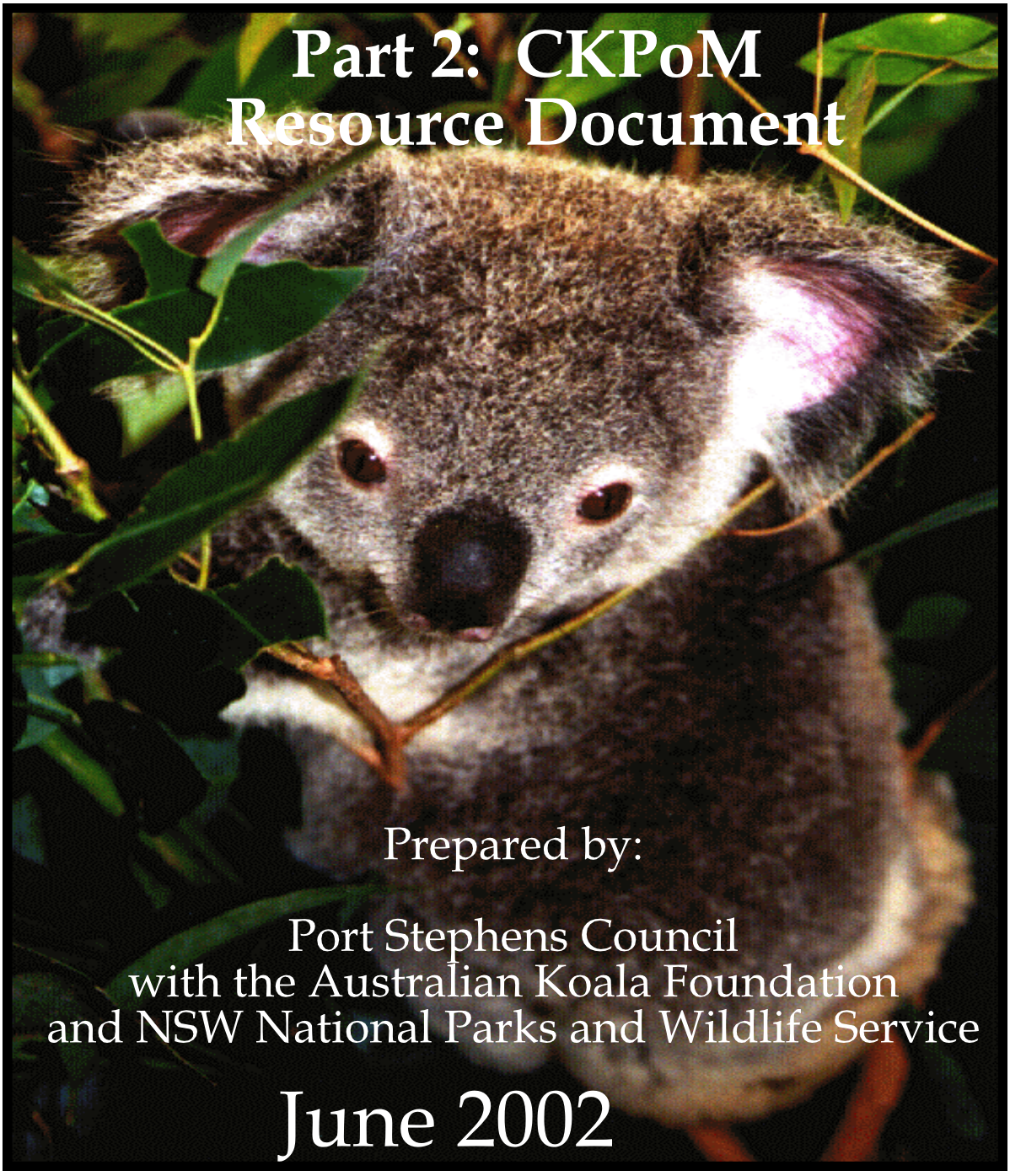
Port Stephens Council Comprehensive Koala Plan of Management (CKPoM)



Part 2: CKPoM Resource Document

Prepared by:

Port Stephens Council
with the Australian Koala Foundation
and NSW National Parks and Wildlife Service

June 2002

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1. INTRODUCTION

1.1 Preamble

This document (hereafter referred to as the CKPoM Resource Document) accompanies the Port Stephens Council Comprehensive Koala Plan of Management (CKPoM). It provides a detailed discussion of issues relating to the management of koalas and koala habitat in the Port Stephens Local Government Area (LGA) and the rationale for the recommendations proposed in the Port Stephens Council CKPoM.

This introductory chapter outlines the development of the Port Stephens Council CKPoM and CKPoM Resource Document, discusses the legislative context of the Port Stephens Council CKPoM and presents the objectives of the Port Stephens Council CKPoM.

1.2 The development of the Port Stephens Council CKPoM

A 1986-87 survey of koalas within New South Wales identified the Port Stephens area on the lower reaches of the Hunter River, just north of Newcastle as one of the richest koala sites in the State (Reed *et al*. 1990). The survey concluded that "the koala population in New South Wales has suffered major contraction of range since European settlement and will contract further as remaining localities continue to be modified by land clearing, fire, continued stocking and urban expansion" (Reed *et al*. 1990).

In response to the above, together with perceived increasing pressures on koalas and koala habitat within the Port Stephens area, it was resolved in 1990 to undertake a joint community-based koala survey and to use this information as a basis to prepare a Koala Management Plan for the Port Stephens LGA.

In May 1992, a community-based koala survey was distributed by post to each of the approximately 16,500 households within the Port Stephens LGA to establish the principal locations of koala populations. The information gained from the survey facilitated the completion of a joint NSW National Parks and Wildlife Service, Port Stephens Council and Hunter Koala Preservation Society Draft Koala Management Plan in September, 1994 (Callaghan *et al.* 1994).

In November 1994, the Australian Koala Foundation (AKF) commenced field research throughout the Port Stephens LGA to prepare an LGA-wide Koala Habitat Atlas which was completed in August 1996 (Phillips *et al.* 1996). As part of the Koala Habitat Atlas project, the AKF commissioned the preparation of a new vegetation map for the Port Stephens LGA. The AKF Koala Habitat Atlas, in conjunction with further interpretation of koala records from the community-based koala survey by the NSW National Parks and Wildlife Service (NPWS), provided the basis for revising the draft Koala Management Plan to produce the Port Stephens Council CKPoM in accordance with State Environmental Planning Policy No. 44 - Koala Habitat Protection. Since the Draft Port Stephens Koala Management Plan (Callaghan *et al*. 1994) the following work has been completed:

- Preparation of a new digitised Vegetation Map of the Port Stephens LGA (see chapter 2 of the CKPoM Resource Document);

- Preparation of an AKF Koala Habitat Atlas for the Port Stephens LGA (see chapter 2);

- Digital comparison and analyses by NPWS of the koala records from the community-based survey against the new Vegetation Map (see chapter 2);

- Digital combination of the Koala Habitat Atlas with the map from the above comparison to produce a final map showing the most important koala habitat (see chapter 2);

- Preparation of a Koala Habitat Planning Map using GIS technology to identify the areas that should be the focus of strategic planning for the long term conservation of koalas within the Port Stephens LGA; including Habitat Buffers and Habitat Linking Areas (see chapter 2);

- Completion of a joint NPWS/AKF scientific paper for publication and for incorporation within the CKPoM Resource Document which describes the innovative approach developed for identifying the most important koala habitat areas for protection within the LGA (Appendix 1 of chapter 2);

- Completion of a historical ecology paper for publication and for incorporation within the CKPoM Resource Document (chapter 3);

- Preparation of the Development Assessment, SWOT Analyses and Monitoring chapters of the CKPoM Resource Document.

- Updating and substantial revision of the Draft Koala Management Plan (Callaghan *et al*. 1994) as the basis for the CKPoM Resource Document; and

- Preparation of the Port Stephens Council CKPoM.

In September 1999, the Draft Port Stephens Council CKPoM was placed on public exhibition for a period of 60 days. In November 1999, Port Stephens Council resolved to extend the exhibition period by three months and to establish a CKPoM Consultative Committee to review the 1999 Draft CKPoM. This committee, which was comprised of 12 community members, three Councillors, an independent chair and 1 technical adviser each from the NSW National Parks and Wildlife Service and the Australian Koala Foundation, finished its deliberations in June 2000. The recommendations of this committee, together with additional public submissions, have been incorporated in this (September 2000) draft of the Port Stephens Council CKPoM and CKPoM Resource Document.

The Port Stephens Council CKPoM has been prepared by Port Stephens Council and the Australian Koala Foundation with the assistance of the NSW National Parks and Wildlife Service. The CKPoM Resource Document has been prepared by Port Stephens Council, the Australian Koala Foundation, and the NSW National Parks and Wildlife Service. Funding for the preparation of the Port Stephens Council CKPoM and CKPoM Resource Document has come from the Australian Koala Foundation, the NSW National Parks & Wildlife Service, the Foundation for National Parks and Wildlife, Port Stephens Council, the National Estate Grant Scheme, Rutile Zircon Mines Pty. Ltd. (RZM) and

from donations received from the Japanese public following the bushfires of January 1994. Additional funding toward the preparation and distribution of the community-based koala survey was provided by Tomago Aluminium and the Hunter Koala Preservation Society.

1.3 Legislative Context

State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44) commenced operation on the 6th January, 1995. SEPP 44 aims to:

"… encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas, to ensure permanent free living populations over their present range and to reverse the current trend of population decline."

SEPP 44 encourages Councils to prepare Comprehensive Koala Plans of Management (CKPoM) to facilitate the processing of Development Applications and to satisfy the aims of the policy.

Draft procedures for preparing Comprehensive Koala Plans of Management have been provided by Lunney *et al*. (1997) and are reproduced in Appendix 1. Accordingly, a CKPoM should:

- *identify present koala populations and (if possible) past populations from historical records;*
- *identify and map koala habitat based on both koala distribution and plant associations;*
- *identify threatening processes and state actions to reverse koala population decline; and*
- *establish procedures to secure and manage koala populations into the future.*

Lunney *et al*. (1997) note that "the adoption of a comprehensive KPoM does not affect the proponent's responsibility to consider whether a development or activity is likely to have a significant effect on a threatened species, including the koala, endangered population, or endangered ecological community, and where significant effect is likely, to produce a Species Impact Statement. Where an action is not covered by the *Environmental Planning & Assessment Act 1979*, a Section 91 Licence may be required under the *Threatened Species Conservation Act 1995*."

Within New South Wales, koalas are now listed as 'Vulnerable' on Schedule 2 of the *Threatened Species Conservation Act 1995*.

1.4 CKPoM Objectives

The principal objectives of the Port Stephens Council CKPoM and CKPoM Resource Document are to:

- *Evaluate and prioritise koala habitat throughout the Port Stephens LGA;*
- *Identify priority conservation areas and strategies to protect significant koala habitat and populations;*
- *Identify threats that adversely impact on koalas and koala habitat within the Port Stephens LGA;*
- *Provide for the long-term survival of koala populations within the Port Stephens LGA by devising conservation strategies to effectively address each of the threats impacting on koalas and koala habitat;*
- *Provide for the restoration of degraded koala habitat areas;*
- *Promote a balanced approach to koala conservation and development;*
- *Ensure that adequate detail is provided with Development Applications in order to assess, minimise and ameliorate likely impacts on koala habitat;*
- *Provide guidelines and development standards to protect koalas and koala habitat;*
- *Provide for effective public awareness and education programs concerning koala conservation issues;*
- *Encourage appropriate eco-tourism programs;*
- *Provide for a formalised approach to the assessment, retrieval, rehabilitation and release of sick, injured, orphaned or distressed koalas;*
- *Identify potential funding sources for implementation of the CKPoM;*
- *Facilitate targeted koala conservation and management oriented research projects within the Port Stephens LGA; and*
- *Provide for the effective implementation and monitoring of the CKPoM.*

These objectives will be achieved through co-operation with the community as a whole.

1.5 Scope of the CKPoM Resource Document

The following chapters of the CKPoM Resource Document seek to define the extent of remaining koala habitat within the LGA, to identify the nature of threats to the remaining koala population and to address each of the objectives specified in section 1.4.

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2. IDENTIFICATION OF KOALA HABITAT IN THE PORT STEPHENS LGA

2.1 Introduction

This chapter outlines the procedure that was undertaken to identify koala habitat and to prepare a Koala Habitat Planning Map for the Port Stephens Local Government Area (LGA). This procedure has provided the ecological basis for the planning provisions contained in the Comprehensive Koala Plan of Management (CKPoM).

The identification of koala habitat within the Port Stephens LGA involved the combination of both field-based survey and community-based survey data, interpreted in the context of a detailed vegetation map. The resulting combined Koala Habitat Map identified and ranked koala habitat as Preferred, Supplementary and Marginal. The scientific procedure used to map koala habitat across the Port Stephens LGA has been published as an independent paper in the refereed scientific journal *Pacific Conservation Biology*. This paper is entitled "Determining the distribution of koala habitat across a shire as a basis for conservation: a case study from Port Stephens, New South Wales" and is attached as Appendix 1 to this chapter.

A Koala Habitat Planning Map was developed on the basis of the combined Koala Habitat Map with the inclusion of habitat buffers and habitat links.

2.2 Procedure for the identification of koala habitat

The sequence followed in the Port Stephens study has involved:

1. Community-based survey;
2. Production of a detailed LGA-wide vegetation map;
3. Field-based survey;
4. Production of a koala habitat map based on the field survey;
5. Production of a koala habitat map based on the community survey;
6. Preparation of a combined koala habitat map; and
7. Preparation of the Koala Habitat Planning Map with Habitat Buffers and Habitat Linking Areas.

1. Community-based Survey

The work in Port Stephens began with the distribution of a community-based survey to all the residents of Port Stephens LGA in 1992. The response rate to this survey was high, with a total of 4 943 koala records collected. The distribution of koala records throughout the LGA showed a distinct pattern, with koalas most frequently seen in an east-west band running parallel to the coastline (Figure 2.1). Sub-sets of these data showed the location of breeding koalas i.e. koalas seen with young (Figure 2.2) and dead koalas (Figure 2.3).

In addition to the collection of records of koalas throughout the LGA, the community survey also included a questionnaire which asked respondents for further information about koala sightings and what things they perceived to be threats to the survival of koalas in the LGA. The survey form also asked what management solutions respondents would be prepared to support in order to help conserve koalas in Port Stephens. The results of the community based survey are presented and discussed in Lunney *et al*. (in press).

2. Production of a Detailed LGA-wide Vegetation Map

A primary requirement of the study was a vegetation map, which covered the entire study area. A map was specifically prepared for this study by a consultant contracted to the AKF. The vegetation map was produced on the basis of interpretation of stereo pairs of 1992-1993 1:25 000 colour aerial photographs with the vegetation described structurally according to Specht (1981) and floristically according to the standards of the NSW Herbarium. Intensive field surveys and ground truthing were also undertaken with the final map identifying 52 distinct vegetation associations throughout the LGA (Figures 2.4 & 2.5).

3. Field-based Survey

The field survey for the CKPoM was provided by the Australian Koala Foundation's Port Stephens Koala Habitat Atlas (Phillips *et al.* 1996). The Koala Habitat Atlas involved extensive fieldwork, which primarily included plot-based surveys for koala faecal pellets. The survey sampled the range of vegetation communities and geomorphological units present within the LGA in order to examine tree species preferences and habitat use from a koala's perspective. The results of 96 primary plot sites and 14 supplementary sites confirmed the following tree species as being preferentially utilised by koalas within the Port Stephens LGA: *Eucalyptus robusta* (Swamp Mahogany) and *E. parramattensis* (Parramatta Red Gum) on all substrates where they occur; and *E. tereticornis* (Forest Red Gum) where it occurs on soils derived from Quaternary alluvials and volcanics. It is also recognised that hybrids of any of these species are also likely to be Preferred Koala Food Trees.

4. Production of a Koala Habitat Map Based on the Field Survey

In order to develop a habitat "model", all data layers (geology, soil landscape, terrain, vegetation, drainage and roads) relating to the study area were either digitised or installed onto a Genamap-based Geographic Information System (GIS). Proportional representations of the identified preferred tree species within each of the vegetation communities were determined from the field data. This information was intersected with underlying soil landscape, drainage and geological data on the GIS.

The Koala Habitat Atlas (KHA) identified, ranked and mapped three categories of koala habitat throughout the Port Stephens LGA on the basis of the presence and proportional representation of each of the preferred tree species, in conjunction with consideration of edaphic factors. The three categories of koala habitat identified by the KHA were: Primary, Secondary and Marginal. A fourth category (Habitat Value Unknown) was applied to vegetation communities comprised principally of tree species whose potential

importance to koalas could not be determined due to the lack of koala faecal pellet evidence from areas where they occur (see Figure 2.6).

5. Production of a Koala Habitat Map Based on the Community Survey

The overall koala records collected during the community survey were used to determine the numbers of koala records associated with each of the mapped vegetation associations. To do this, koala records were overlaid onto the vegetation map of Port Stephens LGA using a GIS. In order to determine apparent vegetation preferences using the community survey results, the density of koala records in each vegetation association was calculated and used as a means of ranking the vegetation. This measure was also used to group vegetation communities into habitat categories (labelled A to E) which were subsequently mapped using the GIS (Figure 2.7).

6. Preparation of a Combined Koala Habitat Map

A combined koala habitat map was produced by merging the two independent koala habitat maps using the GIS according to the procedure outlined below:

- ***Preferred Koala Habitat:*** all KHA Primary Habitat and KHA Secondary Habitat plus Community-based survey Categories A and B (regardless of whether or not they overlap).

- ***Supplementary Koala Habitat:*** where only KHA Marginal Habitat and middle ranking Community-based survey categories C and D overlap.

- ***Marginal Koala Habitat:*** where only KHA Marginal Habitat and the lowest Community-based survey category E overlap.

- ***Unknown:*** includes the portion of the KHA "unknown" category that did not overlap with any community-based survey categories.

7. Preparation of the Koala Habitat Planning Map

The Koala Habitat Planning Map shows each respective category of koala habitat together with Habitat Buffers and Habitat Linking Areas as outlined below (Figure 2.8).

The Koala Habitat Planning Map has been developed from outcomes of the scientific investigation in conjunction with application of biological principles based upon knowledge of koala ecology. These principles acknowledge the importance of factors such as social interaction, population dynamics and dispersal patterns at the koala population level. The planning map has been developed on the basis of the following:

- The need to identify manageable units that have the potential to retain or restore ecological integrity;

- The need to provide reasonable opportunity for safe interaction between koala breeding populations with potential exchange of genetic material; and

- The need to minimise the chance of events such as bushfire from potentially

eliminating a koala population where there is limited or poor potential for recolonisation.

Habitat Buffers

For the Draft CKPoM 1999, a 100m habitat buffer was added to all Preferred Koala Habitat in recognition of the significance of this habitat category. The CKPoM Consultative Committee recommended that instead of 100m Habitat Buffers applying to all Preferred Koala Habitat, the width of Habitat Buffers should be determined on a case-by-case basis using ecological criteria. These ecological criteria are detailed in Appendix 9 of the CKPoM. Habitat Buffers could potentially contribute to the long term conservation of Preferred Koala Habitat by ensuring that incompatible development or land use does not occur immediately adjacent and by helping to protect Preferred Koala Habitat from the detrimental impact of "edge effects", such as nutrient inputs, wind damage and weed invasion. Habitat Buffers also aim to provide for the likely extension of significant koala activity beyond the mapped boundary of Preferred Koala Habitat. Even Habitat Buffers that extend over Mainly Cleared Land may perform this latter function. Hence, all Habitat Buffers, including those that extend over Mainly Cleared Land, should also be afforded the highest level of protection available and considered for potential restoration where applicable.

The buffer also reflects the potential problems associated with placing a line on a map to represent a sharp distinction between vegetation communities, where a broad ecotonal area may actually be present.

Buffers included in Figure 2.8 are categorised according to the type of koala habitat or vegetation with which they overlap. These categories are as follows:

- ***Habitat Buffer over Supplementary Koala Habitat*:** buffer on Preferred Koala Habitat that overlaps with Supplementary Koala Habitat.

- ***Habitat Buffer over Marginal Koala Habitat*:** buffer on Preferred Koala Habitat that overlaps with Marginal Koala Habitat.

- ***Habitat Buffer over Unknown Koala Habitat*:** buffer on Preferred Koala Habitat that overlaps with "Unknown" Koala Habitat.

- ***Habitat Buffer over Other Vegetation*:** buffer on Preferred Koala Habitat that overlaps with Other Vegetation.

- ***Habitat Buffer over Mainly Cleared Land*:** buffer on Preferred Koala Habitat that overlaps with Mainly Cleared Land (with some scattered trees).

Habitat Linking Areas

Habitat Linking Areas were identified in order to establish a sound basis for long term planning to protect and manage remaining areas of significant koala habitat, and where appropriate, to identify degraded areas for potential restoration. The identification and effective management of Habitat Linking Areas is considered to be essential for the effective conservation of koala populations. Habitat Linking Areas would potentially

provide opportunities for the effective movement of dispersing sub-adult koalas between breeding populations and vacant habitat areas. These areas may also provide opportunities for koalas to establish home ranges either as extensions from active breeding populations or by koalas otherwise unable to establish a home ranges within higher quality habitat.

Because koalas are capable of travelling considerable distances between trees (Moon 1990; Prevett 1991), Habitat Linking Areas that overlap with Mainly Cleared Land may still perform the functions outlined above. Development may be permitted in Habitat Linking Areas provided it does not compromise their use by koalas. Therefore, Habitat Linking Areas are to be subject to the same development standards as apply to Supplementary Koala Habitat.

The process of establishing Habitat Linking Areas involved the use of Genamap-based GIS software to identify links wherever a temporary 400m buffer around Preferred Koala Habitat either joined or overlapped. The categories of Habitat Linking Areas are as follows:

- ***Habitat Linking Area over Supplementary Koala Habitat*****:** habitat links that overlap with Supplementary Koala Habitat.

- ***Habitat Linking Area over Marginal Koala Habitat*****:** habitat links that overlap with Marginal Koala Habitat.

- ***Habitat Linking Area over Unknown Koala Habitat*****:** habitat links that overlap with “Unknown” Koala Habitat.

- ***Habitat Linking Area over Other Vegetation*****:** habitat links that overlap with Other Vegetation.

- ***Habitat Linking Area over Mainly Cleared Land*****:** habitat links that overlap with Mainly Cleared Land (with some scattered trees).

Identified Habitat Linking Areas falling over cleared or degraded land provide a basis for further investigation for potential habitat restoration projects with the aim to enhance prospects for the long term survival of the koala population.

2.3 Planning for Koala Conservation in the Port Stephens LGA

The extensive program of ecological research within the Port Stephens LGA places Port Stephens Council at the forefront of efforts to determine the nature of koala habitat utilisation and to identify habitat requirements for the long-term conservation of koalas within a specific planning area.

The Port Stephens Council CKPoM seeks to accomplish this in a manner that will not only provide protection for the identified Preferred and Supplementary Koala Habitat but will also recognise the importance of protecting (and in some cases restoring) Habitat Buffers and Habitat Linking Areas considered crucial for the long term survival of the koala population.

The challenge now involves incorporating the outcomes of this ecological research into Port Stephens Council's planning framework in order to conserve remaining koala habitat and maintain its long-term integrity. This is covered within Chapter 4 'Habitat Conservation Measures' and Chapter 5 'Development Assessment' of the Port Stephens Council CKPoM Resource Document.

The Koala Habitat Planning Map provides the basis for identifying the areas that are considered to warrant the highest level of habitat protection. These areas include all Preferred Koala Habitat and Habitat Buffers. Supplementary Koala Habitat and Habitat Linking Areas also require protection. It should be noted that these categories are worthy of protection whether or not they are known to currently support koalas.

CONCLUSIONS

The ecological research on koalas in the Port Stephens LGA, and the unique approach developed to provide the basis for the CKPoM, has been the result of a successful co-operative arrangement between the NSW NPWS and the AKF. The research has provided the essential detailed information to allow the highest level of habitat protection to be directed at the areas of most importance to the koala population.

The ecological investigation also identified a high level of historical disturbance to koala habitat and koala populations within the Port Stephens LGA (covered in the following chapter titled "Ecological History").

Together with more recent clearing and fragmentation of remaining habitat, threats associated with roaming domestic and feral dogs, cars and bushfire serve to highlight the vulnerability of the remaining koala population.

In the absence of a plan that provides effective habitat protection, together with a strategic approach to long term conservation, the remaining koala population is considered likely to continue to decline to the point of localised extinction.

3. ECOLOGICAL HISTORY

3.1 Preface to the Ecological History paper

The following scientific paper entitled “An Ecological History of Koala Habitat in Port Stephens Shire and the Lower Hunter on the Central coast of New South Wales, 1801-1998” provides the ecological history component of the Port Stephens Council Comprehensive Koala Plan of Management (CKPoM). This satisfies the recommendation of the “Draft Procedures for Preparing Comprehensive Koala Plans of Management under State Environmental Planning Policy 44-Koala Habitat Protection” (Lunney *et al.* 1997) which states that a CKPoM should include “a summary of history of land-use (e.g. clearing, development) in the LGA” and that “particular effort should be applied to researching the history of koalas and koala habitat in the LGA.”

The outcomes of the ecological history research have provided an important perspective on the historical distribution of koala populations and koala habitat throughout the period of European settlement in the Lower Hunter. This perspective provides an explanation for the present absence or substantial decline of koala populations in the western areas of the Port Stephens LGA.

The prevailing absence of koalas from the majority of remaining habitat in western areas of the LGA was established by the results of both the field survey and the community survey. The historical research lends support to the contention that areas in the west of the LGA could support koala populations in the future, subject to adequate natural habitat regeneration and/or successful habitat restoration, management and threat abatement programs.

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4. HABITAT CONSERVATION MEASURES

4.1 Introduction

An effective strategy to conserve koala habitat is essential to provide for the long term survival of the koala within the Port Stephens Local Government Area. The conservation of koala habitat will also benefit other local species of native fauna and help secure future eco-tourism potential within the region. The major threat to the koala is habitat clearing in association with development. Therefore, the primary measures to conserve koalas and their habitat should focus on land use management strategies which control and guide development activities. An explanation of such strategies should be incorporated into the education programs proposed in Chapter 13, to help inform land holders on the rationale and the possible benefits they may receive through their implementation.

The appropriate measures for conserving a particular area of koala habitat will depend upon a number of factors including the ecological significance of the habitat, the nature of permissible land use, the type of threatening processes and the land tenure. In many instances, the appropriate strategy for the conservation of koala habitat will involve the integration of a number of different options including both regulatory (legislative) and incentives-based approaches, in conjunction with an education program. An education program which informs Council staff, developers and the community of the need to conserve koala habitat and which explains how this can be achieved is a crucial component of the habitat conservation strategy. Options for an education program are presented in the education chapter.

Regulatory measures include those employed under land use planning legislation, and encompass both land use planning measures and those employed as part of the development assessment process. The aim of regulatory measures in the context of the Port Stephens Council CKPoM is to establish a suitable minimum standard for effective habitat conservation, for instance, by protecting significant koala habitat from inappropriate development. Incentives-based measures are those that encourage land holders to voluntarily manage koala habitat, often through the provision of financial incentives. The aim of incentives-based measures is to provide for the long term management and where appropriate, the restoration of koala habitat on private lands in the Port Stephens LGA.

The recommended conservation measures for particular management units were identified via the Strengths, Weaknesses, Opportunities and Threats (SWOT) analyses conducted for each of the management units in the Port Stephens LGA. The results of these analyses are presented in Chapter 6 and Appendix 4. The conservation options, both regulatory and incentives-based, that are included within the SWOT analyses are described below.

Some of the conservation measures that were recommended in the Draft CKPoM 1999 were amended by the CKPoM Consultative Committee. The discussion on habitat conservation measures contained in the Draft CKPoM Resource Document 1999 is retained here, together with any amendments made by the CKPoM Consultative Committee.

This chapter also contains discussion on the management of koala habitat on public lands.

This includes identification of the land management agencies that have major land holdings in the Port Stephens LGA, as well as description of the measures which these agencies can use to protect and manage koala habitat in the long term.

4.2 Objectives

The objectives of this chapter on Habitat Conservation for the Port Stephens Local Government Area (LGA) are to:

i) Identify and discuss options for conserving koala habitat; and

ii) Provide the basis for an effective strategy to conserve koala habitat for the long term survival of koalas within the LGA.

4.3 Land Use Planning

Land use planning legislation is an important and pro-active means by which local government can regulate development for effective management of natural resources and protection of the environment. Part 3 of the *Environmental Planning and Assessment Act* 1979 (EP&A Act) provides the legislative guidelines for land use planning in NSW. There are a number of different regulatory mechanisms that can be employed by Councils under part 3 of the EP&A Act to protect koala habitat, as outlined below.

Local Environmental Plans

Local Environmental Plans (LEPs) are the primary means by which local government regulates land use. The Port Stephens Local Environment Plan 1987 (LEP 1987) currently provides the statutory land use framework for the Port Stephens Local Government Area. Through this and future LEPs, a range of options to prevent or control incompatible development activity and to conserve habitat can be explored.

One such option is via the application of land use zones. LEPs indicate the objectives of a given land use zone and specify the range of permissible uses (e.g. types of development), including those which require the consent of Council. Importantly, LEPs provide the opportunity for lands of high conservation values to be zoned for environmental protection. Such zones usually significantly restrict the range of permissible uses to those that are compatible with conservation.

The Port Stephens LEP 1987 is currently under review. This revised LEP, known as Draft LEP 2000, was placed on public exhibition in 1999. . Part of this review aims to provide a performance-based approach and to reduce the number of different land use zones. For example, it is proposed to have only four environmental protection zones, compared with the seven that currently exist. It is intended that the following current land use zones will all be amalgamated into one zone: Environmental Protection 7(a) Wetlands, , Environmental Protection 7(j) Scientific Site, and Environmental Protection 7(k) Flora and Fauna Conservation. This zone will be known as Environmental Protection 7(a). Draft LEP 2000 is intended to be an update and review of the 1987 LEP and does not propose to significantly alter the geographic extent of the different types of land use zones.

It is recognised that the application of an Environmental Protection zone to a number of

areas of high conservation significance to koalas is an essential component of the koala habitat conservation strategy. **Therefore, it is proposed to consult with public authorities with the aim of applying the Environmental Protection 7(a) Zone (as contained in Draft LEP 2000) to public land, other than that zoned Environmental protection 7(c), that contains Preferred and Supplementary Koala Habitat, Habitat Buffers and Habitat Linking Areas**. It is important to note that prior to any rezoning of land to Environmental Protection as mentioned above, the land will first be ground truthed to validate the accuracy of the Koala Habitat Planning Map and in particular refine it in relation to cadastral boundaries. The Koala Habitat Planning Map is based on a vegetation map prepared using 1: 25 000 scale aerial photographs, and hence there are likely to be limitations when relating it to cadastral boundaries. The responsibilities and time-frames for this ground truthing are provided in the Monitoring Chapter of the CKPoM Resource Document.

In addition to providing the opportunity to protect habitat via the application of environmental protection zones, LEPs can regulate the way development is carried out. This can be done by:

- setting objectives against which development proposals can be assessed;
- requiring that certain types of development are carried out with Council consent only; and
- establishing specific criteria or standards for development.

This could be achieved by amending the applicable Port Stephens LEP to include a clause that requires that the provisions of the Port Stephens Council CKPoM be addressed for all proposed development on land within or adjacent to certain categories of koala habitat. It is proposed that the criteria for the assessment of development applications detailed in section 5.4 of the CKPoM Resource Document (and reproduced in Appendices 4 and 5 of the Port Stephens Council CKPoM) will provide the performance criteria for such a clause. The recommended content of this proposed clause is provided in Appendix 2 of the CKPoM Resource Document.

Development Control Plans / Performance criteria for development applications

Development Control Plans (DCPs) are more flexible than Local Environmental Plans as they are not statutory instruments. They aim to provide general guidelines for the implementation of LEP-based provisions. DCPs also aim to co-ordinate orderly development, to reflect community expectations and environmental sensitivities. However, DCPs on their own cannot afford koala habitat with the necessary statutory protection, and hence must be employed in conjunction with other regulatory measures.

While a DCP could be employed as part of the strategy to conserve koala habitat, it is not proposed to do so in the Port Stephens LGA. Instead, the guidelines for the assessment of development applications are provided in the Port Stephens Council CKPoM (Appendices 4 and 5 of the CKPoM). These provisions will be activated by the proposed amending clause of the Port Stephens LEP presented in Appendix 2 of the CKPoM Resource Document. The Port Stephens Council CKPoM will also be a planning tool under SEPP 44, whereby compliance with the Port Stephens Council CKPoM will constitute compliance with SEPP 44 for relevant development applications in the Port Stephens LGA.

Provisions relating to the following matters are contained in Appendices 4 and 5 of the Port Stephens Council CKPoM:

- Required information that must be submitted with development applications;
- Guidelines and survey standards for koala habitat assessment, including requirements for ongoing monitoring;
- Controls on any proposed removal of vegetation within koala habitat or removal of preferred koala food trees;
- Guidelines for the restoration of koala habitat; and
- Guidelines for the location of building envelopes and infrastructure, traffic management, domestic pet ownership, landscaping, swimming pools and fence construction.

The general aims and objectives of the performance criteria for development applications (in accordance with Circular No. B35, DUAP) are:

i) To ensure that the koala population in the Port Stephens LGA is sustainable over the long-term.

ii) To protect koala habitat areas from any development which would compromise habitat quality or integrity.

iii) To ensure that any development within or adjacent to koala habitat areas occurs in an environmentally sensitive manner.

iv) To ensure that acceptable levels of investigation are undertaken, considered and accepted prior to any development in or adjacent to koala habitat areas.

v) To encourage koala habitat rehabilitation and restoration.

vi) Maintain interconnection between areas of Preferred and Supplementary Koala Habitat and minimise threats to safe koala movements between such areas.

vii) To ensure that development does not further fragment habitat areas either through the removal of habitat or habitat links or through the imposition of significant threats to koalas.

viii) To provide guidelines and standards to minimise impacts on koalas during and after development, including any monitoring requirements.

ix) To provide readily understandable advice to proponents preparing development applications and for Council officers involved in the assessment of those applications.

<u>Tree Preservation Order</u>

Tree Preservation Orders (TPOs) are also useful tools in protecting koala habitat by regulating habitat clearing, usually with the statutory backing of the Local Environmental Plan. The current Port Stephens Tree Preservation Order was adopted by Council in 1996 with objectives including "sustaining the biodiversity of our ecosystems."

Port Stephens Council has also adopted a Tree Management Policy which includes specific provisions to consider the Port Stephens Council CKPoM when assessing applications to remove or lop trees. Clause 7.2 (h) of the Tree Management Policy requires that approval to remove or prune a tree can only be given if this does not conflict with the Port Stephens Council CKPoM. Through Council's Local Environmental Plan, tree clearing proposals now also require development approval, which places a further legal obligation on Council to apply the provisions of the CKPoM when considering such proposals.

There is scope within the Tree Management Policy (clause 12) to establish a Register of Significant Trees. Significant trees may include individual or groups of trees that are, for instance, of historic or cultural significance or are recognised as being of value as habitat. It should be pointed out that inclusion of a tree on the Register of Significant Trees does not necessarily preclude the removal of the tree; rather, it flags the need for "especially careful appraisal of any proposal to prune or remove them" (Clause 12.1). While there is a already a legislative need to consider the provisions of the Port Stephens Council CKPoM when granting approval under the TPO (as discussed above), which provides protection to preferred koala food trees, it may be of educative value to consider adding preferred koala food trees to the Register of Significant Trees.

There is also scope within the Tree Management Policy to have preferred koala food tree species listed in clause 2 of the TPO Policy Statement. Trees such as NSW Christmas Bush, Mangroves and Cabbage Tree Palms are currently included in this clause. Tree species that are listed in clause 2 are covered by the TPO regardless of the size of an individual tree, whereas for other tree species minimum size criteria apply (minimum height or minimum girth). The listing of preferred koala food tree species (*Eucalyptus robusta, E. parramattensis* and *E. tereticornis*) would afford protection to young individuals of these species, thus recognising their potential future importance to koalas. Adding preferred koala food tree species to clause 2 is also likely to serve an important educative role.

It is worthwhile to consider amending the Tree Management Policy to better reflect the provisions of the Port Stephens Council CKPoM. Such an amendment could provide guidance on the relative importance to koalas of different tree species or trees within different categories of koala habitat. This could then be reflected in the criteria used to assess Tree Preservation Order applications.

4.4 Performance Criteria for Rezoning Proposals

As mentioned above, part 3 of the EP&A Act provides the legislative framework for land use planning. Proposed amendments to the applicable Port Stephens Local Environmental Plan (LEP), such as a request to rezone land to a different land use zone, are considered by Council under part 3. Consideration of proposals at this stage provides a greater degree of flexibility to address issues relating to the conservation of koala habitat than consideration of development applications under part 4 of the EP&A Act, as it is at this stage when the future land use of a given area is determined. **Thus, it is crucial that due consideration is given to proposed amendments to the Port Stephens LEP to ensure that any proposed changes in land use for land that contains or is adjacent to significant koala habitat are compatible with the long term conservation of that koala habitat.**

The Performance Criteria for Rezoning requests, which are presented below, apply only to circumstances where a request is made of Council to rezone land. They do not apply to individual Development Applications. The performance criteria for development applications are contained in Appendices 4 and 5 of the Port Stephens Council CKPoM. Any activity that is currently allowed under an existing land use zone is not affected by the following Performance Criteria for Rezoning Requests.

Consideration is to be given to the following matters when assessing rezoning requests including any amendment to the Port Stephens LEP Prior to approving any such rezoning proposal, Council is to take into consideration the likely impacts of the development made possible by the rezoning, including environmental impacts on both the natural and built environment, and social and economic impacts on the locality. In particular, Council should be satisfied that the rezoning would:

a) not result in development within areas of Preferred Koala Habitat or defined Habitat Buffers;

b) allow for only low impact development within areas of Supplementary Koala Habitat and Habitat Linking Areas;

c) minimise the removal of any individuals of preferred koala food trees, where ever they occur on the site; and

d) not result in development which would sever koala movement across the site. This should include consideration of the need for maximising tree retention on the site generally and for minimising the likelihood of impediments to safe/unrestricted koala movement.

To facilitate the application of the above performance criteria when assessing rezoning proposals, Council's LEP Amendment Policy should be amended to include these performance criteria. The information required to support a rezoning proposal must include an investigation of the site by an appropriately qualified person in accordance with the Guidelines for Koala Habitat Assessment that are presented in section 5.5 of the CKPoM Resource Document.

4.5 The Development Assessment Process

The development assessment process represents another important means by which Council can regulate development to ensure the protection and effective management of koala habitat. Part 4 of the EP&A Act deals with the submission, assessment and determination of applications to develop land. In assessing applications, the consent authority, which is often a Council, must take into account the provisions of the relevant documents and plans referred to above in Section 4.3.

A detailed discussion of relevant aspects of the development assessment process, including those that relate to Part 4 of the EP&A Act, is provided in Chapter 5 (Development Assessment) of the CKPoM Resource Document. Chapter 5 also identifies how the Port Stephens Council CKPoM will regulate development within or adjacent to koala habitat, by specifying the provisions that will apply to proposed development in such areas.

4.6 Incentives-based Measures

The use of incentives-based measures for conservation is in some respects a relatively new endeavour in Australia, although one that is now receiving increasing attention. Some of the incentives-based habitat conservation measures discussed below have yet to be widely used by local government.

The incentives-based conservation measures listed below are discussed under two headings: voluntary habitat conservation measures; and the incentives mechanisms that could be used to encourage voluntary habitat conservation on private lands.

4.6.1 Voluntary Habitat Conservation Measures

Voluntary habitat conservation measures include the range of mechanisms by which landowners and community groups could voluntarily protect and manage koala habitat. Some of these measures, such as Voluntary Conservation Agreements and Wildlife Refuges (both of which are administered by the NSW National Parks and Wildlife Service), and Property Agreements, which are administered by the Department of Land and Water Conservation, are already being employed. Others, such as voluntary conservation zones, have been subject to only limited implementation to date.

The voluntary habitat conservation measures outlined below differ, among other things, in the degree to which they are binding on landowners and therefore the level of security they provide in terms of koala habitat protection. Voluntary conservation agreements and voluntary conservation zones are binding on landowners and hence would offer a higher level of security and protection. Management agreements and wildlife refuges are generally not binding and subsequently would provide a lesser degree of protection. Property Agreements have the flexibility to be either binding or non-binding, depending on the terms negotiated between the landowner and the Department of Land and Water Conservation.

<u>Voluntary Conservation Agreements</u>

A Voluntary Conservation Agreement is a voluntary, contractual agreement negotiated between the Minister administering the *National Parks and Wildlife Act* and a land-holder, with the aim to conserve areas of specific value for the conservation of natural or cultural heritage within New South Wales.

Lands containing viable habitats of endangered species, significant ecosystems or habitat remnants, or cultural sites may be considered suitable by the National Parks and Wildlife Service (NPWS) for Voluntary Conservation Agreement. While these agreements are voluntary on the part of the land-holder, once entered into they are legally enforceable, run with the title of the land, will be registered with the Registrar-General, and remain until such time as terminated by mutual agreement between both the Minister and the property owner.

Terms of a Voluntary Conservation Agreement may include restrictions on the use of the specified area and the Minister may be authorised under the terms of the agreement to provide technical land management and conservation advice with financial assistance.

While Voluntary Conservation Agreements are currently being successfully used to protect areas of conservation significance within NSW, there are important issues relating to the

resourcing of this initiative. Each Voluntary Conservation Agreement requires considerable resources to progress from the initial negotiation and assessment stage to a signed Conservation Agreement. In the event that Voluntary Conservation Agreements are widely employed to protect koala habitat in the Port Stephens LGA, additional NPWS resources would likely be required within the Hunter District to negotiate and implement them. Given the likely importance of Voluntary Conservation Agreements as a means of ensuring the long term conservation of koala habitat on private land, the NPWS should be approached to provide Hunter District with the necessary additional resources.

Voluntary Conservation Zones

The establishment of Voluntary Conservation Zones within planning instruments such as Local Environmental Plans is recommended by Binning and Thorman (1998) to conserve biodiversity in the Lower Hunter and Central Coast. The existence of such zones would enable landholders to voluntarily rezone land to restrict development with the aim of protecting native vegetation, including koala habitat, over the long term (Binning and Thorman 1998). Because Voluntary Conservation Zones would be incorporated within a planning instrument they would restrict the use of land as per other land use zones, and hence could provide koala habitat with long term protection from development. Thus, they would be considered to be binding on both current and subsequent landholders.

Voluntary Conservation Zones have been employed by Brisbane City Council and Logan City Council in Queensland (Binning *et al*. 1999). Both these Councils have used incentives (a management grant in the case of Brisbane City Council and rate rebates in the case of Logan City Council) to encourage landholders to include land of high conservation significance in these zones (Binning *et al*. 1999). The intent of Logan City Council's Residential Conservation Zone is to provide for: conservation of koala habitat, the protection or enhancement of the conservation values of flora and fauna (including koala) habitat, and a dwelling house and ancillary activities on large lots (LCC 1997). Brisbane City Council's Conservation Zone is employed in conjunction with a binding management agreement and aims to protect areas of high conservation value, significant wildlife habitat and areas of high environmental value (e.g. water catchment) (GCCC 1997).

It may also be possible to apply the concept of Voluntary Conservation Zones to protect koala habitat in the Port Stephens LGA within the existing land use zone framework. Instead of creating a new Voluntary Conservation Zone, landholders would apply to have land rezoned to Environmental Protection (such as Environmental Protection 7a as proposed in the Draft LEP 1999) in return for incentives such as those outlined in section 4.5.2. This process would still function on a voluntary basis.

However, if the concept of Voluntary Conservation Zones is to be used as one of the measures to conserve koala habitat in the Port Stephens LGA, it will be necessary to not only utilise this concept to protect koala habitat from inappropriate development, but to also link it to actions (such as on ground conservation works) that will help ensure that koala habitat is properly managed over the long term. It may not be possible under the existing zoning framework to ensure that such actions are carried out. Therefore, it may be necessary to establish a Voluntary Conservation Zone within the Port Stephens LEP, which lists ongoing management of koala habitat among its objectives. Alternately, it may be possible to utilise the existing Environmental Protection zones in conjunction with management agreements that detail landholder responsibilities and commitments of both parties for the ongoing management of koala habitat.

Property Agreements

The NSW *Native Vegetation Conservation Act 1997* (NVC Act) allows the Director-General of the Department of Land and Water Conservation to enter into a Property Agreement with a landholder. Property Agreements are much more flexible than Voluntary Conservation Agreements; they **may** include terms that are binding to either party and they don't automatically run with the title of the land, although there is scope for them to do so. The criteria for land to which a property agreement can apply is also much less stringent than for Voluntary Conservation Agreements, as Property Agreements can apply "to any land" (NVC Act s.40 (1)). Consequently, Property Agreements are likely to be used more widely than Voluntary Conservation Agreements.

Property Agreements could foster both the protection of remnant native vegetation and the carrying out of on ground works and actions aimed at management. Property agreements may provide provisions for (s.42 NVC Act):

(a) the identification of any land, or of specified vegetation, that is to be set aside for conservation or rehabilitation purposes, and

(b) an outline of the methods and practices for vegetation management on any land to which the agreement relates, including (where appropriate) specific outcomes for each separate parcel of land, and

(c) the provision of financial and technical assistance to a landholder on behalf of the Director-General with respect to vegetation management, and

(d) such other matters as the Director-General considers appropriate and which are included with the consent of the parties to the agreement.

Given all of the above, and particularly their flexibility, Property Agreements could be used as a means to encourage a wide range of landholders to manage koala habitat on their properties.

Management Agreements

Cripps *et al*. (1999) define management agreement as an agreement between a landholder and a third party (such as a council) regarding the management of native vegetation on the landholder's property. They note that management agreements can be either binding or non-binding on the landholder. Binding agreements have legal status and are often used to prevent land uses that are incompatible with native vegetation conservation and to prescribe the management actions necessary to conserve remnant vegetation over the long term (Cripps *et al*. 1999). Non-binding agreements, which do not have legal status, are generally used in order to formalise and secure the commitment of landholders to agreed management actions, such as on ground works (Cripps *et al*. 1999).

Cripps *et al*. (1999) note that councils in NSW are limited in the extent to which they can enter into binding agreements with landholders to protect native vegetation; it is generally only possible via conditions of consent placed on an applicant as part of the development

approval process. Requirements regarding the management of koala habitat on land for which development consent has been granted are addressed in section 5.4 of the CKPoM Resource Document. It will be important to confirm these limitations, particularly if management agreements will be required to effectively apply the concept of Voluntary Conservation Zones to protect koala habitat in the Port Stephens LGA.

Councils in NSW (and elsewhere in Australia) can enter into non-binding agreements with landholders regarding the management of native vegetation (Cripps *et al*. 1999). It is intended that such agreements will be established with landholders and community groups in the Port Stephens LGA who receive management grants to participate in koala habitat protection and restoration projects. This would include those who receive funds under the Natural Heritage Trust devolved grants scheme proposed by Port Stephens Council in February 1999, should that scheme receive funding.

Wildlife Refuges

A Wildlife Refuge can be declared over a property, by joint agreement between the property owner and the National Parks and Wildlife Service, where the property has substantial areas of natural habitat and where the owner is prepared to make a positive contribution to wildlife conservation. Wildlife Refuge status over a property does not affect the title of the land or the owner's rights and can be repealed at any time by notice from either party.

4.6.2 Incentives mechanisms

Some of the incentives mechanisms discussed below have had little or no application to date within the Port Stephens LGA, or indeed elsewhere in NSW, particularly in the context of conserving native vegetation or wildlife habitat. It is very important to note that the incentives mechanisms presented below **must be assessed for applicability to each specific situation on a case-by-case basis**.

Management Grants

Management grants generally involve the provision of funds to individuals or community groups to undertake conservation works (Binning *et al*. 1999). Management grants may be provided for a specific purpose (e.g. the purchase of materials to plant trees or to construct a fence to protect native vegetation), or they may be provided for conservation works in general (Cripps *et al*. 1999). Port Stephens Council already provides grants to community groups to undertake activities related to nature conservation on public land. In some cases these funds are provided directly by Council, although funds are also sought from State and Federal environmental funding schemes. Brisbane City Council has used management grants (up to $1500pa depending on the property value) as an incentive to encourage landowners to place their land in a Conservation Zone via a voluntary, but binding, agreement (Binning *et al*. 1999). As with Brisbane City Council, financial incentives can be provided in the form of management grants rather than rate rebates in order to avoid some administrative complexities (Binning *et al*. 1999).

In the context of conserving koala habitat in the Port Stephens LGA, management grants are probably best used to assist individuals and community groups to undertake conservation works; although their potential use to encourage landowners to voluntarily zone parts of their land to Environmental Protection (as per Brisbane City Council) should also be considered.

Funds for conservation works could be obtained from State Government programs such as the Environmental Trust or Commonwealth Government programs such as the Natural Heritage Trust.

Port Stephens Council was awarded $126, 200 over two years from the Natural Heritage Trust to undertake fencing and revegetation projects to enhance and restore koala habitat in the Port Stephens LGA. This project will be run as a "devolved grants" scheme, whereby community groups and landowners can apply to an assessment panel (comprised of representatives from Port Stephens Council, the Australian Koala Foundation, the NSW National Parks and Wildlife Service, the Lower Hunter and Central Coast Regional Environmental Management Strategy, and the relevant Catchment Management Committees) for funding to purchase trees and materials to enhance and restore koala habitat. The funding for this project will only be available for two years, and is primarily intended to assist community groups to establish their own tree propagation and planting projects. Potential sources of funding for other management grant schemes will need to be investigated (see the Funding chapter for other possibilities).

Rate Rebates

Rate rebates can be used as a financial incentive to conserve native vegetation (including koala habitat) by reducing the amount of rates payable on land that is protected and managed for such a purpose (Cripps *et al*. 1999). Cripps *et al*. (1999; p11) list four means by which rate rebates can be achieved:

- differential rating based on different land use zones or rating categories;
- remission or exemption from rates;
- rate rebate (refunding) or discount of a proportion of the rate payable on land; and
- alteration of land values through the valuation system.

Cripps *et al*. (1999) note that while rate rebates provide landholders with financial recognition of the public benefits of native vegetation (or koala habitat) conservation, the financial incentive of rate rebates will vary according to the land values and rating percentages of a given area of land. For instance, the financial incentive will be less on rural land than on a similar sized parcel of urban land, due to the difference in land values. However, given that there will generally be much larger areas of rural land that would be suitable for a rate relief approach in return for conservation of koala habitat, this financial incentive is also likely to appeal to some rural landholders.

The use of rate rebates as an incentive to conserve koala habitat **should only be considered in instances where a landowner has entered into a binding agreement** that provides the koala habitat with long term security against conflicting land uses. The Voluntary Conservation Agreements and Voluntary Conservation Zones discussed above in section 4.5.1 would offer an appropriate level of security. In fact, s.555 (1b1) of the *Local Government Act 1993* (as amended by the *Local Government Amendment Act 1997*) currently provides for land that is subject to a Voluntary Conservation Agreement to be exempt from all Council rates (Cripps *et al*. 1999).

Logan City Council in Queensland has introduced rate rebates of between 25% and 50% for landholders that rezone land into a new Residential Conservation Zone (Binning *et al*. 1999). However, Binning and Thorman (1998; p.21) note that rate rebates for land managed for conservation have not been employed in NSW (with the exception of land subject to a Voluntary Conservation Agreement), and that "the legal capacity of councils to introduce rate rebates has been questioned". Binning *et al*. (1999) suggest that an amendment to s.493 of the *Local Government Act 1993*, to include conservation as a sub-category to be used to determine rate levels, is necessary to allow land set aside for conservation to be rated differently. While such an amendment would no doubt make it much easier for Councils to introduce a differential rate for land set aside for conservation, recent legal advice suggests that differential rates for conservation purposes could be implemented under the existing legislation.

The cost of initiating a rate rebate scheme for land set aside (via a binding management agreement) for the conservation of koala habitat need not be borne solely by Port Stephens Council. Binning and Young (1997) recommend that Commonwealth and State Governments encourage such council schemes by establishing programs to supplement the cost to councils during a transition period. They suggest that this could work via a program of 5 years duration in which 100% supplementation of the costs are provided by Commonwealth and State Governments for the first two years, decreasing by 33% each year after. Following this transition period, such rebates would then be expected to be incorporated into the rating base of the council.

In fact, local government rate rebate schemes to conserve and manage native vegetation (and therefore koala habitat) are currently eligible for funding under the Natural Heritage Trust (NHT Guide to New Applications 1999-2000). Therefore, it is recommended that, subject to further investigations regarding the capacity of local governments in NSW to provide rate rebates for land set aside for conservation, Port Stephens Council lodge an application for funding from the Natural Heritage Trust to undertake a rate rebate scheme. However, as NHT funds are only guaranteed for one more year (the 2001-2002 financial year), alternate funding sources may also need to be sought. The Steering Committee of the Lower Hunter and Central Coast Regional Environmental Management Strategy could be a potential partner in a rate rebate scheme, given that such a scheme could serve as a trial for some of the conservation measures to be contained in its Regional Biodiversity Conservation Strategy.

Development Incentives

Development incentives involve a landholder being allowed specific development or subdivision benefits (often on one part of their property) in return for dedicating another part of their property to conservation (Binning and Thorman 1998). Binning and Thorman (1998) note that development incentives have been used by local governments in a slightly different context; for instance, Gold Coast Council will permit higher density development in return for property owners setting aside other land for open space. Noosa Shire Council in Queensland use a similar approach; the provision of a "density bonus" in return for the dedication of land as Open Space, as a means of protecting areas of high conservation value (GCCC 1997).

In the context of protecting koala habitat, development incentives could, for example, allow a landholder to intensify their land use on a property currently zoned Rural 1a (e.g. via a

rezoning to permit residential development on part of that property), in return for rezoning another part of it (that contains, for instance, Preferred Koala Habitat) to Environmental Protection. In this way, landholders are given financial incentive to protect koala habitat on their property. However, it is essential that development incentives be applied on a **case-by-case basis**, as there are a number of issues that will need to be addressed before this could be identified as a viable option for a given area of land.

The example provided above, where a property that is currently zoned Rural 1a contains Preferred Koala Habitat on only part of it, affords some idea of the range of issues that may need to be considered. While it may be possible, and desirable, from the point of view of koala habitat conservation to rezone the Preferred Koala Habitat to Environmental Protection in return for rezoning other parts of the land to Residential, a number of factors could mean that it is not possible (or desirable) to rezone part of the land to permit residential development. Such factors could include: constraints on development adjacent to Preferred Koala Habitat, Habitat Buffers or Linking Areas as required under the Port Stephens Council CKPoM, the presence of other threatened species; lack of access to reticulated services (such as water and sewerage); or a number of potential additional constraints to residential development including: prime agricultural land, flooding, aircraft noise, SEPP 14 wetlands, high fire hazard, mineral sands, and steep terrain. In addition to these factors, the area may not be an identified high priority for the release of residential land, in accordance with the Port Stephens Council Beyond 2000 Settlement Strategy.

Transferable Development Rights

Transferable development rights (TDRs) describes a planning tool that can be used to compensate landholders for the loss or restriction of the right to develop their land (Bindon 1992). The TDR concept originated in the United States of America and is based on the premise that the ownership of a variety of rights, such as access rights, mineral rights, airspace rights and development rights (the right to change the use of the land to another use as permitted by existing regulations) are attached to the ownership of land (Pizor 1986), and that each of these rights can be separated from the others and transferred to someone else (Bindon 1992). Bindon (1992) observes that there is a fundamental difference between the American and Australian situations: in America, there appears to be legal precedent regarding the *right to develop land*; whereas in Australia, such a right is contingent on obtaining development consent from the relevant consent authority in accordance with relevant planning legislation and, hence, is more appropriately described as an *expectation to develop land* as permitted under planning legislation.

As a planning tool, a TDR scheme provides a means by which a landholder that is prevented (usually by regulation) from developing their land because of the occurrence of a resource which requires protection, is granted development rights that can be transferred (sold) to someone else to be used elsewhere (Bindon 1992). As a result, the resource is protected, the landholder is compensated and the buyer obtains greater development entitlements for other land (Pizor 1986).

TDR schemes have been used for a variety of purposes in both the United States and Australia. These include: the protection of agricultural land in Maryland, USA (Pizor 1986), the conservation of native vegetation in the New Jersey Pinelands, USA (Pizor 1986), the conservation of heritage buildings in Sydney, Adelaide and Brisbane (Bindon 1992), the consolidation of rural dwellings in Wellington Shire, NSW (Craythorn 1994), and the

protection of water catchment areas and productive agricultural land in the Mount Lofty Ranges, South Australia (Evans 1993). In each of these schemes, the use of TDRs has been adapted to reflect objectives and issues particular to the planning area being considered.

The advantages and disadvantages of the TDR concept, as well as problems with its application as a planning tool have been reviewed by several authors (e.g. Nicholson 1984; Pizor 1986; Bindon 1992; Daines 1992). While a number of authors recognise the utility of the TDR concept as a planning tool (Nicholson 1984; Pizor 1986; Bindon 1992; Evans 1993; although see Daines 1992 for a critique of aspects of the City of Sydney TDR Scheme), and there are instances where TDR schemes have been well received by landholders and developers (though not bankers) (Craythorn 1994), several important points need to be considered. First, TDR schemes can be quite complex to establish and implement and may require the commitment of considerable resources by the authority responsible for facilitating or administering the scheme (Pizor 1986; Bindon 1992). Second, for a TDR scheme to work, there needs to be both suitable areas to which development rights can be transferred and a market (specifically a demand) for extra development entitlements (Pizor 1986; Bindon 1992). Finally, it is recognised (Bindon 1992; Evans 1993) that TDR schemes should not be the only planning tool used to protect a certain resource, but should be employed in conjunction with a range of other measures.

A TDR scheme could be developed in the Port Stephens LGA to encourage landholders to protect koala habitat on their land via one of the binding agreements proposed in section 4.5.1 (Voluntary Conservation Agreement or Voluntary Conservation Zone), or to compensate for the loss of development potential. However, such a scheme will need to address the issues discussed above, and must be developed in close consultation with the community and in particular the groups, such as landholders, facilitators and developers (Pizor 1986), that would be the main participants in the scheme.

Additional Incentives schemes

Two other schemes, a levy-based “Trust” (including a revolving fund) and a “Conservation Program” are also worthy of consideration. Both would be funded by the application of an environmental levy by Council. The former, which would include a revolving fund for land acquisition, could be based on the successful Trust for Nature (Victoria) scheme. This scheme raises money for the acquisition of areas of high conservation significance, which are then protected by a covenant and resold to buyers who are willing to maintain the conservation values of the land. The scheme becomes self-sustaining over time as the funds raised through land sales are used to purchase other sites. Funds from an environmental levy could be used to purchase land containing significant koala habitat, a binding agreement would then be used to protect that habitat and the land resold. Such a scheme could be managed by a consortium of agencies and organisations, including NPWS, the Foundation for National Parks, the Department of Land and Water Conservation and the Nature Conservation Council, which was awarded the management of a revolving fund scheme for NSW. An environmental levy could also raise money for a Conservation Program which provides money for koala habitat restoration, education programs or other initiatives.

4.7 Management of koala habitat on public lands

Crown Lands

A substantial number of Crown Land areas occur within Port Stephens. These areas are administered by the Department of Land and Water Conservation (DLWC) (formerly the Department of Conservation and Land Management – CALM) which is responsible, under the Crown Lands Act 1989, for carrying out land assessments of Crown Lands prior to their reservation, disposal or use for any purpose. The assessment of these lands, and their subsequent classification, could afford secure protection for koala habitat areas.

The Worimi Local Aboriginal Lands Council (WLALC) has lodged a number of Land Claims over vacant Crown Land areas within the Port Stephens LGA. Pending the outcome of these Land Claims, the Department of Land and Water Conservation may undertake assessments for Crown Lands containing koala habitat.

Land Managed by Port Stephens Council

Port Stephens Council manages substantial amounts of public land in the Port Stephens LGA. This includes Council-owned community land and Crown Land of which Council is a trustee or has care, control and management. Council is undertaking land management planning for the public land it controls. This will include preparation of Plans of Management under the *Local Government Act 1993* for each parcel of land. When preparing these Plans of Management, Council should incorporate the relevant provisions of the Port Stephens Council CKPoM.

National Parks Estate

The NSW National Parks and Wildlife Service (NPWS) has statutory responsibilities for the conservation and management of the State's cultural and natural heritage. NPWS managed estate areas within Port Stephens are detailed below.

Tomaree National Park

Tomaree National Park covers some 3300 hectares of coastal lands between Anna Bay and Shoal Bay. Approximately 2400 hectares of the Park has been transferred to NPWS from the Hunter Water Corporation since exhibition of the 1994 draft of this Koala Plan of Management. Tomaree National Park, particularly the recent additions, contains some areas of Preferred Koala Habitat and substantial areas of Supplementary Koala Habitat.

Moffats Swamp Nature Reserve

This reserve is located east of Medowie and covers some 150 hectares. The area contains Preferred Koala Habitat and has added significance due to overall linking habitat values for koalas.

Seaham Swamp Nature Reserve

This reserve is located within the township of Seaham and occupies 11 hectares. The reserve contains significant waterbird habitat and a small amount of Marginal Koala Habitat.

Kooragang Nature Reserve

Kooragang Nature Reserve is at the southern extremity of Port Stephens Local Government Area. It covers 2926 hectares of predominantly estuarine communities including the edge of Fullerton Cove.

Wallaroo Nature Reserve

This nature reserve was gazetted in February 1999 as part of the recent transfer of land managed by State Forests of NSW to National Parks estate under the Lower North Coast Regional Forestry Agreement. It covers 2780 hectares of land (of which less than half is in the Port Stephens LGA) and is located in the northern part of the Port Stephens LGA between the Williams River and the Pacific Highway and the adjacent Dungog LGA. Marginal Koala Habitat covers much of the Wallaroo Nature Reserve, although there are strips of Preferred Koala Habitat and associated Habitat Buffers and Habitat Linking Areas along watercourses.

Karuah Nature Reserve

This nature reserve was also gazetted in February 1999 as part of the recent transfer of land managed by State Forests of NSW to National Parks estate under the Lower North Coast Regional Forestry Agreement. It comprises parts of the former Karuah, Wallaroo and Medowie State Forests to the north west and south west of Karuah. It covers approximately 2300 hectares, of which only a small proportion is within the Port Stephens LGA. It contains some Preferred and Marginal Koala Habitat.

Tilligerry Nature Reserve

This nature reserve, which was gazetted in March 1999, covers 120 hectares of land and is located on both sides of Taylors Beach Road, Taylors Beach and along the creek south of Taylors Beach. This land was formerly Crown Land and contains both Preferred and Supplementary Koala Habitat.

Worimi Nature Reserve

This nature reserve, also gazetted in March 1999, covers 500 hectares of predominantly estuarine land along the western shore of Port Stephens from Karuah to Big Swan Bay. It contains small amounts of Preferred Koala Habitat.

The NPWS will continue to identify potential additions to the managed reserves under its control. Potential new reserves within the Port Stephens LGA include land at Salamander Bay and on the Tomago Sandbeds.

State Forests of NSW

As noted above, one of the outcomes of the recent Lower North Coast Regional Forestry Agreement was the transfer of land managed by State Forests of NSW to National Parks and Wildlife Service estate, culminating in the recent gazettal of Wallaroo and Karuah Nature Reserves.

State Forests of NSW will continue to be licensed by NPWS for any activities likely to affect threatened species, including the koala. Part of the licensing process includes requirements in terms of standardised koala surveys and the application of ameliorative prescriptions. State Forests of NSW should be encouraged to refer to the Port Stephens Council CKPoM when undertaking koala surveys as part of the assessment of proposed logging operations.

Hunter Water Corporation

In excess of 16 percent of the land within the Port Stephens LGA has been zoned as Environmental Protection 7c Water Catchment Areas to protect potable water aquifers and catchments. Much of this land remains in a relatively natural state and includes some highly significant koala habitat. However, substantial areas of these lands have been significantly degraded as a result of heavy mineral sand mining operations.

The Hunter Water Corporation is responsible for administering these lands and protecting

water reserves from contamination, through relevant legislation and use of restrictive covenants over private land within catchment areas.

The management and administration of these water catchment areas by the Hunter Water Corporation has significant bearing on the conservation of koalas and koala habitat within the Port Stephens LGA.

On the land it manages, the Hunter Water Corporation has cooperated in a post wildfire koala research project that was carried out by the National Parks & Wildlife Service and assisted by the Native Animal Trust Fund.

Commonwealth Department of Defence

The Commonwealth Department of Defence is another major landholder in the Port Stephens LGA, owning approximately 3900ha. The major users of the land are: the Royal Australian Air Force (RAAF), which occupies RAAF Base Williamtown and Salt Ash Air Weapons Range; the Army, which uses Gan Gan Army Camp (which is currently nominated by the Department of Defence for disposal); and the Royal Australian Navy, which occupies Fort Wallace at Fern Bay for accommodation. The Department of Defence also leases the Salt Ash Drop Zone for parachute training, although this is currently under review. The Defence Estate Organisation (Central & Northern NSW) has responsibility for the environmental management of Defence land in the LGA.

In managing this land, the Defence Estate Organisation must comply with the requirements and intent of Commonwealth environmental impact legislation, including the Commonwealth *Endangered Species Protection Act 1992*, and it is Defence policy to comply with the standards of relevant State legislation, where this does not conflict with Commonwealth legislation and policy (Department of Defence 1998). Thus, the Department of Defence should be encouraged to adopt the standards for koala habitat management contained in this CKPoM.

4.8 Best Practice Management by Council as a Developer

Port Stephens Council is one of the biggest property developers in the Port Stephens LGA. This represents a great opportunity for Council to provide the lead for the development industry by demonstrating best practice management of koala habitat. Hence, the principles and standards of the Port Stephens Council CKPoM should be rigorously applied to all developments and activities carried out by Port Stephens Council.

4.9 Actions To Date

Since the exhibition of the draft Koala Management Plan (Callaghan *et al*. 1994), the following actions have taken place:

i) Council prepared a LEP which amended Clause 9 of the Port Stephens LEP 1987 so as to convert the Environment Protection (Wildlife Refuge) Zone to an Environment Protection (Flora and Fauna Conservation) Zone, as set out in the Fern Bay LEP;

ii) Council prepared an amending LEP to rezone Preferred Koala Habitat on the Tilligerry Peninsula to Environment Protection 7(k);

iii) Council prepared an amending LEP which deleted the provision of Clause 37 of the Port Stephens LEP which applied to areas identified as koala habitat. This had the effect of not permitting silica sand extraction in those areas;

iv) Council adopted a Tree Management Policy in association with its Tree Preservation Order;

v) Council appointed a Environmental Projects Officer. Duties include preparation of the State of Environment Report, coordination of environmental projects and provision of advice on environmental management issues;

vi) Council appointed a Vegetation Management Officer whose responsibilities include implementation of the Tree Preservation Order, enhancing community awareness about native vegetation and the environment in general, development of a strategy for rehabilitation of degraded lands and coordination of vegetation rehabilitation projects for wildlife;

vii) Council adopted a system for processing applications to remove or lop trees; and

viii) The Australian Koala Foundation, Port Stephens Council and Rutile Zircon Mines Pty Ltd (RZM) entered into an agreement which lead to an AKF Field Biologist being housed within Council to assist with the preparation of the Port Stephens Council Comprehensive Koala Plan of Management and to provide advice to Council, the community and developers on the development assessment process as it relates to koalas and their habitat.

4.10 Habitat Conservation Recommendations

See section 4.2 of the Port Stephens Council CKPoM.

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5. Development Assessment

5.1 Introduction

The rationale for establishing assessment guidelines is to standardise the treatment of issues relating to the management of koalas and koala habitat within the development assessment process. This will provide guidance to Council staff, consultants and developers, particularly in relation to the interpretation of the Koala Habitat Planning Map (see chapter 2), and will ensure consistency in assessment across the Port Stephens LGA. Thus, the Port Stephens Council CKPoM provides guidelines to facilitate the assessment of development applications (DAs) as they relate to koalas and koala habitat.

It is intended that this chapter will be used by Council planners when determining Development Applications (DAs) as well as consultants (including flora and fauna consultants) contracted by the proponents. It has been prepared following thorough consultation with Council planners, the National Parks and Wildlife Service, the Department of Urban Affairs and Planning and flora and fauna consultants.

5.2 Objectives

The objectives of this development assessment chapter are to:

i) Discuss the development assessment process in the context of koalas and koala habitat;

ii) Establish guidelines for the assessment of development applications (DAs) that potentially affect koalas or koala habitat; and

iii) Establish guidelines for minimum survey standards and recommended techniques to be applied by consultants when carrying out assessments in conjunction with ii) above.

5.3 The Development Assessment Process

The development assessment process refers to the procedure by which development and land use is assessed and regulated. In New South Wales, the *Environmental Planning and Assessment Act 1979* (EP&A Act), and subsequent amendments, provides the primary legislative framework for the development assessment process.

Part 4 of the EP&A Act provides the legislative framework for the assessment of development applications. In assessing an application to develop land, a consent authority has to refer to a variety of sources, many of which stem from the provisions of the EP&A Act (Binning *et al*. 1999). These include: state environmental planning policies

(SEPPs), regional environmental plans (REPs), local environmental plans (LEPs), development control plans (DCPs), deemed environmental planning instruments, council codes/policies, directions under section 79C of the EP&A Act, and Department of Urban Affairs and Planning circulars (Farrier 1993).

Of particular relevance to the assessment of development applications as they relate to koalas and koala habitat is section 5A (The '8 Part Test' of Significance) of the EP&A Act and State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44).

Section 5A of the EP&A Act (as amended by the *Threatened Species Conservation Act 1995* – TSC Act) requires that a consent authority, when considering a DA under Part 4 of the EP&A Act, must consider whether the development is likely to significantly affect threatened species, populations or ecological communities, or their habitats. As the koala is listed as a Vulnerable species in Schedule 2 of the TSC Act, it is necessary to consider whether a proposed development is likely to have a significant impact on koalas or their habitat. This is done formally via the application of the '8 Part Test' of Significance, which involves consideration of the eight factors listed in s.5A of the EP&A Act. These eight factors are:

(a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction,

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,

(c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed,

(d) whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community,

(e) whether critical habitat will be effected,

(f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region,

(g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process, and

(h) *whether any threatened species, population or ecological community is at the limit of its known distribution.*

If it is determined that a proposed development is likely to have a significant effect on a threatened species, population or ecological community, it will be necessary to prepare a Species Impact Statement (SIS), or to modify the proposed development or activity such that a significant effect is unlikely (NPWS 1996). When an SIS is prepared to accompany a DA, the concurrence of the Director General of National Parks and Wildlife, or consultation with the Minister for the Environment is required before any consent can be issued (NPWS 1996). The need for this assessment procedure is not negated by the existence of Koala Plans of Management prepared under SEPP 44, although the Guidelines for Koala Habitat Assessment contained in section 5.5 will substantially contribute to such assessments for the koala.

As mentioned in chapter 4, there is less flexibility when considering proposals under Part 4 of the EP&A Act compared with that under Part 3, because, in the case of the former, the legislative framework as regards the range of permissible uses is largely established. There is, however, a need to recognise an important type of development that is assessed under Part 4 of the EP&A Act, which by its nature provides for a degree of flexibility in addressing koala habitat issues: the subdivision of land. Subdivision of land is the division of land into two or more parts (s.4B EP&A Act). At the subdivision stage, lot sizes and lot layouts are determined and covenants (under the *Conveyancing Act 1919*) can be established, which provides scope for the proposal to be adapted to allow for the protection of koalas and their habitat. However, as subdivision generally results in a decrease in lot sizes and hence an intensification of land use, subdivision can greatly reduce the potential for koala habitat to be protected. Thus, it is important to ensure that subdivisions are compatible with the long term conservation of koalas and koala habitat. Guidelines for the assessment of subdivisions and other DA's that may affect koala habitat are provided in section 5.4.

SEPP 44 applies to land greater than 1ha in LGAs that are listed in Schedule 1 of SEPP 44. These LGAs represent the known geographic range of the koala in NSW. SEPP 44 requires that a council, prior to granting consent to a development application, must consider the likely impact of the development on koala habitat. This is done by following the procedure outlined in SEPP 44. This includes the need for investigations first for potential koala habitat and then core koala habitat and, if the latter is identified, the preparation of a Individual Koala Plan of Management (KPoM). The SEPP provides for and encourages councils to prepare Comprehensive KPoMs (CKPoM), which apply to a whole LGA. The approval of a CKPoM by a Council and the Director General of Urban Affairs and Planning means that Individual KPoMs need not be prepared for DAs that apply to land which contains core koala habitat. The determination of a DA that applies to land that contains core koala habitat must be consistent with the relevant KPoM. When approved, the Port Stephens Council CKPoM will provide the basis for the assessment of DA's under SEPP 44 in the Port Stephens LGA.

5.4 Development standards and assessment criteria

The application of the development standards and assessment criteria outlined below will be triggered by proposals that either overlap or are adjacent to areas of Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas, as the effective conservation of these koala habitat categories is considered to be integral to the long term survival of koalas in the Port Stephens LGA. They will also be triggered by proposals that apply to sites that contain preferred koala food trees. A decision as to whether the land to which a development application applies overlaps or is adjacent to any of the koala habitat categories listed above, or whether a site contains preferred koala food trees, can only be made on the basis of an investigation of the site by an appropriately qualified person in accordance with the "Guidelines for Koala Habitat Assessments" contained in section 5.5 of this chapter.

As noted by Lunney *et al*. (1998) (see chapter 2), Preferred Koala Habitat is the most important category of koala habitat in the Port Stephens LGA. Hence, remaining Preferred Koala Habitat should be afforded the highest level of protection possible. Supplementary Koala Habitat is also important to the long term conservation of koalas in the Port Stephens LGA and thus also requires protection, albeit with less restrictions on development than for Preferred Koala Habitat (Lunney *et al*. 1998).

Habitat Buffers (as determined by the ecological criteria contained in Appendix 9 of the Port Stephens Council CKPoM) could potentially contribute to the long term survival of Preferred Koala Habitat by ensuring that incompatible development or land use does not occur immediately adjacent and by helping to protect Preferred Koala Habitat from the detrimental impact of "edge effects", such as nutrient inputs, wind damage and weed invasion. Habitat Buffers may also provide for the likely extension of significant koala activity beyond the mapped boundary of Preferred Koala Habitat. Even Habitat Buffers that extend over Mainly Cleared Land may perform this latter function. Hence, all Habitat Buffers, including those that extend over Mainly Cleared Land, should also be afforded the highest level of protection available and considered for potential restoration.

Habitat Linking Areas have the potential to provide opportunities for the safe movement of koalas between breeding populations or into areas of vacant habitat. Depending upon features such as the size and quality of the koala habitat they contain, Habitat Linking Areas may also provide for the establishment of koala home range areas either as an extension from breeding populations or by koalas otherwise unable to establish home ranges within better quality habitat. Because koalas are capable of travelling considerable distances between trees (Moon 1990; Prevett 1991), Habitat Linking Areas that overlap with Mainly Cleared Land may still perform such important functions. Development may be permitted in Habitat Linking Areas provided it does not compromise their use by koalas. Therefore, Habitat Linking Areas are to be subject to the same development standards as apply to Supplementary Koala Habitat.

Thus, we have the following hierarchy (in order of decreasing importance) as regards the relative importance of koala habitat categories and the corresponding requisite level of protection:

- Preferred Koala Habitat and all Habitat Buffers (highest level of protection); and

- Supplementary Koala Habitat and all Habitat Linking Areas (high level of protection, but less than above).

To put this in perspective, the amount of land likely to be affected by the development standards and assessment criteria within the Port Stephens LGA is detailed in Table 5.1.

Table 5.1. Area of Preferred Koala Habitat, Supplementary Koala Habitat (excluding those areas that overlap with either Habitat Buffers or Habitat Linking Areas), and Habitat Linking Areas in the Port Stephens LGA. Also shown is the proportion of the total area of the LGA, the proportion of each habitat category that is currently included in each of the following broad groupings of land use zones: development zones (DEVEL), which includes all Rural Small Holdings zones (except Rural 1c1), all Residential zones, all Business zones and all Industrial zones; rural zones (RURAL), which include all Rural zones (except Rural 1c2, 1c3, 1c4 and 1c5); environmental protection zones (EP), which include all Environmental Protection Zones; and all other zones (OTHER). Note: KH = Koala Habitat. The areal extent of Habitat Buffers and their degree of overlap with the groupings of land use zones could not be calculated as their width is to be determined on a case-by-case basis using the criteria specified in Appendix 9 of the Port Stephens Council CKPoM.

Habitat Category	Area (ha)	% of LGA	% DEVEL	% RURAL	% EP	% OTHER
Preferred KH	7 371	9	5	45	37	13
Habitat Buffer						
Supplementary KH	7 454	9	9	34	49	8
Habitat Linking Area	5 732	7	10	55	23	12

Therefore, 9% of the LGA will be subject to the highest level of protection. This includes a considerable proportion of land that is currently zoned Environmental Protection (37% of Preferred Koala Habitat) or Rural (45% of Preferred Koala Habitat). Approximately 5% of all Preferred Koala Habitat (or 352ha, of which 239ha is zoned 1c2, 1c3, 1c4, or 1c5) overlaps with the development zones (as defined in Table 5.1). A further 16% of the LGA will be subject to the next highest level of protection. However, this includes a considerable proportion of land that is currently zoned Environmental Protection (49% of Supplementary Koala Habitat and 23% of Habitat Linking Areas) or Rural (34% of Supplementary Koala Habitat and 55% of Habitat Linking Areas). Approximately 9% of all Supplementary Koala Habitat (or 708ha, of which 33ha is zoned 1c2, 1c3, 1c4, or 1c5) and 10% of all Habitat Linking Areas (or 552ha, of which 240ha is zoned 1c2, 1c3, 1c4, or 1c5) overlap with the development zones considered in Table 5.1.

Performance Criteria for Development Applications

The following criteria (a-h) apply to all developments (excluding development applications proposing agricultural activities). **Note**: The CKPoM Consultative Committee recommended that separate performance criteria be prepared for agricultural development. These criteria are provided in Appendix 5 of the Port Stephens Council CKPoM. For the purposes of this section, native vegetation is defined as any of the following types of indigenous vegetation: trees (including saplings and shrubs), understorey plants, groundcover or plants occurring in a wetland (as per sections 4 and 6 of the *Native Vegetation Conservation Act 1997*).

Council may waive the provisions of a), b) and c) above **only** for the purposes of establishing a building envelope and associated works, and **only if** the proponent can demonstrate:

1. That the building envelope and associated works **cannot** be located in such a way that would avoid the removal of native vegetation within Preferred or Supplementary Koala Habitat, Habitat Buffers, or Habitat Linking Areas, or removal of preferred koala food trees;

2. That the location of the building envelope and associated works **minimises** the need to remove vegetation as per 1 above;

3. That, in the case of subdivisions, they are designed in such a way as to retain and enhance koala habitat on the site and are consistent with the objectives of this appendix; and

4. That koala survey methods (as per the Guidelines for Koala Habitat Assessment in section 5.5) have been used to determine the most appropriate location for the building envelope and associated works (so as to minimise the impact on koala habitat and any koala populations that might occur on the site).

The Performance Criteria are as follows:

Proposed development (other than agricultural activities) **must:**

a) Minimise the removal or degradation of native vegetation within Preferred Koala Habitat or Habitat Buffers;

b) Maximise retention and minimise degradation of native vegetation within Supplementary Koala Habitat and Habitat Linking Areas;

c) Minimise the removal of any individuals of preferred koala food trees, where ever they occur on a development site. In the Port Stephens LGA these tree species are Swamp Mahogany (*Eucalyptus robusta*), Parramatta Red Gum (*Eucalyptus parramattensis*) and Forest Red Gum (*Eucalyptus tereticornis*). An additional list of tree species that may be important to koalas based on anecdotal evidence is included

in Appendix 8 of the Port Stephens Council CKPoM (as recommended by the CKPoM Consultative Committee);

d) Make provision, where appropriate, for restoration or rehabilitation of areas identified as Koala Habitat including Habitat Buffers and Habitat Linking Areas over Mainly Cleared Land. In instances where Council approves the removal of koala habitat (in accordance with dot points 1-4 of the above waive clause), and where circumstances permit, this is to include measures which result in a "net gain" of koala habitat on the site and/or adjacent land;

e) Make provision for long term management and protection of koala habitat including both existing and restored habitat;

f) Not compromise the potential for safe movement of koalas across the site. This should include maximising tree retention generally and minimising the likelihood that the proposal would result in the creation of barriers to koala movement, such as would be imposed by certain types of fencing. The preferred option for minimising restrictions to safe koala movement is that there be no fencing (of a sort that would preclude koalas) associated with dog free developments within or adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas. Suitable fencing for such areas could include:

   i) fences where the bottom of the fence is a minimum of 200 mm above ground level that would allow koalas to move underneath;

   ii) fences that facilitate easy climbing by koalas; for example, sturdy chain mesh fences, or solid style fences with timber posts on both sides at regular intervals of approximately 20m; or

   iii) open post and rail or post and wire (definitely not barbed wire on the bottom strand).

   However, where the keeping of domestic dogs has been permitted within or adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas, fencing of a type that would be required to contain dogs (and which may also preclude koalas) should be restricted to the designated building envelope. Fences which are intended to preclude koalas should be located away from any trees which now or in the future could allow koalas to cross the fence.

g) Be restricted to identified envelopes which contain all buildings and infrastructure and fire fuel reduction zone. Generally there will be no clearing on the site outside these envelopes. In the case of applications for subdivision, such envelopes should be registered as a restriction on the title, pursuant to the *Conveyancing Act 1919*; and

h) Include measures to effectively minimise the threat posed to koalas by dogs, motor vehicles and swimming pools by adopting the following minimum standards.

i) The development must include measures that effectively abate the threat posed to koalas by dogs through prohibitions or restrictions on dog ownership. Restrictions on title may be appropriate.

ii) The development must include measures that effectively minimise the threat posed to koalas from traffic by restricting motor vehicle speeds, where appropriate, to 40 kph or less.

iii) The development must reduce the risk of koala mortality by drowning in backyard swimming pools. Appropriate measures could include: trailing a length of stout rope (minimum diameter of 50mm), which is secured to a stable poolside fixture, in the swimming pool at all times; designing the pool in such a way that koalas can readily escape; or enclosing the pool with a fence that precludes koalas. This last option should include locating the fence away from any trees which koalas could use to cross the fence.

Information to Accompany Applications

The following information must be submitted with applications for development (excluding development applications proposing agricultural activities) on **sites that contain** Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas.

1. An assessment of koala habitat, by a suitably qualified person, in accordance with the attached Guidelines for Koala Habitat Assessment, which appear in section 5.5.

2. Clear details concerning which vegetation is to be cleared or disturbed and that which is to be retained.

3. Details of any proposed building envelopes and fire fuel reduction zones and the means by which they are to be enforced.

4. Proposed measures to restore or rehabilitate koala habitat, including measures which will result in the net gain of koala habitat.

5. Proposed measures to allow the safe movement of koalas across the site including road designs and speed mediation measures, fence construction details where fencing is proposed, and swimming pool specifications.

6. Proposed measures to mitigate the impacts on koalas by dogs.

7. Details of any proposed program to monitor koalas and koala habitat, during and following development activity on a site. Monitoring programs would not be required for single lot developments. Rather, they would be expected for subdivisions.

The following information must be submitted with applications for development on **sites that are adjacent to** Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas.

8. Proposed measures to mitigate the impacts by dogs on koalas which occupy adjacent habitat. This must include measures (such as education of dog owners, appropriate signs, or restrictions on dog ownership) that reduce the likelihood of domestic dogs straying into koala habitat.

9. Proposed measures to mitigate the impact on koalas of motor vehicles travelling to the site. This must include appropriate traffic control measures on roads which run through or adjacent to nearby koala habitat and which are subject to increased traffic volumes due to the development on the site.

5.5 Guidelines for Koala Habitat Assessments

The Guidelines for Koala Habitat Assessments in the Port Stephens LGA serve the following functions:

- provide the information necessary to support a rezoning proposal under Part 3 of the EP&A Act; and

- provide the information necessary to support a development application being considered under Part 4 of the EP&A Act.

As regards the latter, application of these guidelines will also substantially contribute to consideration of the impact of a proposed development on koalas or their habitat as required under s.5A of the EP&A Act.

The Guidelines for Koala Habitat Assessments **must** be carried out by a person or persons with qualifications and experience in tree species identification and, in the case of assessments of koala habitat utilisation at Step 4, qualifications and experience in biological science and fauna survey and management. This should also include experience in conducting koala surveys. It is necessary that a brief curriculum vitae of each person involved with assessments conducted using these guidelines be appended to the survey report.

Koala Habitat Assessment in the Port Stephens LGA should include the following steps as the minimum acceptable approach (see Figure 9 for a summary flow chart):

1. Preliminary Assessment;

2. Vegetation Mapping;

3. Koala Habitat Identification; and

4. Assessment of the proposal.

Figure 5.1. Flow chart that summarises the procedure to be undertaken when conducting Koala Habitat Assessments in the Port Stephens LGA. See text for a more detailed explanation. The following abbreviations are included in the flow chart: KHPM=Koala Habitat Planning Map; PKH=Preferred Koala Habitat; SKH=Supplementary Koala Habitat; LGA=Local Government Area; DA=Development Application.

1. **<u>Preliminary assessment</u>**. The preliminary assessment must include the following:

    i) Reference to the Koala Habitat Planning Map for the Port Stephens LGA* (or excerpts thereof) to make a preliminary assessment of the koala habitat on the site of the proposed development (hereafter referred to as the site) and to consider the koala habitat of the site in the broader local (and regional) context; and

    ii) An inspection of the site to determine whether the site contains individuals of preferred koala food trees outside areas mapped as Preferred Koala Habitat.

    (<u>Note</u>: Data licensing agreements will be established to allow consultants to purchase relevant sections of the Koala Habitat Planning Map and the underlying Vegetation Map for such purposes. The former is jointly owned by the NSW National Parks and Wildlife Service and the Australian Koala Foundation, while the Vegetation Mapping is owned by the Australian Koala Foundation. Given that consultants will be requested to provide their site specific vegetation mapping to update and refine the LGA-wide Vegetation Map and Koala Habitat Planning Map, a credit system will be established whereby a consultant would receive credit for contributing to the refinement of the LGA-wide maps.)*

From this it should be determined if the site contains Preferred or Supplementary Koala Habitat, any Habitat Buffers, or Habitat Linking Areas (other than those that overlap with Mainly Cleared Land) according to the LGA-wide Koala Habitat Planning Map and/or if it contains preferred koala food trees. If the site contains any of the above, it will be necessary to proceed to Step 2 Vegetation Mapping.

If the site contains Habitat Linking Areas over Mainly Cleared Land according to the LGA-wide Koala Habitat Planning Map and has an area of more than 1ha, or has, together with any adjoining land in the same ownership, an area of more than 1ha, then it will be necessary to proceed to Step 4 Assessment of the Proposal.

If the site does not contain Habitat Linking Areas over Mainly Cleared Land according to the Koala Habitat Planning Map, or it does contain such Habitat Linking Areas but is less than 1 hectare in size, then no further koala habitat assessment is required and consent for the proposed development (or rezoning) should not be withheld on koala habitat grounds.

A minimum area of 1ha is used to specify whether these guidelines apply to land designated Habitat Linking Area over Mainly Cleared Land to preclude the need for Koala Habitat Assessments on small lots that have been developed previously. Substantial areas in the Port Stephens LGA are currently zoned Residential, have already been built on and overlap with Habitat Linking Areas over Mainly Cleared Land. While koalas are capable of travelling considerable distances between trees and could potentially use Habitat Linking Areas over Mainly Cleared Land to move between patches of Preferred Koala Habitat, it would not be practical to require landowners to undertake a Koala Habitat Assessment to accompany DAs that apply

to small lots that have already been developed. Furthermore, while Habitat Linking Areas over Mainly Cleared Land represent an important opportunity for koala habitat restoration projects, these are likely to be most effective when carried out over larger areas.

2. **Vegetation mapping**. The vegetation of the site should be mapped at the largest scale appropriate, and presented in accompanying reports at A3 size. It is recommended that aerial photography (depending upon scale) complemented by detailed ground-truthing be used as a basis for such mapping. Ground-truthing must include verification of vegetation association boundaries, and systematic sampling of the floristic and structural characteristics (e.g. using methods specified by Walker and Hopkins (1990)) within each vegetation association using standard procedures such as quadrat-based or transect-based survey. The vegetation map must accurately:

i. Show the distribution of vegetation associations (defined on the basis of the floristic composition of the tallest stratum along with structural data, as per Walker and Hopkins 1990); e.g. Open Swamp Mahogany - Broad-Leaved Paperbark Forest), for the site plus a 100m area around the site; and

ii. Show the location of all individuals of preferred koala food tree species; *Eucalyptus robusta*, *E. parramattensis* and *E. tereticornis** and hybrids of any of these species where ever they occur on the site, outside vegetation associations classified as Preferred Koala Habitat.

*(*Note: the field survey (Koala Habitat Atlas) identified* E. tereticornis *as a preferred koala food tree species within the Port Stephens LGA, where it occurs on higher nutrient soils (such as volcanic or alluvial based soils). However, for the purposes of development assessment within the LGA it was resolved that it would be unrealistic to expect the importance of* E. tereticornis *to be accurately differentiated for a given area on the basis of substrate. Even where accurate soil mapping is available for a site, disregard of this species due to a lesser significance to koalas on lower nutrient substrates would fail to acknowledge the potential occurrence of localised higher nutrient areas within broader soil landscapes).*

The boundaries of vegetation associations and the location of preferred koala food trees (where they occur outside of identified preferred koala habitat) are to be accurately surveyed (such as a stadia survey in the case of individual preferred koala food tree species where they occur outside of Preferred Koala Habitat), or mapped through the use of differential GPS, in accordance with points i. and ii. above.

Once a site-specific Vegetation Map has been prepared in accordance with the above standards it should be compared to the LGA-wide Vegetation Map. If the site-specific Vegetation Map is consistent with the LGA-wide Vegetation Map (particularly as regards

the mapping of vegetation associations that comprise Preferred or Supplementary Koala Habitat) then the LGA-wide Koala Habitat Planning Map and the site-specific map of preferred koala food trees will apply for the assessment of the proposal (see Step 3b Koala Habitat Identification). If there are inconsistencies between the site-specific and LGA-wide Vegetation Maps it will be necessary to undertake the procedure for Koala Habitat Identification outlined at Step 3a (i.e. production of a site-specific Koala Habitat Planning Map).

Because the LGA-wide Vegetation Map was prepared from 1: 25 000 scale aerial photographs, there will likely be limitations regarding its accuracy for the purposes of development assessment for a given site. Thus, it is likely that there will be a need to refine vegetation association boundaries when mapped at a larger scale. In instances where the LGA-wide Vegetation Map has accurately identified the vegetation associations, but where there are inaccuracies regarding the location of vegetation association boundaries, it will be appropriate to proceed to Step 3b, provided any such inaccuracies are corrected. This must include surveying or mapping (using differential GPS) of these boundaries as specified above.

Council staff would also ask that consultants notify them of any suspected instances off site where the LGA-wide Vegetation Map appears to be inaccurate (particularly where this could influence the location of Habitat Buffers and/or Habitat Linking Areas across a site), and to assess koala habitat on the site accordingly.

3. Koala Habitat Identification

3a) This step should be applied in instances where the LGA-wide Vegetation Map does not accurately describe the nature of the vegetation on the site. This will require the following:

i. Application of the definitions of Preferred and Supplementary Koala Habitat detailed by Lunney *et al*. (1998)* to the vegetation map to show the distribution of these habitat categories across the site and adjacent areas, where revisions were necessary;

ii. Application of Habitat Buffers to all Preferred Koala Habitat. Habitat Buffers should be differentiated on the basis of the respective habitat category with which they overlap (e.g. Habitat Buffer over Supplementary Koala Habitat or Habitat Buffer over Mainly Cleared Land); and

iii. Approximation of Habitat Linking Areas between all patches of Preferred Koala Habitat that occur within 800m of each other, where revision of the Koala Habitat Planning Map has been necessary. Habitat Linking Areas should also be differentiated on the basis of the habitat category with which they overlap (as per Habitat Buffers). Habitat Linking Areas could be identified using GIS software where this is available. Alternately, site inspections and survey work (to identify areas that are either in use by koalas or that are considered to have the potential to be effectively used

by koalas) could be applied to identify suitable Habitat Linking Areas.

After a site-specific Koala Habitat Planning Map has been produced, proceed to Step 3b.

**Note with regard to applying the habitat categories to specific sites:*

There are a number of considerations relating to application of the habitat categories detailed by Lunney et al*. (1998) to any sites which may have been incorrectly typed by the LGA-wide vegetation survey. In particular, conditions will apply when reassigning any remapped vegetation association to a different habitat category on the basis of the rankings derived from the community-based survey results alone. The reasons for this are outlined below.*

Vegetation associations were identified and ranked in terms of koala habitat from the community-based koala survey by correlating the location of koala records with the LGA-wide vegetation map to determine the overall density of koala records (koala records per hectare) for each vegetation association. This means that the koala habitat rankings for vegetation associations as derived from the community-based survey results are dependent upon the total area for each association as depicted on the original vegetation map. Therefore, in the case of instances where the LGA-wide vegetation map may require substantial revision, habitat categories should be reassigned on the basis of the field survey (KHA) categories in the first instance and Council should be contacted for further advice concerning the application of categories derived exclusively from the community-based survey results (e.g. that the application of habitat categories derived exclusively from the community-based survey results only be permitted when consistent with the original Koala Habitat Planning Map).

The field survey results, as regards the identification of preferred koala food trees, are independent of the LGA-wide vegetation map and can subsequently be reapplied to any corrected vegetation mapping.

3b) This step should be applied after completing Step 3a or in instances where the LGA-wide Vegetation Map accurately describes the vegetation of the site (and where any inaccuracies regarding the location of vegetation association boundaries have been corrected). A site-specific map showing the location of individuals of preferred koala food trees, where ever they occur outside Preferred Koala Habitat, is also required at this step. If the relevant Koala Habitat Planning Map indicates that there is either Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas on the site, and/or the site-specific map indicates that the site contains preferred koala food trees, proceed to Step 4 Assessment of Proposal. If none of the above occur on the site consent should not be withheld on koala habitat grounds.

4. Assessment of Proposal

The final step involves using the information produced from Steps 1 to 3 to assess the appropriateness of the proposal. This must involve reference to the Performance

Criteria for rezoning proposals and development applications contained in the Port Stephens Council CKPoM. This must also include a map showing the key elements of the proposal overlain on the Koala Habitat Planning Map, as revised if necessary. The assessment must also address the impacts of potential future development of the site in the broader context of a catchment area with an outer limit of 1km beyond the site boundary, with particular reference to any areas of Preferred or Supplementary Koala Habitat or Habitat Linking Areas as shown on the Koala Habitat Planning Map.

Rezoning requests must meet the performance criteria specified in Appendix 2 of the CKPoM. Development applications must meet the performance criteria specified in Appendices 4 and 5 of the CKPoM. If an applicant requests that Council waive provisions a), b) and c) of either Appendix 4 or Appendix 5 (and this is given approval), then the following additional survey work is required to identify the most suitable location for building envelopes and associated works.

An assessment of koala habitat utilisation on the site must be undertaken by a suitably qualified person with experience in koala surveys. A standard, reportable survey technique that allows habitat utilisation by koalas to be quantified, such as the AKF's faecal pellet-based Spot Assessment Technique (Phillips and Callaghan 1995; see Appendix 5 of the CKPoM Resource Document), must be employed to identify the extent of significant koala activity levels across the site. When using the Spot Assessment Technique, the minimum density of spot assessment plots should be 1 plot per 1000m^2 of land that contains native trees within the areas where building envelopes and associated works could potentially be located.

Wherever possible, development (building envelopes and associated works) within areas which return significant koala activity levels (30% or greater (Phillips and Callaghan 1995)) should be avoided. Where this is not possible, development should be located in areas which return the lowest koala activity levels.

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6. SWOT ANALYSES

6.1 Introduction

The Port Stephens Local Government Area (LGA) exhibits great diversity in terms of land use, current distribution and nature of koala habitat, and associated land management issues. However, a number of areas within the Port Stephens LGA possess distinct similarities with respect to the aforementioned features. It was subsequently considered pertinent to divide the LGA into a number of geographic areas, referred to as Koala Management Units (KMUs), on the basis of similarities in such features.

Each KMU was examined through a procedure known as SWOT Analyses (Strengths, Weaknesses, Opportunities and Threats) in order to identify the range of issues associated with the conservation of koalas and their habitat and to tailor conservation strategies to the particular characteristics of each KMU.

6.2 Objectives

i) Divide the Port Stephens LGA into KMUs on the basis of similarities in land use, koala habitat and associated land management issues; and

ii) Identify opportunities and determine the most appropriate strategies for the conservation and management of koala habitat within each KMU.

6.3 Koala Management Units

The Port Stephens LGA has been divided into nine Koala Management Units (KMUs) reflecting areas with broad similarities in koala habitat and land use. The nine KMUs are shown in Figure 6.1 and include: Tilligerry Peninsula KMU (No.1); Balickera KMU (No.2); Tomaree Peninsula KMU (No.3); Raymond Terrace KMU (No.4); Medowie KMU (No.5); Tomago Sandbeds KMU (No.6); Karuah/Ferodale KMU (No.7); Fullerton Cove/Stockton Bight KMU (No.8); and Western KMU (No.9).

The nine KMUs for the Port Stephens LGA were identified using existing Council localities as a basis, with amalgamations of those localities considered to share similar features. Adjustments to local area boundaries were made where this was considered necessary.

6.4 Results of SWOT Analyses

An important component of the SWOT analyses involved using Geographic Information Systems (GIS) to estimate the area of each koala habitat category within each of the KMUs. GIS was also used to overlay the Koala Habitat Planning Map with land use

zones in order to calculate the overlap between each habitat category and each land use zone. These data have provided a valuable means of discerning broad trends regarding the existing level of protection for koala habitat as well as identifying current and potential future conflicts between land use and koala habitat protection. This analysis has proven to be a very useful means to determine the appropriate koala habitat conservation strategies for each of the KMUs, and for the Port Stephens LGA as a whole.

However, there is a need to recognise some limitations with respect to the accuracy of these data. These limitations are due to both the scale at which the LGA-wide Vegetation Map (and the subsequent Koala Habitat Planning Map) was produced and limitations inherent in the GIS process used to intersect layers and calculate overlap between land use zones and koala habitat. These issues have been addressed in part by calculating areas to the nearest hectare and proportions to the nearest percentile.

The results of the SWOT analyses for each KMU are summarised in the following tables.

Table 6.1. Tilligerry Peninsula Koala Management Unit (KMU). Summary of Strengths, Weaknesses, Opportunities and Threats. Note: KH = Koala Habitat; CH = PKH/SKH/HB/HLA (combined habitat); PKH = Preferred Koala Habitat; SKH = Supplementary Koala Habitat; HB = Habitat Buffer; HLA = Habitat Linking Area; EPZ = Environmental Protection Zonings; OCZ = Other Compatible Zonings; PRZ = Public Recreation Zoning; DPZ = Defence Purposes Zoning; RSHZ = Rural Small Holdings Zoning; RZ = Residential Zones; IZ = Industrial Zones; CA = Voluntary Conservation Agreement. **NOTE**: Figures for Habitat buffers cannot be provided as buffer widths are to be determined on a case-by-case basis using ecological criteria (Appendix 9 of the CKPoM). Figures for combined habitat (CH) have subsequently been adjusted.

SWOT	High	Mid	Low	Comments
Strengths				
Existing KH				
Preferred KH				18% of the KMU (includes 1 very large area)
Supplementary KH				6% of the KMU (mainly in one area)
Habitat Buffers				
Existing Zonings				
Overlap with EPZ				High: PKH (51%); SKH (40%);; HLA (22%)
Overlap with OCZ				High overlap between CH & PRZ, DPZ & Rural 1a.
Koala Population				Koala population in KMU (high density)
HL to Other KMUs				Potential HLA to Tomago and Medowie KMUs
Weaknesses				
Existing KH				
Preferred KH				Much past clearing and fragmentation of PKH
Habitat Buffers				
Habitat Linking Areas				42% overlap with Mainly Cleared Land
Existing Zonings				
Overlap with Rural 1a				25% of PKH; sand extraction/mining permitted
Overlap with RZ				, 21% HLA
Overlap with CH				27% of RZ, 39% of IZ
Opportunities				
Habitat Conservation				
Voluntary Rezone/CA				PKH on Rural 1a land
Crown Lands				Several portions for Crown Land Assessments
Habitat Restoration				HB/HLA on Mainly Cleared lands
Community Groups				Involvement of established community groups
Education				Promote awareness of koala conservation
Ecotourism				Expand on existing eco-tourism industry
Threats				
Habitat Disturbance				Gradual attrition of habitat in urban areas
Motor Vehicles				Black Spots along Lemon Tree Passage Road
Domestic Dogs				Particularly in/around the urban areas

Table 6.2. Balickera Koala Management Unit (KMU). Summary of Strengths, Weaknesses, Opportunities and Threats. Note: KH = Koala Habitat; CH = PKH/SKH/HB/HLA (combined habitat); PKH = Preferred Koala Habitat; SKH = Supplementary Koala Habitat; HB = Habitat Buffer; HLA = Habitat Linking Area; EPZ = Environmental Protection Zonings; OCZ = Other Compatible Zonings; PRZ = Public Recreation Zoning; DPZ = Defence Purposes Zoning; RSHZ = Rural Small Holdings Zoning; RZ = Residential Zones; IZ = Industrial Zones; CA = Voluntary Conservation Agreement. **NOTE**: Figures for Habitat buffers cannot be provided as buffer widths are to be determined on a case-by-case basis using ecological criteria (Appendix 9 of the CKPoM). Figures for combined habitat (CH) have subsequently been adjusted.

SWOT	High	Mid	Low	Comments
Strengths				
Existing KH				
Preferred KH				6% of KMU, some moderately sized patches
Marginal KH				41% of KMU, very large contiguous patches
Habitat Buffers				
Habitat Linking Areas				47% overlap with Marginal KH
Existing Zonings				
Overlap with EPZ				5% of PKH, , 5% of HLA
Overlap with OCZ				66% PKH, and 61% HLA with Rural 1a or 1g
Overlap with CH				Very low, only 8% of RZ
Koala Population				Low numbers of koalas, but could again support pop
Weaknesses				
Existing KH				
Preferred KH				Much cleared, remainder highly fragmented
Supplementary KH				None in this KMU
Habitat Buffers				
Habitat Linking Areas				52% overlap with Mainly Cleared Land
Existing Zonings				Little with EPZ, but much with OCZ
Koala Population				Local extinction/substantial decline since 1800's
Opportunities				
Habitat Conservation				
Voluntary Rezone/CA				Protect existing and encourage restoration
Habitat Restoration				Large areas to be restored, considered worthwhile
Community Groups				Already undertaking restoration works
Education				Build on existing Landcare network
Threats				
Habitat Disturbance				Little now, past impacts still substantial threat today
Motor Vehicles				Conflict area on highway, important in future?
Domestic Dogs				Currently low, important if pop re-established
Hunting for fur trade				No longer occurring, but past impacts still evident

Table 6.3. Tomaree Peninsula Koala Management Unit (KMU). Summary of Strengths, Weaknesses, Opportunities and Threats. Note: KH = Koala Habitat; CH = PKH/SKH/HB/HLA (combined habitat); PKH = Preferred Koala Habitat; SKH = Supplementary Koala Habitat; HB = Habitat Buffer; HLA = Habitat Linking Area; EPZ = Environmental Protection Zonings; OCZ = Other Compatible Zonings; PRZ = Public Recreation Zoning; DPZ = Defence Purposes Zoning; RSHZ = Rural Small Holdings Zones; RDZ = Residential Zones; RFUDZ = Rural Future Urban D Zone; BZ = Business Zones; IZ = Industrial Zones; CA = Voluntary Conservation Agreement. **NOTE**: Figures for Habitat buffers cannot be provided as buffer widths are to be determined on a case-by-case basis using ecological criteria (Appendix 9 of the CKPoM). Figures for combined habitat (CH) have subsequently been adjusted.

SWOT	High	Mid	Low	Comments
Strengths				
Existing KH				
Preferred KH				20% of KMU, large contiguous patches
Supplementary KH				21% of KMU, large contiguous patch
Habitat Buffers				
Habitat Linking Areas				41% overlap with SKH
Existing Zonings				
Overlap with EPZ				High: 30% PKH, 51% SKH, , 30% HLA
Overlap with OCZ				High: 58% PKH, 28% SKH, , 34% HLA
Koala Population				Existing population, evidence of breeding
Community Support				Several active groups
HL to Other KMUs				Some potential links to Fullerton/Stockton KMU
Weaknesses				
Existing KH				
Preferred KH				Some past clearing, some small urban patches
Supplementary KH				Clearing for subdivision, patches near/within urban
Habitat Buffers				
Habitat Linking Areas				47% overlap with Mainly Cleared Land
Existing Zonings				
Overlap with RZ				12% of SKH
Overlap with CH				Very High: 64% RSHZ, 37% RZ, 29% BZ, 35% IZ
Opportunities				
Habitat Conservation				
Voluntary Rezone/CA				Private Land zoned Rural 1a
Crown Lands				Substantial areas of Crown Land overlap with PKH
Habitat Restoration				Particularly HB/HLA in vicinity of large PKH patches
Community Groups				Involvement of established community groups
Education				Promote awareness of koala conservation
Ecotourism				Build on extensive existing industry
Threats				
Habitat Disturbance				Some proposed subdivisions, attrition urban patches
Motor Vehicles				Particularly Gan Gan Rd, PS Dr, Frost Rd, Anna Bay
Domestic Dogs				Particularly urban areas
Bushfires				High in SKH on Stockton Bight and other areas

Table 6.4. Raymond Terrace Koala Management Unit (KMU). Summary of Strengths, Weaknesses, Opportunities and Threats. Note: KH = Koala Habitat; CH = PKH/SKH/HB/HLA (combined habitat); PKH = Preferred Koala Habitat; SKH = Supplementary Koala Habitat; HB = Habitat Buffer; HLA = Habitat Linking Area; EPZ = Environmental Protection Zonings; OCZ = Other Compatible Zonings; PRZ = Public Recreation Zoning; DPZ = Defence Purposes Zoning; RSHZ = Rural Small Holdings Zoning; RZ = Residential Zone; IZ = Industrial Zone; BZ = Business Zone; CA = Voluntary Conservation Agreement. **NOTE**: Figures for Habitat buffers cannot be provided as buffer widths are to be determined on a case-by-case basis using ecological criteria (Appendix 9 of the CKPoM). Figures for combined habitat (CH) have subsequently been adjusted.

SWOT	High	Mid	Low	Comments
Strengths				
Existing KH				
Preferred KH				9% of the KMU
Supplementary KH				1% of the KMU
Existing Zonings				
Overlap with OCZ				High: 59% PKH, 26% SKH, , 72% HLA
Koala Population				Current population, but likely low numbers
Community Support				Several active groups
HL to Other KMUs				Some links to Tomago Sandbeds KMU in east
Weaknesses				
Existing KH				
Preferred KH				Extensive past clearing, remainder highly fragmented
Habitat Buffers				
Habitat Linking Areas				97% overlap with Mainly Cleared Land
Existing Zonings				
Overlap with RZ				6% PKH, 64% SKH, , 20% HLA
Overlap with CH				15% RSHZ, 15% RZ
Opportunities				
Habitat Restoration				Areas where koalas currently known to occur
Community Groups				Involvement of established groups
Education				Build on work of existing groups
Threats				
Habitat Disturbance				Extensive past clearing, remainder urban fragments
Motor Vehicles				Pacific Hwy black spot, other Conflict Areas
Domestic Dogs				High around urban area

Table 6.5. Medowie Koala Management Unit (KMU). Summary of Strengths, Weaknesses, Opportunities and Threats. Note: KH = Koala Habitat; CH = PKH/SKH/HB/HLA (combined habitat); PKH = Preferred Koala Habitat; SKH = Supplementary Koala Habitat; HB = Habitat Buffer; HLA = Habitat Linking Areas; EPZ = Environmental Protection Zonings; OCZ = Other Compatible Zonings; PRZ = Public Recreation Zoning; DPZ = Defence Purposes Zoning; RSHZ = Rural Small Holdings Zoning; RDZ = Residential D Zone; RFUDZ = Rural Future Urban D Zone; LIZ = Light Industrial Zone; CA = Voluntary Conservation Agreement. **NOTE**: Figures for Habitat buffers cannot be provided as buffer widths are to be determined on a case-by-case basis using ecological criteria (Appendix 9 of the CKPoM). Figures for combined habitat (CH) have subsequently been adjusted.

SWOT	High	Mid	Low	Comments
Strengths				
Existing KH				
Preferred KH				16% of the KMU (some substantial patches)
Supplementary KH				3% of the KMU (mainly in two areas)
Marginal KH				35% of the KMU (includes scattered trees)
Existing Zonings				
Overlap with EPZ				Some overlap with PKH (8%);; HLA; SKH
Overlap with OCZ				Some overlap with PRZ; DPZ;Rural 1a.
Koala Population				Extant Koala population in KMU
HL to Other KMUs				Potential HL to Tomago and Tilligerry KMUs
Weaknesses				
Existing KH				
Preferred KH				Majority of PKH within or abutting RSHZ
Habitat Buffers				
Habitat Linking Areas				64% overlap with Mainly Cleared Land
Existing Zonings				
Overlap with RSHZ				73% of PKH (confers some protection)
Overlap with RDZ				2% of PKH
Overlap with LIZ				4% of PKH
Opportunities				
Habitat Conservation				
Voluntary Rezone/CA				Largely PKH on RSHZ lands
Crown Lands				Limited outside NPWS and SF of NSW estate
Habitat Restoration				HB/HL on Mainly Cleared RSHZ lands
Links to adj. KMUs				Some opportunities to improve/restore links
Community Groups				Involvement of established community groups
Education				Promote awareness of koala conservation
Ecotourism				Limited largely due to restricted public access
Threats				
Habitat Disturbance				Principally on land zoned RSHZ
Motor Vehicles				Conflict Areas in/near the Medowie township
Domestic Dogs				Particularly in/around the Medowie township
Feral Dogs				Mainly in east and north of KMU
Bushfire				Particularly east, north and south of KMU

Table 6.6. Tomago Sandbeds Koala Management Unit (KMU). Summary of Strengths, Weaknesses, Opportunities and Threats. Note: KH = Koala Habitat; CH = PKH/SKH/HB/HLA (combined habitat); PKH = Preferred Koala Habitat; SKH = Supplementary Koala Habitat; HB = Habitat Buffer; HLA = Habitat Linking Areas; EPZ = Environmental Protection Zonings; OCZ = Other Compatible Zonings; PRZ = Public Recreation Zoning; DPZ = Defence Purposes Zoning; RSHZ = Rural Small Holdings Zoning; RDZ = Residential D Zone; RFUDZ = Rural Future Urban D Zone; LIZ = Light Industrial Zone; CA = Voluntary Conservation Agreement. **NOTE**: Figures for Habitat buffers cannot be provided as buffer widths are to be determined on a case-by-case basis using ecological criteria (Appendix 9 of the CKPoM). Figures for combined habitat (CH) have subsequently been adjusted.

SWOT	High	Mid	Low	Comments
Strengths				
Existing KH				
Preferred KH				22% of the KMU (several substantial patches)
Supplementary KH				15% of the KMU (often surrounding PKH)
Habitat Buffers				
Habitat Linking Areas				45% overlap with Supplementary KH
Existing Zonings				
Overlap with EPZ				75% PKH; 65% SKH;; 57% HLA
Overlap with OCZ				20% PKH overlaps with Rural 1a
HWC Lands				Majority of EPZ over Hunter Water Lands
Koala Population				Koala population in KMU (high density)
Weaknesses				
Existing KH				
Preferred KH				Substantial past clearing for sand mining
Habitat Buffers				
Habitat Linking Areas				41% overlap with Mainly Cleared Land
Existing Zonings				
Overlap with RSHZ				5% PKH;; 2% HLA
Overlap with Industrial				16% SKH
Opportunities				
Habitat Conservation				
Voluntary Rezone/CA				Largely CH on Rural 1a lands
NPWS Nature Reserve				Proposed for some of Tomago Sandbeds
Habitat Restoration				HB/HL after sand Mining; Rural 1a lands
Links to adj. KMUs				Some opportunities to improve/restore links
Feral Dogs				Management on Public Lands
Traffic				Management of Black Spots/Conflict Areas
Education				Promote awareness of koala conservation
Ecotourism				Limited (restricted public access)
Threats				
Habitat Disturbance				Rural 1a lands; sand mining on current EPZ
Motor Vehicles				Several Black Spots and Conflict Areas
Domestic Dogs				Mainly in urban areas (eg. Salt Ash)
Feral Dogs				Particularly on Public Lands KMU
Bushfire				Potentially significant (large forest areas)

Table 6.7. Karuah/Ferodale Koala Management Unit (KMU). Summary of Strengths, Weaknesses, Opportunities and Threats. Note: KH = Koala Habitat; CH = PKH/SKH/HB/HLA (combined habitat); PKH = Preferred Koala Habitat; SKH = Supplementary Koala Habitat; HB = Habitat Buffer; HLA = Habitat Linking Areas; EPZ = Environmental Protection Zonings; OCZ = Other Compatible Zonings; PRZ = Public Recreation Zoning; DPZ = Defence Purposes Zoning; RSHZ = Rural Small Holdings Zoning; RDZ = Residential D Zone; RFUDZ = Rural Future Urban D Zone; LIZ = Light Industrial Zone; CA = Voluntary Conservation Agreement. **NOTE**: Figures for Habitat buffers cannot be provided as buffer widths are to be determined on a case-by-case basis using ecological criteria (Appendix 9 of the CKPoM). Figures for combined habitat (CH) have subsequently been adjusted.

SWOT	High	Mid	Low	Comments
Strengths				
Existing KH				
Preferred KH				5% of the KMU (a few substantial patches)
Supplementary KH				<1% of the KMU (mainly in one area)
Marginal KH				64% of the KMU (large contiguous areas)
Habitat Buffers				
Habitat Linking Areas				48% overlap with Marginal KH
Existing Zonings				
Overlap with EPZ				Some overlap with PKH;; HLA
Overlap with OCZ				Some PKH overlap with Rural 1f and Rural 1a
NPWS Lands				PKH overlaps with parts of 2 Nature Reserves
Overlap with SEPP 14				KH overlaps with several SEPP 14 Wetlands
Koala Population				Koala population in KMU (low density)
Weaknesses				
Existing KH				
Preferred KH				Many areas small and geographically separated
Habitat Buffers				
Habitat Linking Areas				37% overlap with Mainly Cleared Land
Existing Zonings				
Overlap with RSHZ				31% of PKH zoned Rural 1a
Overlap with RDZ				18% of PKH zoned Rural 1f Forestry
Opportunities				
Habitat Conservation				
Voluntary Rezone/CA				Largely CH on Rural 1 a lands
Crown Lands				CH near Twelve Mile Creek
Habitat Restoration				HB/HL on Mainly Cleared Rural 1a lands
Links to adj. KMUs				Few opportunities to improve/restore links
Education				Promote awareness of koala conservation
Ecotourism				Limited (restricted access; low density koalas)
Threats				
Habitat Disturbance				Grahamstown Dam augmentation; Rural 1f, 1a
Motor Vehicles				Several Conflict Areas along Pacific Highway
Domestic Dogs				Mainly in urban areas (Karuah)
Feral Dogs				Potentially occur throughout much of KMU
Bushfire				Potentially significant (large forest areas)

Table 6.8 Fullerton Cove/Stockton Bight Koala Management Unit (KMU). Summary of Strengths, Weaknesses, Opportunities and Threats. Note: KH = Koala Habitat; CH = PKH/SKH/HB/HLA (combined habitat); PKH = Preferred Koala Habitat; SKH = Supplementary Koala Habitat; HB = Habitat Buffer; HLA = Habitat Linking Area; EPZ = Environmental Protection Zonings; OCZ = Other Compatible Zonings; PRZ = Public Recreation Zoning; DPZ = Defence Purposes Zoning; RSHZ = Rural Small Holdings Zoning; RZ = Residential Zone; IZ = Industrial Zone; CA = Voluntary Conservation Agreement. **NOTE**: Figures for Habitat buffers cannot be provided as buffer widths are to be determined on a case-by-case basis using ecological criteria (Appendix 9 of the CKPoM). Figures for combined habitat (CH) have subsequently been adjusted.

SWOT	High	Mid	Low	Comments
Strengths				
Existing KH				
Preferred KH				2% of KMU, some moderate patches
Supplementary KH				32% of KMU, some very large patches
Habitat Buffers				
Habitat Linking Areas				8% overlap with SKH
Existing Zonings				
Overlap with EPZ				40% of SKH
Overlap with OCZ				86% PKH, 49% SKH, , 86% HLA(Rural & PRZ)
Koala Population				Existing koala population
HL to Other KMUs				Some links to Tomago and Tomaree KMUs
Weaknesses				
Existing KH				
Preferred KH				Substantial clearing remainder highly fragmented
Supplementary KH				Some clearing, threat from transgressive sand dunes
Habitat Buffers				
Habitat Linking Areas				85% overlap with Mainly Cleared Land
Existing Zonings				
Overlap with Rural 1a				Sand Mining and sand extraction permitted
Overlap with RZ				5% of SKH, , 4% HLA, former at Fern Bay
Overlap with CH				915% of RZ, 17% IZ
Opportunities				
Habitat Conservation				
Voluntary Rezone/CA				PKH at Bobs Farm, SKH along Stockton Bight
Crown Lands				Substantial areas overlapping with SKH
Habitat Restoration				HB/HLA at Bobs Farm & elsewhere, MCL near SKH
Community Groups				Involve existing groups
Education				Build on existing work by community groups
Threats				
Habitat Disturbance				Fern Bay subdivision, transgressive sand dunes
Motor Vehicles				Black spots on Nelson Bay Road, other Conflict Areas
Domestic Dogs				Likely to pose significant threat, partic. near urban
Bushfires				High in SKH along Stockton Bight

Table 6.9. Western Koala Management Unit (KMU). Summary of Strengths, Weaknesses, Opportunities and Threats. Note: KH = Koala Habitat; CH = PKH/SKH/HB/HLA (combined habitat); PKH = Preferred Koala Habitat; SKH = Supplementary Koala Habitat; HB = Habitat Buffer; HLA = Habitat Linking Area; EPZ = Environmental Protection Zonings; OCZ = Other Compatible Zonings; PRZ = Public Recreation Zoning; DPZ = Defence Purposes Zoning; RSHZ = Rural Small Holdings Zoning; RDZ = Residential D Zone; RFUDZ = Rural Future Urban D Zone;; LIZ = Light Industrial Zone; CA = Voluntary Conservation Agreement. **NOTE**: Figures for Habitat buffers cannot be provided as buffer widths are to be determined on a case-by-case basis using ecological criteria (Appendix 9 of the CKPoM). Figures for combined habitat (CH) have subsequently been adjusted.

SWOT	High	Mid	Low	Comments
Strengths				
Existing KH				
Preferred KH				3% of KMU, some moderately sized patches
Marginal KH				26% of KMU, very large contiguous patches
Habitat Buffers				
Habitat Linking Areas				37% overlap with Marginal KH
Existing Zonings				
Overlap with OCZ				66% PKH, and 93% HLA with Rural 1a or 1g
Overlap with CH				Very low, only 4% of Res, 7% Rural 1c
Koala Population				Low numbers of koalas, but could again support pop
Weaknesses				
Existing KH				
Preferred KH				Much cleared, remainder highly fragmented
Supplementary KH				None in this KMU
Habitat Buffers				
Habitat Linking Areas				63% overlap with Mainly Cleared Land
Existing Zonings				Little with EPZ, but much with OCZ
Koala Population				Local extinction/substantial decline since 1800's
Opportunities				
Habitat Conservation				
Voluntary Rezone/CA				Protect existing and encourage restoration
Habitat Restoration				Large areas to be restored, considered worthwhile
Community Groups				Already undertaking restoration works
Education				Build on existing Landcare network
Threats				
Habitat Disturbance				Little now, past impacts still substantial threat today
Motor Vehicles				Currently low, important if pop's re-established
Domestic Dogs				Currently low, important if pop's re-established
Hunting for fur trade				No longer occurring, but past impacts still evident

6.5 Recommended Actions (Opportunities) from the SWOT Analyses

The SWOT analyses have identified actions for each of the nine Koala Management Units (KMUs) within the Port Stephens LGA that are deemed necessary in order to meet the established objectives for the CKPoM. The identified *actions* are outlined in the results summary tables and are detailed as *Opportunities* within the SWOT analyses.

It was decided that for the purposes of the CKPoM, the identified Opportunities from the SWOT analyses should consist of the list of actions that were considered to be both necessary and realistic, rather than documenting a range of potential actions which might be highly desirable from a conservation perspective but that were unlikely to be achieved in the real world.

The recommended actions for each of the Koala Management Units are detailed within the Opportunities section of the SWOT analyses for each KMU (see Appendix 3) and are summarised and presented in section 6.1 of the Port Stephens Council CKPoM.

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7. HABITAT RESTORATION

7.1 Introduction

In the absence of careful management, many koala habitat areas will become further degraded and fragmented, to the detriment of koalas and other native species. Existing land management strategies and practices rarely relate specifically to the restoration of koala habitat, although several community groups in the Port Stephens area do undertake such work. Consequently, a management strategy is considered necessary to identify the principal impacts and to outline opportunities to optimise koala habitat quality within the Port Stephens LGA. Furthermore, as the resources for revegetation works are finite, it is essential that areas be prioritised to ensure the maximum possible benefit of habitat restoration efforts to koala conservation.

Port Stephens Council applied for and was awarded funding in the 1999/2000 round of the Natural Heritage Trust for koala habitat restoration activities throughout the LGA. This project proposal is discussed in the Funding Chapter of the CKPoM Resource Document.

Many of the following issues and impacts have broader implications to other wildlife and land management practices throughout the Port Stephens LGA.

For the purposes of this chapter, the term habitat restoration is used in the same sense as habitat reconstruction, which has been defined by Saunders and Hobbs (1995) as the recreation of the ecological requirements of the target species. For koalas this will involve the provision of trees for food, shelter and social interaction. However, Saunders and Hobbs (1995) maintain that habitat reconstruction means more than simply replanting vegetation (although this is an essential tool); it also involves facilitating the restoration of other ecosystem components and processes that are vital to ecosystem function. Thus, restoration of koala habitat should ideally consist of more than simply replanting suitable species of trees for koalas.

7.2 Objectives

The objectives of the Habitat Restoration chapter are to:

i) Identify principal impacts of land degradation on koala habitat areas;

ii) Identify areas where degradation to koala habitat has occurred or is considered likely to occur;

iii) Identify and discuss appropriate means of addressing impacts and restoring habitat values; and

iv) Detail the criteria to be used to derive a prioritised list of habitat areas to be restored.

7.3 Impacts on Koala Habitat Areas

7.3.1 Koala Habitat Destruction, Degradation and Fragmentation

Habitat destruction and degradation have devastating effects on populations of koalas and other fauna. As well as potential death or injury to koalas during habitat clearing, habitat destruction and degradation can place unnatural pressure on adjacent habitat as remaining animals are confined to smaller areas, with individuals forced to live under sub-optional conditions. The long term effects on koala populations are likely to include increased incidence of disease and mortality, and in severe cases may result in localised extinctions.

Habitat fragmentation can have significant implications for koalas and other fauna populations due to deleterious effects of inbreeding and increased threats from domestic and feral dogs, foxes, motor vehicles and bushfires. Hume (1990) contends that habitat fragmentation is the primary threat to koalas. In addition to the aforementioned deleterious effects, koalas occupying fragmented habitat may suffer nutritional stress, rendering them more susceptible to disease (Hume 1990).

7.3.2 Feral Animals

Feral animals including dogs, foxes, cats and pigs are known to inhabit the Port Stephens LGA. Feral dogs and foxes and to a lesser extent feral cats, are considered to pose a threat to koalas and are addressed in Chapter 10 of this CKPoM.

The impact of feral animals such as dogs and foxes on koalas is exacerbated when habitat is fragmented, as koalas are forced to spend more time on the ground moving between trees, thus making them more vulnerable to predation (Hume 1990). Hence, restoration of fragmented habitat, in conjunction with measures aimed at controlling feral animals, should help to reduce the impact of feral animals on koalas.

7.3.3 Weed Infestation

Like many other coastal areas, the weed problem in the Port Stephens LGA is significant. Bitou bush and Lantana, in particular, are invading natural areas and degrading natural ecosystems.

Weeds could potentially impact on koala habitat by inhibiting natural germination and regrowth of native plant species including koala food trees and by affecting soil nutrient availability.

Weed management and control is central to the effective restoration and management of koala habitat. Where weeds invade native plant communities they can replace existing native vegetation and degrade native habitat. Under the Noxious Weeds Act 1993 there are 34 plants declared for the Port Stephens LGA, however, only nineteen of these are actually known to occur in the area. There also exists a number of other invasive plant species that, although not classified as noxious, can be classed as environmental weeds due to the impact that they may have upon natural ecosystems. Council currently employs two weed control officers who are responsible for implementing Council's noxious weed control program throughout the entire LGA. Council also contributes to noxious and environmental weed control through providing assistance to community groups undertaking weed control

and vegetation management activities, as well as through management of Council's Open Space Areas.

Within the scope of the respective resources and funding allocations, the Hunter Water Corporation, State Forests of NSW, the Department of Land and Water Conservation, Port Stephens Council and the NSW National Parks and Wildlife Service address the issue of weeds with varying degrees of success. Several community organisations, such as Tidy Towns committees, Landcare groups and the Hunter Region Botanical Gardens also undertake weed removal programs in bushland areas.

7.3.4 Bushfires

Severe bushfires have the potential to significantly affect koala habitat and koala populations as was evidenced following the bushfires of January, 1994. Issues associated with bushfires, their potential impacts on the Port Stephens koala population, and management recommendations have been addressed within Chapter 11 of the CKPoM Resource Document.

Habitat fragmentation can exacerbate the harmful effects of bushfires, with recolonisation of habitat by koalas made difficult, or in some cases impossible, where burnt areas are isolated from unburnt habitat supporting breeding aggregations of koalas.

7.4 Areas of Habitat Degradation

The most obvious degradation of koala habitat within the Port Stephens LGA has resulted from agricultural and urban development, sand mining activity and the provision of services such as roads, water, sewage and electricity.

In the early years of sand mining, restoration efforts were often ineffective. Although rehabilitation technology has now improved considerably, vegetation communities that existed in sand mined areas may never fully regenerate. The level of disturbance to adjacent habitat is also likely to affect the diversity of plant and animal species that are available to recolonise.

While the long term survival of koalas within urban environments is questionable, koalas do currently exist within townships such as Lemon Tree Passage, Salt Ash, Anna Bay, Salamander Bay, Medowie and Raymond Terrace. Consequently, the adequacy of remaining habitat (including preferred tree species) within these areas needs to be considered and addressed.

Koala habitat in other areas, including parklands, golf courses, cemeteries and drainage easements, has also suffered from degradation. However, many of these areas are already of benefit to koalas, or could be in the future if planted with suitable food trees.

7.5 Criteria for identification and prioritisation of areas for habitat restoration

Priority must be given to those restoration projects that are likely to maximise the benefit to koala conservation in the Port Stephens LGA. The Koala Habitat Planning Map provides useful guidance in this respect. In particular, Habitat Buffers and Habitat Linking Areas that overlap with Mainly Cleared Land should be given high priority. Recommendations regarding priority areas to be targetted for habitat restoration for each Koala Management Unit are identified via the SWOT (Strengths, Weaknesses, Opportunities, Threats) analyses (see

chapter 6). Additional criteria which would need to be considered in order to prioritise areas for habitat restoration are outlined below. As noted previously revegetation works are an essential tool for habitat restoration.

7.5.1 Intended aims of revegetation works

Hobbs (1993) identifies four ways in which revegetation works can benefit nature conservation. First, revegetation can be used to create buffer strips around existing remnants of native vegetation. This serves to protect the remnant from the harmful effect of external factors (known as 'edge effects') such as nutrient inputs, wind damage and weed invasion. Additionally, if native species are used to establish buffers then they can also provide extra habitat. Land identified on the Koala Habitat Planning Map as Habitat Buffer over Mainly Cleared Land would be suited for such revegetation works.

Second, revegetation can aim to re-establish linkages between currently isolated habitat patches. Linking patches of habitat has the potential to ameliorate some of the detrimental effects of habitat fragmentation, for example by facilitating the exchange of genetic material between sub-populations and thus reducing the chance of inbreeding; by allowing koalas access to additional resources; or by facilitating the dispersal of sub-adult koalas and subsequent recolonisation of unoccupied habitat. High priority will be given to projects aimed at restoration of areas identified as Habitat Linking Areas over Mainly Cleared Land on the Koala Habitat Planning Map. These areas are likely to play a significant role in the long term conservation of koala populations within the LGA, including those that occupy otherwise fragmented habitat.

Third, revegetation can be used to extend existing habitat. This could be accomplished in part by establishing buffers and linkages and thereby increasing the number of trees available for use by koalas for food and/or shelter.

Finally, revegetation can be aimed at enhancing the quality of existing habitat, both to increase its worth as habitat and to stop the encroachment of land degradation such as dieback, soil salinisation, and soil erosion, thus helping prevent further decline in habitat quality.

The habitat restoration program established by the CKPoM will include revegetation works that attempt to address each of these four aims and which have the potential to contribute greatly to the conservation of the Port Stephens koala population. Revegetation works could address an individual aim, or may address several aims concurrently. There may be circumstances where preference needs to be given to one aim over another; for instance it may be desirable to use resources to enhance the quality of existing habitat and Habitat Buffers ahead of restoring linkages between habitat areas. Priority should be given to those works which have greatest potential long term benefit to the Port Stephens koala population.

7.5.2 Size of habitat patches

It makes intuitive sense that for patches of similar habitat, larger patches will generally have the potential to support greater numbers of koalas than smaller patches. Consequently, revegetation aimed at enhancing, buffering, adding to or linking larger remnants will generally be given priority over smaller remnants. However, there may be instances when several small habitat patches collectively have the same potential to support koalas as a

single large patch of similar size. Under such circumstances priority would be assigned using other criteria, for example the effort required for restoration (see section 7.5.7).

In assessing the importance of patch size it will be important to estimate the minimum area of a given habitat type that is capable of maintaining integrity and supporting a viable breeding population of koalas. This would contribute to ensuring that resources are not wasted on unviable habitat areas. Data on home range sizes, such as that collected by the NPWS radiotracking program following the 1994 bushfires, will be important for this process. However, determination of a minimum viable area will be influenced by the nature and quality of the habitat in the first instance.

7.5.3 Shape of habitat patches

The shape of habitat patches is important as it determines the perimeter to area ratio, which in turn usually influences the impact of edge effects. Patches with a high perimeter to area ratio, for example long and narrow patches, are usually subject to greater edge effects than those with lower ratios. Patches that are more susceptible to edge effects will generally require more active management and in extreme cases will not be viable over the long term.

7.5.4 Type of koala habitat

The types of koala habitat that comprise a remnant need to be considered when assigning priority to restoration works, as different habitat types will vary in their value to the long-term conservation and management of koalas (see Chapter 2, Koala Habitat Identification). Three koala habitat categories were identified for the Port Stephens LGA in the CKPoM. In order of decreasing importance to koalas these are: Preferred, Supplementary, and Marginal Koala Habitat. Priority for revegetation works should be given where this involves remnants containing Preferred Koala Habitat over those containing Supplementary Koala Habitat, which in turn should be given priority over remnants containing Marginal Koala Habitat. Where two remnants both contain a particular type of habitat (especially Preferred and/or Supplementary Koala Habitat), priority should be assigned on the basis of the areal extent and shape of the respective habitat types; e.g. revegetation works involving a remnant with a larger area of Preferred Koala Habitat would be ranked higher that that involving a remnant with a smaller area of Preferred Koala Habitat. Again, exceptions to this rule may occur, for example where several small patches of Preferred Koala Habitat have the potential to be effectively linked through habitat restoration.

7.5.5 Size of koala population/presence of extant populations

As population estimates for various remnants throughout the Port Stephens LGA are generally not available there is little opportunity for using this criterion to guide habitat restoration efforts at present. However, as such data becomes available via the monitoring program it will be used to reevaluate priorities where necessary. For instance, priority should be given to works that would be beneficial to a greater number of koalas, and thus should be targeted at areas with larger koala populations. That is not to say that habitat that does not support extant populations should be neglected, nor should the idea of restoring such patches be discounted, as the existence of this vacant habitat could prove crucial in the future. However, initial resources should be directed to those patches that currently support koalas, particularly where prospects for long term survivorship of the population are

considered to be good and are likely to be significantly enhanced by habitat restoration activities.

7.5.6 Presence of threats to koalas

When planning revegetation works it is necessary to consider the potential threats to koalas if they use replanted areas in the future. In the Port Stephens LGA the main threats to be considered in this regard are motor vehicles, domestic and feral dogs, and bushfire. Revegetation works may in fact be detrimental to koalas if they increase the risks associated with such threats. For instance, revegetation works that involve the planting of koala food trees in the vicinity of a major road could result in more koalas being hit by motor vehicles. Similarly, plantings that attract koalas to urban areas may result in a greater number of dog attacks on koalas. The latter problem should be addressed by programs aimed at minimising threats to koalas from domestic dogs. The former problem is probably best solved by avoiding revegetation works in the immediate vicinity of major roads.

7.5.7 Effort required for restoration

In deciding how best to allocate resources to revegetation works, consideration needs to be given to the effort that will be required to achieve the goals of each project. The effort required will depend on the goals that are set (see section 7.5.10 for further discussion on goals), and will also be a function of the degree of modification that has occurred to the area in question (Hobbs and Hopkins 1990). Areas in which ecosystems have been highly modified (e.g. by mining) will require greater effort for restoration than those that have been modified to a lesser degree (e.g. by clearing, or lesser still, by changed fire or grazing regimes; Hobbs and Hopkins 1990). Thus, a decision has to be made on whether resources are used to redress less substantial modifications at a number of locations, or to address instances where the degree of modification has been high in fewer locations, or a combination of the two.

7.5.8 Current land tenure and land use zoning

Current land tenure is an important factor to consider as this will ultimately determine whether planned restoration works can be carried out. Recourse should be made to the land tenure to establish whether permission for works can be obtained, whether the land owner or land management agency can assist with the works, and importantly who will be responsible for the ongoing maintenance of any plantings. Long term security of restored areas will also be a critical issue.

The current land use zonings as identified under the Port Stephens Local Environment Plan (LEP) 1987 and subsequent amendments, and indeed future land use zonings proposed under Council's Draft LEP 1999 also need to be considered. Clearly, the benefit of restoration works could be compromised, or rendered totally ineffective, if for instance, future development occurs in those areas. Thus, priority should be given to areas where the land use zoning or other constraints on potential land use is unlikely to result in the future development and consequent degradation of restored habitat.

7.5.9 Pre-European vegetation of the area

Historical studies that give insight into the distribution of plant communities prior to European settlement need to be considered for at least two reasons. First, they provide guidance on where certain species should be planted, which is needed if revegetation aims to restore the mosaic of plant communities that existed before European settlement. Second, these studies can be used to estimate the extent to which habitat areas were connected in the past. This has important long term implications when considering the reestablishment of links between habitat areas, due to potential detrimental effects on population genetics when two previously isolated populations of a species are connected (Soule and Gilpin 1991). In the case of the Port Stephens LGA such considerations may only apply to any potential programs involving interaction between the koala populations on the east of the Pacific Highway and the small number of individuals that are thought to remain in the west of the LGA. The research on the ecological history of the Port Stephens LGA (Knott *et al*. 1998) as detailed in chapter 3 of the CKPoM Resource Document, will be of great benefit in guiding habitat restoration activities.

7.5.10 Other considerations

Two other issues need to be considered in planning revegetation works aimed at restoration of koala habitat. First, there is a need to define the goals of each restoration project (Hobbs and Hopkins 1990). In particular, a decision needs to be made on whether the goal is to restore the ecosystem to what it was prior to modification, which would perhaps be of greater benefit to other species and in addressing land degradation generally. Alternatively, the goal may be species-specific, i.e. to restore koala habitat. Consideration also needs to be given to what goals are achievable (Hobbs and Hopkins 1990).

Second, because there are many criteria that need to be considered to determine priority, and this determination should be made as objectively as possible, it would be valuable to explore the possibility of using Population Viability Analysis (PVA) to assist with prioritising restoration projects. However, this would depend on the extent to which PVA models for the koala, and in particular for the Port Stephens koala population, have been developed by the time projects are required to be ranked. In any case, the results of a koala specific PVA could be incorporated into ongoing reviews of habitat restoration projects and priorities.

7.6 Guidelines for revegetation works

When undertaking revegetation works, it is most desirable to plant species that naturally occur in the area being replanted. Information on the plant species that naturally occur in an area can be obtained from surveys of remnant vegetation, or, if little natural vegetation remains, from historical records and reconstructions of pre-European vegetation, such as that undertaken by Knott *et al.* (1998).

Revegetation works aimed at restoring koala habitat should include replanting of preferred tree species in areas where these occurred naturally. Preferred koala food trees in the Port Stephens LGA are: *Eucalyptus robusta* (Swamp Mahogany), and *E. parramattensis* (Parramatta Red Gum) wherever they occur and *E. tereticornis* (Forest Red Gum) where it occurs on higher nutrient (such as volcanic or alluvial) soils. *E. robusta* should be considered for planting on swampy or poorly drained soils throughout the LGA; *E. parramattensis* on poorly drained soils in the vicinity of the Tomago Sandbeds; and *E.*

tereticornis on alluvial soils in the west and north of the LGA and volcanic soils, such as those on the Tilligerry and Tomaree Peninsulas. Species known to be preferentially utilised by koalas in other areas; such as *E. microcorys* (Tallowwood), *E. punctata* (Grey Gum) and *E. propinqua* (Small-fruited Grey Gum), should also be considered for planting in areas where they naturally occur in the Port Stephens LGA.

Trees other than preferred koala food trees may also be of significance to koalas; such as for shelter or for social interactions. Hence, other tree species should also be planted. Indigenous understorey and groundcover species should also be planted, as they or the animals for which they provide habitat can contribute to ecosystem function and thus help ensure the long term survival of the ecosystem. Ideally, the information sources described above should be employed to estimate the natural densities of indigenous species and replanting carried out accordingly. Wherever possible, seedlings for replanting should be propagated from seed collected from local plants.

7.7 Management Strategy

A substantial area of the Port Stephens LGA remains in a relatively natural state. The authorities responsible for the management of these areas generally lack the resources to effectively deal with the full range of factors that can adversely affect quality of fauna habitat.

Consequently, methods for providing assistance to land management agencies, where appropriate, should be explored.

7.7.1 Co-ordination of habitat restoration

Effective habitat restoration is generally very labour intensive, requiring a substantial number of dedicated people. People who may be able to assist with habitat restoration programs include community and school groups, Landcare groups, people directed to carry out community service, ecotourism groups, and employment programs such as the Federal Government's Green Corps program.

While these groups and individuals are often capable and willing to undertake this type of work, there is, at present, no overall co-ordination within the Port Stephens LGA. Specific co-ordinating roles are currently the responsibility of different Officers of Port Stephens Council. It would be beneficial to make these tasks the responsibility of one Council Officer.

Council's Vegetation Management Officer is currently employed for three days a week to assess applications under Council's Tree Preservation Order and other tree management matters. Council recently resolved to expand this position to five days a week from the 1999/2000 financial year. While the extra duties of this position have yet to be finalised, they could include co-ordination of community habitat restoration and revegetation programs.

As mentioned previously in section 4.7 of this CKPoM, Port Stephens Council is required to prepare Plans of Management for Council-owned community land and Crown Land of which Council is a trustee or has care, control and management. Where priority areas for koala habitat restoration are identified on land managed by Port Stephens Council, provision should be made in the relevant Plan of Management for their restoration.

7.7.2 Provision of Nursery Stock

In order to undertake the necessary habitat restoration work, an adequate provision of nursery stock would be required. Existing nurseries and/or community groups that currently produce tubestock could be approached to provide suitable species for planting. The stock to be used for restoration projects should ideally be propagated from local provenance seed.

7.8 Recommendations

See section 7.2 of the Port Stephens Council CKPoM.

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8. TRAFFIC MANAGEMENT

8.1. Introduction

Roads and traffic result in some of the most obvious impacts on koalas in the Port Stephens Local Government Area (LGA). An average of 32 koalas have been reported hit by vehicles each year from 1988 to 1997 inclusive. Approximately 74% of these collisions resulted in the koala's death. The problem is even more significant when one considers that not all collisions are likely to be reported, and that almost 200 km of the approximately 600 km of roads within the Port Stephens LGA pass either through or adjacent to koala habitat.

It would be impossible to completely eliminate the impacts of roads and traffic on koalas, due to the nature of koala movements and home ranging behaviour and the substantial amount of habitat affected. Therefore, the management strategies addressed in this chapter aim to reduce the number of koalas hit on roads and to increase driver and community awareness so that when koalas are hit, people will know who to contact and be in a better position to assist.

8.2. Objectives

The objectives of the Traffic Management chapter are to:

i) Identify roads and/or sections of roads within the Port Stephens LGA where koalas are known to cross and/or be hit by traffic; and

ii) Detail relevant management strategies and recommendations to reduce the number of collisions involving koalas and to increase community awareness.

8.3 Statistics

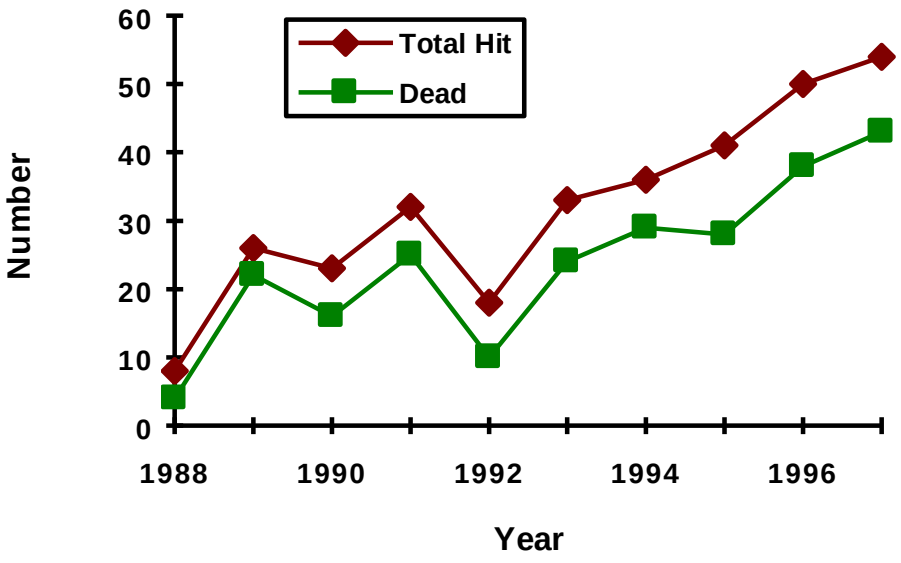
According to figures provided by the Hunter Koala Preservation Society and the Native Animal Trust Fund, 325 koalas were hit by vehicles within the Port Stephens LGA between December, 1987 and March, 1998. The actual number of koalas hit is undoubtedly greater than this, as not all collisions are likely to be reported. This was evident from the Port Stephens Koala Survey which identified a number of koalas hit by vehicles that had not been previously reported.

8.3.1 Fatality Rate

The number of known koala fatalities on Port Stephens roads between December, 1987 and March, 1998 totalled 241. This represents a 74% fatality rate based on the overall number of koalas hit by vehicles and reported to either the Native Animal Trust Fund or the Hunter Koala Preservation Society.

Figure 8.1 shows the number of koalas reported hit by vehicles and the number that died as a result between January, 1988 and December, 1997.

FIGURE 8.1. Koalas Hit By Cars - By Year, 1988-1997.
(Data for 1988 to 1994 inclusive supplied by the Hunter Koala Preservation Society, for 1995 to 1997 inclusive supplied by the Native Animal Trust Fund).



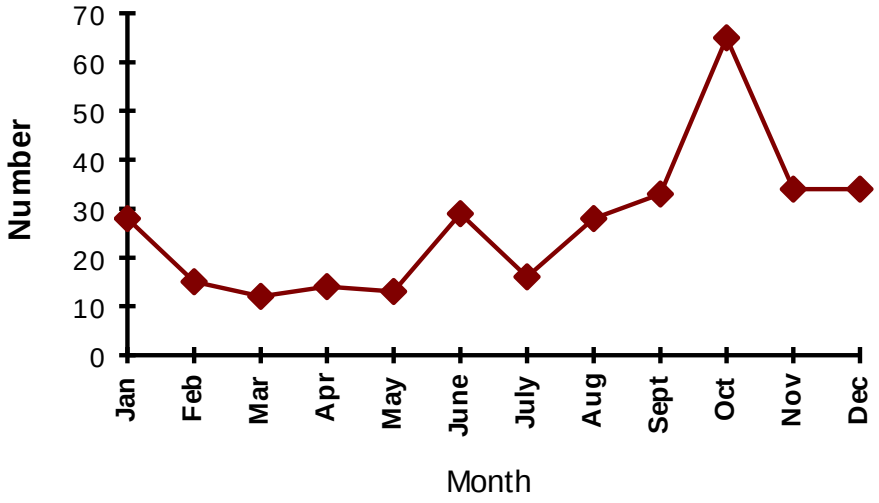
The accuracy of these records has probably improved as the Native Animal Trust Fund (NATF) and the Hunter Koala Preservation Society (HKPS) have become more widely known and local media coverage of koala issues has increased. Consequently, it is expected that people are now more likely to report incidents when koalas are hit by vehicles.

8.3.2 Peak Collision Period

Koalas are likely to be most active in terms of movements within their home range during the breeding season from approximately August to February. During this period the number of koalas hit by cars tends to increase. As illustrated in Figure 8.2, the majority (74%) of reported vehicle collisions with koalas in the Port Stephens LGA occur during the koala breeding season. The lowest number of reported monthly collisions

between January 1988 and December 1997 inclusive occurred during autumn (see Figure 8.2). There is a need for drivers to be especially aware that koalas are likely to be encountered on roads at this time of the year. This should be promoted as part of the education programs presented in chapter 13 of the CKPoM Resource Document.

FIGURE 8.2. Koalas Hit By Cars - By Month, January 1988 to December 1997 inclusive.
(Data supplied by the Hunter Koala Preservation Society and the Native Animal Trust Fund).



8.4 Koala Road Fatalities and Vehicle Speed

Records from the Native Animal Trust Fund for the period 1st January 1994 to 26th March 1998 were used to investigate the potential relationship between the likelihood of a koala surviving a collision with a motor vehicle and the speed zone within which the collision occurred. Only those records that could be confidently located within one of the three major speed zones (60 km/hr, 80 km/hr and 100 km/hr) were used. These included records from a number of different roads throughout the Port Stephens LGA. The koala survival rate following collision within each speed zone is set out in Table 8.1.

TABLE 8.1. Koala Survival Rate Following Collisions within Various Speed Zones. (NATF data from 1st January 1994 to 26th March 1998).

SPEED ZONE	SURVIVAL RATE
60 km/hr	**36% (14 hit, 9 died)**
80 km/hr	**25% (12 hit, 9 died)**
100 km/hr	**21% (38 hit, 30 died)**

While these data may suggest a potential relationship between speed zone and the likelihood of a koala surviving a collision, there was no statistically significant difference in survivorship among speed zones. Analysis of these data suggest that koalas are equally likely to die as a result of a vehicle collision, regardless of whether the speed zone is 60km/h, 80km/h or 100km/h. Notwithstanding, the authors maintain that it is likely to be more difficult for drivers to avoid hitting a crossing koala where the vehicle is travelling at higher speeds.

Additional factors, aside from the speed zone, are considered likely to influence the chances of a driver being able to avoid colliding with a crossing koala. Such factors might include the width of the cleared zone between the road edge and adjacent trees, the presence of roadside depressions, the height of roadside vegetation, the degree of disturbance to habitat in adjacent areas, and the nature of any roadside lighting. These factors may affect a driver's ability to see a crossing koala before it actually reaches the roadway.

8.5. Disturbance to Habitat

When habitat is removed or degraded, resident koalas may be forced to move beyond their normal home range in order to re-establish contact with other members of the local population and/or to satisfy their nutritional requirements. Such forced movements may involve additional road crossings and associated increase in potential conflict with vehicles. Habitat disturbance could be associated with factors such as tree removal, development activity or bush fire.

The road sections within the Port Stephens LGA that have been identified as "black spots" can generally be associated with adjacent areas of koala habitat together with habitat disturbance in the vicinity.

8.6 Identification of Collision Areas

Concentrations of koala collisions occur on Richardson Road and Lemon Tree Passage Road in particular, as well as several other roads within the Port Stephens LGA including the Pacific Highway. On the basis of information obtained from Native Animal Trust Fund records, the Port Stephens community-based koala survey and the Australian Koala Foundation's Koala Habitat Atlas, a number of apparent black spots, conflict areas and potential problem areas have been identified.

The above mentioned data supports the contention that koalas are most likely to be hit on the roads within the Port Stephens LGA that either pass through or adjacent or near to koala habitat. Figure 8.3 shows where koalas have been reported as hit by vehicles within the LGA.

8.6.1 Black Spots

Although difficult to define, a Black Spot for the purposes of the Port Stephens Council CKPoM is a section of road which carries a high traffic volume and where koala collisions are known to occur in relatively high numbers on a regular basis.

Using data from the Native Animal Trust Fund for the period 1/1/94 to 26/3/98, a number of Black Spots have been identified on Richardson Road, Lemon Tree Passage Road, the Pacific Highway, Medowie Road and Nelson Bay Road. Figure 8.3 illustrates these Black Spot locations.

1. Richardson Road

A total of 45 koalas were reported hit by cars along Richardson Road (Photo 1) between 1/1/94 and 26/3/98, 35 of which died as a result. The following areas have been identified as Black Spots along this road:

Campvale

Twenty two koalas were reported hit along an approximately 3 km section of Richardson Road west from the roundabout at the Medowie Road intersection, passing through Campvale. Eighteen of these died as a result. This section of road is characterised by:

i) Preferred and Supplementary Habitat in the vicinity.

ii) Sand mining within nearby areas.

iii) Both 100 km/h and 80 km/h Speed Zones, on a road in good condition that probably encourages even higher speeds.

iv) Poor clear zones on the road verges. Recent slashing of roadside vegetation has sought to improve visibility.

Grahamstown

Ten koalas were reported hit along a 5 km to 6 km section of Richardson Road adjacent to Grahamstown Dam. Nine of these died as a result. This section of road is characterised by:

i) Preferred Habitat in the vicinity (adjacent to the road in parts).

ii) A Speed Zone of 100 km/h.

iii) Nearby residential development at Lakeside Village.

Salt Ash

Ten koalas were reported hit along a 1.5 km section of Richardson Road approaching Salt Ash. Five of these died as a result. This section of road is characterised by:

i) Supplementary and some Preferred Habitat in the vicinity.

ii) Both 100 km/h and 80 km/h Speed Zones.

iii) Rural/residential development.

2. Lemon Tree Passage Road

A total of 26 koalas were reported hit along the entire length of Lemon Tree Passage Road between 1/1/94 and 26/3/98, 19 of which died as a result. The following areas are identified as Black Spots along this road:

Rookes Road to Tanilba Bay

This section includes a 7.5 km stretch of Lemon Tree Passage Road between the western Rookes Road intersection and the start of the Tanilba Bay urban area. Sixteen koalas were reported hit along this section. Ten of these died as a result. This section of road is characterised by:

i) Preferred Habitat to the south of the road along Tilligerry Creek (in parts adjacent to the road), and Other Vegetation (heathland/sedgeland) to the north.

ii) Poor roadside clear zones in places.

iii) Rural/residential development.

iv) Sand mining activities in the vicinity.

v) A history of high fire frequency which may result in increased koala movement following fires.

vi) A Speed Zone of 100 km/h on a road that is long and straight and likely to encourage even higher speeds.

Tanilba Bay to Lemon Tree Passage

This includes a section of Lemon Tree Passage Road approximately 4 km in length between the western edge of the Tanilba Bay urban area and Lemon Tree Passage. Six koalas were reported hit along this section. Five of these died as a result. This section of road is characterised by:

i) Patches of Preferred and Supplementary Habitat adjacent to and in the vicinity of the road.

ii) Residential development.

iii) Speed Zones of 70 km/h and 60 km/h.

3. Pacific Highway

A total of 25 koalas were reported hit at various locations along the Pacific Highway within the Port Stephens LGA between 1/1/94 and 26/3/98. Twenty four of these koalas died as a result. The Pacific Highway now by-passes Raymond Terrace via a section opened in December 1998. The Pacific Highway carries very high traffic volumes. Particular black spots along the Pacific Highway within the LGA include:

Raymond Terrace

A total of eight koalas were reported hit along the old Pacific Highway through Raymond Terrace. Seven of these died as a result. The precise location of some of these records is not available although some localities are given (e.g. two koalas were killed near the Bi-Lo car park). This section of the old highway is characterised by:

i) Isolated patches of Preferred Habitat in the area.

ii) Very high traffic volumes.

iii) A Speed Zone of 60 km/h.

iv) A predominantly urban koala population dependent upon highly fragmented habitat and scattered individual trees, under considerable threat from traffic and dogs in particular.

Heatherbrae/ Motto Farm

The section of the Pacific Highway, approximately 2 km to 3 km in length in the vicinity of Heatherbrae, Motto Farm and Windeyers Creek. Eight koalas were reported hit along this stretch. All of these died as a result. This section of the highway is characterised by:

i) Areas of Preferred Habitat adjacent to and in the vicinity of the road.

ii) Large traffic volumes, condensed from two lanes to one lane between the High School and Raymond Terrace.

iii) A Speed Zone of 80 km/h which is often exceeded.

4. Medowie Road

A total of 16 koalas were reported hit along Medowie Road between 1/1/94 and 26/3/98. Fourteen of these koalas died as a result. One black spot has been identified along this road:

Williamtown to Richardson Road

Twelve koalas were reported hit along the four kilometre section of Medowie Road between the Nelson Bay Road intersection and the Richardson Road intersection. Ten of these died as a result. This section of road is characterised by:

i) Preferred Habitat adjacent to the road.

ii) Sand mining in the vicinity.

iii) Both 90 km/h and 100 km/h Speed Zones on a straight section of road likely to encourage higher speeds.

5. Nelson Bay Road

A total of 15 koalas were reported hit along this road between 1/1/94 and 26/3/98. Nine of these koalas died as a result. The following areas have been identified as Black Spots along this road:

Oakvale/ Salt Ash

Eight koalas were reported hit along the Nelson Bay Road in the vicinity of Oakvale and Salt Ash. Five of these died as a result. This section of road is characterised by:

i) Preferred Habitat adjacent to and in the vicinity.

ii) Rural/residential development.

iii) Both 80 km/h and 90 km/h Speed Zones.

Williamtown

Six koalas were reported hit along the section of Nelson Bay Road in the vicinity of Williamtown. Three of these died as a result. This section of road is characterised by:

i) Preferred Habitat in the vicinity.

ii) Both 80 km/h and 90 km/h Speed zones.

PHOTO 1. Richardson Road, between Grahamstown Dam and Campvale

8.6.2 Conflict Areas

A Conflict Area is defined as a road or part of a road where koala collisions are known to occur periodically or sporadically. The Swot Analyses chapter provides additional discussions pertaining to many of the Conflict Areas. Figure 8.3 shows the Conflict Areas identified within the Port Stephens LGA. These include the following:

- The Pacific Highway between the Old Punt Road intersection and Karuah Bridge;
- Tomago Road between Old Punt Road and Masonite Road;
- Cabbage Tree Road;
- Port Stephens Drive;
- The Bucketts Way;

- Brocklesby Road, Medowie (section running north/south);
- Streets within Lemon Tree Passage, Anna Bay, Medowie, Mallabula and Tanilba Bay;
- Irrawang Street and Elizabeth Avenue and other streets in the vicinity of Boomerang Park, Muree Golf Course and Raymond Terrace Cemetery within Raymond Terrace;
- Masonite Road;
- Gan Gan Road from Anna Bay north to Nelson Bay Road;
- Oyster Cove Road;
- Frost Road;
- Richardson Road near Moffats Swamp;
- Lemon Tree Passage Road near Salt Ash;
- The Pacific Highway near Tomago (between the Hunter Region Botanical Gardens and the Hexham Bridge); and
- The Pacific Highway near the Balickera Canal.

8.6.3 Potential Problem Areas

A Potential Problem Area is defined as a section of an existing or proposed road which passes through or adjacent to known koala habitat, but which is not included within the former two categories. Figure 8.3 shows the Potential Problem Areas identified within the Port Stephens LGA. These include the following:

Pacific Highway Upgrading

The Roads and Traffic Authority is in the process of upgrading the Pacific Highway between Raymond Terrace and Karuah to a four lane dual carriageway. The Koala Habitat Planning Map has identified Preferred Koala Habitat within the vicinity of the highway upgrading works. The community-based koala survey provided a substantial number of koala records along the route.

The RTA has recently commissioned a six year koala monitoring study to investigate the efficacy of ameliorative measures associated with the Pacific Highway upgrading between Newcastle and the NSW/Queensland Border, and to evaluate the extent of impacts on koalas over the study period.

Pacific Highway-Raymond Terrace Bypass

The Roads and Traffic Authority prepared an Environmental Impact Statement (EIS) and Fauna Impact Statement (FIS) for this proposal which acknowledged that the road would impact on koalas and could result in their localised extinction from the Raymond Terrace urban area. The EIS and FIS recommended that a series of underpasses be provided under the road in conjunction with exclusion fencing to prevent koalas crossing the road and to direct them towards the underpasses.

The Raymond Terrace bypass was opened in December 1999 in conjunction with an initial 18 month koala monitoring study, which involves radio tracking. Some initial concerns include the movement of koalas around the current northern extent of the exclusion fencing. In addition to this issue, the current exclusion fencing is likely to funnel koalas onto the underpasses for Mount Hall Road and Richardson Road, where they would be exposed to increased threats from traffic.

The authors maintain that the prospects for long term survival of the remaining Raymond Terrace koala population to the west of the bypass are very poor. It is recommended that recruitment of new animals into the area should be discouraged due to the limited available habitat, lack of suitable habitat further to the west and the high level threats.

Pacific Highway-Karuah Bypass

The Roads and Traffic Authority have commissioned the preparation of an Environmental Impact Statement (EIS) and Species Impact Statement (SIS) for the proposal. The Koala Habitat Planning Map has identified a number of areas of Preferred Koala Habitat within the general location of the proposed bypass.

Fingal Bay Tourist Road

Sinclair Knight and Partners have prepared an EIS for the proposed Fingal Bay Tourist Road on behalf of Port Stephens Council. Both the community-based koala survey (1992) and the preliminary investigations into the EIS identified the presence of koalas in the area. A number of route options were assessed with the preferred option considered likely to be the most environmentally sensitive. However, if this option is considered likely to effect koalas, it will be necessary for the EIS to recommend strategies to minimise impacts.

Port Stephens Drive

Port Stephens Drive is a local road carrying an increasing volume of traffic. Most development potential on the Tomaree Peninsula either occurs in the vicinity or is serviced by this road (South Salamander, Cromarty Bay/Taylors Beach, Salamander Bay and Soldiers Point). The community-based koala survey (1992) suggested that koalas inhabit both the eastern and western sides of this road. The Koala Habitat Planning Map identified both Preferred and Supplementary Koala Habitat on both sides of the roadway. In addition, the general area experiences regular bush fires. Consequently, future development coupled with bush fires could result in more frequent road crossings by koalas.

Proposed Nelson Bay Road Upgrade

The proposed Nelson Bay Road upgrade will include road widening and possible road deviations. Road widening would enable the construction of a dual carriageway to the west of the existing road between Fern Bay and Fullerton Cove Road. Possible new road corridors have been identified to the north of the existing road between Williamtown and south-west of Salt Ash and south of the existing road to the east of Salt Ash. The Koala Habitat Planning Map identified Preferred Koala Habitat in the vicinity of all of the areas described above.

Port Stephens Council and the Roads & Traffic Authority have identified a possible road corridor to enable the construction of a dual carriageway through the sand hills at Salt Ash and Bobs Farm, along Nelson Bay Road. Funding for this work is proposed to come from State road funds administered by the RTA. This proposal is the result of considerable public pressure to improve the road standard, given very high volumes of annual traffic. Koalas are known to inhabit this area.

These authorities have also proposed to upgrade Nelson Bay Road along the existing route between Bobs Farm and Anna Bay. There is Preferred Koala Habitat in the vicinity of this stretch of road.

FIGURE 8.3. Black Spots, Conflict Areas and Potential Problem Areas

8.7 Management Strategies

A number of potential strategies could be used to address the issue of conflict between koalas and traffic. Determination of the appropriate strategy will require consideration of a number of factors ranging from habitat characteristics, to the roadside environment.

8.7.1 Current Strategies

A number of strategies are currently used in the Port Stephens LGA including:

i) Fatality Signs

Fatality signs (Photo 2) may have been successful in highlighting the problem of koala collisions along Lemon Tree Passage Road. However, it is difficult to determine whether these signs have had a positive effect in reducing the number of koala collisions along this section of road. The fatality signs are a unique initiative of Port Stephens Council. They are updated annually in order to keep the community, and more specifically drivers, informed of the known impact. It would be useful to review the use of these signs, particularly in respect to their location and size.

PHOTO 2. Koala Fatality Sign

ii) Wildlife Reflectors

It is considered unlikely that the wildlife reflectors (Photo 3), which are currently installed on sections of Richardson Road and Lemon Tree Passage Road, will reduce the number of collisions between vehicles and koalas. The reflectors which are positioned on guide posts, were originally developed in Europe where deer present a significant traffic management issue. Furthermore, the effectiveness of wildlife reflectors is influenced by the frequency of traffic, which determines the frequency that headlights are reflected into adjacent habitat. However, at this stage, the optimal height for positioning reflectors and the response of koalas to such reflected light has not been determined.

PHOTO 3. Wildlife Reflector

iii) Koala Warning Signs

Koala warning signs have incorporated a number of designs over recent years. In urban areas of Port Macquarie the koala warning sign design illustrates a koala sitting in a tree. More recent designs, such as those used in Coffs Harbour and Port Stephens, illustrate a koala walking along the ground (Photograph No.4). These signs cost up to approximately $200 to purchase and install.

PHOTO 4. Koala Warning Signs

iv) Injured Wildlife Information Signs

When a koala or any native animal is hit by a vehicle and survives, it is important that the animal receives quick and appropriate attention. One method of informing people of appropriate action when they encounter injured fauna is to provide information signs as shown in Figure 8.4. These signs should be located in association with speed zones of 80km/h or less, with consideration also given to their size, to help ensure they can be easily read by passing motorists. Attention should also be given to their location, in particular whether they are likely to be more effective where they are located just before motorists enter a high risk area (and possibly before an animal is hit by a vehicle), or where they are located as the motorist leaves such an area (so they are potentially seen after an animal has been hit by vehicle and the vehicle is leaving the area).

The sign shown in Figure 8.4 has been installed at the following locations in the Port Stephens LGA:

- Either end of the dual carriageway of Nelson Bay Road where it passes through the sand hills between Salt Ash and Bobs Farm;
- On Richardson Road near the intersection with Grahamstown Road (east bound lane) and near Salt Ash (west bound lane);
- On Medowie Road to the south of Medowie (south bound lane) and to the north of Williamtown RAAF Base (north bound lane); and
- On Tomago Road near the entrance to Tomago Aluminium (east bound lane) and near the intersection with Barry Close (west bound lane).

The installation of these signs should be considered for other identified Black Spot and Conflict Areas.

FIGURE 8.4 Injured Wildlife Information Sign

8.7.2 Exclusion Fencing

A number of designs have been developed for koala exclusion fences. One design consists of a flat metal surface facing away from the road, with fence support structures on the side closest to the road as illustrated in Figure 8.5.

A design initially trialled in South East Queensland involved cyclone mesh fencing supported firmly at the base and left floppy at the top. In parts of Northern NSW cyclone mesh fencing has been used with a metal strip attached near the base, such as a section along Old Bogangar Road in the Tweed LGA.

A further design which was trialled in Victoria included the use of a cyclone mesh fence supported by cranked posts with electric wires fitted to the mesh (Prevett, 1991b. pg49).

Potential problems associated with exclusion fencing include the following:

- Exclusion fences contribute to habitat fragmentation which may lead to reductions in genetic diversity, increased vulnerability to disease, impediments to potential recolonisation following severe bushfires, and potential reductions in the long term viability of koala populations;
- Exclusion fences would also function as a barrier to the movement of many other species of native fauna;
- Exclusion fences may be ineffective where there are a number of property accesses onto the road as the design requires a continuous fence-line;
- Exclusion fences require careful consideration and planning in terms of design specifications and placement;
- Exclusion fencing over large areas can be reasonably expensive; and
- In the absence of regular maintenance, they are unlikely to remain effective for koalas and other fauna.

Additional issues relating to exclusion fences are discussed in Appendix 7 of the Port Stephens Council CKPoM.

FIGURE 8.5. Metal Exclusion Fencing

8.7.3 Road Crossings

Road crossing strategies aim to provide opportunities for safe koala road crossings. Four principal methods are available, although none as yet have been demonstrated to function effectively at a population level:

i) Koala underpasses;

ii) Koala crossings; and

iii) Road bridges that span habitat.

i) Koala Underpasses

Current fauna underpass designs vary considerably, although many structures consist of little more than 1.5 m to 2 m diameter pipes underlaying a road and would arguably be of minimal use to fauna. Larger box-style culverts of up to around 3 m by 3 m have been installed on a number of major roads within NSW. Koala-proof fencing is generally installed in an attempt to direct koalas to underpass structures.

However, the effectiveness of underpasses has yet to be determined. As arboreal mammals, koalas are considered likely to be reluctant to enter a relatively small pipe under a road. Prevett (1991b) argues that koalas are highly dependent upon smell and may be deterred through use by other animals, such as foxes or dogs or a dominant male koala. A small number of comparative studies of underpass use by fauna have been undertaken within NSW including investigations by the Australian Museum Business Services concerning the F3 Freeway north of Sydney and the Australian Koala Foundation concerning a section of Old Bogangar Road in the Tweed LGA. Guidelines on the design of koala underpasses are provided in Appendix 7 of the Port Stephens Council CKPoM.

ii) Koala Crossings

Koala crossings are also largely untrialled, see Figure 8.6. Like fauna underpasses, they would involve the use of exclusion fencing to direct koalas to a control point on the road for crossing.

FIGURE 8.6 Koala Crossing

This method would reduce the length of road that could be crossed, and could be coupled with appropriate signs, street lighting, speed zones and road markings at designated koala crossings. This could potentially result in a reduction in collisions with koalas.

iii) Road Bridges

Bridges that span habitat are also considered to be worth trialling. However, this method would involve greater expense in comparison to other methods. This method would not generally be appropriate for existing roads. However, bridges should be considered when new roads are planned for areas where there is no feasible alternative to crossing significant Koala Habitat. This method may be cost effective if considered in conjunction with requirements for drainage and flood mitigation. Guidelines on the design of koala overpasses are provided in Appendix 7 of the Port Stephens Council CKPoM.

8.7.4 Speed Reduction

As stated earlier, the chances of a driver being able to avoid hitting a crossing koala is expected to diminish with increased vehicle speed. The proposal to decrease the speed zone in the black spot along Lemon Tree Passage Road was put to the Traffic Committee in December 1991. The Traffic Committee gave the following reasons for rejecting this proposal:

- *The road is a rural road designed to cater for vehicle speeds of 100km/hr;*
- *People will drive at that speed because it is a perceived safe speed;*
- *It would be difficult to police and would foster negative public attitudes; and*
- *Speed reduction would be contrary to traffic management principles. Council and the Roads and Traffic Authority are currently attempting to reduce travel times between Nelson Bay/Lemon Tree Passage and destination points. Reducing speeds along roads would increase travel times.*

If speed reductions are to be pursued, they would need to incorporate the following:

- Agreement/consent from the Roads and Traffic Authority;
- Agreement from the Port Stephens Traffic Committee;
- Acceptance from the Police who would be responsible for enforcing the reduced speed limit;

- Extensive public consultation and media coverage to facilitate broad community awareness and acceptance; and

- Appropriate sign posting.

It should be noted that for every kilometre over which a speed reduction from 100 km/hr to 80 km/hr was imposed, travel times would increase by around 11 seconds.

Another option in this regard would be to use speed advisory signs similar to those used for road bends, crests and curves. As such signs are not enforceable, they are likely to be more acceptable to the public and relevant authorities. However, an extensive community awareness program would still be required in order to encourage a positive response from drivers.

Another alternative would be to apply speed restrictions to specific stretches of road that are effective only at certain times of the day and certain times of the year, similar to the restrictions that currently apply to streets in the immediate vicinity of a school. Such restrictions are currently being trialled on certain roads in the Redland Shire in south eastern Queensland. In this trial, which is a co-operative effort between the Queensland Department of Environment, the Department of Transport and Redland Shire Council, data on collisions between motor vehicles and koalas were used to identify the roads where koalas were frequently hit. These roads (or stretches of road) were then designated as “Koala Zones” where the maximum speed is reduced by 20km/h between 7pm and 5am, for the months from August to December. These speed zones are enforced as per any other speed zone. The trial is being monitored to determine its effectiveness both in terms of reducing vehicle speeds in these areas and in reducing the number of koala fatalities from motor vehicle collisions. The project, which will run for five years, is currently in its fourth year.

It would be worthwhile to conduct a similar trial on one or more of the identified Black Spots and/or Conflict Areas within the Port Stephens LGA. To this end it is proposed that following consultation with the community, Port Stephens Council write to the NSW Roads and Traffic Authority to seek support for such a trial in the Port Stephens LGA.

8.7.5 Roadside Clearance

The amount and height of vegetation on the side of roads is likely to have an effect on koala collisions. Where there is an area of cleared roadside, crossing koalas could potentially be seen at an earlier stage and hence, the chances for avoiding a collision would be improved.

This strategy would be implemented by regular slashing of roadside areas and the provision of wide shoulders. Council is currently preparing a formal standard for the slashing of roadside clearance zones which will address, among other things, the need to maintain clearance zones along roads where collisions between motor vehicles and koalas are known to have occurred.

8.7.5 Other possible measures

Several other possible ameliorative measures were recommended by the CKPoM Consultative Committee. These were:

- The use of wide, white lines on the road verges to improve night-time visibility of koalas to motorists in koala black spot areas;
- Promote further research on the need for fencing along roads in koala traffic black spot areas; and
- Trial the use of car whistles, such as the “Shu Roo”, as a deterrent to koalas crossing roads when vehicles approach.

8.8 Recommendations

See section 8.2 of the Port Stephens Council CKPoM

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9. DOG MANAGEMENT

9.1 Introduction

Prior to European settlement of the Port Stephens area, dingoes would presumably have been the principal koala predator, apart from species such as the Powerful Owl and Lace Monitor which would potentially predate upon juvenile koalas, and possible hunting by Aborigines. However, as the area became inhabited by Europeans, domestic and feral dogs would have taken over the role of principal predator, other than humans of course, who were responsible for widespread habitat destruction and hunting of koalas for the fur trade.

There are currently over 6,500 registered dogs in the Port Stephens LGA, although the actual number of domestic dogs is likely to be considerably greater, if those unregistered could be taken into account. Irresponsible dog-ownership results in a substantial number of uncontrolled, roaming domestic dogs in parts of the LGA. These roaming dogs, particularly large dogs and dog packs, pose a significant threat to koalas that occupy habitat within and adjacent to urbanised areas.

The significant threat that dogs pose to koalas in the Port Stephens LGA is supported by the results of the community-based survey and the research on koalas conducted on the Tomago Sandbeds following the 1994 bushfires. In the latter study, dogs were found to be the second major killer of koalas after the bushfires (Dan Lunney NPWS pers. comm.).

9.2 Objectives

The objectives of this chapter on Dog Management are to:

i) Reduce the number of dog attacks on koalas;

ii) Increase public awareness of the problem of dog attacks on native fauna; and

iii) Promote responsible dog-ownership within the LGA.

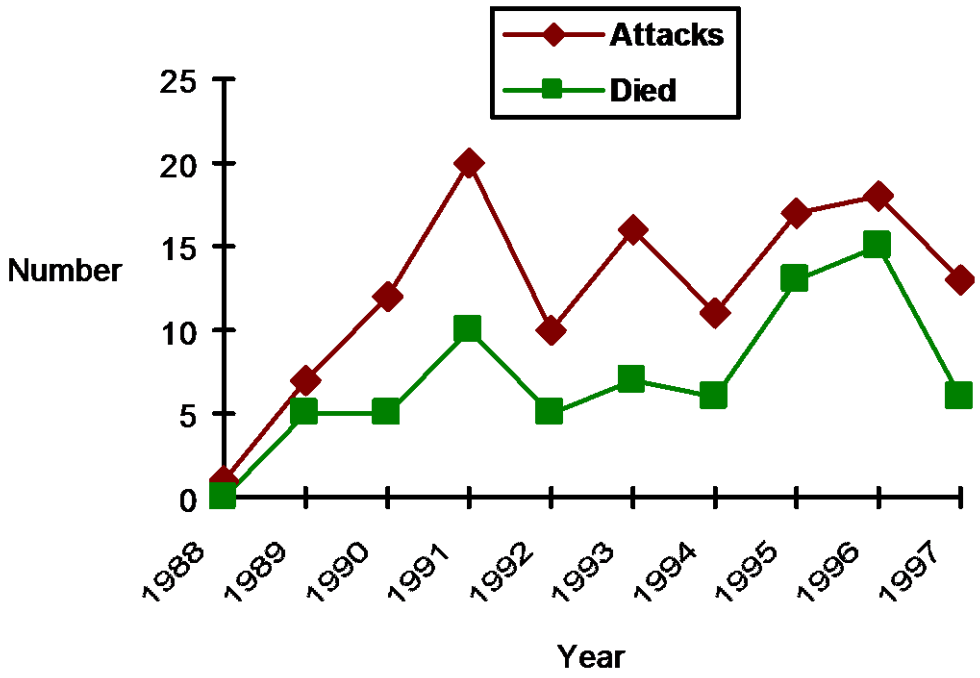
9.3 Statistics

According to data provided by the Native Animal Trust Fund and the Hunter Koala Preservation Society, 125 koalas were attacked by dogs in the Port Stephens Local Government Area (LGA) between January 1988 and March 1998. Seventy-seven of these koalas died as a result of their injuries, representing a 62% fatality rate.

Figure 9.1 shows the number of Koalas reported attacked by dogs and the number of those that subsequently died each year from 1988 to 1997 inclusive. The accuracy of these records has probably improved over time as the Native Animal Trust Fund and the Hunter Koala Preservation Society have become better known within the community, resulting in a greater number of dog attacks being reported to these groups. However, it is considered likely that the recorded statistics underestimate the extent of the problem, as attacks are still likely to occur without being observed or reported.

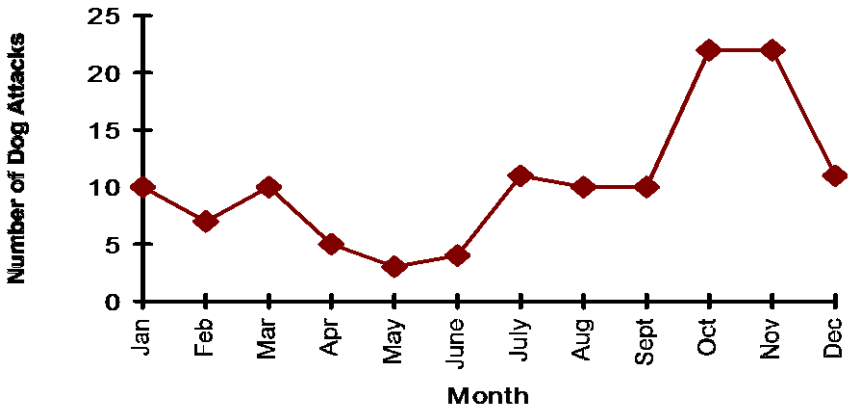
FIGURE 9.1 Dog Attacks - By Year, 1988-1997.

(Data for 1988 to 1994 inclusive supplied by the Hunter Koala Preservation Society, for 1995 to 1997 inclusive supplied by the Native Animal Trust Fund)



The highest number of dog attacks appears to coincide generally with the koala breeding season from August to February, and during October and November in particular (Figure 9.2). The lowest number of attacks occurred during the period April to June, with only 12 attacks recorded during these months between 1988 and 1997.

FIGURE 9.2 - Dog Attacks - By Month, January 1998 to December 1997.
(Data supplied by Hunter Koala Preservation Society and Native Animal Trust Fund)



9.4 Management Strategies

It would be unrealistic to assert that dog attacks on Koalas could potentially be totally eradicated. The most effective method of reducing dog attacks is considered to be through the promotion of *responsible dog-ownership*. A strategy to promote responsible dog-ownership should involve the following:

i) Community education regarding the importance of responsible dog-ownership;

ii) Establishment of a set of community standards to define and to help promote and regulate responsible dog-ownership; and

iii) Establishment of a penalty system to reflect community attitudes to irresponsible dog-ownership.

The following management strategies are available to Council:

* Dog Control through enforcement of the *Companion Animals Act 1998*;
* Provision of dog exercise areas (on-leash and off-leash); and
* Establishment of an education program.

9.4.1 Companion Animals Act

i) Summary

This *Companion Animals Act 1998* repealed both the *Dog Act 1966* and the *Dog Regulation 1997*. Most of the provisions of the *Dog Act 1996* were transferred, with some being updated and amended.

Council is responsible for the administration and execution of the *Companion Animals Act 1998*, which includes the carrying out of patrols, impounding strays, seizing animals where an offence has occurred and undertaking to sell or destroy dogs not claimed.

It is clearly legislated that dogs should be contained within the boundaries of the owner's property or be under effective control by means of a chain, cord or leash when in a public place. Despite this legislation and continual press reports outlining the problems, many owners still allow their dogs to roam free. The irresponsible actions of these owners can result in problems such as dogs defecating on other people's property, attacking and injuring people or animals (including native fauna), causing a traffic hazard or causing a general nuisance.

In addition, both economic and environmental costs associated with irresponsible dog-ownership are incurred by Council and the community.

With respect to koalas and other native or introduced animals, the following sections of the *Companion Animals Act 1998* are particularly relevant:

- The owner of a dog is guilty of an offence under Part 3, Division 1, Section 16 of the *Companion Animals Act 1998* if the dog rushes at, attacks, bites, harasses or chases any person or animal (other than vermin), other than on the property on which the dog was being kept.

- If a dog attacks or bites any person or animal (other than vermin) other than under circumstances referred to in Section 16 (2), an authorised officer may, at any time within 4 hours afterwards, secure or seize the dog in accordance with Section 18. Any other person may seize the dog if it is on the property owned or occupied by the person.

- Under Part 3, Division 1, Section 13 of the *Companion Animals Act 1998* it is an offence for a dog to be in a public place (other than a designated off-leash area), unless under the effective control of a competent person by means of an adequate chain, cord or leash.

- A dog found in a public place, in contravention of Part 3, Division 1, Section 13 may be seized by any person. If the owner of the dog is present, the dog can only be seized by an authorised officer and only then if the contravention continues after the owner has been told of the contravention.

- A dog that has, without provocation, attacked or killed, or repeatedly threatened to attack or chase a person or an animal (other than vermin), can be declared dangerous by a council or a local court under Part 5, Division 1, Section 34 or under Part 5, Division 2, Section 44 respectively. The owner of a dog that is declared dangerous has greater responsibility to ensure that it is

contained so as not to pose a threat to people and animals. If the owner breaches the conditions, Council can approach the Court to fine the owner, and/or destroy the dog and prohibit the owner from owning another dog.

- Under Part 3, Division 1, Section 23 a Court that convicts a person of an offence under a number of provisions of the Act can order that the person is disqualified from owning a dog for a specified period.

It is considered important for the general public to be aware of these provisions so that the impact of domestic dogs on koalas and other animals can be minimised.

Port Stephens Council has prepared a Companion Animals Management Plan (1999) in accordance with the *Companion Animals White Paper 1997*. Local Companion Animal Plans can, among other things, identify areas containing habitat of species, such as koalas, that are vulnerable to predation by dogs (or cats). In such areas, special conditions can be developed to protect native species. These conditions could include, for example, the requirement that owners keep their dogs on their own properties at all times. While the current Port Stephens Companion Animals Plan does not identify such areas for koalas, this could be included in future amendments to this plan.

Chapter 2 of the CKPoM Resource Document identifies and categorises koala habitat throughout the Port Stephens LGA. This provides the means to identify areas where special conditions could be imposed with respect to dog ownership in order to protect koalas. Preferred Koala Habitat was identified as being the most important category of habitat for the long-term survival of the Port Stephens koala population. The following special conditions should be considered with respect to Preferred Koala Habitat:

- Prohibition of dogs in public places containing Preferred Koala Habitat (as provided under s.14 (1) (h) of the *Companion Animals Act 1998*; and

- enforcement of the following additional restriction on current dog owners: that an owner of a dog, upon becoming aware of the presence of a koala on the owner's property, restrain or confine the dog to protect the koala until it has left the premises.

ii) Legal Action

In order for legal action to be taken against the owner of a dog which rushes at, attacks, bites, harasses or chases a koala (without provocation and outside of the property on which the dog was being kept), evidence has to be presented to the Court which proves beyond reasonable doubt that the incident occurred, and that the accused is the owner of the dog in question. This may involve the any one or more of the following:

- A witness to the incident who is prepared to give evidence in Court;

- The requirement for the witness to be able to recognise the dog in question;

- Although not essential, where the incident involved an attack, the presentation of a Veterinarian's report confirming that the koala was attacked by a dog; and

- Photographic evidence of the incident.

Over the last eight years there have only been two convictions under the *Dog Act 1966*, recorded against owners of dogs that have attacked a koala. This reflects the fact that attacks are generally not witnessed or where they are, the witness is often either not in a position or not prepared to give evidence in Court.

iii) Dog Problem Areas

Dog problem areas have been identified from statistics of known locations of dog attacks on koalas, and areas where dogs are known to roam uncontrolled.

In summary, these areas include residential areas of the Tilligerry Peninsula, Salt Ash and some areas of Raymond Terrace and Medowie.

A particular problem involves the tendency of some dog owners to release their dogs at night to roam, which is both difficult to police and likely to increase the risk to koalas. The CKPoM Consultative Committee has recommended that Council undertake an investigation into the number of unregistered dogs in areas where dogs are having an impact on koalas.

iv) Impounding Officer

Port Stephens Council Rangers are responsible for dog enforcement. These officers are well aware of the principal dog problem areas within the LGA. Duties are not restricted to impounding stray dogs, but also involve education of dog owners regarding the reasons for dog control, as well as the provisions of the *Companion Animals Act 1998.*

One of the major problems experienced by the Council Rangers relates to the response time to reach a reported dog problem. For example, if Council receives a dog complaint at Lemon Tree Passage and the Impounding Officer is not on the Tilligerry Peninsula at the time, it will take at least twenty minutes to arrive at the scene. By that time the offending dog may have left the area. The size and geography of the Port Stephens LGA makes it difficult for an officer to respond quickly to all situations.

Council Rangers carry out regular night patrols during summer to assist in controlling dogs that roam at night. The CKPoM Consultative Committee recommended that Council Rangers work split shifts to enable greater availability for dog control.

9.4.2 Dog Exercise Areas

Council has responsibility for the provision of public areas for dog owners to exercise their animals. Under the *Companion Animals Act 1998*, Council must provide at least one off-lead area. However, it is important for these areas to minimise potential conflict with koala habitat. Koalas have been attacked in a number of the currently designated Dog Exercise Areas within the Port Stephens LGA. At present there are 26 areas throughout the LGA that are designated as dog exercise areas. In 16 of these areas dogs are required to be on-lead, while in the remaining 10 areas, dogs can be exercised off-lead. Council recently reviewed its policy on the use of Open Space areas by dogs for the first time since 1987. As part of this review the designation of the aforementioned dog exercise areas were reassessed and additional exercise areas proposed. This included consideration of koala management issues with attention given to the need to prohibit dogs from certain areas and to reduce the potential for conflict in other areas. The CKPoM Consultative Committee recommended that

Council consult more with the Tilligerry Community regarding dog exercise areas.

As evidenced by the statistics, dog attacks on koalas usually result in serious injury and often death. It is important for koala/dog conflict to be reduced in public reserves where koala habitat exists. The following discussion considers some areas where such conflict occurs:

i) Tanilba Bay/Mallabula

Dogs are currently allowed off-lead at Tanilba Bay Waterfront Reserve, from the eastern side of President Wilson Walk to the western boundary of Mallabula Waterfront Reserve (off Bay Street).

This area is identified as Preferred Koala Habitat and is likely to act as a refuge from nearby settlements of Tanilba Bay and Mallabula. Consequently, dogs should be prohibited from this area and another more suitable area established.

An alternative site to exercise dogs is RAF Park off Lemon Tree Passage Road at Tanilba Bay.

ii) Lemon Tree Passage

Koalas are known to inhabit the township area of Lemon Tree Passage where there are substantial numbers of domestic dogs. Consequently, careful dog management is required in order to prevent the loss of the urban koala population.

iii) Raymond Terrace

Boomerang Park is one of the areas frequented by koalas within Raymond Terrace. Dogs are currently allowed to be exercised in Boomerang Park on-lead or off-lead. There is a conflict in this area and Council have undertaken to call for public comment on a proposal to restrict the use of Boomerang Park by dogs to the western section only.

Signposting at public reserves is an important means of advising people whether dogs are allowed and if so under what restrictions. It is important for signs to be provided at each reserve where dogs are prohibited, to advise of the nearest reserve where dogs are allowed.

9.4.3 Education

The role of education in promoting responsible dog-ownership cannot be overestimated. To this end Council has established an Animal Management Committee to consider policy and educational strategies. The *Companion Animals Act 1998* makes provision for Councils to raise revenue to amongst other things, meet expenditure incurred in the execution of the Act, for ongoing community education and the provision of programs to enable responsible companion animal ownership.

Port Stephens Council has also recently introduced the character “Ranger Ralph” to assist in promoting responsible animal ownership and is preparing more educational literature for distribution to the public.

Press releases should be issued prior to the koala breeding season, which corresponds to the peak period for dog attacks on koalas . This will coincide with regular night patrols by Council Rangers over that period. Publicity should also be sought when a series of dog attacks occurs and/or when an owner has been convicted of an offence under the *Companion Animals Act 1998* following a dog attack on a koala.

The CKPoM Consultative Committee recommended that educational material include information on the most suitable breeds of dogs to keep in relation to koalas.

9.4.4 Other dog management issues

The CKPoM Consultative Committee highlighted the need to manage dogs in association with new subdivisions. The Committee recommended that in each proposed new subdivision, the application of section 88e of the *Conveyancing Act 1919* be investigated in the context of controlling dog ownership via covenants on title.

9.5 Recommendations

See section 9.2 of the Port Stephens Council CKPoM.

Principal Authors: Stephen Leathley and John Callaghan

10. FERAL ANIMAL MANAGEMENT

10.1 Introduction

The Port Stephens Local Government Area is known to contain a range of feral animal populations including feral dogs, foxes, cats, pigs, rabbits and goats. It is anticipated that feral animals currently effect land administered by each of the principal land management agencies and organisations within the Port Stephens area, as well as private land holders.

The principal land management agencies within the Port Stephens LGA include Port Stephens Council, National Parks and Wildlife Service, Hunter Water Corporation, State Forests of NSW, the Department of Land and Water Conservation, and the Defence Estate Organisation. In addition, a number of community organisations, including the Native Animal Trust Fund and the Hunter Koala Preservation Society, have a direct interest in managing the impact of feral animals on native fauna.

Several feral animal species within the Port Stephens LGA are considered likely to have the potential to impact significantly upon koalas.

10.2 Objectives

The objectives of the Feral Animal Management Chapter include the following:

i) Identify the likely impacts of feral animals on koalas;

ii) Identify issues that should be addressed in feral animal management; and

iii) Develop a strategy to reduce the impact of feral animals on koalas.

10.3 Likely Impacts of Feral Animals on Koalas

Feral dogs are considered to have the greatest potential to impact directly upon koalas, from the range of feral animal species known to occur within the Port Stephens LGA. Foxes and to a lesser extent feral cats are considered to have the potential to take small, old, or otherwise dehabilitated koalas. However, feral dogs are considered capable of taking even large, healthy adult koalas.

10.3.1 Feral Dogs

The ability of a feral dog to take and kill an adult koala was evidenced by the documented predation of an adult female koala which had been rehabilitated by the Native Animal Trust Fund. This koala had been fitted with a radio transmitter as part of a National Parks and Wildlife Service research project to follow the fate and behaviour of rehabilitated koalas that were released after the January, 1994 bushfires. The koala was found dead, and superficially buried with transmitter intact. A post mortem examination confirmed that the koala had been killed by a dog. In

view of the relatively remote location of the incident from urban areas, the koala was considered to almost certainly have been taken by a 'feral' dog.

10.3.2 Foxes

Foxes are known to prey upon native fauna, as well as upon introduced species including rabbits.

The ability of foxes to take koalas was evidenced by Mr Andrew Krockenberger, during the conduct of his Ph.D. research project on a koala population near Nowendoc in NSW. As reported in the July 1992 Australian Koala Foundation Newsletter, Mr Krockenberger maintained that at least six koalas had been scavenged after death by foxes in his study area over a twelve month period. In addition, he was confident that three of these six koalas were killed by foxes.

10.3.3 Feral Cats

Feral Cats are known to occur in most habitats across Australia including many offshore islands. The diet of feral cats in Australia is known to be highly varied, and to include a range of small to medium-sized mammals (Newsome, 1991).

Feral cats are likely to only present a minor threat to koalas, although they may have the potential to take young animals.

One respondent to the Port Stephens Koala Survey indicated that a feral cat had been seen feeding on a koala within the Port Stephens LGA. However, this cat may have been scavenging upon an already dead koala.

10.4 Management Issues

It is considered that the following issues should be addressed to facilitate the development of an effective Feral Animal Management Strategy.

10.4.1 The Extent of the Problem

The current distribution of feral dogs, foxes and cats within Port Stephens Local Government Area should be identified.

The Port Stephens Vertebrate Pest Animal Management Committee has undertaken a Community Survey of Port Stephens residents to obtain feral animal records and to determine community attitudes to feral animal issues and management practices. Research undertaken by staff and students from the University of Newcastle (see section 10.6 of the CKPoM Resource Document) has and will continue to contribute to the identification of the distribution of feral animals within the Port Stephens LGA.

The CKPoM Consultative Committee discussed the issue of chicken carcasses from chicken farms in the Port Stephens LGA providing a supplementary food source for feral animals, which was likely to provide for an increase in feral populations, and thereby have a greater impact on koalas and other native fauna. The Committee recommended that chicken farmers who are providing such a supplementary source

of food for feral animals be encouraged to dispose of their chicken carcasses through alternative processes.

10.4.2 Priority Feral Animal Management Areas

Areas where koalas are known to occur and where there is a recognised feral animal problem should be identified and prioritised for feral animal management. Identification of these priority areas should be carried out with consideration to the identified categories of koala habitat. For example, areas of Preferred Koala Habitat where feral dogs are known to occur should be identified as a priority areas for feral dog management.

Over the medium term, it could be beneficial to design and implement a community survey for records of feral animal species as well as community attitudes to feral animals and potential approaches to feral animal management. The information gained from a survey of this nature would facilitate the further assessment of target species, priority areas and management options.

10.4.3 Management Options

Suitable feral animal management options should be identified and evaluated on the basis of relevant legislation, research findings, past experience, target species, animal ethics and environmental suitability.

10.4.4 Funding Options

A number of potential sources of funds may be available to implement a Feral Animal Management Plan for the Port Stephens LGA including the Commonwealth Government 'Feral Pests Program', administered by Environment Australia. All potential funding sources should be thoroughly investigated.

10.5 Feral Animal Management Plan

A co-ordinated approach to feral animal management should be adopted by all relevant land management agencies within the Port Stephens LGA. This would ensure the greatest efficiency of management practices and minimise the likelihood of rapid recolonisation of a particular management area by feral animals following treatment.

To this end, the Port Stephens Vertebrate Pest Animal Management Committee (formerly known as the Port Stephens Feral Animal Management Committee) has been formed. The Committee includes representatives from each of the principal land management agencies and interest groups within the Port Stephens LGA. The Committee has prepared a draft Vertebrate Pest Animal Management Plan which is currently being finalised.

The Committee will also seek to develop an effective community awareness program concerning feral animal management, as well as providing a forum for monitoring the effectiveness of management practices.

While the Committee will be considering all feral animal issues within the Port Stephens Area, issues associated with impacts on native fauna, including koalas, will be given appropriate attention.

The Port Stephens Vertebrate Pest Animal Management Committee has already coordinated a number of baiting programs for feral dogs and foxes within the Port Stephens LGA and has commenced an ongoing community education program.

10.6 Feral Animal Research

A number of Honours and undergraduate Research Projects have been undertaken by University of Newcastle science students for the Port Stephens Vertebrate Pest Animal Management Committee concerning aspects of feral animal biology, ecology and management. A list of completed research projects follows:

- Martin, Naomi (1996) Draft Port Stephens Feral Animal Management Plan. Unpublished document prepared on behalf of Port Stephens Council and Hunter Water Corporation. (Report prepared for third year specialist study program in Environmental Management, at the University of Newcastle).

- Fensom, M and Wall, C. (1996) The use of scats to determine faunal diversity in koala habitats within the Port Stephens Region. (Unpublished report for the Port Stephens Feral Animal Management Committee).

- Fensom, Matthew; Lake, Pam and Lees, Victoria (1996) Brief for the undertaking of analysis of scats of dogs *Canis familiaris*, foxes *Canis vulpes* and cats *Felis catus* in the Port Stephens Council Area. (Brief accompanying funding application).

- Lees, Victoria; Fensom, Matthew; Lake, Pam and Cawthorne, Rachel (1997) Analysis of scats of dogs, *Canis familiaris*, foxes, *Canis vulpes* and cats, *Felis catus* on the Tomago Sandbeds, Port Stephens. (Unpublished report for the Port Stephens Feral Animal Management Committee).

- Lees, Victoria, Fensom, Matthew, Lake, Pam and Cawthorne, Rachel (1997) Analysis of scats of dogs (*Canis familiaris*), foxes (*Vulpes vulpes*) and cats (*Felis catus*) on the Tomago Sandbeds, Port Stephens, N.S.W. Ecological Society of Australia, Conference Abstract.

- Lees, Victoria (1997) Towards the management of Wild Dogs, *Canis familiaris*, and Foxes *Vulpes vulpes*, in Port Stephens, NSW. (Unpublished B. Env. Sc. Hons. Thesis, University of Newcastle).

- Clarke, Matt (1997) The use of scat analysis to assess the effects of seasonality on feral animal predation in the Port Stephens Area. (Unpublished third year Environmental Project, the University of Newcastle).

- Cawthorne, Rachel (1997) Feral animal survey in the Urban interface forests of Medowie and Wallaroo State Forests. (Unpublished report for State Forests of NSW).

- Durie, David and Auld, Shane (1998) A third analysis of predatory vertebrate pests on the Tomago Sandbeds, using scat and hair analysis to identify species used as dietary resource and seasonal variation in diet. (Unpublished report for the Port Stephens Feral Animal Management Committee).

10.7 Recommendations

See section 10.2 of the Port Stephens Council CKPoM.

Principal Authors: John Callaghan and Tim Curran

11. BUSHFIRES

11.1 Introduction

Fire represents a significant threat to wildlife within the Port Stephens Local Government Area (LGA), as was evidenced by the January, 1994 bushfires. Bushfire management features predominantly in the policies and practices of land management agencies within the Port Stephens LGA. This is particularly the case with respect to the NSW Rural Fire Service, which has considerable fire fighting resources, including a number of local Volunteer Bushfire Brigades which operate under the co-ordination of Port Stephens Council's Fire Control Officer. Other land management agencies that have fire fighting resources include: Port Stephens Council, NSW National Parks and Wildlife Service, Hunter Water Corporation, State Forests of NSW and the Department of Defence.

A number of community groups including the Native Animal Trust Fund, the Hunter Koala Preservation Society and Port Stephens Eco-Network maintain a substantial interest in bushfires and their effects on the fauna and their habitat.

Bushfires in the Port Stephens area are considered to have the potential to significantly impact upon koala habitat and local koala populations. A series of fire management principles for the conservation of koalas and koala habitat are presented in Appendix 10 of the Port Stephens Council CKPoM.

11.2 Objectives

The objectives of the Bushfire Chapter include the following:

i) Identify and monitor the impacts of bushfires on koalas and koala habitat within the Port Stephens LGA;

ii) Identify relevant ecological issues that should be addressed through bushfire management programs; and

iii) Recommend appropriate measures to minimise potential adverse effects of bushfires on koalas and koala habitat within the Port Stephens LGA.

11.3 Koalas and Bushfire

Under most circumstances, low intensity bush fires or prescribed (hazard reduction) burns are not considered likely to significantly effect koalas over the short-term. In contrast, high intensity bushfires are known to kill many animals including koalas. While high intensity bushfires are likely to dramatically reduce fauna populations over the short-term, studies of some species and their habitat following bushfire suggests that their long-term survival may not be threatened by high intensity bushfire (Catling 1991).

However, the ability of fauna species to recolonise a specific area of habitat following a high intensity bushfire is likely to be affected by a number of factors including:

i) The extent and intensity of the bushfire;

ii) The rate and nature of habitat regeneration;

iii) The capacity of adjacent fauna populations to provide adequate levels of recruitment to re-colonise burnt areas; and

iv) The impact of threats posed by factors such as feral and native predators, and traffic which could affect the potential for recolonisation from adjacent unburnt habitat, as well as potentially affecting survivorship of any fauna occupying regenerating habitat.

When intense bushfires affect extensive areas of significant habitat for species such as koalas, the impact at the population level could be dramatic over both the short and long-term. This is particularly likely to be the case where habitat has already been highly fragmented, often as a result of development activity, and where the young in the population have been predominantly eliminated.

11.4 The 1994 Bushfires

The intense fires in the Port Stephens area in January, 1994 directly affected approximately 6,000 hectares of koala habitat.

In the aftermath of these fires and with the NSW National Parks and Wildlife Service fully committed along with other fire fighting agencies, the Native Animal Trust Fund co-ordinated a major search and rescue operation for injured and/or distressed fauna. This effort was assisted by numerous volunteers who systematically walked approximately 2,000 hectares of the worst affected areas. The operation recorded a total of 46 koalas dead in the field and resulted in the retrieval of 53 koalas for assessment, and where necessary, care and rehabilitation.

The rescue operation demonstrated not only the substantial concern and support of the community but also confirmed the vulnerability of species such as koalas to intense bushfires. Many koalas that initially survived the fires suffered a range of problems including mild to severe burns (particularly to the hands and feet, nose, ears and in some cases eyes), damage to the lungs and respiratory tract associated with inhalation of smoke and gas, predation by feral dogs, dehydration and difficulty in locating food. Several koalas that appeared to escape serious injury, remained for several days within burnt trees, with no apparent effort to move in search of food.

11.5 Bushfires, Koala Habitat and Associated Plant and Animal Communities

While it is important to prescribe hazard reduction burns that minimise the likelihood of high intensity fires occurring in koala habitat and thus reduce the risk of koalas being killed or injured, it is also important to consider the possible long-term impacts of such prescriptions on both koala habitat and the plant and animal communities that occur in association with koala habitat.

Examination of the long-term impacts of fire requires consideration of the fire regime. The fire regime is the pattern of fire over time and across the landscape (Pickett and White 1985). Components of the fire regime include intensity, frequency and season of occurrence (Gill 1975). The fire regime of hazard reduction burning may differ from that of (unplanned) wildfires; typically, hazard reduction burns are of lower intensity and higher frequency and occur during different seasons, generally spring or autumn, rather than summer, which is typical in the case of wildfires (Williams and Gill 1995).

Recurrent hazard reduction burns could cause changes to koala habitat by reducing the survival of juvenile trees and potentially causing the decline of populations of species that are preferentially utilised by koalas. The majority of *Eucalyptus* species are generally capable of surviving a fire: they can grow new shoots from epicormic buds protected from the fire by bark or in underground lignotubers (Williams and Gill 1995). However, this ability to survive a fire is dependent on the presence of a number of features (e.g. fire resistant bark, stores of buds and energy (starch) reserves), which may not develop in juvenile plants for several years (Keith 1996). In the interim such plants are likely to be killed by fire, and if a series of fires occurs with such frequency that intervals between successive fires are less than that required to develop the aforementioned features, then all such juveniles may be lost, senescent adults will not be replaced, and the population will decline (Keith 1996). Even those plants that have developed energy reserves and a store of buds can be killed by frequent fires, if the interval between fires is insufficient to allow their replenishment (Keith 1996). Both adult and juvenile eucalypts could be killed in this way. However, hazard reduction burns are more likely to affect juvenile eucalypts, as it would be expected that the crown of adult eucalypts would remain largely intact. The season of burning can also be important; energy reserves may be low after periods of rapid plant growth (Cremer 1973), thus making plants more vulnerable to fires that occur soon after such growth periods. Research that addresses the issues raised here as they relate to tree species that are preferentially utilised by koalas in the Port Stephens LGA should be given high priority.

It is widely acknowledged that hazard reduction burns can cause changes to the composition of plant communities, and to the understorey in particular (see review by Williams and Gill 1995). Understorey species that survive a fire and resprout from protected buds may be affected in a similar manner to that outlined above. Species that are usually killed by fire and rely on regeneration from seed to perpetuate their populations could also be lost under a regime of high fire frequencies if plants are killed before they set seed or if stores of seed (either in the soil or the canopy) are depleted before they can be replenished (Benson 1985; Keith 1996). Furthermore, the low intensities of hazard reduction burns may prevent the germination of seeds of species for which there is evidence that high temperatures act as germination cues (Auld and

O'Connell 1991). Changes to the plant species composition of the understorey are also likely to impact on fauna; Catling (1991) noted that hazard reduction burns could result in a simplification of the structure of forests by reducing shrub cover, which in turn may lead to long-term reductions in the abundance and diversity of fauna species.

The above discussion has focused on some of the potential consequences of low intensity, high frequency hazard reduction burns. While it is it is important to manage fuel loads in koala habitat to minimise the risk of koalas being injured or killed, the potential impact of high frequency hazard reduction fires on koala habitat and other plant and animal communities needs to be recognised and where possible avoided. It is recommended that priority be given to research to determine fire management strategies that best meet the objectives of: protecting people and property; reducing the risk of injury or death to koalas; and the long term conservation of koala habitat and associated plant and animal communities within the Port Stephens LGA.

11.6 Role Of Volunteer Fauna Welfare Groups

The work of licensed fauna welfare organisations should be supported whenever possible. While all possible care should be taken to ensure the safety of volunteers, the search and rescue efforts of the Native Animal Trust Fund following the January, 1994 bushfires produced very positive results with respect to both animal welfare and data collection.

11.7 Post Fire Research

A post-fire koala research program is currently being completed by the NSW National Parks and Wildlife Service which followed the fate and habitat use of koalas rehabilitated by the Native Animal Trust Fund following the bushfires of January, 1994. This research project also aimed to investigate the process of recolonisation of regenerating habitat by koalas after fire.

The relevance and importance of this work arose through the community-based survey and this planning process. In turn, the outcomes should further refine the needs of koalas in the Port Stephens area, particularly in relation to habitat loss, distances travelled, trees utilised through the year and survival of a population when fire, dogs and cars remain an issue. The support of the Hunter Water Corporation on whose land much of this work is being undertaken, is acknowledged and appreciated.

An interim report on the aforementioned fire research program follows:

"The impact of the fires of January 1994 on the koala population on and near the Hunter Water Board lands"

Report prepared by Dan Lunney and Wendy Maitz
Biodiversity Survey and Research Division
NSW National Parks and Wildlife Service

(This interim report is from the fire research program being managed by Dan Lunney. Please note that there is another year of detailed analysis to be completed on this research project. Therefore, this chapter will need to be updated in one year's time. It is intended that these results will contribute to bushfire management with respect to koalas in the Port Stephens LGA.)

- The bushfire in January 1994 had a direct and immediate impact on the koala population in Port Stephens LGA, with 46 dead koalas and 53 injured. The injured koalas were brought into care, rehabilitated then released back into the bush.
- Rehabilitated koalas had a similar survivorship to the control (unburnt) koalas.
- The koala population moved back into the burnt bush within two years of the fire.
- Since the fire, a number of control and rehabilitated female koalas have bred once or twice, which is a positive and encouraging result for those involved in rehabilitation.
- The study highlighted the impact of dogs on this koala population. The program revealed dogs to be the second major killer of koalas in the study area, next to the fire.
- The survival of koalas is dependent upon management of threats, such as dogs and cars, and continued assistance and support provided by the local community and through government plans.
- The study demonstrated the importance of unburnt bush for the survival of a koala population, thus the selection and management of remnant bush in a shire or region will dictate the potential for post-fire recovery. It follows that the minimum area for survival in good years leaves a koala population vulnerable in fire-prone years.
- The results are also being incorporated into the State Wide Recovery Plan for Koalas and the National Koala Conservation Strategy for Environment Australia under an ANZECC initiative.

11.8 Fire Management Planning

Land Management Agencies such as the NSW National Parks and Wildlife Service, Hunter Water Corporation and State Forests of NSW operate as public fire authorities in accordance with the *Rural Fires Act 1997* and are required to prepare Bush Fire Risk Management Plans for areas under their control.

In addition to bush fire risk management plans for specific areas, a co-ordinated approach to fire planning and management within Fire Districts and Local Government Areas is facilitated through the *Rural Fires Act 1997* which repealed the *Bush Fires*

(Amendment) Act 1994 and infers responsibilities on Port Stephens Council as a local authority.

The 'Port Stephens Bush Fire Management Committee' formally operated in accordance with a Fuel Management Plan under Section 41AB(4) of the *Bush Fires (Amendment) Act 1994* which identified schemes for the reduction of fire hazards in the Port Stephens LGA.

The Fuel Management Objectives identified by the Port Stephens Bush Fire Management Committee include:

- To reduce the risk of bush fire damage to life and property within the LGA and adjoining lands, through providing personnel trained to a professional standard;
- To effectively manage bush fires for the protection and conservation of the natural, cultural, scenic and recreational features of the area;
- To promote effective and efficient utilisation of local fire fighting resources through co-operative planning arrangements;
- To ensure where practicable the long term conservation of all indigenous, rare, threatened or endangered species and communities; and
- To minimise soil erosion and sedimentation within a catchment area.

The Port Stephens Bush Fire Management Committee established under the *Rural Fires Act 1997* consists of representatives from Port Stephens Council, NSW National Parks and Wildlife Service, State Forests of NSW, the Hunter Water Corporation, the NSW Police Service, the NSW Rural Fire Service, Energy Australia, Tomago Aluminium, CSR Wood Panels, the NSW Fire Brigade, the Department of Defence, the Roads and Traffic Authority, the Nature Conservation Council of NSW, and the Department of Land and Water Conservation and meets quarterly to discuss district fire planning issues including hazard reduction burning and bushfire management.

The *Rural Fires Act 1997* includes the protection of the environment as one of its objectives by requiring activities "to be carried out having regard to the principles of ecologically sustainable development described in section 6 (2) of the *Protection of the Environment Administration Act 1991*". In accordance with the *Rural Fires Act 1997*, Bush Fire Management Committees are required to have regard to these principles in carrying out any function that affects the environment. In addition, the issue of a fire permit or a notice requiring the establishment of a fire break under the *Rural Fires Act 1997* does not affect any requirement to obtain a licence under Part 6 of the *Threatened Species Conservation Act 1995.*

The *Rural Fires Act 1997* requires each Bush Fire Management Committee to prepare both a draft plan of operations and a draft bush fire risk management plan. The *Rural Fires Act 1997* specifies that a draft bush fire risk management plan "may restrict or prohibit the use of fire or other particular fire hazard reduction activities in all or specified circumstances or places to which the plan applies." The *Rural Fires Act 1997* indicates that "A plan might, for example, prohibit the use of fire because of its effect on fauna or

flora in, or the cultural heritage of, a particular place." Both of these draft plans are required to be prepared and submitted to the Bush Fire Co-ordinating Committee within three months after the constitution of the Bush Fire Management Committee. A draft plan of operations is required to be prepared and submitted within each successive 2 year period following the constitution of the Committee. A draft bush fire risk management plan is required to be prepared and submitted within each successive 5 year period.

11.9 Mapping Bushfires

Recent research indicates that it may be possible to use satellite imagery for the purposes of bushfire history mapping as an alternative to conventional methods which often rely heavily upon the availability of post-fire aerial photograph coverage.

Digital and visual analysis of Landsat TM imagery data could potentially be used for the purposes of identifying burnt vegetation, mapping fire boundaries and fire intensity, and for monitoring post-fire regrowth on the basis of spectral reflectance values.

11.10 Recommendations

See section 11.2 of the Port Stephens Council CKPoM

12. KOALA WELFARE

By Daniel Lunney and Alison Matthews
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12.1 Introduction

Carers and carer groups in NSW require a licence from the NPWS (Wildlife Licensing Unit, NPWS, PO Box 1967, Hurstville NSW 2220). All issues to do with koala care in NSW have now been dealt with in a NPWS policy document entitled **"Guidelines and Conditions for Koala Care in NSW"** prepared by D. Lunney and A. Matthews (June 1997), incorporating extensive public consultation. This document is included here complete and unabridged and should be referred to when dealing with all issues relating to koala welfare in Port Stephens LGA.

GUIDELINES AND CONDITIONS FOR KOALA CARE IN NEW SOUTH WALES

June 1997

Daniel Lunney and Alison Matthews
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1. INTRODUCTION

1.1 Standards for the care of koalas

Many reasons have been identified for caring for koalas, including the need to maintain the health and integrity of local populations, the personal satisfaction of rehabilitating and returning a koala to the wild, a moral responsibility for care, an emotional involvement, a commitment to community quality of life and spirit, and the public expectation of government responsibility for both the welfare of individual koalas and for ensuring the long-term survival of koala populations in the wild.

Koalas may require assistance as a result of disorientation through loss or fragmentation of their habitat, disease, injury (often associated with traffic or dog attack), death of a mother with dependent young, bushfire, or the necessity to relocate a koala away from a highly dangerous location. Koala welfare incorporates issues such as rescue, care, hand raising, rehabilitation and release. It is desirable that every temporarily disadvantaged wild animal is given the best available care to maximise its chances of successful return to the wild. In the case of a high profile and vulnerable species like the koala, it is vital to set and maintain the highest standard of care. The koala is listed as a Vulnerable species in New South Wales under the *Threatened Species Conservation Act 1995*. These conditions and guidelines have been prepared to assist in the recovery of this species.

From a welfare viewpoint, the primary aim of wildlife rehabilitation is to return each individual to the wild population with maximum chances of survival. The length of time a koala is held, the means by which it is held and the place of release are crucial factors. Beyond these principles, there are many points that need to be addressed so that there is consistency among individuals and among groups. This document draws together the considerable experience of koala care that exists in the community and frames the conditions of care in the context of this skill and understanding.

1.2 Legislation and policy

The koala is a protected species under the *National Parks and Wildlife Act 1974* and it is an offence to harm a protected species and the definition of "harm" in the legislation (in addition to its normal meaning) includes hunt, shoot, poison, net, snare, spear, pursue, capture, trap, injure or kill. The legislation also imposes restrictions on holding protected fauna, including for the purpose of rehabilitating an animal which is incapable of fending for itself. When a person comes into possession of a sick, injured or orphaned protected species, such as a koala, but has not been licensed to rescue, hold and rehabilitate protected fauna by the National Parks and Wildlife Service, or a licensed wildlife rehabilitation organisation, they are legally required to notify the Director-General of the National Parks and Wildlife Service in writing within seven (7) days and to comply with any direction given. In the case of a koala, in every situation, directions will be given that it immediately be passed to a skilled licensed/authorised koala carer.

Since the mid-1980s the New South Wales National Parks and Wildlife Service has supported the establishment of specialist wildlife rehabilitation organisations. These train their members in the skills of animal care and wildlife rehabilitation, authorise appropriately trained and skilled members who have the necessary facilities and other resources to care for particular groups or species of animals and then supervise and monitor their activities. These groups also ensure that their members are kept up-to-date with advances in wildlife rehabilitation techniques and encourage peer liaison. There are now over 20 such organisations in NSW and some have regional branches. It is only in a very rare situation, and generally only in a region which does not have a licensed rehabilitation organisation, that the Service will licence an individual to care for sick, injured or orphaned native animals.

These conditions and guidelines refer to the care of koalas by carer groups for the purpose of rehabilitation to the wild, rather than for captive management in zoos or fauna parks. Also they were not written to be binding on researchers, who are subject to the *Animal Research Act 1985*, but where those aspects of research protocols require care and handling of koalas these guidelines may be utilised. to fulfil those requirements. This will particularly apply when a researcher and a carer group are working co-operatively.

These conditions and guidelines are consistent with the Australian and New Zealand Environment and Conservation Council (ANZECC) 1996 *Draft National Koala Conservation Strategy* and contribute to fulfilling Objective 5: 'To manage captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care'. Thus, although parts of this document carry conditions that are binding in New South Wales, it has also been prepared to assist koala carers, other interested parties and the relevant authorities in other states. In doing so, it has provided a worked example of the welfare aspect of wildlife management, a need made explicit by Objective 5 of the *Draft National Koala Conservation Strategy.*

This document has been prepared in two parts: 1) guidelines, and 2) formal conditions for koala care in New South Wales. Both parts have been prepared in conjunction with carers, veterinarians, Service officers and other interested parties through an extended period of negotiation, including workshops, discussions and a wide circulation of drafts for critical comment. The acknowledgments section lists the participants in this process.

Part 1) The guidelines, which outline the concerns, points of interest and importance for koala care. They were prepared to assist carer groups in their detailed response to comply with the conditions when seeking accreditation.

Part 2) *The formal conditions for koala care in New South Wales are presented in italics at the end of each section*. Accreditation is a formal requirement under the *National Parks and Wildlife Act 1974* and is administered through the Field Services Division of the National Parks and Wildlife Service. These are the conditions that need to be met by carer groups prior to, or to preserve, accreditation.

Each of the following topics is dealt with in two parts. The first contains the guidelines, which are in a normal typeface; the other part, which is in italics, states the condition that must be satisfied to obtain or maintain accreditation as a koala care group in New South Wales.

2. REQUIREMENTS FOR CARERS

Everyone who cares for koalas must be appropriately skilled and have appropriate facilities, access to reliable sources of a variety of recognised koala food tree species and an ability to collect it.

2.1 Training

- Training for new carers should cover all aspects of the care that they will be expected to undertake, and may consist of one or all of the following options:
    a) Carers course/workshop;
    b) Apprentice System (one-on-one training with an accredited carer or fauna park);
    c) Experience in koala hospital situation in districts where this is possible;
    d) Voluntary work in fauna parks or zoos where this is possible.
- Training should cover all aspects of handling, observation, restraint, treatment and tree identification and leaf collection.
- Training should include an assessment of competence and be appropriately recorded.

Conditions: New carers must be trained by an accredited carer or group.

2.2 Licensing

Carers and carer groups in NSW require licences from the NPWS (Wildlife Licensing Unit, NPWS, PO Box 1967, Hurstville NSW 2220) Phone (02) 9585-6481, FAX (02) 9585-6401.

Conditions: New carers must be registered in a licensed group. The group must provide a detailed training program and a list of all registered carers as requirements to gain or continue to hold a licence.

2.3 Accreditation

- An independent Accreditation Committee will be established by the National Parks and Wildlife Service to undertake the accreditation of organisations and in the case of appropriate groups, their regional branches. (Only in special cases will individuals, not part of a group, receive accreditation.) This Committee will comprise at least a Service officer, a carer and a veterinarian.
- Koalas will not be permitted to be held by groups or individuals who have not been accredited to care for koalas. An accreditation system will be established to ensure that each carer group and individual carers are accredited as having the expertise and facilities etc, to provide excellent care for koalas.
- An accredited group/branch will be required to establish its own Accreditation Committee to review the credentials of each of its own carers.
- Koalas will be permitted to be cared for only by accredited carers. Each accreditation committee will establish grievance procedures and undertake grievance resolution.
- Trained and accredited wildlife rescuers may rescue a koala and transport to a vet or accredited carer, or hold temporarily.

Conditions: An independent Accreditation Committee, established by the National Parks and Wildlife Service, and consisting of at least a carer, veterinarian and a Service officer, will undertake the accreditation of organisations applying for accreditation. A carer group is to set up an accreditation committee, keeping all appropriate records (such as minutes and correspondence). The formal procedures for accreditation need to be listed by each committee and this must be used in the accreditation of each carer or carer group.

2.4 Facilities

- Homecare specific requirements - facilities must be available for: intensive care, intermediate care and rehabilitation.

- Individual carers need not have all facilities, but all should be available within a care group.
- Facilities are to be checked for suitability by the co-ordinator in the accredited care group.
- If possible, a carer is to have no dogs or cats and the facilities must be in a quiet area. If they are owned by the carer, then they should never have contact with koalas which are in care.

Conditions: All facilities for each stage of care must be available within a group. A detailed list of facilities must be prepared as part of the accreditation process. Each carer must have their facilities checked for suitability by the group co-ordinator and a record kept.

3. LIAISON WITH VETERINARIANS

- Carers should advise vets that they are an accredited carer and offer assistance.
- Common experience and practice shows that an authorised or experienced person is often required to restrain and feed the koala while in veterinary care.
- Carers should be respected for their expertise, but should not tell vets what to do. Rather, they should advise on the best practice, including medication and restraining.
- When koalas are taken directly to the vet, by the public (including police, RTA and council workers), the vet should notify the carer group in the area.
- The carer group has a responsibility to disseminate current information on koala care and a list of experienced vets in koala care to all vets in the area.
- Vets should not hold koalas in care if there are appropriate care facilities available in the carer group.
- Within veterinary facilities, koalas should be in isolation and vets should not hold koalas in pet kennel areas.
- Carers must respect veterinary advice on euthanasia of koalas, but retain the right for a second opinion from another vet.
- Vets instructions relating to medication should be adhered to.
- No animal medication, human medication, ointment or herb should be administered to a koala in care unless it has been approved by a vet.

Conditions: Carers must advise the vets in the area of their existence, what information is available and the best procedures for koala care. Carers must respect the vet's professional rights and responsibilities.

4. RESCUE

- Members of the public who find a sick, injured, orphaned or otherwise distressed koala should note its location and condition and contact the local koala care group or the National Parks and Wildlife Service as soon as possible. Members of the public should not attempt to capture or transport the animal.
- The carer group should attend ASAP with proper catching gear, restraining and transport equipment.
- Carer groups should ensure that all vets, RTA, RSPCA, police and firefighting in the area have the contact numbers of the group.

4.1. Criteria to rescue

- Sick, injured and orphaned wild koalas which are unable to fend for themselves should be rescued.
- Extreme care should be taken when rescuing orphans that the mother is not nearby.
- Juvenile koalas with weights estimated in excess of 3 kg should not be rescued on the grounds of being orphaned.
- Wild koalas should not be handled or moved unless considered absolutely necessary. An example of a dangerous situation would be a koala on a median strip on a highway.
- If a koala is in an unusual place but appears healthy and in no immediate danger it should be left alone and its location reported to the carer group or the National Parks and Wildlife Service.
- Koalas in a research program are the responsibility of the researcher under the *Animal Research Act 1985*. Contact can be made with the researchers to discuss their project or liaise with the researcher via the NPWS District Manager. Research koalas may not be rescued unless by prior arrangement with the researcher. It is in the interests of the researcher to notify the local carers of the program and to discuss contacts and actions should an animal in the program be found sick or injured or in a dangerous situation. If a carer, or anyone, considers that the welfare of a koala in a research program is being neglected, they should contact the researcher and discuss options for change. If that proves unsatisfactory, the concerned person should then contact the chair or secretary of the Animal Care and Ethics Committee (ACEC) that gave the authority to the researcher.

Conditions: Only koalas which have a poor chance of survival from obvious signs of injury or disease, or that are orphaned, or that are in a dangerous location, may be rescued. No koala known to be covered by an Animal Research Authority may be rescued without consent of the researcher.

4.2. Catching and retrieving injured animals

- Always assess the danger to the rescuer.
- Ask bystanders to stand back and remain quiet. Rescuers must be assertive but not aggressive to onlookers. Rescuers should explain what is happening with the animal.
- Use a blanket or cloth bag to wrap the animal - first place it over the head when catching so the risk of biting to the rescuer is minimised.
- Pick the koala up from behind. A koala can be picked up safely from behind by the lower forearms. Alternatively, bring the koala to the ground and hold it on the ground and ease into an appropriate catching bag. Do not pick up from the front by the ribcage or wrists.
- Put in a carrybox or similar properly-secured container.
- Prop animal up with towels into sitting position.
- Avoid unnecessary handling and avoid loud noise, dogs and unnecessary photos.
- Be conscious of possible injuries, such as fractures, when handling injured animals.
- If attending a road accident at night, rescuers should wear bright-coloured clothing to reduce the risk of being hit by other vehicles, or use a reflective sign.

Conditions: Procedures for catching and retrieving koalas must be specified by the carer groups in seeking accreditation. Procedures should include methods of catching, holding and securing for transportation. Koalas may only be handled by an authorised person.

4.3. Transport

- The koala must be restrained in containers for transport. Suitable containers include garbage bins with plenty of large holes for ventilation and air circulation; two clothes baskets tied together; or custom-made koala boxes.
- In emergency situations, hessian bags are suitable but not preferred- a light canvas bag or large pillowcase is adequate. Do not use hessian bags to contain koalas unless there is no

alternative as they can damage claws and shed fibres that can be inhaled. Do not transport koalas suffering burns in canvas bags.

- Koalas are not to be transported on the body of carers.
- The koala should be kept dark, quiet, and warm (15-25 degrees Celsius).
- Do not transport the koala in the boot , or with dogs in the vehicle, or with the radio on.
- Be conscious of the time factor - act quickly and get the animal to a vet or carer by the most direct route.
- If possible, transport the koala with leaves picked from the area. The smell may relieve some stress.
- Do not leave koalas in any container for a long period.
- Ensure that the koala and container are out of direct sunlight when being transported.
- Koalas should not be moved from home care unless for treatment or to an external location within the home care premises or for the purposes of pre-release or release to the wild.

Conditions: Each koala care group is to establish detailed criteria under which koalas are to be transported.

5. CRITERIA FOR ENTERING CARE OR FOR EUTHANASIA

- The following questions should be asked:
    a) Should the koala be released immediately?
    b) Is it able to be rehabilitated?
    c) Is euthanasia the best welfare option?
- The decision on the fate of the koala is to be made by the carer and a vet and/or koala coordinator.
- In deciding, a note is to be taken of the animal's past history if its identification is known (eg. by microchip or eartag).
- Reasons for euthanasia include:
    a) No chance of a normal life, eg. loss of tongue, limb;
    b) Signs of extreme pain and stress;
    c) Serious and multiple wounds eg. from dog bites which usually become infected.
- Euthanasia to be performed by a vet.
- If a fire victim, burns on paws are not always evident for a couple of days, so the animal should be held for later assessment.

Conditions: The decision to take a koala into care or to euthanase is to be made by the carer and a veterinarian and/or group co-ordinator. The carer group must review each decision to assist in refining the decision making process. A record of the reasons for decision must be kept on a standard record form.

6. CARE

There are three stages in the care of koalas:

1. First 12 hours - may be temporary care following rescue;
2. Next 48 hours - koalas are considered wild in care;
3. Long-term care (greater than 48 hours) - koalas are considered captive;

The conditions for long-term care require a substantial commitment of resources, time and record keeping. The only reason for long-term care is that the koala is likely to improve in health and be rehabilitated to the wild.

Conditions: Detailed specifications, record sheets, inspection procedures and care protocol need to be formally established for koalas in long-term care as a requirement for accreditation.

6.1 Assessment

- The initial assessment of the koala needs to be thorough but should be performed with as little disturbance as possible.
- Check the pouch to see if a joey is attached to the teat. If so, do not anaesthetise the mother.
- Koalas should be assessed for wounds, fractures (including jaw area), ticks, swollen lymph glands, anaemia (check colour of gums) as well as more obvious signs such as wet bottom and conjunctivitis.
- Koalas should be weighed. Normal body weights vary across the koala's range. Carers should be aware of the normal body weights for different ages and sex of the koalas in their area.
- *Chlamydia* status can be checked by the clinical presence of conjunctivitis and wet bottom. Clearview test kits may help.
- Dehydration can be critical in sick animals. Hydration status can be assessed by changes in skin tone. In normal condition, the skin over the scapula (shoulder blade) area should slide freely and, when pinched, skin on the top of the head, between the ears, should snap quickly back to place. Dry rough skin on the paws and nose is a sign of dehydration.
- Body condition can be assessed by palpation over the scapula area. In poor condition, the edges and spine of the scapula become prominent.
- Body temperature can be checked. Normal body temperature is 35.5-36.5°C.
- In care having been assessed by a vet.
- There should be a monthly review of koalas in long-term care by the carer group co-ordinator and records to be kept of the decision to remain in care.
- Mature/aged koalas in excess of 8 years, particularly males, should not be held in captive conditions for more than 6 months.
- Koalas in care for more than 6 months should be re-evaluated.
- A check list for assessment should be prepared by the care group. An opportunity exists here for an exchange of information among care groups as to what should be on this list.

Conditions: The health status of the koala must be assessed to decide what treatment the koala requires. A decision must be made and recorded by the carer as to whether the koala is to be released within 48 hours or to go into long-term care.

6.2. Holding /Housing

- Minimum standards should be identified by the group and deal with all aspects of holding and housing. The Standards for Exhibiting Koalas set by NSW Agriculture (Appendix 1) may be used as a guide. Standards should be set for conditions under temporary holding, normal care, intensive care and long-term care.
- Many issues have been identified for consideration. These include:
    - a quiet environment;
    - not accessed by the public;
    - walls and floors should be constructed of materials which can be easily sterilised;
    - design to be such that temperature is controlled, with natural lighting and ventilation;

    - use of lawn lockers, garages and laundries are not suitable.
- Koalas in care for more than 12 hours should be contained in housing more structured than the conditions necessary for the rescue and holding in the first 12 hours.
- Depending on the state of the animal, a licensed carer is to decide how the animal is to be housed. Temporary housing may include baskets, cots or enclosures.
- Diseased koalas should be housed in isolation from other koalas.

Conditions: The minimum standards for enclosure design and management must be prepared by each carer group as a requirement for accreditation. This must include housing requirements for koalas under intensive care as well as non-intensive care, temporary holding and long-term care.

6.3. Diet

6.3.1. Fluid balance

- Dehydration can be critical in sick animals. The following are offered to rectify and maintain positive fluid balance.
- Drip under veterinary supervision.
- Subcutaneous fluids under veterinary supervision.
- Oral fluids can be administered, such as "Lectade" and "Portagen". Dehydrated koalas which don't recognise free water should accept fluids via a syringe.
- Koalas should be encouraged to lap fluid from a shallow container. Feeding by unnatural methods, such as syringes and eye droppers, should be restricted to animals which are incapable of lapping.
- Milk supplements should only be given to injured, sick, dehydrated or juvenile animals.
- Other ways to restore and maintain positive fluid balance are:
    a) feed younger leaves;
    b) spray leaves with water before offering;
    c) ensure leaves are as fresh as possible and standing in water.

6.3.2. Dietary supplements

- Supplementary feeding with:
    a) "Portagen"/ high protein baby cereal. If adding high protein baby cereal, changes in faeces should be closely monitored; excess use can cause diarrhoea.
    b) "Wombaroo"
    c) Glucose and water
    d) "Divetelac"
    e) "Prosobee"
    f) Yoghurt in the milk mixtures.

6.3.3. Leaves

- Offer three to five species a minimum of twice daily in areas where this is possible. Wet the leaves with water spray, and stand leaves in container with water supply. Also offer a supply of clean bark, water and dirt, unless on a drip or immobile.
- Leaves are to be collected from trees in such a manner as not to destroy the bush. Leaves should not be collected from the roadside where they are likely to be contaminated with high levels of lead.
- A list should be prepared of preferred koala browse leaves available in the area of the carer group.
- Carers should demonstrate that they have guaranteed access to adequate supplies of fresh leaves.

- Koalas should be offered the leaf species found in the potential release area.

Conditions: The diet, method of feeding and source and species of leaves must be codified by the carer group as a requirement for accreditation.

7. ORPHANED/HAND-REARED KOALAS

- A hand-reared orphan is back or pouch young raised by a carer.
- Orphaned koalas present the problem of knowing the right age or weight for release. Koalas are normally independent at 18 months (2-3 kilograms; the range generally represents the geographical increase in weight from north to south. However, local population variation on weight is acknowledged and in establishing criteria for orphans, local background data are to be included in the submission for accreditation.) The age or weight at release should not be greater than the age or weight at which the koala would normally be independent of its mother. However, orphans from diseased and aged koalas, or mothers who have been sick or injured for some time before being found, are usually debilitated, dehydrated and hence small for their age and slow to grow. On the other hand, orphans from road kills are often well fed and developed and adapt well to hand rearing. Thus discretion must be taken when assessing the weight/age of orphans.
- The regular weighing of an orphan to ensure adequate weekly weight gains, observing progress, independence and activity should help indicate the time for release.
- The date of release and hence the length of time the koala is kept in care is an issue, especially if it coincides with the tick and breeding season. For males, this release time could cause extra stress. Alternatively, this is the normal time for dispersal and establishment for males.

Conditions: The age or weight at release of orphaned koalas must not be greater than the age or weight at which the koala would normally be independent of its mother. Carer groups must establish criteria for identifying, caring for and releasing an orphan, including a weight that is appropriate for the local area, as a requirement for accreditation.

8. PUBLIC EXHIBITION

At no time should koalas being rehabilitated for eventual release be placed on public exhibition or used for educational purposes. Contact with humans should be minimised at all times to ensure koalas maintain a healthy fear of human presence.

Conditions: Koalas in care undergoing rehabilitation must not be placed on public exhibition or be used for educational purposes.

9. CRITERIA FOR RELEASE

- At regular intervals the carer and vet must consult on the welfare and state of the animal. Communication must be maintained between carer, co-ordinator and vet to decide on release date.
- A set of criteria to assess ability to be released to be developed by each carer group.

For example:

Category	Criteria for release
Age	> weaning age (2 kg)
Teeth wear	not worn down to gums (Vet assessment required for old koalas)
Eyes	bright, clear, clean
Ability to climb	must be able to climb - check for healing of injuries
Ability to feed	independent feeding - check for healing of jaw injuries
Chlamydia status	absence of wet bottom/ conjunctivitis/ swollen lymph nodes
Body weight maintenance	consistent with age and history and holding body weight
Behaviour	appears alert, ears up, etc.
Signs of capture stress, need to be released immediately	pacing behaviour, vocalisations

- Release at the earliest opportunity. For koalas in long-term care, animals may be retained for one week after treatment has finished to monitor if symptoms return.

Conditions: Koalas must be released at the earliest opportunity, after having satisfied the criteria for release.

10. PRE- RELEASE

10.1 Rehabilitation for koalas in long-term care or hand-reared

- Exercise wherever possible. Koalas with fractures should be in an area where it is at least able to walk after 6-8 weeks.
- Appropriately sized tree forks and cross branches should be available to the koala to match its development and confidence. These should be renewed whenever possible so that the bark is fresh.
- Hand-reared koalas should be gradually weaned into different stage trees and away from contact with the carer.
- Koalas in long-term care or hand-reared are to be placed in a rehabilitation area for a period of tree climbing under normal weather conditions prior to release. They should have access to the ground so they become familiar with travelling on the dirt and grass. Koalas should display natural behaviour as much as possible.
- Capture at night when the koalas come down to the ground is a good option to reduce stress and injury.

Conditions: Koalas in long-term care or hand-reared must be placed in a rehabilitation area for a period of tree climbing under normal weather conditions prior to release.

10.2 Identification

- All koalas must be ear tagged. Ear tagging should be done, if possible, a couple of days before release. Koala ears are to be clipped and prepped with alcohol prior to tagging. Males are to be tagged in the left ear, females right ear. The tag should be placed with the point to the front of the ear so the tagger can check for veins and target the tag away from them.
- Ear tags must be numbered so that individual animals can be identified.
- Ear-tagging is to be applied only to koalas which are already in care and only by a trained person or under the supervision of a veterinary surgeon or a National Parks and Wildlife

Service officer with appropriate experience, or a researcher holding a current Research Authority from an accredited Animal Care and Ethics Committee. A koala may not be captured for the sole purpose of tagging without both a Research Authority from the National Parks and Wildlife Service and an appropriate Research Authority from an Animal Care and Ethics Committee.

- Records must be kept of all tagged koalas.
- All koalas may be microchip, ie. a microchip inserted with a needle beneath the skin and read with an electronic microchip reader.
- Plucked hair for genetic studies of population is acceptable, and a convenient time to do this is while the koala is being marked, eg tagged and/or microchipped. The easiest way to pluck the hair is with tweezers of a pair of pliers to make sure that the bulb of tissue at the base of the hair is attached. It is this tissue that is analysed. Eight to ten hairs are sufficient, and on or around the ear can be a convenient site.

Conditions: Koalas must be ear tagged prior to release by an appropriately trained person and records kept. The record form needs to part of the submission for accreditation.

11. RELEASE / RELOCATION

- Koalas should be released as close to their original encounter location as possible so that the animal has a reasonable opportunity to resume life in its original home range.

- Relocation should only be considered as a last resort to remove a koala from immediate and imminent danger or threat and where the koala is considered to be independent and appears to be in a healthy condition. The decision to relocate must be made by two people.
- A potential relocation or release site should not be a site of known high danger or threat (eg. beside a busy road). The original capture site can create dilemma for release if it is deemed to cause recurring injury over the short-term (eg. in a killer dog area or near a black spot on the road).
- A potential relocation site should preferably have secure tenure and compatible land management.
- A potential relocation site should be one known to already support a population of koalas.
- Relocations should be part of an approved strategy or local koala management plan which should consider potential adverse effects associated with manipulation of gene pools, spread of disease, potential inability of a koala to cope with relocation, potential disruption of resident koalas at the relocation site and potential destabilisation of koalas at the encounter site due to removal of a key individual. Care groups should prepare a list of potential relocation and release areas (where site of origin unknown), if there is no local strategy, and gain approval of district office of the National Parks and Wildlife Service and relevant landholders.
- The district office of the National Parks and Wildlife Service should be notified of the proposed release of all koalas so they have the option to attend.
- Release of koalas within Service areas will generally not be approved unless it is consistent with a Plan of Management or the animal was originally recovered from the area.
- Knowledge of koala habitat and any previous release or relocation of the animal is essential for deciding on relocation.
- Koalas which are suffering from a communicable disease should not be relocated to an area outside its home range.

Conditions: The site of release of koalas must be as close to the initial encounter site as possible except for koalas being relocated out of immediate danger. The release of all koalas must be made in consultation with the district office of the National Parks and Wildlife Service.

12. OPTIONS FOR NON RELEASABLE KOALAS

- Option 1 - Euthanasia is acceptable for all suffering animals. If no possibility of reasonable care , euthanasia is the preferred option.
- Option 2 - Released into "safe" areas - eg rehabilitation or feral proof areas.
- Option 3 - Place into a licensed zoo or fauna park, which already holds a captive colony of koalas, with approval from the Director-General of NPWS.
- Option 4 - Used for teaching with approval from an Animal Care and Ethics Committee to be obtained by the recipient of the non-releasable koala .
- Option 5 - Used in research programs with approval from an Animal Care and Ethics Committee to be obtained by the recipient of the non-releasable koala.

Conditions: Koalas deemed to be non-releasable must be either euthanased or, following the recipient obtaining an appropriate authority or licence, be placed in a licensed zoo or fauna park, kept in a "safe area" and/or used for teaching and research.

13. PROTOCOL FOR DEAD KOALAS

- Often when a carer is contacted, the koala is already dead, usually killed by a car or a dog. The information on blackspots is valuable to record, and samples from these koalas can contribute to research. Collect all relevant information, where possible, such as location, cause of death, date, sex and aged of koala.
- Samples are to be made available for research, where possible.
- An autopsy protocol is to be established. All koalas should be autopsied where cause of death is not positively known. An option that can be utilised is the Wildlife Pathology Service (University of Sydney free service).

Conditions: Autopsies must be undertaken where possible, a protocol established, and animals or tissues made available to researchers.

14. RECORD KEEPING

- Each koala must be given a registration number, call number or identifying code at rescue.
- Each carer should keep records of all animals which come into their care and a database should be kept by one nominated person to register and regularly update all details within each group. Records should be kept in duplicate, eg. hardcopy and on disc. Copies should be provided to the district NPWS on a regular basis, who then send these at least annually to the licensing unit in Field Services Division in Head Office.
- Records should be kept on standard forms. The care group should develop a detailed standard record form(s) for individual carers.
- The following details should be recorded: time and date of rescue, location of rescue, name and phone numbers of initial contacts, rescuers and carers, circumstances for being taken into care, approximate age, weight, sex of the koala, condition of the koala, treatment undertaken, veterinary details, daily records of eating, urinating, defecating, observations and approximate volumes, treatments and dosages, type of leaf offered and eaten, identification tag number, fate including release or relocation details or autopsy results.
- Recording of the original location of koalas, including details of habitat, on Atlas of NSW Wildlife data cards is encouraged.

Conditions: A standard record sheet must be prepared for each rescued koala. Each koala rescued must be given an identifying code. The record sheet must accompany the koala and a copy kept in a central record system of the carer group. The care group must develop a detailed standard record form(s) for individual carers as a requirement for accreditation.

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APPENDIX 1

Standards for Exhibiting Koalas

(Phascolarctos cinereus)

in New South Wales

Exhibited Animals Protection Act, 1986

A publication of the Director-General, NSW Agriculture
pertaining to the conditions of display of koalas
(pursuant to Clause 8(2) of the Exhibited Animals Protection Regulations, 1995

GENERAL REQUIREMENTS

1.1 Construction

a) Enclosures shall be constructed of such materials and be maintained in sufficiently good repair to ensure that they will contain the animals at all times and are to be safe for the animals, for the staff attending them, and for the public.

b) Enclosures, or the perimeter fence in the case of an establishment where koalas are permitted to free range, shall be designed in such a way as to prevent the entry of wild koalas. This requirement only applies to establishments located in areas where wild koalas are known to occur.

c) Enclosures may be of open, semi-enclosed or totally enclosed design.

d) Sufficient shelter must be provided to allow protection from wind, rain and extremes in temperature and allow sufficient access to shade during the hot periods of the day.

e) The size and shape of enclosures for *P.cinereus* shall provide freedom of movement, both vertically and horizontally.

f) The enclosure shall be well drained and have either a readily cleanable substrate or be of a material which can be replaced to avoid the accumulation of faeces and urine.

1.2 Isolation Facilities

Suitable isolation facilities shall be provided for quarantine of incoming or sick animals.

1.3 Protection from Noise, Harassment and Stress

Each operator exhibiting koalas to the public shall:

a) Provide a sufficient number of experienced, identifiable staff in attendance at any session allowing visitors to handle koalas to protect the koalas from abuse and harassment where koala handling occurs and to ensure that stress on the koalas does not occur.

b) Ensure koalas are not placed directly on any visitor or directly held by any visitor for any purpose. Handling koalas by members of the public shall be restricted to patting, stroking and cuddling to the extent of putting an arm around the koala while the animal remains on a fixed perch.

c) Ensure that koalas are not repeatedly removed from objects to which they are clinging.

1.4 Enclosure Furniture

a) There must be at least two tree forks per koala not less than 1.8 metres above ground and not closer than 0.9 metres to the next fork.

b) All supports and branches shall provide sufficient traction for koalas to climb easily and safely.

Clause 2 Hygiene

Substrate of enclosures shall be cleaned daily. The supports and branches shall be replaced as necessary and be maintained in a clean and hygienic condition, free from the accumulation of faeces and urine.

Clause 3 Records

3.1 Identification

Each koala shall be individually identified by an approved method of identification.

3.2 Record-Keeping

a) Establishments shall keep records of all koalas on an individual basis in a form which can be quickly and easily examined, analysed and compared with those kept by other establishments.

b) All documents and other information pertaining to each animal, including records from previous locations, must be kept safely. Animals moving to new locations must be accompanied by copies of all records relevant to those animals.

c) The records shall provide for each koala at least the following information:

i) the correct identification number, scientific name, any personal name and any distinctive markings;

ii) the origin (i.e. details of the wild population or of the parents and their origin, and of any previous location);

iii) the dates of acquisition and disposal, with details of circumstances and addresses;

iv) the date or estimated date of birth, and the basis on which the date is estimated, or the date of the first emergence of the juvenile from the pouch;

v) weight on arrival, and thereafter monthly. The requirement for weighing animals monthly shall not apply to koalas which are either free-ranging within the perimeter barrier of the establishment, or are not dependent on hand-feeding for nourishment.

vi) clinical data, including results of physical examination by a qualified veterinarian and details of and date when any form of treatment was given, together with results of routine health examinations;

vii) breeding and details of any offspring;

viii) the date of death and the results of the post mortem reports which must be performed by a qualified veterinarian.

d) The Director-General may require records of daily leaf collections to be maintained, including details of -

i) leaf species,

ii) area of collection,

iii) weights of leaves before and after feeding,

iv) the identities of the koalas which fed on the leaves.

Records may be required to be submitted to the Director-General at three monthly intervals for a period of two years from the date of initial issue of a permit to exhibit koalas.

3.3 Transaction Records

a) A written report, including records of any clinical observations, shall be submitted to the Director-General within 30 days, on every transport operation, in particular detailing any problems arising and with suggestions as to how these may be avoided.

b) The Director-General must keep a current summary of transport advice, based on these reports and provide a copy to applicants for their information.

Clause 4 Diet and food collection

4.1 General

a) An establishment applying for a permit to exhibit koalas must satisfy the Director-General that it has guaranteed access to adequate fresh supplies of leaves from at least three suitable koala food tree species. This is important when particular species can be susceptible to insect attack at particular times of the year. Known food trees include the species listed below:

E.botryoides	Southern Mahogany
E.camaldulensis	River Red Gum
E.camphora	Broad-leafed Sally
E.citriodora	Lemon-scented Gum
E.cypellocarpa	Mountain Grey Gum
E.goniocalyx	Long-leafed Box
E.grandis	Flooded Gum
E.haemastoma	Scribbly Gum
E.maculata	Spotted Gum
E.microcorys	Tallowwood
E.nicholii	Small-leafed Peppermint
E.obliqua	Messmate
E.ovata	Swamp Gum
E.paniculata	Grey Ironbark
E.pilularis	Blackbutt
E.propinqua	Small-fruited Grey Gum
E.punctata	NSW Grey Gum
E.radiata	Narrow-leafed Peppermint
E.robusta	Small Mahogany
E.rubida	Candle Bark
E.saligna	Sydney Blue Gum
E.scoparia	Wallengarra White Gum
E.sideroxylon	Red Iron Bark
E.tereticornis	Forest Red Gum
E.viminalis	Manna Gum

b) A sufficient quantity of eucalypt leaves shall be provided continuously and replaced at least once daily.

c) Preferred species of eucalypt should be supplemented by a variety of different species of eucalypt as a precaution against local or seasonal differences in digestibility and palatability of dietary leaf matter. Both young and mature leaves should be provided.

d) Feed must be presented as close and accessible to the koalas perch as possible and care taken to prevent wastage of feed placed out of reach.

e) Fresh soil shall be provided, but not around the base of perches, to provide for supplementation of mineral intake or alternatively a mineral salt lick be provided.

f) Clean accessible drinking water facilities shall be provided. Water shall be replaced at least once daily.

4.2 Quality of Food Leaves

Frequency of leaf cutting and the operation of leaf storage facilities shall ensure the koalas receive palatable, uncontaminated, nutritionally adequate food leaves.

Clause 5 Transport

5.1 Quarantine

a) Koalas to be transferred between establishments must be subject to a period of 30 days quarantine at either the importing or exporting establishment unless an exemption from the quarantine period is advised and certified by a veterinarian following a complete veterinary examination.

The certificate must also establish that the koala is -

i) not in a weakened or emaciated condition; and

ii) is free from
- keratoconjunctivitis,
- pneumonia,
- dermatitis, and
- urogenital discharge,

before release from quarantine.

5.2 Transport Cage

Koalas must be transported individually in solid framed cages measuring at least 95cm x 75cm x 95cm high. The cages must have removable, leakproof metal drop trays fitted at the base. Sides and top must be of stout wire mesh and be fitted with light hessian or shadecloth covers. Each cage must be fitted with a resting branch providing at least two forks.

5.3 Feeding in Transit

a) Koalas must each be accompanied by at least 3.6kg of the leaves on which they are normally fed; the leaves being left on the stem and the base of the stem remaining in water or sealed.

b) One kilogram of these leaves must be placed in the cage with the koala before departure.

5.4 Stress Reduction

a) Koalas must not be subjected to temperatures greater than 30 degrees or less than 10 degrees Centigrade during the trip.

b) Koalas must be accompanied by a keeper familiar with the animals being transported at all times except during air transport.

c) Noise must be minimised during transport.

d) Time from caging to destination must be minimised.

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13. EDUCATION

13.1 Introduction

Education has a key role to play towards ensuring the long term survival of the koala population in the Port Stephens LGA. The principal means through which the community can gain a full appreciation of relevant issues and actions which they can undertake to aid koala conservation, is through education programs. Consequently, relevant environmental groups and government agencies need to participate effectively in public education through such measures as:-

- Education within schools and community groups;
- Raising the profile of koala conservation issues in the media; and
- By making relevant information more accessible through information brochures and publications.

While many organisations are already involved in the dissemination of information concerning koala related issues to the residents of Port Stephens, there are other opportunities that could be pursued and more formal processes developed.

Overall objectives need to focus on educating people about the importance of retaining and managing koala habitat in the Port Stephens LGA, which is essential to the ongoing survival of the Port Stephens koala population. Other messages to be brought to the awareness of Port Stephens residents include what action to take, and who to contact, if they encounter an injured or distressed koala; the importance of responsible dog ownership; and the need to drive with caution in signed koala road crossing areas.

13.2 Objectives

The educative objectives are to:

i) Heighten public awareness regarding the presence of koalas in the Port Stephens LGA;

ii) Ensure information on all relevant issues relating to koalas is made readily available;

iii) Inform the community how they can help to conserve the koala population of Port Stephens; and

iv) Advise the community on appropriate action in cases where sick, injured, distressed or dead koalas are encountered.

13.3 Educational Strategies

13.3.1 Information Brochures and Newsletters

Information brochures can be either general or can deal with specific koala-related issues. Initial resources should be put towards a multi-informational brochure which would be widely distributed. Three avenues already exist for distribution of information of this type. They are:

- The Tilligerry Habitat Association and the Hunter Koala Preservation Society have used the funds from the NSW Environmental Trust to produce brochures for residents on how they can help protect koalas (see Appendix 4).

- Port Stephens Council produce a Health and Environment Newsletter twice per year. This newsletter can be used to remind the public of the start of the koala breeding season, and the need for additional care to be taken to minimise the risk of dog attacks on koalas or collisions between koalas and motor vehicles. It can also be used to make the public aware of the results of any trials of ameliorative measures suggested by the Port Stephens Council CKPoM, and of updates to the status of the Port Stephens koala population.

- Port Stephens Council regularly distributes rate notices to landowners in the LGA. Appropriate information on Koalas could be included with these rate notices, providing an additional avenue of distributing information to the community.

13.3.2 Signs

A number of koala-oriented signs already exist in the Port Stephens area. These vary from promotional to koala warning signs on roads. Specific recommendations regarding signs have been addressed in detail within the Traffic Management Chapter of the CKPoM Resource Document.

13.3.3 Environmental Education

When requested, the Hunter Koala Preservation Society, Native Animal Trust Fund, Port Stephens Council and the National Parks and Wildlife Service currently address school and community groups concerning koala conservation issues. However, at this stage there is no formalised and coordinated program.

Port Stephens Council has an environmental education and awards program for schools in the area. The education program involves visits by “Ranger Ralph” a character who delivers messages about responsible dog ownership and other environmental issues. The education program also includes annual awards, with one category dedicated to “Habitat and Ecosystem”. A koala education package could be delivered using this existing program.

Binning and Thorman (1998) have identified a number of education strategies which may also be of benefit to Koala conservation in the Port Stephens LGA. These include;

- Educating councillors and council staff, including planners and outdoor staff
- Providing information on economic benefits provided by native vegetation, such as tourism, clean water and fisheries

- Low key advertising. The use of logos that incorporate the koala could be used to foster a local identity for marketing koala conservation
- Educating developers and consultants in areas such as new legislative and policy directions, through information sheets. This could be linked to the development application process and to Council's Development Assessment Panel.

13.3.4 Telephone Hold

One suggestion to communicate koala conservation issues, and options for community involvement, is to record and play relevant information on the telephone hold systems at Port Stephens Council and the National Parks and Wildlife Service District Office. This could be done in conjunction with the provision of a range of other information.

13.3.5 Extension Support – Land for Wildlife Scheme

Land for wildlife is a voluntary scheme which aims to encourage and assist private landowners, or registered groups of landowners to provide habitats for wildlife on their property, even though the property may be managed for other purposes. Land for Wildlife provides advice and assistance to not only farmers, but to all persons managing land who may be interested in the scheme. In recognition of the contribution being made by landowners there are no fees associated with the scheme, and landholders may withdraw at any time if they wish. Land for Wildlife does not legally bind participants in any way and it does not alter the legal status of their property. It does not convey the right of public access and it does not mean that the area is an official wildlife sanctuary.

Land for Wildlife can offer advice to landholders on a variety of topics. These include;

1. Integrating wildlife habitat with other uses of private land to the benefit of the landowner and the wildlife.

2. Managing wildlife habitat,

3. The fauna occurring in an area, its ecological role and its needs.

4. Other forms of assistance or incentives that are available to landowners

Land for Wildlife also offers the opportunity for participants to share their ideas and experiences through publications, at field days and through other activities. Schemes of this nature are backed up by dedicated extension staff who help participating landowners access the range of skills and resources that are available.

Land for Wildlife Schemes welcome and encourage landowners who are committed to

1. Managing all or part of their property in a way which clearly aims for the maintenance and enhancement of native habitat; and/or

2. Attempts to integrate nature conservation with other land management objectives.

The Land for Wildlife status of the property will be retained as long as these objectives continue to be upheld. If the property changes ownership, then the new owners need to reapply for registration under the scheme. Land for Wildlife is responsive to the needs of landholders and recognises that each landholder will have a different capacity to participate in the scheme.

It is anticipated that a program of this nature will be developed through the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCC REMS), and supported by each participating Council. The opportunity would therefore exist to provide

advice and assistance to landowners wishing to voluntarily protect and restore koala habitat in Port Stephens through this program.

13.3.6 Media

i) Media Releases

The Hunter Koala Preservation Society, National Parks and Wildlife Service, Council, the Native Animal Trust Fund and the Australian Wildlife Hospital have increased media coverage of koala issues over recent years, particularly in association with the Port Stephens Community Koala Survey and Koala Management Plan. However, it is important to ensure that this continues after the CKPoM has been completed and endorsed. Media releases concerning specific issues could be forwarded on a weekly or fortnightly basis to local television and radio stations and newspapers. National media coverage should be sought in the case of major events. In the event that the media is reluctant to publish weekly or fortnightly items, other avenues such as Council's Ranger Ralph or Mayors Column could be regularly utilised to heighten community awareness on Koala issues.

ii) Weekly Column

The Hunter Koala Preservation Society, the Native Animal Trust Fund and the Australian Wildlife Hospital could also investigate placing a regular article in one of the local newspapers concerning local koala and other native fauna cases and including phone numbers of carers and rescuers.

13.3.7 Other

The Hunter Koala Preservation Society, the Native Animal Trust Fund and the Australian Wildlife Hospital currently provide educational booths and stalls at local fetes and during Save the Koala Month (every July). It is considered important that this continue along with the promotion of these groups' activities through regular newsletters, to interested individuals or organisations as well as to their members.

Increasing utilisation of the Internet by the community means that this could also be used as an important educative tool. The Port Stephens Council, Australian Koala Foundation and National Parks and Wildlife Service web sites could potentially carry regularly updated information on Koala management issues. An e-mail hot line could also be established. Inquiries made by the community could be forwarded to this e-mail address, where they would be answered by a suitably qualified person.

Another opportunity is the placement of advertisements on local buses that provide messages relating to koala conservation. Of particular relevance would be messages asking motorists to slow down in the vicinity of "Black Spots" or "Conflict Areas". It would be worthwhile targeting bus routes that go through "Black Spots" or "Conflict Areas"

A large number of enquires about koala welfare are general in nature and often wide ranging. Most of these questions can be adequately answered by reading Koala Summit. Managing Koalas in New South Wales (1990) edited by D. Lunney, C.A. Urquhart and P. Reed. Published by the (NSW) National Parks and Wildlife Service, Hurstville ($19.95 including postage).

The CKPoM Consultative Committee recommended that greater levels of consultation need to be undertaken by Council with the community in relation to new planning policies and instruments such as Draft LEP 1999 and the Draft Port Stephens Council CKPoM.

13.4 Recommendations

See section 13.2 of the Port Stephens Council CKPoM.

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14. TOURISM

14.1 Introduction

Port Stephens has been the holiday playground for Newcastle and the Lower Hunter Valley for decades, and has been recognised as a key Tourism Node in the Tourism Masterplan for NSW published by Tourism NSW (1993). Visitors are attracted primarily to the Tomaree Peninsula which boasts some of the most beautiful waterways and coastline in NSW. In 1996/97, the tourism industry in Port Stephens catered for 2,304,000 visitor nights (PSC Community Profile 1999), a level which injects approximately $152 million annually into the local economy (Tourism Trends - NSW).

While the Tomaree Peninsula remains the main focus of tourist activity in the LGA, the remainder of the LGA is also experiencing growth in tourist numbers. In particular, the Tilligerry Peninsula is becoming a popular destination for those seeking a quieter holiday retreat with a more environmental focus (Port Stephens Council Community Profile 1999). It is important to recognise that tourism can continue to deliver a major share of economic growth to the region, provided that the natural assets upon which it is based are protected for future generations.

One way of ensuring the preservation of these natural attributes is the development of a sustainable eco-tourism industry in Port Stephens. This is not to be confused with `nature based tourism', which includes `*all forms of tourism that rely on or incorporate visitation to natural environments*'. In Port Stephens nature based tourism currently includes;

- aboriginal cultural sites
- sightseeing
- bush walks
- dolphin and whale watch cruises
- fishing
- snorkeling and scuba diving
- cycling, sailing, paddle boats etc. making use of nature settings
- wild flowers

Nature based tourism therefore relies upon the natural environment to exist, however it makes no provision for managing these natural assets to ensure their long term protection. Eco-tourism, however, is a form of tourism which does provide for the sustainable management of the natural resource upon which it is based.

The Australian National Eco-tourism Strategy which was developed in 1994 defines eco-tourism as `*nature based tourism that involves education and interpretation of the natural environment and is managed to be ecologically sustainable'* (Evans–Smith 1994). The term `ecologically sustainable' is regarded by the strategy as meaning that there is an appropriate return to the

local community in addition to facilitating the long term conservation of the resource (Evans–Smith 1994).

The National Strategy also identifies four key elements which represent the foundation for defining eco-tourism in Australia. These include the natural environment, ecological and cultural sustainability, education and interpretation, and the provision of local and regional benefits (Evans–Smith 1994).

In an effort to promote eco-tourism, a Regional Eco-tourism Plan has been developed through a partnership between the Commonwealth Department of Tourism, and Gloucester, Great Lakes, Dungog, and Port Stephens Councils. This plan focuses upon the development of a new eco-tourism region consisting of the Port Stephens, Myall Lakes, and Barrington Tops areas. The Plan aims to suggest ways in which all stakeholders involved in the tourism industry in this region can unite in order to develop a sustainable eco-tourism industry.

The vision established by this Plan is to `*establish an eco-tourism industry based on the uniqueness and strength of our natural areas'*, and for the region to `*have an ecologically, culturally, and economically sustainable eco-tourism industry that will be internationally competitive and domestically viable*'. It also states that eco-tourism in the region `*will set an example for environmental quality and cultural authenticity while realising an appropriate return to the local community and conservation of the resource*'.

The Regional Eco-tourism Plan includes a number of actions which are consistent with the conservation of koalas and their habitat. These include:

- The adoption of standards by tourism operators of the National Ecotourism Accreditation Program;
- Incorporation of Eco-tourism into other relevant plans and strategies;
- Considering ecological constraints in new developments;
- Including minimal impact information into all interpretative and promotional material about the region;
- Monitoring and minimising the impacts of tourism visitation;
- Council monitoring and review of tourist operations which are approved;
- The monitoring of environmental impacts of eco-tourism developments in sensitive natural areas;
- Assigning natural areas to each operator as part of permit systems. This enables exclusive use along with responsibilities for conservation;
- Operator responsibilities for monitoring;
- Permit systems limiting number of operators; and
- Assistance in monitoring the success and adherence to accreditation standards.

Port Stephens Council's Strategic 30 Year Plan also embraces the development of eco-tourism and nature based tourism in the LGA. It recognises that `*tourism that takes advantage of, and protects the natural environment will co-exist comfortably with the resident population….and that Port Stephens will be reaping the benefits of consciously developing a nature based tourism industry*'. Key actions generated within this plan include:

- Tourism marketing opportunities will focus on the natural attractions of the region, and
- The Regional Ecotourism Plan will be implemented

14.2 Objectives

The objectives of this chapter are to:

i) Establish a structure for 'koala' based eco-tourism to operate in the Port Stephens LGA;

ii) Identify suitable eco-tourism activities which are compatible with the overall objectives of the Port Stephens Council CKPoM;

iii) Establish an accreditation scheme for operators;

iv) Identify suitable areas for 'koala' based eco-tourism;

v) Promote Port Stephens as a destination to see `wild koalas'; and

vi) Identify how tourism can facilitate implementation of recommendations from other chapters of the Port Stephens Council CKPoM.

14.3 Structure

Tourism in Port Stephens is controlled through the private sector by the membership based organisation Port Stephens Tourism Limited (PSTL). The PSTL Board is structured in such a way that every tourism sector is represented and no one sector can control the board. A position on this Board is reserved for a person representing environmental interests. This position is currently filled by a representative from Eco-network Port Stephens. The Company Articles and Memorandum also provide for sub-committees to be formed for specific purposes.

One of these subcommittees is responsible for matters relating to the development and management of eco-tourism based activities in Port Stephens. This subcommittee represents an avenue for implementation of recommendations pertaining to eco-tourism which are outlined within the Port Stephens Council CKPoM.

PSTL is linked to Port Stephens Council via a Joint Venture Agreement which provides for a Joint Venture Committee (four council members and four PSTL members) to consider and recommend approval of marketing initiatives proposed in the Marketing Plan prepared by Council Tourism staff.

14.4 Identification of suitable areas and activities for Koala based ecotourism

Rigorous assessment of the environmental suitability and sustainability of any proposed koala based eco-tourism activity is essential. This would need to take into account the potential effects

of any proposed operation on koalas and koala habitat, as well as on other plant and animal communities.

In order to maximise chances of observing Koalas in the wild, accessible habitat areas need to be identified. In most situations these areas would need to be located on public land with good quality access tracks, and be relatively close to a tourist centre, but in some instances they could be located on private land after formal negotiations with the landowner.

Establishment of a licencing system is required to ensure that all tourism based activities complement the natural environment, and ensure that habitat degradation is minimal or eliminated altogether. Accreditation for operators either locally or through the National Scheme would help ensure best environmental practice approaches to tourism activities are adopted. It is also desirable that, in order to become accredited, tourist operators be required to obtain formal approval from the CKPoM Steering Committee for any proposed activities involving either the promotion or conduct of koala habitat tours, or the promotion of koalas as a tourist attraction.

The CKPoM Steering Committee should also prepare guidelines for the conduct of koala-based tourism to help ensure that the environment is managed appropriately and the highest regard for the welfare of koalas is maintained.

14.5 Tourism Opportunities

The opportunity exists for tourism activities revolving around local koala populations to be enhanced through the development of co-operative activities between the Port Stephens Visitors Centre, Port Stephens Tourism and other operators. Activities already in existence include koala spotting walks coordinated by Tilligerry Habitat, and tree planting programs undertaken by the Japanese tourist market. The CKPoM identifies priority areas for replanting to restore koala habitat and linking areas between patches of habitat. Tourism-based activities could possibly be used to facilitate the restoration of some of these areas.

14.6 Activity Integration

Tourism activity should strive for maximum benefit by working through the Port Stephens Visitors Centre, and Port Stephens Tourism. These organisations provide the linkages with the Region, State and National tourism offices which facilitate exposure to the domestic and international tourist markets. This would also facilitate integration with other nature based tourism attractions in the region.

14.7 Research and Ecotourism

The Eco-tourism subcommittee of Port Stephens Tourism should encourage formal links to be established with the Schools of Tourism & Environmental Science at Newcastle University and other Universities. The student programs at all levels will provide opportunities to link research with tourism activity. Eco-tourists may also participate in certain aspects of research work and habitat restoration activities.

14.8 Promotion

Statistics indicate that the desire to see Australian native animals is one of the main reasons overseas visitors come to Australia. The occurrence of such animals, particularly the koala, in relatively natural habitat within 2 hours drive of Sydney is a considerable attribute of the area. Promotion of this fact presents a significant opportunity for the area.

14.9 The assistance of tourism in implementing the CKPoM

Tourism revolving around Koalas and their habitat in Port Stephens has the potential to provide an effective tool for implementing aspects of the CKPoM. One particular way it may do this is through raising community awareness in regard to koala management issues. This can change individual attitudes and behaviour, as well as stimulating community pressure to improve environmental practices in other sectors of the community. Another way that tourism may benefit implementation of the CKPoM is through the provision of funding. This could be achieved via a number of methods including;

- Membership / Accreditation fees for accredited koala based tourism operators
- Site visit fees where these can be legitimately charged
- Voluntary donations from tourists

14.10 Recommendations

See section 14.2 of the Port Stephens Council CKPoM.

Principal authors: Stephen Leathley, Michael Schmidt, David Bonjer, Steve Wilson and Tim Curran

15. FUNDING

15.1 Introduction

Successful implementation of the Port Stephens Council CKPoM will require appropriate levels of funding to resource the recommendations. Funding can be sought from a number of sources including State and Federal Government grants, Council revenue, the National Parks and Wildlife Service, and private or corporate sponsorship. Appropriate funding sources need to be identified for each of the recommendations of the Port Stephens Council CKPoM that require a financial input.

15.2 Objectives

The objectives of this chapter are to:

i) Identify possible sources of funding for implementation of the Port Stephens Council CKPoM; and

ii) Specify responsibilities for securing required funds.

15.3 Sources

15.3.1 Government Grants

Numerous State and Federal Departments operate various environment-based funding programs. Some of the more relevant programs include the following:

i) Environmental Trust Grants (New South Wales Environment Protection Authority)

The Environmental Trust Grants operate as three separate trusts:

- Environmental Education Trusts;
- Environmental Research Trusts; and
- Environmental Restoration and Rehabilitation Trusts.

Applications for these grants are usually sought through the media at the beginning of each year and grantees are notified of results during July.

ii) Commonwealth Natural Heritage Trust

The numerous grants available for environmental projects including those that were formerly considered under such programs as Landcare, Bushcare, Rivercare, Endangered Species, Weeds and Introduced Pests, and National Wetlands now come under the Commonwealth umbrella of the Natural

Heritage Trust. The individual programs still exist, however all funding applications are now received simultaneously, usually in March of each year. Most of the grants require some form of community participation, however the priorities for funding change each year. Such funding is particularly relevant for tasks relating to habitat restoration and public education.

Port Stephens Council was successful with an application in the 1999/2000 round of the Natural Heritage Trust for funding to facilitate the Port Stephens Koala Habitat Restoration Project. This project aims to reverse the decline in koala habitat throughout the LGA via habitat restoration and protection activities. Funding to the amount of $126,200 over two years was awarded. The project will operate as a devolved grants scheme to be administered by Council. Community groups will undertake the on ground works, with projects being allocated funding by an Assessment Panel consisting of representatives from Council, the Australian Koala Foundation, the Lower Hunter and Central Coast Regional Environmental Strategy (LHCCREMS) group, the NSW National Parks and Wildlife Service and the relevant Catchment Management Committee.

iii) Eco-tourism Grants Program (Commonwealth Department of Tourism)

In the past, the Commonwealth Department of Industry, Science and Tourism has had funding programs focussing on eco-tourism. This program was utilised to develop the Regional Eco-tourism Plan discussed in Chapter 14 of the CKPoM Resource Document. However, priorities for tourism funding change each year and there is no indication as yet of the priorities for next years program.

iv) Catchment Management Committees

Catchment Management Committees such as the Karuah/Great lakes CMC and the Williams River CMC are in the process of developing Catchment Management Plans. Such plans usually cover issues relating to native vegetation cover. The CMCs also have discretionary funds for minor, community based projects (usually under $5000).

15.3.2 Port Stephens Council

Port Stephens Council carry out a number of environmental projects and programs relating to vegetation management. Some of these are internally funded, however increasingly the Council relies on external grants to be able to carry out large scale environmental projects. This is partially due to increased environmental responsibilities under the *Local Government Act 1993* and the *Threatened Species Conservation Act 1995*.

Port Stephens Council has devoted considerable resources to the preparation of the Port Stephens Council CKPoM and CKPoM Resource Document.

15.3.3 National Parks and Wildlife Service

The National Parks and Wildlife Service will continue to contribute staff resources towards the implementation of the Port Stephens Council CKPoM. The National Parks and Wildlife Service has also devoted considerable resources to the preparation of the Port Stephens Council CKPoM and CKPoM Resource Document.

The Service will also continue to seek funding through both internal allocations and external grant programs, towards scientific research (including fire research) and the general implementation of the Port Stephens Council CKPoM.

15.3.4 Roads and Traffic Authority

The Roads and Traffic Authority should be approached to provide funding for relevant projects detailed in the Traffic Management section of the CKPoM Resource Document. The recommendation of that section details those items considered to be the Roads and Traffic Authority's responsibility. To date the Roads and Traffic Authority has been cooperative and is currently funding the wildlife reflector program. They are also obliged, by virtue of the conditions of their consent, to undertake a monitoring/research program associated with the fauna underpasses for the Raymond Terrace Pacific Highway Bypass.

15.3.5 Private Sources

Private organisations are often willing to provide assistance to koala-related projects, as exemplified by Tomago Aluminium and McDonalds Food Stores, who made contributions towards the conduct of the Port Stephens postal koala survey, and RZM Pty Ltd, who are contributing to the employment of the AKF Field Biologist in the Port Stephens LGA.

The Australian Koala Foundation is currently contributing to the employment of the AKF Field Biologist and has also devoted considerable resources to the preparation of the Port Stephens Council CKPoM and CKPoM Resource Document.

Other private organisations could be approached particularly where a project has potential to gain media exposure.

Of particular relevance here is the need for the media, particularly the many foreign TV crews, to channel some of the funds that flow from their documentaries back to research, habitat monitoring, koala welfare and the implementation of the Port Stephens Council CKPoM. Viewers wishing to make a donation to the organisations that have produced the Port Stephens Council CKPoM should be given full directions within any documentaries.

15.4 Recommendations

See section 15.2 of the Port Stephens Council CKPoM.

Principal Authors: John Callaghan and Daniel Lunney

16. RESEARCH

16.1 Introduction

Koala habitat management, koala population management and land use planning should be guided wherever possible by the outcomes of relevant scientific research. In addition, research can provide a basis for monitoring and evaluating the effectiveness of management programs.

A range of koala research projects have been undertaken within the Port Stephens LGA in relation to topics such as tree species preferences, habitat utilisation, impact of bushfires, home-ranging behaviour, and predation. However, not all koala research to date has been directed to areas of specific importance to authorities such as Port Stephens Council for the purposes of land use planning and habitat management. Additionally, there has been no centralised co-ordination and/or dissemination of koala research findings for the LGA.

Limitations in terms of available funding for research projects together with the presence of significant threats to koalas within the Port Stephens LGA, accentuates the importance of directing research to areas where the outcomes are likely to be of greatest use for monitoring, evaluating and refining koala habitat and population management initiatives.

16.2 Objectives

The objectives for the Research Chapter include the following:

i) Encourage and facilitate koala research focusing on topics where current information is lacking;

ii) Ensure effective utilisation and application of research findings towards koala management practice and decision making;

iii) Encourage ongoing involvement of final year and postgraduate University students and University staff in appropriate koala research within the Port Stephens LGA; and

iv) Facilitate the involvement of volunteers in koala research projects, including members of local environmental and koala welfare organisations.

16.3 Potential Future Koala Research Projects for the Port Stephens LGA

The following list identifies a number of potential research topics which would enhance koala management planning and practice within the Port Stephens LGA. This list is by no means exhaustive and is intended only as a preliminary guide. The list draws upon the identified scientific research topics contained within Objective 3 of the National Koala Conservation Strategy (ANZECC 1998), particularly those that relate to assessing the viability of koala populations and formulating and testing approaches to re-establishing and/or recovering koala populations and habitat as detailed under the first two sub-headings below.

Assessment of the viability of koala populations (ANZECC 1998):

- surveys of reproductive success in a wide range of koala populations;
- detailed population studies to establish rates of increase of selected koala populations and to allow prediction of trends in population viability and identification of potential threatening processes; and
- estimates of home ranges and movement patterns and their relationship to threats such as vegetation clearance, roads, wildfires and dogs.

Formulation and testing of approaches to re-establishing and/or recovering koala populations and habitat (ANZECC 1998):

- research on the effects on koala populations of fire, predators (especially dogs and foxes), motor vehicles, forest fragmentation and other processes which alter habitat characteristics, along with processes that exacerbate these effects;
- research on approaches to mitigating these effects and the effectiveness of these approaches in both the short and long term;
- research on approaches to re-introducing koalas to rehabilitated habitat and the effectiveness of theses approaches in both the short and long term;
- research on genetic variability on existing populations and the implications for translocation programs.

Additional Specific Potential Research Projects:

- Investigation of mapped Koala Habitat Linking Areas within the Port Stephens LGA to develop a prioritised listing of potential habitat restoration projects, in accordance with the Habitat Restoration Chapter.
- Evaluation of potential methods for reducing koala road mortality including the use of slow speed zones, underpasses, exclusion fencing, warning signs and driver education, in accordance with the Traffic Management Chapter.

- Genetic assessment of koala populations within the Port Stephens LGA to establish the level of genetic diversity and relatedness amongst sub-populations, including those sub-populations with suspected minimal out-breeding due to habitat fragmentation and/or geographic isolation. This research could potentially determine whether remaining koalas in western parts of the LGA are more closely related to those in the east or to koala populations further to the west or north, outside of the Port Stephens LGA.

- Identification of potential release sites for hand-reared or rehabilitated koalas, where it is determined to be inappropriate to return them to the rescue site.

- Effects open resident (and relocated koalas) associated with the introduction of new koalas into an area as a result of any authorised relocations.

- Investigation into the feasibility and requirements for developing a program in conjunction with the NSW National Parks and Wildlife Service and the CKPoM Steering Committee with aim of re-establishing a koala population in suitable habitat in the western portion of the Port Stephens LGA.

- Ongoing research into the success of koala rehabilitation and release programs and re-colonisation following severe bushfire (as is currently being undertaken by the NSW National Parks an Wildlife Service).

- Ongoing Research concerning the effects of predation by domestic and feral dogs and foxes on koalas in the Port Stephens LGA, in conjunction with the Port Stephens Vertebrate Pest Animal Management Committee.

- Potential costs and benefits of koala oriented eco-tourism in the Port Stephens area, in accordance with the Ecotourism Chapter.

- Identification of lands within the Port Stephens LGA where Voluntary Conservation Agreements could benefit koala habitat conservation and management, in accordance with the Habitat Conservation Chapter and the SWOT Analysis Chapter.

- Assessment of the health status and management implications of koalas in urban areas such as Lemon Tree Passage, Raymond Terrace, Salt Ash and Medowie.

- Follow-up community-based koala survey each ten years to assist with assessment of the ongoing conservation status of koalas, and the public attitudes and perceptions towards koala management within the Port Stephens LGA under the CKPoM.

- Effectiveness of the strategies and implementation of the Port Stephens Council CKPoM, in accordance with the Monitoring Chapter.

16.4 Recommendations

See section 16.2 of the Port Stephens Council CKPoM

Principal authors: John Callaghan and Tim Curran

17. MONITORING PROGRAM

17.1 Introduction

An ongoing monitoring program will be commenced in conjunction with adoption of the Port Stephens Council Comprehensive Koala Plan of Management (CKPoM). As part of this program a number of performance indicators will be identified to provide a means to determine the level to which the key goals have been achieved and to quantify the success or failure of the measures specified within the CKPoM. The monitoring program will also include a procedure to be followed should the CKPoM fail to meet the identified performance indicators. A proposal for funding the monitoring program also needs to be specified. It is intended that the Port Stephens Council CKPoM will be regularly reviewed with the potential for periodic amendment of the measures employed where necessary.

The monitoring program will be co-ordinated by the CKPoM Steering Committee, as described in Chapter 18 Implementation, established to oversee the implementation of the CKPoM..

17.2 Objectives

The objectives of this chapter are to:

i) Identify suitable performance indicators upon which to gauge the success of the Port Stephens Council CKPoM over time;

ii) Detail an appropriate ongoing monitoring program including identification of those responsible for undertaking the program;

iii) Allocate responsibilities for seeking funding for the monitoring program;

iv) Specify a procedure to be followed should the Port Stephens Council CKPoM fail to meet any one or more of the identified performance indicators;

v) Define the procedure for annual reporting on the status of koala populations and koala habitat within the Port Stephens LGA; and

vi) Define an acceptable procedure for annual reviewing and amending the Port Stephens Council CKPoM if and where necessary.

17.3 Performance Indicators

This section identifies the performance indicators to be used by the CKPoM Steering Committee (as identified in Chapter 18 Implementation of the CKPoM Resource Document) to periodically evaluate the Port Stephens Council CKPoM. The performance indicators consist of a number of specific conservation goals which will be used to assess the success or failure of the plan's recommendations. These conservation goals are:

- Loss of koala habitat within areas identified as Preferred and Supplementary Koala Habitat, Habitat Buffers and Habitat Linking Areas is:

  i) minimised and restricted to that permissible in accordance with the performance criteria for development applications (see the Development Assessment chapter of the CKPoM Resource Document and the performance criteria for development applications in Appendices 4 & 5 of the CKPoM); and

  ii) reduced in each successive year over the next five years (initially).

- Annual koala population assessments undertaken at designated monitoring sites indicate that the majority of the surveyed koala populations, including urban populations, are stable or thriving (determined on the basis of activity levels, evidence of successful breeding, signs of disease, mortality and survivorship, and population estimates) within 5 years from the adoption of the Port Stephens Council CKPoM.

- Annual statistics indicate a decrease in koala mortality due to collisions with motor vehicles, in conjunction with stable or increasing koala population estimates in the vicinity of identified black spot areas.

- Annual statistics indicate a decrease in koala mortality due to dog attacks, in conjunction with stable or increasing koala population estimates in the vicinity of identified high risk dog-attack areas.

- A minimum of 20 hectares of koala habitat per year is replanted (and successfully maintained in subsequent years) throughout the LGA in areas identified as a high priority for restoration according to the criteria outlined in the Habitat Restoration chapter.

In addition to the conservation goals listed above, the Port Stephens Council CKPoM should be assessed in terms of implementation of each of the proposed actions. For instance, the success of the habitat conservation strategy should be assessed initially by determining whether each of the proposed habitat conservation measures have been implemented on schedule. The schedule for implementation for each of the actions presented in the Port Stephens Council CKPoM should be determined by the CKPoM Steering Committee, with reference to the priority assigned to each action in the CKPoM.

17.4 Monitoring Program

The monitoring program will aim to periodically update evaluations on the status of the koala population and koala habitat within the Port Stephens LGA. The status of the koala population will be assessed in terms of estimated koala numbers, evidence of breeding activity, clinical signs of disease, records of mortality and the overall distribution of koalas within the LGA. The program will also seek to record changes in the amount and quality of available koala habitat as well as changes in the levels of habitat utilisation. The impact of threatening processes upon the koala populations will be monitored to determine the level of success or failure of the measures within the Port Stephens Council CKPoM. The relative significance of each threatening processes will also be regularly assessed to ensure resources are focused in the highest priority areas.

17.4.1 Koala Habitat

The vegetation and koala habitat maps presented in chapter 2 of the CKPoM Resource Document show the distribution of vegetation associations and koala habitat across the Port Stephens LGA at the time of survey. It will be necessary to periodically update the LGA-wide Vegetation Map to incorporate subsequent clearing or regrowth of native vegetation and to allow for fine-scale refinement of vegetation association classifications and mapping. Amendments to the vegetation map may necessitate corresponding changes to the koala habitat map and the Koala Habitat Planning Map. Because the process to amend these maps is complex it is proposed that this procedure be carried out no more frequently than once a year, to allow all the necessary amendments to be incorporated together. In the interim it will be necessary to make Council's planners, NPWS and DUAP aware of any necessary amendment to ensure that any proposed development or activity likely to affect that area can be assessed accordingly.

It is proposed that the procedure for this notification will be as follows. Where it is likely that changes to the Vegetation Map, koala habitat map or the Koala Habitat Planning Map will be necessary, the relevant areas will be cross hatched to denote the need for revision. This will be done on the digital copy of these maps held by Council. Hard copies of the maps showing the areas in question will be distributed to NPWS and DUAP, along with a written description of the property and the recommended reclassification of the vegetation. The complete step-wise procedure for updating the maps is shown in Figure 17.1.

Port Stephens Council will seek funding to purchase and interpret the latest available satellite imagery for the Port Stephens LGA in early 2000. This data would be classified using GIS software to identify all cleared and partially cleared/heavily disturbed areas within the LGA. The resulting map would then be digitally compared to the CKPoM Koala Habitat Planning Map to determine the extent of any additional habitat clearing/disturbance and/or habitat rehabilitation/restoration with respect to each category of koala habitat including identified Habitat Buffers and Habitat Linking Areas. It is proposed that a similar exercise be undertaken at four year intervals to coincide with Port Stephens Council's Comprehensive State of the Environment Reporting and as an important component of the ongoing monitoring program.

Port Stephens Council and the CKPoM Steering Committee will continue to refine the mapping of koala habitat within the LGA with input from the community and consultation

with landowners, and taking into account the any information from Development Applications and rezoning requests.

The CKPoM Steering Committee will establish and maintain a register of any koala habitat clearing activities and habitat restoration projects within the LGA. The matters listed on this register which suggest likely substantial disturbance to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas will be investigated and included within annual monitoring reports.

Port Stephens Council will also be responsible for overseeing refinement of the LGA-wide Vegetation Map. This will include assessing the work done by consultants in conjunction with rezoning proposals and/or development applications where refinement of the Vegetation Map is necessary. In addition, Council will maintain a register of other potential discrepancies or inaccuracies in the vegetation map and will be responsible for assessing these areas to refine the classification of vegetation associations, where time and resources permit. The procedure by which such refinement will be formally incorporated into the Port Stephens Council CKPoM is outlined in Figure 17.1.

FIGURE 17.1. Step-wise procedure for updating and refining the vegetation and koala habitat maps.

17.4.2 Koala Population

Estimated Localised Population Size and Status

The following methods will be used to establish initial population estimates as well as for the purposes of ongoing monitoring:

Urban Populations: Annual Phone-in Census

The annual phone-in census will be conducted on the same set day each year. The census would be co-ordinated by the CKPoM Steering Committee and conducted on a weekend day during mid to late spring when any back-young or recently independent young (from the previous breeding season) are likely to be observed with their mothers. The annual phone-in census would be conducted from Council Chambers, subject to approval from Port Stephens Council. The census would require very effective publicity and could be undertaken with assistance provided by volunteers from the Native Animal Trust Fund and the Hunter Koala Preservation Society. A database for recording census results would be established at Port Stephens Council by the CKPoM Steering Committee. This survey could be conducted in conjunction with collection of information for Council concerning other issues, such as sightings of feral animals, to ensure a more efficient use of resources and to potentially increase public participation.

The CKPoM Steering Committee would utilise the census information, in conjunction with NATF and HKPS records, to assess the status of urban koala populations throughout the LGA.

Non-urban Populations: Transect-based Searches

Annual transect-based searches of designated monitoring sites will be co-ordinated by the CKPoM Steering Committee. These searches would be conducted during daylight hours using volunteers from the NATF, HKPS, Hunter Botanical Gardens, The Wilderness Society, and interested members of other local groups and the local community. Assistance with field co-ordination of search teams would be sought from the Hunter District NPWS.

Transect-based searches would be conducted during mid to late spring each year. Search sites will be determined by the CKPoM Steering Committee and will be replicated each search period. The conduct of searches including areas searched, search procedures and search effort will be consistent for each search period, although there may be justification for identifying additional search areas over time. The Koala Management Units defined in chapter 6 of the CKPoM Resource Document will be used for the purposes of selecting designated search sites.

Search sites should be one kilometre square and should be selected to incorporate identified areas of Preferred and/or Supplementary Koala Habitat and wherever possible should include areas where evidence of koala activity, as recorded during assessments for the Koala Habitat Atlas, suggested the presence of a stable breeding population in the area. A minimum of four sites would be identified in the western portion of the LGA.

Detailed search protocols and procedures for distribution to potential participants would be prepared by the CKPoM Steering Committee. A training session would be held for search team leaders prior to each search period which would include procedures for conducting searches for koalas, communication protocols and emergency procedures in the event of injury.

The CKPoM Steering Committee will record the location of each koala observation together with other relevant details in both map form and on a database at Port Stephens Council, following each search period. The data will be analysed and interpreted by the CKPoM Steering Committee in conjunction with the amount of each category of koala habitat within each survey area and the results of previous search periods to assess the status of non-urban koala populations within the designated survey areas. The outcomes of these analyses will be included within annual CKPoM monitoring reports.

Estimated LGA-wide Koala Population Size and Status

In addition to the above surveys, the distribution and status of koala populations within the LGA will be assessed and reported annually on the basis of results from the aforementioned surveys in conjunction with broader assessments of koala activity levels through application of the Australian Koala Foundation's Spot Assessment Technique (Phillips and Callaghan (1995); see Appendix 5). This approach would involve surveying koala faecal pellet evidence and determining subsequent koala activity levels at plot sites located across the LGA.

A minimum of ten plot-based spot assessment sites will be established by the CKPoM Steering Committee within each of Preferred, and Supplementary Koala Habitat, Habitat Buffers and Habitat Linking Areas. Five of the spot assessment sites within each habitat category will be located within areas where koala activity and/or koalas have already been recorded. The remaining sites within each habitat category will be located in areas where there is no prior evidence of use by koalas. Where possible, the latter sites should be located within five kilometres of an area of habitat where the activity level recorded during Koala Habitat Atlas fieldwork suggested occupation by a stable koala breeding population. Approximately 30% of the sites should be located to the west of the Pacific Highway.

All koala faecal pellets will be removed from within the prescribed search catchments around the base of each tree within established plot sites during each annual assessment period.

Spot assessment results will be compared with those from previous monitoring periods and will be used, together with the estimates for urban and non-urban populations and the total amount of each category of habitat within the LGA, to estimate the likely status of the LGA-wide koala population.

The CKPoM Steering Committee will collate existing research results on koala faecal pellet longevity and determine if any additional research is required.

The annual CKPoM monitoring report will include consideration of the assessed population trends in each of the areas surveyed. The status of the koala population within the LGA will be assessed each reporting period in terms of changes in local population estimates, evidence of breeding activity, evidence of disease, recorded

distribution of koalas within the LGA, mortality statistics and the outcome of a Population Viability Analysis.

Population Viability Analysis (PVA)

Population Viability Analysis (PVA) is a process that aims to provide an indication of the likelihood that a particular population of a species will become extinct within a specified time, and under a certain set of circumstances (Possingham *et al*. 1993). While PVA can be carried out using various methods including experimentation, observation or by comparison with species of similar life histories, this process often involves the application of complex computer simulation models (Possingham 1995). These simulation models provide as output the probability of extinction of the population for the given time and set of circumstances (Possingham 1995). The necessary items for input will vary according to the model used for the analyses and the objectives of the simulation, but can include attributes such as home range size, population densities, fecundity, mortality, population growth and movement (see for example; Lindenmeyer and Possingham, 1996). These models can also incorporate the impact of catastrophes such as bush fire on a population (Possingham, 1995). At this stage it remains undetermined whether an effective PVA model can be developed for application to the koala which takes into account the complexities of koala society.

According to Possingham (1995), PVA can provide new insights into the conservation requirements of a particular species as well as highlighting aspects of a species' biology requiring further research. Such use of PVA involves the application of 'sensitivity analysis' to the results generated from computer simulation models. Sensitivity analysis is carried out by repeating PVA simulations while systematically varying the values of input parameters to determine which cause significant change to the probability of a population extinction (Possingham, 1995). PVA can potentially be used to rank management options, in conjunction with a sensitivity analysis to test the ranking (Possingham *et al*. 1993).

While we do not have the necessary data at present to undertake a comprehensive Population Viability Analysis, we can use this approach to demonstrate that a number of factors are likely to effect the long-term viability and persistence of the Port Stephens koala population. As more information becomes available concerning the Port Stephens koala population, the potential for effectively using PVA will be enhanced as will the potential of the model to guide future refinement of management strategies.

It is proposed that the CKPoM Steering Committee investigate the potential for developing a koala specific model for undertaking PVA for the Port Stephens LGA which, if successful, could form a component of the monitoring program.

17.4.3 Threatening Processes

The impacts of threatening processes, in addition to those associated with land clearing, will also be reported on an annual basis including road collisions, dog attacks, feral predators, bushfires, and incidence of disease. Statistics supplied by the Native Animal Trust Fund (NATF) and the Hunter Koala Preservation Society (HKPS) will be utilised for

this purpose. Both the Port Stephens Vertebrate Pest Animal Management Committee and Council's Fire Control Officer will be consulted for input into the annual report.

A register will be maintained by Council to record any cases dealt with by Council Rangers involving domestic dog attacks on koalas. Council road maintenance staff will be encouraged to report any sightings of dead koalas near roads.

17.5 Funding and Participants

The appointment of the AKF Field Biologist in Port Stephens was jointly funded by the AKF, RZM Pty. Ltd. and Port Stephens Council for an initial two year period up to March 2000. This position was extended for a further two-year term from 2000.

Funding will also be required for monitoring programs including spot assessments, foot-based searches and community phone-in surveys. The CKPoM Steering Committee will be responsible for seeking the necessary funding, assistance, resources and sponsorship to implement the ongoing monitoring program. In the future, Environmental Trust Grants may provide a potential funding source for aspects of the monitoring program.

Local community organisations will be encouraged to contribute to the ongoing monitoring program and will provide a critical resource. Potential post graduate research projects involving aspects of the monitoring program will be identified by the CKPoM Steering Committee and promoted through the University network.

17.6 Reporting

A report on the findings of the ongoing monitoring program will be prepared by the CKPoM Steering Committee on an annual basis following adoption of the Port Stephens Council CKPoM.

Reporting on the status of koalas within the Port Stephens LGA, together with actions taken to implement recommendations from the CKPoM and findings of the ongoing monitoring program, should also be undertaken as a component of council's annual State of the Environment Report under the *Local Government Act* 1993.

17.7 CKPoM Review and Amendment

The Port Stephens Council CKPoM will be formally reviewed by the CKPoM Steering Committee at the end of each twelve month period following adoption. Where failure to meet any one or more of the Performance Indicators has been reported, the CKPoM Steering Committee will determine whether the measures established by the Port Stephens Council CKPoM require amendment.

It will also be necessary for the CKPoM Steering Committee to undertake an annual review of the established Performance Indicators, the monitoring program and the extent to which the recommendations of the Port Stephens Council CKPoM have been

implemented. Failure to meet Performance Indicators could potentially indicate that measures proposed by the CKPoM are either not adequate or are not being effectively implemented or alternately, that the indicators selected are unrealistic. In either case, action would be taken by the CKPoM Steering Committee to ensure that necessary amendments are made to measures and/or their implementation, or to the Performance Indicators. It may be necessary to amend the Performance Indicators as more information is collected and collated, particularly with respect to the status of the Port Stephens koala population.

Any proposed amendments to the Port Stephens Council CKPoM, for example revision of the Vegetation Map, koala habitat map and Koala Habitat Planning Map, will be determined by the CKPoM Steering Committee in consultation with the General Manager of Port Stephens Council and the Director-General of NSW National Parks and Wildlife Service. Amendments to the Port Stephens Council CKPoM will require the approval of both the Director-General of Urban Affairs and Planning and Port Stephens Council before they take effect.

17.8 Recommendations

See section 17.2 of the Port Stephens Council CKPoM

Principal Authors: John Callaghan, Stephen Leathley and Tim Curran

18. IMPLEMENTATION

18.1 Introduction

The CKPoM Resource Document has been produced jointly by the Australian Koala Foundation, the NSW National Parks and Wildlife Service and Port Stephens Council with the co-operation and support of numerous individuals and organisations from the local community. It is considered essential to provide for the ongoing involvement of these agencies, organisations and individuals for the effective implementation and updating of the CKPoM Resource Document and the Port Stephens Council CKPoM.

18.2 Objectives

The objectives of the Implementation Chapter are to:

i) Provide a formal framework for implementation of the Port Stephens Council CKPoM;

ii) Facilitate the ongoing involvement, support and promotion of the Port Stephens Council CKPoM within the local community;

iii) Provide for the ongoing monitoring, evaluation and updating of the Port Stephens Council CKPoM.

18.3 Implementation Strategy

In order to ensure the recommendations of the Port Stephens Council CKPoM are implemented, a CKPoM Steering Committee should be established. This Committee would be responsible for overseeing the implementation of the CKPoM. Core members would consist of a representative from each of Port Stephens Council (PSC), the NSW National Parks and Wildlife Service (NSW NPWS), the Australian Koala Foundation (AKF), the Department of Urban Affairs and Planning (DUAP), the Native Animal Trust Fund (NATF), the Hunter Koala Preservation Society (HKPS), the Australian Wildlife Hospital (AWH) and a minimum of three groups or individuals representing landholder interests. A Councillor from Port Stephens Council would chair the CKPoM Steering Committee.

Representatives from other organisations including the Roads and Traffic Authority (RTA); Hunter Water Corporation (HWC); State Forests of NSW (SF); Worimi Local Aboriginal Land Council (WLALC); the University of Newcastle; and Port Stephens Fire Control (PSFC) would be called upon for input as required by the Committee.

Principal responsibilities for each representative are outlined below:

Core Members

*PSC Councillor	Chair the committee and represent Port Stephens Council
*PSC; *(1 member)*	land use planning, rezonings, development consents, habitat protection and management, dog control, traffic management, ecotourism.
*NSW NPWS; *(1 member)*	habitat protection and management, threatened species legislation, conservation agreements, research, koala welfare, new area acquisitions.
*AKF; *(1 member)*	habitat protection, population assessment, threat management, expert advise, research, monitoring.
*DUAP; *(1 member)*	land use planning, rezonings, planning policy, habitat protection and management, SEPP 44
*NATF; *(1 member)*	koala care and rehabilitation, volunteer assistance with research and monitoring, publicity and promotion, data base, funding.
*HKPS; *(1 member)*	koala welfare and habitat protection issues, publicity and promotion, data base, funding.
AWH	koala care and rehabilitation, publicity and promotion, funding.
*Landholder *(3 members)*	represent the interests of landholders and liaise with local landholder groups.

Occasional Members

*HWC;	koala management on Hunter Water Corporation lands.
*SF of NSW;	koala management on State Forests of NSW lands.
*WLALC;	koala management on Worimi lands.
*University;	research, other as necessary.
*RTA;	advise on relevant projects including road mortality relief measures.

*PSFC;	advise on Hazard Reduction and bushfire.
*Researchers;	advise on outcomes of local koala research.

The CKPoM Steering Committee should convene immediately following formal endorsement and adoption of the Port Stephens Council CKPoM.

The CKPoM Steering Committee should seek to ensure the relevance of the Port Stephens Council CKPoM over time through revision as necessary. Any amendments to the CKPoM will require formal approval from the Director General of Urban Affairs and Planning and Port Stephens Council.

The CKPoM Steering Committee should meet quarterly over the first twelve month period and then as often as considered necessary by the Committee. Port Stephens Council will provide the Committee with administrative support.

The CKPoM Steering Committee should seek to promote and publicise any major events concerning implementation of the Port Stephens Council CKPoM, including any opportunities for involvement of the local community.

18.4 Recommendations

See section 18.2 of the Port Stephens Council CKPoM.