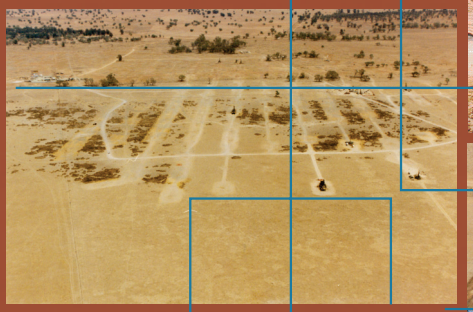
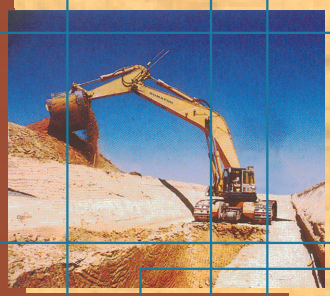
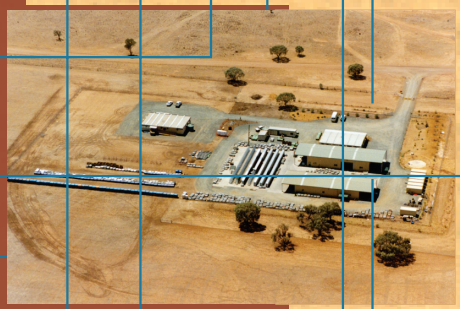
Cowal Gold Operation

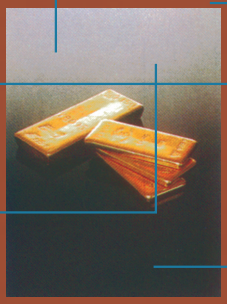
Land Management Plan

October 2003









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COWAL GOLD PROJECT

LAND MANAGEMENT PLAN

OCTOBER 2003
Project No. HAL-02-07/1/11
Document No. LMP01-U
ID: 685074

PREFACE

This Land Management Plan (LMP) has been prepared to meet the requirements of Condition 3.10(A)(i) of the Cowal Gold Project Development Consent. Where there is any conflict between the provisions of this LMP and the applicable statutory requirements (ie. licences, permits, consents and relevant laws) the statutory requirements are to take precedence.

In accordance with Consent Condition 3.2 this LMP is to be revised/updated at least every five years, or as otherwise directed by the Director-General, in consultation with the relevant government authorities.

It is the responsibility of Barrick to refer to the latest versions of any statutory instruments or guidelines that are referenced in this LMP, but have not been appended.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

The Cowal Gold Project (the Project) is located approximately 38 kilometres (km) north-east of West Wyalong, New South Wales (NSW) (Figure 1). The Project is owned by Barrick Gold Australia Ltd (Barrick).

Consent Condition 3.10(A)(i) for the mine and pipeline consent requires the preparation of the enclosed Land Management Plan (LMP). The consent conditions and the corresponding sections of this Plan that address the conditions are outlined below.

Consent Condition			Section
3.10	***Land Management***		
	The Applicant shall:		
	(A) (i)	prior to commencement of construction works prepare a Land Management Plan for all its land holdings to provide for proper land management in consultation with DLWC, NSW Agriculture, and BSC, and to the satisfaction of the Director-General. The plan shall be consistent with the fauna management plan (condition 3.4) and shall include, but not be limited to:	Sections 1 to 12
		(a) pastures and remnant vegetation management;	Sections 4 and 5
		(b) control of vermin and noxious weeds as required by the Rural Lands Protection Authority, the Prickly Pear Authority and other relevant authorities;	Sections 6 and 7
		(c) integration of the latest versions of the Jemalong Land and Water Management Plan and the Lake Cowal Land and Water Management Plan; and	Section 2
		(d) feral animal control.	Section 7

Note: NSW Agriculture have advised that the Prickly Pear Authority no longer exists and the control of Prickly Pear is dealt with under the *Noxious Weeds Act, 1993 (*NSW Agriculture, pers. comm., 13 May 2003).

In addition:

- Consent Condition 3.2 provides:

  The management plans are to be revised/updated at least every five years, or as otherwise directed by the Director-General, in consultation with the relevant government authorities. They will reflect changing environmental requirements or changes in technology/operational practices. Changes shall be made and approved in the same manner as the initial environmental management plan. The plans shall also be made publicly available at BSC within two weeks of approval of the relevant government authority.

  This condition is addressed in the Preface.

- Consent Condition 3.10(B) provides:

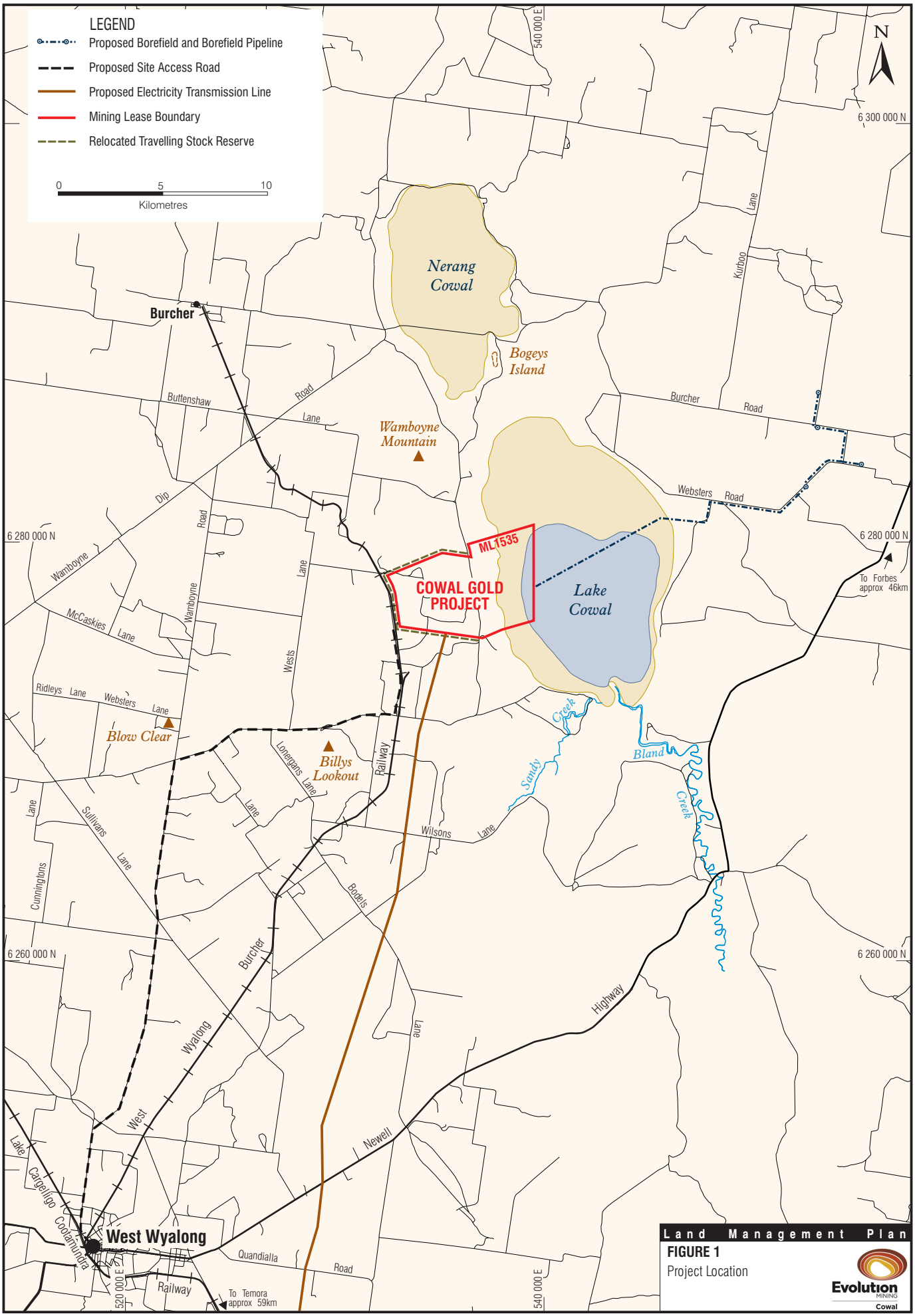
  The Applicant shall minimise the removal of trees and other vegetation from the mine site and restrict any clearance to the areas occupied by the mine activity, buildings and paved surfaces, and those areas necessary for fire control in accordance with BSC's requirements, and have regard to the draft Mid-Lachlan Regional Vegetation Management Plan (or its final version).

  This condition is addressed in Section 5.

- Consent Condition 3.10(C) provides:

  The Applicant shall not locate topsoil stockpiles within any area of Wilga Woodland in the DA area as identified in figure 3-13 of the EIS.

  This condition is addressed in Section 5.2.



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- Consent Condition 3.10(D) provides:

  The Applicant shall not disturb any area of Belah Woodland in the DA as identified in figure 3-13 of the EIS.

  This condition is addressed in Section 5.2

- Consent Condition 4.3 provides:

  The Applicant shall as a landowner have an on-going regard for the provisions of the latest versions of the Jemalong Land and Water Management Plan, Lake Cowal Land and Water Management Plan, Mid-Lachlan Regional Vegetation Management Plan, and any future catchment/land and water management plans that may become relevant to the area.

  This condition is addressed in Section 2.3 and at other locations in the Plan where relevant.

- Consent Condition 8.7 establishes the requirements for a Community Environmental Monitoring and Consultative Committee (CEMCC). This condition is reproduced in full in Section 10.1.

- Consent Condition 8.8 establishes the requirements for an Independent Environmental Audit (IEA) and an Independent Monitoring Panel (IMP). This condition is reproduced in full in Section 11.

- Consent Condition 9.2 establishes reporting requirements as reproduced in full and discussed in Section 12.

- Consent Condition 10 outlines the requirements for receipt and response to community complaints. This condition is reproduced in full and discussed in Section 10.2.

- In accordance with Consent Condition 12.1, the Applicant is obliged to ensure all statutory requirements are fully met.

1.1 OBJECTIVES AND SCOPE

The objective of this Plan is to provide for proper land management for all of Barrick's landholdings.

In fulfilling this objective, and in accordance with the requirements of Development Consent condition 3.10(A)(i), the LMP:

(i) is consistent with the Flora and Fauna Management Plan (FFMP) (Development Consent Condition 3.4);

(ii) includes the management of pastures and remnant vegetation;

(iii) includes control of vermin and noxious weeds as required by the Rural Lands Protection Board, Bland Shire Council (BSC) and NSW Agriculture; and

(iv) integrates the latest versions of the Jemalong Land and Water Management Plan and the Lake Cowal Land and Water Management Plan.

The LMP is structured as follows:

Section 1: Outlines the objectives of the Plan and details relevant consent conditions.

Section 2: Identifies legislative requirements and guidelines applicable to the Plan.

Section 3: Identifies Barrick-owned land.

Section 4: Describes pasture management.

Section 5: Describes remnant vegetation management.

Section 6: Details weed control measures (including noxious weeds).

Section 7: Details feral animal and vermin (pest) control.

Section 8: Identifies other land management issues.

Section 9: Describes mine rehabilitation and long-term landuse.

Section 10: Summarises stakeholder consultation and complaints receipt.

Section 11: Provides a description of IEA processes.

Section 12: Outlines reporting requirements for land management related issues.

In accordance with requirements of Consent Condition 3.10(A)(i), the Department of Land and Water Conservation (DLWC) (now part of the Department of Infrastructure, Planning and Natural Resources [DIPNR]), NSW Agriculture and BSC have been consulted during the preparation of this LMP. All references to DLWC in this document should be read as DIPNR. Where applicable, reference is made to consultation notes or verbal advice from these regulatory authorities throughout this report. The LMP will be prepared to the satisfaction of the Director-General of DIPNR and is consistent with the FFMP referred to in Consent Condition 3.4(a).

In accordance with the requirements of Consent Condition 3.10(A)(i), this LMP applies to all Barrick-owned land associated with the Project. It is therefore the responsibility of the Barrick staff assigned responsibilities in land management to implement proper land management in accordance with this Plan.

Notwithstanding, the BSC and Condobolin Rural Lands Protection Board (CRLPB) have powers to direct Barrick to undertake weed or pest control that does not comply with this LMP in accordance with their roles under the *Noxious Weeds Act, 1993* and *Rural Lands Protection Act, 1998* respectively.

2 LEGISLATIVE AND APPROVAL REGIME

2.1 CONDITIONS OF AUTHORITY ML1535

Conditions of Authority ML 1535

The Department of Mineral Resources (DMR) has requirements in the Conditions of Authority for Mining Lease (ML) 1535 that relate to rehabilitation and vegetation clearance in the mining lease area. Relevant Conditions of Authority include:

Rehabilitation

12. (a) Land disturbed must be rehabilitated to a stable and permanent form suitable for a subsequent land use acceptable to the Director-General and in accordance with the Mining Operations Plan so that:

- *there is no adverse environmental effect outside the disturbed area and that the land is properly drained and protected from soil erosion.*

- *the state of the land is compatible with the surrounding land and land use requirements.*
- *the landforms, soils, hydrology and flora require no greater maintenance than that in the surrounding land.*
- *in cases where revegetation is required and native vegetation has been removed or damaged, the original species must be re-established with close reference to the flora survey included in the Mining Operations Plan. If the original vegetation was not native, any re-established vegetation must be appropriate to the area and at an acceptable density.*
- *the land does not pose a threat to public safety.*

(b) Any topsoil that is removed must be stored and maintained in a manner acceptable to the Director-General.

13. The lease holder must comply with any direction given by the Director-General regarding the stabilisation and revegetation of any mine residues, tailings or overburden dumps situated on the lease area.

These conditions are addressed in Section 9.

Prevention of Soil Erosion and Pollution

14. Operations must be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, unless otherwise authorised by a relevant approval, and in accordance with an accepted Mining Operations Plan. For the purpose of this condition, water shall be taken to include any watercourse, waterbody or groundwaters. The lease holder must observe and perform any instructions given by the Director-General in this regard.

This condition is addressed in Sections 8.2 and 8.3.

Trees and Timber

19. (a) The lease holder must not fell trees, strip bark or cut timber on the lease without the consent of the landholder who is entitled to the use of the timber, or if such a landholder refuses consent or attaches unreasonable conditions to the consent, without the approval of a warden.

(b) The lease holder must not cut, destroy, ringbark or remove any timber or other vegetative cover on the lease area except such as directly obstructs or prevents the carrying on of operations. Any clearing not authorised under the Mining Act 1992 must comply with the provisions of the Native Vegetation Conservation Act 1997.

(c) The lease holder must have any necessary licence from the Forestry Commission of New South Wales before using timber from any Crown land within the lease area.

This condition is addressed in Section 5.

Mining Operations Plan (MOP)

25. (1) Mining operations, including mining purposes, must be conducted in accordance with a Mining Operations Plan (the Plan) satisfactory to the Director-General. The Plan together with environmental conditions of development consent and other approvals will form the basis for-

(a) ongoing mining operations and environmental management; and

(b) ongoing monitoring of the project.

(4) The Plan must present a schedule of proposed mine development for a period of up to seven (7) years and contain diagrams and documentation which identify:-

(e) flora and fauna management plan for the mine;

(f) progressive landscape and rehabilitation management plan including schedules;

(g) areas of particular environmental, ecological, archaeological and cultural sensitivity and measures to protect these areas; and

(l) environmental monitoring program listing the location of monitoring points, frequency of monitoring and parameters to be monitored.

This condition is addressed in Section 9.

Annual Environmental Management Report (AEMR)

26. (1) Within 12 months of the commencement of mining operations and thereafter annually or, at such other times as may be allowed by the Director-General, the lease holder must lodge an Annual Environmental Management Report (AEMR) with the Director-General.

(2) The AEMR must be prepared in accordance with the Director-General's guidelines current at the time of reporting and contain a review and forecast of performance for the preceding and ensuing twelve months in terms of:

(a) the accepted Mining Operations Plan;

(b) development consent requirements and conditions;

(c) Environment Protection Authority and Department of Land and Water Conservation licences and approvals;

(d) any other statutory environmental requirements;

(e) details of any variations to environmental approvals applicable to the lease area; and

(f) where relevant, progress towards final rehabilitation objectives.

(3) After considering an AEMR the Director-General may, by notice in writing, direct the lease holder to undertake operations, remedial actions or supplementary studies in the manner and within the period specified in the notice to ensure that operations on the lease area are conducted in accordance with sound mining and environmental practice.

(4) The lease holder shall, as and when directed by the Minister, cooperate with the Director-General to conduct and facilitate review of the AEMR involving other government agencies and the local council.

This condition is addressed is Section 12.

2.2 LEGISLATION

Soil Conservation Act 1938

Under this Act, where the Commissioner of the Soil Conservation Service of New South Wales considers that any act (or failure to carry out an act) has caused or is likely to cause soil erosion or soil degradation in relation to land, the Commissioner may issue a notice upon the owner or occupier of the land requiring the owner or occupier to abstain from doing the act or to carry out the act as specified in the notice. It is an offence to fail to comply with the notice.

Rivers and Foreshores Improvement Act 1948

Under this Act a person must not:

- make an excavation on, in or under protected land; or
- remove material from protected land; or
- do anything which obstructs, or detrimentally affects, the flow of protected waters, or which is likely to do so,

unless the person is authorised to do so by a permit under Part 3A of the Act.

The following definitions are relevant:

"Material" means any part of the surface of any land or any matter lying beneath that surface.

"Protected land" includes land that is the bank, shore or bed of protected waters, or not more than 40 metres from the top of the bank or shore of protected waters (measured horizontally from the top of the bank or shore).

"Protected waters" means a river lake into or from which a river flows, coastal lake or lagoon (including any permanent or temporary channel between a coastal lake or lagoon and the sea).

A permit under Part 3A is not required for activities carried on pursuant to the authority of a mining lease (that is, within the mining lease area).

It should be noted that any work within the bed, or 40 metres of the high bank of any flow line, or Lake Cowal, <u>outside</u> the mining lease may require a permit under Part 3A of the Act.

Catchment Management Act 1989

This Act establishes Catchment Management Boards or Trusts including, relevantly, the Lachlan Catchment Management Board. The role of the Boards or Trusts includes development of catchment blueprints which are 10-year advisory plans for integrated catchment management. There are 21 blueprints covering the whole of NSW. They were endorsed by the NSW Government in late 2002 and they are the overarching integration mechanism for natural resource planning. The Lachlan Catchment Blueprint covers West-Wyalong and the Project and was prepared by the Lachlan Catchment Management Board.

Protection of the Environment Operations Act 1997

Offences and duties under the *Protection of the Environment Operations Act* relevant to this LMP include a person who pollutes any waters is guilty of an offence (s120). Substances that may cause water pollution includes any ashes, soil, earth, mud, stones, sand, clay or similar inorganic matter (Schedule 3 POEO (General) Regulation 1994). It is a defence in a prosecution under section 120 that the pollution was regulated by an environment protection licence, the conditions of which had not been contravened.

Under section 148, a duty is imposed on certain persons to notify the Environment Protection Authority (EPA) or local council where a pollution incident occurs in the course of an activity so that material harm to the environment is caused or threatened. The persons upon whom the duty is imposed include the person carrying on the activity and the occupier of the premises on which the incident occurred.

2.3 POLICIES AND PLANS

A number of regional, state and commonwealth polices and plans are relevant to this Plan including those summarised below. The integration of the LMP with regional, state and commonwealth policies and plans is recognised as important. Where practicable and appropriate, this LMP integrates management recommendations resulting from the policies/plans described below.

National Objectives and Targets for Biodiversity and Conservation 2001 – 2005

The *National Objectives and Targets for Biodiversity and Conservation 2001 – 2005* (Environment Australia, 2001) document sets objectives and targets for 10 priority outcomes which the Commonwealth, States and Territories should pursue between now and 2005. The management actions relevant to this LMP are to:

- restore native vegetation and terrestrial ecosystems; and
- restore freshwater ecosystems.

Lachlan Catchment Blueprint

The Lachlan Catchment Blueprint, also known as the Integrated Catchment Management Plan for the Lachlan Catchment 2002 (Lachlan Catchment Management Board, 2003), provides direction for the changes needed in natural resource management within the Lachlan Catchment. The Blueprint provides a framework for the investigations and research that needs to be undertaken, the on ground actions that need to occur, the advisory and education services that need to be in-place and the commitment that government needs to make to resource the plan. A number of key natural resources issues identified in the catchment are addressed by the Blueprint, including those relating to salinity, native vegetation management, water quality and quantity, soil health, biodiversity and cultural heritage.

Mid Lachlan Regional Vegetation Management Plan and Strategy

The Mid Lachlan Regional Vegetation Management Plan and Strategy (MLRVMP) has been developed "*to promote the sustainable management of native vegetation in the Mid Lachlan Region in a manner which is balanced, achievable and supported by the Region's local communities*" (DLWC, 2001). The Mid Lachlan Regional Vegetation Management Plan and Strategy provides a framework for the enhancement and re-establishment of native vegetation in the Mid Lachlan Region.

Jemalong Land and Water Management Plan

The Jemalong Land and Water Management Plan (JLWMP) (Glasson and Duff, 2001) aims to guide the development of the Jemalong Irrigation District so that land and water resources are used in a way which is profitable and improves and sustains the environment for current and future generations. The goals of the Jemalong Land and Water Management Plan to achieve this are:

1. To reduce accessions to the watertable, thereby helping to minimise salinity and water logging.
2. To increase the economic viability of the Jemalong Land and Water Management Plan area.
3. To increase awareness of the value of land and water management planning.
4. To increase the implementation of best management practices.
5. To alleviate the adverse effects of local agricultural practices on soil and water quality.

The JLWMP provides strategies for on-farm options (such as landforming, farm planning, recycling systems, high volume outlets, soil fertility testing and improving pastures), as well as regional options (such as vegetation, floodway levees and rain reject storages).

Bland Creek Catchment Plan

The Bland Creek Catchment (BCC) covers an approximate area of 940,950 hectares (ha) and is the southern portion of the Lachlan Catchment containing Lake Cowal. There are six subcatchments within the BCC, of which the Project is located in the north of the Barmedman sub-catchment.

The Bland Creek Catchment Plan (Bland Catchment Committee, 2002) is divided into two stages. Stage one was developed to address local natural resource and land management issues and an economic analysis of the issues, presenting a 'no-plan' scenario. The Catchment Plan developed by stage one has collated existing information on the Catchment, provides an overview of the Catchment's physical features and socio-economic status and gives an account of the extent and severity of each issue at a subcatchment level. Stage two was developed from the findings of stage one and provides a Catchment Action Plan, in which priorities are set for future 'on-ground' activities. The BCC Action Plans identify a number of proposed actions to overcome threats and barriers to natural resource management. Actions are provided for soils, water, native vegetation and biodiversity, and salinity.

Land and Water Management Plan for Lake Cowal and Associated Wetlands

The Land and Water Management Plan for Lake Cowal and Associated Wetlands (LWMPLC) (Australian Water Technologies, 1999) is a component of the Jemalong Land and Water Management Plan. The objectives and actions outlined in the plan are consistent with the vision to manage the lake in a way that sustains and enhances the economic, social and ecological well being of the Lake Cowal area for future generations. This plan is referred to in the consent conditions as the Lake Cowal Land and Water Management Plan.

Threat Abatement Plan for Predation by the Red Fox 2001

The plan provides a strategy for fox control for the conservation of native fauna in NSW. The plan identifies best-practice methods for fox control which aim to maximise the effectiveness of control programmes while minimising their impacts on non-target species (NPWS, 2001).

3 BARRICK LANDHOLDINGS

This LMP is applicable to both the mining Project area and Barrick's other rural land holdings in the Lake Cowal area which total approximately 10,600 ha (Figure 2). The eastern boundary of Barrick-owned land is located along the approximate north/south centreline of Lake Cowal (Figure 2). The western boundary primarily follows the West Wyalong Burcher Railway with the boundary in the south west crossing over the railway (Figure 2). Barrick-owned land is currently divided by Crown Land in the form of a Travelling Stock Reserve (TSR), a Game Reserve and a Railway. Approximately 4,600 ha (43%) of Barrick-owned land is situated within Lake Cowal. The current landuse of Barrick-owned land is grazing and cropping as discussed below in Section 3.1.

In order to manage Barrick-owned lands, including those outside of the immediate Project area, Barrick will assign responsibilities for land management (including implementation of this LMP) to appropriate Project personnel. Significant portions of Barrick-owned land may be licensed to other parties for agricultural purposes (Section 3.2).

3.1 LANDUSE/VEGETATION OVERVIEW

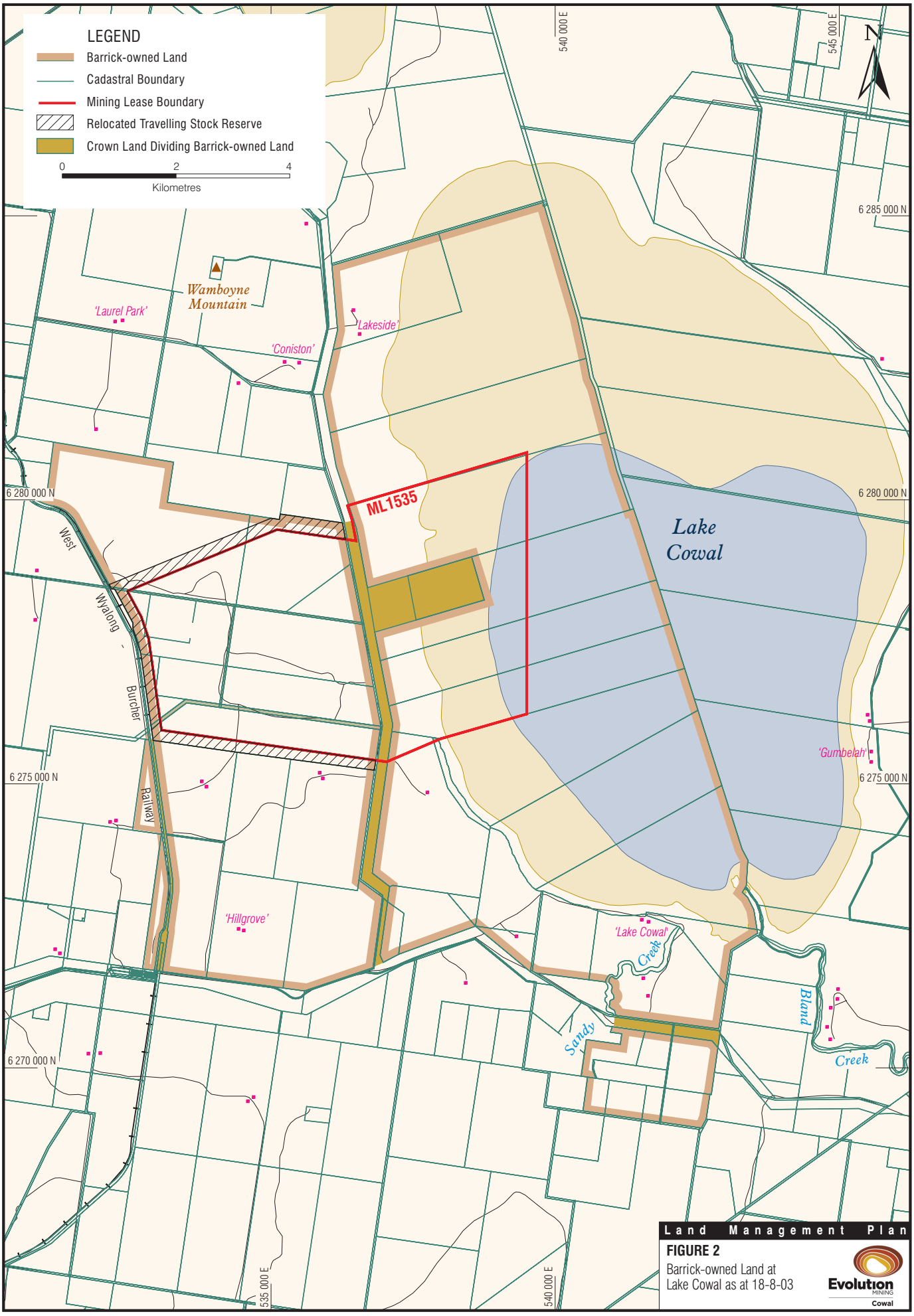
Since European settlement, the extent, structure and management of native vegetation in the region has undergone extensive modification (North Limited, 1998). Clearing is the most noticeable of these changes, however several other processes have changed the original characteristics of the Project area including grazing of native vegetation and pastures, weed/pest incursion, possible alterations to fire regimes, modifications to waterways, and isolation of remnant vegetation (*ibid.*).

As a consequence, the vast majority of Barrick-owned land comprise cleared, grazing and cropping lands, which are currently licensed to local landholders engaged in primary production. Notwithstanding, patches of remnant vegetation occur on Barrick-owned lands.

Vegetation communities that have been identified include (North Limited, 1998; Bower, 2003):

- Remnant Woodland (*Eucalyptus dwyeri - Acacia doratoxylon, Callitris endlicheri*);
- Eucalypt Woodland (*E. dwyeri - E. populnea - E. microcarpa - Callitris glaucophylla - Casuarina cristata*);
- Predominantly Cleared Agricultural Land with Scattered Bimble Box (*Eucalyptus populnea*) Woodland;
- Fringing River Red Gum (*Eucalyptus camaldulensis)*;
- Lignum (*Muehlenbeckia florulenta*);
- Lake Bed (*Eragrostis australasica - Medicago polymorpha*);
- Mixed Woodland (*Acacia pendula - Casuarina cristata*);
- Wilga Woodland (*Gerjera parviflora - Casuarina cristata*); and
- Belah Woodland (*Casuarina cristata*).

The current extent of these vegetation communities is shown on Figure 3. Historical landuse practices have included grazing (and/or cropping in some areas such as the lake bed) of all of these vegetation communities.



Land Management Plan

FIGURE 2

Barrick-owned Land at Lake Cowal as at 18-8-03

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LEGEND

Barrick-owned Land (Current as at August 2003)

Mining Lease Boundary

Vegetation Communities

1 Remnant Woodland (*E. dwyeri - Acacia doratoxylon - Callitris* sp.)

2 Eucalypt Woodland (*E. dwyeri - E. populnea - E. microcarpa - Callitris glaucophylla - Casuarina cristata*)

3 Predominantly cleared agricultural land with scattered Bimble Box Woodland (*E. populnea*)

4 Fringing River Red Gum (*Eucalyptus camaldulensis*)

5 Lignum (*Muehlenbeckia florulenta*)

6 Lake Bed - Scattered areas of *Medicago polymorpha* and Canegrass (*Eragrostis australasica*)

7 Mixed Woodland (*A. pendula - Casuarina cristata*)

8 Wilga Woodland (*Geijera parviflora - Casuarina cristata*)

9 Belah Woodland (*Casuarina cristata*)

0 1000 2000

Metres

Source: After North Limited (1998a)
Bower (2003)
Aerial Photo AAM Surveys (August 2002)

Land Management Plan

FIGURE 3

Vegetation Communities Within Barrick-owned Land

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HAL-02-07 RMP Land_002A

3.2 LICENCE AGREEMENTS

Grazing and cropping activities will be restricted within ML 1535 during construction, operation and rehabilitation of the Project. Barrick-owned land outside the Project area (with the exception of remnant vegetation enhancement areas – Section 5.4) will continue to be utilised for farming/agricultural production by Barrick and/or licensees that sign agreements to conduct agricultural activities on Barrick-owned land. Currently, these typically include the following clauses relevant to the licensee's obligations for land management in the license area.

The licensee must:

- not use any part of the Licensed Area for hunting or camping purposes;
- obtain all consents, licences or authorities, and comply with all applicable laws, in relation to the licensee's use of the Licensed Area;
- not do or carry out on the Licensed Area any harmful, illegal or offensive act;
- maintain, replace, repair and keep the Licensed Area in good condition, except for fair wear and tear;
- promptly make good, to the satisfaction of Barrick, any damage to the Licensed Area for which the licensee is liable;
- use reasonable precautions to keep the Licensed Area free of nuisances, feral animals, noxious weeds and rodents;
- not make any alterations or additions to the Licensed Area without Barrick's prior written consent; and
- comply with all laws and with all requirements or notices received from any competent authority regarding the use of the Licensed Area by the licensee including but not limited to:
  - laws relating to the preservation of Aboriginal sites and protected areas, and comply with Barrick's reasonable directions in relation to the protection of Aboriginal sites and protected areas on the Licensed Area;
  - laws relating to the environment, and comply with Barrick's reasonable directions in relation to the protection and rehabilitation of the environment on and about the Licensed Area.

4 PASTURE MANAGEMENT

In accordance with Consent Condition 3.10(A)(i)(a) the following sub-sections describe how pastures will be managed on Barrick-owned land.

4.1 TRAVELLING STOCK RESERVE (TSR)

The relocated TSR will be separated by fencing from Barrick's mining operations to ensure the unimpeded movement of stock in the relocated reserve. Pastures on the relocated TSR will be managed by the CRLPB.

4.2 IDENTIFICATION OF PASTURE AREAS ON BARRICK'S LANDHOLDINGS

All Barrick-owned land has historically been subject to agricultural activities and no areas have been specifically excluded from grazing (Bill Shallvey, pers. comm., August 2003). An aerial photograph of Barrick-owned land and remnant vegetation is provided on Figure 3.

Barrick-owned land supports both native and improved pastures. The properties can be defined as low country (lakebed) and high country (*ibid*). Essentially the low and high country are east and west respectively of the fringing River Red Gum community (Figure 3).

Lakebed country hosts extensive areas suitable to open grazing. Limited areas are dominated by Lignum and Canegrass however there are areas that support native (endemic) pastures. (*ibid*).

Much of the lakebed has been subjected to infestations of Chinese Lantern, Lippia and Thistles. These infestations are difficult to eradicate, but can be partially controlled by good farming practices (*ibid*).

High country has a mixture of agricultural country that supports both native (Windmill Grass, Spear Grass and Native Clover) and improved (Lucernes and Clovers) pastures (*ibid*).

While the areas are subject to cereal cropping there are areas such as creek lines, hills and Gilgai country that have not been cultivated. These areas support both native and improved pastures (*ibid*).

4.3 MANAGEMENT OF GRAZING

Barrick will manage stock in enhancement areas in order to encourage the natural regeneration of native plant species as recommended by the LWMPLC, MLRVMP, JLWMP and the NSW Wetlands Management Policy (Section 5.4.2) through fencing control and the application of grazing management.

The MLRVMP provides vegetation guides for grazing and suggests that an appropriate grazing regime be developed and implemented. Grazing regimes are systems by which stock on any specific property are managed and can vary according to various factors as follows (DLWC, 2001):

- Timing – plants flower and set seed at differing times throughout the year so, where practicable, grazing will be timed on Barrick's landholdings to reduce impact on preferable flowering pasture species (ie. to maximise the setting of seed and sustainability of the pasture species).
- Duration – duration of stock on specific pasture areas will be managed by Barrick to reduce adverse effects on paddock biomass and revegetation potential.
- Stocking rates – Barrick will manage stocking rates to achieve optimal removal of paddock biomass whilst retaining sufficient cover to facilitate regrowth during paddock recovery/spell periods (periods in which stock is removed from paddocks to allow pasture regrowth).
- Recovery periods – Barrick will manage recovery periods to allow sufficient time for pasture regrowth according to varying paddock conditions.
- Stock type – Barrick will manage different stock types (ie. sheep, cattle, etc.) in accordance with their specific requirements and impacts on vegetation (eg. sheep graze lower to the ground and therefore have a greater potential for vegetation depletion and thus will be rotated between paddocks more swiftly or maintained in smaller flocks than cattle).

Barrick will require Licencees of each property to prepare a Farm Management Plan. If in the future Barrick intended to farm these properties then a farm manager would prepare plans, to cover all Barrick owned property.

Tactical Grazing is the approach promoted by NSW Agriculture for the implementation of best management practice in grazing (NSW Agriculture, 2003a). This practice contains four main components that will act as a guideline for Barrick-owned land as described below:

- S*etting objectives* – Desired outcomes could include such things as:
  - the efficient use of existing native pastures to maximise productivity;
  - eradification of noxious weeds where required; and
  - use of best farming practices, such as "minimal tillage" cultivation.
- *Determining strategies – Barrick will work with Licencees to develop strategies in order to achieve set outcomes. These strategies will aim to achieve the objectives (eg. maximise the productivity of native grasses on areas of poorer soils). Strategies may need to be altered due to various fluctuating factors such as seasonal conditions, climate variation and market conditions.*
- *Implementing tactics – Farm Management Plans will be agreed between Licencees and Barrick to achieve the desired outcomes (eg. managing grazing to improve native pastures). Tactical responses to manage changing conditions will be required by Barrick to achieve desired outcomes.*
- *Monitoring results* – Barrick will assess the initial objectives. Monitoring of results may lead to a change in management strategies, or changes to objectives in future Farm Management Plans.

Grazing management needs to be flexible, it cannot be based on simple recipes or driven by a set of rules that might claim to suit all pasture types, pasture conditions and enterprise types (NSW Agriculture, 2003a). Tactical Grazing recognises that grazing management decisions need to be made within a framework that considers farm and enterprise objectives (*ibid*). Decisions should be based on pasture type, the recent history and present condition of each pasture paddock, short and long-term pasture productivity and finally the specific requirements of livestock that graze within the system (*ibid.).*

4.4 MANAGEMENT OF NATIVE PASTURES

The dominant species of native pasture on Barrick-owned land include *Danthonia* sp., *Austrostipa* sp.*, Cynodon* sp.*, Paspalidium* sp.*, Chloris* sp. and *Enteropogon* sp*.* (Colin Bower, pers. comm., September 2003). Native pasture is recognised as an asset due to its drought and fire tolerance, ability to grow on poor quality soils with limited nutrient value and adaptations to survive periods of high stress (Walters *et al.,* 2000). In addition, native grasses are important components of natural ecosystems (*ibid.*).

Damage to native pastures generally results from regular or continuous overgrazing (DPI, 1995). To assist in the establishment or to maintain the health of existing native perennial grasslands intermittent grazing and periodically resting areas until seed set will allow seed banks to be maintained and maximise production (Walters *et al.,* 2000).

Barrick-owned land will be managed to avoid overgrazing and subsequent damage to native pastures. This will be achieved by implementing a Tactical Grazing approach as described in Section 4.3.

With regard to managing stock in areas of remnant native vegetation, the emphasis will be on carefully controlling and managing grazing pressure (DLWC, 2001). The best approach to maintaining a site's biological diversity may be one of periodic stock exclusion, rather than total exclusion (*ibid*). There is evidence that exclusion results in dramatic improvements in the structural complexity of vegetation, increased groundcover and the re-emergence of a range of orchids, grasses and other understorey species (*ibid*.). Further discussion of stock management in vegetation enhancement areas on Barrick-owned lands is provided in Section 5.4.

4.5 MANAGEMENT OF IMPROVED PASTURES

Improved pastures on Barrick-owned lands are primarily based on clovers (*Trifolium* sp.) and medics (*Medicargo* sp.) including Lucerne (*Medicargo sativa*) (Bill Shallvey, pers. comm., August 2003).

Paddocks requiring pasture renovation or re-establishment and those paddocks suitable for harvesting of the aforementioned pasture seeds will be identified. Fertilisers and tillage techniques may be utilised on improved pastures. Direct drilling and minimum tillage techniques will be preferentially used to minimise soil disturbance and fertilisers may be applied periodically to improve soil fertility (Section 8.3). The Tactical Grazing approach will be implemented for improved pastures on Barrick-owned land.

4.6 POST-CLOSURE PASTURE MANAGEMENT

Areas of Barrick-owned land will continue to be available for pastures and other agricultural uses following mine closure. The areas available for different types of landuse will be determined by land ownership and consultation and agreements with regulatory agencies. Further discussion on long-term landuse is provided in Section 9 of this Plan.

5 REMNANT VEGETATION MANAGEMENT

5.1 VEGETATION CLEARANCE PROTOCOL

In accordance with Consent Condition 3.4(a)(vii) which requires the protection and enhancement of existing retained habitats within the mining lease area and 3.10(B) which requires the minimisation of removal of trees and other vegetation from the mine site, a Vegetation Clearance Protocol (VCP) has been developed for the Project (Figure 4). All vegetation clearance activities required by the Project will be conducted in accordance with the VCP. The VCP will be implemented by suitably qualified person(s) and coordinated by the Environmental Manager.

In accordance with Consent Condition 3.10(B) and the FFMP, clearance activities within the mining lease area will be restricted to the areas occupied by mine activities, buildings and paved surfaces, and those necessary for fire control. The VCP is consistent with the JLWMP and LWMPLC to minimise vegetation clearance in the region.

The key components of the VCP are (Figure 4):

- delineation of disturbance areas;
- pre-clearance surveys;
- fauna management strategies;
- vegetation clearance procedure; and
- a link to the Threatened Species Management Protocol (TSMP).

VEGETATION CLEARANCE PROTOCOL

DELINEATION OF DISTURBANCE AREAS

Delineation of areas to be cleared of native remnant vegetation. Remnant native vegetation immediately adjoining proposed clearance areas to be clearly marked or fenced to prevent accidental damage during vegetation clearance activities or construction works.

PRE-CLEARANCE SURVEYS

Stage 1 - Preliminary Habitat Assessment

Inspection of individual trees located within the proposed disturbance area for features with the potential to provide roosting and/or nesting resources for birds, bats and arboreal mammals (defined as 'habitat trees'). Each habitat tree identified is to be clearly marked. Information recorded may include (but not necessarily be limited to) habitat tree characteristics and fauna observations.

Stage 2 Secondary Habitat Assessment

Utilising information recorded by the preliminary habitat assessment, habitat trees may be surveyed further to assess their usage by birds, bats and/or arboreal mammals. This stage may include (but not necessarily be limited to) spotlighting for arboreal mammals, observations of hollows and nests for nesting bird species or bat surveys using Anabat electronic detectors. This stage to be conducted with consideration of seasonal and temporal factors.

Habitat tree utilised by non- threatened fauna as a roosting and/or nesting resource.

Threatened flora or fauna species identified during pre-clearance surveys

THREATENED SPECIES MANAGEMENT PROTOCOL (TSMP)

Threatened Species Management Strategy Phase of the TSMP is to be initiated.

Threatened flora or fauna species identified during pre-clearance surveys

YES

NO

FAUNA MANAGEMENT STRATEGIES

Identification of management strategies to minimise the impact of clearing activities on resident fauna in the short-term and minimise the loss of habitat in the long-term (initiatives to be incorporated into the rehabilitation and enhancement programmes).

Short-term management strategies may include:

- observations of hollows;
- capture and release of fauna;
- bat roost relocation;
- timing of vegetation clearance;
- alternative felling methods;
- modification of the disturbance area; and/or
- a combination of management measures.

Long-term management strategies may include:

- the placement of nesting boxes in suitable habitat for birds and arboreal mammals;
- the placement of roosting boxes in suitable habitat for bats; and
- inclusion of hollow-developing tree species in the rehabilitation programme.

VEGETATION CLEARANCE

Vegetation clearance activities undertaken with consideration of seasonal factors (wherever practicable, vegetation clearance to be undertaken during late summer/early autumn).

Inspection of trees felled for the presence of fauna. Injured fauna to be collected and temporarily cared for in accordance with the plans for the rescue and rehabilitation of wildlife, detailed in the FFMP. Uninjured fauna to be released into nearby suitable habitat at an appropriate time of day.

Where practicable, habitat features (eg. hollows) to be salvaged for utilisation in the rehabilitation or habitat enhancement programmes.

Maximise the harvesting of valuable timber resources and to effectively recycle or dispose of other vegetative parts.

Land Management Plan

FIGURE 4

Vegetation Clearance Protocol

Evolution MINING Cowal

The FFMP provides further discussion of the VCP and the TSMP and their implementation.

5.2 BELAH AND WILGA MANAGEMENT IN THE ML

In accordance with Consent Condition 3.10(C) and the FFMP, topsoil stockpiles within the ML will not be located within any area of remnant Wilga Woodland (Figure 3). Avoidance of Wilga areas within the ML will reduce the area of some soil stockpiles in comparison to the stockpiles shown on Figure 5-2 of the Project Environmental Impact Statement (EIS) (North Limited, 1998).

In accordance with Consent Condition 3.10(D) and the FFMP, no disturbance of Belah Woodland will be undertaken within the ML (Figure 3).

5.3 COMPENSATORY WETLAND MANAGEMENT PLAN INITIATIVES

The Compensatory Wetland Management Plan (CWMP) prepared for the Project incudes measures to conserve and enhance wildlife values within ML 1535 and around Lake Cowal. These measures include the Compensatory Wetland, the enhancement of the remaining areas of existing wetland within ML 1535 and the New Lake Foreshore.

As discussed in the CWMP the Compensatory Wetland covers an area of approximately 140 ha of existing wetland within ML 1535, including the fringing River Red Gum remnant vegetation community (Figure 5). The remaining areas of wetland within ML 1535 (excluding the New Lake Foreshore) comprise approximately 620 ha of wetland (Figure 5).

A number of management measures will be implemented within the Compensatory Wetland and remaining areas of wetland within ML 1535 including:

- the prevention of livestock from entering the enhancement areas to encourage the natural regeneration of native plants;
- measures to minimise the spread of weeds and competition with native flora;
- measures to minimise the occurrence of feral pests; and
- limiting vehicular access.

The planting of native wetland species may also be conducted to facilitate the regeneration of native vegetation. Further discussion of these management measures is provided in the CWMP.

5.4 REMNANT VEGETATION ENHANCEMENT PROGRAMME

The Remnant Vegetation Enhancement Programme (also discussed in the FFMP) provides an opportunity to conserve the regional biodiversity and to enhance the habitat available to flora and fauna. During Project construction and operation, areas of remnant vegetation and areas of Lake Cowal wetland located within Barrick-owned land will be managed to maintain and enhance their inherent conservation values. The Remnant Vegetation Enhancement Programme is consistent with the LWMPLC, MLRVMP, JLWMP and Lachlan Catchment Blueprint to conserve and enhance remnant vegetation in the region.

Four areas containing remnant vegetation and/or Lake Cowal wetland have been selected for enhancement and are shown on Figure 5. The management measures to be implemented within each enhancement area are described in Section 5.4.1. Monitoring will be conducted to assess the effectiveness of the vegetation management measures as described in Section 5.4.2.

LEGEND

- Barrick-owned Land (Current as at August 2003)
- Mining Lease Boundary
- Disturbance Area
- Enhancement Area

Note: Area 1 excludes the Quarry utilised by the Bland Shire Council

Compensatory Wetland Management Plan Initiatives

- Compensatory Wetland
- New Lake Foreshore
- Enhancement of Remaining Wetland Areas Within ML 1535

Vegetation Communities

1. Remnant Woodland (*E. dwyeri - Acacia doratoxylon - Callitris* sp.)
2. Eucalypt Woodland (*E. dwyeri - E. populnea - E. microcarpa - Callitris glaucophylla - Casuarina cristata*)
3. Predominantly cleared agricultural land with scattered Bimble Box Woodland (*E. populnea*)
4. Fringing River Red Gum (*Eucalyptus camaldulensis*)
5. Lignum (*Muehlenbeckia florulenta*)
6. Lake Bed - Scattered areas of *Medicago polymorpha* and Canegrass (*Eragrostis australasica*)
7. Mixed Woodland (*A. pendula - Casuarina cristata*)
8. Wilga Woodland (*Geijera parviflora - Casuarina cristata*)
9. Belah Woodland (*Casuarina cristata*)

0 1000 2000
Metres

Source: After North Limited (1998a)
Bower (2003)
Aerial Photo AAM Surveys (August 2002)

Land Management Plan

FIGURE 5

Remnant Vegetation Enhancement Programme - Enhancement Areas 1 to 4

Evolution MINING Cowal

HAL-02-07 RMP Land_001A

The enhancement areas are also discussed in the FFMP.

5.4.1 Management Measures

The management measures to be implemented within enhancement areas 1 to 4 are described below and in the FFMP. Area 1 excludes the quarry utilised by the BSC.

Stock Access Management and Natural Regeneration of Native Plants

The areas selected for enhancement at Lake Cowal have historically been cropped and/or grazed. Livestock can have direct and in-direct impacts on remnant vegetation and wetlands. The concept of preventing livestock from entering areas of remnant vegetation to encourage natural regeneration is a widely accepted practice and, in accordance with Consent Condition 4.3, is recommended by the LWMPLC, MLRVMP, JLWMP and the NSW Wetlands Management Policy. The de-stocking or reducing stock access to remnant vegetation is also encouraged by the NPWS (NPWS, pers. comm., 21 May 2003).

In order to encourage the natural regeneration of native plant species, livestock will be controlled in enhancement areas 1 to 4 through fencing control and management. The management of livestock will vary between enhancement areas, as outlined in Table 1.

Table 1
Livestock Management within Enhancement Areas

Enhancement Area	Livestock Management
1	Stock will be prevented from entering enhancement area 1 by Year 1 of mine operations.
2	Natural regeneration of native wetland vegetation within enhancement area 2 is only likely to occur after a flood event. Weeds can be more difficult to control once livestock are excluded (DLWC, 2001), so light grazing of the wetland areas by stock may be undertaken to assist with weed control and pasture management prior to the first flood event occurring, following the commencement of construction. Light grazing of enhancement area 2 may continue following the flood event to assist with weed control and pasture management. Livestock will also be prevented from entering the portions of enhancement area 2 that are revegetated with native plant species, as described below.
3 and 4	Stock will generally be prevented from entering enhancement areas 3 and 4 by Year 1 of mine operations. However, light grazing of portions of these enhancement areas by stock may be undertaken to assist with weed control and pasture management. Eucalypt regeneration in the riparian zone is likely to be best over relatively bare soil. The complete removal of livestock may result in a heavy cover of weeds, which could prevent or reduce eucalypt seedling growth. Livestock will also be prevented from entering portions of the enhancement areas that are revegetated with native plant species, as described below.

Revegetation

It is anticipated that preventing livestock from entering the enhancement areas will naturally increase flora species diversity and abundance.

Notwithstanding, selective planting of native vegetation may be conducted in enhancement areas 1 to 4 to increase the quantity of remnant vegetation and to link areas of existing remnant vegetation, where practicable. Livestock will be prevented from entering any portions of the enhancement areas which have been revegetated with native plant species. Native species that are potentially suitable for revegetation in the enhancement areas are provided in Table 2.

Table 2
Potential Revegetation Species for Enhancement Areas

Scientific Name	Common Name	Scientific Name	Common Name
Eucalyptus populnea ssp. *bimbil*	Bimble Box	*Rumex brownii*	Slender Dock
Eucalyptus microcarpa	Grey Box	*Rumex tenax*	Shiny Dock
Eucalyptus melliodora	Yellow Box	*Chloris truncata*	Windmill Grass
Eucalyptus sideroxylon	Mugga Ironbark	*Bothriochloa macra*	Redleg Grass
Eucalyptus camaldulensis	River Red Gum	*Danthonia* sp.	Wallaby Grasses
Casuarina cristata	Belah	*Enteropogon acicularis*	Curly Windmill Grass
Callitris endlicheri	Black Cypress Pine	*Eragrostis parviflora*	Weeping Lovegrass
Callitris glaucophylla	White Cypress Pine	*Austrostipa scabra*	Speargrass
Acacia pendula	Myall	*Austrostipa densifolia*	Foxtail Speargrass
Acacia doratoxylon	Lancewood	*Sida intricata*	-
Acacia stenophylla	River Cooba	*Marsilea drummondii*	Common Nardoo
Alectryon oleifolius	Rosewood	*Eragrostis australasica*	Canegrass
Geijera parviflora	Wilga	*Muehlenbeckia florulenta*	Lignum

Source: After Anne Clements and Associates (1995), Charles Sturt University (1997)

The location in which particular species will be planted will be determined in consideration of the existing occurrence of each vegetation community, as well as slope, elevation and soil. Native vegetation will be established in these areas through planting and/or direct seeding. Revegetation activities will be implemented by a suitably qualified person(s) and co-ordinated by the Environmental Manager.

Weed Control

Weeds are one of the major causes of environmental degradation in the Mid Lachlan region (DLWC, 2001). Weed control within the enhancement areas will be conducted in accordance with the applicable procedures detailed for Barrick-owned land in Section 6.

Pest Control

Management measures for the control of pests including rabbits, feral pigs, feral cats, wild dogs and foxes will be implemented in accordance with the procedures outlined in Section 7.

Limiting Vehicular Access

Damage by vehicles can result in the compaction of soil (which reduces infiltration of water into the soil and restricts root growth, and consequently natural regeneration), the spread of weeds and disturbance to vegetation. In order to reduce the degree of disturbance to the enhancement areas, vehicular access will be limited throughout mine construction and operation to authorised personnel only. Authorisation for vehicular entry into the enhancement areas will be determined by the mine site managers.

Surface Ripping

Surface ripping may be conducted to improve water infiltration and root establishment within the enhancement areas if soil compaction is identified as an inhibitor to regeneration. The progress of regeneration will be assessed as a component of the Remnant Vegetation Monitoring Programme (Section 5.4.2).

5.4.2 Remnant Vegetation Monitoring Programme

Remnant vegetation monitoring will be conducted within the enhancement areas to:

- assess the progress of natural regeneration;
- determine whether vegetation planted within the enhancement areas is establishing; and
- determine the need for any maintenance and/or contingency measures (such as the requirement for revegetation, supplementary plantings and weed control).

A number of survey plots (50 x 20 m) will be established within each enhancement area to obtain quantitative data on species diversity and abundance. Specifically:

- Each flora survey plot will be systematically searched to compile a list of vascular plant species observed within the plot.
- A count will be made of all individuals of each tree and shrub species occurring within the plot.
- The ground layer will be sampled using four permanent 5 x 1 m quadrats, with two quadrats placed at each end of the 50 x 20 m survey plot. Every ground layer species recorded within the 5 x 1 m quadrats will be rated for its percentage cover of the ground surface.

The survey plots will be monitored annually (when not inundated) after Year 2 of mine operations. Control plots may also be established at sites outside of the enhancement areas to provide a reference point against which the management measures can be assessed.

Further to the above, visual observations will be made on a regular basis of areas revegetated with native plants to assess the establishment success and the health of planted vegetation. This information will be utilised to determine the need for any supplementary plantings that may be required.

6 WEED MANAGEMENT

Development Consent Condition 3.10(A)(i)(b) requires "*control of vermin and noxious weeds as required by the Rural Lands Protection Authority, the Prickly Pear Authority and other relevant authorities;"*. Consultation with the State Council of the Rural Lands Protection Boards (State Council, pers. comm., 13 May 2003) which governs the Rural Lands Protection Board system in NSW has confirmed that the "Rural Lands Protection Authority" does not exist. It is considered that the intention of the consent condition was to generically refer to the CRLPB which has jurisdiction over the Project area.

6.1 OVERVIEW

Weed species are effective competitors for resources and have the potential to exclude native species from the landscape, resulting in changes in the composition and structure of plant communities. Weeds are one of the major causes of environmental degradation in the Mid Lachlan Region (DLWC, 2001). In addition, weeds may degrade the ecological value of fauna habitat. Barrick's weed management aims are therefore to minimise the possibility of new weed incursion and control the spread of any existing weeds on Barrick-owned land (Figures 2 and 3).

Sivertsen and Metcalfe (1995 in North Limited, 1998) mapped the remnant native vegetation of the Forbes and Cargelligo Southern Wheat-belt, an area encompassing some 2,400,650 ha. A total of 117 exotic species were recorded. The weed species identified were primarily grasses, composites, peas and saltbushes.

Flora surveys conducted in the Project area and surrounds have recorded up to 86 weed species, five of which are listed as noxious on the Bland Shire Noxious Weeds list. However only one of these noxious species, African Boxthorn (*Lycium ferocissimum*), was recorded from within the ML area and is usually controlled by grubbing or pushing with a bulldozer or grader (NSW Agriculture, pers. comm., 8 April 2003). Other noxious and general weeds commonly found in the local area include:

- Bathurst Burr – widespread, but controlled by spraying;
- Johnson Grass – confined to drainages, controlled by bulldozing or other mechanical removal (NSW Agriculture, pers. comm., 8 April 2003); and
- Chinese Lantern – widespread in the lake area, controlled by a combination of spraying and competitive cropping.

In accordance with Consent Condition 3.10(A)(i)(b), consultation has been undertaken with the CRLPB, BSC, NSW Agriculture and DIPNR (formerly DLWC) to determine their requirements for the weed control (including noxious weeds) (BSC, pers. comm., 4 and 10 April 2003; NSW Agriculture pers. comm., 8 April 2003; CRLPB, pers. comm., 8 August 2003; DIPNR (formerly DLWC), pers. comm., 26 August 2003).

The results of the above consultation indicate that the BSC is the primary authority with responsibility for weed control in the Bland Shire in accordance with the requirements of NSW Agriculture, with the CRLPB managing weeds on lands under its control (eg. travelling stock reserves) in accordance with the requirements of BSC.

Consent Condition 3.10(A)(i)(b) also requires the applicant to conform with the requirements of the Prickly Pear Authority with regard to noxious weed control. NSW Agriculture have advised that this authority no longer exists and the control of Prickly Pear now falls under the *Noxious Weeds Act, 1993,* which is administered by them (NSW Agriculture, pers. comm., 13 May 2003).

The following sub-sections outline Barrick's weed management strategy and procedures that will be implemented in accordance with the requirements of BSC by the assigned Barrick personnel responsible for land management.

6.2 CONTROL OF NOXIOUS WEEDS

Consultation was conducted with BSC in the preparation of this Plan regarding control of noxious weeds on Barrick-owned land. The BSC recommends that control methods for noxious weed species identified on Barrick-owned land be subject to the *Noxious Weeds Act, 1993*, and be conducted in accordance with endorsed weed management plans.

The Minister of Agriculture under Section 7 and 8 of the *Noxious Weeds Act, 1993* lists declared noxious weed species for each shire in NSW. The NSW Agriculture declared noxious species list for the Bland Shire is provided in Appendix A. The BSC has further refined this list to include only those species that are known to occur in the Bland Shire (Table 3).

Table 3
Noxious Weeds Recorded in the Bland Shire

Common name	Scientific name	Category
African Boxthorn	*Lycium ferocissimum*	W2
Bathurst Noogoora Burrs	*Xanthium* spp.	W3
Buffalo Burr	*Solanum rostratum*	W3
Devil's Claw (purple-flower)	*Proboscidea louisianica*	W3
Galvanized Burr	*Sclerolaena birchii*	W3
Hemlock	*Conium maculatum*	W2
Johnson Grass	*Sorghum halepense*	W2
Prickly Pear	*Opuntia* spp.	W4f
Scotch Thistle	*Onopordum* spp.	W2
Silverleaf Nightshade	*Solanum elaeagnifolium*	W3
Spiny Burrgrass	*Cenchrus incertus*	W3
St John's Wort	*Hypericum perforatum*	W2
Wild Radish	*Raphanus raphanistrum*	W3

Source: NSW Agriculture and BSC

W1: The presence of the weed on land must be notified to the local control authority and the weed must be fully and continuously suppressed and destroyed.

W2: The weed must be fully and continuously suppressed and destroyed.

W3: The weed must be prevented from spreading and its numbers and distribution reduced.

W4f: The weed must not be sold, propagated or knowingly distributed. Any biological control or other control programme directed by the local control authority must be implemented.

Noxious weeds will undergo the recommended levels of control in accordance with their NSW Agriculture category within Barrick-owned land (Figure 2).

In addition, the BSC has committed to detailed weed management plans developed by the Lachlan Valley Noxious Weeds Advisory Group for the following species:

- African Boxthorn (*Lycium ferocissimum*);
- Johnson Grass (*Sorghum halepense*);
- Scotch/Illyrian Thistle (*Onopordum* spp.);
- Silverleaf Nightshade (*Solanum elaeagnifolium*);
- Spiny Burrgrass (*Cenchrus incertus*);
- St. Johns Wort (*Hypercium perforatum*); and
- Wild Radish (*Raphanus raphanistrum*).

In accordance with BSC advice, Barrick will control these species in accordance with the Lachlan Valley Noxious Weeds Advisory Group weed management plans. The weed management plans are provided in Appendix B.

6.3 WEED MANAGEMENT STRATEGY

The strategy for weed management on Barrick-owned land includes the following:

- identification of weeds by annual site inspections (Section 6.6);
- communication with other landholders/leaseholders and regulatory authorities to keep weed management practices in line with regional weed control activities (Section 10.1);

- mechanical removal of identified noxious weeds and/or the application of approved herbicides in authorised areas (herbicide use in wetland areas will be strictly controlled);
- implementing follow-up site inspections to determine the effectiveness of the weed control measures; and
- where practicable, prevention of the establishment of new weeds on Barrick-owned land by minimising seed transport of weed species to and from the Project during mine construction and operation through the use of a vehicle wash bay (primarily for use on agricultural and earthmoving equipment that are likely to carry weed seeds).

The implementation of weed management strategies will typically occur according to seasonal and climatic requirements.

6.4 WEED PREVENTION

The cheapest and most effective form of weed management is prevention (Bayley, 2000). In addition to the vehicle wash bay described above to minimise weed transport by agricultural vehicles and earthmoving equipment, the following preventative measures will be implemented on Barrick-owned land (*ibid.*):

- Movement of stock – where practicable stock brought to a property will be put in a confined area for a week to allow weed seeds in their digestive tracts to be expelled.
- Stock feed – stock feed is a common way in which weeds are spread. Where practicable, Barrick will buy feed which is locally grown to reduce introduction of new weeds and feed out in a confined area to restrict weeds that may emerge so they can be dealt with.
- Reduce on-farm weed sources – where practicable, Barrick will keep fencelines, livestock yards, laneways and areas around sheds free of weeds (ie. to minimise the spread of weeds via physical removal or spraying of weeds in these heavily trafficked areas).

6.5 WEED MANAGEMENT PROCEDURES

Physical removal and chemical application are the main weed control methodologies. In some cases, control can be effective by planting grasses or native plants that out-compete the weeds. The following procedures will be adopted where necessary:

- Any species of uncertain classification will be sampled and identified by BSC or local NSW Agriculture officers. Advice will be sought from BSC for the control of any new identified weeds on Barrick-owned land.
- Notification of BSC if a noxious weed is identified on Barrick-owned land with a W1 classification.
- Mechanical/hand removal of identified weeds and/or recommended chemical (herbicide) control.
- If herbicides are used, permission will be sought from the occupiers of the land.
- Weed control measures will generally be undertaken when conditions are favourable (ie. after rainfall and before flower set).

There is likely to be a range of noxious and other general weeds that could occur on Barrick-owned land. Available control methods depend on the species, climate, location and topography of the landscape. If Barrick is unsure of an appropriate or suitable control method for a specific weed problem, it will consult relevant Agfacts and Agnote publications (available from NSW Agriculture) and/or discuss the nature of the specific weed problem with local offices of BSC and NSW Agriculture.

6.5.1 Non-Chemical Weed Control Methods

Bayley (2000) describes a range of non-chemical weed control methods that may be applicable to the Project. These include:

- hand weeding;
- mulching and smothering;
- slashing and mowing;
- burning (requires suitable licenses as described in the Bushfire Management Plan [BMP]);
- cultivation;
- weed seed collection;
- green manuring;
- hay or silage making;
- competitive crops and pastures; and
- crop and pasture rotation.

These control methods will be considered and utilised where appropriate.

6.5.2 Herbicide Use

Typical herbicide application techniques that will be considered include (DLWC, 2001):

- spraying (spot application or over a broad area of infestation);
- cut and paint (applied to weed trees);
- stem injection (applied to weed trees);
- frilling (application to a series of notches around the trunk of a large weed plant); and
- stem-painting (useful for vines and smaller weed plants).

Empty herbicide containers will be managed in accordance with the Project Hazardous Waste and Chemical Management Plan (HWCMP).

As discussed in Section 9.8 of the FFMP, the use of herbicides within the Lake Cowal high water mark will be strictly controlled. Within these areas, physical removal methods will be employed, where practicable. Where physical control methods are not suitable, a herbicide registered for use in aquatic situations by the Australian Pesticides and Veterinary Medicines Authority (formerly the National Registration Authority) may be used. This registration will be indicated on the label of the herbicide (DLWC, 1998).

6.6 WEED MONITORING AND REPORTING

As mentioned in Section 9.8 of the FFMP, Barrick will implement a weed monitoring programme at the commencement of construction. Barrick-owned land will be surveyed for weeds annually. Follow up inspections will also be made of specific areas following the implementation of weed control measures (to assess the success of the weed controls). Follow up inspections may be required after control implementation, depending on the weed species and nature of the problem. Weed monitoring will be conducted by suitably qualified personnel from a slow moving vehicle.

Weed monitoring will include identification of:

- extent of weed occurrence (noxious or otherwise);
- details of weed distribution (ie. locations of infested areas) and possible reasons for any infestations (eg. a change in landuse practices);
- optimum herbicide application or physical removal timing (for implementation of controls);
- any resistance to a herbicide type or herbicide application technique (on the basis of success of previous controls); and
- identification of any new weed species that may be carried into the Project area on vehicles accessing the site and become established near the vehicle wash-down area.

General weed management activities will be reported in the AEMR (Section 12). As a component of the AEMR reporting, the weed control programme will be assessed for performance annually, and amended where necessary (eg. to implement new control measures as advised by BSC or NSW Agriculture). Proposed significant amendments to weed monitoring and management will be discussed with BSC.

BSC will also be consulted for the suitable control of any new noxious weed species if encountered in the Project area to meet the requirements of the *Noxious Weeds Act, 1993*.

7 PEST (FERAL ANIMAL AND VERMIN) CONTROL

Feral animals can be defined as an introduced species which has established self-perpetuating wild populations in Australia (DLWC, 2001), while vermin are generally considered to be mammals or birds which are harmful to crops, farm animals or carry disease. In accordance with Consent Condition 3.10(A)(i)(b) consultation has been undertaken with the CRLPB, BSC and NSW Agriculture to determine their requirements for the control of vermin. As NSW Agriculture classifies vermin and feral animals as “pests”, consultation with these same groups has occurred in respect of feral animals.

NSW Agriculture has indicated that the term “pest” incorporates reference to all “vermin” and “feral animals” (NSW Agriculture, pers. comm., 9 April 2003). As such, the term “pest” is utilised hereafter in this Plan when referring to vermin and/or feral animals.

NSW Agriculture have advised the terms “vermin and feral animal control” should more simply be referred to as “pest control” (NSW Agriculture, pers. comm., 9 April 2003). The term “pest control” therefore incorporates the control of both feral animals and vermin and as the preferred terminology of NSW Agriculture has been adopted hereafter in this Plan.

The results of the above consultation indicate that the CRLPB is the primary authority with responsibility for the implementation of pest control in the Bland Shire in accordance with the requirements of the *Rural Lands Protection Act, 1998*.

Pests can be divided into categories of declared or perceived pests. The following sub-section describes these two categories.

7.1 DEFINING DECLARED AND PERCEIVED PESTS

Declared pests are those with a Pest Control Order declared by the Minister under the *Rural Lands Protection Act, 1998*. Vertebrate animals with Pest Control Orders under the Act are rabbits, feral pigs and wild dogs. Invertebrate animals with pest control orders under the Act are two species of locust. These animals are subject to mandatory control by the landholder.

Perceived pests are those animals that are perceived to be a pest in a particular area or at a particular time (eg. mice in plague proportions) (NSW Agriculture, pers. comm., 9 April 2003). The Minister can declare a Pest Control Order on a perceived pest within a particular area or at a particular time under the *Rural Lands Protection Act, 1998*. Once declared, these animals would undergo the same mandatory pest control procedures as declared pests. Examples of animals that could be perceived pests that have been recorded on the Project site and surrounds are foxes, hares, feral cats, non-native rats and mice (North Limited, 1998 – Appendix C).

Foxes are perceived to be a general pest in the Project area (NSW Agriculture, pers. comm., 9 April 2003). Foxes are not on a Pest Control Order and control of foxes is not mandatory, but the use of 1080 poison to control them can be permitted under a Pesticide Control Order issued by the EPA.

7.2 PEST CONTROL ACTIVITIES

Control of pest animals is an important component of land management. Barrick will place emphasis on the prevention of incursion of pest animal species as well as post incursion treatment in accordance with the requirements of CRLPB. In relation to pest control, BSC defer responsibility to the CRLPB (BSC, pers. comm., 4 April 2003) who utilise the NSW Agriculture publication *Draft Vertebrate Pest Control Manual* (CRLPB, pers. comm., 8 April 2003), attached as Appendix C. NSW Agriculture also recommend utilising the aforementioned *Draft Vertebrate Pest Control Manual* for pest control (NSW Agriculture, pers. comm., 9 April 2003).

Property fences do not necessarily restrict pests. Rather, areas of pest animal abundance tend to be defined by natural features (eg. topography and watercourses) or by food availability (NSW Agriculture, 2003b). Most pests are highly mobile and can readily replace those that are killed in control programs (DLWC, 2001). Unless actions are well planned and co-ordinated across a broad area, individual control programmes are unlikely to have any lasting effect (*ibid.*).

Barrick will undertake pest control operations in conjunction with adjacent landholders for more effective pest control in accordance with CRLPB and NSW Agriculture recommendations. This will be achieved through regular consultation with the CRLPB and NSW Agriculture (prior to and following annual pest inspections) and during consultation with local landholders and landholder groups through the CEMCC process (Section 10.1).

NSW Agriculture has developed a Draft Vertebrate Pest Control Manual (NSW Agriculture, 2003b – Appendix C). Barrick personnel responsible for land management will use this manual as a guide (particularly Sections 3.3 to 3.5, 3.10 to 3.14 and the sections on individual vertebrate pests) for pest control activities on Barrick-owned land in consultation with the CRLPB and NSW Agriculture. Pest control activities will incorporate the following:

- regular property inspections to assess the status of pest populations within Barrick-owned land;
- mandatory pest control for declared pests (ie. rabbits, pigs and wild dogs) in accordance with Pest Control Orders under the *Rural Lands Protection Act, 1998*; and
- inspections to assess the effectiveness of control measures implemented and review these if necessary.

The Draft Vertebrate Pest Control Manual (Appendix C) provides an overview of the use of physical control methods, poisons, fumigants as well as describing the biology and suitable control procedures for rabbits, feral pigs, wild dogs, mice and foxes. Barrick will control pest species in general accordance with this manual, and update control strategies and methods as required by the CRLPB and NSW Agriculture.

Vertebrate pest control methods that can be employed are summarised in Table 4.

Table 4
Summary of Vertebrate Pest Control Measures

Pest	Typical Controls
Rabbit	• poisoning/baiting (with 1080/pindone) • destruction of warrens (ripping and/or blasting) • fumigation of warrens • flooding of warrens • removal of harbouring vegetation (eg. blackberry) • shooting, trapping and other direct physical control methods
Feral Pig	• poisoning (with 1080) • shooting • trapping
Wild Dog	• poisoning (with 1080) • trapping • shooting • fencing
Fox	• poisoning (with 1080) • shooting
Mouse	• barriers • traps • encouraging raptors • baiting/poisoning
Feral Goat	• mustering • trapping • shooting

After: NSW Agriculture, 2003b

Suitable pest controls will be determined in consultation with surrounding landholders, CRLPB and NSW Agriculture prior to the commencement of an integrated pest control programme on Barrick-owned land. This will assist in integrating the controls implemented on Barrick-owned land with other pest control in the local area/region.

In order to minimise the risk of the use of poisons and baits to native fauna and the Lake Cowal wetland, non-chemical control methods will be examined as a first priority on Barrick-owned land and poisoning of vertebrate pests will not be employed within the vegetation enhancement areas (Section 5.4.1) or the high water mark of Lake Cowal unless Barrick is specifically directed to do so by the CRLPB in accordance with relevant permits and the requirements of the *Rural Lands Protection Act, 1998, Pesticides Act, 1999* and the Agvet Code.

In addition, NPWS have indicated that the use of 1080 for the control of feral pigs requires high doses of 1080 in baits such as grain and is considered a significant risk to non-target species (NPWS, pers. comm., 27 August, 2003). NPWS suggests, other methods such as trapping and shooting of feral pigs are preferred methods. Barrick will utilise these preferred methods for pig control where practicable.

Notwithstanding, the use of 1080 for the control of foxes (with appropriate controls to minimise risks to non-target fauna) is considered to be the most effective and target specific method of fox control currently available (NPWS, 2001). The *Threat Abatement Plan for Predation by the Red Fox (*NPWS, 2001*)* will be used to guide fox control within the ML in accordance with Section 4.4.2 of the EIS (North Limited, 1998).

The use of any pesticides on Barrick lands will be conducted in accordance with relevant permits and the requirements of the *Pesticides Act, 1999* and the Agvet Code. A summary of the requirements of these Acts is provided in Section 2.

7.3 FERAL CAT THREAT ABATEMENT PLAN

The NSW Scientific Committee has declared feral cats to be a 'Key Threatening Process' in NSW. In 2000, the Committee determined that predation by the feral cat adversely affects more than two threatened species and could cause species that are not threatened to become threatened, and is therefore eligible for listing as a 'Key Threatening Process' under the *Threatened Species Conservation Act, 1995*.

As described in Section 9.9 of the FFMP, the NSW National Parks and Wildlife Service (NPWS) is currently drafting a Threat Abatement Plan to reduce the impact of feral cats on threatened species in NSW. When complete, the plan will:

- outline actions to manage the threat of feral cats on threatened species;
- explain how the success of these actions will be measured;
- identify the authorities that will be responsible for carrying out these actions; and
- if possible, give a cost estimate and timetable for implementation of the plan.

As a component of the drafting process, the NPWS is gathering further information on the available feral cat management methods. It is required that management methods be humane, effective and efficient. Traditional methods such as baiting, trapping and shooting are not considered effective for large-scale management programs.

On completion, the recommendations of the Feral Cat Abatement Programme for the humane control of feral cats will be implemented within the Project area in accordance with Section 4.4.2 of the EIS (North Limited, 1998).

8 OTHER LAND MANAGEMENT ISSUES

8.1 BUSHFIRE MANAGEMENT

Barrick have developed a separate BMP for the Project. The BMP describes fuel management strategies, planning and implementation procedures for hazard reduction on Barrick-owned land and also aims to identify appropriate strategies for reducing fire hazards and related risks and impacts to life, property and the environment to assist in reducing the potential spread and intensity of any bushfire within Barrick-owned lands.

As outlined in the BMP, appropriate strategies to be adopted for fuel management include:

- fuel management by means other than burning; including such methods as grazing, slashing, pruning, mulching or other operations (such as ploughing, herbicide application and rolling);
- fuel management via burning where conventional fuel management strategies are inappropriate, impracticable or not successful (undertaken in consultation with relevant authorities); and
- maintaining designated firebreaks around the Project borefield stations, the ML boundary and, internally, around mine infrastructure.

8.2 SOIL AND EROSION MANAGEMENT

Loss of productivity could occur within Barrick-owned land due to erosion and/or soil degradation. Soil health is essential for agricultural and ecological sustainability, and bare ground is prone to erosion and weed invasion (Glasson and Duff, 2001). Barrick will aim to prevent land degradation (ie. erosion, salinity, and loss of soil structure and nutrients) and rehabilitate previously degraded land or land affected by their activities where practicable. This aim is in accordance with the principles of the MLRVMP, JLWMP and LWMPLC to reduce soil erosion and damage to soil characteristics.

Soil, erosion and sediment control in the Project area are discussed in detail in the Project Soil Stripping Management Plan (SSMP) and Erosion and Sediment Control Management Plan (ESCMP), which contain a number of erosion control procedures that assist in mitigating potentially adverse impacts on soil reserves.

8.3 USE OF FERTILISER AND CHEMICALS

The application of chemical pesticides or herbicide or chemicals used for stock treatment in accordance with Sections 6 and 7 of this plan will be recorded by Barrick. The records kept will include details of the areas (ie. paddocks) and rates at which the chemical was applied in accordance with the requirements of the *Pesticides Act, 1999*.

Where practicable, the use of herbicides, pesticides and fertilisers on Barrick-owned land in close proximity to Lake Cowal, or in areas that could result in direct runoff from agricultural areas into the lake will be minimised.

9 MINE REHABILITATION AND LONG-TERM LANDUSE

9.1 MINE REHABILITATION

Mine rehabilitation works will be undertaken progressively as construction activities and mining proceed, in accordance with Consent Condition 3.6 and Section 5 of the EIS (North Limited, 1998). Rehabilitation will be undertaken promptly in accordance with a progressive rehabilitation programme.

The rehabilitation programme general principles include (North Limited, 1998):

(i) The rehabilitation of Project landforms is to be progressive and conducted in accordance with approved, verified plans which are to be updated annually.

(ii) The stability of newly prepared (ie. topsoiled) landforms prior to the establishment of long-term vegetation is to be protected via the construction of moisture-retaining graded drains, water-holding structures (eg. surface depressions) and, where appropriate, the use of authorised hybrid cover crops to provide initial erosion protection.

(iii) Rehabilitation of the outer embankments of the tailings storages to be grassed during processing operational years, reducing habitat opportunities for avifauna.

(iv) Endemic groundcover, understorey, and tree seed and seedlings would be cultivated and utilised.

(v) The annual rehabilitation programme and budget is to be prepared by a site team incorporating the Project's senior management.

Rehabilitation works will be detailed in the MOP in accordance with the requirements of the DMR (DMR, 2002).
The MOP describes all mining and mining related activities, rehabilitation plans and land use outcomes over the MOP period (maximum 7 years). The MOP will be in a format endorsed by the DMR and will contain plans and text which identify and define the area(s) proposed to be disturbed, mining and rehabilitation method(s) to be used and progressive rehabilitation schedules.

For each area to be rehabilitated, the MOP will describe, where relevant (DMR, 2002):

- physical and chemical characteristics of mining and processing waste of emplaced material relevant to rehabilitation;
- method of land shaping;
- characteristics of all cover material including sealing/drainage layers, subsoil/topsoil;
- thicknesses of cover layers and methods of laying and compaction;
- drainage and erosion control consistent with material characteristics or erosion risk;
- final landform profile and slopes;
- soil treatment;
- vegetation species and methods of their establishment;
- the extent to which agreed rehabilitation outcomes and land use have been met; and
- maintenance activities/requirements.

DMR requirements relating to the MOP and rehabilitation are included in the ML 1535 Condition of Authority 25 (4)(f) (Section 2.1).

9.2 LONG-TERM LANDUSE

Upon the cessation of mining operations, tenure of ML 1535 will be maintained by Barrick until such time as lease relinquishment criteria (required by DMR and DIPNR) are satisfied. It is anticipated that lease relinquishment criteria will include (North Limited, 1998):

- landform stability;
- maintenance of downstream water quality;
- establishment of self-sustaining revegetation;

- satisfaction of all lease conditions; and
- removal of hard-stand areas and infrastructure.

Barrick will develop a strategy for the long-term (ie. post mine closure) landuse of its landholdings, including the Project area. The strategy will include the planning of appropriate landuses in the Project area and on Barrick-owned land outside the ML (ie. conservation, agriculture or recreation), long-term management of the area (ie. monitoring and maintenance), environmental impacts of any planned landuses and maintenance of necessary drainage characteristics and other features provided on the site.

The strategy for long-term landuse of the Project area and Barrick-owned land will be submitted by Year 7 of mining operations or five years before mine closure, whichever is the earlier. The strategy will be developed in consultation with the DIPNR, EPA, NPWS, BSC, the CEMCC, and to the satisfaction of the Director-General.

10 CONSULTATION AND COMPLAINTS RECEIPT

10.1 COMMUNITY ENVIRONMENTAL MONITORING AND CONSULTATIVE COMMITTEE

A CEMCC will be set up for the Project in accordance with Consent Condition 8.7. The condition is reproduced below:

> ***8.7 Community Consultative Committee***
>
> *Community Environmental Monitoring and Consultative Committee (CEMCC)*
>
> *The Applicant shall:*
>
> *(i) establish a Community Environmental Monitoring and Consultative Committee and ensure that the first meeting is held before the commencement of construction works. Selection of representatives shall be agreed by the Director-General and the appointment of an independent Chairperson shall be to the satisfaction of the Director-General in consultation with the Applicant and BSC. The Committee shall comprise two (2) representatives of the Applicant (including the Environmental Officer), one (1) representative of BSC, one (1) representative of the Lake Cowal Environmental Trust (but not a Trust representative of the Applicant), four community representatives (including one member of the Lake Cowal Landholders Association), to monitor compliance with conditions of this consent and other matters relevant to the operation of the mine during the term of the consent.*
>
> *Representatives from relevant government agencies (including DUAP) may be invited to attend meetings as required by the Chairperson. The Committee may make comments and recommendations about the implementation of the development and environmental management plans. The Applicant shall ensure that the Committee has access to the necessary plans for such purposes. The Applicant shall consider the recommendations and comments of the Committee and provide a response to the Committee and Director-General.*
>
> *(ii) The Applicant shall, at its own expense:*
>
> *a) nominate two (2) representatives to attend all meetings of the Committee;*
>
> *b) provide to the Committee regular information on the progress of work and monitoring results;*
>
> *c) promptly provide to the Committee such other information as the Chair of the Committee may reasonably request concerning the environmental performance of the development;*
>
> *d) provide access for site inspections by the Committee;*
>
> *e) provide meeting facilities for the Committee, and take minutes of Committee meetings. These minutes shall be available for public inspection at BSC within 14 days of the meeting.*

(iii) The Applicant shall establish a trust fund to be managed by the Chair of the Committee to facilitate the functioning of the Committee, and pay $2000 per annum to the fund for the duration of gold processing operations. The annual payment shall be indexed according to the Consumer Price Index (CPI) at the time of payment. The first payment shall be made by the date of the first Committee meeting. The Applicant shall also contribute to the Trust Fund reasonable funds for payment of the independent Chairperson, to the satisfaction of the Director-General.

(ix) By year 5 of mining operations the Applicant shall, in consultation with CEMCC, identify and discuss post mining issues, particularly in relation to reduced employment and consequent impacts on West Wyalong, and develop a plan for the phase out of the mine workforce. The plan will be reviewed during the year of mining operations following the scale down of the year 8 mining operation workforce. The impacts of the year 8 scale down shall be monitored by the Applicant and results used in planning for full mine closure.

(x) The Applicant shall, in consultation with the CEMCC, develop appropriate strategies to support activities which promote special interest tourism related to the co-existence of mining and the Lake Cowal environment.

The CEMCC will comprise representatives of BSC, Lake Cowal Foundation Ltd (formerly the Lake Cowal Environmental Trust), two Barrick representatives and four community representatives including one from the Lake Cowal Landholders Association.

The CEMCC will provide opportunities for members of the community to attend CEMCC meetings to discuss specific issues relevant to them, including land management issues such as weed and pest control. Landowners who register complaints will be invited to join in discussion of the issue at the next CEMCC meeting.

Items of discussion at these meetings may include land management, mine progress, environmental monitoring and rehabilitation activities.

10.2 COMPLAINTS REGISTER

A process for the handling of complaints, resolution of disputes and land acquisition in the event of affectation is provided below in accordance with the requirements of Project consent conditions and to facilitate prompt and comprehensive responses to any community concerns.

A complaints register will be maintained by the Environmental Manager in accordance with Consent Condition 10.1(a).

The condition is reproduced below:

10.1 Community Consultation (including Aboriginal community)

(a) <u>Complaints</u>

The Environmental Officer (refer condition 3.1) shall be responsible:

(i) for receiving complaints with respect to construction works and mine operations on a dedicated and publicly advertised telephone line, 24 hours per day 7 days per week, entering complaints or comments in an up to date log book, and ensuring that a response is provided to the complainant within 24 hours; and

(ii) providing a report of complaints received every six months throughout the life of the project to the Director-General, BSC, EPA, DMR, and CEMCC, or as otherwise agreed by the Director-General. A summary of this report shall be included in the AEMR (condition 9.2(a)).

Information recorded in the complaints register with respect to each complaint will include:

- date of complaint;
- name, address and telephone number of complainant;
- nature of complaint; and
- response action taken to date.

An initial response will be provided to the complainant within 24 hours. Preliminary investigations into the complaint will commence within 48 hours of complaint receipt.

11 INDEPENDENT ENVIRONMENTAL AUDIT

An IEA will be conducted in accordance with Consent Condition 8.8 and may include land management related issues. The condition is reproduced below:

8.8 Third Party Monitoring/Auditing

(a) An Independent Environmental Audit shall be completed:

- *six monthly during construction;*
- *12 months after commencement of ore processing;*
- *then every three years thereafter until decommissioning of the mine and ore processing operations respectively, or as otherwise directed by the Director-General.*

The Applicant shall conduct an environmental audit of the mining and infrastructure areas of the development in accordance with ISO 14010 - Guidelines and General Principles for Environmental Auditing, and ISO 14011 - Procedures for Environmental Auditing (or the current versions), and in accordance with any specifications required by the Director-General. Copies of the report shall be submitted by the Applicant to the Director-General, BSC, EPA, DLWC, DMR, NPWS and CEMCC within two weeks of the report's completion for comment.

(i) The audit shall:

a. assess compliance with the requirements of this consent, licences and approvals;

b. in the event of any non-compliance, report on the effectiveness of the environmental management of the mine as it may relate to the area of non-compliance;

c. be carried out at the Applicant's expense; and

d. be conducted by a duly qualified independent person or team approved by the Director-General in consultation with BSC and CEMCC.

(ii) The Director-General may, after considering any submission made by the relevant government agencies, BSC and CEMCC on the report, notify the Applicant of any requirements with regard to any recommendations in the report. The Applicant shall comply with those reasonable requirements within such time as the Director-General may require.

(b) Independent Monitoring Panel

(i) The Applicant shall at its own cost establish an Independent Monitoring Panel prior to commencement of construction. The Applicant shall contribute $30,000 per annum for the functioning of the Panel, unless otherwise agreed by the Director-General. The annual payment shall be indexed according to the Consumer Price Index (CPI) at the time of payment. The first payment shall be paid by the date of commencement of construction and annually thereafter. Selection of the Panel representatives shall be agreed by the Director-General in consultation with relevant government agencies and the CEMCC. The Panel shall at least comprise two duly qualified independent environmental scientists and a representative of the Director-General.

(ii) The panel shall:

a. provide an overview of the independent audits required by condition 8.9 above;

b. regularly review all environmental monitoring procedures undertaken by the Applicant, and monitoring results; and

c. provide an Annual State of the Environment Report for Lake Cowal with particular reference to the on-going interaction between the mine and the Lake and any requirements of the Director-General. The first report shall be prepared one year after commencement of construction. The report shall be prepared annually thereafter unless otherwise directed by the Director-General. Copies of the report shall be provided to those parties which receive the AEMR (condition 9.2) and shall be made publicly available at Bland Shire Council within two weeks of the report's completion.

12 REPORTING

An AEMR will be prepared in accordance with the requirements of Consent Condition 9.2 and DMR requirements (Condition of Authority 26 – Section 2.1) and submitted to the Director-General. The condition is reproduced below:

9.2 Environmental Reporting

Annual Environmental Management Report (AEMR)

(i) The Applicant shall, throughout the life of the mine and for a period of at least five years after the completion of ore processing operations, prepare and submit an Annual Environmental Management Report (AEMR) to the Director-General. The AEMR shall review the performance of the mine against the environmental management plans (refer condition 3.2), Mining Operations Plan (refer condition 2.1), the conditions of this consent, and other licences and approvals relating to the mine. To enable ready comparison with EIS predictions, diagrams and tables, the report shall include, but not be limited to, the following matters:

a) an annual compliance audit of the performance of the project against conditions of this consent and statutory approvals;

b) a review of the effectiveness of the environmental management of the mine in terms of EPA, DLWC, DMR, NPWS, NSW Fisheries, and BSC requirements;

c) results of all environmental monitoring required under this consent or other approvals, which includes interpretation and discussion by a suitably qualified person;

d) from results of fauna monitoring, records of any fauna deaths due to mine operations;

e) a listing of any variations obtained to approvals applicable to the subject area during the previous year;

f) the outcome of the water budget for the year and the quantity of water used from water storages and Bland Creek palaeochannel borefield;

g) rehabilitation report;

h) environmental management targets and strategies for the next year.

(ii) In preparing the AEMR, the Applicant shall:

a) consult with the Director-General during preparation of each report for any additional requirements;

b) comply with any requirements of the Director-General or other relevant government agency; and

c) ensure that the first report is completed and submitted within twelve (12) months of this consent, or at a date determined by the Director-General in consultation with DMR.

(iii) The Applicant shall ensure that copies of each AEMR are submitted at the same time to the Director-General, EPA, DLWC, DMR, DSC, NPWS, NSW Fisheries, the BSC and CEMCC, and be available for public information at the BSC within 14 days of submission to these authorities.

The AEMR will describe the following land management related issues:

- the area of Barrick-owned land under licence agreements and a figure illustrating these areas;
- a description of weed and pest control activities and associated monitoring programmes;
- any alterations to weed or pest management requirements;
- remnant vegetation management monitoring results (Section 5.4.3);
- a summary of any complaints received in relation to land management; and
- any CEMCC decisions or recommendations relating to land management.

13 REFERENCES

Anne Clements and Associates (1995) *Terrestrial Flora Report: Lake Cowal District.* In NSR Environmental Consultants Pty Ltd (1995) *Lake Cowal Gold Project Environmental Impact Statement.* Appendix F.

Australian Water Technologies (1999) *Land and Water Management Plan for Lake Cowal and Associated Wetlands.* Report prepared for the Jemalong Land and Water Management Plan Steering Committee.

Bayley, D. (2000) *Efficient Weed Management – Protecting Your Investment in the Land.* Published by NSW Agriculture.

Bland Catchment Committee (2002) *Bland Creek Catchment Plan*. Report prepared by Growing Rural Communities for the Bland Catchment Committee.

Bower, C. (2003) *Mapping Vegetation Communities on Barrick-owned Land and the Cowal Gold Project*. Unpublished Report.

Charles Sturt University (1997) *Cowal Gold Project Area Botanical Survey*. Report prepared for North Limited.

Department of Land and Water Conservation (DLWC) (1998) *The Constructed Wetlands Manual* Vol 1-2. NSW Government.

Department of Land and Water Conservation (DLWC) (2001) *Mid Lachlan Regional Vegetation Management Plan and Strategy*.

Department of Mineral Resources (2002) *Guidelines to Mining, Rehabilitation and Environmental Management Plans.*

Environment Australia (2001) *National Objectives and Targets for Biodiversity Conservation 2001-2005*. Canberra.

Glasson, A. and Duff, S. (2001) *Jemalong Land and Water Management Plan Project Overview and Negotiated Outcomes*. Report prepared under the guidance of Jemalong Land and Water Management Plan Negotiation Team.

Lachlan Catchment Management Board (2003) *Lachlan Catchment Blueprint*. Department of Land and Water Conservation.

North Limited (1998) *Cowal Gold Project: Environmental Impact Statement*. Prepared by Resource Strategies Pty Ltd.

NSW Agriculture (2003a). *Tactical Grazing.* Compiled by Alan Bell, Technical Specialist (Grazing Systems).

NSW Agriculture (2003b) *Draft Vertebrate Pest Control Manual*. NSW Government. In prep.

NSW National Parks and Wildlife Service (NPWS) (2001). *Threat Abatement Plan for Predation by the Red Fox (Vulpes vulpes).* NSW National Parks and Wildlife Service, Hurstville.

Qld Department of Primary Industries (DPI) (1995). *Managing Native Pastures – a grazier's guide.* Compiled by Ian Partridge.

Sivertsen, D. and Metcalfe, T. (1995) Natural Vegetation of the Southern Wheatbelt (Forbes and Cargelligo 1:250,000 Map Sheets). *Cunninghamia* 4(1):1030-28.

Walters, C. Whalley, W. Huxtable, C. (2000) Grassed Up – Guidelines for Revegetating with Australian Native Grasses. NSW Agriculture, Dubbo.

APPENDIX A

DECLARED NOXIOUS WEEDS IN THE BLAND SHIRE

Declared Noxious Weeds in the Bland Shire

Common name	Scientific name	Category
African boxthorn	*Lycium ferocissimum*	W2
Alligator weed	*Alternanthera philoxeroides*	W1
Bathurst Noogoora Californian Cockle burrs	*Xanthium spp.*	W3
Black knapweed	*Centaurea nigra*	W1
Blackberry	*Rubus fruticosus (agg. spp.)*	W2
Broomrape	*Orobanche spp.*	W1
Buffalo burr	*Solanum rostratum*	W3
Cabomba	*Cabomba spp.*	W4g
Columbus grass	*Sorghum x almum*	W2
Devil's claw (purple-flower)	*Proboscidea louisianica*	W3
Devil's claw (yellow-flower)	*Ibicella lutea*	W3
Dodder	*Cuscuta campestris*	W2
Galvanized burr	*Sclerolaena birchii*	W3
Harrisia cactus	*Harrisia spp.*	W4f
Hawkweed	*Hieracium spp.*	W1
Hemlock	*Conium maculatum*	W2
Horsetail	*Equisetum spp.*	W1
Johnson grass	*Sorghum halepense*	W2
Karroo thorn	*Acacia karroo*	W1
Kochia	*Kochia scoparia*	W1
Lagarosiphon	*Lagarosiphon major*	W1
Mesquite	*Prosopis spp.*	W1
Mexican feather grass	*Nassella tenuissima syn Stipa tenuissima*	W1
Miconia	*Miconia spp.*	W1
Parthenium weed	*Parthenium hysterophorus*	W1
Prickly acacia	*Acacia nilotica*	W1
Prickly pears	*Opuntia spp.*	W4f
Rhus tree	*Toxicodendron succedaneum*	W2
Salvinia	*Salvinia molesta*	W1
Scotch Illyrian Stemless thistles	*Onopordum spp.*	W2
Senegal tea plant	*Gymnocoronis spilanthoides*	W1
Siam weed	*Chromolaena odorata*	W1
Silverleaf nightshade	*Solanum elaeagnifolium*	W3
Spiny burrgrass	*Cenchrus incertus*	W3
Spiny burrgrass	*Cenchrus longispinus*	W3
Spotted knapweed	*Centaurea maculosa*	W1
St John's wort	*Hypericum perforatum*	W2
Water hyacinth	*Eichhornia crassipes*	W1
Water lettuce	*Pistia stratiotes*	W1
Wild radish	*Raphanus raphanistrum*	W3
Willows	*Salix spp.*	W4g

Noxious Weed Categories

W1	The presence of the weed on land must be notified to the local control authority and the weed must be fully and continuously suppressed and destroyed.
W2	The weed must be fully and continuously suppressed and destroyed.
W3	The weed must be prevented from spreading and its numbers and distribution reduced.
W4a	The weed must not be sold, propagated or knowingly distributed and any part of the weed must be prevented from growing within 3 metres of the boundary of a property.
W4b	The weed must not be sold, propagated or knowingly distributed and any existing weed must be prevented from flowering and fruiting.
W4c	The weed must not be sold, propagated or knowingly distributed and the weed must be prevented from spreading to an adjoining property.
W4d	The weed must not be sold, propagated or knowingly distributed and the weed must be fully and continuously suppressed and destroyed if it is: 3 metres in height or less, or within half a kilometre of remnant urban bushland, as defined by SEPP 19, and is not deemed by council as having historical or heritage significance or is over 3 metres in height and not included in a Management Plan approved by the local control authority.
W4e	The weed must be fully and continuously suppressed and destroyed. All reasonable precautions must be taken to ensure produce, soil, livestock, equipment and vehicles are free of the weed before sale or movement from an infested area of the property.
W4f	The weed must not be sold, propagated or knowingly distributed. Any biological control or other control program directed by the local control authority must be implemented.
W4g	The weed must not be sold, propagated or knowingly distributed.

APPENDIX B

WEED MANAGEMENT PLANS (LACHLAN VALLEY NOXIOUS WEEDS ADVISORY GROUP)

AFRICAN BOXTHORN MANAGEMENT PLAN

COVER PAGE

1.1 PLAN TITLE

African Boxthorn Management Plan for the Central West Region.

1.2 PLAN PROPONENTS

The Lachlan Valley Noxious Weeds Advisory Group.

Group Secretary : Kevin Nelligan
Cowra Shire Council
PO Box 342
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Group Scribe: John Spencer
Lachlan Shire Council
PO Box 216
Condobolin NSW 2877
Ph. 02 68954444
Fax. 02 68953478
Email lachl@mpx.com.au

Group Chairman ... ...
Don Lawrence LVNPAC

Date ... .../... .../.1999

1.3 NAME OF PLANT

African Boxthorn (Lycium Ferocissimum)
Weed of national significance No

1.4 PLAN PERIOD

1 July 2000 to 30 June 2005 (5 years)

1.5 AREA OF OPERATION

Signatories to this plan include:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cowra Shire Council
Weddin Shire Council
Cootamundra Shire Council

1.6 AIM

To substantially reduce the extent of African Boxthorn infestations and prevent the spread to new areas within the region in order to increase primary production.

1.7 OBJECTIVES

1. No African Boxthorn older than two years on Council land.
2. No rare or isolated infestations older than two years on private property.
3. Heavy infestations are reduced by 25% by the end of the plan.
4. All infestations new and old located.
5. Landholders will be given the opportunity to learn about effective chemical control techniques, cropping practices and rotation options.

TABLE OF CONTENTS

STAKE HOLDERS

2.1 SIGNATORIES

Local control authorities include the following councils:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cowra Shire Council
Weddin Shire Council
Cootamundra

2.2 OTHER KEY STAKEHOLDERS

Other key stake holders include:-

Land owners
SRA
RTA
NSW Agriculture
State Forests
Landcare groups
Lachlan Catchment Management Committee
Department of Land and Water Conservation
National Parks and Wildlife
Rural Land Protection Boards

BACKGROUND AND GENERAL FACTS

3.1 REASON FOR THE PLAN

The capacity of African Boxthorn to replace more desirable plant species makes it a threat to agricultural and horticultural production. The plant has a significant capacity to colonise the refuge areas used by stock e.g. tree shelters. This along with the replacement of fodder plants makes this plant a very undesirable one in the agricultural production system.

3.2 DESCRIPTION OF THE PROBLEM

African Boxthorn is found across the whole region. Because plant distribution is widespread in the region it impacts on production in most council areas listed in this plan. In high rainfall areas it occurs in dense impenetrable thickets which removes the land it is growing on entirely from production. In the drier ares thickets are not as dense but the impact on production is just as great. Thus African Boxthorn is a problem for three main reasons:-

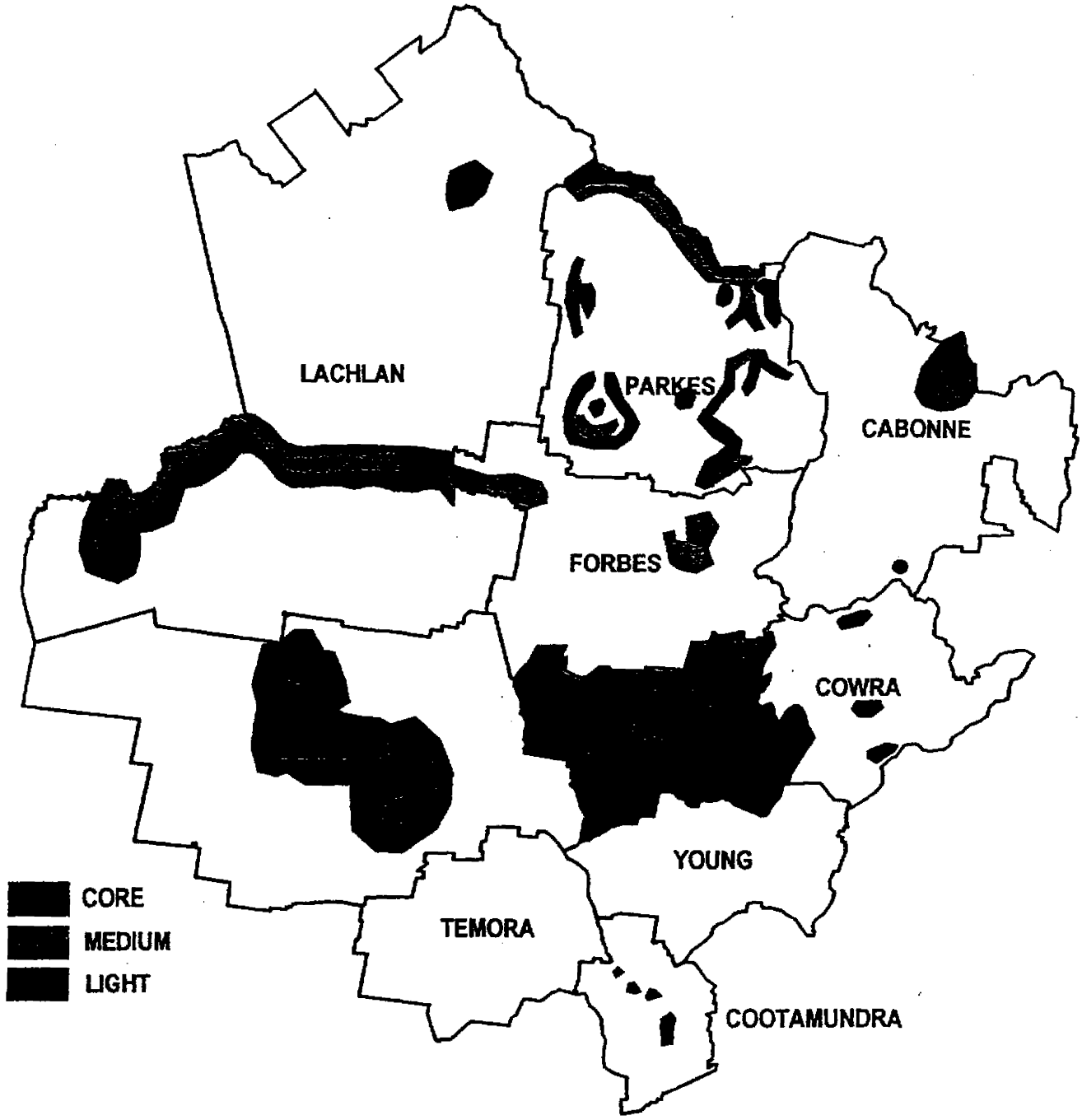
1. It causes loss of production to plant and livestock industries and the costs of control impact on the cost production.
2. Its presence on public land such as reserves, roads, railway lines and waterways can lead to considerable loss of species diversity.
3. The plant has no aesthetic or recreational value at all.
4. This plant is a host in the life cycle of fruit fly. Because the fruit sets in Autumn to Spring fruit fly will infect outside annual fruiting season.
5. Harbour for noxious animals (e.g. rabbits).

The plant is found on private land, on stock reserves and road sides.

3.3 DISTRIBUTION OF KNOWN INFESTATIONS

See map overleaf

DISTRIBUTION OF KNOWN INFESTATIONS - "BOXTHORN"



3.4 WEED BIOLOGY/ECOLOGY

The Affrican boxthorn seeds germinate at any time during the year. The boxthorn plant does not flower for the first 2 years. After which time the plant flowers and bears fruit during the summer months.

The boxthorn plant is a shrub that grows to about 5m high and approximately 3m across. The stem of the the plant is brown when it is a young plant and becomes grey as it matures. The plant is heavily branched with 15cm spines on the stem and main branches, with smaller spines on branchlets.

The leaves of the african boxthorn plant are glaborous and mor or less fleshy and grow to 3.5cm long and 2.5cm wide. The leaves are clustered, shortly stalked and are ovate to elliptical in shape.

The flowers of the plantare white with lilac to paurple markings in the throat and are about 1cm in diameter.They are shortly stalked , fragrant and have five petals and also five unequal teeth.

The fruit of the african boxthorn is a orange to red globular or ovoid berry about 1cm in diameter smooth,shiny and shortly stalked.

The seeds of the african boxthorn are light brown or yellow ovoid, irregular and flattenened. They are also smooth , dull and have small raised dots on the surface.

The root system is extensive with a deeply branched taproot, which produces new growth when broken.

3.5 METHOD AND RATE OF SPREAD

African Boxthorn is mainly spread by seed, and is greatly assisted in its spread by birds which eat the berries and pass the seed intact from their gut.

Seeds may be dispersed by water, water and soil movement (e.g. mud on machinery), adherence to animal fur and wool, can also assist with dispersal. Seeds passing through animals can also remain viable.

3.6 ROLES AND RESPONSIBILITIES OF LAND MANAGERS

Land owners and / or occupiers have the prime responsibility in containing and controlling Boxthorn on their land.
Shire Weeds Officers have inspectorial responsibility for ensuring that landholders carry out control activities.
Shires are responsible for containment and control on roads.
Whilst Rural Lands Protection Boards are responsible for control on TSRs.
State Rail Authority is responsible for containment and control on railway enclosures.

LEGISLATIVE AND REGULATORY SITUATION

4.1 CURRENT DECLARATION

Council	Current Declaration
Parkes Shire Council	W2
Forbes Shire Council	W2
Cabonne Shire Council	W2
Bland Shire Council	W2
Lachlan Shire Council	W2
Cootamundra Shire Council	W2
Cowra Shire Council	W2
Weddin Shire Council	W2

A W2 weed means that the weed must be fully and continuously suppressed and destroyed.

4.2 DECLARATION CHANGES

No declaration changes are envisaged in the next year.

4.3 ENFORCEMENT STRATEGY

Stakeholders must familiarise themselves with the Noxious Weeds Act and also with the issues paper known as "Review of Legislation Concerning the Control of Weeds in NSW".

CONSIDERATIONS

5.1 OPPORTUNITIES TO BE EXPLOITED

Opportunities for advertising the need to contain and control African Boxthorn will be exploited as and when they arise. For example district shows, radio and TV advertising.

5.2 INDUSTRY SECTORS

Industry sectors, whether they be private, government or semi government, should be aware of this weed and its potentially damaging effects. They should be aware of the way the plant is spread and must be familiar with control strategies to minimise the risk of its spread. With this in mind they should also be aware of the weeds categorisation within their area so as to prevent breaches of the Noxious Weeds Act 1993.

5.3 ECOLOGICAL

Because this weed is a vigorous competitor, its removal or reduction can be expected to increase the plant bio-diversity of areas where it was dominant.

5.4 SPECIES MANAGEMENT

Continual surveillance and inspection across the region is the best way of minimising the spread of boxthorn. The detection of new plants early in the growth phase will reduce the cost of control and increase the kill rate.

5.5 COMMUNITY

Because African Boxthorn is aided in its spread by birds this weed is somewhat more difficult to contain than other weeds. Community involvement should centre on early identification of the weed and quick subsequent control measures.

5.5 EXTENSION AND EDUCATION

The extension program for boxthorn will consist of field day displays and demonstrations. Displays at district shows. The educative process can be achieved by one to one landholder contact during the inspection process.

5.7 LINKAGES TO OTHER STRATEGIES

The National Weeds Strategy (Australia)
The NSW Weeds Strategy

5.8 CONTINGENCIES

The main contingencies which may impact on this plan are:-

- Flooding will reduce access to the core areas along rivers creeks and watercourses. Reduced access will coincide with increased germination of seeds as well as greater than usual seed dispersal due to flooding. Such events are bound to affect the achievement of the projects performance indicators. The best strategy to combat this contingency is preemptive control. i.e. LCAs have to make sure suppression and control are continuous and thorough.

- Absentee landholders along with resistance by landholders to suppression and control measures are seen as inhibitive towards the project's objectives. The use of notices and legal action under the Act are seen as measures to counter this.

- Lack of resources by landholders may be another contingency to be overcome. The extension and educative role of the LCA may overcome this problem. The problem is one of allocation of resources not lack of resources.

PERFORMANCE INDICATORS

6.0 PERFORMANCE INDICATORS

Objective	Performance Indicator	Action	By Whom
1. No African boxthorn older than two years on Council land.	1. All council land free of boxthorn older than 2 years by the end of the plan.	1. Herbicide treatment and inspection.	1. LCA,
2. No rare or isolated infestations older than 2 years on private property.	2. Constant inspections of known properties indicates no plants older than two years by the end of the plan.	2. Mechanical treatment Herbicide treatment Inspection notices	2. Landholders, LCAs
3. Heavy infestations are reduced by 25% by the end of the plan.	3. Infested areas to be assessed at start of the program and assessed each year. Average reduction is expected to be about 5%.	3. Mechanical treatment Herbicide treatment Inspections Notices	3. Landholders LCAs
4. All infestations, new and old located.	4. Comparison of mapped areas beginning of plan compared with end of plan	4. Inspections , mapping and recording	4. LCAs Landholders
5. Landholders will be given the opportunity to learn about effective chemical control techniques, cropping practices and rotation options	5. At the end of the plan farmers will be aware of agronomic and cultural measures which will help contain this weed.	5. Publicity Field days Participate in Orange Field day display Annually. TV advertising campaign Sept. and Jan. annually Display NSW Ag. Brochures at seed merchant premises.	5. LCAs NSW agriculture

MONITOR AND REVIEW PROCESS

7.0 MONITOR AND REVIEW PROCESS

Plan members will meet annually to discuss progress and review performance. An annual report based on the performance indicators in section 6.0 will be prepared. Failure to meet performance indicators will be documented in the report and remedial action agreed with the stakeholder will be documented as well.

BENEFITS

8.0 BENEFITS

Genuine long term benefits are expected to flow from this plan. The industries expected to benefit across the region are :-
Grazing (meat and wool)/Fodder
Viticulture
Horticulture
Tourism

Cost reductions can be expected to flow to these industries (the economic value has not been assessed) because direct weed control costs may be less if the plan objectives are met.
Substantial increases in revenue to these industries can be expected (the economic value has not been assessed) because of increased production if the plan objective s are met.
There are a number of environmental benefits to reducing infestations of African boxthorn including the eradication of an area that accommodates noxious pests. There are also aesthetic benefits to eradicating boxthorn contaminated areas like visual improvement of watercourses.

JOHNSON GRASS MANAGEMENT PLAN

COVER PAGE

1.1 PLAN TITLE

Johnson and Columbus grass Management Plan for the Central West Region.

1.2 PLAN PROPONENTS

The Lachlan Valley Noxious Weeds Advisory Group.

Group Secretary : Kevin Nelligan
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Group Scribe: John Spencer
Lachlan Shire Council
PO Box 216
Condobolin NSW 2877
Ph. 02 68954444
Fax. 02 68953478
Email lachl@mpx.com.au

Group Chairman ... ...
Don Lawrence LVNPAC

Date ... .../ ... .../.1999

1.3 NAME OF PLANT

Johnson grass Sorghum halepense
Columbus grass Sorghum x almum Parodi
Weeds of national significance No

1.4 PLAN PERIOD

1 July 2000 to 30 June 2005 (5 years)

1.5 AREA OF OPERATION

Signatories to this plan include:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cowra Shire Council
Weddin Shire Council
Cootamundra Shire Council

1.6 AIM

To substantially reduce Johnson grass/Columbus grass infestations and prevent their spread to new areas.

1.7 OBJECTIVES

1. All new outbreaks of Johnson grass and Columbus grass are treated in the year in which they are discovered on private and public lands.
2. Document all infestations within 2 years.
3. Reduce infestations in core areas on private lands.
4. Landholders will be given the opportunity to learn about effective control techniques, cropping practices and rotation options.

TABLE OF CONTENTS

STAKE HOLDERS

2.1 SIGNATORIES

Local control authorities include the following councils: -

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cowra Shire Council
Weddin Shire Council
Cootamundra Shire Council

2.2 OTHER KEY STAKEHOLDERS

Other key stake holders include:-

Land owners
SRA
RTA
NSW Agriculture
State Forests
Landcare groups
Lachlan Catchment Management Committee
RLPBs

BACKGROUND AND GENERAL FACTS

3.1 REASON FOR THE PLAN

Johnson grass (sorghum halepense) is a serious weed in most parts of the world. It has spread rapidly in Australia since about 1970 and is a declared noxious plant for the whole of New South Wales. It is a problem mainly on areas that have been cropped and along roadsides, railway lines and water courses. Columbus grass is thought to be derived from a natural cross between an unknown cultivated variety of sorghum and the Johnson grass weed. Because of the difficulty in distinguishing Johnson grass seed from Columbus grass seed the rest of this plan will apply to both weeds.

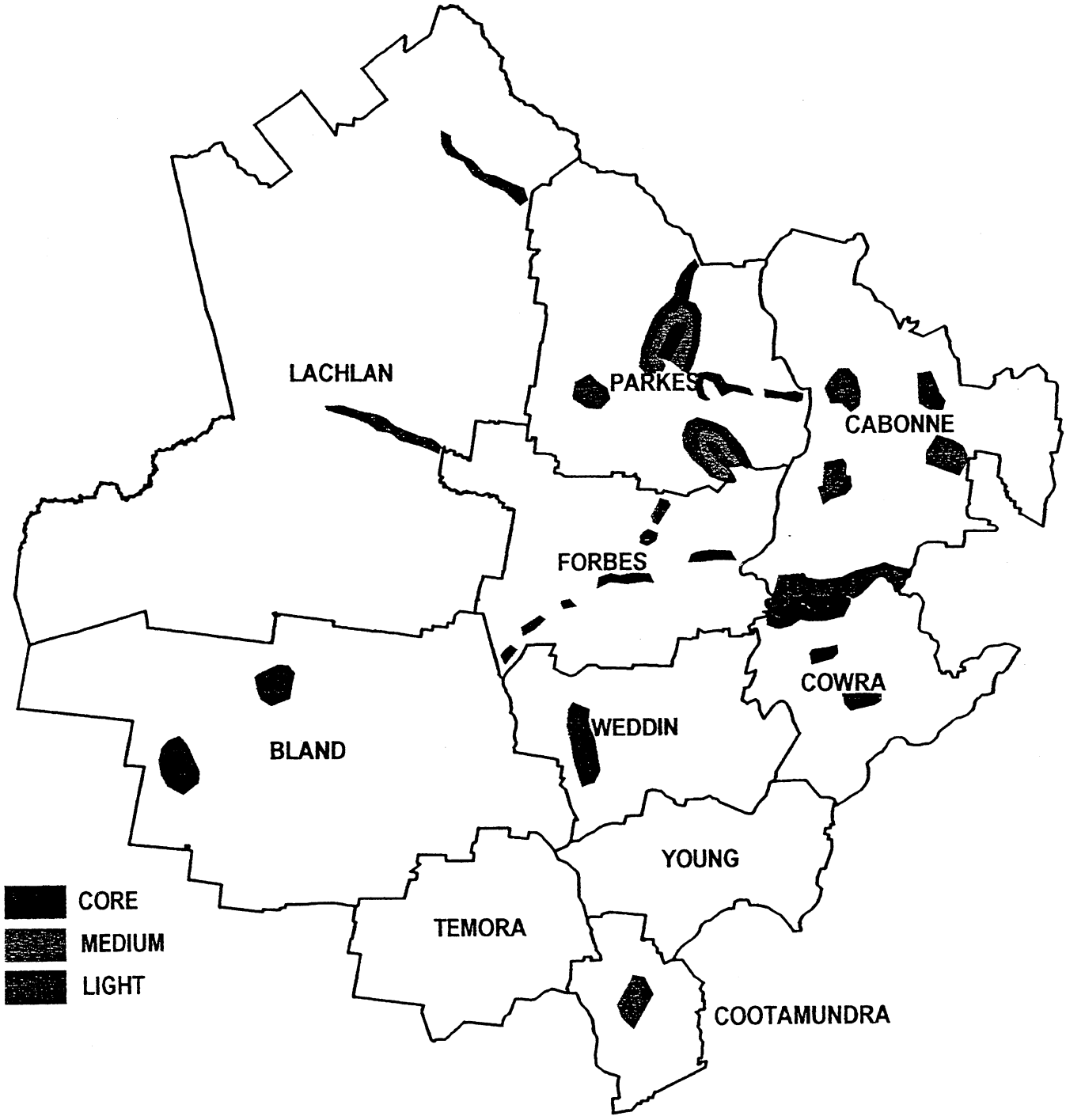
3.2 DESCRIPTION OF THE PROBLEM

Considered one of the worlds worst weeds. It causes severe crop loss as a result of direct competition, allelopathic action and by acting as an alternate host to crop pests and diseases. Johnson grass readily invades arable lands and is capable of taking over whole paddocks.

3.3 DISTRIBUTION OF KNOWN INFESTATIONS

See map on the following page

DISTRIBUTION OF KNOWN INFESTATIONS - "JOHNSON GRASS"



3.4 WEED BIOLOGY/ECOLOGY

Seeds germinate in spring and early summer. Seedling growth is slow at first as rhizomes and secondary tillers develop from axillary buds on the basal portion of the seedling shoot about 3 weeks after emergence. Growth rate of the leaves increases rapidly thereafter, equally and exceeding the rate of root growth. Rhizome growth rate remains slow until flowering, which commences about 7 weeks after emergence, then accelerates. Flowers and rhizome production continue until autumn, but there are two separate main periods of panicle emergence, early summer and late summer – early autumn. Rhizomes become dormant in late autumn and frosts kill aerial growth. New shoots develop from the rhizomes the following spring. At the northern limit of its growth range in Canada, however, although four biotypes capable of overwintering in the vegetative state are known, severe frosts usually kill rhizomes as well as aerial growth.

Rhizome shoots exhibit a similar growth pattern but they emerge earlier in the season and grow faster in the field than seedling plants.

3.5 METHOD AND RATE OF SPREAD

Seed is the principal means of spread. The detached spikelets are blown in the wind, float on water, stick to woll and fur, and pass relatively unharmed through animal and bird digestive tracts. Seed may also be spread as a contaminant in agricultural produce and in mud sticking to machinery and other vehicles.
Localised spread occurs as rhizomes grow away from the parent plant, and when rhizome fragments are moved during cultivation and road grading.

3.6 ROLES AND RESPONSIBILITIES OF LAND MANAGERS

Land owners and / or occupiers have the prime responsibility in containing Johnson grass to its core areas.
Shire Weeds Officers have inspectorial responsibility for ensuring that landholders carry out control activities.
Shires are responsible for containment and control on roads.
Rural Lands Protection Boards are responsible for containment and control on TSRs and reserves.
State Rail Authority is responsible for containment and control on railway enclosures.

LEGISLATIVE AND REGULATORY SITUATION

4.1 CURRENT DECLARATION

Council	Current Declaration
Parkes Shire Council	W2
Forbes Shire Council	W2
Cabonne Shire Council	W2
Bland Shire Council	W2
Lachlan Shire Council	W2
Cowra Shire Council	W2
Weddin Shire Council	W2

A W2 declaration means that the weed must be fully and continuously suppressed and destroyed.

4.2 DECLARATION CHANGES

No declaration changes are envisaged in the next year.

4.3 ENFORCEMENT STRATEGY

Stakeholders must familiarise themselves with the Noxious Weeds Act and also with the issues paper known as "Review of Legislation Concerning the Control of Weeds in NSW".

CONSIDERATIONS

5.1 OPPORTUNITIES TO BE EXPLOITED

Opportunities for advertising the need to contain and control Johnson grass will be exploited as and when they arise. For example district shows, radio and TV advertising.

5.2 INDUSTRY SECTORS

Industry sectors, whether they be private, government or semi government, should be aware of this weed and its potentially damaging effects. They should be cognizant with and adhere to high standards of hygiene whenever they come into contact with it (e.g. machinery, soil or stock) so as to minimise the risk of its spread. With this in mind they should also be aware of the weeds categorisation within their area so as to prevent breaches of the Noxious Weeds Act 1993.

5.3 ECOLOGICAL

Because this weed is a vigorous competitor, its removal or reduction can be expected to increase the plant bio-diversity of areas where it was dominant.

5.4 SPECIES MANAGEMENT

Population density reduction in the core areas should lead to increased ability of more desirable species such as phalaris and paspalum to compete with this weed. Objective 3 is not necessarily complete eradication of the weed from 25% of its existing core area, it is more likely a thinning of density by 25%. On the other hand objective 1 if achieved will make it very difficult for the weed to establish new areas. Johnson grass readily cross pollinates with other sorghum species. This means that control and containment measures will mean the destruction of other sorghum species such as Silk forage sorghum which do have some grazing value.

5.5 COMMUNITY

Johnson grass is a major weed and as such all members of the community may be considered responsible for its control and containment. For example it is known to grow around backyard aviarys from contaminated bird seed. This weed has the potential to seriously reduce summer crop yields and because of this is of great interest to summer croppers and irrigators.

5.6 EXTENSION AND EDUCATION

The need for an integrated control program needs to be spelled out to stakeholders. The integration must include crop rotation,cultivation,competing crops and chemical measures all of which need to be inculcated into the operational practices of farmers. This will be achieved by field days and one to one education during the inspection process.

5.7 LINKAGES TO OTHER STRATEGIES

The National Weeds Strategy (Australia)
The NSW Weeds Strategy

5.8 CONTINGENCIES

Control of this weed is seen as difficult because of its ready regeneration from rhizomes. However this barrier can be overcome by using residual herbicides.
Another problem is the crowding of pasture species by the rapid and rank growing Johnson grass. This can be overcome by repeated slashing which prevents seeding reduces plant vigour and increases the vigour of desirable species such as paspalum.
Another barrier is the desire by some farmers to preserve feed such as Silk forage sorghum which may be growing near or with Johnson and Columbus grass. This has to be strongly discouraged because of the propensity of Johnson grass to cross breed.

PERFORMANCE INDICATORS

6.0 PERFORMANCE INDICATORS

Objective	Performance Indicator	Action	By Whom
1. All outbreaks of Johnson grass are treated in the year in which they are discovered on private and public lands.	1. All infestations are treated by the end of March annually.	1. Herbicide treatment Inspections Notices	1. LCA Landholder And RLPB
2. Document all infestations within 2 years	2. Document all infestations within 2yrs.	2. Inspections, mapping and recording	2. LCA
3. Reduce infestations in core areas on private lands.	3. Area infested reduced by 20% over period of plan.	3. Herbicide treatment Inspections Notices	3. LCA Landholder
4. Landholders will be given the opportunity to learn about effective control techniques, cropping practices and rotation options.	4. At the end of the plan farmers will be aware of agronomic and cultural measures which will help contain this weed.	4.Publicity, field days. Participate in Orange Field day display annually. Display NSW Ag. Brochures at seed merchant premises	4. LCA NSW agriculture

MONITOR AND REVIEW PROCESS

7.0 MONITOR AND REVIEW PROCESS

Plan members will meet annually to discuss progress and review performance. An annual report based on the performance indicators in section 6.0 will be prepared. Failure to meet performance indicators will be documented in the report and remedial action agreed with the stakeholder will be documented as well.

BENEFITS

8.0 BENEFITS

Genuine long-term benefits are expected to flow from this plan. The industries expected to benefit across the region are: -
Grazing (meat and wool)/Fodder
Viticulture
Horticulture
Tourism

Cost reductions can be expected to flow to these industries (the economic value has not been assessed) because direct weed control costs may be less if the plan objectives are met.
Substantial increases in revenue to these industries can be expected (the economic value has not been assessed) because of increased production if the plan objective s are met.

RESOURCES

9.0 RESOURCES

Considerable time and effort will need to be invested in this plan by LCAs in the region if the plan objectives are to be met. Bearing in mind that the region has other weeds to contend with, the allocation of resources is a difficult task.

However the allocation of time and resources will reflect the uneven distribution of the weed across the region.

REFERENCES

Dellow. J. Monaghan N. (1982). **Agfact: P7.6.9.** Johnson grass. NSW Agriculture

Cuthbertson. E.G., Parsons.W.T. **Noxious Weeds of Australia** Inkata Press

Cunningham. G.M, Mulham W.E, Milthorpe. P.L. Leigh J.H. **Plants of Western New South Wales** Soil Conservation Service of New South Wales

SCOTCH THISTLE MANAGEMENT PLAN

COVER PAGE

1.1 PLAN TITLE

Scotch Thistle/Illyrian Thistle Management Plan for the Central West Region.

1.2 PLAN PROPONENTS

The Lachlan Valley Noxious Weeds Advisory Group.

Group Secretary : Kevin Nelligan
Cowra Shire Council
PO Box 342
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Email council@cowra.nsw.gov.au

Group Scribe: John Spencer
Lachlan Shire Council
PO Box 216
Condobolin NSW 2877
Ph. 02 68954444
Fax. 02 68953478
Email lachl@mpx.com.au

Group Chairman ... ...
Don Lawrence LVNPAC

Date ... .../... .../.1999

1.3 NAME OF PLANT

Scotch Thistle *Onopordum acanthium*
Illyrian Thistle *Onopordum illyricum*
Weeds of national significance No

1.4 PLAN PERIOD

1 July 2000 to 30 June 2005 (5 years)

1.5 AREA OF OPERATION

Signatories to this plan include:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cootamundra Shire Council
Cowra Shire Council
Weddin Shire Council

1.6 AIM

To contain Scotch thistles to existing infestation areas and prevent its spread to new areas.

1.7 OBJECTIVES

1. All marginal infestations of Scotch Thistle and Illyrian thistle are treated in the year in which they are discovered on private and public land.
2. Locate new and existing infestations.
3. Establish buffer zone around core areas on private property.
4. Landholders will be given the opportunity to learn about effective control techniques, cropping practices and rotation options.
5. Minimize the spread of thistle from isolated and marginal infestations.

TABLE OF CONTENTS

STAKE HOLDERS

2.1 SIGNATORIES

Local control authorities include the following councils:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cootamundra Shire Council
Cowra Shire Council
Weddin Shire Council

2.2 OTHER KEY STAKEHOLDERS

Other key stake holders include:-

Land owners
SRA
RTA
NSW Agriculture
State Forests
Landcare groups
Lachlan Catchment Management Committee
RLPBs

BACKGROUND AND GENERAL FACTS

3.1 REASON FOR THE PLAN

Scotch thistle and Ilyrian thistle affect large areas of grazing land, competing with improved pastures for nutrients. These thistles affects stock productivity and also pasture crops.

3.2 DESCRIPTION OF THE PROBLEM

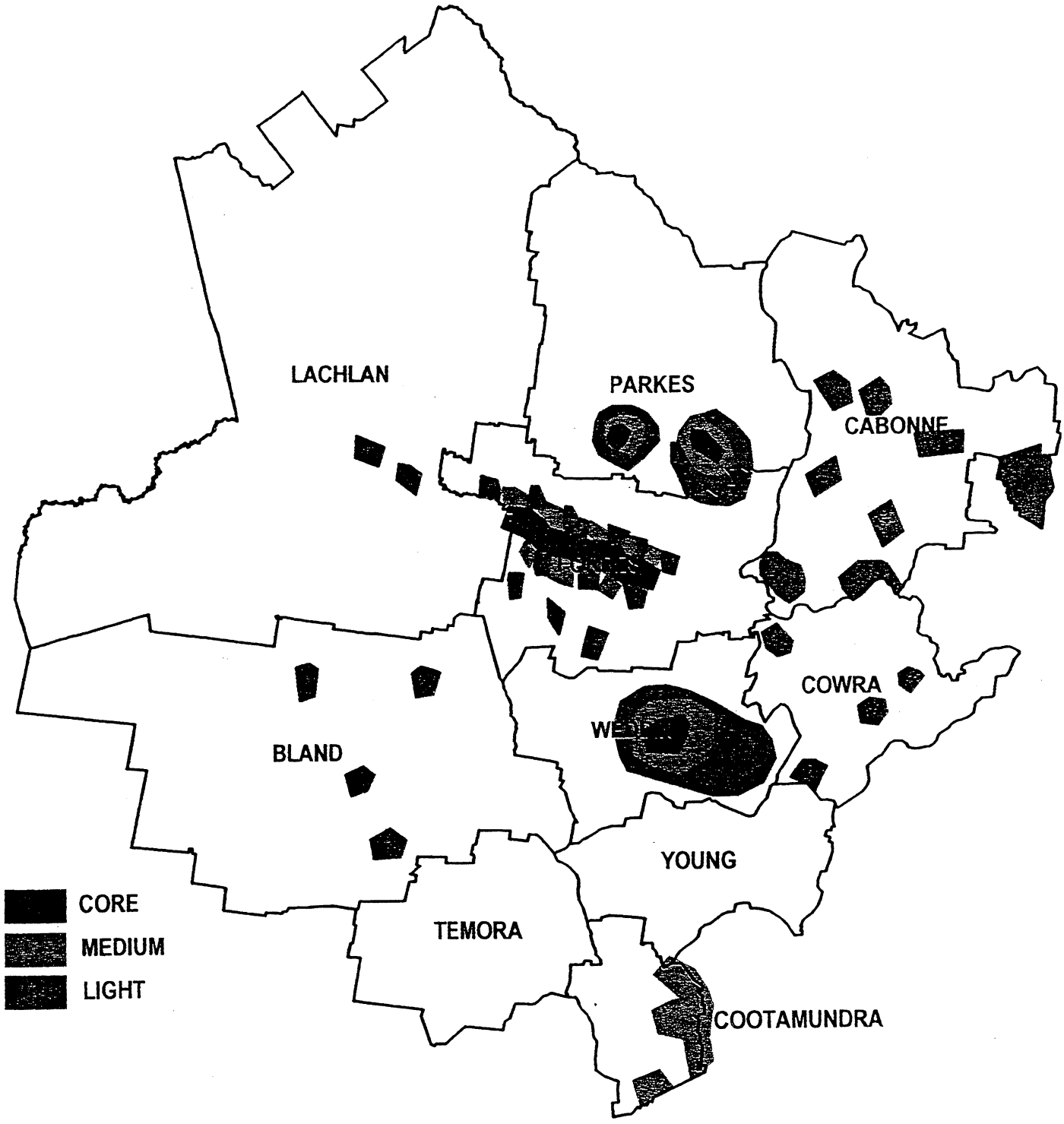
Thistles favour subhumid temperate regions. They occur as a competitive weed of Australian pastures mostly in winter rainfall areas of the south east in the 500 to 850 mm rainfall zone, but do not grow in waterlogged areas.

Thistles are a problem because of their highly competitive nature. Thistles reduce yields in improved pastures and also pasture crops. Livestock generally do not eat Scotch thistle, but when they do they tend to gets abrasions in the head area. Scotch thistle can attach to an animals coat and are very costly to the wool industry.

3.3 DISTRIBUTION OF KNOWN INFESTATIONS

See map on the next page

DISTRIBUTION OF KNOWN INFESTATIONS - "SCOTCH THISTLE"



3.4 WEED BIOLOGY/ECOLOGY

Scotch thistle and Illyrian thistle germinate at any time during the year, with their favourable periods in the late summer-autumn and late winter-spring periods. Early germinated plants are annuals flowering in the following spring and summer. Later germinating plants are either annual biennials, with the biennials flowering in the second spring summer period. They grow up to 2 metres. These two weeds often occur together and because of this this plan treats them as one.

The scotch thistle plant consists of one main stem with branches coming out from that stem and is and is covered in wooly hairs giving a whitish apppearance.

The leaves of the scotch thistle plant are broadly lanceolate to ovate, margins cut or toothed, undulate and spiny. The rosettes leaves are stalked and grow up to 40cm long. Whilst the stem leaves are similar but sessile with bases extended to the stem.

The flowers of the plant are of a purple or mauve colour. The head of the flower is between 2 and 6cm in diameter and are supported by a spiny bracts, the base of which is woolly. The base of the flower ends in sharp orange spines.

The seed of the Scotch thistle plant is grey with a darker mottling and grow to between 4 and 5mm The seed is quadrangular, transversely wrinkled and have pappus of toothed hair s which can be up to twice the length of the seed.

The root of the scotch thistle is a stout taproot.

3.5 METHOD AND RATE OF SPREAD

The scotch thistle can be spread by two means by seed or by severed root pieces,however, the former is the most common method. The seed is spread via contaminated hay. Sometimes the seeds are spread through strong gusts of wind or even through the digestive tracts of stock and birds.

3.6 ROLES AND RESPONSIBILITIES OF LAND MANAGERS

Land owners and / or occupiers have the prime responsibility in containing Thistle to its core areas.
Shire Weeds Officers have inspectorial responsibility for ensuring that landholders carry out control activities.
Shires are responsible for containment and control on roads.
Rural Lands Protection Boards are responsible for containment and control on TSRs and reserves.
State Rail Authority is responsible for containment and control on railway enclosures.

LEGISLATIVE AND REGULATORY SITUATION

4.1 CURRENT DECLARATION

Council	Current Declaration
Parkes Shire Council	W2
Forbes Shire Council	W2
Cabonne Shire Council	W2
Bland Shire Council	W2
Lachlan Shire Council	W2
Cootamundra Shire Council	W2
Cowra Shire Council	W2
Weddin Shire Council	W2

W2 means the weed must be continuously suppressed and destroyed.

4.2 DECLARATION CHANGES

No declaration changes are envisaged in the next year.

4.3 ENFORCEMENT STRATEGY

Stakeholders must familiarise themselves with the Noxious Weeds Act and also with the issues paper known as "Review of Legislation Concerning the Control of Weeds in NSW".

CONSIDERATIONS

5.1 OPPORTUNITIES TO BE EXPLOITED

Opportunities for advertising the need to contain and control Scotch and Illyrian thistles will be exploited as and when they arise. For example district shows, radio and TV advertising.

5.2 INDUSTRY SECTORS

Industry sectors, whether they be private, government or semi government, should be aware of these weeds and their potentially damaging effects. They should be cognizant with and adhere to high standards of hygiene whenever they come into contact with them (e.g. machinery, soil or stock) so as to minimise the risk of their spread. With this in mind they should also be aware of the weeds categorisation within their area so as to prevent breaches of the Noxious Weeds Act 1993.

5.3 ECOLOGICAL

Because this weed is a vigorous competitor, its removal or reduction can be expected to increase the plant bio-diversity of areas where it was dominant.

5.4 SPECIES MANAGEMENT

There are a number of options available to reduce the scotch thistle infestations. Isolated scotch thistle plants should be grubbed , with as much as possible of the taproot removed. Ploughing can eliminate young plants. Some perennial grasses compete strongly with scotch thistle, although still in the research stage this may be the key to the overall extinguishment of the scotch thistle problem. These include demeter fescue and phalaris. Herbicides are also an effective tool against the scotch thistle problem. It is possible to spray Thistle with selective herbicides in perennial pasture paddocks. Biological controls are also available.

5.5 COMMUNITY

Because this plant favours pasture improved fertile soils it is a problem for the farming community because it competes well with improved pasture species. Newly sown improved pasture can often be overrun by a high germination of thistle seeds. Thus community ownership of this problem is confined to the farming sector.

5.6 EXTENSION AND EDUCATION

The extension program for Scotch thistle will consist of field day displays and demonstrations. Displays at district shows. The educative process can be achieved by one to one landholder contact during the inspection process.

5.7 LINKAGES TO OTHER STRATEGIES

The National Weeds Strategy (Australia)
The NSW Weeds Strategy
Lachlan River Catchment Management Plan

5.8 CONTINGENCIES

Biological control is seen by farmers as the all encompassing strategy. This is seen as a barrier to proper integrated control of Thistle because of over reliance on only one strategy.
Ignorance is another barrier. Not all stakeholders recognise the serious nature of this weed.

PERFORMANCE INDICATORS

6.0 PERFORMANCE INDICATORS

Objective	Performance Indicator	Action	By Whom
1. All marginal infestations of Scotch thistle are treated in the year in which they are discovered on private and public land.	1.All new outbreaks treated annually.	1. Herbicide Mechanical grubbing Biological control Inspections Notices	1. LCA Landholders
2. Locate new and existing infestations .	2. Maps completed within 2 years	2. Map areas inspect and record.	2. LCA
3. Establish buffer zone around core areas on private property.	3.At the end of the plan buffer zones maintained..	3.Herbicide Mechanical treatment Biological control Inspections Notices	3. LCA Landholders
4. Landholders will be given the opportunity to learn about effective control techniques, cropping practices and rotation options.	4. At the end of the plan farmers will be aware of agronomic and cultural measures which will help contain this weed.	4. Publicity, Field days. Participate in Orange Field Day display annually. Display NSW Ag. Brochures at seed merchant premises	4. LCA NSW Agriculture.
5. Minimise the spread from isolated and marginal infestations.	5. At the end of the plan all isolated and marginal infestations have been contained.	5. Herbicide Mechanical treatment Inspections	5. LCA Landholders

MONITOR AND REVIEW PROCESS

7.0 MONITOR AND REVIEW PROCESS

Plan members will meet annually to discuss progress and review performance. An annual report based on the performance indicators in section 6.0 will be prepared. Failure to meet performance indicators will be documented in the report and remedial action agreed with the stakeholder will be documented as well.

BENEFITS

8.0 BENEFITS

Genuine long term benefits are expected to flow from this plan. The industries expected to benefit across the region are :-
Grazing (meat and wool)/Fodder
Viticulture
Horticulture
Tourism

Cost reductions can be expected to flow to these industries (the economic value has not been assessed) because direct weed control costs may be less if the plan objectives are met.
Substantial increases in revenue to these industries can be expected (the economic value has not been assessed) because of increased production if the plan objective s are met.

RESOURCES

9.0 RESOURCES

Considerable time and effort will need to be invested in this plan by LCAs in the region if the plan objectives are to be met. Bearing in mind that the region has other weeds to contend with, the allocation of resources is a difficult task.

However the allocation of time and resources will reflect the uneven distribution of the weed across the region.

REFERENCES

Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (1992). Plants of Western New South Wales . Inkata: Melbourne.

Parsons, W.T.; Cuthbertson, E.G. (1992) *Noxious weeds of Australia* Inkata: Melbourne

SILVERLEAF NIGHTSHADE MANAGEMENT PLAN

COVER PAGE

1.1 PLAN TITLE

Silverleaf Nightshade Management Plan for the Central West Region

1.2 PLAN PROPONENTS

The Lachlan Valley Noxious Weeds Advisory Group.

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Group Scribe: John Spencer
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Email lachl@mpx.com.au

Group Chairman ... ...
Don Lawrence LVNPAC

Date ... .../... .../.1999

1.3 NAME OF PLANT

Silverleaf Nightshade (*Solanum eleagnifolium*)
Weed of national significance **No**

1.4 PLAN PERIOD

1 July 2000 to 30 June 2005 (5 years)

1.5 AREA OF OPERATION

Signatories to this plan include:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cowra Shire Council
Weddin Shire Council
Cootamundra Shire Council

1.6 AIM

To contain Silverleaf Nightshade to existing infestation areas and prevent its spread to new areas.

1.7 OBJECTIVES

1. Limit outbreaks of Silverleaf nightshade by controlling all new infestations in the year of discovery and prior to seed set.
2. Contain existing core areas to present boundaries by the formation of buffer zones.
3. Landholders will be given the opportunity to learn about effective control techniques, cropping practices and rotation options .
4. All new infestations located.

TABLE OF CONTENTS

STAKE HOLDERS

2.1 SIGNATORIES

Local control authorities include the following councils:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cowra Shire Council
Weddin Shire Council
Cootamundra Shire Council

2.2 OTHER KEY STAKEHOLDERS

Other key stake holders include:-

Land owners
SRA
RTA
NSW Agriculture
State Forests
Landcare groups
Lachlan Catchment Management Committee
RLPBs

BACKGROUND AND GENERAL FACTS

3.1 REASON FOR THE PLAN

The capacity of SilverleafNightshade to replace more desirable plant species makes it a threat to agricultural and horticultural production. This plant also may have a detrimental affect on stock health due to its hypericum content.

3.2 DESCRIPTION OF THE PROBLEM

Silverleaf nightshade is considered a weed because it is said to seriously reduce crop and pasture production , with some suggesting as a result of this that it may be one of the worst weeds of the NSW wheat / sheep belt. It is also said to exude plant inhibitors, interfere with harvesting and animal husbandry practices and can also be a host to plant diseases and phytophagous insects.

Silverleaf nightshades vast root system, measured to a depth of 2m, enables it to compete with summer crops and pastures. Its root system also removes water and nutrients from a large volume of soil over summer leaving same depleted for the following winter crops. It may also compete with cover crops grown in vineyards and orchards.

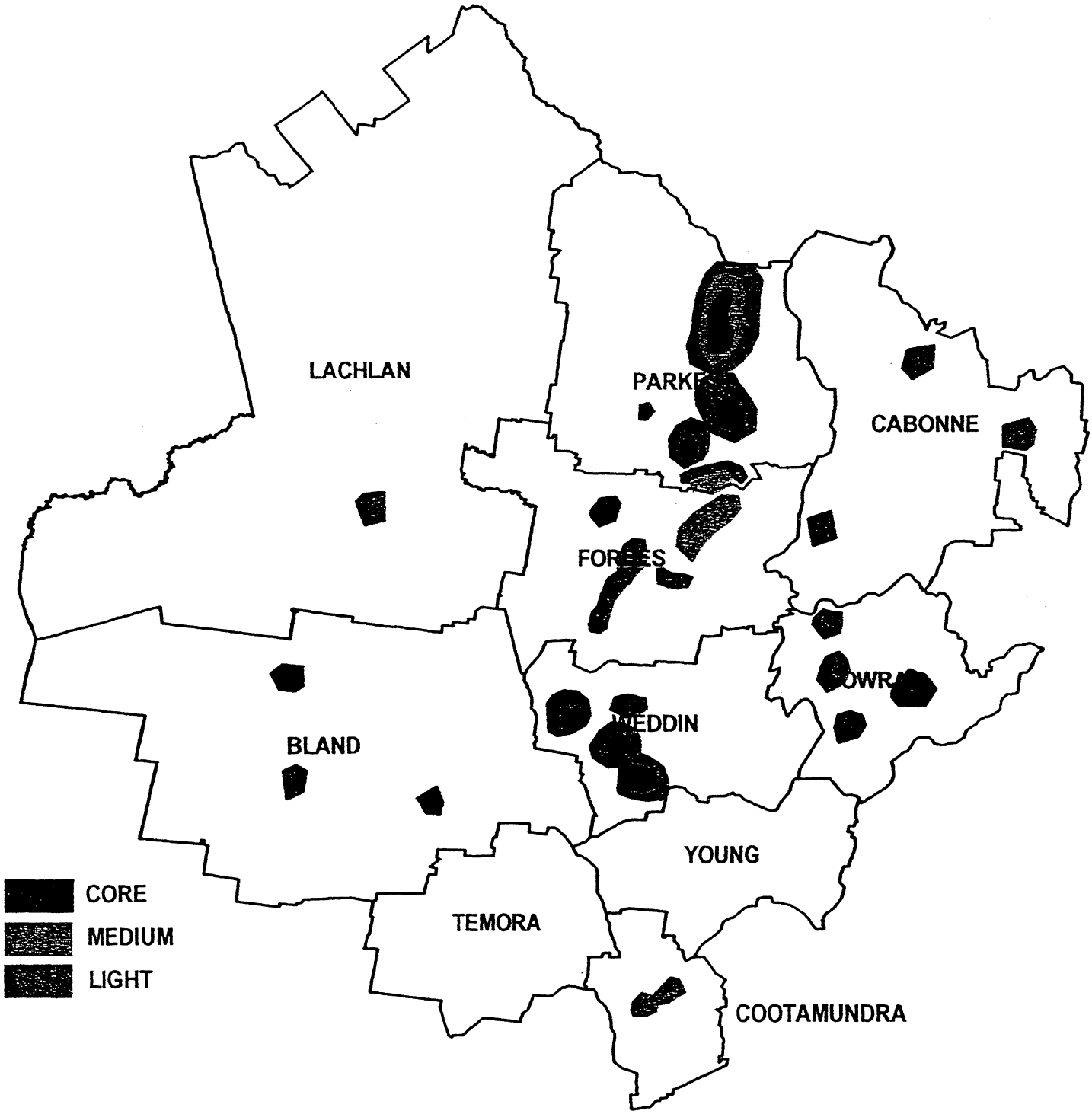
Silverleaf nightshade has been identified as being toxic to animals, with cattle suggested to be more affected than sheep or goats. Some cattle and horse deaths have been reported overseas.

The occurrence of this weed on farming land as suggested may result in productivty losses through competition and because it is considered very difficult to kill, extensive control costs are incurred.

3.3 DISTRIBUTION OF KNOWN INFESTATIONS

See map on the following page.

DISTRIBUTION OF KNOWN INFESTATIONS - "SILVERLEAF NIGHTSHADE"



3.4 WEED BIOLOGY/ECOLOGY

Sliverleaf nightshade is an erect , herbaceous/shrub-like, multistemmed, summer growing, perennial to 1m tall with an extensive underground root system. Its seeds germinate in autumn with much root growth in the first few months. New shoots emerge from lateral roots each spring.

Plant stems are erect and branching towards the top. They are often covered with reddish prickles to 5mm long which are fine and straight. These prickles may also appear on petioles and leaves. All parts of the plant are covered with hairs. Leaves are silvery white, stalked, alternate, veined, oblong-lanceolate to 15 cm long. Leaf margins are undulate and often scalloped.

Flowering commences in November and continues through until March. Flowers are purple to violate and sometimes white, to 3.5 cm in diameter. They have five petals, five fused anthers, which are prominent and yellow. First flowers appear terminally whilst later flowers appear in lateral positions. They are supported on small stems(petioles).

Fruiting occurs from December to March and they normally ripen within 4 to 8 weeks. Fruits are a smooth globular berry 8 to 14 mm in diameter and are green prior to ripening when they become a mottle yellow to orange colour. There are around 75 seeds in each fruit. Seeds are brown, smooth, flattened, rounded to 4mm in diameter.

3.5 METHOD AND RATE OF SPREAD

Spread is via root segments and seed. Cultivation is suggested as a major cause of spread as it breaks roots into segments with plants recorded regenerating from fragments as small as 1cm. Contaminated machinery, water, birds and livestock are reported as being vectors for the dispersal of seed. Seeds have been reported as remaining viable following digestion by stock, thus stock movement following ingestion may be another vector for the spread of seed.

3.6 ROLES AND RESPONSIBILITIES OF LAND MANAGERS

Land owners and / or occupiers have the prime responsibility in containing Silverleaf nightshade to its core areas.
Shire Weeds Officers have inspectorial responsibility for ensuring that landholders carry out control activities.
Shires are responsible for containment and control on roads.
Rural Lands Protection Boards are responsible for containment and control on TSRs and reserves.
State Rail Authority is responsible for containment and control on railway enclosures.

LEGISLATIVE AND REGULATORY SITUATION

4.1 CURRENT DECLARATION

Council	Current Declaration
Parkes Shire Council	W3
Forbes Shire Council	W3
Cabonne Shire Council	W3
Bland Shire Council	W3
Lachlan Shire Council	W2
Cowra Shire Council	W3
Weddin Shire Council	W2

W2 means the weed must be fully and continuously suppressed and destroyed.

4.2 DECLARATION CHANGES

No declaration changes are envisaged in the next year.

4.3 ENFORCEMENT STRATEGY

Stakeholders must familiarise themselves with the Noxious Weeds Act and also with the issues paper known as "Review of Legislation Concerning the Control of Weeds in NSW".

CONSIDERATIONS

5.1 OPPORTUNITIES TO BE EXPLOITED

Opportunities for advertising the need to contain and control Silverleaf nightshade will be exploited as and when they arise. For example district shows, radio and TV advertising.

5.2 INDUSTRY SECTORS

Industry sectors, whether they be private, government or semi government, should be aware of this weed and its potentially damaging effects. They should be cognizant with and adhere to high standards of hygiene whenever they come into contact with it (e.g. machinery, soil or stock) so as to minimise the risk of its spread. With this in mind they should also be aware of the weeds categorisation within their area so as to prevent breaches of the Noxious Weeds Act 1993.

5.3 ECOLOGICAL

Because this weed is a vigorous competitor, its removal or reduction can be expected to increase the plant bio-diversity of areas where it was dominant.

5.4 SPECIES MANAGEMENT

This is a difficult weed to manage. Some cultural and agronomic practices need to be addressed if Silverleaf nightshade is to be contained.

1. Spraying with 24D to prevent seed set. Follow this up with sowing a grass such as phalaris to compete with the Nightshade.
2. Direct drilling and minimum tillage. These practices reduce vegetative reproduction which occurs when mechanical tillage chops the Nightshade into pieces.
3. Not undersowing crops with lucerne. This allows the paddocks infected to be sprayed with 24D in the summer.

5.5 COMMUNITY

Community activities must be coordinated to maximise the growth of desirable species whilst destroying or minimising Silverleaf nightshade growth and its ability to set seed. Activities will be integrated and may include :-

Preventative measures
Cultural controls

5.6 EXTENSION AND EDUCATION

Extension and education activities are key components of weed management plans and as such should ensure client ownership of the problem and participation in the development and implementation of solutions. If people are unable to identify Silverleaf nightshade, are unaware of the potential problems it can cause and lack an understanding of management options, then they are unlikely to act. Likewise, if they are unaware of the potential penalties they face under the Noxious Weed Act, should they not implement controls, they are also unlikely to act.

Extension messages must address these issues and may be delivered through the electronic and print media, field days / workshops (which may also assist in the formulation of messages), personal contact during inspections and through the provision of printed material to the general public. Issues that need to be addressed are:-

1. Education in crop /pasture selection in paddocks that are already infested.
2. Ongoing inspection in core areas.
3. Ongoing inspection in areas around core areas.
4. Lack of adequate herbicides.
5. Changing industries eg grapevines (which will not tolerate spray drift) planted next to infested paddocks.
6. Ignorance and landholder attitudes.

5.7 LINKAGES TO OTHER STRATEGIES

The National Weeds Strategy (Australia)
The NSW Weeds Strategy
The NSW Silverleaf Nightshade Management Plan(under development).
Ungarie Nightshade Action Management Plan

5.8 CONTINGENCIES

The main barriers to this plan are seen as:-

Financial
Resource
Seasonal constraints
Lack of adequate herbicides

PERFORMANCE INDICATORS

6.0 PERFORMANCE INDICATORS

Objective	Performance Indicator	Action	By Whom
1. Limit outbreaks of Silverleaf nightshade by controlling all new infestations in the year of discovery and prior to seed set.	1. Maintain an annual account of all new outbreaks and compare these with previous years.	1. Carry out inspections of all areas prone to incursions and treat all roadsides with herbicide.	1. LCA, landowner, or RLPB
2. Contain existing core areas to present boundaries by the formation of buffer zones.	2. Clean buffer zones in core areas	2. Herbicide treatment Inspections Notices Treat buffer zones	2. LCA and landholders
3. Landholders will be given the opportunity to learn about effective control techniques, cropping practices and rotation options.	3. At the end of the plan farmers will be aware of agronomic and cultural measures which will help contain this weed.	3. Publicity, Field days. Participate in Orange Field Day display annually. Display NSW Ag. Brochures at seed merchant premises	2. LCA NSW Agriculture
4. All new infestations located	4. Document all new infestations by the end of the plan	4. inspection, mapping and recording	4. LCA

MONITOR AND REVIEW PROCESS

7.0 MONITOR AND REVIEW PROCESS

Plan members will meet annually to discuss progress and review performance. An annual report based on the performance indicators in section 6.0 will be prepared. Failure to meet performance indicators will be documented in the report and remedial action agreed with the stakeholder will be documented as well.

BENEFITS

8.0 BENEFITS

Genuine long term benefits are expected to flow from this plan. The industries expected to benefit across the region are :-
Grazing (meat and wool)/Fodder
Viticulture
Horticulture
Tourism

Substantial cost reductions can be expected to flow to these industries (the economic value has not been assessed) because direct weed control costs may be less if the plan objectives are met.
Substantial increases in revenue to these industries can be expected (the economic value has not been assessed) because of increased production if the plan objective s are met.

RESOURCES

9.0 RESOURCES

Considerable time and effort will need to be invested in this plan by LCAs in the region if the plan objectives are to be met. Bearing in mind that the region has other weeds to contend with, the allocation of resources is a difficult task.
However the allocation of time and resources will reflect the uneven distribution of the weed across the region.

REFERENCES

Anon (1998). Review of Legislation Concerning the Control of Weeds in NSW. NSW Government May 1998.

Anon (1998) Noxious Weeds Declaration list, October 1998

Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (1992). Plants of Western New South Wales. Inkata: Melbourne.

National Weeds Strategy (Australia)

NSW Weeds Strategy

The Eastern and Western Riverina Noxious Weeds Advisory Groups (1999) Noxious Weed Management Plans for the Greater Riverina Region

SPINY BURRGRASS MANAGEMENT PLAN

COVER PAGE

1.1 PLAN TITLE

Spiny Burrgrass Management Plan for the Central West Region.

1.2 PLAN PROPONENTS

The Lachlan Valley Noxious Weeds Advisory Group.

Group Secretary : Kevin Nelligan
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Email lachl@mpx.com.au

Group Chairman ... ...
Don Lawrence LVNPAC

Date ... .../... .../.1999

1.3 NAME OF PLANT

Spiny Burrgrass *Cenchrus incertus / Cenchrus longipinus.*
Weed of national significance No

1.4 PLAN PERIOD

1 July 2000 to 30 June 2005 (5 years)

1.5 AREA OF OPERATION

Signatories to this plan include:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cootamundra Shire Council
Cowra Shire Council
Weddin Shire Council

1.6 AIM

To reduce the area of spiny burrgrass infestations and stop its spread into uncontaminated areas.

1.7 OBJECTIVES

1. Clearly document existing spiny burrgrass infestations within 2 years and reduce the area infested.
2. Contain existing infestations of spiny burrgrass to core areas.
3. Investigate and promote the use of integrated weed management so that 90% of affected land managers are aware of such activites by the end of the plan period.
4. Limit spread by preventing the movement of contaminated machinery, produce, soil and livestock.
5. Contain and control marginal and rare infestations on public and private lands.
6. Landholders will be given the opportunity to learn about effective control techniques, cropping practices and rotation options.

TABLE OF CONTENTS

STAKE HOLDERS

2.1 SIGNATORIES

Local control authorities include the following councils:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cootamundra Shire Council
Cowra Shire Council
Weddin Shire Council

2.2 OTHER KEY STAKEHOLDERS

Other key stake holders include:-

Land owners
SRA
RTA
NSW Agriculture
State Forests
Landcare groups
Lachlan Catchment Management Committee
National Parks and Wildlife
Rural Land Protection Boards

BACKGROUND AND GENERAL FACTS

3.1 REASON FOR THE PLAN

Spiny burrgrass is considered a weed because of the burr that occurs as the plant matures. This burr has a detrimental affect on stock. The harsh burr has the ability to damage the skin reducing the hide value, can cause yield losses if it becomes attached to wool and also can cause ulceration of the mouth if stock attempt to eat it.

3.2 DESCRIPTION OF THE PROBLEM

Spiny burrgrass is generally found in semi-arid and temperate sub-humid regions where the annual rainfall is between 250 and 500mm. In these areas it is often found growing on disturbed lighter soil.

Spiny burrgrass is a problem because it causes loss of production in livestock industries.

The plant is found on private land, on stock reserves and road sides.

3.3 DISTRIBUTION OF KNOWN INFESTATIONS

See map in the next page.

3.4 WEED BIOLOGY/ECOLOGY

Spiny burrgrass germinates mainly through spring and early summer, however germination may occur at any time of the year except mid winter. The optimum germination temperature range is 10 to 20 degrees celsius. Light may suppress germiantion and seeds may establish froma depth up to 20 cm. Continuous germination often makes it difficult to check with solitary control operation.

If moisture is plentiful, vegatitive growth in spring and summer is fast with burr production generally occurring between Decmber and April when most plants die off.

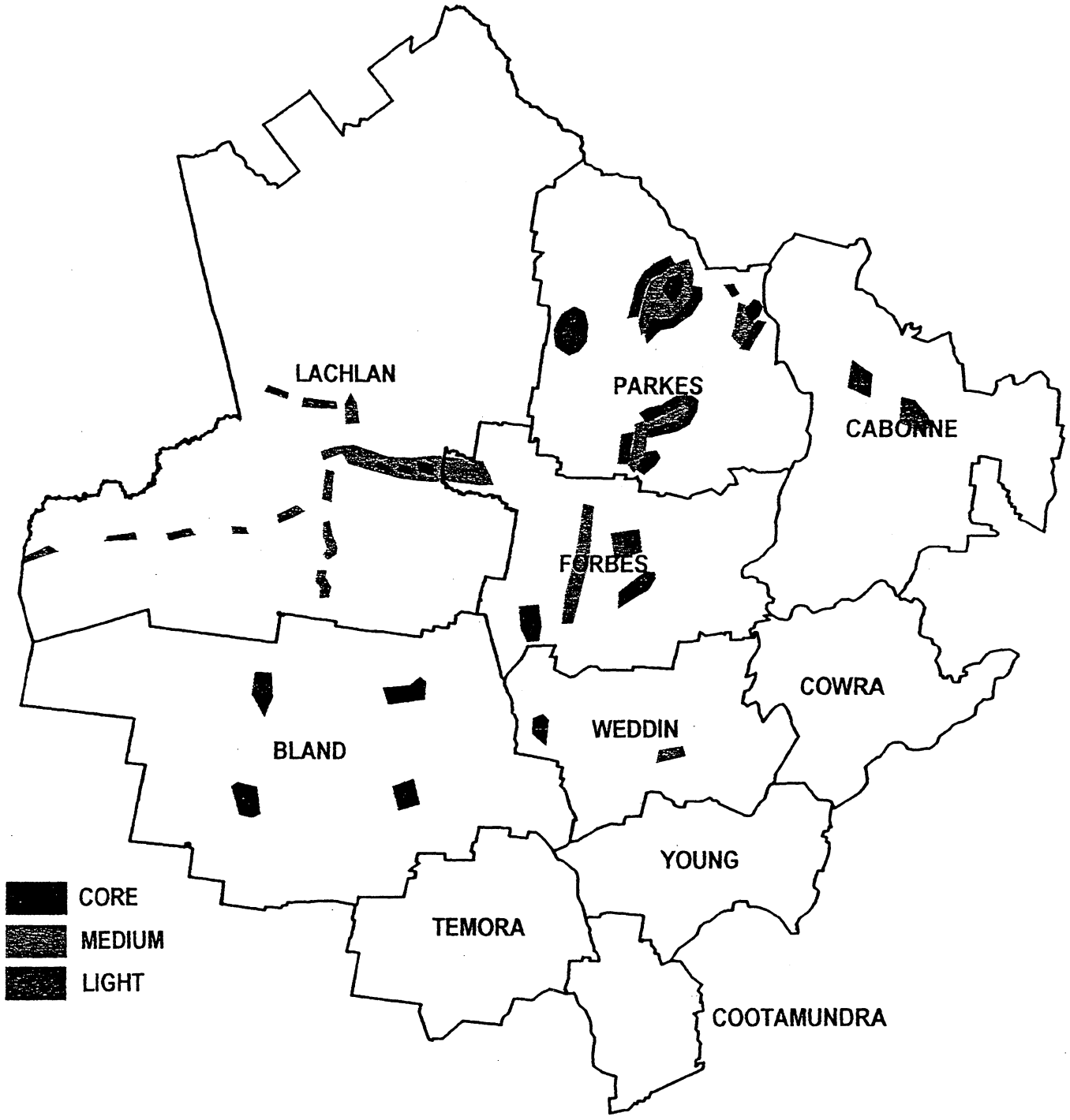
Plant stems can be many and arise from the base where fibrous shallow growing roots form at basal nodes when in contact with the soil. Stems may be either erect, ascending or spreading and may be flattened at their base and hairless. Leaves can grow to 20cm long and 8mm wide. They are flat or folded, finely serrated and taper to a point, having a ligule to 1.5mm long fringed with hairs.

Inflorescence consists of a spike-like panicle to 8.5 cm long and 20mm wide. Up to 40 burrs are born on a zigzagged, hairless or rough stem. Burrs, excluding the spines (for which there can be up to 40 growing to 7mm long), grow to 7mm in diameter and can be variable in shape. Burrs normally produce between 1 and 4 seeds with plants producing up to 1000 seeds. Seeds are 2 to 4mm long and 2 to 3mm wide and are capable of germination soon after seed set. Seed is suggested to be not long lived in the soil.

3.5 METHOD AND RATE OF SPREAD

Spiny burrgrass is spread via seed. The burrs in which the seed is housed and transported have barbed spines and are readily detached from plants when ripe adhering to the wool, skin or fur of animals, clothing of people or tyres of passing vehicles. Seed may also be spread in soil normally sand. This soil may be transported from an infested area either as a commodity or as a contaminate on vehicles moving away from such areas.

DISTRIBUTION OF KNOWN INFESTATIONS - "SPINY BURR GRASS"



Water in river, creeks and irrigation channels may spread seed, however the seeds are very rarely spread by wind.

Quarantine and or superior hygiene play a vital role in limiting the rate of spread of this weed. A lack of plant competition may create opportunities / openings for spiny burrgrass to spread.

3.6 ROLES AND RESPONSIBILITIES OF LAND MANAGERS

Land owners and / or occupiers have the prime responsibility in containing spiny burrgrass to its core areas.
Shire Weeds Officers have inspectorial responsibility for ensuring that landholders carry out control activities.
Shires and Rural Lands Protection Boards are responsible for containment and control on roads and TSRs.
State Rail Authority is responsible for containment and control on railway enclosures.

LEGISLATIVE AND REGULATORY SITUATION

4.1 CURRENT DECLARATION

Council	Current Declaration
Parkes Shire Council	W2
Forbes Shire Council	W2
Cabonne Shire Council	W2
Bland Shire Council	W2
Lachlan Shire Council	W2
Cowra Shire Council	W2
Weddin Shire Council	W2

A W2 is a weed that must be fully and continuously suppressed and destroyed.

4.2 DECLARATION CHANGES

No declaration changes are envisaged in the next year.

4.3 ENFORCEMENT STRATEGY

Stakeholders must familiarise themselves with the Noxious Weeds Act and also with the issues paper known as "Review of Legislation Concerning the Control of Weeds in NSW".

CONSIDERATIONS

5.1 OPPORTUNITIES TO BE EXPLOITED

Opportunities for advertising the need to contain and control spiny burrgrass will be exploited as and when they arise. For example district shows, radio and TV advertising.

5.2 INDUSTRY SECTORS

Industry sectors, whether they be private, government or semi government, should be aware of this weed and its potentially damaging effects. They should be cognizant with and adhere to high standards of hygiene whenever they come into contact with it (e.g. machinery, soil or stock) so as to minimise the risk of its spread. With this in mind they should also be aware of the weeds categorisation within their area so as to prevent breaches of the Noxious Weeds Act 1993.

5.3 ECOLOGICAL

Spiny burrgrass is a poor competitor, for this reason it does not affect the flora of an area it is more likely to occupy land denude or semi denude of other vegetation.

Good ground cover in the spring and summer appear to limit spiny burrgrasses ability to establish and set seed. In situations where this is so, the biodiversity of the location is unlikely to change. It, thus from an ecological perspective is unlikely to reduce catchment values.

5.4 SPECIES MANAGEMENT

There a many options available to both help reduce the spread of spiny burrgrass and reduce the infested area. Constant surveillance should be carried to identify new outbreaks, early control is the key to eradicating spiny burrgrass. Quarantine measures can also be used effectively. It is very important to keep a record of the area which is infested, preferable through the use of maps.

To eliminate spiny burrgrass management activities should aim to maximise desirable species competition, whilst destroying or minimising spiny burrgrass growth and its ability to set seed. Activities that may be adopted to carry out this aim are appropriate preventive measures, cultural controls, spraying of registered chemicals and biological controls when they are made available.

5.5 COMMUNITY

The general community feel that spiny burrgrass is of little concern. The community is not aware of the problems it can cause. When spiny burrgrass comes into contact with a persons skin, the skin can become very irritated. For this reason spiny burrgrass can reduce the recreational value of land.

5.6 EXTENSION AND EDUCATION

Is important to educate the members of the community about weeds and their potential risks. Many people cannot identify spiny burr grass (it is especially difficult to identify before it produces a seed head) they are therefore unaware of the problems which are caused by the weed and also the penalties which they may face under the Noxious Weed Act.

The public should be educated through various media both printed and electronic to make them aware of spiny burrgrass and how it affects the environment.

5.7 LINKAGES TO OTHER STRATEGIES

The National Weeds Strategy (Australia)
The NSW Weeds Strategy
The NSW Spiny Burrgrass Management Plan (1997-2001)
South West Spiny Burrgrass Action Project
Lachlan Catchment Management Plan

5.8 CONTINGENCIES

1. Identification difficult, therefore spray whole area using a residual spray.
2. Accurate maps.
3. Limited time to spray when seed forms.
4. Lack of competition from native species, overrun with Rhodes grass and Lovegrass.
5. Limited public awareness of the weed and the problems it can cause.
6. Lax attitudes or ignorance on the part of machinery operators, people moving stock, soil or produce which may be contaminated with weed seed.

PERFORMANCE INDICATORS

6.0 PERFORMANCE INDICATORS

Objective	Performance Indicator	Action	By Whom
1. Clearly document existing spiny burrgrass infestations within 2 years and reduce the area infested	1. Document within 2yrs and the area infested reduced by the end of the plan	1. Inspections, mapping and recording Inspect all known infested annually.	1. LCAs
2. Contain existing infestations of spiny burrgrass to core areas	2. . Ensure all buffer zones are treated	2. Herbicide treatment and integrated management. Inspections and issue notices	2. LCA, landowners, or Rural Land Protection Boards.
3. Investigate and promote the use of integrated weed management so that 90% of affected land managers are aware of such activities by the end of the plan period.	3. Affected landholders are aware of the benefits of integrated weed management	3. Notices , advices and inspections. , promote species replacement	3. LCAs.
4. Limit spread by preventing the movement of contaminated machinery, produce, soil and livestock.	4. Limited spread of spiny burr grass from infested areas	4. Signs on public areas warning of penalties for removal of material containg spiny burr grass. Advertising when signs are erected by 1/7/2001	4. LCAs, Rural Land Protection Boards.
5. Contain and control marginal and rare infestations on public and private lands	5. No known marginal or rare infestations left untreated.	5. Inspections every 3 weeks, issue notices, herbicide treatment	5. LCAs, Rural Lands Protection Boards and landholders.
6. Landholders will be given the opportunity to learn about effective control techniques, cropping practices and rotation options.	6. At the end of the plan farmers will be aware of agronomic and cultural measures which will help contain this weed.	7. Publicity, Field days. Participate in Orange Field Day display annually. Display NSW Ag. Brochures at seed merchant premises	5. LCA. NSW Agriculture.

BENEFITS

8.0 BENEFITS

Genuine long term benefits are expected to flow from this plan. The industries expected to benefit across the region are :-
Grazing (meat and wool)/Fodder
Viticulture
Horticulture
Tourism
CONTAIN FOR PEOPLE THAT HADN'T GOT IT.
Substantial cost reductions can be expected to flow to these industries (the economic value has not been assessed) because direct weed control costs may be less if the plan objectives are met.
Substantial increases in revenue to these industries can be expected (the economic value has not been assessed) because of increased production if the plan objective s are met.

MONITOR AND REVIEW PROCESS

7.0 MONITOR AND REVIEW PROCESS

Plan members will meet annually to discuss progress and review performance. An annual report based on the performance indicators in section 6.0 will be prepared. Failure to meet performance indicators will be documented in the report and remedial action agreed with the stakeholder will be documented as well.

RESOURCES

9.0 RESOURCES

Considerable time and effort will need to be invested in this plan by LCAs in the region if the plan objectives are to be met. Bearing in mind that the region other weeds to contend with, the allocation of resources is a difficult task.
However the allocation of time and resources will reflect the uneven distribution of the weed across the region.

REFERENCES

Anon (1998) Review of Legislation concerning the Control of Weeds in New South Wales. *NSW Government May 1998*

Anon (1998) Noxious Weeds Declaration list, October 1998

Cunningham, G. M., Mulham, W.E, Milthorpe, P.L. & Leigh, J.H. (1992).
Plants of western New South Wales. Inkata: Melbourne

Lamp, C. A., Forbes, S.J. & Cade, J.W. (1990). *Grasses of temperate Australia: a field guide.*
Inkata: Melbourne

Milvain, H. (1997). Herbicide control of noxious weeds 1997: *A guide to noxious weed control in non-crop situations.* NSW Agriculture: Orange

Murrumbidgee Catchment Management Plan

National Weeds Strategy (Australia)

NSW Spiny burrgrass Management Plan: September 1997 to May 2001

NSW Weeds Strategy

Parsons, W. T. & Cuthbertson E.G. (1992). *Noxious weeds of Australia.*
Inkata: Melbourne

The Eastern and Western Riverina Noxious Weeds Advisory Groups
Noxious Weed Management Plans for the Greater Riverina Region

ST. JOHNS WORT MANAGEMENT PLAN

COVER PAGE

1.1 PLAN TITLE

St . Johns Wort Management Plan for the Central West Region.

1.2 PLAN PROPONENTS

The Lachlan Valley Noxious Weeds Advisory Group.

Group Secretary : Kevin Nelligan
Cowra Shire Council
PO Box 342
Cowra NSW 2794
Ph. 02 63402000
Fax . 02 63402033
Email council@cowra.nsw.gov.au

Group Scribe: John Spencer
Lachlan Shire Council
PO Box 216
Condobolin NSW 2877
Ph. 02 68954444
Fax. 02 68953478
Email lachl@mpx.com.au

Group Chairman... ... ...
Don Lawrence LVNPAC

Date... .../... .../.1999

1.3 NAME OF PLANT

St. Johns Wort Hypericum perforatum
Weed of national significance No

1.4 PLAN PERIOD

1 July 2000 to 30 June 2005 (5 years)

1.5 AREA OF OPERATION

Signatories to this plan include:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cowra Shire Council
Weddin Shire Council
Cootamundra Shire Council

1.6 AIM

To limit St. Johns Wort to existing infestations in core areas and prevent its spread from marginal areas.

1.7 OBJECTIVES

1. Suppress and destroy all new outbreaks before seed sets in the year of discovery.
2. Locate all infestations on Council land.
3. Limit the spread of St. Johns Wort from core areas.
4. Minimise the spread from marginal areas.
5. Landholders will be given the opportunity to learn about effective control techniques, cropping practices and rotation options.

TABLE OF CONTENTS

STAKE HOLDERS

2.1 SIGNATORIES

Local control authorities include the following councils:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cowra Shire Council
Weddin Shire Council
Cootamundra Shire Council

2.2 OTHER KEY STAKEHOLDERS

Other key stake holders include:-

Land owners
SRA
RTA
NSW Agriculture
State Forests
Landcare groups
Lachlan Catchment Management Committee
National Parks and Wildlife
Rural Lands Protection Boards

BACKGROUND AND GENERAL FACTS

3.1 REASON FOR THE PLAN

The capacity of St.Johns Wort to replace more desirable plant species makes it a threat to agricultural and horticultural production. This plant also may have a detrimental affect on stock health due to its hypericum content.

3.2 DESCRIPTION OF THE PROBLEM

St. Johns Wort is found in the more temperate sector of this region. Its main habitat is in areas with greater than 600mm rainfall per year and at elevations of between 600 to 1500m. However encroachments of this plant outside its ideal habitat have been mapped in the west of the region (for example in the Lachlan and Bland shires)
The major infestations of this plant are in the east of the region where the plant is a vigorous competitor for nutrients,light and moisture to the point where it can eliminate all competition. This characteristic is assisted by the fact that the plant is not a desirable grazing species to most commercial stock.
Thus Wort is a problem for two main reasons:-

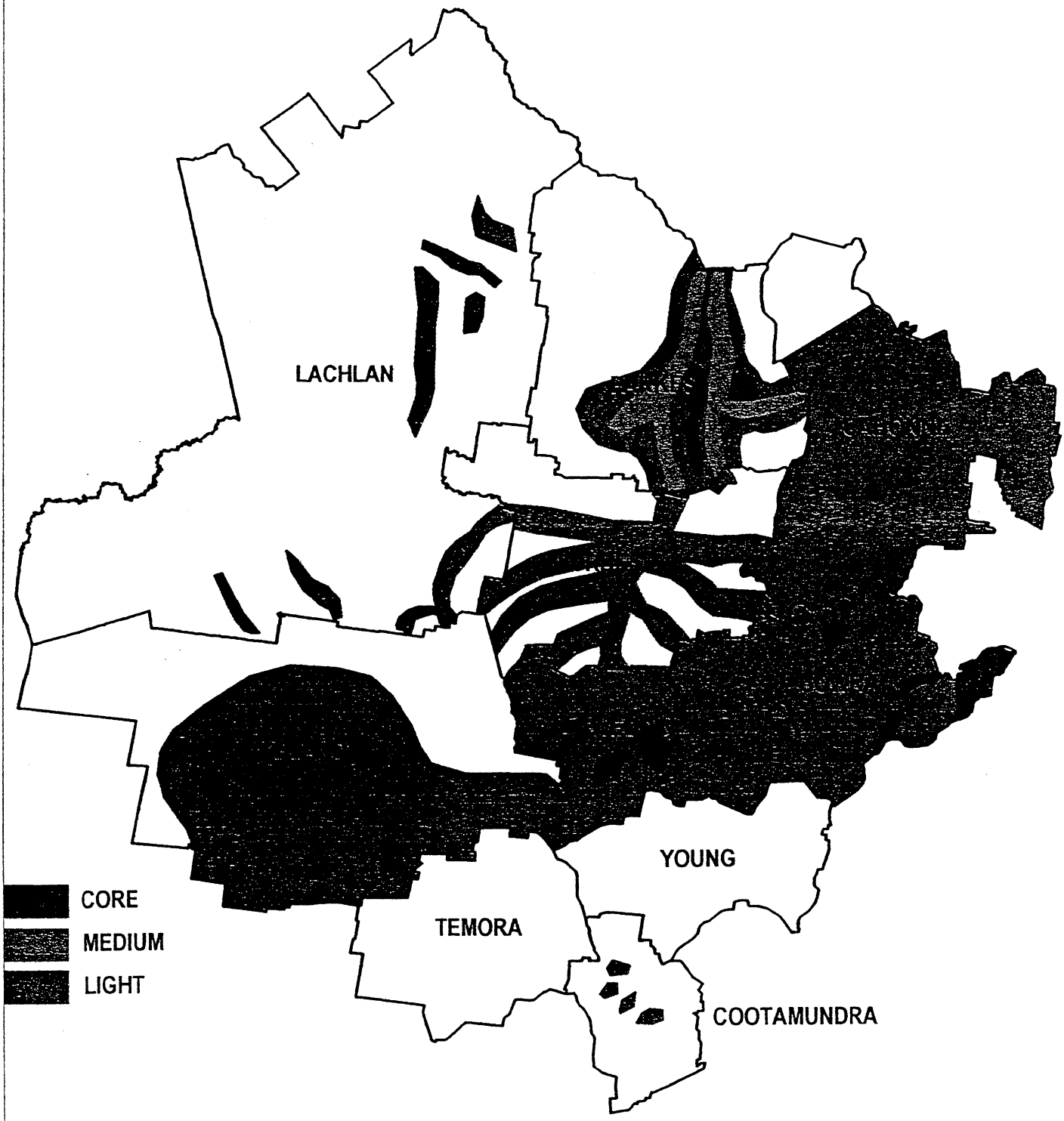
1. It causes loss of production to plant and livestock industries and the costs of control impact on the cost production.
2. Its presence on public land such as reserves, roads, railway lines and waterways can lead to considerable loss of species diversity.

The plant is found on private land, on stock reserves and road sides.

3.3 DISTRIBUTION OF KNOWN INFESTATIONS

Please see following page for map.

DISTRIBUTION OF KNOWN INFESTATIONS - "ST. JOHNS WORT"



3.4 WEED BIOLOGY/ECOLOGY

St. Johns Wort germinates from autumn to spmg in the presence of light , when temperatures are mild and following rain which is required to remove an inhibitor. Following establishment, this perenial plant has two different growth forms. During autumn and winter growth is in the form of non-flowering, densely foliated, prostrate stems to 30 cm long. In spring, plants produce flowering leafy hairless stems, which are erect and woody.

Leaves are stalkless, opposite and green (lighter on lower surface) to 3cm long. They are a narrow oblong (ovate to linear) shape, having many tiny oil glands which give them a perforated appearance when held up to the light.

Flowering occurs during late spring through to mid summer (does not normally occur in a plant's first year of growth). Flowers are golden yellow to 2.5cm in diameter and occur in terminal clusters on a forked leafy panicle.

Fruits are sticky to 10mm long. They are a three-celled capsule containing many seeds (1mm by 0.5mm, cylindrical, light brown and pitted) which are released on ripening in the summer. Plants may produce up to 30,000 seeds which may remain viable for 12 years.

The root system of St. Johns wort plants is a combonation of verticle roots growing to 1m deep and lateral roots (rhizomes) which occur just below the soil surface. Laterals can produce buds that become new plant growth (suckers).

3.5 METHOD AND RATE OF SPREAD

St.Johns Wort is mainly spread by seed, however spread can also result from rhizome growth and dispersal following fragmentation by soil disturbance such as cultivation (if left undessicated).

Seeds may be carried short distances by wind however dispersal by water, water and soil movement (e.g. mud on machinery), adherence to animal fur and wool, and as contaminants of produce are the main forms of movement. Seeds passing through animals can also remain viable.

3.6 ROLES AND RESPONSIBILITIES OF LAND MANAGERS

Land owners and / or occupiers have the prime responsibility in containing Wort to its core areas.
Shire Weeds Officers have inspectorial responsibility for ensuring that landholders carry out control activities.
Shires are responsible for containment and control on roads. Whilst Rural Lands Protection Boards are responsible for containment and control TSRs.
State Rail Authority is responsible for containment and control on railway enclosures.

LEGISLATIVE AND REGULATORY SITUATION

4.1 CURRENT DECLARATION

Council	Current Declaration
Parkes Shire Council	W2
Forbes Shire Council	W2
Cabonne Shire Council	W3
Bland Shire Council	W2
Lachlan Shire Council	W2
Cowra Shire Council	W2
Weddin Shire Council	W2
Cootamundra Shire Council	W2

A type W2 weed means that the weed must be fully and continuously suppressed and destroyed. A W3 type weed means the weed must be prevented from spreading and its numbers and distribution reduced.

4.2 DECLARATION CHANGES

No declaration changes are envisaged in the next year.

4.3 ENFORCEMENT STRATEGY

Stakeholders must familiarise themselves with the Noxious Weeds Act and also with the issues paper known as "Review of Legislation Concerning the Control of Weeds in NSW".

CONSIDERATIONS

5.1 OPPORTUNITIES TO BE EXPLOITED

Opportunities for advertising the need to contain and control St.Johns Wort will be exploited as and when they arise. For example district shows, radio and TV advertising.

5.2 INDUSTRY SECTORS

Industry sectors, whether they be private, government or semi government, should be aware of this weed and its potentially damaging effects. They should be cognizant with and adhere to high standards of hygiene whenever they come into contact with it (e.g. machinery, soil or stock) so as to minimise the risk of its spread. With this in mind they should also be aware of the weeds categorisation within their area so as to prevent breaches of the Noxious Weeds Act 1993.

5.3 ECOLOGICAL

Because this weed is a vigorous competitor, its removal or reduction can be expected to increase the plant bio-diversity of areas where it was dominant.

5.4 SPECIES MANAGEMENT

Integrated weed management is the key to the eradication of St Johns Wort. This includes the spraying of roads and the biological control of inaccessible land. There are a number biological options available to contain St Johns wort both flora and fauna. The plant species that are effective in controlling St Johns wort are Australian commercial phalaris, Sirosa phalaris, Currie cocksfoot, Subterranean clover. The insects that are effective in the control of St Johns wort are Chrysolina beetles, Agrilus hyperici, Gall midge, Aphis chloris and Aculus hyperici. Hygienic methods must be used when moving livestock and machinery.

5.5 COMMUNITY

The development of an economic use for St.Johns Wort has clouded its pariah status as a weed. Indeed the debate over what constitutes a weed and under what circumstances will swing back and forth according to the farming industries concept of economic value and economic impact.

For the moment this plant is still Category W2 which as far as this paper is concerned means that the community needs to be educated as to its economic impact rather than its economic value as a herbal medicine.

A major barrier to achieving the stated objectives is the perception by some sections of industry that this plant has commercial value. Because of this it may prove difficult in the term of this plan to convince some stakeholders of the extent of this problem.

5.6 EXTENSION AND EDUCATION

The public needs to be educated to the health risks of the plant ie skin contact may cause irritation. The dry mature plant is a fire hazard in summer and its infestation of recreational sites is both a health problem and an aesthetic problem. The use of extract from this plant has been touted by the 'alternative health' industry to produce benefits ranging from wet dreams to a cure for gout. However the public need to be made aware of the potential problems of St. Johns Wort as well as the penalties, for failing to implement control, under the Noxious Weeds Act. Personal contact through inspections is perhaps the best way to get this message across. To this end funding received under this plan will be committed to inspection costs.

5.7 LINKAGES TO OTHER STRATEGIES

The National Weeds Strategy (Australia)
The NSW Weeds Strategy
The NSW St. Johns Wort Management Plan
Lachlan River Catchment Management Plan

5.8 CONTINGENCIES

The main barrier to this plan is seen as the growing ambivalence of the landholder section of the stakeholders towards the economic value of this plant. Extension and education during inspections must be aimed at countering this .

PERFORMANCE INDICATORS

6.0 PERFORMANCE INDICATORS

Objective	Performance Indicator	Action	By Whom
1 Suppress and destroy new outbreaks in marginal areas before seed sets in year of discovery.	1.All known infestations on council land sprayed by the end of January annually.	1. Herbicide treatment	1. LCAs, Rural Lands Protection Boards.
2. Locate all infestations on Council land.	2. All infestations are located annually	2 Inspections, mapping and recording.	2. LCAs
3. Limit the spread of St Johns Wort from core areas.	3. Limit the spread from core areas to less than 5%	3. Integrated weed management by treatment of core areas Release of biological control agents. Inspections and issue of notices	3. LCAs landholders
4. Minimise the spread from marginal areas.	4. Ensure all marginal areas areas treated annually	4. Inspections issuing of notices	4. LCAs landholders Rlpbs
5. Landholders will be given the opportunity to learn about effective control techniques, cropping practices and rotation options	5. At the end of the plan farmers will be aware of agronomic and cultural measures which will help contain this weed.	5. Publicity, Field days. Participate in Orange Field Day display annually. Display NSW Ag. Brochures at seed merchant premises.	5. LCAs NSW Agriculture.

MONITOR AND REVIEW PROCESS

7.0 MONITOR AND REVIEW PROCESS

Plan members will meet annually to discuss progress and review performance. An annual report based on the performance indicators in section 6.0 will be prepared. Failure to meet performance indicators will be documented in the report and remedial action agreed with the stakeholder will be documented as well.

BENEFITS

8.0 BENEFITS

Genuine long term benefits are expected to flow from this plan. The industries expected to benefit across the region are :-
Grazing (meat and wool)/Fodder
Viticulture
Horticulture
Tourism

Cost reductions can be expected to flow to these industries (the economic value has not been assessed) because direct weed control costs may be less if the plan objectives are met.
Substantial increases in revenue to these industries can be expected (the economic value has not been assessed) because of increased production if the plan objective s are met.

RESOURCES

9.0 RESOURCES

Considerable time and effort will need to be invested in this plan by LCAs in the region if the plan objectives are to be met. Bearing in mind that the region has other weeds to contend with, the allocation of resources is a difficult task.
However the allocation of time and resources will reflect the uneven distribution of the weed across the region.

REFERENCES

Campbell, M.H., & Watson, R.W. (1994). **Agfact: P7.6.1.** St Johns wort. NSW Agriculture

Fisher, J. (1998). **Agnote: DAI/66.** Legal issues in harvesting St. Johns wort . NSW Agriculture

Sampson, B. (1994). **Agnote: Reg 2/097.** Biological control of St. Johns wort. NSW Agriculture

Anon (1998) Review of Legislation Concerning the Control of Weeds in NSW. NSW Government May 1998.

Anon (1998) Noxious Weeds Declaration list, October 1998

Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (1992).
Plants of Western New South Wales . Inkata: Melbourne.

The Eastern and Western Riverina Noxious Weeds Advisory Groups
Noxious Weed Management Plans for the Greater Riverina Region.

WILD RADISH MANAGEMENT PLAN

COVER PAGE

1.1 PLAN TITLE

Wild Radish Management Plan for the Central West Region.

1.2 PLAN PROPONENTS

The Lachlan Valley Noxious Weeds Advisory Group.

Group Secretary : Kevin Nelligan
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Group Scribe: John Spencer
Lachlan Shire Council
PO Box 216
Condobolin NSW 2877
Ph. 02 68954444
Fax. 02 68953478
Email lachl@mpx.com.au

Group Chairman ... ...
Don Lawrence LVNPAC

Date ... .../... .../.1999

1.3 NAME OF PLANT

Wild Radish *Raphanus raphanistrum L.*

Weed of national significance No

1.4 PLAN PERIOD

1 July 2000 to 30 June 2005 (5 years)

1.5 AREA OF OPERATION

Signatories to this plan include:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cootamundra Shire Council
Cowra Shire Council
Weddin Shire Council

1.6 AIM

To reduce the area of Wild Radish infestations and stop its spread into uncontaminated areas areas.

1.7 OBJECTIVES

1. Promote measures that will reduce the spread of Wild Raddish seed.
2. Ensure control and containment measures reduce the area infested on council controlled land.
3. Ensure control and containment measures reduce the area infested on private land.
4. Landholders will be given the opportunity to learn about effective chemical control techniques, cropping practices and rotation options.

TABLE OF CONTENTS

STAKE HOLDERS

2.1 SIGNATORIES

Local control authorities include the following councils:-

Parkes Shire Council
Forbes Shire Council
Cabonne Shire Council
Bland Shire Council
Lachlan Shire Council
Cootamundra Shire Council
Cowra Shire Council
Weddin Shire Council

2.2 OTHER KEY STAKEHOLDERS

Other key stake holders include:-

Land owners
SRA
RTA
NSW Agriculture
State Forests
Landcare groups
Lachlan Catchment Management Committee
RLPBs

BACKGROUND AND GENERAL FACTS

3.1 REASON FOR THE PLAN

Wild radish affects both crops and pastures by reducing yields and contaminating grains, seeds and hay. Wild radish seeds are difficult to remove from grain and also contain toxins that can affect livestock. Wild radish also is a host for a range of plant diseases and other pests.

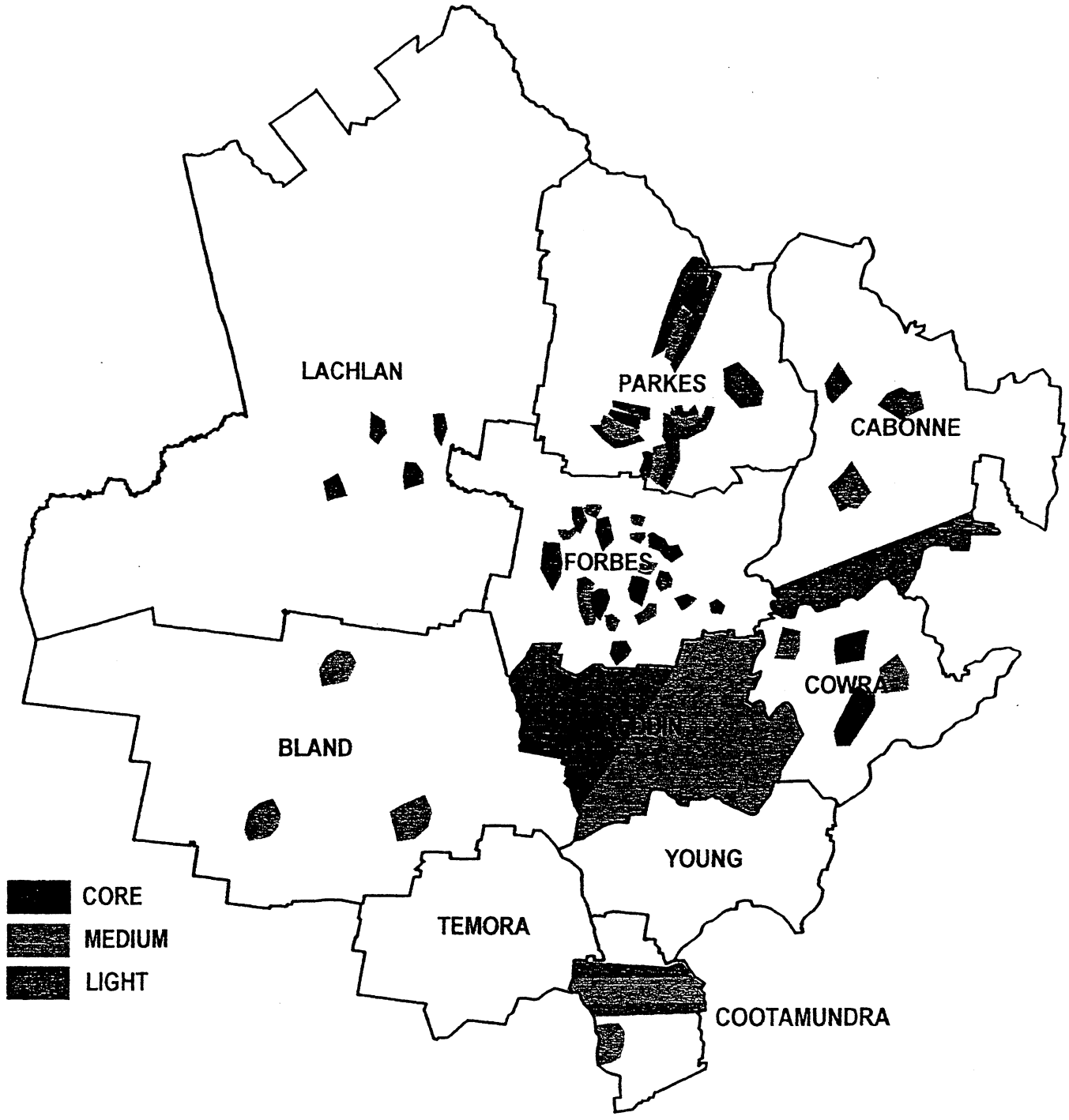
3.2 DESCRIPTION OF THE PROBLEM

Wild radish is an extremely competitive weed and it is essential to control it early before competition with crops results in major grain yeild losses. It is a prolific seeder. Even low density infestations can reduce crop yields. Also this weed germinates throughout the year and over several seasons eradication requires thorough and persistent spraying. It is primarily a weed on cultivated land and would account for the majority of chemical costs for farmers in the region.

3.3 DISTRIBUTION OF KNOWN INFESTATIONS

See map on the next page

DISTRIBUTION OF KNOWN INFESTATIONS - "WILD RADISH"



3.4 WEED BIOLOGY/ECOLOGY

Wild radish is an annual or occassionally biennial plant growing to 1.5m Wild radish generally germinates after autumn rains when the day and night temperatures can range from 5 to 20 degrees celsius, however wild radish can germinate anytime throughtout the growing season. Cultivation tends to encourage germination in wild radish.

Wild radish has a bluish green stem, with its lower leaves being deeply lobed with a broad terminal lobe at the apex. The upper leaves are narrow, shorter and often undivided. The leaves are course with stiff short bristles.

The flowers of the wild radish plant are either white or pale yellow with violet viens. Flowers are clustered together. The flowers have four alternating petals which are between 2.5 and 4.0 cm in diameter.

The seeds of the wild radish plant are formed in 2 cell cylindrical pods which are between 3 and 8cm long and from 3 to 6mm wide. The pods are longitudinally ribbed and constricted between the seeds and stand on erect spreading stems approximatley 1.5cm long.The pod breaks into single seed units when ripe.

The seeds are of a reddish or yellowish brown, broadly ovoid, 2 to 4mm long, covered with a fine surface network.

The root system of the wild radish plant consist of a slender taproot 80 to 160cm long with fibrous laterals in the upper 20cm of soil.

3.5 METHOD AND RATE OF SPREAD

Wild radish seeds are spread through wind, water, animals and man. The main way that wild radish is spread is through the contamination of agricultural produce and contamination of agricultural machinery.

3.6 ROLES AND RESPONSIBILITIES OF LAND MANAGERS

Land owners and / or occupiers have the prime responsibility in containing Wild raddish to its core areas.
Shire Weeds Officers have inspectorial responsibility for ensuring that landholders carry out control activities.
Shires are responsible for containment and control on roads.
Rural Lands Protection Boards are responsible for containment on TSRs and reserves.
State Rail Authority is responsible for containment and control on railway enclosures.

LEGISLATIVE AND REGULATORY SITUATION

4.1 CURRENT DECLARATION

Council	Current Declaration
Parkes Shire Council	W2
Forbes Shire Council	W2
Cabonne Shire Council	W2
Bland Shire Council	W3
Lachlan Shire Council	W2
Cootamundra Shire Council	not declared
Cowra Shire Council	W3
Weddin Shire Council	W2

W2 means the weed must be fully and continuously suppressed and destroyed.
W3 means the weed must be prevented from spreading and its numbers and distribution reduced.

4.2 DECLARATION CHANGES

No declaration changes are envisaged in the next year.

4.3 ENFORCEMENT STRATEGY

Stakeholders must familiarise themselves with the Noxious Weeds Act and also with the issues paper known as "Review of Legislation Concerning the Control of Weeds in NSW".

CONSIDERATIONS

5.1 OPPORTUNITIES TO BE EXPLOITED

Opportunities for advertising the need to contain and control Wild Radish will be exploited as and when they arise. For example district shows, radio and TV advertising.

5.2 INDUSTRY SECTORS

Industry sectors, whether they be private, government or semi government, should be aware of this weed and its potentially damaging effects. They should be cognizant with and adhere to high standards of hygiene whenever they come into contact with it (e.g. machinery, soil or stock) so as to minimise the risk of its spread. With this in mind they should also be aware of the weeds categorisation within their area so as to prevent breaches of the Noxious Weeds Act 1993.

5.3 ECOLOGICAL

Because of Wild Radishe's ability to compete with other species its reduction and control will lead to rejuvenation of other plant life where wild radish is dominant.

5.4 SPECIES MANAGEMENT

Identification of wild radish outbreaks early is the key to minimising infestations. If infestations are found early in the plant cycle then control measures can be implemented earlier leading to faster eradication. Where wild radish is present, management activities should aim to maximise desirable species competition whilst destroying or minimising wild radish growth and its ability to set seed. Stakeholders should use preventative measures, registered chemicals and cultural controls to reduce wild radish infestations.

5.5 COMMUNITY

Wild radish affects those people involved in agricultural industries because of reduced yields and productivity. Buyers of grain buyers the buy the grain and fodder are also affected because Raddish seed is a major contaminant in grain like wheat, barley and canola. However large proportions of the general public are not aware of the major problem that wild radish is.

5.6 EXTENSION AND EDUCATION

Extension and education are key components of weed management. It is important that members of the public can identify wild radish, understand the potential problems it can cause and be made aware of the potential penalties under the Noxious Weed Act.

Extension messages must address these issues and may be delivered through, the electronic and print media, field days /workshops (which may also assist in the formulation of messages), personal contact during inspections and through the provision of printed material to the general public.

5.7 LINKAGES TO OTHER STRATEGIES

The national strategy (Australia)
The New South Wales Weeds Strategy
Lachlan Catchment Management Plans

5.8 CONTINGENCIES

The main barrier is seen as educating farmers to use seed free of Raddish. The seed is very hard to clean from cereal seed hence this is a weed which is easily spread from farm to farm through the purchase of contaminated seed and hay.

Another barrier is educating farmers to use seed that is resistent to herbicides that may be used to control raddish, for example the new strains of canola.

PERFORMANCE INDICATORS

6.0 PERFORMANCE INDICATORS

Objective	Performance Indicator	Action	By Whom
1. Promote measures that will reduce the spread of Wild Raddish seed.	1. Response to landholder questionaire, 1/7/2001 and another questionaire at end of the plan 1/7/2005	1. Develop and distibute questionaire	1. LCA
2 Ensure control and containment measures reduce the area infested on council controlled land.	2. All known outbreaks of roadside Wild Raddish are treated	2. Spraying of council land completed annually by 31st December.	2. LCA
3 Ensure control and containment measures reduce the area infested on private land.	3. The number of properties infested reduced compared with the start of the plan	3. Mapping Recording Issue notices	3. LCA Landholders
4. Landholders will be given the opportunity to learn about effective chemical control techniques cropping practices and rotation options.	4. At the end of the plan farmers will be aware of agronomic and cultural measures which will help contain this weed.	4. Publicity Field days Participate in Orange Field day display annually TV advertising campaign Sept .and Jan. annually Display NSW Ag. Brochures at seed merchant premises	5. LCA Nsw Agriculture

BENEFITS

8.0 BENEFITS

Genuine long term benefits are expected to flow from this plan. The industries expected to benefit across the region are :-
Grazing (meat and wool)/Fodder
Cropping
Horticulture

Cost reductions can be expected to flow to these industries (the economic value has not been assessed) because direct weed control costs may be less if the plan objectives are met.
Substantial increases in revenue to these industries can be expected (the economic value has not been assessed) because of increased production if the plan objectives are met. For example it is known that 10 Raddish weed plants per square meter will reduce yields by 10%-20%.

MONITOR AND REVIEW PROCESS

7.0 MONITOR AND REVIEW PROCESS

Plan members will meet annually to discuss progress and review performance. An annual report based on the performance indicators in section 6.0 will be prepared. Failure to meet performance indicators will be documented in the report and remedial action agreed with the stakeholder will be documented as well.

RESOURCES

9.0 RESOURCES

Considerable time and effort will need to be invested in this plan by LCAs in the region if the plan objectives are to be met. Bearing in mind that the region has other weeds to contend with, the allocation of resources is a difficult task.
However the allocation of time and resources will reflect the uneven distribution of the weed across the region.

REFERENCES

Anon (1998). Review of Legislation Concerning the Control of Weeds in New South Wales. *NSW Government May 1998*

Anon (1998) Noxious Weeds Declaration list, October 1998

Cheam, A.H. & Code, G.R. (1995). The biology of Australian Weeds 24. *Raphanus raphanistrum L. Plant Protection Quarterly,* **10**(1), pp2-13

Milvain, H. (1997) *Herbicide control of noxious weed 1997: A guide to noxious weed control in non-crop situations.* NSW Agriculture: Orange

Murrumbidgee Catchment Management Plan

National Weeds Strategy (Australia)

NSW Weeds Strategy

Parsons, W.T. & Cuthbertson, E.G. (1992) *Noxious weeds of Australia.* Inkata: Melbourne

APPENDIX C

DRAFT VERTEBRATE PEST CONTROL MANUAL

NSW Agriculture

David Croft
Wagga Wagga Agricultural Institute
WAGGA WAGGA, NSW 2650
Tel. (02) 6938 1986
Fax. (02) 6938 1995

The 2003 version of the NSW Agriculture's Vertebrate Pest Control Manual is currently in preparation. This draft of the Manual has been made available to certain organisations on the understanding that until it has been fully edited and approved by NSW Agriculture, it will remain as a draft document only.

The information contained is the best available at the time of issue and may not apply in all circumstances. Readers must obtain confirmation of information.

The information in this document will be subject to change and neither the authors or NSW Agriculture accepts any liability from the interpretation or use of the information set as out in this draft document.

David Croft
Agricultural Protection Officer
Murray/Murrumbidgee Region

14 August 2003

Vertebrate pest control manual

Fifth edition, 2003

Agricultural Protection Program
NSW Agriculture

SUMMARY
This Manual was written primarily for Rural Lands Protection Board, National Parks and Wildlife Service and other government officers involved in the control of vertebrate pests in NSW. However, it is also essential reading for staff of other agencies involved in vertebrate pest control. It is intended to promote uniform standards of control, administration and safety throughout the State.

Control techniques and a general summary of the biology and behaviour of the major vertebrate pests (rabbits, feral pigs, wild dogs, foxes, mice, feral goats and deer) are detailed.

The legal responsibilities which govern the control of vertebrate pests under the Rural Lands Protection Act 1998 are defined. The restrictions which control the use of pesticides, particularly 1080, under the Pesticides Act are outlined.

As the only personnel allowed to handle 1080 poison in NSW are Authorised Control Officers (ACO's) then this Manual provides the 'Legislative and Policy Requirements', 'Administration' and Poisons Sections relating to pest animal management, poisons and bait mixing rates. To retain authorisation, an ACO must attend the first available NSW Vertebrate Pest Management Course and have a working knowledge of the Vertebrate Pest Control Manual.

This publication evolves from and replaces the Rabbit Inspectors' Vertebrate Pest Control Manual (1977), Vertebrate Pest Control Manuals 1990 & 1996, and most 1080 circulars previously issued. It is designed to be easily updated and enlarged by the inclusion of Pest Control Orders, Pesticide Control Orders, Agfacts, Advisory Notes, Agnotes and circulars.

IMPORTANT: USE OF PESTICIDES

ALWAYS READ THE LABEL

Users of agricultural (or veterinary) chemical products must always read the label and any Permit before using the product, and strictly comply with the directions on the label and the conditions of any Permit. Users are not absolved from compliance with the directions on the label or the conditions of the permit by reason of any statement made or not made in this publication.

Parts of the chemical use pattern quoted in this publication are approved under Permit(s) issued by the National Registration Authority and in force at the time the publication was prepared. Persons wishing to use a chemical in the manner approved under Permit should obtain a copy of the relevant permit from the NRA and must read all the details, conditions and limitations relevant to that Permit, and must comply with the details, conditions and limitations prior to use.

Draft for the NSW Agriculture Vertebrate Pest Control Manual
Author - David Croft May 2003

CONTENTS

PEST ANIMALS

RABBIT BIOLOGY AND CONTROL

* Rabbit biology
* Rabbit control
* Monitoring rabbit populations and control progress
* Initial reduction: poisoning with 1080
* Pindone bait for rabbits
* Extensive control: warren destruction by ripping
* Follow-up control: warren destruction by blasting
* Follow-up control: fumigation
* Follow-up control: warren flooding
* Follow-up control: other forms of harbour destruction
* Mop-up (advanced) control
* Myxomatosis
* Rabbit calicivirus disease (RCD)
* Fencing
* Advanced spotlight counting techniques for rabbits and other pest animals

FERAL PIG BIOLOGY AND CONTROL

* Feral pig biology
* Impact of feral pigs
* Integrated feral pig management

WILD DOG BIOLOGY AND CONTROL

* Wild dog biology
* Agricultural impact
* Wild dog control
* Poisoning
* Trapping
* Shooting
* Fencing
* Guard dogs

FOX BIOLOGY AND CONTROL

* Fox biology
* Fox control
* Using 1080 fox baits
* Electric fencing
* Shooting
* Guard dogs

MOUSE BIOLOGY AND CONTROL

* Mouse biology
* Mice as pests
* Mouse control – physical
* Mouse control – chemical

FERAL GOAT BIOLOGY AND CONTROL

* Feral goat biology
* Agricultural and environmental damage

* Feral goat control

MONITORING TECHNIQUES

FURTHER READING

ACKNOWLEDGMENTS

APPENDICES AND INSERTIONS
Pesticide Control Orders
Pest Control Orders
Agfacts
Agnotes

Abbreviations and Acronyms

ACO	Authorised Control Officer *– person authorised to use 1080.*
APO	Agricultural Protection Officer *– employee of NSW Agriculture who assists the ACO.*
DV	District Veterinarian
EP & A	Environmental Planning and Assessment Act, 1979
EPA	Environmental Protection Authority
NPWS	National Parks and Wildlife Service
POCTAA	Prevention of Cruelty to Animals Act, 1979
PPE	Personal Protection Equipment
RLPB	Rural Lands Protection Board
TSCA	Threatened Species Conservation Act, 1995
VO	Veterinary Officer

INTRODUCTION

Pest Animal Control in NSW

In NSW, pest animal control is the responsibility of landholders and land managers who occupy both private and public land. All occupiers of land are obliged under the Rural Lands Protection Act 1998 to continually suppress and destroy pest animals on their land. Animals that are currently declared pest species in NSW are wild dogs, rabbits and feral pigs.

The Rural Lands Protection Act 1998 is administered by the 48 Rural Lands Protection Boards (RLPB's). All staff employed by RLPB's are responsible for:

- Providing advice and assistance to landholders on pest animal control strategies.
- Promoting, organising and coordinating group control programs.
- Providing regulatory functions to ensure landholders comply with the Rural Lands Protection Act.

Authorised Control Officers (ACO's)

Sodium monofluoroacetate (1080, pronounced ‘ten-eighty’) is one of the most effective vertebrate pest control tools available in NSW today. However, the high toxicity of 1080 means that under the Pesticides Act 1999, its use is closely regulated by the Environment Protection Authority (EPA). Only persons who have been appropriately trained and have passed the approved practical and written 1080 examinations handle 1080 solution and prepare baits from that solution.

These Authorised Control Officers (ACO's) include selected staff from Rural Lands Protection Boards, NSW Agriculture, the National Parks and Wildlife Service, State Forests of NSW and other appropriate land management authorities from government.

1.0 Legislative and policy requirements

Rural Lands Protection Board pest control officers work within a number of Acts and Regulations, as well as conditions set by NSW Agriculture. This ensures that vertebrate pests are controlled effectively and efficiently, that the rights of all landholders are protected, and that safety standards are maintained at a high standard.

For these reasons, it is most important that pest control officers know and understand the contents of this section of the manual as well as the Acts and Regulations referred to, particularly the:

* Rural Lands Protection Act 1998,
* Pesticides Act 1999 and
* OH&S Regulation 2001.

Other Acts (and associated Regulations) that a pest control officer will need to be familiar with are the:

* National Parks and Wildlife Act 1974.
* Threatened Species Conservation Act 1995.
* Occupational Health & Safety Act 2000
* Prevention of Cruelty to Animals Act 1979
* Environmental Planning and Assessment Act 1979
* Game and Feral Animal Control Act 2002.
* Local Government Act 1993.
* Companion Animals Act 1998.

Some Acts authorise the use of poisons, authorise officers and describe techniques while other legislation may determine the control on use of poisons and pest control programs. Pest control officers must remember that the relevant legislation in NSW for vertebrate pest control and pesticide use may vary from legislation in the other states.

Although there are far too many acts and provisions to list in this section, complete copies of legislation are available on the web at: http://www.austlii.edu.au or http://www.lawfoundation.net.au/

1.1 RELEVANT SECTIONS AND REGULATIONS OF THE RURAL LANDS PROTECTION ACT 1998

The more relevant parts of the Act are summarised here in simplified form. This summary does not replace Part 11 of the RLP Act 1998; it is intended only to give a broad overview of the duties and responsibilities of Rural Lands Protection Boards, landholders and pest control officers.

Pest animals

The Minister may proclaim any animals or birds to be a pest animal in any part of NSW (and also vary or withdraw the proclamation) by publishing in the Government Gazette [RLP Act 1998, P11, S143]. Currently, rabbits, wild dogs and feral pigs are declared pest animals under the relevant Pest Control Orders for each species.

The Pest Control Order (PCO's)

Under the RLP Act 1998 S143, the Pest Control Order may direct that particular control methods are to be used. These PCO's include methods to remove a pest animal, methods to prevent the spread of a pest animal, and may include methods to remove or destroy harbour. [see each individual Pest Control Order].

The object of this Part of the RLP Act is to facilitate the control of pest animals or birds on designated public or private land that are adversely impacting on agricultural enterprises or the local environment or both.

Order to use control methods

Rural Lands Protection Boards may order the occupier or owner of any land to control pest animals using any legal method: applying a registered or permitted pesticide; fumigating; digging in or out; ploughing in or out; explosives; trapping; dogging;

removal or destruction of harbour; ripping; and shooting. The Order can also specify that alternative methods be used, within a specified period of time. [RLP Act. 1998. S143 (3, 4) Pest Control Orders].

RLP Boards may apply to the Minister for a control order to suppress or eradicate a pest bird or animal on private or public lands.

Responsibility to control
Occupiers of private land to which a control order applies must implement any control measures specified in that order [RLP Act, 1998, S155]. Occupiers or managers of public land to which a control order applies must '*to the extent necessary to minimise the risk of the pest causing damage to any land*' implement any control measures specified in that order [RLP Act, 1998 S156].

An occupier of any public lands, such as RLPB's (on travelling stock routes and reserves) State Forests, National Parks and Local government bodies eg. Local Councils (roads, reserves etc) are also responsible for the control of pest animals [RLP Act, 1998, S156].

A Board, its employee or an agent may enter such land and take such measures and carry out such work as required by the order for the control of pest animals [RLP Act 1998, S169]. An authorised officer can only enter land if a PCO authorises this action (Section 142(2)(f)) [*– which the PCO does not authorise at this point I time*] or if 169(b) is not complied with. A Board should ensure they go through the 'notice' and 'individual eradication order' process first.
Where there are reasonable grounds to believe that pest animals are being kept in captivity on residential premises, a person authorised by a Board may obtain from a Magistrate, a warrant authorising entry onto the premises for the purpose of controlling any such animals. [RLP Act, 1998, S170].
Under section 191[RLP Act, 1998] an authorised officer could also enter a premise if:

1. The occupier allows them to enter,
2. If the entry is required urgently and the Board authorises the officer to enter, and
3. Entry is required to eradicate a captive pest that is being kept without lawful authority.

Destruction of harbour
Occupiers of land that remove or destroy pest animal *harbour* (including habitats and refuges) as part of a pest control program will need to ensure that such work is consistent with the Local Vegetation Management Plan.
There may also be a requirement to determine whether the destruction of harbour, which may be habitation for threatened or native species, contravenes the Threatened Species Conservation Act (1995

Power of entry (general)
Authorised Officers and other persons authorised by an RLP Board have the right to enter any land to determine whether this Act is being followed. [RLP Act, 1998 S182, S183]

An authorised officer of a RLP Board may enter premises or any lands and take such steps as are necessary to determine that the provisions of the Act and any control order are being complied with [RLP Act, 1998, S182].
However, notice of entry must be given at least one day prior to entry [RLP Act, 1998, S191].

Control work by RLP Board
After twenty four hour's notice to the occupier or owner of its intention to undertake work, a RLP Board may authorise its staff or contractors to enter land and carry out necessary control work and destruction of harbour. [RLP Act, 1998, S169]

However, a Board will need to issue a notice to the occupier before issuing an individual eradication order.

The Pest Eradication Order
An Eradication Order to control pests and the methods available will be on a letter

devised by the Board. This may be delivered personally or posted to the person's usual or last known address. In the case of a corporation, an Order may be left at the registered office with an adult employee of the corporation or posted to the usual or last known place of business or corporation. [RLP Act, 1998, S 240]

1.2 GENERAL REGULATIONS UNDER THE PESTICIDES ACT 1999 AND THE AGVET CODE 1994

In 1995 all responsibilities for registering pesticides and issuing permits for off-label use were transferred from the States to the National Registration Authority (NRA) – now the Australian Pesticides & Veterinary Medicines Authority (APVMA). The Act under which Pesticides are administered by the APVMA is the *Agricultural and Veterinary Chemicals Code Act 1994* (referred to as the AgVet Code).

Under the AgVet Code, all pesticides possessed, sold, supplied or intended for use must be registered. It is an offence to possess or to use an unregistered pesticide unless approval has been granted through Pesticide Control Orders and Minor Use Permits

The Pesticides Act 1999 contains provisions for the control of use of pesticides, and is administered by the Environment Protection Authority (EPA). Pesticide Control Orders have state-wide coverage and customise controls over chemical use, the preparation of bait and the use of each vertebrate pesticide. Copies of each PCO should be kept with this Manual.

Relevant parts of the Pesticides Act and the Ag Vet code are summarised here in simplified form. This summary is not intended to cover every aspect of the Act and are intended only to give a broad summary of how they affect vertebrate pest control.

Definitions

Harm -includes poison, injure, contaminate, infect, distress, maim, impair or kill

Injure -any kind of physical or psychological injury whether permanent or temporary, including conditions such as nausea, allergic reactions dizziness, headache, stress and running nose or eyes

Damage-impair value or usefulness

Risk

Any person using a pesticide must not wilfully or negligently use in a manner that:

* damages the property of another
* injures another person
* harms any non-target plant or animal (On-farm exceptions apply)
* causes material harm to protected fauna or an animal that is a threatened species (No on-farm exception) [Any use also needs to consider transient wildlife]

The penalties for such offences range from $120,000 - $250,000.

Labels

Labels are approved under the AgVet Code. It is illegal to detach, alter, deface, obliterate or destroy the label on a pesticide container or to affix other labels.

Reading the Label

It is the legal responsibility of the user of a pesticide to read or have explained to him or her all the details and instructions contained on the label before each use.

Possession, supply and sale

It is an offence under the AgVet Code to supply or possess an unregistered pesticide unless you have approval under a relevant Pesticide Control Order or Permit issued by the APVMA or EPA.

Following label directions

The user of a pesticide must strictly follow the directions on the registered label when preparing for use, using, storing or disposing of the pesticide. It is an offence under the Pesticides Act 1999 to wilfully or carelessly disregard any instruction on a registered label. The user of a pesticide can only use a

registered product, must follow all the directions on the label (however can use a lower rate or concentration if not expressly prohibited) and must not store any pesticide in unlabelled containers.

Summary of the Regulation for Keeping Records of Pesticide Use

Records have to be kept by all people who use pesticides for commercial purposes. This includes farmers, horticulturalists, aerial and ground-rig operators, pest controllers and local and public authorities who use pesticides. The Regulation would apply to:

* spraying crops, plants, stock or produce and dipping fruit
* baiting pests (rabbits, feral pigs, wild dogs, foxes, mice and locusts etc) whether by air or by ground control techniques.

The Regulation does not apply to people who use pesticides for domestic household or garden purposes.

Why the Regulation?

The aim is to help people who use pesticides as part of their business to keep records to show the pesticides were applied properly. This will be especially helpful if there is a problem such as pesticides drifting away from where they were sprayed, pesticide residues in produce or where someone gets sick during or after a pesticide application.

The Regulation can help keep track of pesticide usage and indicate what works and what doesn't. In addition, records will help to work out how much of a pesticide is needed for a specific task and help identify problems with resistance to pesticides. This could help reduce costs.

What needs to be recorded?

There is no prescribed form. Records can be in any suitable format; kept in a diary or in a printed 'Pesticide Application Record' book. An example is in Appendix 1

Details required are:

* Product name
* Date/time
* Target pest
* Owner contact details
* Description of the treated area
* Applicator contact details
* Rate and quantity
* How it was applied
* Equipment used
* Weather before and during pesticide application

Records must be made in English and kept for 3 years. If a contractor or Board applies pesticides to someone else's property, then they have to provide a copy of the record of pesticide application and both parties have to keep this record for three years. EPA officers are authorised to check these records at any reasonable time.

Training for Pesticide Users

All pest control personnel should complete competency based training to at least Certificate III level. However, Authorised Officers have the added responsibility of supplying and instructing land managers on the safe use and effective use of a pesticide so training to AQF level IV is the minimum recommended. There are a number of training providers for chemical users including Smarttrain (NSW Agriculture & TAFE), and Chemcert.. Check with your local Agricultural Protection Officer or the EPA for contact details and course dates.

For further information, check the EPA website:
http://www.epa.nsw.gov.au/topics.htm

1.3 RELEVANT SECTIONS UNDER THE NATIONAL PARKS & WILDLIFE ACT 1974

Unlawful liberation of animals

A person shall not liberate, anywhere in New South Wales, any animal (other than a homing pigeon or a captured animal which is native to New South Wales) unless under and in accordance with a licence under

section 127 (National Parks & Wildlife Act 1974 Part 7, S109).

Licence to liberate animals
An authorised officer may issue a licence authorising a person to liberate an animal anywhere, or in a specified locality or specified localities, within New South Wales (National Parks & Wildlife Act 1974, Part 9, S127).

Schedule 11 of the National Parks & Wildlife Act 1974 lists "Unprotected fauna" which includes rabbits, dogs, pigs and foxes.

1.4 RELEVANT SECTIONS UNDER THE THREATENED SPECIES CONSERVATION ACT 1995

This Act deals with threatened and endangered species in NSW. Schedule 1 lists the Endangered species, populations and ecological communities. Schedule 2 lists the vulnerable species while Schedule 3 details the threatening processes. All those responsible for pest animal and weed control need to be aware of the conditions of this Act.

1.5 RELEVANT SECTIONS UNDER THE PREVENTION OF CRUELTY TO ANIMALS ACT 1979

The objects of this Act are:
(a) to prevent cruelty to animals, and
(b) to promote the welfare of animals by requiring a person in charge of an animal:
(i) to provide care for the animal, and
(ii) to treat the animal in a humane manner, and
(iii) to ensure the welfare of the animal.

Agricultural exemptions
There are a number of practices that are exempt from POCTA that are considered routine agricultural practice. Although most cover control programs on agricultural land, there is an exemption for control programs on Crown land. However, all broadscale pest animal control programs and control programs on public land require the appropriate levels of environmental assessment as outlined in the EP&A Act 1979.

Use of Certain Types Traps
(1) A person shall not, in a prescribed part of New South Wales, set a trap of a prescribed type
(2) A person must not:
(a) in any part of New South Wales, set a steel-jawed trap, or
(b) possess a steel-jawed trap with the intention of using it to trap an animal.
(3) In this section:
"steel-jawed trap" means a trap that has jaws that are made of steel, iron or other metal and that are designed to spring together and trap an animal when a leg or other part of the animal's body comes into contact with, or is placed between, the jaws, but does not include a soft-jawed trap (that is, a trap with steel jaws that are offset and padded) The maximum penalty is currently 250 penalty units in the case of a corporation and 50 penalty units or imprisonment for 6 months, or both, in the case of an individual.
[Prevention of Cruelty to Animals Act 1979, S23].

Use of dogs for pest animal control
It is a fine line between the legal use of dogs for the control of pest animals, particularly feral pigs and rabbits and sport. Although the Prevention of Cruelty to Animals Act 1979 does not prohibit the use of dogs to detect, flush or hold animals especially feral pigs, it is clear that such animals are to be killed as humanely and as quickly as possible after capture. Under no circumstances can dogs be used for coursing or for sporting or recreational entertainment. It is the responsibility of any individual to demonstrate that they have behaved in a responsible manner and that no unnecessary pain was inflicted. There is also an obligation to ensure that all dogs are

retrieved, and not left to contribute to the existing wild dog problem.

For further information on any animal welfare issue or for a copy of any of the prepared Codes of Practice for the Welfare of Animals, contact the NSW Agriculture Animal Welfare Unit on (02) 6391 3715.

1.6 RELEVANT SECTIONS UNDER THE GAME AND FERAL ANIMAL CONTROL ACT 2002.

What are 'Game Animals'?

(1) For the purposes of this Act, a "game animal" is any of the following that is living in the wild:
deer (Family cervidae),
California quail, pheasant, partridge, peafowl & turkey.
(2) Any of the following animals that is living in the wild is also a "game animal" for the purposes of this Act:

(a) pig,
(b) dog (other than dingo),
(c) cat,
(d) goat,
(e) rabbit,
(f) hare,
(g) fox.

Note: A game hunting licence is not required for hunting the animals listed in subsection (2) on private land, and accordingly is only required if the animals are living in the wild on public land—see section 18.
(3) However, a game animal does not include any animal that is or is part of a threatened species, population or ecological community within the meaning of the Threatened Species Conservation Act 1995, or that is protected fauna within the meaning of the National Parks and Wildlife Act 1974 . [Game and Feral Animal Control Act 2002, S5 (1) & (2)].

1.7 NSW AGRICULTURE POLICY FOR OBTAINING AND STOCKING 1080 POISON

The relevant Pesticide Control Orders under Section 38 of the Pesticides Act 1999 allow the possession of 1080 poison and the preparation and sale of baits by Rural Lands Protection Boards and other authorised persons, subject to conditions specified in the relevant Pesticide Control Order and Minor Use Permit.

Purchase of 1080
Only those Rural Lands Protection Boards or other approved agencies which employ an Authorised Control Officer (ACO) may obtain or use 1080 (see Section 1.7 for authorisation requirements).

Boards may only obtain 1080 poison by placing a written order with NSW Agriculture, which will place bulk orders with the wholesaler each May and October.

Each NSW Agriculture Agricultural Protection Officer is personally responsible for organising the delivery of 1080 to Boards in his or her region.

1.8 AUTHORISED CONTROL OFFICER QUALIFICATIONS AND REQUIREMENTS FOR 1080 USE

Requirements for authorisation
The only personnel allowed to handle 1080 poison are the Authorised Control Officers (ACO's).
To become an Authorised Control Officer, an officer must:

* Study thoroughly all of 'Legal and Departmental Requirements' (Chapter 1) in this manual, Section 2.8 of 'Administration', and all of Section 3 relating to poisons and bait mixing rates. Boards must ensure that the prospective ACO has learnt these sections thoroughly before undertaking a 1080 induction course.
* Undergo a 1080 induction course approved by NSW Agriculture.
* Pass the 1080 authorisation examination on the first two steps above. This test will be given after the finish of the induction course. The Agricultural

Protection Officer will then conduct induction training for officers who pass. This may include some practical field work.
* Pass a practical 1080 bait preparation test.

Possess AQF 4 Chemical Users Certificate (Smarttrain or Chemcert)

Retention of authorisation

To retain authorisation, an ACO must:
* attend the first available NSW Vertebrate Pest Management Course
* pass an equivalent 1080 authorisation examination within 12 months
* pass an equivalent 1080 authorisation examination at least once every four years.

The authority to handle 1080 may be revoked at any time by the EPA if the conditions stipulated on the label, in this manual, a Pesticide Control Order or a Permit, are not observed.

Animals for which 1080 may be used

1080 may be used only for the destruction of those species that have a relevant Pesticide Control Order. Currently, rabbits, feral pigs, wild dogs and foxes are covered. Such use is authorised by Pesticide Control Orders made under the Pesticides Act 1999. Copies of these Orders and any Minor Use Permits should be kept with this Manual.(An Authorised Officer will need to update these PCOs from time to time).

Records of 1080 use

Each ACO must record, in his or her 1080 Poisons Register, details of receipt and use of 1080 poison, including solution and baits. The 1080 Poisons Register must detail receipt and use of 1080 poison immediately after and on the day of receipt or use (see Appendix for details of this Register). The Register must be kept for at least three years from the last date recorded in it. Only the ACO may make Register entries.

1.9 REGISTER OF 1080 USE

One of the conditions under which an Agency may obtain 1080 is that it keeps a 1080 Poisons Register (1080 Register books will be provided by NSW Agriculture on request). Only officers authorised to use 1080 may make entries in this Register.

Figure 1.2 illustrates a completed sample page of the Register and demonstrates the entries required. Note that all relevant columns are filled in each time 1080 is received or used and that for every entry, a date and the ACO's signature are included. An estimate of area poisoned should be made, although it is understood that this is only an estimate.

A monthly inventory must be made of all 1080 stocks by the ACO and submitted to the ACO's 1080 Supervisor, usually the District Veterinarian (DV), for checking prior to presentation at the Board's monthly meeting, with recommendations for purchase of additional 1080 as needed.

The 1080 Supervisor must regularly audit the Register and ensure that copies of the Register entries are sent to the regional Agricultural Protection Officer, NSW Agriculture, at the end of every calendar month. The Agricultural Protection Officer is responsible for checking and calculating poison usage for each pest species.

The role of the 1080 Supervisor

The supervisor is usually the DV or Veterinary Officer (VO) responsible for the RLP district. The supervisor is responsible to the Board and the Board is responsible to the Director-General for ensuring that:

* The receipt of 1080 from the manufacturer and its safe storage by ACO's is properly effected.
* The 1080 is issued only to staff authorised to use 1080.
* Entries in each Poisons Register are properly recorded.
* Records and reports on the use of 1080 submitted as required to NSW Agriculture
* The poison is used in a safe manner.

* Any reports or unsafe usage of 1080 are investigated thoroughly and corrective action is recommended to the Board.

Regular audits of 1080 stocks and the 1080 Register are to be made at least four times a year by the ACO in the presence of the 1080 supervisor.

Audits of 1080 Registers and safe storage of keys
Before an ACO goes on leave, all 1080 supplies must be audited and the Poisons Register signed before giving the key to any other ACO for use during the period of absence. If there is no other ACO, the keys must be kept by the ACO.

If an ACO resigns, the supervisor will audit the 1080 supplies. If there is no other ACO with the Board to accept the keys, the 1080 Supervisor will keep the keys to the 1080 cabinet until a replacement ACO has been appointed.

Storage of 1080 poison
All 1080 poison must be stored within a locked steel cabinet, and the key kept only by the ACO.

The 1080 storage cabinet must be securely fixed inside a room to which unauthorised persons are not admitted. This room is to be used solely for the storage of 1080 poison and stock solution (see the Poisons Section in this Manual for details of this room).

Accidental spillage
In the case of accidental spillage or leakage of 1080 poison, the spill must be contained and the ACO must report it immediately to the 1080 Supervisor or Agricultural Protection Officer, and record the incident in the Poisons Register. The local shire council must be informed if a 1080 spillage reaches the sewer or stormwater system.

Field mixing equipment
A lockable, leak-proof, metal box must be secured to or within each ACO's vehicle for the transport of 1080 poison to the field for mixing baits. There must also be a separate box for a respirator, gloves and the Poisons Register (See Poisons Section for a detailed list of required equipment).

Safe and effective use of 1080
The ACO should withhold 1080 poisoned bait if:
* he or she is not satisfied that it will be used safely or effectively by a land manager in accordance with directions, or
* the person receiving the bait is unknown or unreliable.

Distance Restrictions and Public Notification
Minimum distances for laying 1080 baits have been set to minimise the risk to not-target animals (particularly humans and domestic dogs and cats). If control is necessary in the areas excluded from baiting, other control methods must be used. Instructions relating to distance restrictions and public notification are contained in the Pesticide Control Order (refer to the specific species PCO) which are issued to landholders before they are allowed access to 1080 poison baits by the Rural Lands Protection Board.

Public notification
The requirements for public notification are contained in the Pesticide Control Order (refer to the specific species PCO) which are issued to landholders before they are allowed access to 1080 poison baits by the Rural Lands Protection Board. Pesticide Control Orders and Permits outline who must be notified prior to laying 1080 bait.

Notice of application of pesticides to vacant Crown land, public areas or Travelling Stock Reserves
When pesticides such as 1080 or pindone are applied to travelling stock reserves or areas of public land not under the control of any Authority, Rural Lands Protection Boards are required to provide the following notification:

Publish a notice in a newspaper or newspapers circulating in the district in which the reserve is located, at least twice, with an interval of not less that 7 days between publication. The last notice is to be not less than 7 days before the laying of poison baits. Conspicuous weather-proof signs are to be placed on the reserve warning that pesticides have been used (see the relevant Pesticide Control Order).

Disposal of plastic bags and unused baits
The requirements for disposal of plastic bags and unused baits are contained in the Pesticide Control Order (refer to the specific species PCO). In general, empty containers may be burnt in an open fire as prescribed by a notice of approval under the *Clean Air (Control of Burning) Regulation 1995*. Persons using 1080 baits and wishing to dispose of bait packaging are subject to a number of conditions listed in each PCO.

Baits must be destroyed by deep burial only or returned to the supplier (mostly the local RLPB) for destruction. Unopened containers of FoxOff or Doggone are to be returned within 1 month of issue to the issuing Board. If the containers are intact they may be reissued.

1.10 AUTHORISED CONTROL OFFICER QUALIFICATIONS FOR PINDONE AND BROMADIOLONE USE

Authorised Control Officers will need to be given induction training to gain qualifications for Pindone and Bromadiolone use. This training can be done at the time of the 1080 induction training or can be at a later date at the discretion of the APO.

1.11 OFFICER QUALIFICATIONS FOR FERAL ANIMAL AERIAL SHOOTING TEAM (FAAST) TRAINING

The Feral Animal Aerial Shooting Team (FAAST) training is a system for accrediting NSW government and semi-government employees to carry out aerial shooting of animals from helicopters. Only employees of the NSW government departments, such as NSW Agriculture and NPWS or semi-government agencies such as RLPB's, who have graduated from FAAST training can become FAAST accredited shooters.

FAAST Training courses are held every 3-4 years or when the demand for more trained shooters necessitate a course. For safety reasons, only six students are trained per course. Students are required to complete a rigorous training program in the safe use of firearms, the humane destruction of animals and helicopter safety. They are also required to complete an annual shooting and firearm familiarisation program to maintain their marksmanship standards.

The Authorised Officer should contact the FAAST Management Committee, State Council or the local Agricultural Protection Officer for details when planning a pest management program that requires the services of a FAAST accredited shooter.

VERTEBRATE PESTICIDE REGISTER FORM

Authority_____ Start Date_____ Finish Date_____

Address of Agency:_____

Operator/s Contact Details _____

Target Species_____

Pesticide Details

Product Name	Situation/Use	Application Rate/Quantity	Quantity Used	Equipment
Eg. Fox Off 1080	Mound Baiting	1/1ha	50	Nil

Weather Conditions

Temperature	Weather Conditions	Wind Speed/ Direction
[ ] Cool <20º	[ ] Showers	[ ] Strong [ ]
[ ] Warm 21º-25º	[ ] Overcast	[ ] Gusty [ ]
[ ] V/Warm 26º-30º	[ ] Clear Sky	[ ] Light [ ]
[ ] Hot >30º	[ ] Variable	[ ] Calm [ ]

Description of Control Area: _____

_____Map attached (recommended) Yes [ ] No [ ]

Comments:_____

_____

_____

_____

(Signature)**.....**

AL537-11 (Standard for ND prepared by Jeff Thomas)

No: 56751

MONTH: _____ **YEAR:**____ **1080 POISON REGISTER** _____ **RLP BOARD**

1080 POWDER - Names of ACO's that use this register 1. 2. 3. 4.

Date		Powder b/f	(gms)	Powder Used	(gms)	Powder on hand	(gms)	Solution mixed	(mis) (This figure to be carried forward to the appropriate row in the solution on hand column)
Date		Powder b/f	(gms)	Powder Used	(gms)	Powder on hand	(gms)	Solution mixed	(mis) (This figure to be carried forward to the appropriate row in the solution on hand column)

1080 LIQUID

Date of entry	Solution used (mls (* = number of baits))							Solution on hand	Bait		Area poisoned (ha)	Group ID	Poison supplied to		Officer's Signature
	Rabbit	Pig	Fox	Fox-off*	Dog	Doggone*	Goat	(c/f)	Type	Amt			Name	Property address	
									Totals row (fill in ALL unshaded columns at end of month and/or when page is full)						

Groups 1. 2. 3.

2.0 Administration

2.1 ORGANISATION OF VERTEBRATE PEST CONTROL IN NSW

Under the *Rural Lands Protection Act 1998*, Pest Control Orders have been issued for rabbits, feral pigs and wild dogs. It is the responsibility of the Rural Lands Protection Boards to enforce thorough and continual control to occupiers of land to which the Pest Control Order applies.

Introduced animals such as foxes, hares, feral cats, feral goats, feral horses, feral donkeys, and non-native rats and mice are listed in the *National Parks and Wildlife Act 1974* (Schedule 11-Unprotected fauna). Occupiers of land in NSW are not obliged to control these introduced species.

Sulphur-crested cockatoos and galahs are protected state-wide but a general exemption exists in the Central and Western Divisions. Crows and ravens (5 species) are declared locally unprotected in all counties of the State except those of Northumberland, Cumberland and Camden, where they are protected.

In urban areas, the responsibility for rat and mouse control lies with householders and control is often carried out by private pest control firms. When mice reach plague proportions in rural areas, individual landholders may attempt control. Rural Lands Protection Boards and NSW Agriculture can supply poison bait and give advice on control.

Dingoes are the only native mammal not protected under the National Parks and Wildlife Act 1974. If landholders wish to control native animals (apart from dingoes) they must apply for a permit from the National Parks and Wildlife Service.

2.2 CONTROL GROUPS

Property fences do not restrict pests and so it is pointless limiting control strategies to artificial boundaries. Areas of pest animal abundance tend to be defined by natural (topographic, etc) perimeters or by food availability. It is easier to provide advice and motivate people as a group than to attempt one-to-one control and information transfer.

Landholders are often participants in some sort of group; be it a bushfire brigade, footrot, Landcare or social group and are more at ease dealing with complex issues as a group rather than individually. It would therefore be more logical that existing groups be utilised to coordinate pest and feral animal control activities.

Working as a facilitated group allows for better coordination and communication, not only from advisers but also between participants. For example, during a pest control program, everyone in the group knows who is baiting, where baits are laid, how much toxic bait has been distributed, and when that bait is likely to be picked up or destroyed.

Where a pest may be difficult to control, the use of a group's resources to assist one for the benefit of all justifies a coordinated approach. Peer pressure can be applied judiciously to protect all within an area if required.

The role of a coordinator for a pest control group is beneficial and does not have to be restricted to any one person. It is, however, advisable to have a coordinator who is not the ACO, who has credibility, is well respected by all in the group and is able to draw on the experiences of many other groups. The coordinator should be the provider of good advice and information and liaise with the local ACO.

Recommended Guide for Initiating a Group Control Program

1. Agree as a group that there is a problem.
2. Decide what you (and the group) want to achieve, by whom and by when. Discussion with all landholders is important.
3. Is the program achievable; both in practical and economic terms? There is no sense starting a project if the goals are too high, there is no room for adjustment and if the cost exceeds 10% of a landholders gross annual income (unless they are incredibly rich in which case they would not be farming).
4. Draw a map (or use topographic maps) and highlight the problem areas on the map. Include:

    - known habitat and obstacles (and possibly give a 'potential' factor, see Section 2.6) and
    - pest animal density (see Section 2.6)

During the planning process, remove land tenure/boundaries, and then at the end of the program overlay the tenure back on the map. This provides a far more equitable way of determining ownership and eventual costs.

5. PRIORITISE - this may be the higher density areas first, or low first, or flat country etc.
6. Prepare an information package for landholders.
7. Conduct monitoring (following the guidelines in the Vertebrate Pest Control Manual).
8. Organise contractors where applicable.
9. Liaise with **all** landholders.
10. Run the program.
11. Liaise throughout the program with the landholders.
12. Do post control inspections and monitoring.
13. Promote the results and bathe in the glory

2.3 VERTEBRATE PEST MANAGEMENT PLANS

Each Rural Lands Protection Board must have a Vertebrate Pest Management Plan for rabbits, feral pigs and wild dogs in its' District. These plans were initially developed by the Vertebrate Pest Control Advisory Committee, Rural Lands Protection Boards and NSW Agriculture.

The purpose of these Vertebrate Pest Management Plans is to assist Rural Lands Protection Boards to develop clearly defined control strategies and associated policies for each major pest species. They also:

- Allow Boards *and* NSW Agriculture to articulate their plans and policies to ratepayers, the general public, and government for accountability reasons.

- Allow Boards *and* NSW Agriculture to measure progress in vertebrate pest control by the use of performance indicators and a management information system. It should be noted that NSW Agriculture is required by the Minister to also develop and manage its component of the plans.

Control plans are a critical component of the sustainable agriculture ethic, an environmentally sound approach to farming aimed at ensuring the long term viability and profitability of agriculture through decreased land degradation and responsible land management. It is very important that Rural Lands Protection Boards and NSW Agriculture demonstrate to the public and government that they are fully committed to the sustainable agriculture concept through action.

The plans should set objectives, state what has to be done to achieve those objectives, designate who does what, and provide a means of assessing how these objectives will be achieved . It is now more apparent than ever that a coordinated planned approach to control is required.

2.4 PEST ANIMAL MANAGERS

To formulate successful Vertebrate Pest Management Plans, the Pest Animal Manager needs to ask - "What are the objectives?

a) To completely eradicate pests from the whole Board?
b) Effectively control pests for the present?
c) Remove pests from certain areas eg. Group control schemes, and reduce the impact in all other areas?
d) Control pests in only some parts of the Board?

Next, a Pest Animal Manager needs to ask –

- how well do I know my district,
- what degree of pest animal control is being achieved in the district and
- how much of this control has been achieved as a result of my efforts?
- Since I have been the Pest Animal Manager, has there been any change in the number of infested properties?
- What part, if any, did I take in bringing about any change (that has occurred) in the number of infested properties?

If pests are still in the district, is it:

- because of some insurmountable problems caused by difficult terrain?
- because some method of pest control is not known to me, to the landholders or to the Board?
- because of landholder apathy? If so, what can be done in an endeavour to stir landholders out of their apathy?
- because of a lack of clear objectives for pest animal control?
- because of ineffective communication?
- because control programs are not effectively coordinated?

2.5 PROPERTY INSPECTIONS: POINT TO CONSIDER

Inspecting properties is one of the major functions of an authorised officer to determine if the RLP Act is being complied with. Therefore inspection procedures must be clearly understood.

Property inspections are usually the best means of obtaining information and may be done on a property by property basis or over large areas by aerial inspection.

A Pest Animal Manager should concentrate on one area or a group of properties for say a week or fortnight. This method of inspecting means reinspections can also be carried out systematically and simultaneously on a group basis. This cuts down on unnecessary travelling and less time in running from one end of the Board to the other than if properties are inspected at random throughout the Board area each week.

If property inspections are carried out systematically on a group basis, the reinspections will be confined to one area for that month.

Some Boards inspect on a block basis, moving slowly through the Board. It is slow, but can be effectively carried out especially if there is more than one Ranger within a Board. Other Boards may prefer a fortnight or month periodically in each division.

It is not recommended to go into an area and inspect one property then move off to another area and inspect another property. Landholders feel they are being victimised if their property is singled out for an inspection in their area and no one else around them has been inspected.

The use of standardised performance indicators (densities and potential), property inspection reports and monthly vertebrate pest reports will provide the necessary information to be able to prepare a density map of the board and to measure progress.

A five-step plan and a model of the property inspection sequence are given in the

following text and in Figure 2.1. The definitions used for infestation levels are given in Section 2.7.

Insert Figure 2.1 hereabouts
See David Croft for electronic copy

Step 1
Inspect the property for the presence of pests and to determine what control measures are being carried out.

(a) If the pest level is acceptable (good management), then all that is required is another inspection when the property comes up for reinspection in the Board's timetable. This is the goal to which Boards should be working for every property.
(b) If there is a low to moderate infestation, the authorised officer goes to Step 2.
(c) If there is a high level of infestation, the authorised officer goes to Step 3 if the landholder has made some attempt to do some control; or directly to Step 4 (or Step 5) if no effort has been made.

Step 2
If inspection reveals that the property is lightly to moderately infested the occupier should be advised of their responsibilities under the Rural Lands Protection Act, and advised on how to control the pest animal/s present.

(a) If the work is carried out and the reinspection reveals that the pest level is acceptable, the property need not be reinspected for a set interval.

(b) If the pest level at reinspection is not satisfactorily improved, the authorised officer goes to Step 3.

At this stage the Board should issue a landholder with a "Notice of intention to serve an individual eradication order" before the individual eradication order is issued. (See RLP Act 1989, S159).

Step 3
Recommending the serving of an Eradication Order by the Board. This needs to be done if the warning in Step 2 is ignored or if the first inspection in Step 1 finds that although some work has been done, there is still a high level of infestation. This Order explicitly states the methods of control.

(a) If the work is carried out and reinspection reveals that the pest level is acceptable, the property need not be reinspected for a set interval.

(b) If the pest level at reinspection is still unsatisfactory, but the occupier has made a substantial effort and just needs more time, a new Order should be issued to extend the time limit.

(c) If the pest level at reinspection remains unsatisfactory and little or the occupier has made no effort, the authorised officer goes to Step 4 or Step 5.

Step 4
Recommending that the Board start a prosecution. This step is required following the situations described in Step 3 (c).

(a) If the pest level at reinspection is satisfactory following a successful prosecution, the property need not be reinspected for a set interval.

(b) If the pest level at reinspection is still unsatisfactory following the prosecution, repeat Step 4.

Step 5
An alternative to Step 4 is for the Board to enter the property under Section 169 of the Rural Lands Protection Act and conduct the control program. This step can only be carried out if:

(a) a pest control order authorises the taking of such action, or
(b) the owner or occupier of the land has failed to comply with a pest control order or an eradication order applying to the land.

Boards may also impose a charge to cover the reasonable expenses of any action taken by an authorised officer as a consequence of the occupier or owner failing to take any action the occupier or owner is required to take under Section 169 (See RLP Act 1989, S171 (1b)).

Recording
Once a property inspection has been carried out, the information should be filed, put on Board or Division maps, property cards or on computer, so that anyone can access it easily, understand it, and act on it if necessary.

The use of tabulated material and maps can help the Board see the progress, or lack of it, in a program of control for a particular property or a particular part of the district.

Control Objectives and Timing
With sufficient information to determine the areas that need targeting for either advice or a control program, planning strategies can be implemented. It may be that a poisoning program is required to reduce a rabbit population to a manageable level. In this case, it may take 3-4 months to organise a poisoning program.

2.6 INDEMNITY FORMS FOR EACH VERTEBRATE PEST SPECIES

Supplying 1080 or Pindone Bait to a Landholder
Before supplying 1080 bait, the ACO must get the landholder or person in charge to sign an undertaking that releases the ACO and the Rural Lands Protection Board from any liability for accidental poisoning on the landholder's property.

See Figures 2.4 and 2.5 for examples of indemnity forms.

An authorised officer must not issue 1080 bait material to a person who is not the owner or occupier (or agency representative) of the land on which the 1080 baits are to be used; unless the authorised officer knows that person to be the manager or authorised agent of the owner or occupier.

If the authorised agent is not known to the ACO, then a 'letter of introduction' from the occupier is required.

Local Government and other government agencies must have an indemnity signed by the person in charge of, or responsible for, the baiting. That person will sign an indemnity form 'for and on behalf of' their agency if the agency is laying the bait.

A person who owns or occupies more than one property must complete a separate indemnity form for each property before any 1080 bait may be used on the specified property.

Board Laying Bait at the Request of the Landholder
Where the Board lays the bait at the request of the landholder, then a consent form should be completed by the landholder. An indemnity form is not required.

Consent Forms should be used where the Boards lay the bait. See Figures 2.6 and 2.7 for examples of Consent Forms.

Where a Board or other agency lays baits for a landholder who is unable to erect the required signs, then the name of the nominated person needs to be included in a consent/indemnity form (see Figure 2.6).

Contract Work
If the Board carries out contract work for a landholder or an agency (for example a Council or National Park), then the Board cannot insist on the landholder or the agency signing an indemnity form. The contract will determine the arrangements.

Records
Where a Rural Lands Protection Board is laying the bait on request or on contract, a record of the bait laid has to be made and

kept (2 copies– one for the Board, the other for the landholder/contract agency) as stated in the records regulations of the Pesticides Act, 1989.

Statutory Powers
Where the Board lays the bait as part of its statutory power to enter and conduct the control program under Step 5, no indemnity or consent form is required.

It should be noted that the correct forms should be used according to the situation. Indemnity Forms should be used where a landholder lays the bait.

Indemnity and consent forms should be kept for a minimum of two years so that they can be correlated with the poisoning register.

The relevant Pesticide Control Orders and Minor Use Permits relating to conditions for poisoning rabbits, feral pigs, wild dogs and foxes must be handed to and understood by landholders when they receive poisoned bait or sign the indemnity form, or sooner.

2.7 PERFORMANCE INDICATORS FOR VERTEBRATE PEST CONTROL

A formal record of inspection may need to be presented during court cases and so should include all relevant detail. For rabbits, note the number of animals seen, number of fresh signs, number and state of activity of warrens present, and the areas of property infested.

Numbers seen is an important indicator of density when related to the time of day. For example, if rabbits are seen around midday it would indicate a high density, whereas if they are not seen until late afternoon it would indicate a low to medium density. If pigs are present, note the numbers seen and number of fresh signs, and decide whether pigs are living on the property or only moving in daily to feed. Report of the effectiveness of any control work that has been done.

The property inspection *pro forma*, which could be adopted by Rangers and RLPB's, is a means of recording vertebrate pest abundance and their potential to cause agricultural damage. (Refer to Sections 2.5.1 to 2.5.3) For examples of a Property Inspection Report and Monthly Report see Figures 2.2. & 2.3.

The use of this format is encouraged for property inspection reports. The advantages of this system are that:

- It requires a minimum of effort in the field
- Information will be consistent.
- It is easy to read and comprehend
- Monthly and annual reports can include these tables with the totals of each category. This can be related to the previous year and the Boards' objectives.
- If all RLPBs adopt this system, information can be collated statewide and the 'big picture' can be more accurately assessed.

Rabbits

Potential	**Abundance**			
	0 nil	**1 low**	**2 med**	**3 high**
A nil				
B low				
C med				
D high				

Code definition - Rabbits

Code	**Density**	**Definition**
3	High	Rabbits seen at any time much sign of activity (active warrens, dung hills, scratchings).
2	Medium	Some rabbits seen at any time and/or much active sign.
1	Low	Few or no sightings and/or little active sign.
0	Nil	No rabbits

Potential. Potential is indicated by the factors which contribute to the quick build-up of rabbits, ie. warrens, logs, blackberries, boxthorn, etc. and pressure from nearby heavily infested areas.

Code	Definition
A	No factors present
B	Little harbour, single holes, easily destroyed.
C	Significant harbour, warrens, burrows, logs, bushes, etc., which with concentrated effort could be eliminated.
D	Intractable harbour, ie. areas where it is impossible to eliminate all harbour, eg. Rocky hills, steep gullies, etc.

The aim to is to reach 'OA' grading

Feral pigs

Abundance	0 nil	1 low	2 med	3 high

Code definition

Code	Density	Definition
3	High	Regular sightings day/night, abundant fresh sign.
2	Medium	Some sightings day/night, obvious fresh sign.
1	Low	No/few sightings day/night, very few fresh sign.
0	Nil	No pigs or sign

Wild dogs

Abundance	0 nil	1 low	2 med	3 high

Code	Density	Definition
3	High	Abundant tracks and sign, howlings at night, regular sightings and/or some predation.
2	Medium	Obvious track and sign, some howling, occasional sightings and/or some predation.
1	Low	Few tracks and sign, very few sightings, very little predation.
0	Nil	No dogs or sign.

2.8 FIELD NOTEBOOK

Every authorised officer should carry a pocket or stenographer's notebook in the field. The field notebook provides a ready reference that will be invaluable for writing reports for the Board, recalling details of discussions between landholder and officer, and for comparing degrees of infestation before and after control. More importantly, the notebook can be referred to as a memory aid during legal proceedings, and should therefore be kept for at least 12 months after the final entry.

The field notebook should be filled in during the inspection and should refer to the inspection report.

2.9 MONTHLY REPORTS

Each authorised officer is required to submit a monthly report to the officer's Board. This report should be a concise summary of the officer's work for that month. Detailed information should be put into the monthly report only when problem areas are brought

to the attention of the Board. A suggested format for the report is shown in Figure 2.3

When the monthly report is presented to the Board, the authorised officer should have on hand the records of previous action for each property. These are not to be included with the report, but should be available for reference.

2.10 PROSECUTIONS

An occupier of any (private or public) land on whom a general (or limited) destruction obligation in relation to a pest is imposed by a pest control order must eradicate any pest on the land by any lawful method (or, if the order specifies a method to be used, by the method specified) [RLP Act 1998, Sections 155 & 156].
Occupiers who fail to carry out their obligation are guilty of an offence [RLP Act 1998, Sections 155 & 156]. The Board can serve an Eradication Order on the occupier or owner of land requiring the suppression and destruction of all pest animals stated in an Eradication Order. If the occupier or owner refuses or fails to comply with the order then the occupier or owner is guilty of an offence [RLP Act, 1998, Section 167].

Prosecution should be a last resort. The authorised officer should offer advice on the problem before considering this: there should be education before prosecution.

Boards should not attempt prosecution if the relevant authorised officer has not attended all 3 legal Training Courses conducted by NSW Agriculture.

Background for prosecutions
Where possible, the authorised officer should contact the landholder to establish three things: whether that person is the occupier or owner, the boundaries of the holding in question; and what steps if any have been taken to control pest animals. This ensures that any problems (for example, infestations and lack of work) are actually on that property. If necessary, determine the property boundaries by using maps.

Where possible, the authorised officer should be accompanied by the landholder during the inspection, to whom the Board's control policy should be explained. This will ensure that the correct property is inspected and that the landholder will see any infestations located by the authorised officer and will discuss what control is required.

The whole property should be thoroughly inspected during the first inspection and later reinspected to determine whether any work has been done.

During the inspection, the authorised officer should determine the degree of infestation, the number of pest animals, warrens and burrows, and any harbour present. Look for general physical signs of pest animal activity such as fresh signs of scratches, dung heaps and patches of fur from fighting (rabbits), and recent camp sites (feral pigs). Where some work has been done, try to determine, by questioning the landholder or from physical signs, when the work was done. For example, warrens ripped, reopened and covered with grass would indicate that work had been done before the last rain. Ripped warrens that have been reopened and flattened by weathering would also indicate that some time had passed since work was done. The time elapsed since fumigation can be seen from the freshness of the work, the number of active reopenings present and the condition of soil where dug back and filled in. If work has been done, but a number of active reopenings are present, it would indicate that the landholder is not maintaining a close surveillance of the area and therefore not carrying out the requirements of the Act to 'fully and continuously suppress and destroy'. Try to question the landholder after the inspection to confirm your findings.

A spotlight count conducted at night, preferably with the landholder present, is a useful tool to estimate population levels.

All relevant information should be recorded accurately in the field notebook (see Section 2.6) on a paddock-by paddock basis during the inspection. Name the paddocks if known; otherwise, describe the area so that the landholder cannot argue that you were in the wrong paddock or on the wrong property. Any statements landholders make regarding work done should also be recorded in the field notebook.

It is important to write down the relevant details of any conversation in the "I said', 'he said' form as soon as possible after the conversation. Record the date, the time and the place of interview. If your memory fails you in the witness box, these notes in the field notebook can be looked at to refresh your memory.

On the completion of the inspection, the property inspection report form should be completed (see Section 2.5). On this form, after discussion with the landholder on control methods, recommend the type of work that the landholder should do and what the landholder intended to do. The landholder should receive a copy of this report at the completion of inspection or, if not present then, by mail.

If the authorised officer is recommending to the Board that action be taken against the landholder (service of an Notice, Eradication Order or legal action), a special report should be prepared for the Board setting out in chronological order all the relevant facts of the inspection including any settlements by the landholder.

Elements of offence

Before prosecution is considered, the authorised officer must read the relevant parts of the Rural Lands Protection Act and understand the elements of the offence that must be proved. The officer must also be satisfied that the person to be prosecuted has committed the offence. Whatever the offence, certain fundamental facts have to be established beyond all reasonable doubt, otherwise the charge will be dismissed.

Prosecution procedure

If the Board decides to take legal action, a detailed special report should be given to the Board's solicitor and discussed with them. The solicitor should then be able to determine if the Board has a case and what Section of the Act should be used.

If the Board approves the prosecution, an 'information' (initiating document) is laid before the Clerk of the Local Court, and the case is set down on a day for 'plea or mention'. On the day set down for 'plea or mention', the case will be heard if the defendant pleads guilty or does not appear. If the defendant pleads not guilty the case will be set down for hearing at a later date. If possible, the authorised officer should go into the courtroom early and listen to other cases to become familiar with the court, the magistrate and the procedures.

The authorised officer should have a short, typed statement of the facts prepared for the plea or mention date in case the defendant pleads guilty or does not appear.

The authorised officer must take to the court two up-to-date copies of the Rural Lands Protection Act (including the Regulations): one for their own use and one for the magistrate. The officer must have a complete knowledge of the facts of the case and the relevant provisions of the Act and Regulations, and must be ready to answer any question asked by the magistrate (for example, the maximum penalty and whether the defendant has had prior convictions under the Act).

The authorised officer, who is the 'informant' in the case, should give clear details of:

- the property named
- the size of the property
- degree of infestation
- type of terrain
- type of harbour
- work or lack of work done

- number of warrens and pest animals seen
- time of inspection
- results of discussions with the landholder

The report must be factual. If there is any doubt, the landholder should be given the benefit of the doubt. The authorised officer must state whether work was done thoroughly or otherwise, and must give dates and results of each inspection and details of any work carried out since the previous inspection.
Previously successful prosecutions have used photographs taken on the property to illustrate large warrens and/or a general lack of work. Good photographs include landmarks of the property to prove that they were in fact taken on that property. Maps of the property may be used to show the areas of infestation and give a clear picture of the problem.
Situations where the Board has shown some leniency towards the occupier should be mentioned. For example, poisoning work carried out with the Board's assistance, but follow-up work not done, extensions of time given to complete the work because the occupier was busy with shearing; and control work held up by harvesting or bad weather. Authorised officers should also bring to the court's notice that the Board was prepared to assist the landholder in any way possible.

The evidence put before the court must always be factual and accurate. The authorised officer should always clearly state what work the landholder had done (if any) and explain where faults exist in work done. For example, the Board may have served an Order instructing that 1080 poison be used, followed by ripping of warrens and burrows, with continuous follow-up work to keep ripped warrens closed. The landholder may in fact have carried out the first two requirements, but failed to carry out further work on reopened warrens in the past few months. These facts should be stated. The court will generally allow the officer, when giving evidence, to refer to the field notebook as a memory refresher if the record was made soon after the event.

If the defendant pleads not guilty, the Board should retain a solicitor. An interview with the solicitor should be arranged well before the hearing date to allow the case to be prepared. The solicitor should be familiar with the Rural Lands Protection Act and be given a copy.

Sometimes, the court may call on the Board's Administrative Officer to produce proof of service of notices and of the Board's approval to begin action from the minutes of the Board meeting.

Figure 2.2

PROPERTY INSPECTION REPORT

Date:

Time:

Inspector:

Property name and location: (lat:long/GPS reading where possible)

Owner's name and postal address:

Area inspected: (size, location, soil type, seasonal conditions, description of country, etc)

Livestock:

Work done by occupier to control pest animals:

2.5.1 Rabbits

Potential	Abundance			
	0	**1**	**2**	**3**
A				
B				
C				
D				

Feral Pigs	**0**	**1**	**2**	**3**
Abundance				

Wild Dogs	**0**	**1**	**2**	**3**
Abundance				

Comments:

Figure 2.3

MONTHLY VERTEBRATE PEST REPORT FORM

_____ RURAL LANDS PROTECTION BOARD

Month: _____ Year: _____

Total rateable properties in district: _____ Total area: _____ ha

Property Inspection Summary:

	No. of property inspections	No of property reports written	Notices issued	Eradication Orders issued
Rabbits				
Feral pigs				
Wild dogs				
Totals				

Pest animal control summary:

	No. of group control programs	Total No. of landholders in programs	Area (ha) of group programs	No. of individual control programs	Area (ha) of single programs
Rabbits					
Feral pigs					
Wild dogs					
Foxes					
Mice					
Plague locust					
Totals					

Pest Animal Populations* summary:

	Nil	Light	Moderate	Heavy	Reasons *(eg Seasonal, breeding, control)*
Rabbits					
Feral pigs					
Wild dogs					
Foxes					
Mice					
Plague locusts					
Other					

** Indicate whether populations are up or down from the previous month U = Up, S = Same, D = Down*

Rabbits summary:

Releases of RCD ***(Number)***	**Confirmed Reports of RCD** *(nil, few or many)*	**Myxomatosis reports** *(nil, few or many)*	**Reasons**

Field days:……Meetings:…….

Comments:

Ranger: _____ Admin Officer/Manager/Chairman:_____

Figure 2.4

INDEMNITY FORM RE USE OF 1080 POISON

POISONED BAIT RECEIVED BY LANDHOLDER/AUTHORISED AGENT

Rural Lands Protection Board

I,……..of……...…being
(print name) (address)

The owner/authorised agent of the owner/occupier of the property known as ……...…hereby (cross out whichever is inapplicable)

acknowledge that I have received the following information relating to safe use of 1080 Poisoned baits, from an authorised Officer of the ……..Rural Lands Protection Board.

1. A copy of the relevant **Pesticide Control Order** detailing 'Directions for Use': which sets out in detail the directions for safe use of '1080' baits and a copy is supplied herewith for:
   1080 Rabbit baits -- 1080 Wild Dog baits -- 1080 Fox baits – 1080 Feral Pig baits. (Circle appropriate bait type)

2. I am aware and have read the contents of the relevant **Pesticide Control Order** listed above.

3. I am aware of the poisonous nature of '1080' and that I should remove any livestock from the area to be poisoned for rabbits or feral pigs and keep them removed during the poisoning program.

4. I am aware of the obligations to notify and inform every person whose boundaries are within one (1) kilometre of the intended bait site **at least 3 days** before intended use of poison on the property described and that I have to place the required warning signs of the use of '1080' poison as directed in the relevant **Pesticide Control Order** listed above.

5. I undertake to destroy all prepared bait not laid, in compliance with the **Pesticide Control Order.**

6. I understand that I can obtain a copy of the **Material Safety Data Sheet (MSDS)** in relation to the mixed 1080 bait from an Officer of the Board.

I hereby declare that I have given no less than three (3) days notice either by telephone/personal contact or writing and such notice has been received by every person whose property boundaries are within one (1) kilometre of the intended bait sites.

Names of Persons Notified: ……

……

I acknowledge having received ……of prepared ……baits for
(wt or no.) (description)

……and ……..signs, for use on the property, ……..……area to be
(pest animal) (1 form per property)

baited……..ha in the district of……...from an officer of the said Board.

In consideration of the Board supplying me with such poisoned bait material, I accept full responsibility for the use of the said '1080' Poison and I agree to indemnify and keep indemnified at all times the Rural Lands Protection Board, its Directors, Officers, Servants and Agents, against all actions, proceedings, claims, demands, costs and expenses whatsoever in respect of any personal injury of loss of livestock or any other loss whatsoever which may have occurred in the use by me and/or my agents or employees in the use of '1080' Poison bait material.

Date this……day of ……, 200…….

…….. ……
Owner/Authorised agent of Owner/Occupier Officer of the Board

Figure 2.5

INDEMNITY FORM RE USE OF PINDONE POISON

POISONED BAIT RECEIVED BY LANDHOLDER/AUTHORISED AGENT

Rural Lands Protection Board

I,……..of……...…being
(print name)

The owner/authorised agent of the owner/occupier of the property known as ……...…hereby
(cross out whichever in inapplicable)

acknowledge that I have received the following information relating to safe use of Pindone Poisoned baits, from an authorised Officer of the ……..Rural Lands Protection Board.

1. A copy of the relevant **Pesticide Control Order** detailing 'Directions for Use: Pindone Rabbit Bait' which sets out in detail the directions for safe use of Pindone baits and a copy supplied herewith.

2. I am aware and have read the contents of the **Pesticide Control Order** listed above.

3. I am aware of the poisonous nature of 'Pindone' and that I should remove any livestock from the area to be poisoned and keep them removed during the poisoning program.

4. I am aware of my obligations to notify and inform all adjoining neighbours **at least 3 days** before intended use of the poison on the property described and that I have to place the required warning signs of the use of 'Pindone' poison as directed in the **Pesticide Control Order** listed above.

5. I undertake to destroy all prepared bait not laid, incompliance with the **Pesticide Control Order.**

6. I understand that I can obtain a copy of the **Material Safety Data Sheet (MSDS)** in relation to the mixed pindone bait from an Officer of the Board.

I hereby declare that I have given no less than three (3) days notice either by telephone/personal contact or writing and such notice has been received by all adjoining neighbours.

Names of Persons Notified:……

……

I acknowledge have received ……of prepared ……bait
(wt or no.) (description)

and ……signs for use on the property…….., area to be baited…….ha, in the

district of…….... from an officer of the said Board.

In consideration of the Board supplying me with such poisoned bait material, I accept full responsibility for the use of the said 'Pindone' Poison and I agree to indemnify and keep indemnified at all times the Rural Lands Protection Board, its Directors, Officers, Servants and Agents, against all actions, proceedings, claims, demands, costs and expenses whatsoever in respect of any personal injury of loss of livestock or any other loss whatsoever which may have occurred in the use by me and/or my agents or employees in the use of 'Pindone' Poison bait material.

Date this……day of ……, 20…….

……. ……
Owner/Authorised agent of Owner/Occupier **Officer of Board**

Figure 2.6

CONSENT/INDEMNITY FORM RE USE OF '1080' POISON

POISON LAID BY BOARD OR OTHER AGENCIES

……..Rural Lands Protection Board or Agency

I.……of ……..

…….. Being owner/occupier of the property known as

……..…do hereby consent to an officer, servant or agent of

the …….. Rural Lands Protection Board laying '1080'poisoned bait material on that portion of the property described hereunder and that neither the said Board nor its officers, servants or agents shall be under any legal liability whatsoever to me for the death or injury to any person or stock arising from the conduct of the said poisoning or any action taken in connection therewith. When baiting rabbits or feral pigs I will keep the area described hereunder freed of stock until ……mm of rain has fallen after completion of the poisoning, or the poisoned bait material has been picked up or thoroughly covered with earth. **I / My nominee** (delete one) will erect the required notices and inform adjoining neighbours at least 3 days prior to baiting and, in the case of all animals, will inform all occupiers of properties whose boundaries are within 1 km of the intended bait sites

Description of Area:

……

……

……

My nominee (if applicable):……..

Address:……..

Dated this…….**day of**……. **20**…….

Signature of owner/occupier …… **Witness** ……..

☐ Pesticide Control Order issued and read by the owner/occupier of the property.

☐ Signs issued

Figure 2.7

CONSENT FORM RE USE OF PINDONE POISON
POISON LAID BY BOARD

---------- Rural Lands Protection Board

I……of ……..

…….. Being owner/occupier of the property known as

……..…do hereby consent to an officer, servant or agent of

the …….. Rural Lands Protection Board laying Pindone poisoned bait material on that portion of the property described hereunder and that neither the said Board nor its officers, servants or agents shall be under any legal liability whatsoever to me for the death or injury to any person or stock arising from the conduct of the said poisoning or any action taken in connection therewith.

I will inform adjoining neighbours at least 3 days prior to baiting and erect the required notices.

Description of Area:

……

……

……

……

……

……

Date this …….. day of……. 20…….

Signature of owner/occupier…….. Witness……..

☐ Pesticide Control Order issued and read by the owner/occupier of the property.

☐ Signs issued

3.0 Poisons and fumigants

3.1 INTRODUCTION TO PESTICIDES

Pesticides means a relevant pesticide within the meaning of the Pesticides Act 1999, which in general refers to any substance or gas which is used for the purpose of controlling pests. See also the *code of practice for the safe use and storage of chemicals (including pesticides and herbicides) on agriculture* WorkCover NSW, see Government Gazette of the State of New South Wales, No 126, 28 August 1998 Page 7000.

Pesticides

In considering the risk management procedures for pesticides reference must also be made to the risk management procedures for hazardous substances. Not all pesticides are hazardous substances, though many are. Therefore, with regard to a particular fumigant or pesticide it will still be necessary to check the supplied information to determine if it has also been labelled as a hazardous substance. An additional consideration that is not addressed in the health and safety risk management procedures is the importance of observing environmental protective measures. Applying certain fumigants such as phosphine and chloropicrin is considered to be scheduled work and requires the relevant certificate of competency, as outlined in clauses 266 and 278 of the OHS Regulation 2001. RLPB Rangers who have completed ACO training have been exempt from these requirements for rabbit fumigation only.

3.2 RESPONSIBILITIES

Employer

The employer is to ensure there is in place appropriate policies and workplace procedures to effectively manage safely the use of pesticides at the workplace. In particular with the use of pesticides the Board is to ensure the following matters are addressed in the plan;

- the register of pesticides used by the Board ;
- that employees or persons hold the appropriate certificates of competency to carry out the tasks associated with the use of pesticides at the workplace
- the maintenance of all registers and records as required under the OHS Regulation 2001 and Pesticides Act 1999;
- ensuring suppliers of substances provide the appropriate documentation (Permits, labels, MSDS etc) before the substance is used at the workplace;
- that there is available the appropriate first aid measures.

Administrative Officer

The Administrative Officer is responsible for ensuring that there are in place the policies and procedures to meet the statutory obligations under the legislation. In particular the Administrative Officer, in consultation with employees, is to ensure employees are provided with information, instruction and training with regard to the use and possible exposure to pesticides at the workplace.

Supervisors

Supervisors are to ensure employees are made aware of the specific risk control procedures for the use of pesticides at work locations. With regard to the application of pesticides supervisors are to ensure only employees, or in the case of engaged contractors, the persons have the appropriate competency certificates to undertake the tasks. Supervisors are to ensure tasks are carried out according to the adopted risk management procedures. Before commencing an application of pesticides the managers or supervisors responsible for the activity must be satisfied all the necessary

procedures are appropriate for the location and that any PPE and emergency equipment is on hand.

Employees
Employees are responsible for carrying out all activities in a safe manner in accordance with procedures and training undertaken. In particular employees are not to use fumigants or pesticides other than in accordance with instructions and adopted risk management procedures. Employees are also to cooperate with any health surveillance programs considered on medical advice to be necessary. In accordance with the OHS Regulation 2001, see Clause 28, an employee is to notify the employer of any matter which could affect the capacity to comply with its statutory duties to ensure a safe workplace under the OHS Act 2000 and OHS Regulation 2001.

Contractors
If contractors are engaged for the purpose of applying pesticides they are required to submit a safe work plan with regard to the use of the pesticides. As required it is the responsibility of the contractor to comply with the specific statutory provisions, to all the necessary competency licensees and on request to make available copies of MSDS's. The relevant risk management procedures for the application of pesticides are to be observed. Before commencing an application of pesticides the contractor responsible for the activity must be satisfied all the necessary procedures are appropriate for the location and that any PPE and emergency equipment is on hand.

The up to date legal requirements are found in the current Pesticide Control Orders (previously referred to as Pesticide Permits). If there is doubt about the legal requirements of a pesticide application, refer to the current relevant Pesticide Control Order.

3.3 MEASURING TOXICITY

People handling poisons must have an understanding of toxicity (toxic quality) for their own safety, to control the target pest most economically and to minimise the risk to non-target animals.

The toxicity levels cited in this manual refer to acute oral toxicity levels of the active ingredient.

The toxicity of a poison varies with:
* The species. (Refer to Appendix 1).
* The weight of the animal. A pig weighing 100kg will need to ingest twice as much poison to receive a lethal dose as a pig weighing 50kg. (This works well in practice because most 100kg pigs will eat about twice as much poisoned bait 50kg pigs.)
* The method of administration. Poisons generally are more toxic when eaten than when applied to the skin. They are most toxic when injected into the bloodstream.

The toxicity of a solid or liquid poison is usually given as the number of milligrams (mg) of a poison per kilogram (kg) liveweight of an animal, that will kill a certain percentage of a group of animals, of that species. (see the following explanations of LD_{50} and LD_{100}). Toxicity is measured by giving different dose rates to several groups of animals of the one species and then plotting the dose rate that kills a certain percentage. Accidental poisonings are generally the only means of calculating the toxicity of poisons to humans and to rare animal species. Naturally in these cases the sample size is small and the standard error is large.

LD_{50}
The LD_{50} (Lethal Dose 50%) is the amount of a poison in milligrams per kilogram liveweight that will kill 50% of a group of animals of one species. The LD_{50} of a poison is a convenient way of comparing different poisons and, most importantly, the

effects of one poison against different animal species. The lower the LD_{50} the more susceptible the species is to the poison.

Table 3.1 has been included to show the relative effects of 1080 bait on different species of animals.

LD_{100}

The LD_{100} (Lethal Dose 100%) is the amount of a poison in milligrams per kilogram liveweight that will kill 100% of a large group of animals of one species. While and LD_{100} has advantages of an LD_{50}, it is much more difficult to determine and so is seldom used. There are always individual animals that are tolerant to a poison. The sample size needs to be large and LD_{100} figures often depend on the number of tolerant animals in the test group and the extent of their tolerance.

Application

The LD_{50} rate is not the amount of poison put in pest animal baits. The aim of a baiting program is to kill all the target animals that consume bait. For example, the LD_{50} of 1080 for dogs is 0.1 mg/kg. therefore, 1mg of 1080 will kill 50% of dogs weight 10kg and 3 mg of 1080 will kill 50% of dogs weighing 30kg.

In order to ensure that the largest, most tolerant dogs will die from eating poisoned baits 6 mg of 1080 (0.3 mL 1080 solution) is injected into wild dog baits.

3.4 THE USE OF 1080 POISON AS A VERTEBRATE PESTICIDE IN NSW

1080 (pronounced 'ten-eighty') or sodium fluoroacetate, is a naturally occurring compound produced by many species of Australian plants. It is used in New South Wales and other Australian States as a vertebrate pesticide to control rabbits, feral pigs, wild dogs and foxes. Sale, possession and use of 1080 is strictly regulated under the *Pesticides Act 1999,* the *Rural Lands Protection Act 1989* and the national *Agvet Code 1994.* 1080 is one of the most closely regulated and monitored pesticides in NSW. Strict conditions controlling the use of 1080 are specified in Pesticide Control Orders issued by the Environment Protection Authority (EPA) and the National Registration Authority (NRA).

Advantages of 1080 as a poison

* **Cost: -** 1080 poison is relatively cheap. This is important for cost effective vertebrate pest control and in removing any temptation for unscrupulous people to seek less acceptable 'home-made' alternatives.
* **Convenience: -** 1080 poison is easy to mix, baits are readily prepared and the clean up process is quick, safe and efficient; with 1080 being highly soluble in water.
* **Availability: -** The continued availability and use of 1080 poison for vertebrate pest control in NSW is critical as there are no alternative pesticide that meets the suite of requirements listed above.

Physical and chemical properties

In its pure form, commercial 1080 is an odourless white powder, which is highly soluble in water. It produces a clear solution, said to be tasteless but which may have a slight salty or vinegar taste. A black or dark blue dye is incorporated into commercial 1080 powder to distinguish the resulting solution from water. 1080 is not soluble in organic solvents, fats or oils. It becomes unstable above about 110°C and decomposes at about 200°C.

Sodium fluoroacetate occurs naturally in about 40 native plant species in Australia, primarily of the genera, *Gastrolobium, Oxylobium* and *Acacia,* which grow in Western Australia, across northern Australia in the Northern Territory and in central Queensland. No fluoroacetate bearing plants

are known to occur in NSW or the other southern States.

1080 is an organic compound, which is stable in the absence of water. However, once in solution, 1080 is readily degraded in the environment by microbial action.

1080 was first synthesised in Europe in 1896 and developed in the USA as a rodenticide during the 1940s. It was first used in Australia in the 1950s to control rabbits.

Mode of action

1080 can be absorbed through the stomach, intestines, lungs, mucous membranes and open cuts. It is not readily absorbed through healthy skin.

Once ingested, 1080 is metabolised from fluoroacetate to fluorocitrate, which blocks the tricarboxylic acid (TCA) cycle, disrupting oxidative metabolism and resulting in death. The heart, brain and kidneys are the organs most prominently affected.

There is a latent period lasting from 30 minutes to three hours in warm-blooded animals while these metabolic processes are completed. There are no signs of 1080 intoxication during this latent period between ingestion of 1080 and onset of poisoning. Death occurs within 4 to 24 hours after ingestion. There is no known antidote for a lethal dose of 1080.

Animals that ingest a sub-lethal dose of 1080 survive the challenge because the body can metabolise and excrete the chemical, either as fluoroacetate or as non-toxic metabolites. These metabolic processes also mean that 1080 does not accumulate in the body and mammals are able to completely excrete all traces of a sub-lethal dose within one week.

Is 1080 humane?

Depending on the species, death from 1080 results from cardiac failure (humans and rabbits)**,** convulsions or subsequent respiratory paralysis (dogs) and central nervous system dysfunction, or a combination. Many species show symptoms consistent with central nervous system dysfunction ranging from tremors and muscular spasms, through to running, 'paddling' and convulsions. The perception of whether an animal feels pain during this process is greatly influenced by the perception of the person observing these symptoms. Although 1080 poisoning causes central nervous system dysfunction, these effects are similar to those experienced by humans during epileptic fits. Animals eventually loose consciousness in an equivalent way to human epileptics undergoing *Grand Mal Seizures*. It has therefore been inferred that the symptoms of central nervous system stimulation caused by fluoroacetate poisoning in *canids* (dogs and foxes) are not associated with significant pain. There is limited objective evidence with which to validate this assessment. However, one person who survived accidental 1080 poisoning subsequently reported feeling no pain, even during very severe convulsions. This account is consistent with the epilepsy analogy mentioned previously.

Research has concluded that there is no evidence that 1080 causes pain in rabbits and it is suggested that the symptoms of central nervous system stimulation caused by fluoroacetate poisoning in *canids* are not associated with pain. Nevertheless, it is recognised that some community uncertainty regarding 1080 remains, in part because its effect on the central nervous system gives animals the appearance of being distressed. It is also recognised that current technology cannot yet provide objective measures to adequately address these community concerns.

At the present time, the use of 1080 poison is essential to prevent the otherwise extreme environmental and agricultural impact of feral rabbits, foxes, dogs and pigs. The community therefore relies on the use of

1080 and whilst we all seek to better understand and manage questions regarding its humaneness, the community can be reassured by what is already known about 1080 and by the strict legislative controls over 1080 use.

For this reason, organisations like RSPCA Australia, while reflecting community uncertainty regarding the humaneness of 1080, accept its continued use provided relevant State authorities continue to strictly control this use.

Primary and secondary poisoning

Primary poisoning refers to the poisoning of an individual animal by consuming a toxic substance. For example, a rabbit suffers primary poisoning by eating 1080 poisoned carrot bait. Secondary poisoning occurs where another animal, usually a carnivore, discovers and consumes the carcase of the poisoned animal. Because most *canids* are highly susceptible to 1080 poison, it may be that sufficient poison remains in the carcase to cause their death. Birds of prey and other avian scavengers are less likely to be at risk due to their greatly reduced susceptibility to 1080 poison and the fact that they are less likely to eat enough of the carcase to receive a lethal dose.

The Pesticide Control Order requires persons who put out 1080 poisoned baits to collect uneaten 1080 bait material and if possible, poisoned carcases, and to dispose of them safely, in an attempt to reduce this risk of secondary and non target poisoning.

Sensitivity to 1080 and minimising the risk to non-target animals

All species are potentially susceptible to 1080 poison but differences in sensitivity between species means that the dose needed to kill some species can be eaten safely by others. For example, a bait that will kill a fox will not harm a wedge tailed eagle. As a generalisation, carnivores (and especially canids) are the most susceptible to 1080 poisoning, followed by herbivores, with birds and reptiles much less susceptible. In general, introduced species are much more susceptible than native wildlife. The relative sensitivity of various species to 1080 is shown in more detail in Appendix 1. Careful selection of dose rates can exploit these differences in sensitivity between species.

There is also variation in dietary preferences between species and these differences can be exploited by selecting bait substrates which are more attractive to target species and less attractive to non-target species. Feeding behaviour also differs between species and can also be exploited by using bait placement strategies which make baits more available to target species and less available to non-target species.

There is no single procedure that guarantees 1080 bait will always be totally target specific. However, an appropriate combination of correct dose rate, most appropriate bait material and bait placement strategy for each target species, greatly enhances the target specificity and reduces the risk to non-target animals. Nevertheless, as with any pesticide, there will be occasional non-target impacts. The non-target animals most at risk from 1080 are spotted tailed quolls and domestic dogs. It is appropriate that the community is aware that there is a small risk from 1080, a risk that it needs to balance against the enormous adverse impacts those pest animals would cause to agriculture and the environment without 1080.

Measuring 1080 powder, solution, baits and LD_{50}s

Amounts of 1080 are expressed as either a weight of powder (milligrams, grams, kilograms) or volume of solution (millilitres or litres). When preparing powder to solution, 1g of powder is mixed with 30mL of water.

Never dilute 1080 solution

LD_{50}s, for example, are always expressed in **mg of active 1080/kg bodyweight** while the actual application of 1080 to bait is measured in mL (of solution).

Table 3.1 The amount of active 1080 in solution and in each bait type.

Powder (mg or g)	Solution (mL)	Bait
1 mg	0.03	
3 mg	0.1	1 fox bait
6 mg	0.2	1 dog bait
10 mg	0.3	
100 mg	3.0	
1 g	30.0	
4 g	120.0	20 kg carrots
8 g	240.0	20 kg oats for rabbits
10 g	300.0	20 kg grain for pigs

3.5 1080 STORAGE, MIXING AND BAIT PREPARATION FACILITIES

Possession and use of 1080 poison and/or products are governed in NSW by the Pesticides Act, 1999. Storage of 1080 is governed by the EPA and WorkCover, which requires that 1080 be stored in a part of the premises partitioned off or otherwise separated from the remainder of the premises, and to which the public is not permitted entry. (While the provisions of this manual are picked up in the PCOs, storage is also controlled by the OH&S Reg 2001, ie both pieces of legislation apply).

The minimum facilities required by the EPA are a 1080 preparation and storage room, a bait preparation room and a Moree-type bait mixer.

1080 poison storage room
This room must be securely locked, be no smaller than 2m x 3m and be used for no other purposes. It must include:

- A bunded concrete floor, drained for effective washing-down into a sewerage system or absorption pit.
- The drain must be closed off at all times other than when the equipment is being hosed down. The sealed floor must be able to contain the total volume of 1080 stored if the entire contents were spilt.

The drainage of each facility, whether to a septic system or into the sewerage system is regulated by local government. Contact the relevant department of your local government for the requirements for sewer and septic disposal systems.

In general, where the facility drains to a sewerage system, a 'dilution pit' must be installed. This pit, of at least 200 L capacity, must be accessible for sampling.

An alternative for those boards where facilities are presently connected to the sewer is to divert the drain to an absorption pit (rubble drain) to totally avoid the sewerage system. In the long term this may prove the best method. It is advisable to seek guidance and approval from the local council.

Absorbent material, *eg.* lime should be on hand to soak up any major spillage

- 1080 solution containers must be stored on a tray capable of capturing the entire contents of the maximum amount of 1080 liquid that is likely to be stored.
- A washing tub for cleaning 1080 mixing utensils.
- A hand basin and water tap (this basin could alternatively be placed in the bait preparation room).
- Separate storage lockers: one lockable for 1080 stock solution and mixing utensils; and one for gloves and respirators. The 1080 locker must be securely fixed inside the room and be kept locked.

- Refer to Circular 94/17, *Pesticide storage*, for further information on pesticide storage or WorkCover and the Code of Practice that covers storage requirements.

All equipment used for mixing 1080 bait must be clearly labelled '1080 Poison' in large red lettering.

1080 safety equipment
The following is a list of basic safety equipment needed to handle 1080 solution and 1080 baits:

- Half face or full face respirator (with suitable dust and particulate filters). Filter cartridges do not last indefinitely; labels will give the appropriate time intervals for replacing cartridges. The respirator should be worn when mixing 1080 baits. It is also advisable to wear it when mixing dusty baits such as grain or pellets.
- A face shield is advisable.
- Strong plastic containers for holding bulk 1080 solution with large mouths and good seals for field use. Regularly check the containers, particularly corners, for damage.
- Overalls, rubber boots and washable hat. These are to be worn when handling solution and preparing baits.
- A lockable metal box for carrying 1080 solution into the field.
- Plastic buckets that allow comfortable handling of poisoned baits.
- Towel, soap, dish or bucket.
- Plenty of clean water.

1080 washing procedures
As 1080 is extremely soluble in water it is easy to clean up by washing down with plenty of water after you have been handling 1080 solution or baits.
All equipment should be thoroughly rinsed in water and allowed to drain. When washing down in the field, waste water, bait and other waste should be buried in a pit.

Authorised Control Officers must wear their rubber boots, gloves and overalls while washing down equipment. They then wash their gloves, remove them and their overalls, then wash their hands and face with soap and water.

Bait preparation room
Figure ?? illustrates a floor plan that would satisfy the minimum requirements of the EPA, for 1080 storage and bait preparation facilities. This room must be no smaller than 3m x 4m and include:

- A bunded concrete floor drained for effective washing-down into a sewerage system or absorption pit, as per poison preparation room.
- Adequate space for bait-cutting and mixing machines, packaging of bait, and temporary storage of poisoned bait awaiting distribution.
- Storage lockers for plastic bags, indemnity forms and all pesticide registers.
- A tap with a hose for washing-down facility and equipment after the poisoning of bait.

The bait preparation room and the room for storing 1080 solution must be securely locked. Walls of weldmesh or similar material are suitable for the bait preparation area.

This bait preparation room may be an extension of the 1080 storage room, but a lockable door must separate the two sections.

Ratepayers and unauthorised board staff may not enter the 1080 mixing room, but can enter the bait preparation area under the supervision of an ACO to use bait-cutting machines and to load bait.

Dyeing 1080 solution and bait

It is compulsory to dye all 1080 bait either blue or green. The reasons for dyeing are:

- The distinctive colouring readily identifies the bait as being poisoned with 1080.
- There is strong scientific evidence that the dyeing of bait does not affect the amount taken by rabbits and feral pigs, but does reduce the amount taken by birds.
- The dye readily indicates where 1080 solution moves through the bait preparations and distribution process. This will assist authorised control officers to improve work practices and thereby reduce contamination of clean areas by 1080.
- The dye indicates the efficiency of the 1080 mixing process.

For further information on dyeing 1080 solution and bait refer to NSW Agriculture circulars AI 94/6 and AI 94/19. Addresses of suppliers are available from Agricultural Protection Officers.

3.6 PREPARING 1080 BAIT

1080 Bait Mixer
Early bait mixing techniques dosed baits unevenly and exposed the ACO to 1080 mist and/or dust.

An enclosed mixer (Figure 3.2), initially designed by the Moree Rural Lands Protection Board and since modified, overcomes these two problems. This type of mixer is required as the minimum standard.

Using the Bait Mixer
Loading. The machine is loaded from the top through a square opening with a hinged lid. Maximum loads are 25 kg of carrots, 22 kg of grain or 16 kg of pellets. Meat baits are not to be used in the mixer.

Poison application. A Rega 'GEM' sprayer or equivalent mounted on the right-hand side of the machine applies the 1080 stock solution. A plastic hose, with a filter and foot valve, draws the poison from a measuring cylinder.

The 1080 liquid is pumped to 2 spray nozzles that are adjusted to give a fine, even, fan-shaped spray. The spray nozzles can be removed for cleaning.

A holder for the measuring cylinder must be mounted on the wall of the mixing room or on a stake in the field so it can't be knocked over. Because of vibration, it must not be mounted on the mixer. The solution should be lower than the pump to prevent syphoning.

Poisoned bait is removed through an opening in the bottom of the drum covered by a plate sliding on runners. This machine is designed only for plastic bags, which are spiked onto hooks on each corner of the runners.

1080 bait can be prepared in the field providing the following conditions are met:

- All safety equipment such as overalls, gloves, respirator (if necessary) and rubber boots and plenty of water are taken to the site.
- The 1080 solution is transported to a suitable site in a locked metal box, secured to or in the ACO's vehicle.
- The bait mixer or meat tray is placed in a shallow pit (about 10cm deep) to ensure all chaff or blood is contained on one site.
- Only ACO's handle 1080 solution.

At the completion of the bait preparation, the mixer/tray is washed down before removing it. All mixing and washing must be done over a 10-25 cm deep hole that is filled in when the job is finished. All empty bags must be deep buried or burnt; while

surplus baits must be deeply buried, to prevent accidental poisoning. The pit must also be checked for any leakage and rectified where necessary.

3.7 PLASTIC BAGS FOR 1080 POISONED BAIT

Under the Pesticides Act, 1080 bait material must be supplied to the user in an approved container impervious to the poison and of sufficient strength to prevent leakage arising from the ordinary risks of handling and transport.

Suitable plastic bags are a minimum of 100 microns (100 mu) thick. Addresses of suppliers are available from Agricultural Protection Officers.

Figure 3.3 shows an example of the required labelling on bags.

3.8 1080 POISON: DISTANCE RESTRICTIONS AND PUBLIC NOTIFICATION

Minimum distances for laying 1080 baits have been set to minimise the risk to not-target animals (particularly humans and domestic dogs and cats). If control is necessary in the areas excluded from baiting, other control methods must be used. Instructions relating to distance restrictions and public notification are contained in the Pesticide Control Order (refer to the specific species PCO) which are issued to landholders before a Rural Lands Protection Board allows them access to 1080 poison baits.

Public notification
The requirements for public notification are contained in the Pesticide Control Order and Permit (refer to the specific species PCO) which are issued to landholders before they are allowed access to 1080 poison baits by Rural Lands Protection Boards. Pesticide Control Orders and Permits outline who must be notified prior to laying 1080 bait.

Notice of application of pesticides to vacant Crown land, public areas or travelling stock reserves
When pesticides such as 1080 or pindone are applied to travelling stock reserves, areas of public land under the control of Rural Lands Protection Boards, areas of public land under the control of another Authority, then Rural Lands Protection Boards are required to ensure that the following notification is provided:

Publish a notice in a newspaper or newspapers circulating in the district in which the reserve is located, at least twice, with an interval of not less that 7 days between publication. The last notice to be not less than 7 days before the laying of poison baits. Place conspicuous weather-proof signs on the reserve or area warning that pesticides have been used (see relevant Pesticide Control Orders).

3.9 1080 POISONING NOTICES

Notices must be posted immediately before 1080 poisoning operations start on a property and must remain up for a least four weeks. Refer to the relevant Pesticide Control Orders for details on where the signs must be placed. Notices must specify which animal is being poisoned, and the date of poisoning.

INSERT -- Figure 3.4 . A 1080 poisoning notice fixed to a tree. The notice shows the recommended style and layout given in Section 3.9

Boards must keep adequate supplies of these notices for each animal species. It is

suggested that the stock on hand be checked as part of the monthly 1080 audit.

The following are the required specifications for the notices (see Figure 3.4 for an example of the layout).

Size and materials
Use 253 gsm white System board (cardboard) or a similar synthetic (Corflute etc.) of approximately 40cm x 30 cm.

Lettering
Lettering is to be in red (preferably suing a sans serif condensed typeface), about 7 cm high for the words '1080' and 'RABBIT' (or 'WILD DOG', 'FOX' or 'FERAL PIG') 'POISON', about 5cm high for the words 'LAID ON THIS PROPERTY'; and about 1 cm high for the words 'DATE POISON LAID / / '. The date can be written in permanent marking pen.

3.10 PINDONE

Pindone is an anticoagulant poison used for rabbit control throughout NSW. Pindone is registered as PIN-25® or Rabbait Liquid Pindone Concentrate® and must be used in accordance with the current relevant Pesticide Control Orders issued under the Pesticides Act. The terms and conditions and the schedule should be read by all persons using this pesticide. The Pesticide Control Order lists the type of bait and the way the poison may be used.

Pindone is currently available as PIN 25® which contains 2.5% pindone in an inert base of castor sugar and corn starch or as Rabbait Liquid Pindone Concentrate®, also 2.5% pindone in an inert base. When it is consumed over several days, the clotting power of the blood is reduced, causing internal haemorrhage and eventual death 4 - 11 days after consumption.

It is necessary to administer two applications of poison bait to ensure rabbits receive a lethal dose. Few rabbit carcasses will be seen after poisoning because most rabbits die in the warren, but rabbits may be active in the treated area for many days after eating the poisoned bait.

Anticoagulants have a low level of hazard to humans and domestic animals when used according to the label. However, because of its high cost, Pindone should only be considered for use in place of 1080 where:

- rabbits are to be controlled in urban or closely settled areas
- the landholder objects to the use of 1080 and is willing to accept the added cost
- for economic reasons stock must be returned to the treated paddock soon after a control program.

Toxicity
The oral LD_{50}s for technical pindone are given in Table 3.3. ('Technical' poisons are the more pure form from which commercial poisons are made.)

Safety
Concentrate. Handle pindone with the same extreme care used for all poisons:

- Always use the total contents of the pack. Never mix part of a container.
- It is poisonous if swallowed.
- Do not inhale dust.
- Do not touch the bait.
- Use a scoop or measure.
- Wash thoroughly with soap and water if pindone is split on unprotected skin.
- When preparing bait wear elbow-length PVC gloves.
- Wash hands after use.
- After each day's use wash gloves.
- If poisoning occurs go to a doctor or hospital quickly
- Vitamin K_1 (phytomenadione) is antidotal.

- This antidote can also be given to accidentally poisoned pets or livestock by a veterinarian.

Bait
- It is poisonous if swallowed.
- Do not inhale dust
- Do not touch the bait
- Use scoop or measure
- If on skin and after each baiting, wash thoroughly with soap and water
- Wash hands after use.

Storage
Pindone is supplied in 200 g plastic containers and need only be stored in secure facilities. It does not have the same strict requirements as 1080 stock solution for storage. However, many users have a lockable pindone storage cabinet within their 1080 facility.

Insert -Table 3.3 Approximate LD_{50} values for pindone for a range of animals

3.11 RABBIT FUMIGANTS

Note: All fumigants should be stored in well-ventilated areas and not opened in confined spaces. Where possible, fumigants should be stored adjacent to a vent or metal grill to the outside and the storage facility should be fitted with roof ventilators. Fumigants should never be stored in a fully enclosed building. Check WorkCover specifications if you are unsure of the storage requirements.

PHOSPHINE

Physical and chemical properties
Phosphine is a colourless gas with a slight garlic odour. It remains gaseous at all normal temperatures and spreads quickly, being only 20% heavier than air. The gas can react with copper, copper compounds, silver and gold at higher temperatures and humidity.

Phosphine is produced from tablets available under a number of brand names such as Phostoxin Rabbit Fumigation Tablets ®, Rentokil Gastion Rabbit Fumigation Tablets ®, Pestex Rabbit Fumigation Tablets ® and Fumitoxin Rabbit Fumigation Tablets ®. Tablets come in tubes and packs with varying numbers ranging from 30-100 tablets.

This gas is generated when aluminium phosphide tablets are exposed to air moisture. Tablets weigh 3 g and begin to emit phosphine immediately on exposure to moisture. Complete decomposition takes about 48-72 hours depending on the humidity.

Poisoning occurs by inhalation (although swallowing a tablet would be lethal). The gas is not readily absorbed through the skin.

Toxicity
For humans, the short term exposure limit (STEL) is 0.3 ppm; and concentrations of 50 ppm are immediately dangerous to health.

Safety
These substances can be handled relatively safely by operators using impervious gloves and overalls. A respirator is usually only required if the officer enters an enclosed area where phosphine may be liberated. As the gas is generated more rapidly on contact with moisture, all protective clothing should be dry.

Storage
Phosphine-generating substances should be stored in a locked area that is adequately ventilated to prevent poisoning or a heavy gas concentration if there has been some form of leakage. Fumigants should never be stored inside a closed building unless one wall of the enclosure is constructed of mesh or has sufficient ventilation as close to ground level as possible, or where it could get wet. Store at least 5 m away from any

liquid and particularly Class 6 poisons such as 1080, larvacide, CSSP and Pindone.

CHLOROPICRIN

Physical and chemical properties

Chloropicrin is a tear-gas that was used for chemical warfare in World War I. It works as a fumigant by evaporation of the liquid but the gas does not spread as quickly as phosphine, being five and a half times as dense as air. Chloropicrin is non-corrosive to copper and brass but attacks most other metals.

Poisoning occurs by inhalation. Chloropicrin gas is highly irritating to the lungs and eyes. In liquid form it will cause burns and must be immediately washed off affected skin or eyes. Remove any contaminated clothing immediately.

Chloropicrin is the active ingredient of the liquid available in 500 mL bottles as Larvacide Rabbit Fumigant® Chloropicrin can be used as a static fumigant on rag, dung or other absorbent material, or used through a pressure fumigator such as those manufactured by AgMurf.

Toxicity

For humans, the time weighted average (TWA or long term exposure limit) for chloropicrin is only 0.1 ppm. (Chronic exposure to chloropicrin is not a risk as the gas is so irritating at low doses, being a very strong tear gas, that it would be impossible to hang around long enough for chronic toxicity to occur.).

Safety

When handling chloropicrin the officer should have adequate protective clothing; overalls, elbow-length impervious gloves and an approved, full-face, canister-type respirator at the ready when handling the material. The officer should take advantage of any wind or natural draught to avoid breathing the vapour.

Storage

This fumigant has similar storage conditions as phosphine. Chloropicrin should be stored in a locked area that is adequately ventilated to prevent poisoning or a heavy gas concentration if there has been some form of leakage. It should never be stored inside a closed building unless one wall of the enclosure is constructed of mesh or has sufficient ventilation.

Store in the 1080 bait preparation room. Store in a tray capable of holding at least 25% of the maximum amount of larvacide that will ever be stored. The tray should be constructed and tested as described for 1080 storage except that plastic or brass may be a more durable material than galvanised steel.

Soda ash or lime should be stored to be used to neutralise any larvacide spillage that occurs. Keep approximately an equal amount of soda ash or lime and larvacide. That is, if there is usually about 50L or larvacide in store keep about 50 kg of soda ash or lime.

3.12 CSSP PHOSPHORUS PIG POISON - GENERAL PROPERTIES

CSSP is phosphorus and carbon bisulphide mixed in molasses. It is available in NSW only through RLPB's and is packaged in 1.4 kg tins.

The method of use is to place 60 g of CSSP in carcasses of sheep, cattle, pigs, goats and kangaroos. Its mode of action is severe gastro-intestinal irritation and liver damage. CSSP is highly combustible - keep it away from heat, sparks and naked flames.

Store in the bait preparation room in a tray capable of holding at least 25% of the maximum amount of CSSP that will ever be stored.

CSSP is poisonous if swallowed and can be absorbed through the skin. It has a highly

corrosive vapour that must not be inhaled. Use only in a well ventilated areas. When opening containers or preparing baits, wear cotton overall s buttoned to the wrist, and elbow length PVC gloves. If CSSP is split on the skin, immediately was the area with soap and water. Wash hands and face immediately after use. Do not transport CSSP in the cabin of a vehicle. After each day's use, wash contaminated clothing and gloves.

3.13 FIRST AID: GENERAL PROCEDURES FOR ACUTE POISONING

(Taken from the Smarttrain AQF IV Reference Manual).

Occupational exposures resulting in poisoning by a vertebrate pesticide (or any other pesticide) is relatively rare in Australia. In the event of an actual or suspected poisoning the following steps should be taken:

- Positively identify the chemical. Identification can be made from:
  - the product label(which also contains First Aid instructions),
  - MSDS (which contains instructions for medical practitioners), or
  - the Poisons Information Centre on 13 11 26.

General

- **Summon expert help.** Either send one person to summon the nearest doctor or ambulance or take the victim to the nearest hospital or doctor. Contact the Poisons Information Centre and maintain contact until the patient arrives at the medical facility.

- Establish what has happened. The doctor or hospital needs to have a clear idea of how the poisoning occurred and what pesticide was involved. Save any containers or labels and save any vomitus for analysis; but DO NOT induce vomiting.

- If the victim is unconscious clear the mouth of false teeth and vomit, then tilt the head back and bring the jaw forward to ensure a clear airway.

- If the victim is unconscious and not breathing, roll the victim onto their back and commence expired air resuscitation, avoiding direct mouth to mouth contact if indicated on the label. The use of a one way resuscitation mask is advisable.

NOTE: Extreme care and avoiding direct mouth to mouth contact is essential if a fumigant such as phosphine tablets or chloropicrin are known or suspected as being swallowed.

- If convulsions or fits occur, ensure that the airway is kept clear. A gag, if available, may be put between the teeth to protect the tongue. While the above first measures are being carried out, the victim may be transported to medical aid.

Skin

- Remove any contaminated clothing and wash the skin thoroughly with running water. Hair may require shampooing and any pesticide residues may have to be removed from under skin folds or fingernails. Avoid contact with heavily contaminated clothing and vomitus. Wear rubber gloves to undress, wash and handle the victim.

Eyes

- Where the eyes have been splashed, hold the eyelids apart and flush continuously with running water. Continue flushing until advised to stop by the Poisons Information Centre or doctor.

Figure 3.? to be inserted "Coma position for unconscious victims of poisoning".

Ensure the safety of others. If a poison is spilt, have it cleaned up and disposed of using the method described on the Material Safety Data Sheet (MSDS) for that product.

Establish exactly what has happened. This is so that the doctor or hospital will have a clear idea of which poisons have been involved. Save any containers or labels. Save any vomitus for analysis.

Remove any contaminated clothing and wash the skin thoroughly.

If eye have been splashed open them and irrigate with copious quantities of running water.

If the victim is unconscious clear the mouth of false teeth, food and so on by sweeping the finger round the back of the tongue. Use a cloth to wipe out any liquid that has accumulated. Tilt the head back and bring the jaw forward to ensure a clear airway (See Figure 3.?). If they are breathing, place them in the Coma position (see Figure 3.?).

If convulsions or fits occur ensure that the victim may breathe by turning them on their sides and by maintaining their airway (see Figure 3.?). To ensure that the tongue is not bitten, insert a gag between the teeth. While the above first aid measures are being carried out, the victim may be transported to medical aid or a doctor. For the treatment of specific poisoning see Section 3.14.

For instructions on artificial respiration and external cardiac compression, contact the local Ambulance Service or First Aid training provider listed in the Yellow Pages.

Figure 3.? to be inserted. Head position, which ensure a clear airway for unconscious victims of poisoning.

3.14 FIRST AID: SPECIFIC RECOMMENDATIONS FOR INDIVIDUAL POISONS

The following information is taken from the relevant Material Safety Data Sheet (MSDS).
In all of these cases, medical assistance should be obtained as soon as possible.

1080

1080 is a deadly poison. Prompt treatment is vital whenever contact is made with this product.

Swallowed: If swallowed, more than 15 minutes from a hospital, and victim is conscious, give a glass of water and transport to hospital or doctor. Promptness is vital.

Eye: If 1080 comes into contact with eyes, hold eyes open and wash continuously. Remove running water. Ensure irrigation under eyelids by occasionally lifting eyelids. Do not attempt to remove contact lenses unless trained. Transport to hospital or doctor immediately

Skin: If 1080 comes into contact with skin, wash skin with soap and water for 15 minutes. Remove contaminated clothing and footwear. Ensure contaminated clothing is thoroughly washed before using again. Transport to hospital or doctor immediately.

Inhalation: If fumes or combustion products are inhaled, remove the victim to fresh air. Lay victim down and keep warm and rested. If breathing is shallow, or has stopped, ensure clear airway and apply resuscitation or oxygen if available. Transport to hospital or doctor immediately.

Eye Wash: Eye wash stations, baths or plenty of running water should be available

whenever chemical products are being used. Wherever there is any possibility of skin exposure, deluge showers and washing facilities should be provided.

Chloropicrin

If there is any contact by any route (apart from very minor inhalation), contact the Poisons Information Centre or a doctor immediately. Do not wait for symptoms of poisoning. Workers should have a plentiful supply of soap and water for washing present when chloropicrin is being used.

Eye wash baths should be available when chloropicrin is being used. Where practical, deluge showers should be provided when this product is being used.

Swallowed: If swallowed, contact the Poisons Information Centre or a doctor immediately. Do not wait for symptoms of poisoning.

Eye: If this product comes into contact with eyes, hold eyes open and wash thoroughly with running water. Ensure irrigation under eyelids by occasionally lifting eyelids. Do not attempt to remove contact lenses unless trained. Transport to hospital or doctor immediately.

Eye wash station or baths should be available where product is being used. Deluge showers or washing facilities should be provided where this product is being stored.

Skin: If this product comes into contact with skin, wash for at least 15 minutes with soap and water. Remove contaminated clothing and footwear. Ensure contaminated clothing is thoroughly washed before using again. Transport to hospital or doctor.

Inhalation: If fumes or combustion products are inhaled, remove to fresh air. Avoid becoming a victim. Lay victim down and keep warm and rested. If breathing is shallow, or has stopped, ensure clear airway and apply resuscitation or oxygen if available. Transport to hospital or doctor immediately.

Phosphine **(aluminium phosphide: Gastion, Pestex etc.)**

If poisoning occurs, go to a doctor or hospital quickly.

Swallowed: If swallowed, rinse mouth with water. Contact a doctor or Poisons Information Centre immediately. Do not give mouth to mouth resuscitation, even if the patient has ceased breathing unless the rescuer uses Air-viva, Oxy-viva or a one-way mask. Resuscitate in a well-ventilated area.

Eye: If aluminium phosphide comes into contact with eyes, hold eyes open and wash with running water for at least 15 minutes. Ensure irrigation

Eye wash stations or baths should be available where aluminium phosphide is being used. Deluge showers or washing facilities should be provided where aluminium phosphide is being stored.

Skin: If aluminium phosphide comes into contact with skin, wash for at least 15 minutes with soap and water. Remove contaminated clothing and footwear. Ensure contaminated clothing is thoroughly washed before using again. Transport to hospital or doctor if skin irritation develops.

Inhalation: If fumes or combustion products are inhaled, remove to fresh air. Lay victim down and keep warm and rested. If breathing is shallow, or has stopped,

ensure clear airway and apply resuscitation or oxygen if available. Transport to hospital or doctor immediately.

Pindone

If poisoning occurs, go to a doctor or hospital quickly.

Swallowed: If swallowed contact a doctor or Poisons Information Centre immediately and transport to a hospital.

Eye: If Pindone comes into contact with eyes, hold eyes open and wash with running water. Ensure irrigation under eyelids by occasionally lifting eyelids. Do not attempt to remove contact lenses unless trained. Transport to hospital or doctor if eye irritation develops.

Skin: If Pindone comes into contact with skin, wash skin with soap and water. Remove contaminated clothing and footwear. Ensure contaminated clothing is thoroughly washed before using again. Transport to hospital or doctor if skin irritation develops.

Inhalation: If fumes or combustion products are inhaled, remove to fresh air. Lay victim down and keep warm and rested. If breathing is shallow, or has stopped, ensure clear airway and apply resuscitation or oxygen if available. Transport to hospital or doctor immediately.

Bromadiolone

If poisoning occurs, go to a doctor or hospital quickly.

Swallowed: If swallowed, contact a doctor or Poisons Information Centre and transport to a hospital or doctor immediately.

Eye: If this product comes into contact with eyes, hold eyes open and wash with running water for at least 15 minutes. Ensure irrigation under eyelids by occasionally lifting eyelids. Do not attempt to remove contact lenses unless trained. Transport to hospital or doctor immediately if eye irritation develops.

Skin: If this production comes into contact with skin, wash for at least 15 minutes with soap and water. Remove contaminated clothing and footwear. Ensure contaminated clothing is thoroughly washed before using again. Transport to hospital or doctor if skin irrigation develops.

Inhalation: If fumes or combustion products are inhaled, remove to fresh air. Lay victim down and keep warm and rested. If breathing is shallow, or has stopped, ensure clear airway and apply resuscitation or oxygen if available. Transport to hospital or doctor immediately.

In all cases do as little as possible, and get the affected person to a doctor/emergency ASAP.

For Medical Practitioners
The standard references (for doctors not 1st aiders) are:

- Reigart & Roberts, *Recognition & Management of Pesticide Poisonings,* 5th ed 1999, and
- *WorkCover's Training Manual for WorkCover Authority Authorised Medical Practitioners.*

Appendix 1. The approximate oral LD_{50} for 1080 for a range of species in areas were *there are no fluoroacetate bearing plants*. The amounts of 1080 and number of baits for an LD_{50} are for individuals of the weight shown in the 'Bodyweight' column; *they will not be correct for individuals of other weights*. LD_{50}s preceded by ~ indicate that the value is only approximate; all other values in the same row will then also only be approximate.

Species	Bodyweight (kg)	LD_{50} (mg/kg)	Amount of 1080 for LD_{50} (mg)	Approximate amount of bait for an LD_{50}: Dingo baits @ 6mg/bait (no. of baits)	Fox baits @ 3 mg/bait (no. of baits)	Rabbit bait Carrot @ 180 mg/kg (grams of bait)	Pig bait Grain @ 450 mg/kg (grams of bait)
Native amphibia and reptiles							
Spotted grass frog. *Limdodynastes tasmaniensis*	0.046	~ 60.00	2.76	0.46	0.92	15.3	6.1
Shingle-backed lizard. *Tiliqua rugosa*	0.468	205.90	96.36	16.06	32.12	535.3	214.1
Bearded dragon. *Pogona barbatus*	0.267	<110.00	<29.37	<4.90	<9.79	<163.2	<65.3
Blotched blue tongued lizard. *Tiliqua nigrolutea*	0.434	336.40	146.00	24.33	48.67	811.1	324.4
Sand goanna. *Varanus gouldii*	0.84	43.60	36.62	6.10	12.21	203.5	81.4
Lace monitor. *Varanus varius*	3.65	100.00	365.00	60.83	121.67	2027.8	811.1
Native mammals							
Fat-tailed dunnart. *Sminthopsis crassicaudata*	0.013	2.06	0.03	< 0.01	0.01	0.1	0.1
Dusky antechinus. *Antechinus swainsonii*	0.06	3.21	0.19	0.03	0.06	1.1	0.4
Brown antechinus. *Antechinus stuartii*	0.035	1.85	0.06	0.01	0.02	0.4	0.1
Swamp rat. *Rattus lutreolus*	0.154	1.71	0.26	0.04	0.09	1.5	0.6
Bush rat. *Rattus fuscipes*	0.12	1.13	0.14	0.02	0.05	0.8	0.3
Grassland melomys. *Melomes burtonii*	0.07	2.65	0.19	0.03	0.06	1.0	0.4
Canefield rat. *Rattus sordidus*	0.15	1.28	0.19	0.03	0.06	1.1	0.4
Water rat. *Hydromys chrysogaster*	1.00	~ 2.94	2.94	0.49	0.98	16.3	6.5
Northern quoll. *Dasyurus hallucatus*	0.75	5.66	4.25	0.71	1.42	23.6	9.4
Tiger quoll. *Dasyurus maculata*	2.80	1.85	5.18	0.86	1.73	28.8	11.5
Brushtail possum. *Trichosurus vulpecula*	2.60	0.75	1.95	0.33	0.65	10.8	4.3
Brown bandicoot. *Isodoon obesulus*	1.23	~ 7.00	8.61	1.43	2.87	47.8	19.1
Long-nosed bandicoot. *Perameles nasuta*	1.20	7.70	9.24	1.54	3.08	51.3	20.5
Common wombat. *Vombatus ursinus*	24.00	0.22	5.28	0.88	1.76	29.3	11.7
Long-nosed potoroo. *Potorous tridactylus*	1.10	~ 0.15	0.17	0.03	0.06	0.9	0.4
Red-necked wallaby. *Macropus rufogriseus*	19.00	< 0.21	< 3.99	< 0.66	< 1.33	< 22.2	< 8.9
Eastern grey kangaroo. *Macropus giganteus*	47.00	~ 0.22	10.34	1.72	3.45	57.4	23.0
Red kangaroo. *Macropus rufus*	30.00	~ 3.20	96.00	16.00	32.00	533.3	213.3
Dingo. *Canis familiaris dingo*	16.00	0.11	1.76	0.29	0.59	9.8	3.9

Species	Bodyweight (kg)	LD_{50} (mg/kg)	Amount of 1080 for LD_{50} (mg)	Approximate amount of bait for an LD_{50}: Dingo baits @ 6mg/bait (no. of baits)	Fox baits @ 3 mg/bait (no. of baits)	Rabbit bait Carrot @ 180 mg/kg (grams of bait)	Pig bait Grain @ 450 mg/kg (grams of bait)
Native birds							
Crimson rosella. *Platycercus elegans*	0.14	~ 0.87	0.12	0.02	0.04	0.7	0.3
Eastern rosella. *Platycercus eximius*	0.10	~ 3.45	0.35	0.06	0.12	1.9	0.8
Red-rumped parrot. *Psephotus haematonotus*	0.06	~ 5.25	0.32	0.05	0.10	1.8	0.7
White-winged chough. *Corcorax melanorhamphos*	0.33	~ 1.75	0.58	0.10	0.19	3.2	1.3
Galah. *Cacatua roseiapilla*	0.31	6.40	1.98	0.33	0.66	11.0	4.4
Sulphur-crested cockatoo. *Cacatua galerita*	0.80	3.56	2.85	0.47	0.95	15.8	6.3
Grey shrike-thrush. *Colluricinla harmonica*	0.07	~>12.00	0.84	0.14	0.28	4.7	1.9
Australian magpie-lark. *Grallina cyanoleuca*	0.09	~ 6.75	0.61	0.10	0.20	3.4	1.3
Australian magpie. *Gymnorhina tibicen*	0.32	9.91	3.17	0.53	1.06	17.6	7.0
Pied currawong. *Strepera graculina*	0.30	13.10	3.93	0.65	1.31	21.8	8.7
Laughing kookaburra. *Dacelo novaeguineae*	0.30	~>6.00	1.80	0.30	0.60	10.0	4.0
Little raven. *Corvus mellori*	0.56	3.10	1.74	0.29	0.58	9.6	3.9
Australian raven. *Corvus coronoides*	0.585	~ 5.10	2.98	0.50	0.99	16.6	6.6
Little crow. *Corvus bennetti*	0.40	13.40	5.36	0.89	1.79	29.8	11.9
Black kite. *Milvus migrans*	0.56	18.50	10.36	1.73	3.45	57.6	23.0
Wedge-tailed eagle. *Aquila audax*	3.10	9.50	29.45	4.91	9.82	163.6	65.4
Emu. *Dromaius novaehollandiae*	40.00	~ 250.00	10000.00	1666.67	3333.33	55555.6	22222.2
Introduced mammals							
House mouse. *Mus musculus*	0.14	8.33	1.17	0.19	0.39	6.5	2.6
Black rat. *Rattus rattus*	0.229	0.76	0.17	0.03	0.06	1.0	0.4
Sheep. *Ovis aries*	38.00	0.52	19.76	3.29	6.59	109.8	43.9
Goat. *Capra hircus*	37.00	~ 0.50	18.50	3.08	6.17	102.8	41.1
Pig. *Sus scrofa*	55.00	1.04	57.20	9.53	19.07	317.8	127.1
European cattle. *Bos taurus*	520.00	0.39	202.80	33.80	67.60	1126.7	450.7
Horse. *Equus caballus*	500.00	~ 0.41	205.00	34.17	68.33	1138.9	455.6
Rabbit. *Oryctolagus cuniculus*	1.50	0.37	0.55	0.09	0.18	3.1	1.2
Cat. *Felis catus*	4.20	0.40	1.68	0.28	0.56	9.3	3.7
Fox. *Vulpes vulpes*	4.70	~ 0.12	0.56	0.09	0.19	3.1	1.3
Man. *Homo sapiens*	72.00	2.00	144.00	24.00	48.00	800.0	320.0

This table was compiled by Bob Harden, Manager Vertebrate Pest Unit NPWS Armidale

Poisons Information Centre Phone 13 11 26

Appendix 2. Vertebrate Pesticides used in NSW

Pesticide	Registration	Dose rate	Bait type	Application Rate	Target species
1080	Under Permit Under Permit Under Permit Under Permit	0.18-0.46g/kg active 0.31-0.46g/kg active 3mg per bait active 6mg per bait active	Carrots, oats, pellets Grain, fruit, veg FoxOff, meat etc Doggone, meat	4-8 kg/ha or 2.5 kg/km of trail 5-75 kg /trail or bait station 10 baits/km or 1 bait/ha 4 baits/km or 16 baits/100 ha	Rabbits Feral Pigs Foxes Wild dogs
Pindone	Registered as Pin 25 and Rabbait	0.49g/kg	Carrots and oats	Up to 10 kg/km of trail or in bait stations	Rabbits
Zinc Phosphide	Registered as "MouseOff"	25g/kg active	Grain Grain	0.4 - 1 kg/ha from the air 0.4 - 1 kg/ha	Mice
Alphachloralose	Under Permit	990g/kg active	Grain	15 grams of product per 1 kg of wheat or other grain	Pest Birds
Strychnine	Under Permit	1 gram per cloth approx 300x400mm	Cloth on leg-hold traps	1-2 cloths per trap	Wild Dogs
Bromadiolone	Under Permit for concentrate. Reg as Bromakil etc.	0.05 g/kg active in propylene glycol	Wheat (soft)	1 kg/kilometre of trail or 100 g/bait station to a maximum of 2kg/km	Mice
Phosphine	Registered as Gastion, Fumatoxin etc.	570g/kg aluminium phosphide	Fumigation tablet	1-2 tablets per warren opening	Rabbits
Chloropicrin	Registered	1631 g/litre active (500mL bottle)	liquid	3-5 mL/warren but can be upto 20 mL	Rabbits
CSSP	Registered	40g/kg Phosphorus 50.8 g/kg Carbon bisulphide 2 g/kg Molasses	Applied to carcases Applied to grain	60 gm per carcase 1.4 kg CSSP/80kg wheat (3 bushel bag)	Feral Pigs

Compiled by David Croft, Agricultural Protection Officer, WAGGA WAGGA

Poisons Information Centre Phone 13 11 26

Rabbit biology and control

RABBIT BIOLOGY

Origin

The European rabbit (*Oryctolagus cuniculus*) is native to north-western Africa, Spain and Portugal and it is now found in the USA, Chile and most of western Europe as far north as southern Scandinavia. But the release into Australia and New Zealand has caused the greatest problems.

The first recorded rabbits arrived with the First Fleet and were most likely silver-greys or domesticated meat rabbits. The first recorded occurrence of rabbits causing concern was in Tasmania in 1827. Many islands in Bass Strait and the Tasman Sea had rabbits released on them to provide sustenance for ship-wrecked sailors.

There seems to be little doubt that the mainland rabbit horde originated from a shipment of twenty-four genetically wild rabbits consigned to Mr. Thomas Austin of "Barwon Park", near Geelong. The rabbits established at "Barwon Park" for game were so successful that by 1865, 20,000 rabbits had been killed off with an estimated 10,000 remaining.

The north and westward spread across Victoria was rapid. By 1880 rabbits had reached and crossed the Murray River and by 1886 had reached the Queensland border. With savanna woodland merging into the western plains as well as the Lachlan, Darling and Murray River systems providing a very favourable habitat, there were no obstacles to prevent rabbits spreading westward, north or even north-east. This rate of spread suggests that man contributed to their ultimate distribution with tramps known to carry rabbits around. Trappers and shooters were probably also responsible for the rapid spread.

By the late 1880's, rabbits had begun to ecologically consolidate on the land they had invaded with their population density peaking concurrently with sheep numbers. Rabbits had also crossed South Australia and into Western Australia, arriving at Geraldton in 1907; a journey of 1,760 kilometres in just sixteen years.

Rabbits now inhabit approximately 4 million square kilometres but mostly south of the Tropic of Capricorn. They have established in environments ranging from sub-alpine areas to stony deserts, sub-tropical grasslands to wet coastal plains but particularly in Mediterranean type climates; these are areas generally associated with livestock production or that which supports the great majority of Australia's rural production.

Distribution in New South Wales

The rabbit is found throughout most of this State with the general exception of the black soil areas. Although there is no accurate figure on the present distribution, past surveys indicate that at least three quarters of the state has some degree of rabbit infestation. Approximately 8% would have a high and extremely detrimental population of rabbits.

Recognition and sign

The only animal in Australia that could be confused with the rabbit is the hare. However, the hare has longer, black-tipped ears, longer legs and a loping gait. Rabbits and hares are amongst the easiest of European mammals to observe directly, for they frequent open ground and are at least partially diurnal. They can be distinguished from all other mammals by their long ears,

long hind legs and short fluffy tails. Their footprints are also distinctive. Rabbits and hares are most active at dawn and dusk, and feed by grazing and browsing.

Rabbit droppings are often similar to hares', depending on food eaten, but they are distinguished from lamb faeces by the absence of flat facets on the surface. Scrapes, dung heaps, burrows and warrens are evident when rabbits are present.

Habitat

Rabbits prefer short grass areas (either found naturally as in semi-arid areas or resulting from heavily grazed pastures), with harbour (warrens, blackberries or fallen logs) nearby. These animals can adapt to a wide variety of habitats, though in general they avoid large cultivated areas, forests, floodplains and black soil country. Human habitation does not deter rabbits and they may become a problem around home gardens, shearing sheds and other farm buildings.

Behaviour

Rabbits are most active from late afternoon until early morning, but they can be active at any time if they are undisturbed or if their numbers are high. Activity appears to decrease at night if there are high winds or rain, which limits their ability to detect predators. Communication is mainly by smell, but alarm signals are given by flashing the tail while running and by thumping with the hind feet.

Daily movements are generally within 150 to 200 m of the warren but this distance can increase during droughts (up to 1500 m has been observed), or decrease during the breeding season.

The dominant buck has freedom of movement within the whole home range and so has access to the greatest number of females. Territorial boundaries are well defined and are marked mainly by the dominant buck with urine, faeces and an exudate from a chin gland. These boundaries are strictly maintained and defended by all the members of the group against the entry of strangers. At the end of the breeding season these boundaries break down allowing for the dispersal and spread of the young.

Dispersal

Dispersal is obligatory in mammals to avoid inbreeding; rabbits are no exception. Very young rabbits (20-60 days old) are more likely to disperse than older rabbits. Adult rabbits rarely disperse. Most dispersal is from warrens with a high rabbit density to warrens with a low density or to adjacent social groups.

Rabbits usually do not travel vast distances, but movements in excess of 20 km have been recorded.
Newly emerged kittens may move up to 1.5 km to a new warren complex. The general rule of thumb is that movement (and reinvasion of control areas) can and will occur, yet mass movements over long distances is mostly when food is limiting. It is usually difficult to distinguish between recolonisation and reproduction *in situ* after a control program, so it is better to conduct a proper control program which has some form of buffer area against migration.

Diet

Rabbits are herbivorous (plant-eating) and eat a wide variety of plants including crops, roots, pastures, young trees and young vines. With a mean (average) body weight of 1.6 kg, a rabbit can consume up to one third of its own weight daily although the average daily intake is around 100-150 g. The maintenance requirements for a rabbit and a 45 kg sheep are 284 Mj a year for rabbits and 2438 Mj a year for sheep. This equates to a ratio of approximately nine rabbits to one DSE (dry sheep equivalent).
The skulls of lagomorphs are easily recognised by their very obvious chisel-

shaped incisors (as in rodents) with a small second pair of upper incisors close behind the first. The lower incisors fit between these upper pairs keeping them well ground and sharp. Consequently, rabbits can graze plants to ground level and prefer soft, short and succulent plants rather than woody or stalky taller species.

Grazing generally continues throughout the night, varying from 2.5 to 6 hours. Where the warren complex supports a large population of rabbits, feeding grounds or rabbit lawns develop a short distance from the warren with a central dung heap.

Coprophagy

Food is well masticated, entering the stomach as fine particles. As part of their digestive process they form two types of faecal pellets; soft and hard. The soft pellets, which have a high bacterial content, are produced mainly during the daylight hours when the rabbits are not grazing. These soft pellets are eaten directly from the anus and reingested (coprophagy) extracting the remaining protein and moisture. Thus, a more complete digestion of the fibrous material and allows rabbits to survive with minimum free water.

The hard pellets seen on the ground and at dung heaps are the end result of the digestion process and are usually dropped during the normal grazing period from late afternoon and throughout the night.

Social Structure and Breeding

The warren complex forms the basis for a distinct social structure with a well-defined hierarchy closely aligned with the breeding season. Once breeding ceases the structure weakens and eventually breaks down.

The main breeding season is determined primarily by rainfall and the early growth of high protein plants, and so varies throughout the State. In the south, it usually starts after the autumn break and finishes in late spring whereas in other parts of the State breeding results from the increased vegetation during spring. Rabbits can breed at any time provided there is short green feed supplying sufficient protein.

Harsh conditions occurring during the breeding season may induce anoestrus or cause the doe to cease lactating and/or resorb any foetuses. This mechanism allows the breeding nucleus to be preserved at the expense of the more vulnerable young.

With the onset of breeding, social groups of seven to ten rabbits form, governed by a dominant buck and a dominant doe. There is a high level of aggression, strong territorial behaviour and the evolution of social hierarchies. A few breeding groups together form a social entity and occupy a common grazing and sheltering ground.

Both males and females reach sexual maturity between three and four months of age. Does are induced ovulators which results in synchronisation of oestrus. With a large number of receptive females, subordinate bucks are able to mate while the attention of the dominant buck is busy mating with other does.

The gestation period for rabbits is 28-30 days. There is no post-partum anoestrus and the doe generally mates again within an hour of parturition. Under favourable conditions an adult female can produce seven or eight litters in a year. Although the litter size varies according to the doe's age and social status, seasonal conditions and nutrition, the average number is four to five kittens in the first litter, rising to about eight by the end of the season. Consequently, one doe can produce between 50 and 60 offspring in a single breeding season. When the females from this doe's first litters reach sexual maturity at three months, they too will reproduce. So in one breeding season, one adult doe may be responsible for the production of in excess of one hundred rabbits.

CSIRO researchers found that although dominant females made up only 24% of the population, they produced 51% of the kittens. The second ranking does made up 43% and produced 42% of the kittens, while the third and fourth ranking subordinates (33%) produced only 7%.

The young are usually born in nests of grass and belly fur, which may be in part of the warren complex or, if from a subordinate female, in a breeding stop. The breeding stop is a short single entrance burrow less than a metre long and about 30 cm below ground. After the birth and first feeding, the doe leaves the stop fully covering the entrance. She visits the stop four to five times each 24 hour period to feed the young, concealing the entrance at each departure.

The kittens are born blind and hairless. Their eyes open after seven to ten days and they emerge from the warren at about eighteen days. They are usually weaned at this stage leaving the nest when 23-25 days old. If the doe dies or abandons her young, they can survive from 16 to 18 days of age.

Mortality

Apart from human intervention for control or sport, natural adult rabbit mortality does not generally suppress a rabbit population. When discussing population dynamics, the emphasis is mainly on nestling mortality and natural factors. Kitten mortality in the wild is extremely high with up to 80 per cent dying before they reach 3 months of age. But in a favourable year with a temperate Mediterranean climate, an 85 % mortality is needed to suppress a ten-fold population increase.

Disease: One of the most devastating diseases to rabbits is myxomatosis but this debilitating and mostly fatal disease needs vectors for transmission. Unless mosquitoes or rabbit fleas are present, infection will not occur. This, with the variable virulence of different strains, and with viral attenuation, the effectiveness of myxomatosis should not be relied on as a primary control method.

In cold wet climates, apart from drowning in flooded burrows, coccidiosis is more likely to be fatal than myxomatosis. This disease is caused by an internal parasite, *Eimeria stiedai* that is most prevalent along coastal areas and in the New England region of NSW. Internal parasites mainly affect adults by impairing reproduction and reducing populations but can also cause a high mortality of the young.

Parasites: Rabbits have few external parasites except fleas. The rabbit flea, *Spilopsyllus cuniculi* (Dale) is an important vector for myxomatosis while the stick-fast and other fleas have little direct effect. The Spanish rabbit flea, *Xenopsylla cunicularis* has been released throughout the semi arid areas of Australia as the vector for myxomatosis (see Section 4.13 Myxomatosis). However, in western areas where Rabbit Haemorrhagic Disease (RHD) has been successful, then the Spanish rabbit flea has to be considered as one of the possible vectors.

Predation: Predation can account for substantial losses of both healthy and starving rabbits. Besides the fox, dingo, cat and dog there are a number of avian species that prey on the rabbit in Australia. The wedge-tail eagle is probably the most effective, followed by goshawks, falcons and barn owls. Ravens, goannas and snakes may also prey on kittens.

When rabbit numbers are low, predation can reduce the annual crop of young by approximately 25%. In denser populations this proportion decreases to about 10% with predation playing little part in population control.

Starvation: The only factor that seems to operate in a density-reducing manner is starvation. The lack of food stops reproduction and can result in the deaths of nestlings, then eventually killing the adults. Drought causes dispersal, which leads to exposure and vulnerability to prey. This is

the time when control programs are the most effective.

Symbiosis: An interesting phenomenon that occurs in most areas is that of a predatory species living in an active rabbit warren. Rabbits will allow feral cats, foxes or goannas to share a warren without any fear. In return for the accommodation, the predators do not touch their hosts, yet may prey on rabbits in a neighbouring warren. Generally, symbiotic relationships only occur when rabbit numbers are high and when predation has little effect on population dynamics.

RABBIT CONTROL

Many land managers do little or no rabbit control, relying on myxomatosis, predators and drought; ignorant of the fact that rabbits can breed rapidly and that myxomatosis is unreliable for successful control**.**

Yet some consider rabbits an economic and environmental pest. They achieve high levels of control by using a combination of control techniques and recognise that the expense of destroying rabbits can be completely wasted if the established rabbit warrens remain. These land managers require minimal effort to keep rabbits under control and include rabbits in their normal land management plan. Some then join with neighbours to attain a common standard of suppression throughout their district.

The primary goal in rabbit control is to minimise the economic and environmental damage caused by rabbits by reducing the population to a level where it does no harm and cannot quickly build up.
This requires a number of steps. Too often the control program is halted after the first step and numbers rapidly build up again.

Remember that it is not the number destroyed but the number remaining that is the problem.

The steps to follow for effective control are explained below.

Step 1 — Initial reduction

If rabbit densities are medium to high, the first step is to reduce the population to a manageable level. This initial control is usually accomplished by a poisoning program, but only during the non-breeding season. If control must be carried out during the breeding season, use ripping or fumigating instead of poisoning. If a myxomatosis outbreak is present during the inspection, it might be better to delay control to see if the disease will achieve this initial reduction.

If the rabbit density is low, go straight to Step 2.

Step 2 — Extensive control

This phase is the most important part of the control program because it is where an effective reduction of rabbits and harbour should be achieved. The initial control brings the population down to a manageable level while extensive control further reduces the population to a level where it cannot recover quickly. On a property where rabbit numbers are low, the control program can often start with the extensive control phase. Extensive control consists of harbour destruction, usually by ripping warrens, using explosives, pressure fumigating, burning fallen logs and eliminating blackberries.

Step 3 — Advanced control

Advanced control is optional and dependent on economics, but it should be the future goal of RLP Boards and land mangers. At the completion of the extensive control phase, there are usually a small number of rabbits surviving. Assuming no immigration, further control at this point pays the biggest dividends by making it impossible for the population to build up. Techniques used here are spotlight shooting, trapping around active areas and dogging. Regular and

effective monitoring of the rabbit population is also an important part of this phase.

If these steps are followed correctly, and the last two steps repeated as part of the overall property management program, then it should be unnecessary to repeat the initial reduction step (except possibly in drought years). This should be the goal of all land managers and RLP Boards. **Repetitive poisoning, year after year, is bad pest management and can result in poison shyness!**

MONITORING OF RABBIT POPULATIONS AND THE EFFECTIVENESS OF CONTROL

When managing livestock or pests in crops (weeds and insects), the land manager will continually assess the problem and determine the most cost effective management option. Yet with rabbit control, many fail to monitor the problem and within a short period rabbit numbers have built up again. It is vital for successful rabbit control that the population density is determined first and then where they live and where they feed.

Property Maps - A rough outline of where rabbits occur can be circled on a property map by RLPB staff during a property inspection or by the land manager. The map can then be refined to include priority warrens, small warren complexes, feeding grounds *etc,* with density and potential codes (see Section – Performance Indicators – Vertebrate Pests). Probable trail lines, priority numbering and timing, as well as possible control techniques should also be suggested. These maps can be used as part of the overall property management plan and to assess progress over the years.

Spotlight Counts - A spotlight count can be a simple matter or a complex and effective strategy. A simple count may be a 2-3 km drive through an area of known rabbits to get a better estimate of the population and to see where the feeding grounds are. Knowing where and how many rabbits are present makes it easier to determine the placement and rate of poisoned bait and provides a more cost- effective control.

The more complex spotlight counts require a set path and at least three to five counts over consecutive nights. The more counts that are done and the greater the accuracy of the information collected, the easier it is to calculate population reductions and to gauge the effectiveness of the control program. This also allows for annual comparisons of properties in similar areas. For details of advanced spotlight counting techniques and a recording sheet, see the Monitoring section or consult your regional Agricultural Protection Officer.

Other Types of Monitoring - There are many types of monitoring. The easiest is visual observation such as sightings and scratchings. Bait stations and the amount of bait consumed during free feeding are more reliable techniques. Transect counts of active warrens (eg the number of warrens in a straight line) or the proportion of active entrances in warrens, and can also be used as a guide to rabbit populations and control effectiveness.

INITIAL REDUCTION:- POISONING WITH 1080

1080 must be used in accordance with the current Pesticide Permit (See also Poisons section). All persons using this pesticide should read the terms and conditions and the schedule.

Essential points

- The time to poison rabbits is when they are not breeding. During breeding, rabbit movements are much more limited and consequently they are less likely to find the bait unless much more trail is laid. Moreover, kittens over 17 days old can survive, even if the mother is poisoned,

and subsequent breeding by these survivors can cause rapid regrowth of the population.

- Poisoning should only be carried out in paddocks that have been heavily grazed. This forces rabbits to find and eat the bait. It also allows the landholder to use those paddocks fully before poisoning, the wait a longer period before restocking, leaving more time for the surplus bait to weather.

- The objective is not only to decrease the population and consequent rabbit damage, but also to prevent quick population build-up. If only a small part of an infested area is poisoned, even a total kill will be worthless because the population will quickly build up due to immigration from surrounding areas.

- A kill of as close as possible to 100% must be obtained for a successful poisoning operation. Keep in mind that it is not the number killed but the number left alive that is important. Percentage reductions mean nothing if rabbit numbers are extreme. For example, a 5% residue from an original population of 5000 is 250 rabbits; whereas an original population of 500 leaves only 25 rabbits. The latter is much easier to manage.

- Landholders **must** adhere to all the requirements of the Pesticide Permit and inform all adjoining neighbours at least three days before laying poison baits.

- Rabbit poisoning is only the first step in the control program. Poisoning should be followed rapidly by harbour destruction, including warren ripping, log burning and blackberry removal; and by continual fumigating, shooting and dogging of survivors of the initial poisoning.

Rabbit baits for poisoning — carrots and oats

Carrots are effective rabbit bait, being used extensively throughout more than two thirds of NSW and combining high acceptability with reasonable economy.

Carrot baits are cut in a carrot cutter before the poisoning operation. This cutter should have a swift, clean action that avoids cutting too many small chaffy pieces or large chunks. Baits should be roughly 2 cm on a side and about 5g in weight.
While carrots are generally recommended, oat grain has certain advantages in dry seasons because it is readily available, suitable for storage, and easier to handle as it does not deteriorate or require processing. Pellets, when available, have similar advantages to oat grain.

Free feeding
It is a requirement of the 1080 Pesticide Permit for rabbit baits that there is a minimum of two free feeds. Free feeding has two main advantages. Firstly, it provides a guide to the rabbit population and secondly, it allows for a more accurate determination of the amount of poisoned bait required to give maximum knock down yet leave minimum bait for non target species. Failure to administer at least two free feeds is not only poor practice but it is a breach of the Permit and penalties apply.

Normally, three free feeds should be used. Two free feeds only may be used when specifically recommended by an ACO. This should only be recommended when pasture conditions are so poor that no increase in bait take is expected from a third free feed and where follow-up work is insisted upon.

Rabbits vary in their readiness to accept strange food. Shy rabbits may take a number of days to accept the bait, being gradually encouraged to eat by watching the more adventurous rabbits eating the bait.

When poisoning, the population remaining after poisoning is the measure of success. The more rabbits eating the bait, the more

successful the poisoning will be. Therefore, to encourage even the shyest rabbits to begin feeding, it is essential to put out unpoisoned bait for a number of free feed periods.

For different infestation levels, a general rule of thumb is to start the first free feed with the quantities shown in Table 4.1. The amount of bait in the second free feed should be increased if most of the first free feed was taken during the first night or decreased if bait remained after the second night. If the rate of acceptance is variable during the first and second free feeding, then it is essential to put out a third free feed.

Table 4.1 Suggested quantities of bait for first free feeding of rabbits

Level of infestation	**Trailing**		**Hand Broadcasting**	**Aerial and mechanical ground broadcasting**
	Carrots and Oats (kg/ha)	**Pellets (kg/ha)**	**Carrots (kg/ha)**	**Carrots (kg/ha)**
Light infestations	4-5	1-2	4-8	n.a
Medium infestations	5-8	2-3	8-10	4
Heavy infestations	>8	>3	10-15	6

Placement of baits:- trailing

Trailing is done by cutting a continuous furrow with a disc or bait layer. This furrow should be cut cleanly, about 10 cm wide and 2 cm deep. A cut furrow provides a visible guide to the location of the trail and to the bait. Also, the freshly turned soil is intended to attract rabbits. Before trailing, the area to be poisoned should be looked at to get a rough idea of the rabbit density and to locate the warrens, any other surface harbour, and especially the feeding grounds (see Figure 4.1).

Insert Figure 4.1 hereabouts

Feeding grounds and areas around and between warrens should be trailed. Feeding grounds can often be identified by open areas where the grass is short and lawn-like and where scratching is common. Rabbits do not feed on the warren, so it is a waste of time and bait running a trail through a warren. Trails can circle a warren but maintain a 3-5 metre wide gap where possible. Small pockets or isolated areas should not be ignored. The main idea is to take the furrow to the rabbit. A general rule of thumb is to use 16 km of trail for each 100 ha, with trails about 40 m apart.

When trailing use three free feeding periods, at least 48 hours apart, and increase each free feed until a small amount of bait is left on the trail.

Placement of baits:- broadcasting

Broadcasting consists of spreading bait thinly over the area to be poisoned, by hand, by rotary super spreader or by aircraft. This method is mainly used in areas where it is impractical or impossible to run a trail due to terrain, large rocks, fallen timber or crops; or because trailing might lead to erosion. For aerial broadcasting, the ACO must ensure that the distance restrictions in the Pesticide Permit are complied with. Hand broadcasting can then be used to the limit of the distance restrictions for ground baiting.

In many areas the two methods can be combined by trailing in the flat, open areas and broadcasting in the rougher, isolated areas.

Broadcasting bait by hand.

Hand broadcasting from horseback or motor bike or on foot is an effective means of dealing with rabbits in areas inaccessible to the trails. Baits are simply broadcast by hand close to warrens and on feeding or play grounds. Rabbits will not feed in the burrow, so all bait should be placed at least 3 metres away from the burrow mouth.

Hand broadcasting can be used in conjunction with a trailing program or as a

separate spot poisoning program. If carried out along the same lines as that for trail baiting, excellent results can be obtained.

Aerial baiting.
Aerial baiting programs are an effective means of dealing with a rabbit problem in steep, rocky and hilly areas where ground baiting techniques cannot be employed.

The high costs involved in aerial baiting programs could be wasted unless the following two are noted:

- The program needs to be undertaken at a time when rabbits are stressed for food so they will readily seek out the bait. This is usually about mid to late summer.

- The area to be baited should be heavily grazed before the program. Also, as it is not possible to collect or cover baits, the area cannot be restocked until sufficient rain has fallen to render baits safe. This may take some time.

There are a number of restrictions and legal requirements associated with aerial baiting programs. A landholder should discuss the intended program with the control officer of the local Rural Lands Protection Board several months in advance.

Aerial and mechanical ground broadcasting.
When aerially or mechanically ground broadcasting, use two free feeds at least three days apart.

Aerial broadcasting can be carried out by using parallel swathes about 25 m apart using the same spacing. For different infestation levels, start the first free feed with the quantities shown in Table 4.1.

Poison bait should be laid three to five days after the last free feed.

Aerial baiting of rabbits in water catchment areas immediately surrounding bodies of water
Restrictions apply to the aerial application of 1080 baits in water catchment areas.

Aerial 1080 baiting of rabbits in water catchment areas will not be permitted without specific prior approval from the Director-General, NSW Agriculture. Application for approval must be made by the Rural Lands Protection Board. Approval will be based on:

- The extent of the rabbit problem requiring aerial baiting.

- Details of why the problem in the specific area cannot be dealt with by the conventional means of ground baiting and harbour destruction.

- Written permission from all government authorities and private landholders whose land will be treated under the proposed program. National Parks and Nature Reserves are not to be included in the area to be baited.

- An appropriate map of the area to be treated.

- The name of the person who will have the overall supervision and responsibility for the program.

To receive approval, the Rural Lands Protection Board must demonstrate that there is no practical alternative to aerial baiting and that appropriate precautions will be taken to avoid any chance of contaminating water storages. Applications must be forwarded from the Board to the regional Agricultural Protection Officer.

In addition to the information required in the application to the Director-General, the baiting program itself must adhere to the following conditions:

- All the requirements specified in the current Pesticide Permit

- To ensure that the above distances are maintained, ground markers should indicate to the aircraft where the bait is to be laid.

- Before the Board makes an application to the Director-General, they must consult their regional Agricultural Protection Officer. That officer will oversee the program and will be responsible for approaching the relevant local authorities for permission to carry out the program.

- In the event of accidental contamination of the reservoir, contact the relevant authorities immediately. These are: NSW Agriculture, Department of Land And Water Conservation, Sydney Water, NSW Health Department and the Environmental Protection Authority.

Poisoning
Poisoned bait is laid after the free feed period at two-thirds to three-quarters of the optimum free feed rate (see sections 4.2 for the factors that ensure a successful poisoning operation and 4.3 for free feeding rates). The Poisons – 1080 section gives mixing rates for 1080 rabbit baits. Poisoned baits are laid at the following intervals after the last free feed:

- Trailing (carrots and oats)—minimum of 2 days.

- Trailing (pellets)—minimum of 4 days.

- Broadcasting (carrots)—3 to 5 days.

Post-poisoning procedure
After poisoning, any poisoned bait remaining is a danger to livestock unless it is thoroughly covered or denatured. The use of a scarifier or an implement to cover the bait will reduce the possibility of excessive baits remaining accessible to non-target species. Steady rain or wet conditions are required to dilute and denature 1080 baits.

It is generally agreed that it is safe to restock after 100 mm of steady rain for carrots and 50 mm of steady rain for oats and pellets. However, this is by no means always true; the landholder should be told that this is only a guide and is not guaranteed. **The longer the period before restocking, the less the hazard, especially if a good growth of pasture results from the rain.**

PINDONE BAIT FOR RABBITS

Pindone is registered as PIN-25 and must be used in accordance with the label or, where specified, the Pesticide Permit. All persons using this pesticide should read the terms and conditions and the schedule.

Preparation
Chopped carrots are the preferred bait although manufactured pellets or oats can be used. After mixing, the bait must be bagged, but when using plastic bags, take care to avoid excess bait sweating which can wash the poison off the bait. It is preferable to use bait as soon as it is prepared and keep it cool.

Placement, free feeding and poisoning
See section 4.4 for additional information on when to poison, placement of bait, trailing and other bait distribution methods.

At least two, but preferably three free feeds are suggested at two-day intervals to get an idea of rabbit numbers and to get the maximum effect from the poisoning program. Start feeding at the same rates as recommended under `Free feeding' for 1080 in section 4.4.

Follow the free feeds with two or more applications of poisoned bait, two to three days apart. If all the free feed is taken, double the amount of carrots for the first application of poisoned bait and continue

doubling for consecutive baitings until some bait is left.

Some important factors to remember about the toxicity and use of anticoagulants are:

- They take a number of days to kill. Poisoning programs should not be assessed until 10 to 14 days after the first poisoned feed (up to 21 days in some instances).

- Increased dosage levels of anticoagulants may not always bring about increased toxicity, especially if bait ingestion occurs daily.

- Excessively large doses have little influence on shortening the time until death if the bait is constantly available.

- If the concentration of an anticoagulant is increased above that recommended, bait acceptance may diminish significantly. Most anticoagulant concentrates are bitter or taste salty and have been formulated to be the most acceptable to the target species.

EXTENSIVE CONTROL: WARREN DESTRUCTION BY RIPPING

Ripping of warrens is the major type of harbour destruction that can be very useful as an initial control method, the principal control method or as an advanced control method. Ripping techniques depend heavily on local conditions such as soil type and position of the warren as well as the equipment available to carry out the work. Only the basics of warren ripping are mentioned here. The ACO will have to rely on local experience to determine what are the most suitable techniques for the area.

It is wise to have barking dogs run over the area to force surface rabbits into warrens before the start of ripping. Yappy house pets or backyard dogs are ideal for this task however, it is advisable not to use valuable working dogs; particularly sheep dogs. When warrens are active and have been cleaned out, usually indicated that breeding is imminent or happening, it is essential to drive over the area thoroughly. Otherwise, rabbits forced out of the warrens through social interaction will be missed and can rapidly reopen a "dead" warren.

Use tines at least 900 mm long. Start ripping at least 3 m beyond the outermost burrow opening of the warren. This allows the ripper to get to a maximum depth before the warren is reached and increases the chance of ripping tunnels outside the visible warren diameter. Obstacles and harbour such as logs and blackberries should be removed to increase the effectiveness of ripping.

If parts of a warren cannot be ripped because of obstructions such as trees or fences, be sure to fumigate these burrows a few hours before ripping. If ripping near trees or stumps, back up to them and rip away from the trees so that the tines travel along roots and not across them.

In general, clay soils should be ripped when damp and sandy soils when dry but be guided by local successes. Where possible, scatter some grass seed over the ripped area to allow for faster regeneration of the site. Unless ridges and hollows are severe there is no need to smooth over. These ridges tend to catch water and wind blown seed and disperse the "rabbit" smell which allows for a faster rejuvenation of the site.

An economic ripping technique, particularly applicable to open country, is to begin ripping from one of the long sides of the warren and follow with the second rip down the centre. Next rip towards the centre from the first rip and out toward the other edge from the second rip (see Figure 4.2a); repeat until the warren is fully covered.

An alternative ripping technique which can also be used in more hilly terrain is to begin ripping from one of the long sides of the warren, each time reversing over the last rip (see Figure 4.2b). Each new rip starts only in the same direction as the first rip. This technique increases the packing effect of the ripped warren; however, it can be done only with a three-point-linkage ripper. The Department of Land and Water Conservation recommends that all ripping be done across the slope, and warns that slopes exceeding 18° should not be ripped. If it is not possible to rip all of the warren across the slope at least 2 or 3 cross rips should be used to reduce the risk of erosion.

FOLLOW-UP CONTROL: WARREN DESTRUCTION BY BLASTING

Blasting is a follow-up technique sometimes used to destroy warrens that cannot be ripped, such as those along creek banks and under trees. However, explosives can only be used by holders of a certificate of competency as a powderman or a powderman's learner's permit endorsed "Agricultural Blasting", a "permit to Receive Explosives" issued by the Police Department and a "Licence for Keeping Explosives".

Legal requirements

Relevant parts of the Acts, training courses, licensing requirements and the care and use of explosives may be obtained from the WorkCover Authority, NSW.

FOLLOW-UP CONTROL: FUMIGATION

Fumigation can be very effective for controlling rabbits:

- as a follow-up technique to ripping or blasting,
- in inaccessible places such as rocky outcrops,
- along fences and around trees,
- on riverbanks where it is not possible to rip,
- for treating small, isolated infestations discovered when doing other work,
- in places where ripping is undesirable because of the risk of erosion and
- as a possible alternative to 1080 poisoning on properties where 1080 cannot be used: the property may be too close to town; the occupier may not allow 1080 (or any other poison) to be used; the removal of stock may not be possible; or the use of poisoning is not advisable because the rabbits are breeding. This is an important but rarely considered reason for using fumigation.

An example of the indemnity form to be used when hiring out rabbit fumigators is given in the Legal Section of this Manual.

Types of fumigants

Phosphine is produced from tablets available under the brand names Phostoxin Rabbit Fumigation Tablets®, Rentokil Gastion Rabbit Fumigation Tablets®, Pestex Rabbit Fumigation Tablets® and Fumitoxin Rabbit Fumigation Tablets®. Tablets come in tubes and packs ranging from 30 to 100 tablets.

Chloropicrin is the active ingredient of the liquid available in 500 mL bottles as Rentokil Larvacide Rabbit Fumigant®. Chloropicrin can be used as a static fumigant on rag, dung or other absorbent material, or used through a pressure fumigator such as those manufactured by AgMurf.

Basic rules for fumigation

Before the fumigation, run dogs over the area to chase rabbits underground.

- For fumigation to be effective, all openings of a warren must be found and sealed.

- Remember that fumigants are also lethal to humans. Labels must be read and safety recommendations followed.

- Follow-up is essential and fumigated burrows must be checked for reopenings on the fifth or sixth day.

Static fumigation
Static fumigation consists of placing a pellet or a liquid into active entrances and allowing the gases released to diffuse through the warren. The two fumigants used for this method are phosphine (Gastion®, Phostoxin® etc) and chloropicrin (Larvacide®).

Procedure for static fumigation
If possible, dog the area and then prepare the warren for static fumigation by cutting back each burrow mouth until there is at least 30 cm of soil between the surface and the burrow tunnel (see Figure 4.4). This not only ensures a better seal when blocking the hole, but also exposes any branches of the burrow that are close to the outlet.

Once the hole is cut back, place the fumigant at least 60 cm down each burrow. With phosphine this only requires placing a tablet well down the hole. Under dry conditions it is advisable to wet the tablet or place the tablet wrapped in wet newspaper or in a camel melon. Alternatively, the round tablets can be rolled down a length of poly pipe and followed by some water.

Chloropicrin can be used in two ways. The liquid can be poured onto a small square of hessian, a piece of dried cow dung or any other absorbent material and placed as far down the tunnel as possible. Or a Larva-gun, which screws directly onto a special unbreakable copper bottle and squirts 5 mL into the tunnel with two pulls of the trigger, can be used if available.

Once the fumigant is in place in the burrow, carefully seal the opening. Do this with a clod of dirt that has a tuft of grass attached (the grass facing down the hole), with a ball of crumpled newspaper or an old superphosphate bag, or with a camel melon. This prevents loose dirt from covering the fumigant and also makes it more difficult for a rabbit to dig out. Finally, break in the sides of the dug-back area and fill in level with the soil surrounding the burrow opening, and trample down to give a good seal.

Repeat the above steps until all holes are sealed.

Pressure fumigation
Forcing the poison gas into the warren under pressure has advantages over static fumigation in allowing all the openings to be found and ensuring that the gas reaches all parts of the warren system.

The only fumigant recommended for pressure fumigation is chloropicrin mixed at various concentrations with diesel or kerosene.

Procedure for pressure fumigating
1. Always stand side-on to the wind when filling the tanks and during fumigation.

2. After dogging the area, start the motor and run for at least 90 seconds.

3. Turn on the diesel or oil tap and establish the appropriate smoke emission level.

4. Place the hose of the fumigator well down an active upwind warren entrance. Carefully seal around the hose with tamped soil and allow smoke to emerge from a number of entrances.

5. Once there is sufficient smoke *then* turn on the larvacide tap to the recommended drip rate (normally 60 drips per minute). **NB.** On Agmurf fumigators, the chloropicrin tank is copper and the diesel tank is aluminium.

6. Carefully seal all holes and cracks that white smoke emerges from starting upwind and progressing downwind.

7. Once all holes are sealed and no more smoke is visible, Turn off the chloropicrin and diesel and let the machine run for a further 90 seconds. This not only clears residue fumigant from the machine but agitates the gas throughout the warren complex.

8. Turn off the fumigator motor, remove the hose and seal the hole completely.

9. Check that all holes are filled in and smoothed over. Sprinkle with grass seed where possible.

Safety
Phosphine and chloropicrin are extremely dangerous in enclosed spaces. Opened and partly used bottles of chloropicrin or tubes of phosphine tablets must not be returned to storage. Emptied chloropicrin bottles should be buried in burrows, which should then be sealed. Phosphine tablets may be placed inside spare resealable flasks kept on hand especially for that purpose. Do not store phosphine tablets in an opened tube, unless the tube is placed in a sealable can.

Phosphine is not cumulative and is fairly rapidly eliminated from the body. However, chloropicrin is cumulative and takes a relatively long time to be eliminated. Therefore, care must be taken to breathe as little as possible of this during fumigation. (See section 3.12, First aid: specific recommendations for individual poisons.)

FOLLOW-UP CONTROL: LP GAS

Rid.a.Rabbit: The "Rid.a.Rabbit" machine is basically a blower unit that pushes a mixture of liquid petroleum gas (LPG) and air into a warren complex. Once vapours are visible at a number of entrances, the mixture is "fired" with an electronic igniter.
The result is that all the oxygen is removed from the warren and rabbits die from acute hypoxia or suffocation.

The machine is supplied complete with gas bottle, blower unit, igniter, service tools, safety sheets, operating instructions and personal protective equipment; all in a sturdy wooden carry box. A video on use and safety is provided as well. However, as pointed out in the promotional material, it appears that it is no more dangerous than using a gas barbecue.

Fire Risk: When the LPG and air mixture is ignited, there is some flame associated with the ignition. Considering this, most operators would use the machine with caution and have a fire extinguisher handy. Where flammable material is close to a warren, the area should be cleared prior to ignition. During periods of high fire danger, alternative techniques would be used.

Recommendations: Although the machine works relatively well, it does not cause implosion nor does it destroy the structure of the warren. The instruction manual recommends the filling in of holes to restrict movement into or out of the warren after treatment. To minimise rapid re-invasion, it has always been recommended that, as a precaution in ripped warrens, 2-3 phosphine tablets are placed into the warren and then the entrances sealed.

Thus, in the interest of effective rabbit control when using the "Rid.a.Rabbit"; that after ignition and a safe time period in case of a misfire, each warren has 2 - 3 phosphine tablets placed in the most active entrance prior to all holes being filled in. This would not only minimise the possibility of rapid reinvasion of the warren but should ensure that:

- any surviving rabbits do not escape
- that it is also an additional measure of ensuring all rabbits die humanely and quickly within the warren
- during re-inspection, an assessment of any re-openings will provide a visual guide to the effectiveness of the work.

The additional expense of phosphine tablets (around 13 cents per tablet) is minimal when considering the time it may take if a warren has to be re-treated because of re-invasion from outside rabbits.

FOLLOW-UP CONTROL: WARREN FLOODING

In some areas where warrens are near creeks or channels, water can be pumped in to the warren complex. As with fumigation, once the water starts to spill from the entrances, then seal all holes. Warrens need regular inspection to ensure that they are not reopened quickly.

FOLLOW-UP CONTROL: OTHER FORMS OF HARBOUR DESTRUCTION

The main forms of rabbit harbour, in addition to warrens, are blackberry bushes, other vegetation and fallen logs. Any property with abundant blackberry bushes or fallen logs will almost always rapidly regain its rabbit population after initial control; therefore the destruction of harbour must be part of any control program. Fallen logs can be heaped and burnt but blackberry control is more involved.

There are three alternatives that can be considered for removal of blackberries but where possible, obtain advice from your local Weeds Inspector or District Agronomist:

1. **Spray, burn and improve.** Spray blackberries in the leafy stage with a suitable registered herbicide as recommended on the label, and then burn after they have dried. Follow with a pasture improvement program (reseed and apply superphosphate) at rates recommended by the local District Agronomists.
2. **Mechanically destroy and improve.** Slash or bulldoze the blackberries and follow with a pasture improvement program.

Graze, burn and improve. Sheep at heavy stocking rates may graze blackberries back to the bare canes, which can then be burnt as per the recommendations of the chemical label. Burning should follow as soon as possible after the lifting of fire restrictions in early autumn. A pasture improvement program should then follow.

Goats have been recommended in the past but there is a risk that goats will eat everything except the target plants and may eventually create another pest problem. Landholders should discuss the options of "cell grazing" or ProGraze for noxious weed management with their local Agronomist or Livestock Officer. Responsible goat management needs to consider both agricultural production and environmental outcomes.

For more details on other weeds that provide harbour and on techniques, equipment and possible contractors, contact the local Weeds Inspector or District Agronomist.

MOP-UP (ADVANCED) CONTROL

Mopping-up is probably the most advanced control and is used when rabbit numbers are at a very low level, biologically (but not necessarily economically). This is when control is most effective. When the rabbit population is high, each individual rabbit removed does not have much effect on the reinfestation potential; therefore, a large percentage must be removed to have any effect. However, when numbers are very low, the removal of each rabbit has a far greater long-term effect on the reinfestation potential.

To successfully remove rabbits, all techniques need to be considered and any number used.

Once this advanced stage is reached only periodic checks and the occasional use of a specific control method is necessary to keep a property rabbit-free.

Shooting
An easy and effective way to remove rabbits when numbers are low is to shoot at night using a rifle or shotgun and a spotlight. However, the provisions of the Firearms and Dangerous Weapons Act, 1973, must be followed.

If the control officer or the landholder is a competent shooter, a .22 calibre rifle is the most satisfactory weapon because it is accurate, is deadly within the range of most spotlights and uses inexpensive ammunition. A shotgun can be effective but does not have the range of a rifle and the ammunition is more expensive.

Trapping
Trapping is permitted under the Rural Lands Protection Act of 1998 if it is part of a rabbit control program and should only be used to clean up the last few rabbits. Trapping should not be used as a primary method of control when rabbit numbers are high. All traps (particularly Soft-jawed spring traps) must only be used in accordance with the code of practice (see below). Soft-jawed spring traps cannot be used in a built up area ***eg.*** within town or village boundaries etc. Steel jawed traps are illegal.

Placement of soft-jawed spring traps.
Traps can be placed in any area showing signs of rabbit activity. These include burrows or warrens, dung heaps, earth mounds, along rabbit netting fences or near hollow trees and logs. Traps set on dung heaps, along fences and on mounds near warren openings usually trap only older rabbits. Traps set in burrow openings will trap kittens and older rabbits.

Code of Practice: In summary, it is essential that:

- All traps are to be checked as soon as possible after dawn to reduce unnecessary suffering to captured animals.
- All traps are to be inactivated as soon as possible after dawn to prevent capturing non-target animals during the day.
- When setting traps where other animals could accidentally be caught, dig a deeper trench so that when the trap is set, a depression of 5 to 6 cm remains. Most larger animals will step over such a depression, while rabbits will be attracted to the fresh soil.

Barrel netting or mesh traps.
These traps are relatively easy to make. The trap consists of a cylinder, 12 to 15 cm in diameter and a metre in length, made from rabbit netting or light mesh. One end is closed off and it has two hinged gates or flaps, making three Sections about 35 cm long. At the gates, heavy-gauge wire on light steel rod supports the trap and acts as a non-return frame for the gate. When the rabbit pushes into the cylinder and moves past a gate, the gate closes behind it. If the rabbit pushes back, the gate will press against the retaining circle of wire. See Figure 4.?.

MYXOMATOSIS

Since the initial outbreak of myxomatosis in the early 1950s, the disease has become steadily less effective against rabbits. This reduced effectiveness has been due to two main factors: virus attenuation and increased genetic resistance of rabbits.

Virus attenuation
The highly virulent virus known as Standard Laboratory Strain killed over 99% of infected rabbits when released in 1950, and caused a major reduction in rabbit populations. However, attenuated (less virulent) viruses rapidly appeared in the field (field strain viruses), and as early as 1955 the most prevalent viruses killed only about

90% of infected susceptible rabbits under laboratory conditions. In the field there are irregular outbreaks of the disease and each outbreak may have different results.

Genetic resistance
During the early years of myxomatosis (1950 to 1960), genetic resistance built up rapidly in rabbit populations. During this period kittens caught in the field and challenged in the laboratory with an attenuated field strain of virus showed a drop in mortality from 90 per cent in 1950 to 25 per cent by 1960. However, since then, very little change seems to have taken place, so indicating that the system is in equilibrium.

Rabbits that recover from an attack of myxomatosis are generally immune for life. They may become reinfected, but this is seldom fatal.

Transmission of myxomatosis
Rabbits usually become infected with myxomatosis after being bitten by an insect vector (carrier) which has picked up virus particles from the blood of an infected rabbit. These virus particles do not undergo any of their life cycle in these insects (as in some other diseases), but are simply carried on the mouthparts of insects which bite or pierce the skin of rabbits.

Mosquitoes are the usual vectors of myxomatosis virus during summer outbreaks of the disease. Some of the mosquitoes identified as vectors are not obvious, as they do not bite humans. An outbreak caused by mosquito transmission generally spreads rapidly and infects a large number of rabbits at any one time.

The European rabbit flea (*Spilopsyllus cuniculi*) was brought to Australia in 1966 by CSIRO and released from quarantine in 1968. It has been a useful vector for myxomatosis, being present on the rabbit throughout the year. The flea breeds only when the rabbit breeds, since it requires a hormone present in pregnant rabbits to mature its eggs. Flea numbers are therefore greatest during the breeding season when they are most useful for spreading myxomatosis.

However, the European rabbit flea cannot tolerate hot dry conditions and requires the blood from pregnant rabbits for its own survival.

Thus, the Spanish rabbit flea (*Xenopsylla cunicularis*) was recently released into a number of rabbit populations in the semi-arid areas of Australia, including a number of sites in western NSW. Although the distribution of European and Spanish fleas may overlap in the central districts of the state, the Spanish rabbit flea thrives in dry climates (being resistant to desiccation) so it is not expected to become established in wetter tablelands and coastal regions.

Spanish rabbit fleas do not require rabbit hormones to breed and thus can breed all year round, albeit slowly in winter. They spend most of their time in the warren, only jumping on to a rabbit to feed. Thus they feed on many different rabbits and as a result are excellent vectors of myxomatosis.

Several other insects which parasitise rabbits, including the stickfast flea and several small mites, also transmit myxomatosis, but their importance in field outbreaks is thought to be insignificant.

Causes of a myxomatosis outbreak
The causes of myxomatosis outbreaks are still obscure. There is evidence suggesting that some recovered animals may carry the virus in a latent (not yet virulent) form and become carriers at certain times, but this is not confirmed. Dried virus is remarkably stable and dried-out carcases of rabbits that died from myxomatosis might provide infective dust that could infect other rabbits. It has been shown that virus dried on thistles can infect rabbits, and that mosquitoes can remain infective for months. Active virus

can remain in populations for long periods, spreading very slowly. Any one or all of these sources of virus could be responsible for an outbreak of myxomatosis when vectors are plentiful.

The effects of myxomatosis outbreaks

The effects of myxomatosis outbreaks vary enormously: sometimes many rabbits are killed; at other times very few. Temperature appears to play an important role, with higher mortalities during winter outbreaks and lower mortalities during summer outbreaks. In one population under careful observation, a prolonged winter outbreak killed 90 per cent of the susceptible rabbits, whereas a rapid summer outbreak some years later killed only 30 per cent.

Experimental evidence shows that naturally occurring myxomatosis outbreaks have a substantial depressing effect on rabbit populations even where the presence of the disease is not very obvious.

Current myxomatosis recommendations

The European rabbit flea is a useful vector and worth introducing during the rabbit breeding season. As there are no longer any commercial suppliers, it is probably worth shooting some rabbits in an area where fleas have established, placing the rabbit carcase in a plastic bag immediately and collecting the fleas in the bag. Captured fleas should then be tipped into selected warrens within 24 hours. The following year, you should have a ready source of fleas.

Because Spanish rabbit fleas do not spend long on rabbits, only getting on them to feed, few fleas can be caught and relocated by catching rabbits. The only effective way to collect Spanish rabbit fleas is to aquire them from the floor of a warren with a scoop of sand and transfer that sand to another warren.

In areas where the European rabbit flea is fully established, a virulent strain of myxomatosis may be introduced during the breeding season by capturing young rabbits, infecting them with the strain, and releasing them near their home warren. It is important to infect only half- to three-quarter grown rabbits, as these are unlikely to have been exposed to myxomatosis before, and are therefore unlikely to be immune.

Natural outbreaks of myxomatosis are most frequent in early summer (towards the end of the breeding season) and the introduction of a virulent virus then allows it to spread without competition from field viruses while susceptible animals are entering the population. However, there is doubt about the usefulness of this practice. One trial conducted over four years demonstrated that annual releases of a virulent virus had no impact in the adult rabbit population.

Myxomatosis and rabbit control

Some of the confusion about the importance of myxomatosis in rabbit control arises from the use of the word `control'. To a biologist, a factor `controlling' a rabbit population may be one which keeps a rabbit population fluctuating around a density of, say, 35 rabbits per hectare, rather than allowing it to increase to 50 rabbits per hectare.

When rabbit control authorities use the term ‘control’, it should mean the reduction of a rabbit population to such a low level that damage and reinfestation becomes negligible or nil.

Financial savings can be made in a rabbit control program by capitalising on naturally occurring outbreaks of myxomatosis, which reduce rabbit populations to a more manageable level. However, once a complete control program has reduced rabbits to a level where they do no damage, the population is too low for a myxomatosis epidemic to occur.

Achieving and maintaining this population level is best done through a well organised rabbit control program, including the systematic destruction of harbour, and

constant vigilance in dealing with any reinfestation, rather than depending on myxomatosis which is notoriously unreliable in effectiveness and spread.

RABBIT HAEMORRHAGIC DISEASE (RHD)

Originally called Rabbit Calicivirus Disease or RCD, Rabbit Haemorrhagic Disease is an airborne virus that affects only rabbits. This includes both the wild type and the derived domestic strains of the European rabbit (*Oryctolagus cuniculus*). The virus was first noticed in farmed rabbit colonies in China in 1984 and in Europe in 1988. In Italy it is known to have killed some 64 million farmed rabbits.

Rabbit Haemorrhagic Disease is caused by the rabbit calicivirus which belongs to a diverse family of viruses known as theCaliciviridae; so called because of their cup-like shape on the surface (*from the Latin, Calix [pl. Calices] means a cup of a flower*). Different caliciviruses cause different diseases in different animals, yet most are specific *eg.* feline calicivirus affects cats and rabbit calicivirus affects only rabbits. However, some can infect a range of species, for example the San Miguel Sea Lion Virus can affect sea lions, pigs and possibly humans.

The virus underwent extensive testing for virulence and effects on native and domestic animals prior to being tested on Wardang Island. Early results indicated that the calicivirus was highly infective, kills rabbits quickly and was rabbit specific (does not affect other animals or humans). This was tested on 28 different species *viz*
Domestic animals - horses, cattle, sheep, deer, goats, pigs, dogs, cats and fowls
Feral animals - foxes, hares, ferrets, rats and mice
Aust Native mammals - bush rats, spinifex hopping mice, plains rats, fat-tailed dunnarts, northern brown bandicoots, brush-tailed bettongs, tammar wallabies and brush-tailed possums
Birds - long-billed corellas, feral pigeons, silver gulls, brown falcons and emus and
Reptiles - common blue tongue lizard.

In October 1995 the virus escaped (most likely on bush flies) from the quarantine area of Wardang Island to Point Pierce, Yunta and the Flinders Ranges in South Australia. The initial impact was:

- a 95% reduction of rabbits in the Flinders Ranges National Park
- most of the surviving rabbits were between 3-6 weeks old
- many rabbits succumbed to predation or myxomatosis
- massive regeneration of bullock bush without the rabbits.

By December 1995 the virus had infected rabbits in the Broken Hill area and was slowly moving east. NSW Agriculture and Rural Lands Protection Board staff monitored the spread of the disease as it travelled throughout the western parts of the state and towards the eastern seaboard.

Unlike myxomatosis, the virus is normally transmitted by direct contact, so it does not necessarily need a vector to spread it from one rabbit to another. Trials have shown that the Spanish flea and other insects such as mosquitoes and bush flies may be suitable vectors if the transmission of the virus is within a couple of hours after infection. Although RHD is highly contagious, it needs close contact for successful transmission.

The research have shown that, after being infected with even a small quantity of the virus, most wild rabbits became progressively quieter have an increased temperature and respiratory rate and died at 20-24 hours after infection. They also died very quietly and without distress. Although the calicivirus is highly infective, it only affects a proportion of rabbits less than 6 weeks old.

Further, a non-lethal virus has been identified in the slopes and tablelands of NSW, which can elicit antibodies that may provide some protection for rabbits from this disease. This may explain why some rabbit populations have survived RHD outbreaks or deliberate releases by rabbit control authorities.

Rabbit Calicivirus and Mutation
All genetic material can mutate. Mutation in a virus can:

- have no effect
- lead to the destruction of the virus
- make it less harmful (virulent)
- make it more virulent
- in very rare cases, enable it to infect other species

It is extremely rare for a mutation to enable a virus to infect a different species.

Rabbit Calicivirus: No Effect on Humans
Rabbit calicivirus has been widespread in Europe and Asia for over 15 years. Even though there has been close contact between people and diseased rabbits, no transmission of virus to humans has ever been reported. Although many countries have researched and documented rabbit calicivirus and Rabbit Haemorrhagic Disease there is no evidence of any risk to humans.

Current RHD Monitoring
Field studies continue to assess:

- The extent and impact on rabbits
- Do surviving rabbits recover or have they just missed infection?
- Whether there is any interaction with myxomatosis?
- The persistence of the virus in the environment
- The role of insects and other vectors in the transmission of the disease
- The effect of climatic conditions on the spread of the disease

Calicivirus will only be a tool to assist in rabbit control, not a stand-alone rabbit eradication agent.

OTHER TECHNIQUES

Fencing
Rabbit-proof netting fences are very expensive to construct and are generally not used by many landholders. In 2000, the average construction cost for a rabbit-netting fence was approximately $4,500 per kilometre without labour. This cost does not include the extra cost and time involved in rabbit proofing stays and gateways (sections of the fence which are unfortunately often overlooked). In comparison, the average cost for a Ringlock/hinge joint fence was around $2,000 without labour.

Rabbit-proof netting fences are now most often used in special circumstances, such as the protection of a relatively small, high-value crop, tree lots or excluding harbour areas such as rocky hills. Yet, when stressed, rabbits will climb over or dig under most rabbit-proof fences. It is important that fences are checked regularly for holes or for anything against the fence if the integrity of the fence is to be maintained. If necessary, a capping or electric wire may be needed to stop rabbits going over the fence.

If a rabbit-proof fence is required, then netting barriers should protect posts and stays, gates should be swung so that rabbits can't move between the gate and posts or get underneath. A correctly positioned bedlog will prevent rabbits from moving under a gate.

Deterrents And Revegetation
After a major harbour destruction program with ripping or explosives, or after fumigation or gassing, you should try to minimise recolonisation. One way is to revegetate the area as quickly as possible. The use of volatile compounds such as fertiliser or commercial animal repellents

such as D-Ter® can reduce the rate of visitation and allow vegetation to re-establish.

Next the warren needs to be seeded. This can be any available seed that will give a reasonable cover. It may be easy to cut some pasture grass and thresh by hand over the warren. Whichever way is the easiest, the quicker the warren surface is covered in vegetation the quicker the soil will recover and reduce reinvasion by rabbits.

Further Reading

Williams, K., Parer, I., Coman, B.,Burley, J. and Braysher, M. (1995) *Managing Vertebrate Pests: Rabbits.* Australian Publishing Service, Canberra

Feral pigs

FERAL PIG BIOLOGY

Origin

The feral pig in Australia is a descendant of various breeds of *Sus scrofa*, the domestic pig. In the north of Australia there is some indication that a number of other species of pigs were also brought to Australia including the *Sus celebensis* and the *Sus papuensis*.

Records indicate the presence of domestic pigs immediately following the arrival of the First Fleet. Pigs were kept by settlements unrestrained and in semi-feral conditions. Stock could readily escape and wander and by the 1880's pigs had run wild in NSW.

Distribution

Feral pigs are widely distributed in New South Wales, Queensland, the Northern Territory and the Australian Capital Territory. Isolated populations also occur in Victoria and Western Australia, on Flinders Island in Bass Strait and on Kangaroo Island in South Australia. Tasmania occasionally has temporary populations due to accidental releases.

In NSW feral pig populations are found primarily in western areas, their distribution closely related to the location of inland watercourses and flood plains. Increasingly populations are appearing in the tablelands and coastal areas of eastern NSW, probably due to the deliberate release of animals.

Habitat

Feral pigs need to live in moist areas that can provide adequate food and water and enough shelter to protect against extremes of temperature. In particular dense shelter is required for protection against high temperature.

In Australia feral pigs are found in a variety of habitats which can provide these requirements including rainforest areas, monsoon forest patches, paperbark swamps, open floodplains, marsh areas, semi arid floodplains, dry woodlands and subalpine grasslands and forests.

Home ranges and movement

Home range is determined by habitat type, food supply, the size of individual animals, and population density. On a daily basis feral pig ranges are quite small, although the seasonal or overall home ranges may be much larger. Mature males tend to have a larger home range than sows. In the Western Division of NSW a boar may have a home range of 43 square kilometres whereas in north-west NSW a boar may only have a home range of around 10 square kilometres. Weather conditions and food availability effect the movement of feral pigs. In hot weather days may be spent in one area, with nights spent feeding in a another. In many habitats there is a seasonal trend of movement between specific areas depending on the current food supply. Feral pigs will readily swap between food sources so that excessive movement is not required. Even if disturbed feral pigs will not move far and will readily return to their home ranges.

Behaviour

Feral pigs restrict their activity to cooler parts of the day. In hot weather they are primarily nocturnal. Even in cooler weather they tend not to be active during the middle of the day.

Feral pigs consistently use trails from one area of use to another, such as from shelter to food supply or water. Marking of these trails is common with trees or logs rubbed or tusked. Rubbing also assists to reduce ectoparasite infection as does wallowing in mud or dusty depressions. Mud and dust also helps the animal to regulate their body temperature.

Social structure
Sows and piglets generally run together as a group. Immature males and females may also stay with the group until they reach maturity, or they may run as a juvenile group until they mate. At about 18 months males become more solitary only rejoining a group for mating or to feed on localised food sources.

Group sizes vary depending on the season and habitat. In the forests of south-west WA group sizes rarely exceed 12 whereas in more open country up to 40 or 50 pigs may form a mob. In times of severe food and water shortage large groups of 100 or more may gather around remaining waterholes.

Diet
Feral pigs are opportunistic omnivores. Their preference is for succulent green vegetation, fruit, grain, and a wide variety of animal material such as frogs, fish, reptiles, birds and small mammals. They will also eat underground plant material such as roots, bulbs, corms and fungi. The requirement for protein and energy is high, particularly for breeding, successful lactation and growth of young.

Reproduction
Feral pigs are polyoestrous, being able to breed throughout the year. Breeding success depends on the availability of nutrients, in particularly energy and protein. Successful mating normally coincides with the seasonal abundance of food in different habitats.

Female feral pigs reach sexual maturity once they reach a weight of 25-30 kilograms, which normally occurs between 7 and 12 months. Males become sexually mature around 18 months. The gestation period is 112-114 days and an average litter size is 5 - 6 piglets.

A litter is weaned after 2 - 3 months and mating can occur again around the same time. Under favourable conditions two litters can be weaned in a period of 12 months. This breeding capacity allows feral pigs to quickly recover from a population setback, and to quickly increase their populations in periods of favourable conditions.

Mortality
Mortality of feral pigs in their first year of life, particularly from foetal stage to weaning, is high, varying from 10-100% depending on conditions. Mortality is due to factors such as loss of foetuses, adverse weather conditions, accidental suffocation by sows, loss of contact, predation from feral dogs, and starvation.

Starvation can affect pigs of all ages- lactation of sows can cease if protein levels are not adequate and excessive tooth wear in older pigs can interfere with eating. Lack of appropriate nutrients also leaves feral pigs more susceptible to parasites and diseases. Adult mortality may vary from 15 - 50 % with few feral pigs in the western division of NSW living more than five years.

Disease
Feral pigs can be hosts or vectors of a number of endemic parasites and diseases, some of which can affect other animals or people. Livestock health can be significantly affected by:

* leptospirosis,
* porcine brucellosis,
* melioidosis,
* tuberculosis,
* sparganosis,
* porcine parvovirus,
* Murray Valley encephalitis and other arboviruses.

A number of worm species also carried by feral pigs can affect livestock.

Human health can be affected by leptospirosis, through contact with urine of affected feral pigs; porcine brucellosis, through handling raw feral pig meat; and tuberculosis and sparganosis, through eating inadequately cooked feral pig meat.

Feral pigs are also susceptible to, and can be hosts or vectors of a number of exotic parasites and diseases. Feral pigs are also capable of carrying and spreading a number of exotic diseases and parasites if these were to enter Australia.
These include foot-and-mouth disease, swine vesicular disease, African swine fever, Aujeszky's disease, trichinosis and classical swine fever.

IMPACT OF FERAL PIGS

Pest status

Feral pigs are declared a noxious animal under the *Rural Lands Protection Act 1989*. This declaration means that feral pigs are to be continually suppressed and destroyed by landholders. It is illegal to keep or transport live feral pigs. The definition of feral pigs includes all pigs born in the wild, all pigs running in the wild, and all pigs that have at any time, run in the wild.

Agricultural impact

Feral pigs prey on newborn lambs. They also reduce yields in grain, sugarcane, fruit and vegetable crops through consuming or trampling plants. Fences and water sources can be damaged, and dams and waterholes fouled through wallowing and defecation. Feral pigs also compete with livestock for pasture and damage pasture through up-rooting vegetation.

Environmental impact

Feral pigs disturb natural environments through rooting up soils, grasslands and forest litter and consuming a range of native plants. There is some evidence that they may also help spread rootrot fungus that is responsible for dieback disease in native vegetation. Feral pigs also eat a range of live native animals including earthworms, beetles, centipedes, amphipods, snails, frogs, lizards, snakes, turtles and their eggs, and small ground-nesting birds and their eggs.

Recognition and sign

Recognition of damage by pigs, or sign of pigs in an area, can be determined by looking for:
- faeces, marks and hoof-prints on pads and trails,
- nests made by sows,
- ground rooting,
- wallow depressions,
- mud rub marks on tree trunks, logs or fence posts,
- tusk marks on trees,

Reduced lambing percentage with little or no sign of lamb carcasses may also indicate pigs.
Regular sightings of pigs and abundant fresh sign normally means high numbers of feral pigs; some sightings of pigs and obvious fresh sign indicates medium numbers of feral pigs; no or few sightings of pigs and very little fresh sign indicates low numbers of pigs.

INTEGRATED FERAL PIG MANAGEMENT

When impact is experienced due to feral pigs the extent of the problem needs to be thoroughly investigated, including an assessment made of what levels of impact are acceptable. If a decision is made that some form of management is desirable then a plan should be developed and costed accordingly, including an assessment of the cost of management, whether financial or otherwise, against the cost of impact.

Management of feral pigs can include reducing numbers with control techniques, which subsequently reduces damage, or preventing damage through modification of land use or physical components of the enterprise. Management of feral pigs and the impact they cause will normally require a number of methods in combination.

Physical modification can include enterprise substitution and fencing.
When a decision is made to reduce numbers it is important to remember that individuals in any pest population will vary in their

susceptibility to a control method. It is only with using a number of methods that a population can be reduced by a significant percentage.

Initial control of a population with a method to which a high percentage of the population is susceptible is important. This is normally followed by *secondary control* methods designed to reduce the population further and prevent it building back up.

Initial control methods include shooting from helicopters and 1080 poisoning. *Secondary control* methods include trapping, shooting from the ground and CSSP poisoning.

Enterprise substitution
A decision may be made that a viable option is to change the type of enterprise in areas susceptible to impact from pigs, for example from lambing paddocks to wethers or from farming to grazing. This is normally a last resort but does occur in some instances.

Fencing
Fencing is sometimes used to protect valuable enterprises in small areas. Effective pig proof fences have been designed but need to be thoroughly maintained to sustain their effectiveness.

1080 Poisoning
1080 poisoning can be an effective initial control of pig numbers if undertaken in a methodical manner. It is particularly effective if green feed and other food sources are scarce. 1080 poison is mixed with grain, manufactured pellets, cucurbits, root vegetables, apples or quinces, to form a bait. Only ACO's in NSW can prepare bait and supply it to landholders.1080 bait is used in bait stations or along trails although manufactured pellets and grain can only be used in bait stations. 1080 Poison is regulated under an off-label Permit which details the particulars of it's use.
Bait stations are constructed by enclosing an area, normally about 1000 square metres, with fencing which will not allow stock in, but can allow pigs to enter by pushing underneath. Bait material is placed in a furrowed area or on the ground within the fenced are. Bait stations are normally used in areas where stock cannot be removed and where it is preferable to have a permanent structure to be re-used when needed.

If pigs are readily using set trails and stock has no access to an area baiting along trails may be appropriate.

For both bait station and trail baiting it is essential that adequate 'free-feeding' of unpoisoned bait material occurs prior to poisoning. Free feeding ensures that the maximum number of pigs are attracted to, and are feeding on the bait material, and that excessive poisoned bait is not layed.
Feral pigs may take some time to begin to feed on the bait material provided, depending on what food sources are already available. Once they begin to feed at the bait station or along trails, progressively offer more bait material each, as it is consumed, until consumption is no longer increasing. Once the amount being taken is consistent adjust accordingly to ensure the minimum amount of bait material is left at the end of a night.

The period of free feeding may take up to two weeks or more and must be a minimum of three nights. Poisoned bait material of the correct volume can then be provided for a maximum of three consecutive nights. After this time all remaining poisoned bait must be removed and where possible carcasses of poisoned pigs should be collected and burnt to prevent poisoning of non-target wildlife or domestic animals.

Helicopter Shooting
Shooting feral pigs from helicopters is an effective method for an initial knockdown of numbers, which is species specific and can be used in areas that are inaccessible from the ground. Helicopter shooting can be expensive if not properly planned however so it is important to have coordination and

cooperation from a number of groups or organisations.

Usually a helicopter carries one shooter, who will normally use a shotgun or a .308 SLR, and a spotter who looks for and keeps track of pigs including the number successfully shot. An experienced pilot is also important who can readily provide the best position for the shooter to have a successful shot.

Persons who shoot from helicopters should attend a *Feral Animal Aerial Shooter Training Course* (FAAST course) conducted by NSW Agriculture, NSW National Parks and Wildlife Service, and Rural Lands Protection Boards.

Trapping

Trapping of feral pigs is an effective technique to use as a follow up after an initial knockdown of a population, and as a maintenance technique to prevent numbers quickly building back up. Trapping is flexible as most traps can be easily moved to where pig activity is current, the exact numbers of pigs controlled is known, there is no danger to livestock or other domestic animals and where available, carcases can be sold to a chiller. If checked routinely they also pose little risk to wildlife.

A number of trap designs are effective. The construction of the entrance door to the trap is the most important part of the design. The door must work effectively to allow pigs to enter the trap but not allow them back out.

Traps should be set up where feral pig activity is current. It is normal to set up traps near waterholes, on regular trails, or at other sites where pigs are moving regularly such as through a hole in a fence.

Begin by providing bait material at the site. Bait types can include grain, or fermented grain, pellets, vegetables, fruit, meat or carcasses that they are already feeding on. Once pigs are readily consuming the bait construct a trap around the bait site with a trail of bait leading to the trap entrance. Leave the trap door tied open for a number of nights until pigs are readily entering the trap to feed. The trap can then be set. Check the trap regularly, preferably every day, and humanely destroy any pigs caught. Pigs should not be left for excessive periods in traps.

Ground Shooting

Shooting feral pigs from the ground is a method normally used opportunistically to follow up and maintain numbers after an initial knockdown program has occurred. Often ground shooting is conducted using dogs to locate feral pigs which can be effective as long as both the dogs and the pigs are treated in a humane fashion. Ground shooting should not be conducted prior to, or during any other program of control as it disrupts normal feral pig activity and may cause feral pigs to temporarily disperse to other areas.

CSSP Poisoning

CSSP Poison is a yellow phosphorus based poison that can be used opportunistically as a follow up to a knockdown program. Landholders can buy CSSP Poison from the RLPB and store on farm until needed.

A specified amount of CSSP poison is deposited in an animal carcass where feral pigs are active, either in a carcass which pigs are already feeding on, or in a carcass in the vicinity of feral pig activity. The poisoning action of the poison can be considered inhumane and there is some cause for concern for poisoning of non-target species.

Wild dog biology and control

WILD DOG BIOLOGY

Origin

The term wild dog (*Canis familiaris*) refers in this Manual to feral dogs originating from the introduction by Europeans, feral dog/dingo hybrids and dingoes. The definition of a 'wild dog' in the Pest Control Order No. 2 (Rural Lands Protection Board Act 1998) is: *"…any dog, including a dingo, that is, or has become wild, but excludes any dog kept in accordance with the Companion Animals Act 1998, the Exhibited Animals Protection Act 1986, or the Animal Research Act 1985 or any legislation made in replacement of any of those Acts*".

Current Distribution

There are two main discrete populations of wild dogs in New South Wales. The eastern population ranges along the coast and tablelands, while the western population is predominantly in the north-western corner of the State. Wild dogs are very adaptable. They can live successfully in semi-arid to rainforest environments, providing there is an adequate supply of native game.

Characteristics

Wild dogs are basically short haired and range in colour from white, black brown or yellow to any combination of these. The ancestry of dingoes (those dogs present before European settlement) is uncertain but it is assumed they originated somewhere in Asia. Feral dogs are descended from various breeds of European domestic dogs and since their introduction have interbred with the purebred dingo population. Weights of adult wild dogs range from 10 to 71 kg, depending upon breed. Usually, adult wild dogs are between 11 and 24 kg for males and females are 10 to 22 kg.

Habitat

Wild dogs can live in a wide variety of habitats, but prefer areas of low human density with good food sources and shelter.

Diet

The basic diet of wild dogs consists of small kangaroos and wallabies, rabbits, wombats, rodents, birds and reptiles. Domestic livestock have been found to constitute only a small percentage of the wild dogs' diet.

Home ranges

Home ranges of wild dogs vary from 400 to 5,000 ha, averaging 2,700 ha. Some areas of their ranges are used frequently and others rarely or not at all. The pattern of use involved thoroughly searching one area at a time before moving to another area, where further intensive food searching occurs. Movements follow well defined paths along topographic features. Home range shape is determined to a large extent by topography, with distinguishing features forming boundaries. The dogs move throughout the day and night but are most active at sunrise and sunset and least active during the middle of the day.

Behaviour

Activity occurs during day and night, but is greatest at dawn and dusk. Two basic types of movement, searching and exploratory, occur. Searching movement appears to be associated with hunting because it is characterised by intense activity in a small area, typified by frequent, large, angular changes in direction. Exploratory movement appears to be used when moving from one hunting area to another, and in moving around the home range boundary.

Surplus killing, where a number of prey animals are attacked in one event, is a

behaviour that wild dogs have in common with other canids such as foxes and wolves. This behaviour leads to the killing of livestock in excess of the nutritional requirements of the dog or dogs involved. This is sometimes viewed as "killing for fun".

Social structure

Dingoes have a flexible social system based on small groups that occupy and defend a territory. Each member of a group occupies a home range within the territory, which overlaps the ranges of other group members. Consequently, the group rarely meets as a pack. Instead, members meet and separate again throughout the day or on subsequent days. This explains why dingoes are mostly seen as individuals. However, research suggests that as a dingo population increases or its prey population declines, group cohesion increases resulting in a change in hunting and feeding strategies. Packs form to hunt and feed upon larger prey such as large kangaroos and calves.

Cohesion within the group is maintained by various means of communication. Boundaries of home ranges and territories are marked by scents in urine and faeces, while howling allows distance communication. When individuals meet, facial expressions and body postures are used to communicate.

Breeding

Dingoes breed once a year, usually between April and May, whereas wild dogs, including hybrids, of similar size can breed twice a year without a seasonal trend. However it is extremely rare for two litters to be successfully raised in one year. Very large feral dogs may breed only once every 9 months.

After a 63-day pregnancy, a litter of usually four to six pups is born in a hollow log or cave den, which may be used in successive years by the bitch. While the pups are small, they are confined to the den, suckled and fed solid food brought to them from kills made by the parents. The solid food may be carried, dragged back or eaten and later regurgitated for the pups by the bitch or both parents.

When large enough to travel, the pups are taken from the den to kills and eventually to other dens throughout the home range of the parents. Weaning occurs at 6 to 8 weeks but the pups remain with the parents until they are 6 to 12 months old. Pups that become independent at an early age often die because of their small size and inexperience, while the older, more experienced pups have a much higher survival rate.

Although bitches may breed in their first year, not all do. This is thought to be the result of social subordination of these younger animals by older animals.

Diseases and parasites

Wild dogs suffer from or carry a number of diseases (such as sheep measles, hydatids and toxoplasmosis) that are important diseases of livestock domestic animals and wildlife. They can also become infected with mange, distemper, hepatitis or parvovirus, which they probably originally contracted from domestic dogs and foxes.

The introduction of certain exotic diseases to this country would have far reaching economic and social implications. Wild dogs could act as a reservoir of infection, making eradication of the disease extremely difficult. In this respect, wild dogs would be an important host and reservoir of rabies. The establishment of rabies in wild dog populations would be extremely disturbing because it would completely alter the community's approach to outdoor activities like forestry, bushwalking and camping and to the keeping of domestic dogs.

Human health

Wild dogs have a number of parasitic worms, some of which can be important to humans, for example roundworms.

To humans, the most important parasite of wild dogs in south-eastern Australia is the hydatid tapeworm. This worm is present in a high percentage of wild dogs and is import because its intermediate stage (the hydatid cyst) is sometimes fatal to man. The incidence of hydatid worms in wild dogs is probably high because infected wallabies form a large proportion of the dog's diet. Care should be taken to wash hands thoroughly after handling wild dogs or injured or killed stock.

AGRICULTURAL IMPACT

Wild dogs affect livestock industries through predation and disease. Sheep, cattle, goats and poultry are all victims, with the sheep industry being the most affected.

Sheep

On a total industry basis, wild dogs are an insignificant predator, however, that section of the sheep industry located adjacent to or in a wild dog habitat often suffers severe localised predation. It is not uncommon for some sheep producers to lose 20 to 30 sheep a night to wild dogs. The cost of predation is not confined to direct losses through stock being killed. Other stock are mauled and require treatment; the stock owner has to spend time supervising and protection his stock; stock are stressed, affecting weight gain and wool growth; mismothering occurs; and capital outlay is required for fence construction or other control techniques, including trapping, shooting and baiting.

Cattle

Cattle are much less prone to wild dog attack than sheep because they are larger and the cows are more intimidating than ewes when defending their offspring. Young calves or drought-affected young cattle are the most vulnerable to attack. In areas where hydatids disease is endemic in wild dogs, a large proportion of cattle offal is condemned at abattoirs.

Predation patterns

Predation occurs in all months with peaks in May to July and October. The pattern varies slightly among Rural Lands Protection Board areas and it is only through diligent and accurate recording and reporting by landholders to these Boards that a meaningful picture can be developed for each area. This information can then be used to help formulate a management plan aimed at reducing or preventing wild dog damage.

Recognition and signs of predation

The following procedure is suggested for determining if wild dogs have been responsible for predation.

If the ground is suitable, tracks may implicate wild dogs. The wild dog footprint is larger and rounder than a fox's, often very deep at the site of attack because of the pressure exerted during the killing. Pieces of wool with patches of skin attached and blood trails are good indicators of wild dog attacks. If adult sheep or calves are the prey then wild dogs must be implicated, although the presence of wild dog footprints at the carcass does not necessarily mean predation was the cause of death.

Wild dogs often attack from behind as sheep or calves move away. If these animals survive they may have substantial tissue damage around the hindquarters, be lame, be without tails or have skin hanging from them. Sometimes, ears are chewed off older cattle as dogs attack from the front. Surviving calves often only show teeth marks as evidence of dog attack, and the area around the bite becomes swollen through infection and flystrike. Skinning or plucking of carcases will often reveal the extensive bruising caused by wild dog attacks.

The age, body position and location of a sheep or calf carcass will give some idea of whether wild dogs were involved. Wild dogs will attack sheep of all ages but rarely attack cattle older than 12 months. Attacks can occur anywhere, whereas stock dying of natural causes generally die in a protected area. A carcase with 'paddling' signs would suggest predation was unlikely.

Wild dogs generally kill their prey by bites to the throat, causing damage to the trachea and blood vessels, leading to suffocation. Blood around the throat is therefore good evidence of wild dog predation.

WILD DOG CONTROL

Wild dogs have large home ranges that often include a number of land holdings. It is therefore important that landholders approach solving wild dog problems as a group.

The primary goal of wild dog control is to prevent or reduce stock losses. Simply reducing wild dog numbers may not do this, as a few individual dogs may be doing most of the damage. The aim of wild dog control then should be to remove or exclude the offending individuals, or to reduce the likelihood of a potentially damaging wild dog moving into agricultural land and interacting with stock. No single control technique will solve a persistent wild dog predation problem. It is therefore necessary to include a combination of methods if the problem is to be successfully addressed.

POISONING

Preparation of 1080 Meat Baits

The bait types permitted in NSW for the control of wild dogs are specified in the current Pesticide Control (1080 Wild Dog Bait) Order. After the meat baits have been cut into pieces of approximately 250 gm in size, they should be drained overnight on wire mesh. This removes excess fluid that might otherwise leach out the 1080 and cause it to collect in the bottom of the container. All poisoned baits must be used on the day of preparation, where possible. They must not be stored. Each meat bait is injected with 0.2 ml of 1080 stock solution using a standard 1.0 ml vaccinating gun accurately calibrated. A heavy duty plastic 'back-pack' container to hold the 1080 solution should be connected to the injection gun by a clear plastic hose. The container must be clearly labelled with '1080 POISON' in large red letters. A plastic shield that fits behind the needle will protect the operator from 1080 solution that may squirt back.

Poisoning Procedures:

There are four different wild dog poisoning situations requiring different procedures. They are aerial baiting, large-scale ground baiting, small-scale ground baiting and emergency baiting.

The following conditions apply to all four situations:

- The distance restrictions specified in the current Pesticide Control (1080 Wild Dog Bait) Order must be followed. 1080 may be used in National Parks or Nature Reserves only at the discretion of the National Parks and Wildlife Service
- Notices stating that 1080 baits for wild dogs are laid on the property must be exhibited, as specified in the current Pesticide Control (1080 Wild Dog Bait) Order to indicate the area in which baiting will be carried out.
- The occupier is required to complete indemnity forms.
- Adjoining properties must be notified as specified in the current Pesticide Control (1080 Wild Dog Bait) Order.

The following additional conditions apply to each special situation:

Aerial baiting

Aerial baiting by fixed-wing aircraft is only permitted in the western division. Fixed-wing

aerial baiting has been replaced by helicopter bait placement in the eastern division, which may only be used for large-scale control. Specific approval from the Director General of Agriculture is required.

A written application is to be submitted through the relevant Agricultural Protection Officer to the Director General of Agriculture and must include:

- a list of stock losses and maimings in the Wild Dog Control Association district over the last 12 months
- the number of sightings of dogs
- a list of participating landholders and property names
- reasons why ground baiting cannot be effectively carried out, keeping in mind that aerial baiting should only be carried out in inaccessible country that cannot be traversed by ground means.
- the name of the ACO who will be poisoning the bait
- when it is proposed to conduct the aerial baiting
- the type of meat bait is to be used and how much is to be poisoned
- the name, address and phone number of a contact person within the Association with whom the Agricultural Protection Officer can liaise
- topographic maps showing proposed flight paths for each baiting run
- written authorities from District Foresters where State Forest of NSW land is to be baited.

A sample application form is to be provided at the end of this section and should be used for all intended aerial baiting. (Get an electronic copy from Chris Lane or Tony Barnes)

- **Rural Lands Protection Boards are permitted to carry out both preventive and reactive aerial and ground baiting control programs provided that:**
- It is established that definite predation trends exist which show when and where attacks on stock are probable.
- Where practicable, preventive baiting programs are conducted concurrently by neighbouring Wild Dog Control Associations so that a continuous and effective buffer zone is maintained.
- If required, more than one group-baiting program (by aerial, ground or both) can be allowed each year. Each case for large-scale baiting programs must be able to withstand critical examination (predation must be occurring or accurate historical data must indicate a high probability that it is about to occur).

The procedures that apply to bait placement are as follows:

- The local Wild Dog Control Association needs to meet to prepare an application in a standardised form and with the required maps to seek the Director General of NSW Agriculture's approval of aerial bait placement for wild dog control.
- If baiting is to take place on State Forests of NSW land, written approval must be obtained from the State Forests of NSW and submitted with the application to the Director General of NSW Agriculture.
- The Agricultural Protection Officer should then arrange a further meeting to be attended by delegates of the Association, the RLPB's Authorised Control Officer and any other government agencies involved.
- At the meeting the application and maps should be modified if necessary. The fully completed application with the maps and all the necessary forestry approvals are then submitted through the APO, requesting the Director General of NSW Agriculture's approval. Such submission must be made at least two months before the proposed baiting.
- The APO must consider the merits of the proposed bait quantities and location. Any variation on previous bait placements should be justified. The APO if recommending approval of the

program, should consider that based on the information provided aerial baiting is required to prevent a large-scale predation problem in the areas concerned. The APO will take account of the history of predation problems in the area.

- The APO should return the maps to the Association for use during bait placement. Only photocopies of the maps, with baiting sites and National Park and State Forest boundaries highlighted, need to be sent to NSW Agriculture's Head Office.
- The APO will receive advice of the Director General's approval or otherwise. The APO should then forward written advice of the approval, including any special conditions, to the RLP Board who in turn should advise the Association. The APO should advise the ACO of any changes to the maps that were originally submitted.
- Landholders wishing to have their property baited must be informed of their obligations as specified in the current Pesticide Control (1080 Wild Dog Bait) Order. It is the responsibility of the Association's Secretary to ensure that current Pesticide Control (1080 Wild Dog Bait) Orders are issued to all Association members. 1080 notices must be issued by the Wild Dog Control Association at their organising meeting so that the landholders can display them before the baiting takes place.
- On the baiting day, the Association must ensure that all indemnity forms are signed, and delete from the Association's maps any areas that are not covered by indemnity forms. If baiting is to be carried out on State Forests of NSW land leased to a private occupier, the same procedures are to be followed as for all other participating landholders**.**

It is the joint responsibility of the Association members and the aerial navigator to ensure that:

  - The bait is placed at the locations shown on the approved map presented by the Association.
  - The bait applied does not exceed the quantities shown on the map for each location.
- Associations are not permitted to bait in National Parks or Nature Reserves, or place bait by air within certain distances of public and private facilities without approval from the Minister for the Environment. These distance restrictions are outlined in the current PCO.
- Labelled 1080 plastic bags must be used to hold poisoned bait. These bags must be burnt after use. The bags may be emptied into bins in the helicopter.
- Where possible, Wild Dog Control Associations should arrange their aerial/ground baiting programs to coordinate with neighbouring Wild Dog Control Associations.
- If a government authority proposes to conduct aerial 1080 bait placement on land wholly under its control, approval is required from the government authority responsible for that land.

Ground Baiting (Large Scale)

Large scale ground baiting, within a group program over a number of properties or within one large property can be used when there is a substantial predation problem caused by a number of wild dogs. Use of more than fifty (50) 1080 baits on a large property or a number of properties must be organised by the Rural Lands Protection Board's ACO. The ACO who supplies 1080 baits, must record the number of individual baits supplied to each ratepayer. The baits should be laid in such a way that any uneaten baits can be readily found and destroyed.

Ground Baiting (Small Scale)

Where a person lays 1080 baits on a property of less than 100 ha, that person may lay up to fifty (50) 1080 baits. Baits must be checked not later than the 3rd night after those 1080 baits have been laid. All baits not taken by the 7th night after the baits were laid must be

collected and destroyed. All untaken baits are to be disposed of as detailed in the PCO. This does not preclude replacement baiting for longer than 7 nights where baits continue to be taken.

Emergency Ground Baiting
A person whose stock are being mauled, killed or harassed may lay up to fifty (50) 1080 baits. This is the only occasion where the normal 3 day public notice period is not required. The landholder must however, notify anyone, whose property boundary lies within one kilometre of a baiting location, immediately before laying the baits. Where soil conditions allow, baits must be placed in a shallow hole, covered with a clod of earth, and tied to a support such as a fence. This reduces the risk to non-target animals.

Bait Stations
Bait Stations are set up using meat or manufactured 1080 baits. The baits are either buried about 10-15cm below the surface and covered by sieved or raked sand/soil or placed on the surface and sieved soil mounded on top. (Soil from the immediate area is the preferred type, as it does not contain unusual odours which dogs may be wary of). The soil around the bait or mound is also raked to form a square about 1 m^2. This allows for the easy identification of all visitors to the station through tracking and scat observation. Consideration is also given to the way the station has been interfered with when the bait was taken.

Distance between stations can vary greatly depending on the above factors and for wild dogs could be **1km to 5km apart.** It is preferable that stations be established at a substantial distance apart. Resident wild dogs generally cover enough territory to encounter a station at the above density. Fewer stations not only equates to fewer opportunities for non-targets to take baits, but it also means fewer opportunities for baits to be removed by canids and cached elsewhere. When reducing the number of stations it is preferable to increase the area being baited as well as to extend the length of time that the baiting is carried out.

Before stations are loaded with poison bait, a period of free feeding using non-poisoned baits might be carried out. Any stations visited by non-target species eg quoll, are then discontinued. The risk of poisoning threatened or non-target species is then greatly reduced by ensuring that only target animals are taking the bait. Stations should then be loaded with a single 1080 poisoned bait, provided the total number of baits does not exceed 16 baits per km^2. Stations should be checked regularly. Baiting should continue until dogs taking baits stops. Poisoning must be immediately discontinued if removal of baits by susceptible non-target animals is suspected.

TRAPPING
Trapping is a specialist activity and is best conducted by experienced or trained operators. Only rubber or soft jawed traps, or modified, padded and offset toothless jaw spring traps can be used for control of wild dogs in NSW. Spring traps should be used in accordance with the Code of Practice included in circular no. PPB 88/14 of 21 January 1988, the Standard Operating Procedures for spring traps and the Prevention of Cruelty to Animals Act 1979 (POCTA).

In summary, the above circular and POCTA Act provides a minimum standard for the use of spring traps in the control of wild dogs. There are three objectives: to restrict use of spring traps to situations where no practicable alternative exists, to maximise the humaneness with which they are used, and to minimise risk to non-target species.
A pamphlet and a video describing the minimum standards for the modification of toothed spring traps to make them legal is available from most RLPB's.

Conditions under which use is acceptable
For wild dogs these conditions are met where control is required in inaccessible country, or where a particular dog is causing stock losses and is unlikely to be killed by other means, or as part of an integrated program that includes other methods.

Trapping procedures
Trapping is generally considered to be effective only if an experienced and competent person carries it out. Numerous mistakes can be made with traps, which will educate wild dogs. It is therefore important that traps be used correctly and only when necessary. The use of spring traps is labour-intensive and while they are of value in removing problem dogs they are of little value in general population reduction.

The advantage of spring traps is their versatility, as they can be used under a wide variety of conditions. They are often the only means of removing specific problem dogs. The best place to set a trap is either on or near a regular dog pad. The dog can be attracted to the trap by using a lure of decoy (usually a dog urine-based mixture), which it will investigate because it suggests a strange dog has visited its territory.

Placement of Traps
Traps should only be set in areas regularly frequented by the target species:

- beside regularly used pads;
- near scent mark- or scratch- points.

Dog traps should be either tied to objects that will give when the dog pulls against the trap (drags) or firmly anchored by a short chain that has a shock absorbing spring included in its length. Long chains and light drags are likely to cause injury to a trapped dog. Although injuries with soft-jawed traps are uncommon, most serious injuries are caused by entanglement of the chain with obstacles or by the dog gaining sufficient momentum at the end of a long chain to cause injury, rather than the trap itself. .

Servicing the Traps
Traps should be serviced at least once per day. Where it is impracticable to service dog traps on a daily basis, strychnine cloths should be wrapped around the jaws so that trapped dogs die quickly, rather than from exposure or thirst.

Treatment of Captured Animals
Captured dogs must be approached carefully and quietly to reduce panic, further stress, damage and pain. Live animals should be killed as quickly and painlessly as possible; by a single shot to the brain with a small calibre rifle.

Strychnine Cloths
Rural Lands Protection Boards are permitted to prepare and distribute strychnine cloths for use on soft-jawed traps. These should be used where traps cannot be serviced daily. Cloth preparation is described in PPB circular 86/68 of 4 November 1986.

In summary that circular states the Strychnine Content and Size of Cloths
A maximum of one gram of strychnine is to be incorporated into each cloth on a weight for weight basis. Each cloth should measure approximately 300mm x 40mm.

Strychnine Stock Solution
The impregnation of cloths will require the preparation of a stock solution. This is to consist of one litre of water in which is to be dissolved the entire contents of one 25g bottle of strychnine hydrochloride. This solution (2.5% W/V) will be used in the preparation of twenty-five (25) cloths. Stock solution is not to be stored. Any solution remaining after preparation of cloths is to be disposed of by deep burial. Containers used for the preparation of cloths should be clearly identified and kept exclusively for that purpose. Rubber gloves MUST be worn during solution and cloth preparation.

Method of Cloth Preparation/Use

Only 1080 authorised officers can prepare the cloths. Twenty-five cloths are to be soaked in one litre of stock solution, then removed and laid out to dry in a safe and secure area. Cloths should be wrapped around the jaw of the trap and fastened by soft wire or string.

Packaging
Each trapper's allocation of cloths is to be placed in labelled plastic bags and sealed. A maximum of two treated cloths per bag is permitted (ie sufficient for one trap). Appropriately labelled plastic bags are available from Chungs Plastic Bags or Churchill and Coombes (contact details available from your regional Agricultural Protection Officers).

Security
All strychnine powder, strychnine cloths and mixing equipment must be stored within a locked steel cabinet and keys kept only by the officer who has prepared them. The cabinet must be securely fixed inside a room to which unapproved persons are not permitted to enter. The same room can be used for the storage of 1080 as specified in the Vertebrate pest Control Manual.

Record of Strychnine Use
Each authorised Board is to maintain a strychnine register giving details of receipt and use of strychnine powder.

SHOOTING

Shooting is usually an opportunistic control method. Shooting accounts for dogs that are shot either by landholders who encounter them by chance while patrolling their properties, by landholders or hunters who attract the dogs to a vulnerable position by calling or using some other type of lure or by dog drives involving up to thirty people.

Shooting is generally only effective in specific situations. It could be considered to play an important role in controlling problem dogs but it does not have a significant impact on a regional basis because it is so opportunistic.

FENCING

Fencing, either conventional or electric, can provide an effective barrier to wild dogs providing it is adequately maintained. Conventional wild dog fences need to be at least 180 cm high and constructed of netting, which makes them very expensive. Most landholders can no longer afford such a barrier, so they resort to either upgrading old fences with electric outriggers or constructing a much cheaper all-electric fence. Barrier fences are of particular help when a property adjoins wild dog habitat or when neighbours neglect control.

When constructing an electric fence it is important to consider the behaviour of wild dogs. As a rule, they prefer to push through, push under or dig under a fence, in that order. Consequently, the fence should be designed to cater for this behavioural pattern. It must be remembered that other animals such as kangaroos, wombats and feral pigs may also test the fence and breach it, leaving an opening for a wild dog.; Regular maintenance and the incorporation of a monitoring system into the fence system will assist supervision.

Figure 1. Recommended electric fence for feral animal and wildlife control (to be redone if ?)

Do we need this diagram?? Does anyone that would access this Manual use or recommend this type of fence???

LIVESTOCK GUARDING ANIMALS

Guard dogs are relatively new to Australia, but have been used for centuries in Europe to protect sheep and goats from wolves and, more recently, in America against coyotes. They have met with mixed success in North America and have limited application in Australia because of our extensive sheep management system.

Llamas and donkeys have been used to protect overseas livestock from wolves and coyotes and might be useful in some Australian conditions. The use of livestock guarding animals has not been adequately tested in Australia.

DOG CONTROL IN TOWN AREAS

Individual dogs or dog packs creating a nuisance within a town or village are the responsibility of the municipal or local authority concerned and are not a Rural Lands Protection Board responsibility. 1080 poison must not be used in urban areas where dogs are causing a public nuisance. Some Boards provide cage traps to those landholders who adjoin a town.

Further Reading

Fleming, P., Corbett, L., Harden, R. and Thompson, P. (2001). *Managing the Impacts of Dingoes and Other Wild Dogs.* Australian Publishing Service, Canberra

PERMISSION TO INCLUDE PROPERTY IN PROPOSED AERIAL BAITING PROGRAM FOR WILD DOGS

I …… ….. (name)

of ……..……(address)

…… (town)

……. (telephone)

……..(fax)

being the owner / duly authorised agent of the owner / occupier of the property known as:

Property name ……

Situated at …….. within the ……RLPB District

Give permission for the ……Wild Dog Control Association and / or the Rural Lands Protection Board to lay poisoned (1080) meat baits for wild dogs by air on the above listed property during the aerial baiting program proposed for (DATE) Month ……Year 20……

The signing of this form does not replace the need for a legal Indemnity form, which must be signed by the owner / occupier prior to the laying of the baits.

Signed …… (Owner / Legal Occupier)

Date …….

Fox biology and control

FOX BIOLOGY

Origin

European settlers introduced the European red fox (*Vulpes vulpes*) into Australia as early as the 1850's, although the most successful releases took place in southern Victoria in the early 1870's. Foxes were introduced primarily for sporting purposes such as fox hunts.

Within 20 years, foxes had achieved pest status in some parts of Victoria and they had reached their current distribution on mainland Australia within 100 years. It has been suggested that the spread of foxes was strongly linked to the spread of rabbits across the country and that both species were helped along by deliberate introduction as European settlement expanded.

Distribution in New South Wales

The red fox is found throughout all parts of New South Wales. Densities vary from around 1/km^2 in the coastal forests, around 2/km^2 in the semi-arid grazing lands and subalpine regions and 5-7/km^2 in the temperate grazing lands, which cover much of NSW.

Fox populations have also established in many urban areas, especially where there is cover provided by parklands and reserves and food is easy to find and they can also be found in the Central Business Districts of most large cities in Australia.

Habitat

Foxes have successfully colonised an extreme range of habitats, from urban areas to deserts throughout Australia except for the tropical far north and Tasmania.

Studies overseas suggest that fragmented environments are more favoured as these offer a wider range of shelter, food and den sites than in more uniform forest or rangelands.

Behaviour

The red fox is solitary by nature and relies on stealth and cunning to find prey and to avoid contact with humans or other predators. Foxes are most active at night, either hunting or patrolling their territory, but daytime activity is common, especially by adults feeding cubs. By day they usually rest in their hide, which may be a hollow log or tree, an enlarged rabbit burrow or dense undergrowth.

Studies indicate that family territories vary with habitat type and food availability, ranging from 2 to 5 km^2 and boundaries are marked by urine and faeces scent. Foxes usually move within their own territories but will travel up to 25 km in search of food.

Individuals can disperse at about 30 km per year to find new territories. Individual home ranges can overlap at some times of the year, but most social groups have a territory which they will defend against other foxes. Territory size is determined by population density, which is limited by food and other resources. Territories are marked by urine and faeces. Scent marking is used to indicate an individual animal's sex and breeding status.

Adult foxes can weigh between 4.5->9kg and can eat 300-450gm of food per day.

Food

The fox is an opportunistic predator and scavenger, being primarily carnivorous. In the grazing areas of NSW the primary diet of foxes consists of sheep (either as carrion or as young lambs), rabbits and house mice. However, foxes will take small native animals as well. They readily eat fruits and insects when available, especially if other prey species are scarce.

When there is abundant food, foxes will often bury excess food. This is known as 'caching'.

When food is scarce, such as in winter, cached food is recovered.

The fox is a serious predator of lambs, and earlier studies suggested that foxes enter lambing paddocks as a scavenger and as a predator of weak or unhealthy lambs. Recent research using ultrasound pregnancy testing of ewes suggests that true lamb losses may be as high as 30%, because graziers did not know how many lambs their ewes were carrying.

Foxes are also suspected of causing the serious depletion of some native animal species including Rock Wallabies, Bettongs, Numbats, Mallee Fowl and the Murray River Tortoise.

Breeding
Females come into oestrus for 2 to 3 days over 2 to 3 weeks in winter. Gestation lasts 51 to 53 days before a litter of 3 to 5 young is born in a den. Weaning occurs at 4 to 6 weeks. The young appear from the den in late spring, at about 6 weeks of age. The cubs leave the den at about 10-12 weeks and are independent by 6 months of age. Males are fertile throughout winter and early spring. Both sexes reach sexual maturity in their first year.

There may be a proportion of the female population that does not breed each year, but this is more likely where there is low mortality in the group. These vixens can help in the raising of cubs.

Mortality factors
Mortality factors are not fully understood. The abundance of available food such as rabbits, especially during winter or drought periods, appears to have a controlling influence on the overall population, as will diseases such as distemper and mange.

The use of poison baits to protect lambing flocks and endangered native fauna populations only has a short-term effect on local fox numbers. Where foxes have been removed from an area, migration from untreated areas generally occurs in less than 5-6 weeks.

FOX CONTROL

Poisoning
Fox predation can cause significant lamb and kid losses, so control is sometimes needed to protect flocks from particular foxes or to protect other agricultural enterprises from fox predation. Destruction of foxes is environmentally desirable because of the impact they have on native animal species.

Fox poisoning with 1080 in NSW is regulated by the Pesticides Act, 1999 administered by the Environment Protection Authority (EPA) and can be carried out only under conditions set down in a specific 1080 Fox Baiting Permit issued by the National Registration Authority.
Conditions for use of 1080 fox baits include the following:

* Baits will not be laid unless distance restrictions can be observed and great care is taken when laying baits in closely settled farming areas to avoid accidental poisoning of domestic dogs.

* Excessive numbers of baits are not used and the ACO keeps a record in the 1080 Register of the number of individual baits supplied to each ratepayer.
* The number of baits for any one property does not exceed 50, unless the baiting program is organised by an ACO.

* On properties of less than 100ha, poison baits must be checked not later than the 3rd night after laying and remaining baits recovered and destroyed before the 7th night.

* Where practicable, baits are laid by hand in such a way that uneaten baits can be readily found again and destroyed if necessary. All fox baits are to be buried.

* Baits for foxes are either 100g meat baits, offal such as lamb's tongues, heart or liver pieces, fowl heads, chicken wingettes or manufactured baits such as FOXOFF®.

Using 1080 fox baits

[Note: The preparation and distribution of 1080 baits is detailed in the relevant Pesticide Control (1080 Fox Bait) Order and in the Poisons Section of this Manual. The following does not replace any instructions in the Pesticide Control Order (PCO).**]**

Fox baiting is primarily carried out to reduce predation and to control the population. Mostly, it is conducted on a rural property during lambing or kidding. Poisoning with 1080 is considered to be the most cost efficient method of fox control, especially if it is done over a large area on a cooperative basis with neighbours.

The fox baiting program

The most efficient way of conducting a fox control program is over a number of properties and to have the Authorised Control Officer from the local Rural Lands Protection Board to coordinate it.

The strategy used must address the following questions:

* How many properties are to be involved?
* How long before lambing or kidding will the first poisoning take place?
* How often will poisoning occur?
* What baits will be used. 100g pieces of meat or offal, lambs tongues, fowl heads, chicken wingettes or FOXOFF®?
* How many baits will be required?
* Who is going to be responsible for organising the supply of baits?
* Where should all landholders meet to have the baits poisoned?

The approved 1080 baits that can be issued for fox control are either 100g pieces of boneless red meat or offal, fowl heads, chicken wingettes or FOXOFF® baits. Fowl heads are best prepared by injection through the eye into the brain cavity.

FOXOFF® baits come packed in trays of 30 x 35g "Econobaits" or 12 x 60g baits and contain a lethal dose of 1080 poison in each bait.

Every bait contains sufficient 1080 to kill the heaviest of foxes.

Only 50 baits per property can be issued at a time unless the program is organised in conjunction with the RLP Boards Authorised Control Officer. The APO can approve the use of any reasonable number of baits. When distributing baits the following technique is recommended:

Baiting in extensive agricultural areas:

* Lay baits near fences, tracks and other access points to the baiting area as well as through the body of the paddock. Foxes have an exceptional sense of smell so they will locate baits over a wide area.
* Bury baits at 200 to 500 m intervals. Do not place baits too close together as foxes will eat more than one bait especially if following a trail. As a guide, start with about 50 baits per 400 ha.
* A rabbit trap setting tool is ideal to dig the small hole so that baits have a couple of centimetres of soil over them. In areas with potential risk to non-target species, such as Quolls, then baits should be buried about 10 cm deep.
* Do not worry about leaving human scent because foxes are not frightened by it.
* Begin baiting at least a week before lambing/kidding starts and continue poisoning at weekly intervals until bait take is minimal. If baiting ceases during

the early stages of a prolonged lambing or kidding, it may be necessary to begin baiting again when foxes start to migrate into the area.

* Where possible, bait sites should be marked. Bait take can be determined which will give an idea of fox activity. Uneaten baits should be collected and destroyed, thus reducing the chances of working dogs or non-target animals being poisoned.

* If setting up bait stations, especially in sensitive areas, set up sand pads so that tracks of non-target animals can be detected before poisoned baits are placed into the bait stations.

* Carry out spotlight counts before and after baiting to determine the reduction in fox numbers.

Baiting in intensive agricultural areas:

* On properties less than 100ha, baits must be checked no later than the 3rd night and remaining baits picked up and destroyed by the 7th night. If baits are still being taken after this time, replacement baiting may be carried on until bait take ceases.

* Bury baits at roughly 200-500m intervals around the boundary of lambing/kidding paddocks and mark each site so that the baits can be retrieved.

* As an added precaution, baits can also be tied to the fence.

* Begin baiting at least one week before lambing/kidding.

* On properties larger than 100ha, baits should be checked at three, six and nine days after the initial baiting and missing baits replaced.

* Continue baiting at weekly intervals until fox sign disappears.

Do this by assessing bait take and spotlight counts.

In areas where native carnivores such as Quolls are present, bait stations using buried, unpoisoned baits should be set up and monitored. If these baits are taken or disturbed by non-target animals then poisoned baiting should not continue in the area.

Baits are best buried because:

* Foxes prefer to eat buried baits as it part of their caching behaviour. Foxes will often walk past baits placed on the surface.

* Buried baits are less likely to be removed by birds or attacked by ants.

* Less bait is taken by other species, such as feral cats, which do not prey on live lambs/kids.

* Bait keeps fresher for longer periods, especially during summer in central and western NSW.

* Foxes will more readily find and dig baits up than working dogs do.

* Buried baits are more likely to rot away if left buried on site and are therefore less likely to be eaten by working dogs. (Baits left on the surface will quite often dry out but preserve the 1080 in a highly toxic state.)

Foxes will also die after eating 1080 poisoned carrots and rabbits. A well coordinated rabbit control program may significantly suppress fox numbers in some situations.

Electric fencing

Foxes, like dogs, are very intolerant of electric shock. They quickly learn to avoid electrified fences.

If an existing conventional fence is to be used, two offset live wires need to be

incorporated. The bottom live wire should be about 200 mm from the ground and 200 to 250 mm out from the conventional fence. This wire will prevent foxes from going under the fence. The top live wire should be placed near the top of the conventional fence and about 200 to 250 mm out.

Any conventional 6 or 7-wire electric fence is effective provided the wire spacing prevents foxes from leaping through or crawling underneath.

Provision should be made on all fences to prevent foxes from going over the fence at strainer posts, other posts and gates.

Shooting

In general, shooting is used more as a follow on control rather than a primary technique. Sporting shooters and fur hunters can account for high numbers of foxes, especially when fur prices are high. But seldom does this produce a sustainable reduction in the fox population. Shooting is very target-specific but should be used with caution around lambing paddocks because it may disturb the lambing flock and cause mismothering.

Artificial rabbit distress calls are often used to call up foxes to within shooting range. It is recommended that a high velocity rifle fitted with a telescopic sight is used both during the day or at night. At night a spotlight of at least 100W is necessary.

GUARD ANIMALS

There are a number of animals that have been used to protect species susceptible to fox attack. In particular, guard dogs have been used world wide to protect flock animals from wolves, coyotes and foxes.

Guard dogs, such as the Maremma (from Italy), Anatolian Karabash and Akbash (from Turkey) and Pyrenees (from France and Spain) are relatively new to Australia, but have been used for centuries in Europe to protect sheep and goats from wolves. More recently, these dogs have been used in America to protect livestock against coyotes.

Although they have met with mixed success in North America and may have limited application in Australia because of our extensive sheep management system, guard dogs are an acceptable option.

Llama and alpaca have successfully been used with sheep recently while geese have provided some protection for poultry.

Further Reading

Saunders, G., Coman, B., Kinnear, J. and Braysher, M. (1995) *Managing Vertebrate Pests: Foxes.* Australian Publishing Service, Canberra

Mouse biology and control

MOUSE BIOLOGY

Origin

The house mouse *(Mus domesticus)* originated near the present border of Iran and the former U.S.S.R. Mice quickly spread to Europe and subsequently throughout the world. Their introduction into Australia was probably with the early settlers and like most introduced animals, took an immediate liking to the country. With an ability to live on a wide range of foodstuffs, mice were able to accompany people as they explored and colonised.

Distribution in NSW

The house mouse is not restricted to houses or buildings. They are found throughout the State in almost all habitats and have adapted to a wide range of environmental conditions. More importantly, they are common in all agricultural land, particularly cereal and summer cropping areas.

Characteristics

Mice are normally light brown to dark grey on the body, with a light cream belly. Their body length is about 75 mm and adults weigh up to 30 g. The tail is about as long as the body and is almost hairless. In relation to their body, the ears are large and the eyes and feet are small. The long whiskers or vibrissae are very sensitive and are used as sensors when moving about in the dark.

Mice have prominent incisor teeth, which grown continuously and their length is controlled by gnawing. Material may be gnawed yet not tasted or swallowed, so it is difficult to devise a repellent coating against mice. The house mouse is distinguished from Australian native mice by its teeth and by the number of nipples on the female.

The house mouse has a well-marked notch or ledge behind the tip of the upper incisors into which the lower teeth fit. Native species have smooth chisel edges. Also, native species have only four teats whereas the house mouse has at least one additional pair of thoracic or chest nipples.

Food

Mice eat a wide range of foods, consuming about 3-5g daily. In a field situation, mice survive on the seeds of native grasses and thrive on introduced cereal grains. In food storage areas, their diet can include cereals, other grains, vegetables, meat, fish, nuts cheese and non-rancid animal products. They are believed to be attracted to foods such as rolled oats, peanut butter, vegetable oils, molasses and pumpkin seeds. When selecting a bait type, it is important to know that mice will sample all foodstuffs within their range but may not return to a particular feed type for many days.

Water

Mice can successfully live and breed without free water, if the moisture content of the food is at least 15%. Where mice live in sheds and areas where the food supply has a low moisture content, then they need 1-2 g of water daily to survive. In these situations, their activity can be limited by cutting off their access to water.

Reproduction

Mice can start breeding at 6 - 10 weeks of age and produce 10 -12 litters per year. The gestation period is 19 - 21 days with the female re-mating almost immediately after parturition. Young mice begin eating solid food at 11 days and are weaned at 21 days of age. They have a life span of 1-2 years.

Litter size is generally 5 to 6 but can be up to 10. The young are born hairless and blind in a nest of collected materials such as grass, paper, hair, cloth remnants or anything soft that is available.

If there is no infant mortality, one breeding pair of mice could theoretically produce 500 mice within 21 weeks.

In Australia, mice living under field conditions have a seasonal pattern of breeding. This generally begins in early spring and continues until cold or wet conditions develop in late autumn. Mice living in unfavourable seasonal conditions may have a shorter breeding period while those with nests in the warmth of buildings or haystacks are likely to have an extended breeding period.

Plagues
Mouse plagues tend to occur when there is plenty of food and water available, environmental temperatures are not extreme, soil is moist and easy to dig, nesting conditions are favourable, and diseases, parasites and predation are at a low level.

Mouse plagues seem to be increasing in frequency and may be due to changes in agricultural practice. There has been a marked increase in the number of crops grown under irrigation, as well as a change to follow-on summer/winter cropping. In some of the areas with available irrigation, it is not unusual to grow two summer crops that mature at different times and then follow with a winter cereal crop.

Behaviour
Mice are most active at night but can also be seen during the day, particularly around buildings or areas with adequate cover. Their home range is limited to an area of about $5m^2$ in closed buildings; but in crop situation, with available food and water, the home range may be even less. Young mice are forced to seek new areas during periods of high breeding and this is one of the factors associated with the development of a plague. When mice move, they tend to follow the same path from refuge to feeding area. Paths are often confined to walls, pipes or natural barriers and so the tell tale smear marks can be an indication of mouse activity. In the field, distinct tracks through the vegetation become obvious.

Mice can swim and remain under water for lengthy periods. dig, jump upwards at least 30 cm, jump downwards at least 2.5 m without injury, and squeeze through openings as small as 8 mm in width. In addition, they can climb almost any rough surface, climb upside down and run down ropes and electric wires.

Predators
As with all pest species, predation may play a role until there is a rapid population build up. Predators are unlikely to have any effect on numbers when there is a mouse plague. A noticeable increase in the number of predators in an area may indicate a large increase in the mouse population.

In south-eastern Australia the main predators of mice are foxes, feral cats, snakes, falcons, owls, kites, kestrels, hawks and kookaburras. Itinerant bird species such as the black-shouldered kite are good indicators that mouse populations may be increasing. Domestic cats have no impact on mouse populations, contrary to popular myth.

Disease
Although disease can cause a sudden decline in mouse numbers that marks the end of a mouse plague, it is mainly when mice are stressed from restricted food and shelter. It is more likely that overcrowding will allow for parasite infestations to develop and contribute to the spread of disease. A CSIRO research project is still trying to identify any disease or parasite that occur in mice that could be enhanced as a biological control agent.

MICE AS PESTS

Mice are commensal rodents (they live with humans) that have adapted to living in houses and buildings in close association

with humans. Most farm buildings always have a few mice. In the field, mice are always present but mostly in low numbers. Refuge areas such as channel banks and the more densely vegetated pastures are ideal habitat where detection is difficult. Poultry and pig sheds or grain storage facilities are also favoured, particularly if the soil can be excavated easily.

Sown crops
Mice cause damage to almost all sown crops, no matter whether they are winter or summer crop, cereal or oilseed, maize or pasture seed. By digging into the loose soil immediately after sowing, they are able to establish nests and feed on some of the seed or newly emerging seedlings.

Most crops suffer damage prior to seedling emergence and when the grain or seed begins to mature. However, in cereal crops such as wheat, mice chew the growing nodes of the plant and can stop the development of the head or cause the stem to collapse

In recent years, there has been major mouse damage to wheat, oats, barley, soybean, maize, sunflower, sorghum, rice, lucerne seed and other legumes as well as horticultural crops like melons, pumpkins and tomatoes

Stored produce, buildings and machinery
In most farm produce storage, mice will be active. Normally, there may be little pressure put on such storage until there are mice in plague proportions that will test security to the limit. Mice can find the smallest hole and work on it until it is large enough to allow entry. During a plague, it is difficult to maintain a mouse free status of any facility unless there has been a mouse proof component incorporated into the initial design and construction.

In machinery sheds mice can cause major damage to vehicle wiring, upholstery and to electric motors. Damage can be severe to plastic and rubber components that can cause machinery failure when it can least be tolerated.

There have been a number of ultrasonic devices promoted to either repel or reduce mice in buildings. There is no scientific evidence to show that ultrasonic sound can prevent or control damage by vertebrate pests.

The physical properties of ultrasonic sound make this technique unreliable. Firstly, ultrasound diffuses rapidly in open space (what begins as a scream may deteriorate into a whisper in just a few metres). Secondly, ultrasound is very much “line of sight” so pillars, building supports or stored produce will block the sound waves. Also, in many situations the cacophony of other noises will mask the distracting ultrasonic sound to be little more than background noise.

In the absence of rigorous scientific testing, then it is a case of “buyer beware” if considering Ultrasonic sound repellent devices.

Human and animal health
Mice can transmit a number of diseases to humans and livestock. In particular, mice can transmit salmonella to one another, to humans and to domestic animals, encephalomyocarditis (EMC) virus to pigs, fungal skin diseases (ringworms) to cats and humans and leptospirosis to humans and domestic pigs.

MOUSE CONTROL-PHYSICAL

Mouse control should be part of an organised and ongoing program aimed to reduce damage caused during a plague. Mouse-proofing facilities, grazing or mowing channel banks, keeping rubbish around farm buildings to a minimum and general good farm hygiene should reduce the potential for a rapid and unexpected mouse build up.

Once mice are in plague proportion farmers can do little to control mouse numbers. Mouse populations explode when food, temperature and nesting conditions are favourable. But there are a number of control options that are available when a plague is imminent.

Barriers
Unless the building has been constructed with good concrete foundations and sheet metal barriers, then the cost of erecting barriers at a later time has to be weighed up against the potential value of any loss. The costing involved at construction would need to consider foundations, walls, floors, doors and windows, roof and eaves, sewerage and drains. Details on mouse proofing are available from the major pest control companies. Grains Research and Development Council ((GRDC), the local NSW Agriculture Agricultural Protection Officer.

Traps and deterrents
Trapping will have little impact on a mouse plague. The use of snap back traps, water-filled drums and other ingenious devices may be useful early in a plague to reduce invasion into a home or to monitor rate of increase during a plague. If using such traps, the most attractive baiting material is a small patch of leather or felt soaked with peanut butter, linseed or any other vegetable oil and secured to the trigger plate. Bacon rind, pumpkin seeds, raisins or cheese securely fixed on to the trigger plate also work well. Although numerous physical and chemical deterrents have been suggested for repelling mice, none have proved to be successful. Machines that generate sound waves (ultrasonic devices) and coating or impregnating wires have been extensively tested in Australia and overseas; and have not been found to have any value in repelling mice.

Further development of such repellents may result in the further production of an effective rodent repellent.

Raptor perches
Some of the predatory birds such as the raptors like the black shouldered kite, Australian kestrel, brown falcon etc and owls are known to be effective in hunting and catching mice. The Vertebrate Pest Research group has studied the effect of placing perches for raptors in paddocks that were susceptible to mouse damage.

Their results indicate that placing artificial raptor perches around a paddock significantly increased the number of diurnal (daytime) raptors visiting and hunting over these crops. This action reduced the rate at which the mouse population increased and then limited the maximum mouse population density, so the use of these perches to attract birds of prey could be another valuable management tool.

Perches were 3 m high and were best placed at 100m spacings around the crop perimeter. Details of the perches are available from your local Agricultural Protection Officer.

MOUSE CONTROL -CHEMICAL

Small scale
The use of poisonous bait around buildings and storage facilities may be relatively successful for controlling small populations of mice. Once mice begin to plague and the numbers of dead mice appear to be increasing, there may be little or no effect on the overall population. Most of the poisons available are anticoagulants, which are safer for use around humans and domestic animals (except pigs, which have very low tolerance to anticoagulants).

There are two broad categories of anticoagulants; the indandiones and the hydroxycoumarins.

Indandiones: Only one registered product
- pindone (Pin-25®),

- **Hydroxycoumarins:** These include
- bromadiolone (Bromakil®),
- brodifacoum (Talon®),
- coumatetralyl (Racumin®),
- flocoumafen (Storm®)
- warfarin (Ratsak®).

Anticoagulants are marketed as grain or pellets, as blocks, powder or as a liquid and are used as either a bait, drink or tracking powder. All products are available in small or bulk quantities for immediate use.

Large scale (broadacre) baiting

There is still much debate about the effectiveness of large scale baiting to protect crops from mouse damage. Although research has indicated that there is little reduction of damage, most landholders would consider that perimeter and spot baiting does reduce long term damage.

Currently, **bromadiolone** (Bromakil®) is registered in NSW for mouse baiting but only as a crop perimeter bait (a copy of the Pesticide Control Order is available from your local Agricultural Protection Officer).

Zinc phosphide. The National Registration Authority (NRA) and the Environment Protection Authority (EPA) has approved the use of zinc phosphide rodenticide (MouseOff®) for in-crop baiting. The local Rural Lands Protection Board and/or NSW Agriculture will generally control aerial baiting programs in NSW.

State Government agencies including NSW Agriculture, Rural Lands Protection Boards, Environment Protection Authority, WorkCover Authority and National Parks & Wildlife Service can monitor any baiting program.

Crops can only be baited after they have been assessed as "at a reasonably high risk from mouse damage". Strict baiting criteria have already been established to minimise risks. Such baits will not be used in towns or residential areas.

Strict safety procedures have been developed to avoid any hazards during preparation and handling of bait. In general, the recommended rate for zinc phosphide is one kilogram of wheat bait per hectare or about three grains of wheat per square metre. At this rate of application, there should be sufficient bait to kill about 10,000 mice/ha.

Farm poisons not registered for mice should **NOT** be used as they are ineffective and have the potential to cause serious wildlife losses.

Safety

As all the currently used rodenticides are anticoagulants, the safety directions are the same or similar for each. When handling the poison, wear overalls and elbow length PVC gloves. Wash hands after use with soap and water and wash gloves thoroughly at the end of the day.

FIRST AID

If poisoning occurs, get to a doctor or hospital quickly. Vitamin K_1 (Phytomenadione) is antidotal. **Contact the Poisons Information Centre on**

13 11 26

Further Reading

Caughley, J., Bomford, M., Parker, B., Sinclair, R., Griffiths, J and Kelly, D. (1998) *Managing Vertebrate Pests: Rodents.* Australian Publishing Service, Canberra

Feral goats

BIOLOGY

Origin

The goat (*Capra hircus*) was one of the first animals to be domesticated, eight to ten thousand years ago. The origins of the wild goats (*Capra aegagrus*) extend around the dry hills of the Mediterranean basin including Turkey, Iran and Pakistan.

Goats arrived in Australia with the First Fleet in 1788. They were a convenient livestock animal for early European settlers, being relatively small, eating a wide range of plants and providing both meat and milk. The present feral goat populations are descendants from animals introduced for a variety of reasons since 1788. During the 19th century, sailors released many goats onto islands and the mainland for emergency food supplies. Cashmere and Angora goats were imported in an attempt to start a fibre industry in Australia. Goats were spread around Australia by settlers, railway construction gangs and miners who used these domesticated animals as a source of milk and meat. These domestic goats escaped, were abandoned or were deliberately released and these animals established feral herds.

Distribution

In 1993 there were estimated to be 2.6 million feral goats in Australia. Most live in pastoral areas of Queensland, New South Wales, South Australia and Western Australia.

Feral goats occur in all Australian states and in the Australian Capital Territory, but are rare or absent on the mainland of the Northern Territory. They also occur on many Australian offshore islands. The most extensive populations live in semi-arid pastoral areas. Isolated populations occur in higher rainfall and agricultural areas. The highest densities occur in these areas.

Insert map

Habitat

Feral goats are most common on rocky or hilly country in the semi arid rangelands. These areas provide security from predators and the disturbance of man. Goats are not normally found on flat treeless plains, but can be found on flat country with dense shrub cover. Favourable habitat requires availability of shelter, surface water and an abundance of preferred food species. Large numbers of goats do not occur in areas where dingoes are abundant.

Diet

Goats are generalist herbivores that select the highest quality food available. They eat foliage, twigs, bark, flowers, fruit and roots. They will also eat plant litter, seeds and fungi. Goats can eat the majority of plants in the pastoral zone of Australia including prickly acacia, many poisonous or bitter plants and species avoided by sheep and cattle.

Though goats will eat just about anything, they are highly selective feeders and any one of shrubs, grasses or herbs may comprise the principal part of the goats diet at different times or places.

During dry times goats need to drink water. An average size goat will drink between 2 to 4.5 litres of water per day, depending upon temperatures, humidity and reproductive status. Some goats, particularly those in temperate or wet climates, can obtain most of their water requirements from their food and can survive in areas with no permanent fresh water.

Breeding

Conception occurs in feral goats in pastoral areas of New South Wales in all months of the year but the peak rate occurs from late summer

to mid winter. This coincides with the optimum conditions for survival of the mother and young. Breeding rates are influenced by rainfall and, in semi arid areas, most kids are produced in the cooler times of the year. In the temperate region, kids are produced throughout the year.

In drier districts, all sexually mature females in a herd may come into oestrus at the same time and it is thought that it is synchronised by male sexual activity. This can reduce the effects of predation by having a glut of potential victims.

Females can begin breeding at the age of 6 months or when they weigh about 15 kg or more. Males reach sexual maturity at approximately 8 months but competition for access to oestrus females is fierce and it is unlikely that young males are able to mate until they become large, dominant individuals.

Females may be come pregnant in their first year and can become pregnant again soon after giving birth, as lactation does not stop oestrus or pregnancy. Therefore, they can breed twice in a year as their usual gestation period is only 150 days. Twins and triples are common, although it is very rare for all three triplets to be raised to independence. At any time in the high rainfall zone, between 16 and 53% of females have kids at foot and the average litter size is 1.3 kids per female.

Females that are about to give birth leave the group and give birth in a protected spot. Kids are fully active soon after birth, but most, although not all, are hidden by their mothers and only visited for feeding until after a few days they join the mother on her travels. Females may then remain separate from herds containing adult males for 1 – 2 months.

Mortality

The mortality rate of kids from birth to six months is high. Natural mortality rates amongst older goats are unknown but assumed to be about 10%. Adult mortality rates (from all causes including hunting and harvesting) are about 26% in temperate regions.

Dingoes, feral dogs, foxes, wedge-tailed eagles and feral pigs are all predators of feral goats. Dingoes and other wild dogs are the main predators of adult goats and appear to affect feral goat distribution. In northern Australia, goats are rarely present unless wild dogs are absent or controlled to low densities. Foxes are the main predators of feral goat kids in eastern Australia.

Goat populations can rapidly increase after vigorous control programs. High levels of removal of feral goats from a population may increase survival rates and result in a faster than normal rate of increase. Goats have the potential to double their population every 1.6 years in the absence of mortality caused by human control efforts and predation.

Social Structure

Feral goats are social animals and are found in herds, the basic social unit being adult females and their recent offspring. The males leave these matriarchal groups to forms loose associations with similar aged males or larger mixed aged groups which associate with the female's home range during the breeding season, but range over larger areas at other times.

Group size within herds of feral goats varies on both daily and seasonal basis. Much of the seasonal variation seems to be related to the availability of surface water. When water is abundant, groups are generally small and well dispersed. During drier months groups increase in size and consist of both males and females of all age classes. During droughts they tend to congregate in large numbers (500 – 800 goats) and remain near water.

Group composition is highly variable. Feral goats are continually forming, breaking and re-amalgamating herds. Many new associations

are formed when congregating around water sources.

Movements and home ranges
A good knowledge of the home range of feral goats is a pre-requisite to both the effective management of this animal as a resource and to establishment of appropriate strategies for control.

The size of the home ranges of feral goats vary across Australia, being smaller in areas where food, water and shelter are freely available and much larger in semi arid pastoral regions. The boundaries of these areas are not rigidly defined and they are not actively defended to exclude other goats.

Feral goats in areas with ample water and food have small, non-exclusive home ranges generally of about 1.0 to 13.5 square kilometres with males having larger ranges than females. In pastoral regions goat movements are generally much larger, non-exclusive home ranges. These are usually centred close to or around permanent water. Radio tracking of goats on Yerilla Station, in the pastoral areas of Western Australia found the average female home range was 50 km^2 ranging from 14 – 118 km. Males averaged 271 km^2 ranging from 102 – 460 km^2. Data recorded from the Broken Hill region also confirm such large home ranges. Long distance movements of goats have been recorded in semi-arid regions. One male in western NSW moved 87 km in a 10 month period. This degree of mobility makes goat control very difficult, as the rate of re-infestation can be very high. It also makes eradication or containment almost impossible in the event of an exotic disease outbreak. However, feral goats in higher rainfall zones are more sedentary with few goats moving permanently outside their home range.

AGRICULTURAL AND ENVIRONMENTAL DAMAGE

Feral goats may compete with both native animals and domestic stock for food, water and shelter. During droughts, or if feral goat numbers have not taken into consideration for total grazing pressure, goats can have a major impact on native vegetation. Goats grazing habits are destructive, as they can completely strip shrubs of bark and leaves. Goats can destroy the vegetation cover and disturb the balance of species in a community. Overgrazing and movements of goats can lead to soil erosion. Disturbance of the soil by the sharp hooves of goats and the characteristic pawing of the ground by males leaves the soil open to the erosive forces of the rain and wind. Goats may compete with native animals for shelter, which without protection can be exposed to the heat and become easy prey for foxes and wedge-tailed eagles.

Feral goats can carry internal and external parasites, some of which affect sheep and cattle. Feral goats can carry and spread ovine footrot and could also act as a reservoir for and vector of exotic diseases including foot and mouth, rabies, bluetongue and rindepest. This makes them a cause for concern to animal health authorities because of the role they may play if an exotic disease outbreak should occur.

FERAL GOAT CONTROL

Strategic approach
Ideally, managers need to understand how goats are affecting resources so that they can determine how to maximise the benefits of control compared to the costs of that management technique.

There are 4 components of the strategic approach to feral goat management at the local and regional level which are:-

1. Defining the problem is looking at the management outcome that is to be achieved by controlling feral goats.
2. Developing a management plan is setting clear objectives in terms of the production

and/or conservation outcomes being sought. Ideally it should involve all stakeholders in a co-operative approach.
3. Implementation – is the actual control campaign and on ground actions.
4. Evaluation – The efficiency of the operation needs to be monitored to ensure that the control campaign has been carried out in the most cost-effective manner. Monitoring will help evaluation of the success of the management plan and any inefficiencies. After evaluation, the plan is adjusted where needed and the revised plan implemented.

It is important that the advantages and disadvantages of each control method be carefully considered before use, and the relevant codes of practice followed. Usually no single control method will be suitable or efficient for long term sustained management operations and a combination of techniques must be used.

Fencing
Fencing to control goat movements is expensive and difficult to maintain. Goats are intelligent, inquisitive animals who will test fences. Any faults in a fence will be soon detected. Goats will test lower wires of a fence or look for gaps created by surface irregularities or wash-outs. Goats can also climb, so fallen timber, rocks and strainer posts make easy escape route for goats. The electification of wires with standard energisers has been successfully used to modify existing fences to hold goats. Publications are available that outline appropriate fencing to control goat movements.

Mustering
Mustering reduces goat populations and has the advantage that costs can be offset from the sale of captured goats. Many landholders muster opportunistically when they notice a large group of goats on their land. This can be particularly successful during dry periods when goats congregate in large groups near water.

Helicopter or light aircraft are often used to flush goats out of rough country. It has been estimated that an experienced musterer using a highly skilled pilot can reduce goat numbers in an area of rough hills by 80%. In more open flat country, people can easily herd goats into yards on horse or motorbikes usually with dogs.

Trapping at water
Feral goats in semi-arid areas must drink during dry times. Therefore traps at watering points can be effective method of removing goats. Traps are goat proof fences surrounding a watering point that incorporate a one way gate. Gates include spear gates, one way swinging gates or jump down ramps.

These traps are expensive to build but can be used over a long period of time and are particularly effective during periods of drought. They can be ineffective where extensive bodies of permanent bodies of water are present.

Traps must be cleared regularly to avoid the starvation and stress on captured goats. The sale of these goats can offset the building and maintenance costs of these traps.

Ground based shooting
Shooting feral goats from the ground is most successful in the more open pastoral areas, especially when goats are forced to visit water points. However too much harassment can lead to some goats finding alternate water sites or drinking at night.

Ground based shooting can be useful when targeting particular goats. Hunting of feral goats is mainly of recreational value.

Shooting from helicopters
Despite its high costs shooting from helicopters can be an effective means of removal of feral goats, particularly in rugged terrain. Costs will vary with the initial and

target density of goats, habitat, weather and type of helicopter used. The method has been used to manage goats at both high and low densities. An aerial shoot can be particularly successful for removing survivors of mustering or trapping campaigns. It should be noted that survivors of populations that are repeatedly controlled by aerial shooting become wary of helicopters and, while initial cull rates may be high, as few as 21% of known animals may be culled in later shoots.

Judas goat

The Judas goat technique utilises radio-tracking equipment to locate feral goats. A captured, or 'Judas', goat will be fitted with a collar, to which radio transmitters are attached. Goats are strongly social species and within a few days theJudas goat will join up with a herd of feral goats. This group can be located with the radio tracking equipment and shot by hunters, either on foot or by helicopter.

If the Judas goat is not shot it will move away and locate other groups of feral goats. If it is shot, the radio transmitter can be recovered and fitted to another goat, which is then released. Male, female and domesticated wether goats have been used successfully as Judas goats. Sterilized female goats that have had prolonged oestrus induced with hormone implants have been used successfully overseas.

This method is used to find groups that are difficult to locate by normal shooting methods. These are usually low-density populations or survivors of other control methods that have become particularly wary.

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Poisoning

No poison is approved for use to control feral goats in NSW. Poisoning has seldom been successful in attempts to control feral goats because of their large-area movements and the hazard the poisoning techniques pose for non target species.

Animal welfare

- Goats should not be driven to the point of collapse.
- Use of goading devices and dogs for the handling and movement of goats should be kept to a minimum.
- Transport conditions are prescribed and if goats are to be transported long distances to abattoirs or ports, care should be taken to avoid stress to the animals.
- All shooting must be done in a humane manner, preferably using trained shooters with suitable weapons. Goats must only be shot when in range of a lethal shot and clearly visible.
- Shot animals should be checked to ensure that they are dead, and every effort made to locate and destroy wounded animals.

Codes of Practice for the humane handling, removal and destruction of feral goats are available.

Further Reading

Parkes, J., Henzell, R. and Pickles, G. (1996) *Managing Vertebrate Pests: Feral Goats.* Australian Publishing Service, Canberra