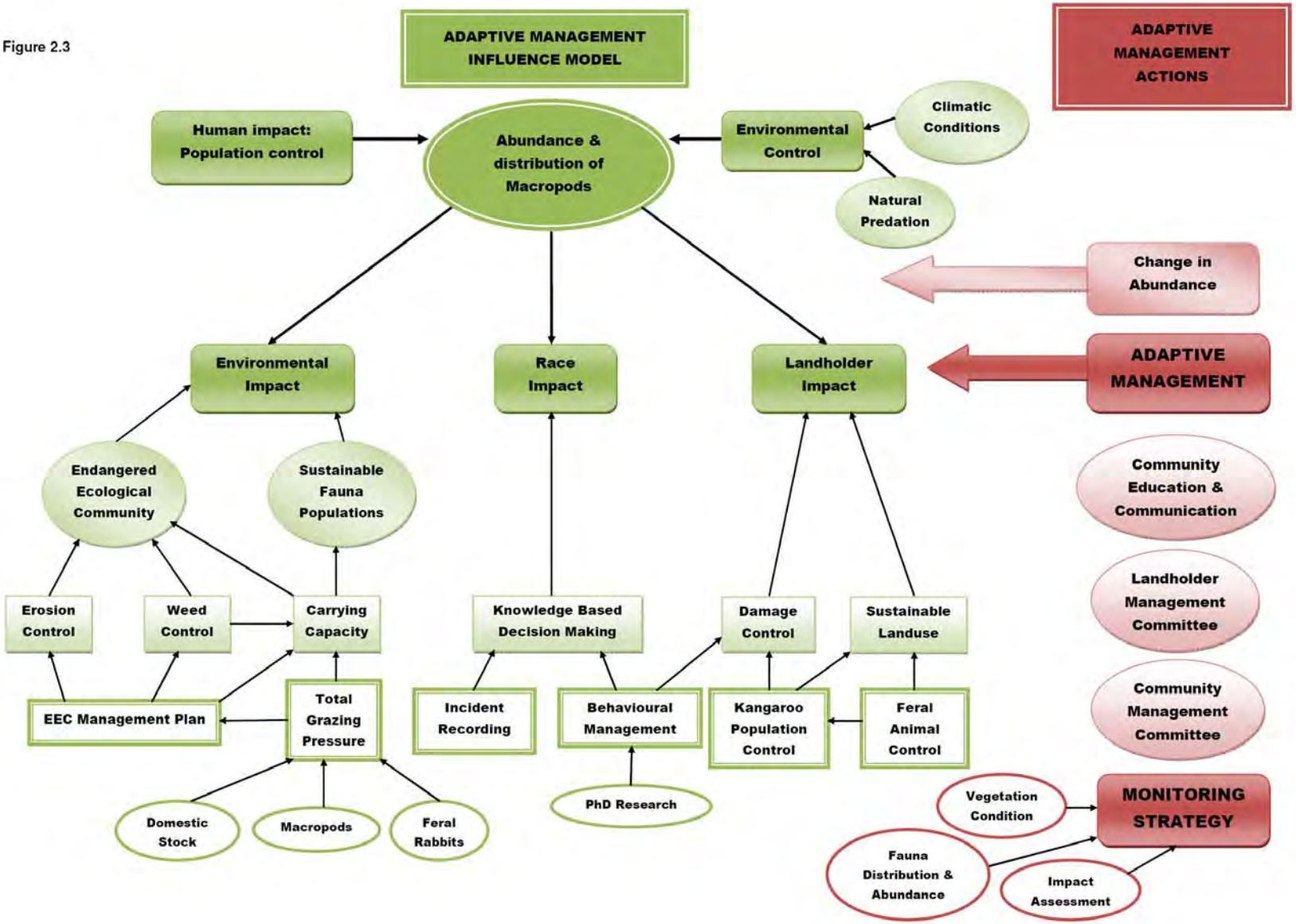
of the management plan in 2012 and a monitoring plan. Integral to this is ongoing communication and co-operation with all landholders within and adjacent to the precinct, other stakeholders and the broader community.

This must be followed by '**evaluation'** of the strategy after the 2012 Bathurst 1000 and include a resurvey of local landholders and community and input from the landholder and stakeholder management committees and the results of the monitoring surveys. An appropriate time for this is February 2013.

Figure 2.3 (next page): A conceptual influence model indicating the interrelationships between the critical elements of the Mount Panorama Fauna Management Strategy and the actions required. The three key separate but interlinked elements of the model are:

1. Race Impact (minimisation of the risk of a collision on the racing circuit);
2. Landholder Impact (management and minimisation of the social and economic impacts) and
3. Environmental Impact (maintenance or improvement of the environmental values of the Mount Panorama precinct).

Figure 2.3


ADAPTIVE MANAGEMENT INFLUENCE MODEL
ADAPTIVE MANAGEMENT ACTIONS
Human impact: Population control
Abundance & distribution of Macropods
Environmental Control
Climatic Conditions
Natural Predation
Change in Abundance
ADAPTIVE MANAGEMENT
Environmental Impact
Race Impact
Landholder Impact
Endangered Ecological Community
Sustainable Fauna Populations
Community Education & Communication
Landholder Management Committee
Community Management Committee
Erosion Control
Weed Control
Carrying Capacity
Knowledge Based Decision Making
Damage Control
Sustainable Landuse
EEC Management Plan
Total Grazing Pressure
Incident Recording
Behavioural Management
Kangaroo Population Control
Feral Animal Control
PhD Research
Domestic Stock
Macropods
Feral Rabbits
MONITORING STRATEGY
Vegetation Condition
Fauna Distribution & Abundance
Impact Assessment

1.3.2. Objectives and Actions

The objectives and actions for this management strategy are founded on the Adaptive Management Influence Model which shows the three critical elements of the strategy and the interlinking components (Figure 2.3).

1.3.2.1. Minimisation of risk of a collision (Goal 1)

Objective 1:

Monitor the relationship between macropod density and distribution within the Mount Panorama precinct and the likelihood of an incident.

Action 1.1: *Implement the monitoring programme that will alert management to any dramatic changes in population density and distribution of the macropod species present on Mount Panorama, especially the Eastern Grey Kangaroo and the Common Wallaroo. Surveys should be conducted in March to detect whether the population densities have changed significantly. Every second year would be sufficient unless there is evidence from landholders of a noticeable increase in abundance.*

Objective 2:

Monitor the behaviour and movement patterns of the sub-populations of macropods within the precinct and the occurrence of race track incidents; objectively assess the likelihood and possible location of an incident.

Action 2.1: *Further fencing (temporary or electric) is the most effective method of reducing the risk of an incident on the track. Recommended locations include (Figure 2.4 indicative locations):*

Inside the track:

1. *Inside the sharp corner (The Dipper) south of the Light Car Club (a well worn macropod track crosses here) (I1).*
2. *Inside John Hinxman picnic area (I2)*

Outside the track:

1. *Along Barry Gurdon drive and then north along the existing fence (O1)*
2. *Along Mountain straight in the vicinity of 196 Mountain Straight. Location of this fence may need to be negotiated with owners and a location may be acceptable (O2)*

Action 2.2: *Implement the monitoring programme (fauna survey protocol) that will alert management to any dramatic changes in behaviour and movement patterns of the macropod species present on Mount Panorama, especially the Eastern Grey Kangaroo and the Common Wallaroo.*

Objective 3:

Assess the possible proximal causes of panic responses by Eastern Grey Kangaroos and Common Wallaroos and develop strategies to minimise this response. This should include consideration of noise from the race, flyover, effects of people noise and movements and dogs.

Action 3.1: *Facilitate further research over a longer time period is required for a more detailed understanding of the behaviour of the Eastern Grey Kangaroo and Common Wallaroo on Mount Panorama. This more detailed information can determine further actions that may be required. A PhD student could be engaged through Charles Sturt University or University of Western Sydney for this purpose.*

Objective 4:

Establish a protocol for a permanent record of EGK and Common Wallaroo incidents and macropod observations on the track and within the Mount Panorama precinct. This should include an appropriately constructed database and a hotline for community input.

Action 4.1: *Develop an electronic data base to store all the observations of macropods during race events and any incidents on the Mount Panorama circuit for use in future assessments.*

Action 4.2: *Encourage all staff to report all observations of EGK and Common Wallaroo, both during race events and throughout the year. Add these to the database. A record sheet is provided in Appendix 3.*

Action 4.3: *Provide a hotline for the broader community to inform Council of their observations of EGK and Common Wallaroo activity in the Mount Panorama precinct both during race events and throughout the year. Publicise this opportunity.*

Objective 5:

Provide for an annual review of macropod behaviour and incidents after each October race event.

Action 5.1: *Require that a recording sheet is completed by all staff monitoring the responses and movements of macropods during closed circuit race events. The recording sheet is provided (Appendix 3).*

Action 5.2: *Incorporate this data into the electronic database (Action 4.1)*

1.3.2.2. Manage and minimise the social and economic impacts (Goal 2).

Objective 6:

Establish a Mount Panorama fauna management committee with an independent chair which includes landholders and stakeholders (including the Bathurst Regional Council) in the Mount Panorama precinct and community members.

Action 6.1: *BRC to facilitate regular meetings of the Mount Panorama macropod and feral animal management committee. This should be annual or as determined by the committee. This committee should review the implementation of the management strategy and continue to address any issues of conflict between fauna (macropods and feral animals) and motor sports or landholders that may arise in the future.*

Action 6.2: *Determine a timeframe for ongoing review and reassessment of the management strategy.*

Action 6.3: *Manage macropod densities as appropriate for the land on which the populations occur [private land, BRC managed land, Crown land, BLALC land]. Develop strategies for management of large threatening Eastern Grey Kangaroo bucks. This can include whether there is sufficient damage being caused by kangaroos in parts of the precinct to apply for an s120 and s121 license from the Office of Environment and Heritage.*

Objective 7:

Develop a community education and communication programme to:

a. Keep the community informed of issues that need to be addressed relating to kangaroo management on Mount Panorama
b. Provide accurate information and engage the community in valuing kangaroos while also minimising their potential impact.

Action 7.1: *Develop a communication and education programme which will inform the community of the ecology of the large fauna on Mount Panorama and the potential for any conflicts to occur between fauna and circuit events.*

Action 7.2: *Develop a communication and education programme to inform the community of the value of the large native fauna on Mount Panorama, including Boundary Road Reserve.*

1.3.2.3. Maintain or improve environmental values (Goals 3 and 4)

Objective 8:

Establish a robust monitoring programme for large native fauna on Mount Panorama which will quantify changes in estimated population size to inform sustainable management strategies for these species. This should include:

a. All target species - Red-necked Wallaby, Swamp Wallaby, Wombat (known anecdotally), Koala (known anecdotally) and the remaining Emu.
b. Assessment of carrying capacity and maintenance of vegetation condition.

This will also be used in building and refining data for Objectives 1 and 2.

Action 8.1: *Commit to regular monitoring of large native fauna in the Mount Panorama precinct based on the 2011 survey protocols and the recommendations in section 2.4.1 (below). This should be carried out in March to allow time for adaptation of the management strategy based on the survey results and should occur at least every second year or as determined by the community management committee.*

Objective 9:

Establish a concurrent programme to monitor the health of the two EECs which will be used to develop a strategy to maintain or improve the condition of this vegetation community within the Mount Panorama precinct.

Action 9.1: *Commit to regular monitoring programme of the vegetation condition and health of the EECs based on the 2011 survey protocols and the recommendations in section 2.4.2 (below). This should be carried out in March to allow time for adaptation of the management strategy based on the survey results and should occur at least every second year or as determined by the community management committee. If there is evidence of a reduction of groundcover below 70% a grazing management strategy will be required.*

Action 9.2: *Undertake a detailed study of the impact of weeds and erosion on the condition of the two EECs, assess their condition and threats and develop a detailed strategy to maintain or improve these vegetation communities within the Mount Panorama precinct.*

Action 9.3: *Develop and implement a comprehensive weed control programme for the precinct.*

Objective 10:

Establish a regular programme of feral animal control, targeting European Rabbits and Red Foxes.

Action 10.1: *European Rabbit control – in association with other landholders in the Mount Panorama precinct and the extended study area develop a co-operative control programme for rabbits that complies with the requirements of the CoP and SOP developed by DPI. This should be carried out within 12 months of the acceptance of the final management strategy by Council. The frequency of follow-up control programmes should be determined by the Precinct Community Management Committee.*

Action 10.2: *Red Fox control – determine whether control of Red Fox is a priority within the Mount Panorama precinct in association with other landholders in the Mount Panorama precinct and the extended study area after rabbit control has been completed. If required, a co-operative control programme that complies with the requirements of the CoP and SOP developed by DPI should be developed through the Precinct Community Management Committee.*

Figure 2.4: Recommended locations for additional temporary fencing. These are indicated in blue. For a description see Action 2.1. I = inside the circuit; O = outside the circuit. Orange arrows indicate previous kangaroo incidents (see Figure 2.1 for explanation).

1.4. Monitoring protocols

Effective monitoring protocols are a critical element of an adaptive management strategy. These are based on the methodology developed during the 2011 field surveys.

1.4.1. Abundance and distribution of macropod fauna

Detailed descriptions of the methods are provided in Attachment: Volume 2. This includes the data sheets used for data recording, methods of analysis and maps of transects – electronic versions are supplied for loading into a GPS and to be used on the ground.

The fauna monitoring protocol:

- Timing: early March. This will enable direct comparison with the March 2011 survey and allow for the timely implementation of control measures, if necessary, prior to the closed circuit events.
- Repeat surveys of walked transects in Sub-areas 1, 2, 3, 4, and 5, using two observers. Evidence from the 2011 surveys and other observations suggest that there is limited movement from the Boundary Road Reserve (Sub-area 6) into the precinct, especially during closed circuit events.
- These should be surveyed by each observer in both the morning and afternoon over three days.
    - Day 1: Transects from Sub-areas 1 and 2
    - Day 2: Transects from Sub-areas 3 and 4
    - Day 3: Transects from Sub-area 5
- Data collection should include group size, flight distance and direction of movement (see data sheet) to detect if these parameters change between years and conditions.
- All species of large fauna surveyed in the 2011 surveys should be counted, including observations and sign of the three feral species.
- Driven survey from the Junktion Recycling Centre, along College Road to Ethelton Road and along track off Vale Road from Omya to ridge above the WMC (include count of any macropods west of, but not visible from, College Road).
- If there is a significant change in the density index of Eastern Grey Kangaroos within the Mount Panorama precinct, a helicopter survey to detect any changes in distribution south of the precinct could be included for comparison with the 2011 helicopter survey results to determine whether there are concurrent changes in the broader distribution of this species.

1.4.2. Vegetation condition

A recommended minimum groundcover monitoring protocol is provided. The key information required for monitoring the impact of total grazing pressure (macropods, stock and rabbits) on the vegetation communities within the Mount Panorama precinct is the percentage groundcover. Maintenance of good groundcover is important for maintaining the condition of all vegetation communities present, and

particularly for the maintenance of the condition of the two EECs. A generally accepted minimum groundcover threshold is 70%, as incorporated in Catchment Action Plans for the Central West CMA and the Murrumbidgee CMA. It has been demonstrated that there is a sharp increase in the rate of water erosion if the groundcover falls below 70% and grazing pressure should be managed to maintain the dominance of large and medium tussock grasses (McIvor 2002a,b).

In accordance with the fauna monitoring protocol, it would be appropriate to exclude the vegetation plots in Sub-area 6 from the vegetation condition monitoring protocol and groundcover monitoring should be carried out at the same time as the fauna surveys, in March. A suggested modification of the pro-forma is provided below (Table 2.2).

Groundcover monitoring protocol:

- Four plots in all Sub-areas except S-a 2 which has two plots. These are
    - Sub-Area 1: plots 1.1, 1.2, 1.3, 1.6
    - Sub-Area 2: plots 2.2, 2.3
    - Sub-Area 3: plots 3.1, 3.2, 3.3, 3.4
    - Sub-Area 4: plots 4.1, 4.2, 4.3, 4.4
    - Sub-Area 5: plots 5.1, 5.2, 5.3, 5.5
- Locations including AMG references are provided in Attachment: Volume 3.
- The assessment data sheet (Appendix 4) should be used for consistency.
- Timing: early March to coincide with the fauna surveys.

Many of the attributes recorded in the baseline survey will remain relatively stable through time and do not require re-recording (e.g. listing the dominant and sub-dominant tree species). Other attributes such as land management or the condition and resilience of the upperstorey vegetation may also be stable and may only warrant a notation if a significant change is observed (e.g. ground layer slashed or grazed or extreme leaf defoliation by leaf-eating insects). The occurrence of drought combined with heavy grazing pressure may justify a condition assessment that includes the full list of attributes as carried out for the baseline survey (see Attachment: Volume 3).