KUMA NATURE RESERVE

PLAN OF MANAGEMENT

NSW National Parks and Wildlife Service

Part of the Department of Environment and Climate Change NSW

September 2007

This plan of management was adopted by the Minister for Climate Change, Environment and Water on 5th September 2007.

Acknowledgments

This plan of management is based on a draft plan prepared by staff of the Snowy Mountains Region of National Parks and Wildlife Service.

Valuable information and comments were provided by
- Staff from the Biodiversity Conservation Section; and
- Members of the Kuma Nature Reserve Steering Committee

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ISBN 1 74122 255 9

FOREWORD

Kuma Nature Reserve covers 182 hectares in the Monaro region of New South Wales, three kilometres southeast of Cooma.

Kuma Nature Reserve contains a sample of the natural temperate grassland of the Southern Tablelands, a plant community typical of the Monaro basalt plains which extend to the north, south and east of Cooma. This plant community is recognised as a threatened ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The grassland habitat of Kuma Nature Reserve contains populations of three species of threatened grassland reptiles: the Grassland Earless Dragon, which is listed as endangered by both New South Wales and Commonwealth Governments; the Striped Legless Lizard, which is listed as vulnerable by both New South Wales and the Commonwealth; and the Little Whip Snake which is listed as vulnerable in New South Wales.

The primary purpose for the reservation and management of Kuma Nature Reserve is to protect populations of these reptiles and a remnant of their natural temperate grassland habitat.

The *National Parks and Wildlife Act 1974* requires a plan of management to be prepared for each park and reserve. A plan of management is a legal document that outlines how a park will be managed in the years ahead.

A draft plan of management for Kuma Nature Reserve was placed on public exhibition from 11 November 2005 until 20 February 2006. The submissions received were carefully considered before adopting this plan.

This plan of management establishes the scheme of operations for Kuma Nature Reserve. In accordance with section 73B of the *National Parks and Wildlife Act 1974*, this plan of management is hereby adopted.

Phil Koperberg
Minister for Climate Change, Environment and Water

CONTENTS

1. INTRODUCTION

1.1 LOCATION, GAZETTAL AND REGIONAL SETTING

Kuma Nature Reserve is located in the Monaro Region of NSW, 3km south east of Cooma. It was dedicated in 2003 and has a current area of 182 ha. It contains a sample of the natural temperate grassland of the Southern Tablelands (NSW and ACT), a plant community typical of the Monaro basalt plains, which extends to the north, south and east of Cooma. This plant community is recognised as a threatened ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The grassland habitat at Kuma Nature Reserve contains populations of three species of threatened grassland reptiles. These are the endangered Grassland Earless Dragon (*Tympanocryptis pinguicolla*) which is listed as endangered under both the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the EPBC Act, the Striped Legless Lizard (*Delma impar*) which is listed as vulnerable under both TSC Act and the EPBC Act, and the Little Whip Snake (*Suta flagellum*) which is listed as vulnerable under the TSC Act. The reserve was purchased primarily to protect the Striped Legless Lizard and Grassland Earless Dragon. The name Kuma has been taken from a very early spelling of Cooma which was the Aboriginal name for the area.

Much of the surrounding countryside is used for sheep and cattle grazing. The natural grassland communities on these properties are in various states of disturbance as a result of modifications such as reduction in diversity, pasture species replacement, application of fertilisers and weed invasion. To the east are areas of exotic and native grasslands, woodland and forest on sedimentary substrates associated with the catchment of the Numeralla River with similar country to the north west, beyond Cooma, associated with the Murrumbidgee River. The reserve is close to the Cooma urban areas and the Cooma Refuse Tip is located to the reserve's west boundary. The reserve is within the Cooma-Monaro local government area. It falls within the Murrumbidgee River catchment.

Prior to being purchased for conservation purposes, the land was privately owned and had a history of heavy year-round grazing, predominantly with sheep. The three threatened reptile species and two threatened plant species have been able to sustain viable populations under this type of grazing regime. Similarly, the natural temperate grassland community has also been retained in a relatively good condition, with a diversity of flora and fauna species persisting. The reserve was purchased just after the 1997 drought and exhibited a reduced vegetation cover but still supported healthy populations of lizards. Research on the habitat requirements of these species suggests that while an open vegetation structure may be critical for the Grassland Earless Dragon, the Striped Legless Lizard prefers a more complex habitat that is provided by the proliferation of lightly embedded surface rock. Prior to European settlement the grasslands in the region would have been grazed by native animals including kangaroos and wallabies.

In the ACT there are a number of grassland reserves that contain the Striped Legless Lizard and where long-term monitoring has been carried out. There have been instances on these reserves where, when grazing was removed, this species became increasingly difficult to detect. This may have been due to the increased difficulty in

capturing lizards in the more dense grassland structure or that a very dense grassland structure was not suitable for the continued survival of these lizard populations. At this stage there is not enough known about the reptiles to determine the optimum balance of habitat requirements to ensure sustainable populations for all threatened species that are present.

One of the biggest challenges for managers of Kuma Nature Reserve is to ensure the continued survival of the two threatened lizard species, which is the primary objective for the reserve, while also trying to restore the grassland integrity. As such, a precautionary approach has been undertaken until further research supports an alternative approach. Grazing by sheep has continued in the reserve as a means of managing the vegetative biomass to ensure the vegetation structure remains open with sufficient inter-tussock spaces. Continued monitoring will be required to ensure that the grazing regime is achieving the objectives for the reserve (refer section 2.2).

1.2 LANDSCAPE

Natural and cultural heritage and ongoing human use are strongly interrelated and together form the landscape of an area. Much of the Australian environment has been influenced by past Aboriginal and non-Aboriginal land use practises, and the activities of modern day Australians continue to influence natural areas through recreational use, cultural practises and the presence of introduced plants and animals.

Kuma Nature Reserve protects a small yet significant area of natural temperate grasslands of the basalt plains of the Monaro. The reserve is dominated by a plateau shaped ridge of basalt rising steeply to 930m asl. This ridge has a number of prominences. Gently sloping foot slopes fall away from the ridge in the northeast and south west to a low point of 850m in the far north of the reserve. The site is typical of the treeless plains of the Monaro and is characterised by its cover of grasses that take on various hues throughout the year. From the plateau within the reserve there are panoramic views in all directions, and particularly over the extensive basalt plains to the south and to the Snowy Mountains in the west.

The geology, landform, climate and plant and animal communities of the area, plus its location, have determined how it has been used by humans. Prior to being gazetted the land was privately owned and used primarily for sheep grazing.

Both Aboriginal and non-Aboriginal people place cultural values on natural areas, including aesthetic, social, spiritual, recreational and other values. Cultural values may be attached to the landscape as a whole or to individual components, for example to plant and animal species used by Aboriginal people. This plan of management aims to conserve both natural and cultural values. For reasons of clarity and document usefulness, natural and cultural heritage, threats and ongoing use are dealt with individually, but their interrelationships are recognised.

2. MANAGEMENT CONTEXT

2.1 LEGISLATIVE AND POLICY FRAMEWORK

The management of nature reserves in NSW is in the context of a legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* (NPW Act), the NPW Regulation, the *Threatened Species Conservation Act 1995* (TSC Act) and the policies of the Department of Environment and Climate Change (DECC). Section 72AA of the NPW Act lists the matters to be considered in the preparation of a plan of management. The policies are a compilation of policies arising from the legislative background and internationally accepted principles of park management. They relate to nature conservation, Aboriginal and historic heritage conservation, recreation, commercial use, research and communication.

Other legislation, international agreements and charters may also apply to management of the area. In particular, the *Environmental Planning and Assessment Act 1979* (EPA Act) requires the assessment and mitigation of the environmental impacts of any works proposed in this plan. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) also applies in relation to actions that may impact on threatened species and communities listed under that Act.

The plan of management is a statutory document under the NPW Act. Once the Minister has adopted a plan, no operations may be undertaken within Kuma Nature Reserve except in accordance with the plan. The plan will also apply to any future additions to Kuma Nature Reserve. Where management strategies or works are proposed for the nature reserves or any additions that are not consistent with the plan, an amendment to the plan will be required.

Nature reserves are reserved under the NPW Act to protect and conserve areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena.

Under the Act, nature reserves are managed to:

- conserve biodiversity, maintain ecosystem functions, and protect geological and geomorphological features and natural phenomena;
- conserve places, objects, features and landscapes of cultural value;
- promote public appreciation, enjoyment and understanding of the reserve's natural and cultural values; and
- provide for appropriate research and monitoring.

Nature reserves differ from national parks in that they are not required, as a management principle, to provide for visitor use.

2.2 MANAGEMENT OBJECTIVES AND DIRECTIONS

Kuma Nature Reserve contains the only known populations of the Striped Legless Lizard under formal conservation management in NSW, and is one of only two such sites of the Grassland Earless Dragon.

The primary objective for Kuma Reserve is:

- to preserve self-sustaining population of the Grassland Earless Dragon and Striped Legless Lizard in their natural temperate grassland habitat.

The secondary objectives for the reserve are to :

- protect a sample of Natural Temperate Grassland of the Southern Tablelands;
- protect other threatened fauna and flora found at the reserve; and
- manage the area in a regional context.

These objectives are in accordance with the conservation mechanisms for the species under the TSC Act. The Act provides for the preparation of species recovery plans and implementation of actions to promote the recovery of the species to a viable position. National recovery plans have been adopted for both the Striped Legless Lizard and the Grassland Earless Dragon, and draft NSW recovery plans have been prepared for both species. A draft National recovery plan for Natural Temperate Grassland of the Southern Tablelands (NSW and ACT) has also been prepared. The relevant actions from these plans are incorporated into this plan of management.

Accordingly, this plan of management emphasises management programs aimed at ensuring the survival and, if possible, the expansion of the populations of the threatened reptiles in the reserve. To achieve this, particular attention will be given to implementation of appropriate research outcomes to maintain appropriate vegetation structure, the control of weeds and re-establishment of appropriate native species to provide optimum habitat for the survival of the reptiles in the reserve.

The plan of management outlines NPWS's commitment to participating in research programs aimed at providing a better understanding of the habitat and management requirements of the Striped Legless Lizard, the Grassland Earless Dragon and the Little Whip Snake.

The plan of management also outlines the public and educational use of the reserve. General public use of the greater area of the reserve will not be promoted because of ongoing research programs and the potential for visitor impact on the threatened species that are present. Instead a small area of the reserve will be set aside for interpretation purposes. In addition a broader community education program will promote the role of remnants and the conservation of locally threatened species.

3. CONSERVATION OF NATURAL AND CULTURAL HERITAGE

3.1 GEOLOGY AND GEOMORPHOLOGY

The geology and parent materials for soil formation in the Monaro are classified by Costin (1954) as being derived from either intrusive or extrusive igneous rocks, metamorphosed, consolidated or unconsolidated sedimentary rocks or fossil soils.

Kuma Nature Reserve soils are derived from extrusive igneous granites comprising tertiary basalts, most extensively developed in the less elevated central tableland tracts of the Monaro Region.

3.2 SOILS

This area is characterised by gently undulating plains to undulating rises with flat summit surfaces on Tertiary basalt. It contains shallow (<50cm) well drained reddish chocolate soils on the crests and upper slopes, with shallow (<50cm) well drained chocolate soils and deep (>150cm) well drained Chernozem on the maximal slopes. On the lower slopes shallow (<40cm) well drained chocolate soils, shallow (<50cm) imperfectly drained Brown Chernozem and moderately deep (>50cm) imperfectly drained Black Chernozem are found. In wetter areas poorly drained Black Earths can be found. Large areas of the reserve are liberally covered by lightly embedded surface rock that provides key habitat for grassland reptiles.

3.3 NATIVE PLANTS AND HABITAT

The reserve contains grassland dominated by Poa Tussock (*Poa sieberiana*). Other common grasses include Red Grass (*Bothriochloa macra*), Wallaby Grasses (*Austrodanthonia* spp.), Corksrew Grass (*Austrostipa scabra* ssp. *falcata*) and Tall Speargrass (*Austrostipa bigeniculata*). The site contains a diversity of forbs. Only four native woody species are found on the site, the Gruggly Bush (*Hymenanthera dentata*) Australian Anchor-plant (*Discaria pubescens), Shrubby Rice Flower (Pimelea pauciflora)* and Blackthorn *(Bursaria sp)*. The grassland community at Kuma Nature Reserve is identified as "*Poa sieberiana - Acaena ovina* grassland on basalt, southern Monaro" and the structure is described as a dense, mid-high tussock grassland (Benson, 1994). Kuma Nature Reserve is the only reserve in NSW that conserves a significant sample of this community.

Grasslands of similar structure and floristics to that in the reserve occur in the region. Floristically more diverse sites of the same community are retained on some travelling stock reserves, council reserves and private property. Sites with a lower floristic diversity than the grassland at Kuma Nature Reserve (ie. especially lacking a diversity of forb species) are more common in the region. Virtually all of the grasslands in the region have been subject to grazing, in various intensities. Many grasslands have been modified by application of fertilisers, and some to pasture modification practises, including the deliberate or accidental introduction of pasture grasses and legumes. Serious weeds such as African Lovegrass and Serrated Tussock have invaded many hectares of grasslands on the Monaro.

The structure and floristics of the grassland at Kuma Nature Reserve is attributed to the lack of fertiliser applications of the prior management. As such, the grassland remnant at Kuma Nature Reserve is considered a good sample of its type.

Preliminary vegetation surveys have been undertaken in the high quality grasslands on the southern section of the reserve, including a general site description of various landscape elements (flats, foot slopes, side slopes and plateau). Permanent monitoring sites, using transect data collecting methods have been established to record long term changes to the vegetation at these sites.

The sites sampled include grasslands dominated by Poa Tussock (*Poa sieberiana*). Other common grasses include Red Grass (*Bothriochloa macra*), Wallaby Grasses (*Austrodanthonia* spp.), Corksrew Grass (*Austrostipa scabra* ssp. *falcata*) and Tall Speargrass (*Austrostipa bigeniculata*). Some of these grasses dominate in certain landform types, and these associations could be described as sub-communities. Other grass species are present including Nineawn Grass (*Enneapogon nigricans*) and a Plumegrass (*Dichelachne* sp.). The sampled sites contain a diversity of forbs, including Many-flowered Knawel (*Scleranthus diander*), Lobe-seeded Daisy (*Brachyscome heterodonta*), Common Everlastings (*Chrysocephalum apiculatum*), Sheep's Burr (*Acaena ovina*), Australian Bindweed (*Convolvulus erubescens*) and Native Woodruff (*Asperula conferta*). Regionally restricted or uncommon forbs recorded include Silky Swainson-pea (*Swainsona sericea*), Notched Swainson-pea (*S. monticola*) and Hoary Sunray (*Leucochrysum albicans*). Silky Swainson-pea is listed as vulnerable on the NSW TSC Act and Hoary Sunray is listed endangered on the EPBC Act.

There are some floristic variations in this community occurring on the different soil types and also minor variation in floristics and structure of the grassland at Kuma Nature Reserve, according to aspect and topographical location.

The Snowy Mountains Highway runs along the reserve's south west boundary and a public road borders the reserve's southeast. Part of the reserve's northern and north western boundary has land with similar grassland floristics and structure as that on the reserve. Land to the reserve's east supports modified pasture. A site with similar grassland lies opposite the reserve, adjacent to the Snowy Mountains Highway. This land is a travelling stock reserve (Four Mile Nimmitabel Road TSR), managed by the Cooma Rural Lands Protection Board.

Grasslands supporting habitat for the two Commonwealth listed reptile species found at Kuma Nature Reserve have been found to the north (Grassland Earless Dragon and Striped Legless Lizard occur on land owned by the Cooma-Monaro Shire Council) and to the west (Grassland Earless Dragon habitat on the Four Mile Nimmitabel Road TSR). Populations of all three threatened reptile species are known to extend into the grassland habitat on private land directly to the north east of the reserve.

Retention of adjacent and connecting areas of native vegetation is important for long term maintenance of the viability of the plant and animal communities of the reserve. These areas currently act as valuable buffers to the core habitat areas on Kuma Nature Reserve, and some areas may be of potential for future additions to the reserve. In turn the reserve acts as a refuge from which species can disperse to other areas. Sympathetic management of adjacent grassland areas would assist in the retention of the important values of the Kuma Nature Reserve.

Desired Outcomes

- The grassland community and its subtypes occurring in the reserve, that provide suitable habitat for threatened reptile species, is conserved.
- Grasslands on crown or private lands adjacent to the reserve are sympathetically managed.

Strategies

- Management of the vegetation and rock surface will aim at maintaining structure and floristics suitable for the retention of habitats for the Grassland Earless Dragon, Striped Legless Lizard and Little Whip Snake. This will primarily be achieved by a managed grazing program (refer section 7.1), weed control (refer section 4.1) and fire management (refer section 4.2).
- Areas of significant species or communities within the reserve will be protected from disturbance.
- The conservation of nearby lands will be encouraged by such means as Voluntary Conservation Agreements, Property Vegetation Plans, environmental planning instruments and communication with neighbours.
- A trial program for re-establishing native forbs will be investigated.
- A transect-based vegetation monitoring program will be undertaken to assess the results of management of the site. Results of monitoring will guide future management prescriptions.
- A minimum disturbance monitoring strategy will be implemented to ensure the ongoing viability of populations of the Grassland Earless Dragon, Striped Legless Lizard and Little Whip Snake. Results of monitoring will guide future management prescriptions.

3.4 NATIVE ANIMALS

Kuma Nature Reserve supports a diverse range of reptile fauna with at least nine species recorded on the reserve during the Eastern Gas Pipeline survey. Frogs, birds and invertebrate fauna on the reserve are typical of such sites across the Monaro. The Banded Lapwing (V*anellus tricolor*), a declining grassland bird, has been recorded at the reserve and at a number of adjacent sites. The only known native mammal species occurring on the reserve are the Eastern Grey Kangaroo (*Macropus giganteus*).

The primary purpose for the gazettal and management of Kuma Nature Reserve is for the protection of populations of the Grassland Earless Dragon (*Tympanocryptis pinguicolla*) which is listed as endangered on both the NSW TSC Act and the Commonwealth EPBC Act, the Striped Legless Lizard (*Delma impar)* which is listed as vulnerable on both the TSC Act and EPBC Act, and a remnant of their natural temperate grassland habitat.

The Grassland Earless Dragon has been recorded at a number of private land and travelling stock reserve sites on the Monaro and also in the Canberra-Queanbeyan region. For the Striped Legless Lizard, apart from recent records from the adjacent Cooma Tip site and Michelago, there are only historical and recent anecdotal records of the Striped Legless Lizard from the Monaro. This species is conserved in a number of

reserves in the ACT, and has also been recorded in the Tumut, Goulburn, Sutton and Yass areas of southern NSW. Both species are also known from Victoria although extensive recent surveys have failed to locate any extant populations of the Grassland Earless Dragon.

Kuma Nature Reserve is the only formal conservation reserve in NSW that protects the Striped Legless Lizard and is one of only two such sites for the Grassland Earless Dragon, the other being the Queanbeyan Nature Reserve approximately 110km to the north.

Although relatively little is known about the biology and ecology of the Grassland Earless Dragon and the Striped Legless Lizard, they appear to have very different life histories. For example the Striped Legless Lizard is relatively long lived (>10 years) whilst the Grassland Earless Dragon is a short-lived species (< 2 years). The species have different activity patterns and, although both occur in natural temperate grasslands, they seem to select different microhabitats within that community (Osborne *et al.* 1993a & b). Invertebrates play an important role as food for the Grassland Earless Dragon and the Striped Legless Lizard. Management of the reserve should aim to maintain a variable tussock structure that will provide optimal habitat for both species.

Whilst being a habitat specialist on natural grasslands, the Striped Legless Lizard does not appear to be reliant on particular vegetation species or communities. This species has been recorded from both exotic and native dominated grassland (Kukolic *et. al.*, 1994; Dorrough and Ash, in press). There is some suggestion that the Striped Legless Lizard may require a dominant cover of perennial tussock forming grass species (Kukolic and Osborne, 1992) and extensive areas of bare ground may limit the species' mobility (Osmond, 1994; Dorrough and Ash, in press). However intertussock spaces and lightly embedded surface rock appear to be an essential component of this species habitat in some areas, including the Monaro basalt plains. In addition to utilising grass tussocks as shelter sites, they are also known to use soil cracks and rocks where such habitat characteristics are present (Hadden, 1995).

Recent survey work conducted on the Grassland Earless Dragon suggests that this species prefers more open sections of natural temperate grasslands where vegetation is sparser or shorter, with taller tussocks adjacent (Osborne *et al.* 1993a, Smith 1994,Nelson 2004). Other work describes the Grassland Earless Dragon using both open and denser areas within grassland habitat (Langston 1996). Specimens of this species have been hand captured from under rocks (Osborne *et al.* 1993a, Osborne *et al.* 1993b) and there is little doubt that the rocky habitat present at the Kuma Nature Reserve is also a significant habitat resource. It also occurs in disturbed habitat and grassland of low diversity. Thus tussock structure, degree of open areas, and rocky habitat should all form part of the habitat monitoring for both the Grassland Earless Dragon and Striped Legless Lizard.

The vulnerable Little Whip Snake is also present on the reserve. This species tends to inhabit grasslands and woodlands on well drained hillsides where it feeds on small skinks and invertebrates. Most of the snakes that have been recorded were found under rocks or logs laying on the soil substrate. The biggest threat to this species includes habitat clearance and predation by feral and domestic cats. The only other known site where this species is protected in NSW is at Turallo Nature Reserve near Bungendore.

Desired Outcomes

- The Grassland Earless Dragon and Striped Legless Lizard are protected. Conservation of these populations will take priority over other management policies and actions.
- Other native species, and in particular threatened species (eg. Little Whip Snake), are conserved in so far as their conservation is consistent with the conservation of the Grassland Earless Dragon and Striped Legless Lizard.

Strategies

- The populations of the Grassland Earless Dragon and Striped Legless Lizard in the nature reserve, and the effect of management actions on the populations, will be monitored using best practice methods for the species and their habitat and in collaboration with the species' Recovery Team.
- Actions outlined in any approved species recovery plans will be applied in so far as such actions are consistent with the objectives and policies of this plan of management.
- A comprehensive fauna survey, including invertebrates, will be conducted for the reserve.

3.5 ABORIGINAL HERITAGE

Kuma Nature Reserve lies within the Merrimans Local Aboriginal Land Council area.

The site was surveyed for Aboriginal heritage items as part of the Eastern Gas Pipeline Environmental Impact Statement in 1996, with an open campsite being recorded on the reserve. A further investigation was conducted in 1998 (by A. Grinbergs). A very dense ground cover (between 80% to 100%) severely inhibited visual observation for artefacts with nil observations during this survey. Since the Monaro was extensively used by the Ngarigo people, potential exists for stone implements and / or flakes to be present on the reserve. No stone arrangements or unusual geological features are evident.

Winter grazing by livestock is considered unlikely to impact on unknown artefact material. During periods of drought or environmental stress to pasture, grazing may be reduced as a management option of the reserve.

Aboriginal communities have an association and connection to the land. The land and water biodiversity values within a landscape are central to Aboriginal spirituality and contribute to Aboriginal identity. Aboriginal communities associate natural resources with the use and enjoyment of foods and medicines, caring for the land, passing on cultural knowledge and strengthening social bonds. Aboriginal heritage and nature are inseparable from each other and need to be managed in an integrated manner across the landscape.

Desired Outcome

- Aboriginal people and communities with an interest in the reserve participate in its management.

Strategies

- Opportunities will be organised for Aboriginal people to visit and learn about the reserve and the various research programs.
- A further archaeological survey may be conducted during a period of drought or when vegetation ground cover is sufficiently reduced to allow for increased visual observation for potential artefacts.

3.6 HISTORIC HERITAGE

An old disused shearing shed and ancillary buildings existed at the site when it was first purchased. They contained significant amounts of unstabilised asbestos fibro sheeting and were removed after being assessed as having limited historical value (Grinbergs 1998). There is a stone wall on the southern boundary, a number of sheep sheds and two wells.

Desired Outcomes

- Historic values and sites within the reserve are conserved.

Strategies

- The stone wall, sheep sheds and wells will be retained in situ.
- Conservation work will be undertaken to conserve the stone wall if necessary.
- Record and conserve sites of past use of the area in consultation with the relevant community groups.

4. RESERVE PROTECTION

4.1 INTRODUCED SPECIES

Weeds

Many of the remaining native grasslands across the Monaro contain significant populations of exotic species. The control of some of these species is a critical component of management. It is impractical to remove all exotic species, and so the aim should be to reduce populations of the most invasive weeds present.

There are a number of particularly invasive weed species present within the reserve, which have the capacity to impact on the integrity of the grassland ecosystem. In particular they are St Johns Wort (*Hypericum perforatum*), African Love Grass (*Eragrostis curvula*), Serrated Tussock (*Nassella trichotoma*), Vipers Bugloss *(Echium vulgare*), Variegated Thistle *(Silybum marianum*) and Saffron Thistle *(Carthamus lantus*).

A comprehensive weed control program has been implemented over the last 4 years with good results for most of these species. Vipers Bugloss, Mullein, St Johns Wort, Saffron Thistle and Variegated Thistle now exist only in isolated patches which are easily managed. Serrated Tussock has also been largely controlled, however an ongoing commitment is essential for long term control.

The major weed species of concern at present is African Love Grass, which has not been controlled in the reserve despite continued annual weed spraying efforts. Recent prolonged drought conditions have accelerated the spread of this weed species and the current winter grazing program has exacerbated weed spraying efforts. For this reason grazing was suspended for the 2005 winter period to assist with identification of weed species during the optimum spraying time. The current grazing regime may be contributing to difficulties in controlling this species and this needs to be taken into account in the future.

Chilean Needle Grass (*Nassella neesiana*) is another very invasive species in the region but has not been identified within the reserve. Continued vigilance will be an important part of ensuring the reserve remains free of this species.

Weed infestations on land adjoining the reserve will impact on the status of weeds within the reserve. It will be important to work co-operatively with adjoining landowners to maximise the opportunity for the long term control of all weed species.

Pest animal species

Pest animal species present at the reserve include the European Fox (*Vulpes vulpes*), European Rabbit (*Oryctolagus cuniculus*), House Mouse (*Mus musculus*) and European Hare (*Lepus europaeus*) although their numbers at present are low. Due to the proximity of the reserve to the Cooma Refuse tip, feral cats (*Felis catus*) can also be expected to occur at the site.

The presence of foxes is likely to impact on a range of fauna including the threatened reptile species. An annual fox baiting program has been carried out at the reserve in conjunction with neighbouring landowners. The impacts on the threatened fauna from

rabbits and hares is likely to be less severe directly, though grazing of sensitive flora species and erosion may result if these pests are not controlled.

Desired Outcomes

- Threatened native animal species are protected from introduced species.

Strategies

- Introduced plants and animals will be controlled, especially where they have a significant impact on native species and neighbouring land.
- Weed control programs will focus on African Love Grass, Serrated Tussock, St Johns Wort and Viper's Bugloss. Other weeds will be controlled as required.
- NPWS will seek the co-operation of neighbours, the Cooma Rural Lands Protection Board and Cooma-Monaro Council in implementing weed and pest control programs
- Fox baiting programs will be carried out in cooperation with reserve neighbours, the Rural Lands Protection Board and other land managers.
- The impacts of rabbits and hares will be assessed and monitored, and control programs will be undertaken as needed.
- The presence of feral cats on the reserve will be monitored and control programs will be carried out in co-operation with the Cooma-Monaro Shire Council if required.
- Control programs for pest species will be designed and implemented in such a manner as to minimise the impact on native species.
- NPWS will implement a monitoring program to assess the effectiveness of its control programs into the future.

4.2 FIRE MANAGEMENT

Fire is a natural feature of the Monaro environment. A combination of low rainfall (generally below 600mm per year), dry forest types, open woodland and grasslands means that fire can occur in the region throughout much of the year.

While illegal malicious fire activity does occur in some areas, it is considered a minimal risk with the majority of wildfire caused by accidental fire escape, for example, escaped campfires and ignition from farm machinery or lightning.

Other than the *National Parks and Wildlife Act 1974*, the legislation significant to fire management on NPWS estate is the *Rural Fires Act 1997*. This recognises NPWS as a fire fighting authority that is responsible for controlling and suppressing fires on areas that it manages, and is responsible for implementing bush fire risk management programs to protect life and property. The *Rural Fires Act* also provides for the formation of Bush Fire Management Committees (BFMC) that develop operations and risk management plans for their areas. These committees include representatives of all fire agencies, volunteer fire fighters, NPWS and community groups. The Cooma Monaro BFMC covers the Kuma Nature Reserve. NPWS is represented on this committee and has participated in developing all plans.

Kuma Nature Reserve is comparatively small at 182 ha. Access to the reserve is via public roads to the north and south of the reserve. There is no internal trail network

within the reserve however, vehicle access to all parts of the reserve is relatively easy. There has only been one recorded wildfire within the reserve in recent history which burnt a small area of the reserve when a fire escaped from the Cooma Refuse Tip located to the west of the reserve. There is no record of previous hazard reduction burning. As the majority of the block is dominated by *Poa sieberiana* and *Austrostipa* species, and common grazing management includes periodic burning, this may have been the practice in past years. Indications suggest that pre-European fire management of Monaro grassland probably involved regular small patch-burns designed to encourage particular food plants or attract grazing fauna.

Given the special nature of the reserve, being comprised of native grassland, fire threshold information is not well known. The most common case with mid altitude grasslands is that species decline is unlikely to occur due to frequent fire by itself. The exception to this is where frequent fire causes loss of topsoil, or where there is significant invasion of perennial weed species. While soils within the Kuma Nature Reserve are not particularly prone to sheet erosion, there is however, potential for species loss through invasion of perennial weeds if burning is carried out without consideration for grassland seasonality.

The fire season for this reserve is generally within the months of December to March although, as with other areas of the Monaro, it is possible for fire to occur under strong windy conditions throughout most of the year. Some local graziers commonly burn *Poa* grasslands during windier days of late winter, as there is potential for the fire to spread through tussock country without burning across breaks as easily. This presents an increased fire risk at this time.

Fire management strategies have been prepared for the reserve. The methodology used to develop fire management strategies is covered by NPWS policies, which are detailed in the NPWS Fire Management Manual, available at NPWS offices, or via the website www.environment.nsw.gov.au. Given the small size of the reserve, combined with distance from the reserve to any assets, and the lack of fire threat, the entire reserve has been zoned as Heritage Management. The primary fire management objectives within this zone are to prevent the extinction of all species that are known to occur naturally within the reserve, and to protect culturally significant Aboriginal and non-Aboriginal sites. Fire management in this zone will focus on those actions appropriate to conserve biodiversity and cultural heritage, while also having cognisance of the need to protect life and property adjoining the reserve.

Kuma Nature Reserve is approximately 5 minutes from Cooma. In the event of fire, it is likely that Rural Fire Brigade units or the NSW Fire Brigade will undertake initial attack operations prior to the arrival of NPWS crews. The reserve is within the Nimmitabel Rural Fire Brigade area of the NSW Rural Fire Service. Response by brigades into the reserve to undertake fire suppression operations is covered by the Bush Fire Management Committee District Operations Plan.

Fire is acknowledged as a potential threat to threatened grassland reptiles which inhabits predominantly grassland communities. While individuals may survive by burrowing or sheltering under surface rocks, the loss of vegetative cover may threaten any survivors due to heat stress or vulnerability to predators (Wilson, 1994).

Desired Outcomes

- Fire is managed in the reserve to:
  - protect human life and property within and adjacent to the reserve.
  - protect threatened species and fire sensitive species and culturally significant sites.
  - maintain those plant communities and plant or animal species which require a particular fire frequency or intensity.
  - manage vegetation biomass if appropriate.

Strategies

- Continue to participate in the Cooma Bush Fire Management Committee. Maintain coordination and cooperation with Rural Fire Service brigades and neighbours with regard to fuel management and fire suppression.
- Suppress all unplanned fires in the reserve as soon as possible.
- Encourage further research into the ecological effects of fire in the reserve and on the threatened reptile species.
- Undertake prescribed burning in the reserve to promote native grass growth if research shows that this is the best response for the threatened species on the reserve.
- No prescribed burning will be undertaken for asset protection. Instead boundary clearing will be used if necessary for protection.
- Use of retardants will be avoided in the reserve.
- As far as possible areas disturbed by fire suppression operations will be rehabilitated as soon as practicable after the fire.

5. PUBLIC USE

As the reserve is essentially a large grassy paddock surrounded by similar grassy paddocks, it does not attract interest or use by the general community and is unlikely to provide a recreational function in the future. The reserve does, however, receive considerable attention from neighbours and local graziers who are interested in the NPWS's approach to the use of grazing as a tool for conserving a threatened species. As native grasslands are considerably under-represented in protected areas, particularly across the Monaro, conservation of this vegetation type is largely reliant on the adoption of sustainable farming practises by the farming community. Kuma Nature Reserve does, therefore, offer NPWS an opportunity to maintain dialogue with the rural community on processes and practises available for the sustainable management of grasslands for conservation on the Monaro.

Because of the limited opportunities for public use of the reserve and the sensitive nature of the habitats of the threatened reptiles, only limited on-site interpretive facilities and promotion is recommended. It may be appropriate to erect some interpretive material at the reserve's entrance and to possibly provide a limited hard surface walking trail to enable visitors to gain a first hand view of the habitat of the threatened reptiles.

The reserve is not far from the town of Cooma and may be used for educational purposes by local community groups, schools and tertiary institutions. It has the potential to provide opportunities for improving understanding of the important role of grassland conservation in an area where many people may be unfamiliar with this concept. In order to promote community understanding and appreciation, a limited number of organised educational visits to the reserve may be provided.

Provision of general information and liaison with neighbours and relevant community organisations is important. Close liaison with Landcare groups and other interested stakeholders on matters of mutual interest is equally important and will be maintained.

Desired Outcomes

- The local community understands and appreciates the natural and cultural heritage and the conservation value of the reserve and support management policies and programs.

Strategies

- Close liaison will be maintained with neighbours, Landcare groups and stakeholders concerning matters of mutual interest.
- Educational visits to the reserve by schools and tertiary institutions will be permitted. Access must be by walking.
- Investigate the feasibility of constructing an interpretive display and a short hard-surface walking trail to enable visitors to view the habitat without adversely impacting on the majority of the site.
- Information about management programs will be provided to neighbours as required.

6. RESEARCH AND MONITORING

Research into the reserve's natural and cultural features and maintenance requirements is important for development of appropriate management practises. Unfortunately the NPWS can carry out very little research because of limited staff and financial resources. Encouraging research by other organisations such as student projects may provide valuable information for management.

Because very little is known about the ecology and habitat requirements of the grassland reptile species, monitoring is critical to ensure that the major objectives of the reserve are being met. A monitoring strategy has been prepared for the reserve and an annual monitoring program is now in place. This program may vary as more data is collected on the species.

Monitoring vegetation and habitat structural changes is also critical in order to assess the health of the habitat and to evaluate the reserve's response to grazing. An annual vegetation monitoring program is in place which measures changes in species abundance, diversity and vegetation structure. It is important that this continues and that results are used to further refine the grazing regime to maximise habitat values for the threatened species.

Desired Outcomes

- Research is undertaken that enhances the information base and assists in management of the reserve.

Strategies

- Implement and review a monitoring program for the threatened species at the reserve.
- Continue to carry out an annual vegetation monitoring program to assess the reserve’s response to grazing.
- Encourage appropriate research by other organisations and individuals that is directly useful for management purposes and to evaluate the success of management programs in achieving the objectives for the reserve.
- Require that any research structures and long term markers are placed in locations that will minimise their visual impact and environmental impact (ie they do not provide perches for birds of prey).
- Prepare a prospectus as a guide to preferred research projects in the reserve.

7. MANAGEMENT OPERATIONS

7.1 GRAZING

Grazing is currently undertaken in Kuma Nature Reserve as it is considered the most convenient method to provide suitable habitat for the Grassland Earless Dragon and Striped Legless Lizard. Both species have existed and persisted on the reserve under a prolonged heavy grazing regime. In other areas where these species occur and where grazing has been removed, the occurrence of these species has been harder to detect.

At this stage not enough is known of their habitat requirements to confidently say that a drastic variation to management of the reserve would not impact on their continued survival at this site. Therefore a precautionary approach is recommended and careful management of the vegetation biomass at the reserve is critical. Because native grazing animals such as kangaroos are no longer present at the site in large numbers, and other small marsupials are locally extinct, continued grazing by sheep is recommended as the most appropriate, feasible and convenient method to manage the vegetation biomass at the site.

The objectives of the grazing activity are to:

- Maintain grassland habitat and structure suitable for threatened reptile habitat;
- Minimise soil erosion;
- Minimise populations of weed species;
- Maximise public support and interest in the management of the reserve;
- Use management methods that are ecologically based, and have relevance to the community; and
- Use management practises that may encourage the conservation of threatened reptile species across the Monaro.

A grazing regime for biomass management has been established at the reserve to maintain an open grassland structure to ensure the continued survival of populations of the threatened reptile species. Grazing is currently carried out using approximately 350 sheep, equivalent to 2.5 DSE per hectare, from April through to September. The reserve is spelled from grazing for the remainder of the year through spring and summer to allow for the grasses and herbs to flower and set seed. Vegetation monitoring has shown an increase in the presence and abundance of native species in the reserve since this regime was introduced.

A steering committee made up of graziers, agronomists and grassland experts was established to oversee the establishment of the grazing program and to advise NPWS of any issues arising from this activity. A Review of Environmental Factors (REF) was completed in 2000, which explored the various options for biomass management including mowing, burning and grazing by native animals and other domestic species. Sheep grazing was recommended as the best method in the short term. It was recognised, however, that in the light of further research other options might be adopted in the future to better achieve the objectives for the reserve.

Outcomes

- Vegetative biomass is managed through grazing to maintain an open grassland structure best suited to the habitat requirement of the threatened species.
- The grazing regime contributes to the biodiversity of the reserve.

Strategies

- Establishing a grazing regime modelled on past management practises which have enabled populations of the Grassland Earless Dragon and Striped Legless Lizard to co-exist on the reserve.
- Continue to monitor impacts of the grazing regime and progressively adopting more precise management strategies to improve habitat values for populations of the Grassland Earless Dragon and the Striped Legless Lizard.
- Investigate grazing management strategies that minimise the introduction and spread of weed species and soil erosion.
- Where possible and compatible with the above objectives, use traditional grazing practises that will have relevance to the local rural community.
- Use the results of the reptile and vegetation monitoring to refine the grazing regime to maximise the benefits for the threatened reptile species habitat.

7.2 INFRASTRUCTURE

There is limited management infrastructure located in the reserve. Management access to the reserve is from two existing gates. Vehicle access to the reserve will be restricted to times of dry weather as the basalt derived clays become very sticky during wet periods. It will be necessary to use vehicles to carry out pest control programs. Quad bikes should be used where possible to minimise track formation.

The reserve has a number of stock proof fences that can be useful for managing grazing across the reserve. Sheep tend to favour certain areas of the reserve, which may cause undesirable impacts in some areas. Fencing can be used to ensure a more even grazing pressure across the reserve or alternatively vary grazing intensity according to a particular grazing prescription. Sheep also tend to overnight or camp in a favourite location each night. These camps receive an increased nutrient load from the accumulation of sheep manure each night. Fencing can be used to spread this pressure across the reserve.

There is very little water available at the reserve for stock. At present stock have to walk a considerable distance daily for water. This limits the ability to manage their movements and grazing habits and causes tracking impacts at particular areas. A bore has recently been constructed to allow for more flexibility for grazing. Water reticulation infrastructure will be required to achieve an efficient and flexible stock watering system.
Any additional infrastructure required for the management of this reserve should not detract from the habitat values or visual amenity of the reserve and should be in keeping with the surrounding rural landscape.

Outcomes

- Grazing management infrastructure, including stock proof fencing and water reticulation, maximise grazing management flexibility and efficiencies.
- Management infrastructure and use is sympathetic to the surrounding environment and does not impact on the habitat values or visual amenity of the reserve.

Strategies

- Vehicles will only be permitted in the reserve for essential management purposes and will not be permitted onto the reserve during wet periods.
- Essential management vehicle use in the reserve will be undertaken in a manner which avoids creation of tracks. Preference will be given to use of quad bikes or similar where appropriate. Areas subject to such use will be rehabilitated if necessary.
- A review will be undertaken of the fencing and changes to existing fencing layout may be made in future.
- A water reticulation system will be installed to achieve a flexible stock watering system.

8. PLAN IMPLEMENTATION

This plan of management establishes a scheme of operations for Kuma Nature Reserve. It will remain in force until amended or replaced in accordance with section 73B of the NPW Act. The plan is part of a system of management which includes the National Parks and Wildlife Act 1974, management policies, established conservation and recreation philosophies, and strategic planning at corporate, directorate and regional levels. The latter may include development of related plans such as regional recreation plans, species recovery plans and conservation plans.

Relative priorities for activities identified in this plan are set out in the table below. These priorities are subject to the availability of necessary staff and funds, and to any special requirements of the Director-General or Minister. High priority activities are those considered imperative to achievement of the objectives and desired outcomes. They must be undertaken in the near future to avoid significant deterioration in natural, cultural or management resources. Medium priority activities are those that are necessary to achieve the objectives and desired outcomes but are not urgent. Low priority activities are desirable to achieve management objectives and desired outcomes but can wait until resources become available.

The environmental impact of proposed activities will be assessed at all stages in accordance with established environmental assessment procedures. If the impacts of any activity proposed in this plan are found to be unacceptable, the activity will not be undertaken or be modified so as to comply with the environmental assessment outcomes.

Strategies

- Undertake an annual review of progress in implementing this plan of management.
- After 5 years, undertake an assessment of the effectiveness of managing Kuma Nature Reserve in accordance with this plan and of the degree of success in achieving the plan’s objectives and desired outcomes. Base the evaluation on the monitoring programs set out in this plan and any others that may be developed.

IMPLEMENTATION TABLE

Reference	Activity	Priority
3.3	Continue to monitor vegetation structure and diversity annually to assess the impacts of grazing on the reserve.	High
3.3	Identify locations of significant vegetation or communities to ensure they are properly protected from disturbance.	Medium
3.3	Investigate logistics for a trial for reintroduction of suitable native forbs for the reserve.	Low
3.3	Investigate options for undertaking Voluntary Conservation Agreements for surrounding properties.	Low
3.4	Continue to monitor populations of Grassland Earless Dragon and Striped Legless Lizard and the effect of management actions on the populations.	High
3.4	Implement recommendations of species recovery plans in so far as such actions are consistent with the objectives of this plan.	High
3.4	A comprehensive fauna survey will be conducted for the reserve.	Medium
3.5	Organise opportunities for Aboriginal people to visit and learn about the reserve	Medium
3.5	A further archaeological survey will be conducted for the reserve when vegetation cover is reduced.	Low
3.6	Record and conserve sites of past use of the area in consultation with relevant community groups.	Low
4.1	Identify opportunities for cooperative weed management programs with adjoining land managers.	High
4.1	Continue to carry out an annual control program for Serrated Tussock, African Love Grass and St Johns Wort. Control other weeds as required.	High
4.1	Fox baiting programs will be carried out regularly in cooperation with reserve neighbours, the Rural Lands Protection Board and other land managers.	High
4.1	Monitor the impact of rabbits and hares on the reserve and implement appropriate programs as required.	Medium
4.1	Monitor for the presence cats at the reserve and implement appropriate programs as required.	Medium
4.2	Continue to participate in the Cooma Bushfire Management Committee meetings.	High
4.2	Encourage further research into the ecological effects of fire in the reserve and on the threatened reptile species.	Low
5	Maintain close liaison with neighbours, Landcare groups and stakeholders concerning matters of mutual interest.	High
5	Investigate feasibility of constructing an interpretive display and short hard surface walking trail to enable visitors to view the habitat without adversely impacting on the majority of the site.	Medium
6	Implement and review a monitoring program for the threatened species at the reserve.	High
6	Prepare a prospectus outlining priority research projects to assist in management of the reserve.	Medium
7.1	Establish a grazing regime based on past grazing practises, which can be reviewed and modified using information from monitoring and research.	High
7.1	Continue to investigate and assess alternative grazing options that minimise weeds and soil erosion and maximise benefits for the threatened reptile species habitat, and make recommendations as required.	Medium
7.2	Install a water reticulation system to achieve a more flexible stock watering arrangements.	High

High priority activities are those imperative to achievement of the objectives and desired outcomes. They must be undertaken in the near future to avoid significant deterioration in natural, cultural or management resources.
Medium priority activities are those that are necessary to achieve the objectives and desired outcomes but are not urgent.
Low priority activities are desirable to achieve management objectives and desired outcomes but can wait until resources become available.

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APPENDICES

1. SPECIES LIST

1.1 FLORA

Native Grasses

Austrostipa bigeniculata
Austrostipa falcata.
Bothriochloa macra
Danthonia spp.
Elymus scaber
Ennneapogon nigricans
Panicum effusum
Poa sieberiana
Poa meionectes

Native Forbs

Acaena ovina
Acetosella vulgaris
Asperula conferta
Brachyscome heterodonta
Carex inversa
Chamaecyse drummondii
Chrysocephalum apiculatum
Crassula sieberiana
Convolulus erubescens
Cullen tenax
Cymbonotus lawsonianus
Desmodium varians
Dichelachne crinita
Dichondra repens
Dichondra sp. A
Einardia nutans
Epilobium billardierianum
Erodium crinitum
Euchiton sp.
Glycine clandestina
Glycine tabacina
Goodenia pinnatifida
Oxalis perennans
Rumex dumosus
Scleranthus diander
Swainsona sericea
Swainsona monticola
Stackhousia monogyna
Vittadinia cuneata
Vittadinia muelleri
Vittadinia triloba
Wahlenbergia spp.

Native Shrubs

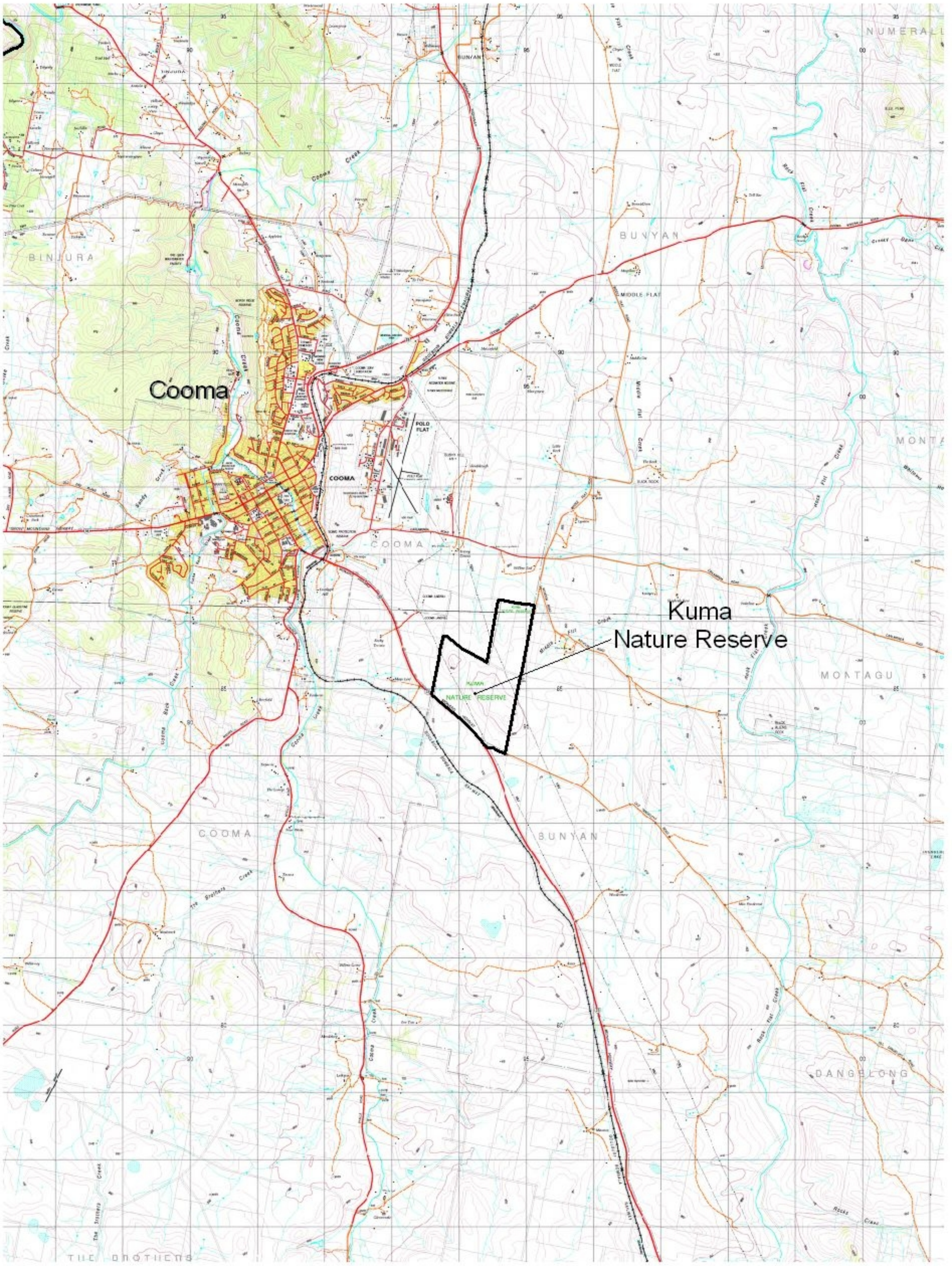
Bursaria sp.
Discaria pubescens
Hymenanthera dentata
Pimelia pauciflora

Exotic species

Aira sp.
Arenaria serpyllifolia
Bromus mollis
Capsella bursa-pastoris
Carthamus lanatus
Cerastium glomeratum
Chondrilla juncea
Cirsium vulgare
Cynodon dactylon
Eragrostis curvula
Erodium sp.
Festuca ovina
Hordeum leporinum
Hypericum perforatum
Hypochaeris glabra
Hypochaeris radicata
Lactuca seriola
Linaria arvensis
Malva parviflora
Medicago spp.
Moencha erecta
Myosotis discolor
Onopordeum acanthium
Paronychia brasiliana
Petrorhagia nanteuilii
Picris hiercioides
Psilurus incurvus
Salvia verbenaca
Spergularia marina
Taraxicum officinale
Tragopogon porrifolius
Trifolium angustifolium
Trifolium arvense
Trifolium campestre
Trifolium glomeratum
Verbascum thapsis
Vulpia spp.

1.2 FAUNA

Family Scinicidae	
Bassiana duperreyi	Bold-striped Cool-skink
Pseudomia pagenstecheri	
Ctenotus uber	Spotted Ctenotus
Egernia cunninghami	Cunningham"S Spiny-Tailed Skink
Egernia whitii	White's Rock Skink
Lampropholis dlicata	Dark-flecked Garden Sunskink
Lampropholis guitchenoti	Pale-flecked Garden Skink
Tiqua nigrolutea	Blotched Bluetongue
Family Pygopodidae	
Delma impar	Striped Legless Lizard
Family Agamidae	
Tympanocryptis pinguicola	Grassland Earless Dragon
Family Elapidae	
Austrelaps ramsayi	Highlands Copperhead
Drysdalia coronoides	
Pseudonaja textilis	Eastern Brown Snake
Suta flagellum	Little Whip Snake
Frogs	
Limnodynastes dumerilii	Banjo Frog
Limnodynastes tasmaniensis	Spotted Marsh Frog
Neobatrachus sudelii	
Crinia parinsignifera	Eastern Sign-bearing Froglet
Crinia signifera	Common Eastern Froglet
Birds	
Alauda arvensis	Eurasian Skylark
Anthus australis	Australian Pipit
Aquila audax	Wedge-tailed Eagle
Cincloramphus mathewsi	Rufus Songlark
Corvus coronoides	Australian Raven
Coturnix pectoralis	Stubble Quail
Eolophus roseicapillis	Galah
Falco berigora	Brown Falcon
Falco cenchroides	Australian Kestrel
Gymnorhina tibicen	Australian Magpie
Hieraaetus morphnoides	Little Eagle
Sturnus vulgaris	European Starling
Vanellus mies	Masked Lapwing
Vanellus tricolour	Banded Lapwing
Mammals	
Vulpes vulpes	European Fox
Oryctolagus cuniculus	European Hare
Mus musculus	House Mouse
Lepus europaeus	European Hare
Macropus giganteus	Eastern Grey Kangaroo



Planning Area and Regional Locality

Kuma Nature Reserve

Map Sheet

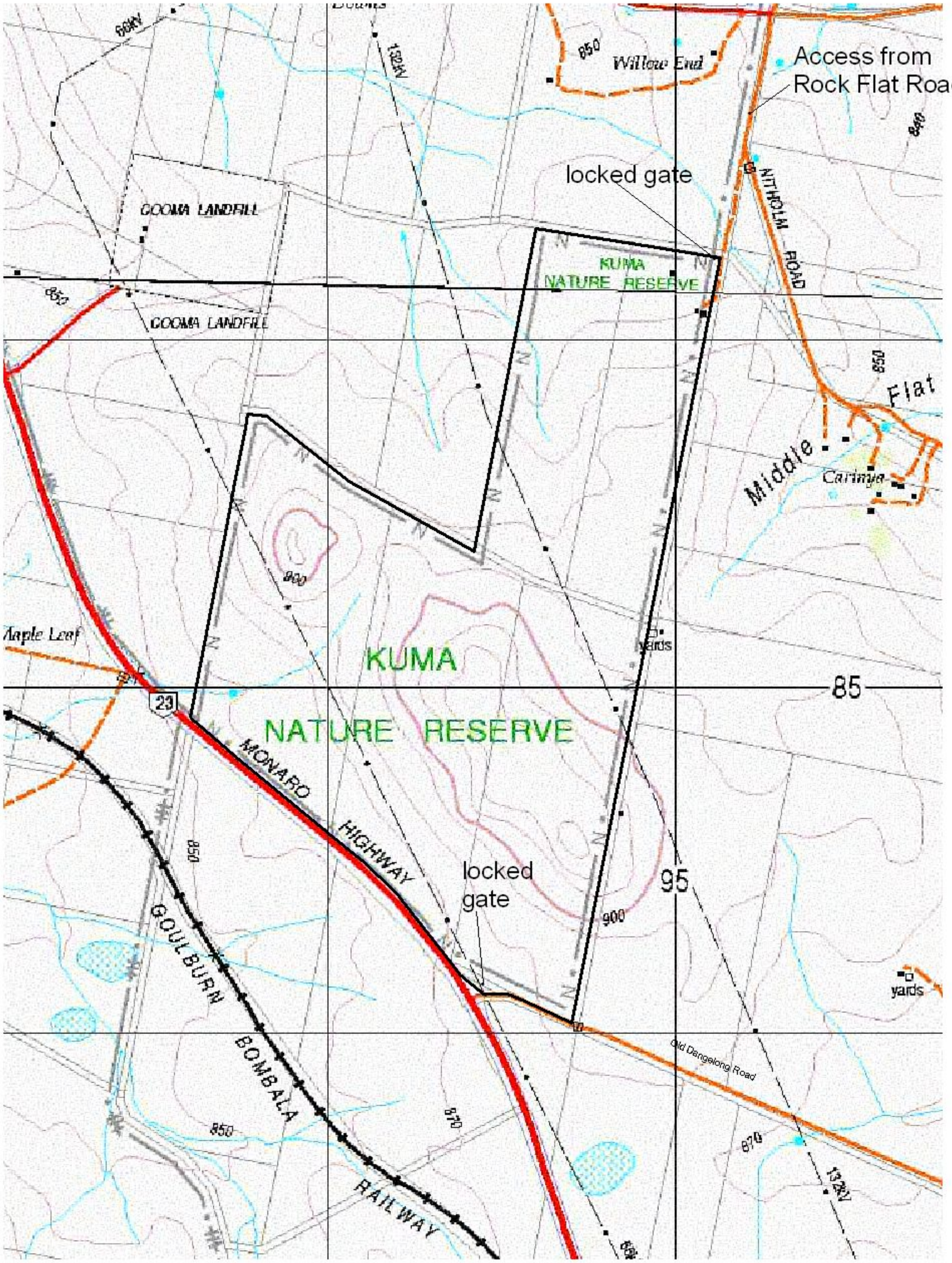
Cooma 1:25,000
8725-IV-S

Department of Environment and Climate Change NSW

0 847 1694 Metres

PROJECTION: AMG Zone 55 (AGD66)

17 October 2007



Nature reserve boundary

Kuma Nature Reserve

Department of Environment and Climate Change NSW

0 164 328 Metres

PROJECTION: AMG Zone 55 (AGD66)

17 October 2007