

**PORT STEPHENS COUNCIL
COMPREHENSIVE KOALA PLAN OF
MANAGEMENT
(CKPoM)**

**Prepared by Port Stephens Council
with the Australian Koala Foundation**

June 2002



Port Stephens Council Comprehensive Koala Plan of Management (CKPoM) – June 2002

This document is to be cited as:

Port Stephens Council (2002). *Port Stephens Council Comprehensive Koala Plan of Management (CKPoM) – June 2002*. Prepared by Port Stephens Council with the Australian Koala Foundation.

Enquiries should be directed to:

Port Stephens Council
PO Box 42
RAYMOND TERRACE NSW 2324
PH: (02) 4980 0255 FAX: (02) 4987 3612
EMAIL: council@portstephens.nsw.gov.au

© 2002 Port Stephens Council.

Table of Contents

	Page
1. Introduction	4
2. Koala Habitat Identification	7
3. Ecological History	8
4. Habitat Conservation Measures	9
5. Development Assessment	13
6. SWOT Analyses	14
7. Habitat Restoration	26
8. Traffic Management	28
9. Dog Management	31
10. Feral Animal Management	34
11. Bushfires	35
12. Koala Welfare	37
13. Education	38
14. Tourism	41
15. Funding	43
16. Research	44
17. Monitoring	46
18. Implementation	49
19. Action Plan	51
20. Glossary of Terms	59
21. Abbreviations	61
22. References	62
23. Appendices	63

List of Figures

- Figure 1. Koala Habitat Planning Map for the Port Stephens LGA**
- Figure 2. Koala Management Units for the Port Stephens LGA**
- Figure 3. Black Spots, Conflict Areas and Potential Problem Areas**
- Figure 4. Guidelines for Koala Habitat Assessment**

Appendices

- Appendix 1. Justification for rezoning of selected areas of public land to Environmental Protection**
- Appendix 2. Performance criteria for rezoning proposals**
- Appendix 3. Proposed amending clause of the Port Stephens LEP**
- Appendix 4. Performance criteria for development applications**
- Appendix 5. Performance Criteria for Development Applications proposing agricultural activities.**
- Appendix 6. Guidelines for Koala Habitat Assessments**
- Appendix 7. Guidelines / Principles for the effective design and construction of koala underpasses / overpasses**
- Appendix 8. Tree species that may be important to koalas in the Port Stephens Local Government Area as identified by anecdotal evidence**
- Appendix 9. Ecological Criteria for the determination of Habitat Buffers for Preferred Koala Habitat**
- Appendix 10. Principles for managing fires and koala habitat**

1. Introduction

The Port Stephens Council Comprehensive Koala Plan of Management (CKPoM) has been prepared for Port Stephens Council by Port Stephens Council and the Australian Koala Foundation (AKF). The NSW National Parks and Wildlife Service (NPWS) assisted these organisations in preparing the CKPoM. The CKPoM Consultative Committee consisting of 12 community members, three Councillors, an Independent Chair, and 1 technical adviser each from the NPWS and AKF, reviewed the Draft CKPoM 1999 and made a series of recommendations which have been included within the document. The CKPoM is also accompanied by the CKPoM Resource Document. The Port Stephens Council CKPoM contains a brief discussion of issues relating to the management of koalas and koala habitat in the Port Stephens Local Government Area (LGA) and the recommended actions to address these issues. The CKPoM Resource Document provides a more detailed discussion of these issues and the rationale for the recommendations proposed in the Port Stephens Council CKPoM.

The Port Stephens Council CKPoM and CKPoM Resource Document were preceded by the Draft 1994 Port Stephens Koala Management Plan (Callaghan *et al.* 1994), which was prepared by the NSW National Parks and Wildlife Service, Port Stephens Council and the Hunter Koala Preservation Society, and the Port Stephens Koala Habitat Atlas (Phillips *et al.* 1996), prepared by the Australian Koala Foundation. The history of the development of the Port Stephens Council CKPoM is detailed in Chapter 1 of the CKPoM Resource Document.

The Port Stephens Council CKPoM is consistent with the National Koala Strategy (ANZECC 1998), in that it seeks to conserve koalas in their existing habitat by identifying and protecting koala habitat and incorporating koala conservation into local government planning processes (Lunney *et al.* 1998).

The Port Stephens Council CKPoM has been prepared in accordance with State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44). The principal aim of this CKPoM is identical to that of SEPP 44:

“...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.”

When the Port Stephens Council CKPoM is approved by both Council and the Director General of Urban Affairs and Planning, it will supersede the requirements of SEPP 44 for the investigation of potential and core koala habitat and the requirement for the preparation of Individual Koala Plans of Management. Effectively, compliance with the Port Stephens Council CKPoM will constitute compliance with SEPP 44 for relevant matters in the Port Stephens LGA. However, where an Individual Koala Plan of Management prepared to accompany a development application has already been approved by both Council and the Director General of Urban Affairs and Planning and it conflicts with the provisions of the Port Stephens Council CKPoM, the provisions of the Individual Koala Plan of Management shall prevail.

1.1 CKPoM Objectives

The principal objectives of the Port Stephens Council Comprehensive Koala Plan of Management are to:

- *Evaluate and rank koala habitat throughout the Port Stephens LGA;*
- *Identify priority conservation areas and strategies to protect significant koala habitat and populations;*
- *Identify threats that impact on koalas and koala habitat;*
- *Provide for the long-term survival of koala populations 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;*
- *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 a formal approach for 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.

1.2 Performance indicators

It is necessary to establish performance indicators against which the success of each of the recommended actions in the CKPoM can be assessed and, if necessary, refined. The performance indicators consist of a number of specific conservation goals. 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 and 5 of this 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 increasing (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 outcomes 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.

See sections 17.1 and 17.2 of this CKPoM and Chapter 17 (Monitoring) of the CKPoM Resource Document for further discussion of how these performance indicators are to be used to monitor the success, and where necessary, to update and refine the Port Stephens Council CKPoM.

2. Koala Habitat Identification

2.1 Synopsis

The accurate identification of koala habitat in a given area is a crucial component of any efforts to conserve koalas in that area. The work of Lunney *et al.* (1998) to identify koala habitat in the Port Stephens LGA provides the necessary basis to prepare a strategy to conserve koala habitat and koala populations in the LGA.

The identification of koala habitat within the Port Stephens LGA (Lunney *et al.* 1998) 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. From this combined map, a Koala Habitat Planning Map (Figure 1), which identified Habitat Buffers on all Preferred Koala Habitat and Habitat Linking Areas, was prepared. 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. The CKPoM Consultative Committee recommended that 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.

The field-based survey, the Australian Koala Foundation's Port Stephens Koala Habitat Atlas (Phillips *et al.* 1996), 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 likely to be Preferred Koala Food Trees.

The procedure undertaken to identify koala habitat in the Port Stephens LGA is detailed in Chapter 2 of the CKPoM Resource Document. The work of Lunney *et al.* (1998) is also reproduced in that chapter.

3. Ecological History

3.1 Synopsis

Research into the ecological history of koala habitat in the Port Stephens LGA (Knott *et al.* 1998) has substantially contributed to the preparation of the Port Stephens Council CKPoM. The outcomes of this 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. It complements the field and community koala surveys undertaken in the LGA. It also provides a detailed history of European settlement and subsequent land use in the Port Stephens LGA and Lower Hunter. Additionally, this research provides an explanation for the current absence or substantial decline of koala populations in the western areas of the LGA.

The ecological history research will help identify areas that are suitable for koala habitat restoration projects and provide guidance regarding the likely pre-European vegetation of areas which have since been predominantly cleared.

The ecological history research (Knott *et al.* 1998) is presented in Chapter 3 of the CKPoM Resource Document.

4. Habitat Conservation Measures

4.1 Synopsis

An effective strategy to conserve koala habitat is essential to provide for the long term survival of the koala within the Port Stephens LGA. Such a strategy will need to involve the integration of a number of different conservation measures, including regulatory (legislative) and incentives-based approaches, in conjunction with an education program.

Chapter 4 (Habitat Conservation Measures) of the CKPoM Resource Document details the range of conservation measures proposed for the Port Stephens LGA. Proposed regulatory measures include: the rezoning of koala habitat on public land to Environmental Protection; the adoption of performance criteria for the assessment of rezoning requests and development applications that apply to land containing koala habitat, the latter via the implementation of an amending clause of the relevant Port Stephens Local Environment Plan and performance criteria for the assessment of development applications; and amendments to Council's Tree Management Policy.

Incentives-based habitat conservation measures that are considered for possible implementation include: Voluntary Conservation Agreements, Voluntary Conservation Zones, Property Agreements, Management Agreements and Wildlife Refuges. Possible incentives schemes that could be employed to encourage landholders to conserve koala habitat include those based on: management grants (eg. for fencing and replanting), rate rebates, a levy based 'Trust' or 'Conservation Program', development incentives and transferable development rights.

There are several land management agencies that have large land holdings in the Port Stephens LGA, including Port Stephens Council, the Department of Land and Water Conservation, the NSW National Parks and Wildlife Service, State Forests of NSW, the Hunter Water Corporation and the Defence Estate Organisation, which manages land owned by the Commonwealth Department of Defence. The potential role of each of these organisations in the management of koala habitat is discussed in Chapter 4 of the CKPoM Resource Document.

Council has recently exhibited a Draft Local Environmental Plan amending the Port Stephens LEP 1987 (known as Draft LEP 1999) that includes the following provisions:

- An Environment Protection 7(a) Zone that applies to land currently zoned 7(a), 7(j) and 7(k);
- Mining and silica sand extraction not be permitted in the 7(a) zone;
- Vegetation clearing be formally defined within Draft LEP 1999 and be permitted only with the consent of Council.

4.2 Actions

The recommended habitat conservation measures for the Port Stephens LGA are listed below.

4.2.1 Port Stephens Council

Rezoning of koala habitat on public land

- i) Consult with public authorities with a view to rezoning public lands not zoned 7c containing Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Buffer Areas and Habitat Linking Areas to Environmental Protection 7a: and
- ii) Seek the agreement of relevant public authorities to manage their land for conservation of koalas

Performance Criteria for Rezoning Requests and Development Applications

- i) Council resolve to amend its LEP Amendment Policy to include the performance criteria for rezoning requests that are outlined in Appendix 2 of this CKPoM;
- ii) Council resolve to prepare a Draft Local Environmental Plan, so as to include a clause that activates the provisions of the Port Stephens Council CKPoM including the criteria to be used for the assessment of any development proposals within or adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers and Habitat Linking Areas, as per the proposed clause in Appendix 3 of this CKPoM;
- iii) Council implement the performance criteria for development applications contained in Appendices 4 and 5 of this CKPoM and which are activated via the amending clause of the LEP specified in Appendix 3;

Other Measures

- i) For the purposes of the Urban Settlement Strategy, the following categories of koala habitat are identified as a constraint on public land outside 7c: Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Linking Areas, and Habitat Buffers.
- ii) Council investigate the potential application of incentive-based measures as listed within section 4.1 of this CKPoM (and discussed in detail in section 4.6 of the CKPoM Resource Document), in conjunction with regulatory measures in order to ensure the effective conservation and management of koala habitat within the Port Stephens LGA;
- iii) Council investigate options for amending its Tree Management Policy to recognise the importance of preferred koala food trees. Possible options include having them listed in Clause 2 of the Tree Preservation Order or in the significant tree register specified in Clause 12 of the Tree Management Policy. An additional list of tree species that may be important to koalas based on anecdotal evidence is included in Appendix 8;

- iv) When preparing Plans of Management for Council-owned community land or Crown Land of which Council is the trustee or has care, control and management, Council should incorporate the provisions of the Port Stephens Council CKPoM; and
- v) Council demonstrate best-practice management of koala habitat by incorporating the principles and standards of the Port Stephens Council CKPoM into all Council developments and activities.

4.2.2. National Parks and Wildlife Service

- i) The National Parks and Wildlife Service will assist with any future review of the CKPoM and assist in the preparation of future standards or guidelines;
- ii) The National Parks and Wildlife Service will discuss with private landholders options for conservation of koala habitat on their lands, including offering incentive instruments such as Voluntary Conservation Agreements to assist in conservation of koala habitat;
- iii) The National Parks and Wildlife Service will investigate options for the establishment of conservation reserves particularly on the Tomago Sandbeds;
- iv) The National Parks and Wildlife Service continue its commitment to providing advice and assistance to other government agencies and private land holders regarding koalas, and other wildlife conservation issues;
- v) The National Parks and Wildlife Service consider relevant findings and strategies from the Port Stephens Council CKPoM for incorporation into a state-wide Koala Recovery Plan in accordance with the *Threatened Species Conservation Act 1995*.

4.2.3. Hunter Water Corporation

- i) The Hunter Water Corporation be requested to refer to the Port Stephens CKPoM when undertaking self-determination (Part V) assessments on Hunter Water Corporation land.

4.2.4. State Forests of NSW

- i) State Forests of NSW be requested to refer to the Port Stephens Council CKPoM when undertaking koala surveys as part of the assessment of proposed logging operations.

4.2.5. Department of Land and Water Conservation

- i) The Department of Land and Water Conservation be requested to refer to the Port Stephens Council CKPoM when undertaking Crown Land Assessments within the Port Stephens LGA; and
- ii) The Department of Land and Water Conservation be requested to incorporate the provisions of this CKPoM in future Regional Vegetation Management Plans that include the Port Stephens LGA.

4.2.6. Commonwealth Department of Defence

- i) The Commonwealth Department of Defence be requested to adopt the standards for koala habitat management contained in the Port Stephens Council CKPoM.

5. Development Assessment

5.1 Synopsis

The development assessment process refers to the procedure by which development and land use is assessed and regulated. This procedure represents an important means by which Council can regulate development to ensure the protection and effective management of koala habitat in the Port Stephens LGA. Assessment guidelines have been established to standardise the treatment of issues relating to the management of koalas and koala habitat within the development assessment process.

Preferred Koala Habitat and Habitat Buffers require the highest level of protection possible (see section 5.4 of the CKPoM Resource Document for discussion). Supplementary Koala Habitat and Habitat Linking Areas also require a high level of protection, though less than that for Preferred Koala Habitat and Habitat Buffers (see section 5.4 of the CKPoM Resource Document). Preferred koala food trees require protection wherever they occur in the Port Stephens LGA.

Performance criteria and development standards have been developed to aid the assessment of development applications that apply to land that contains or is adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas, and/or preferred koala food trees. These performance criteria are outlined in Appendices 4 & 5 of this CKPoM.

Guidelines for Koala Habitat Assessments were developed to provide the information necessary to support a rezoning proposal under Part 3, or a development application under Part 4, of the *Environmental Planning and Assessment Act 1979*. The Guidelines for Koala Habitat Assessments in the Port Stephens LGA are presented in section 5.5 of the CKPoM Resource Document and Appendix 6 of this CKPoM.

5.2 Actions

- Council advertise in the local newspaper all development applications that are lodged in Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Buffers & Habitat Linking Areas
- Council expand the information provided on section 149 certificates to reflect the presence of koala habitat.

6. SWOT Analyses

6.1 Synopsis

The Port Stephens 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.

The Port Stephens LGA has been divided into nine Koala Management Units (KMUs) which are shown in Figure 2 and comprise: Tilligerry Peninsula KMU; Balickera KMU; Tomaree Peninsula KMU; Raymond Terrace KMU; Medowie KMU; Tomago Sandbeds KMU; Karuah/Ferodale KMU; Fullerton Cove/Stockton Bight KMU; and Western KMU.

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. The recommended actions for each KMU are presented below, with the exception of proposed rezonings of land to Environmental Protection, which are listed in section 4.2 of this CKPoM.

See Appendix 5 of the CKPoM Resource Document for the complete SWOT analyses for each KMU.

6.2 Actions

Tilligerry Peninsula KMU

Habitat Conservation: Incentives-based measures

The following area in the Tilligerry Peninsula KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- The patch of Preferred Koala Habitat and associated Habitat Buffers and Habitat Linking Areas to the south east of Tanilba Bay. This patch is in close proximity to the largest patch of Preferred Koala Habitat on the Tilligerry Peninsula.

Habitat Conservation – Crown Lands assessment

- Crown Lands on the Tilligerry Peninsula are currently subject to Aboriginal land claims. The Department of Land & Water Conservation is currently awaiting the outcome of these claims, pending which assessments may be undertaken by the Department of Land and Water Conservation for areas of Crown Land on the Tilligerry Peninsula that contain koala habitat. Pending the outcome of this assessment, Crown Land which contains significant koala habitat may be reserved for Environmental Protection/Conservation. Following such reservation, it is proposed that private reserve trusts be established to manage these areas.

Habitat Restoration

RZM Pty Ltd has regenerated large areas of sand mined land along the northern foreshore of the Tilligerry Peninsula. The habitat restoration strategy for the Tilligerry Peninsula KMU should include provision for the long-term protection and management of these revegetated areas.

Other areas in the Tilligerry Peninsula KMU that should be investigated for potential habitat restoration projects include:

- the cleared areas within or adjacent to the large patch of Preferred Koala Habitat in the south of the KMU, including Habitat Buffers and Habitat Linking Areas that overlap with Mainly Cleared Land;
-
- the Tanilba Bay Golf Course, particularly in those areas that abut the large patch of Preferred Koala Habitat in the south;
- parts of the Habitat Buffer or Habitat Linking Area over Mainly Cleared Land in the north and east, including (in concert with the effective abatement of the threat posed by cars and dogs) those in and around the urban areas of Tanilba Bay, Mallabulla and Lemon Tree Passage; and
- the Habitat Buffer over Other Vegetation on and near the Tilligerry Habitat Reserve. Habitat Restoration is already being undertaken by the Tilligerry Habitat Association, and should be supported, where necessary, by this CKPoM.

Community Commitment

- Future community education, koala monitoring and habitat restoration projects in the Tilligerry Peninsula KMU should be planned in consultation with the Hunter Koala Preservation Society, the Tilligerry Habitat Association, the Native Animal Trust Fund and local Tidy Towns Associations.

Education

- Existing brochures such as those prepared by the Tilligerry Habitat Association and the Hunter Koala Preservation Society should be used as a basis for educating the Tilligerry community about koala conservation issues.
- Council's Health and Environment Newsletter should also encourage responsible dog-ownership and careful driving in areas in the Tilligerry KMU that contain koala habitat, as well as providing information regarding the implementation of the CKPoM.

Traffic Management

Following consultation with the community, appropriate speed mediation, driver warning and education measures should be implemented at each of the identified Black Spots and Conflict Areas within the KMU. The potential implementation of

speed advisory signs or speed zones that apply at specific times of the day and year should be investigated for Lemon Tree Passage Road (in particular). It is recommended that speed advisory signs or speed zones should be applied in conjunction with a marketing program to promote and encourage adherence to the speed limits.

Ecotourism

Given the widespread appeal of the koala, the fact that koalas can regularly be seen in the Tilligerry Peninsula KMU and the overall natural beauty of the Tilligerry Peninsula, there are opportunities for ecotourism activities in this KMU. Such activities are already being run by organisations such as the Tilligerry Habitat Association.

Balickera KMU

Habitat Conservation: Incentives-based measures

The following areas in the Balickera KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- Preferred Koala Habitat along the Williams River floodplain, particularly the larger patches;
- Habitat Buffers and Habitat Linking Areas (including those over Mainly Cleared Land, where there is a commitment by landholders to revegetate) along the Williams River; and
- Preferred Koala Habitat and associated Habitat Buffers and Habitat Linking Areas along the drainage lines in the north and east of the KMU.

Habitat Restoration

The following represents the priorities (from highest to lowest) for the restoration of koala habitat in the Balickera KMU with landowner consent:

1. Enhance existing Preferred Koala Habitat along the Williams River flood plain and adjacent low lying areas. This should include supplementary planting of preferred koala food trees, such as *E. tereticornis* and *E. robusta*, as well as fencing to exclude livestock to protect such plantings and to facilitate natural regeneration. The objective is to increase the density of preferred koala food trees within remnant Preferred Koala Habitat and to ensure the long-term existence of such species in these remnants;
2. Restore koala habitat on land identified as Habitat Buffer over Mainly Cleared Land or Habitat Linking Area over Mainly Cleared Land along the Williams River flood plain and adjacent low lying areas. Again this should involve planting *E. tereticornis* or *E. robusta* where appropriate, as well as fencing to exclude livestock;
3. Restore koala habitat on land identified as Buffer over Mainly Cleared Land or Linking Area over Mainly Cleared Land in the vicinity of the Preferred Koala Habitat along drainage lines in the hills in the north and

east of the KMU. This should include planting of *E. tereticornis* as well as appropriate mixes of species found in nearby forest; and

4. Restore koala habitat on land identified as Mainly Cleared along the Williams River flood plain and adjacent low lying areas. Ultimately, this should be linked with the network of koala habitat restored in accordance with the priorities outlined above.

Community support

- The existing River-Care/Landcare network could be used as the basis for enlisting community support in the Balickera KMU. This will involve co-operation with the Williams River-Care Association, Clarencetown Landcare Group and the Williams River Catchment Management Committee (CMC).

Education

- Education of land holders in this KMU should be an extension of the already existing River-Care/Landcare network in this KMU. Members of the Williams River-Care Association and the Clarencetown Landcare Group, along with individual landholders that are protecting remnant vegetation and/or are undertaking revegetation works should be briefed on how to tailor their activities to further contribute to the conservation of koala habitat. The Williams River Catchment Management Committee should be approached to facilitate contact with these organisations and individuals and to integrate the activities in the Balickera KMU with those elsewhere in the Williams River catchment.

Tomaree Peninsula KMU

Habitat Conservation: Incentives-based measures

Regarding the application of incentives-based conservation measures in the Tomaree Peninsula KMU the following, in particular, should be investigated:

- Land between Anna Bay/Boat Harbour and Salamander Bay/Taylor's Beach that contains Preferred Koala Habitat in particular, and/or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas; and which landholders are willing to either rezone to Environmental Protection (or put in place a Voluntary Conservation Zone, should one be established) or set aside under a Voluntary Conservation Agreement; and
- The provision of Management Grants to landholders willing to undertake koala habitat restoration on priority areas identified below. This will depend on the availability of funding, such as could be provided should Port Stephens Council's recent Natural Heritage Trust application be successful.

Habitat Conservation: Crown Land assessment

- There are several portions of Crown Land in the Tomaree Peninsula KMU. The procedure for undertaking land assessments on areas of Vacant or Reserved Crown Land on the Tilligerry Peninsula that contain koala habitat should also be considered for such land on the Tomaree Peninsula.

Habitat Restoration

Areas in the Tomaree Peninsula KMU that should be investigated for habitat restoration projects include:

- Land between Anna Bay/Boat Harbour and Salamander Bay/Taylors Beach that is identified as Habitat Buffer or Habitat Linking Area over Mainly Cleared Land. Given that there are large contiguous patches of Preferred Koala Habitat in this area, it should be of the highest priority for koala habitat restoration projects on the Tomaree Peninsula; and
- Other land in the Tomaree Peninsula KMU that is identified as Habitat Buffer or Habitat Linking Area over Mainly Cleared Land. This could include such areas located to the south of Soldiers Point and in the vicinity of Mambo Wetland and, pending due consideration of the threat to koalas posed by dogs and cars, such areas within or adjacent to the urban areas of the Tomaree Peninsula KMU.

Community commitment

- Several community groups (Eco-Network Port Stephens, the Tomaree Eco-Watch Association, the Hunter Koala Preservation Society, the Native Animal Trust Fund, and several Tidy Towns Associations) are actively involved in koala conservation in this KMU. Future community education, koala monitoring and habitat restoration projects on the Tomaree Peninsula should integrate and expand on the existing work being done by these organisations, and projects should be planned in conjunction with these groups.

Education

- Existing education programs, such as meetings and field days being run by Eco-Network Port Stephens, and brochures such as those prepared by the Tilligerry Habitat Association and the Hunter Koala Preservation Society for elsewhere in the LGA, should be used as a starting point for educating the community about koala conservation. Other organisations, such as Tidy Towns committees, precinct committees and the NSW Farmers Association should also be approached to participate in education programs.
- Council's Health and Environment Newsletter could also encourage responsible dog-ownership and careful driving in areas in the Tomaree Peninsula KMU that contain koala habitat, as well as providing information regarding the implementation of the CKPoM.

Ecotourism

- Given the widespread appeal of the koala, the fact that koalas are often seen in the Tomaree Peninsula KMU, the overall natural beauty of the Tomaree Peninsula, and the popularity of the Tomaree Peninsula as a tourist destination there are opportunities for ecotourism activities in this KMU.

Raymond Terrace KMU

Habitat Conservation

Regulation of development via the proposed amending clause of the Port Stephens LEP (Appendix 3) and the proposed performance criteria for development applications (Appendices 4 & 5) represents the most appropriate means of conserving koala habitat in this KMU, as there is limited scope for rezoning to protect koala habitat or employing incentives-based measures to protect koala habitat.

Habitat restoration

Habitat restoration activities in this KMU should focus on areas within and around the urban area where koalas are currently known to occur, including: Lakeside, Muree Golf Course, the Raymond Terrace Cemetery, Boomerang Park, Irrawang Public School and Irrawang High School. There is a need to integrate such activities with measures aimed at reducing the impact of motor vehicles and dogs on koalas.

Community commitment

- Future community education, koala monitoring and habitat restoration projects in the Raymond Terrace KMU should be planned in consultation with the Native Animal Trust Fund, the Australian Wildlife Hospital, the Hunter Koala Preservation Society, and local Tidy Towns Associations.

Education

- Given the impact of motor vehicles and dogs on koalas in this KMU, there is a real need to educate the Raymond Terrace community on how they can help ameliorate such threats. This should build on existing education programs and brochures and involve the community groups listed above.

Medowie KMU

Habitat Conservation: Incentives-based measures

The following areas in the Medowie KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- Land that has been identified as Preferred Koala Habitat and Habitat Buffer in the central and south of the KMU, particularly the two largest patches to the south of Ferodale Road and west of Medowie Road currently zoned Rural Small Holdings 1(c1) or 1(c3), the area adjacent to the tail of Moffats Swamp; and
- Land that has been identified as Preferred Koala Habitat and Habitat Buffer to the north of Ferodale Road that is currently zoned Rural Small Holdings, particularly the patch to the west of the land already zoned Environmental Protection 7a.

Habitat Conservation: Crown Lands assessment

- There are some areas of Crown Land in this KMU that contain Preferred Koala Habitat. The Department of Land and Water Conservation be requested to undertake Crown Land assessments of these areas and where appropriate, recommend them for protection.

Habitat Restoration

Areas in the Medowie KMU that should be investigated for koala habitat restoration projects include:

- degraded areas fringing Preferred and Supplementary Koala Habitat associated with Moffats Swamp including Habitat Buffer over Marginal Koala Habitat and Mainly Cleared Land. This would potentially include areas to the east of Moffats Swamp that have been subject to sand mining operations;
- Habitat Buffer over Mainly Cleared Land and Habitat Linking Areas over Mainly Cleared Land or Marginal Koala Habitat throughout the Medowie KMU, pending the effective abatement of the threat posed by dogs and traffic; and
- any areas where there is the potential to restore and or enhance habitat links between this KMU and the Tomago Sandbeds KMU in particular.

Community Commitment

- Future community education, koala monitoring and habitat restoration projects in the Medowie KMU should be planned in consultation with the Native Animal Trust Fund and the Hunter Koala Preservation Society.

Education

- Existing brochures such as those prepared by the Tilligerry Habitat Association and the Hunter Koala Preservation Society should be used as a basis for educating the Medowie community about koala conservation issues.
- Council's Health and Environment Newsletter could also encourage responsible dog ownership and careful driving in areas in the Medowie KMU that contain koala habitat, as well as providing information regarding the implementation of the CKPoM.

Tomago Sandbeds KMU

Habitat Conservation: Incentives-based measures

The following areas in the Tomago Sandbeds KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- the areas of Preferred Koala Habitat, Habitat Buffer, Habitat Linking Areas and Supplementary Koala Habitat in the Salt Ash area; areas of Preferred Koala Habitat and Supplementary Koala Habitat to the north of Masonite Road (near Heatherbrae); and

- areas of Preferred Koala Habitat and Supplementary Koala Habitat to the north of Nelson Bay Road (i.e. those not recommended for rezoning to Environmental Protection).

Habitat Restoration

Habitat restoration should be promoted for all areas within the KMU where Habitat Buffers or Habitat Linking Areas occur over Mainly Cleared Land. This should involve planting *E. robusta*, *E. parramattensis* and *E. tereticornis* as appropriate, as well as fencing to exclude livestock where necessary.

Extensive areas of koala habitat in this KMU are at various stages of regeneration, following RZM sand-mining operations and subsequent restoration activities on the Tomago Sandbeds.

Traffic Management

Appropriate speed mediation, driver warning and education measures are required with respect to each of the identified Black Spots and Conflict Areas within the KMU. The potential implementation of speed advisory signs or speed zones that apply at specific times of the day and year should be investigated for Richardson Road, Lemon Tree Passage Road and Medowie Road in particular. It is recommended that speed advisory signs or speed zones should be applied in conjunction with a marketing program to promote and encourage adherence to the speed limits.

Dog Management

Land management agencies in conjunction with the Port Stephens Vertebrate Pest Animal Management Committee should continue to implement feral dog control measures on the Tomago Sandbeds.

Karuah/Ferodale KMU

Habitat Conservation: Incentives-based measures

The following area in the Karuah/Ferodale KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- the land east of the Pacific Highway, north east of Ringwood Road and north of Old Swan Bay Road where Preferred Koala Habitat, Habitat Buffers and Habitat Linking Areas have been identified over Rural 1a lands.

Habitat restoration

Habitat restoration should be promoted for all areas within the KMU where Habitat Buffers or Habitat Linking Areas occur over Mainly Cleared Land. This should involve planting *E. tereticornis*, *E. robusta*, *E. microcorys* and *E. propinqua* as appropriate, as well as fencing to exclude livestock. It should be noted that such habitat restoration can only be carried out with the consent of landowners.

Traffic Management

Following consultation with the community, undertake appropriate speed mediation, driver warning and education measures on the southern section of the Bucketts Way, the western section of Ringwood Road (approaching the intersection with the Pacific Highway) and Richardson Road near Finnan Park. Input should also be sought from the Roads and Traffic Authority into ameliorative measures proposed in conjunction with upgrading of the Pacific Highway.

Domestic/Feral Dogs

Feral dog management on State Forests of NSW and National Parks and Wildlife Service lands within the KMU should be addressed in conjunction with the Port Stephens Vertebrate Pest Animal Management Committee.

Fullerton Cove/Stockton Bight KMU

Habitat Conservation: Incentives-based measures

The following areas in the Fullerton Cove/Stockton Bight KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- Preferred Koala Habitat and, subject to a commitment from landholders to undertake restoration of koala habitat, associated Habitat Buffers and Habitat Linking Areas over Mainly Cleared Land to the north of Bobs Farm; and
- Land that comprises part of the two large patches of Supplementary Koala Habitat that extend along the Stockton Bight sand dunes.

Habitat Conservation: Crown Lands assessment

There are substantial areas of Crown Land located in this KMU. This includes much of the Supplementary Koala Habitat along Stockton Bight. The procedure for undertaking land assessments (as per the *Crown Lands Act 1989*) on areas of Vacant or Reserved Crown Land on the Tilligerry Peninsula that contain koala habitat should also be considered for such land in the Fullerton Cove/Stockton Bight KMU.

Habitat restoration

Areas in the Fullerton Cove/Stockton Bight KMU that should be investigated for habitat restoration projects include:

- Land to the north of Bobs Farm that overlaps with Habitat Buffers or Habitat Linking Areas over Mainly Cleared Land;
- Other land in this KMU that is identified as Habitat Buffer or Habitat Linking Area over Mainly Cleared Land. This could include such areas located to the south of Williamtown and in the vicinity of Fern Bay; and
- Areas of Mainly Cleared Land located adjacent to the large patches of Supplementary Koala Habitat along Stockton Bight.

Community commitment

Future community education, koala monitoring and habitat restoration projects in this KMU should expand on the existing work being done by organisations such as the Native Animal Trust Fund and Hunter Koala Preservation Society, and projects should be planned in conjunction with these groups.

Education

Existing education programs, such as brochures prepared by the Tilligerry Habitat Association and the Hunter Koala Preservation Society for elsewhere in the LGA, should be used as a starting point for educating the community about koala conservation. Other organisations, such as Tidy Towns committees, precinct committees and the NSW Farmers Association should also be approached to participate in education programs.

The Oakvale Wildlife Farm at Salt Ash should be approached to assist with education programs, for instance, by giving talks on koala conservation to park visitors.

Western KMU

Habitat Conservation: Incentives-based measures

The following areas in the Western KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- The large patches of Preferred Koala Habitat to the south of Seaham;
- Patches of Preferred Koala Habitat and associated Habitat Buffers and Habitat Linking Areas (including those over Mainly Cleared Land, provided there is a commitment from landholders to revegetate) along the Williams River floodplain; and
- Preferred Koala Habitat and associated Habitat Buffers and Habitat Linking Areas to the west of Seaham.

Habitat restoration

The following represents the priorities (from highest to lowest) for the restoration of koala habitat in the Western KMU:

1. Enhance existing Preferred Koala Habitat along the Williams River flood plain and adjacent low lying areas. This should include supplementary planting of preferred koala food trees, such as *E. tereticornis* and *E. robusta* where appropriate, as well as fencing to exclude livestock to protect such plantings and to facilitate natural regeneration. The objective is to increase the density of preferred koala food trees within remnant Preferred Koala Habitat and to ensure the long-term existence of such species in these remnants;
2. Restore koala habitat on land identified as Habitat Buffer over Mainly Cleared Land or Habitat Linking Area over Mainly Cleared Land along the Williams River flood plain and adjacent low lying areas. Again this should

involve planting *E. tereticornis* or *E. robusta* where appropriate, as well as fencing to exclude livestock;

3. Restore koala habitat on land identified as Buffer over Mainly Cleared Land or Linking Area over Mainly Cleared Land in the vicinity of the Preferred Koala Habitat along drainage lines in the hills in the north and centre of the KMU. This should include planting of *E. tereticornis* as well as appropriate mixes of species found in nearby forest;
4. Enhance existing Preferred Koala Habitat and restore koala habitat in the associated Habitat Buffers and Habitat Linking Areas over Mainly Cleared land along the Hunter and Patterson River floodplains. This should also involve planting *E. tereticornis* or *E. robusta* where appropriate, as well as fencing to exclude livestock; and
5. Restore koala habitat on land identified as Mainly Cleared along the Williams River flood plain and adjacent low lying areas, in the first instance, followed by similar areas along the Hunter and Patterson Rivers. Ultimately, this should be linked with the network of koala habitat restored in accordance with the priorities outlined above.

Community support

The existing River-Care/Landcare network could be used as the basis for enlisting community support in the Western KMU. This will involve co-operation with the Hunter Catchment Management Trust, the Williams River Catchment Management Committee (CMC), and the Williams River-Care Association. The Hunter Catchment Management Trust should be briefed on the outcomes of the CKPoM and approached to assist with the integration of these outcomes into natural resource management in the catchment.

Education

Education of land holders in this KMU should be an extension of the already existing River-Care/Landcare network in this KMU. Members of River-Care Associations and Landcare Groups, along with individual land holders that are protecting remnant vegetation and/or are undertaking revegetation works should be briefed on how to tailor their activities to further contribute to the conservation of koala habitat. The Hunter Catchment Management Trust and Williams River Catchment Management Committee should be approached to facilitate contact with such organisations and individuals and to integrate the activities in the Western KMU with those elsewhere in the Hunter and Williams River catchments.

7. Habitat Restoration

7.1 Synopsis

Habitat restoration and revegetation programs are essential for the long-term conservation of koalas within the Port Stephens LGA. The Koala Habitat Planning Map provides a basis for the selection of areas to investigate for koala habitat restoration; Habitat Buffers and Habitat Linking Areas that overlap with Mainly Cleared Land should be targeted in particular. Recommendations concerning specific areas for potential restoration projects for each of the identified Koala Management Units have been indicated in association with the SWOT analyses undertaken for chapter 6 of the CKPoM Resource Document and are presented in section 6.2 of this CKPoM.

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.

The habitat restoration chapter of the CKPoM Resource Document details the criteria that should be considered in order to prioritise areas for habitat restoration. These criteria are listed in section 7.2 of this CKPoM. Priority should be given to those restoration projects that are likely to maximise the benefit to koala conservation. Projects that aim to restore koala habitat should include replanting of preferred koala food trees in areas where these would have occurred naturally.

7.2 Actions

i) Identification and prioritisation of habitat to be restored

Priority areas for koala habitat restoration should be identified on the basis of the recommendations for each Koala Management Unit (see section 6.2 of this CKPoM) together with reference to the criteria outlined in section 7.5 of the CKPoM Resource Document. These criteria are listed below:

- the intended aim of revegetation works;
- size of habitat patches;
- shape of habitat patches;
- type of koala habitat;
- size of koala populations/ presence of extant populations;
- presence of threats to koalas;
- effort required for restoration;
- current land tenure and land use zoning;

- pre-European vegetation of the area; and
- other considerations, including the goal of the project.

ii) Coordination of habitat restoration projects

One Port Stephens Council Officer should be made responsible for overall coordination of community revegetation works within the LGA. This Officer will consult with the CKPoM Steering Committee regarding the koala habitat restoration program.

iii) Land Managed by Council

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.

iv) Nursery Stock

Nursery stock to be used for restoration programs should be propagated from local provenance seed.

v) Weed Management

Council to increase its enforcement of the Noxious Weeds Act, and also its commitment to the management of environmental weeds.

vi) Bushfire Management

Habitat restoration activities will take into account bushfire management principles (eg. the provision of fire breaks and access)

8. Traffic Management

8.1 Synopsis

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. Approximately 74% of these collisions resulted in the koala's death. This indicates the significant threat that motor vehicles pose to koalas in the Port Stephens LGA.

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 that is adjacent or in the vicinity of main roads. However, the management strategies addressed in the Port Stephens Council CKPoM 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.

The Traffic Management chapter (chapter 8) of the CKPoM Resource Document identifies three categories of roads (or sections of roads) within the Port Stephens LGA on the basis of the available koala collision records, including those obtained from the community-based koala survey. These include 'Black Spots', 'Conflict Areas', and 'Potential Problem Areas' (Figure 3 of this CKPoM).

A range of measures to reduce the impact to koalas of motor vehicles travelling along these roads are discussed in chapter 8 of the CKPoM Resource Document. The recommended actions to implement these measures are presented below. Chapter 8 of the CKPoM Resource document also includes a list of management options for koala traffic black spots. Guidelines for the design of koala underpasses and overpasses are provided in Appendix 7.

8.2 Actions

The following actions are recommended:

- i) Fatality Signs
 - Fatality signs erected along Lemon Tree Passage Road be updated by Council annually using information from the Native Animal Trust Fund and the Hunter Koala Preservation Society.
- ii) Black Spots
 - Council install 'Koala Warning' signs and 'Injured Native Wildlife' signs in appropriate locations at identified koala black spots;
 - Following consultation with the community, Port Stephens Council formally approach the Roads and Traffic Authority to support the trial of 'Koala Speed Zones' similar to that being conducted in the Redlands Shire, Queensland. If the RTA supports the trial and the necessary funding can be secured, these 'Koala Speed Zones' should be trialled at selected black spots;
 - Council install speed advisory signs recommending a reduction in speed by 20 km/h at identified black spots where current speed

zones are either 100 km/h or 80 km/h and where the 'Koala Speed Zones' outlined above are unlikely to be trialled. This should be accompanied by extensive promotion, which should incorporate marketing advice with respect to the design, advertisement and implementation of a suitable campaign;

- Council instigate a program for regular slashing of established roadside clear zones, aimed to minimise the height of ground cover at identified koala black spots;
- A research program be promoted by Council, in consultation with the CKPoM Steering Committee, to investigate the potential application of underpasses and overpasses, exclusion fencing and koala crossings within the LGA. Guidelines for designing and constructing effective koala underpasses and overpasses are included in Appendix 7.
- In the event that any of the above measures are determined to merit application at any of the identified koala black spots within the LGA, funding be sought by Council for their installation and monitoring; and
- If it is determined that koala crossings have potential application in specific situations, and that it can be demonstrated that the use of lighting will not deter or inhibit other fauna then Council approach the local energy supplier to investigate the possibility of installing associated street lighting.
- The Steering Committee to investigate additional safety measures for koala black spots such as wide white edge lines on the road to improve night time visibility of koalas to motorists.
- Promote further research on the need for fencing along roads in koala traffic black spot areas.

iii) Conflict Areas

- Council install 'Koala Warning Signs' and 'Injured Native Wildlife Signs' in appropriate locations at identified conflict areas. These warning signs should be funded by Council on local roads, while the Roads and Traffic Authority should be approached with respect to funding for signage on main roads; and
- Council instigate a program for regular slashing of established roadside clear zones, aimed to minimise the height of ground cover at identified koala conflict areas
- Trial the use of car whistles

iv) Potential Problem Areas

- The Roads and Traffic Authority be approached, if necessary, following the release of their Koala Monitoring Report to consider extending the exclusion fencing on the Raymond Terrace Bypass

to the north in order to reduce the chances of koalas moving around the fencing and entering the Raymond Terrace urban area from the east

- The identified potential problem areas within the Port Stephens LGA should be reviewed in conjunction with the annual CKPoM monitoring program.

v) Awareness Campaign

- An awareness campaign, which incorporates an explanation of the rationale for the above measures and information on how to reduce the likelihood of collisions between motor vehicles and koalas, should be incorporated in the education program proposed in chapter 13 of the CKPoM Resource Document. This campaign should target both Council staff and the general public.

9. Dog Management

9.1 Synopsis

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.

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.

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*. An appropriate education campaign is crucial in promoting responsible dog-ownership.

Chapter 9 of the CKPoM Resource Document discusses the range of management strategies available to Council, including regulation under the *Companion Animals Act 1998*. The recommended actions relating to dog management are listed below.

9.2 Actions

i) Litigation

- Where evidence likely to result in a conviction has been obtained, Council will prosecute under the Companion Animals Act 1998 the owner of any dog which (without provocation and outside of the property on which the dog was being kept) rushes at, attacks, bites, harasses or chases a koala.

ii) Council Rangers

- Council direct additional resources for dog control within the Port Stephens LGA; and
- In the event that Council secures funding to employ an additional Ranger, consideration be given to conducting additional night patrols during the koala breeding season (August to February), with patrols in areas where dogs are known to pose a threat to koalas a priority.
- Port Stephens Council Ordinance Officers to work split shifts to enable greater availability for dog control.

iii) Dog Control

- Where appropriate, Council declare a dog to be dangerous where the dog has attacked or killed a koala or repeatedly threatened to attack or repeatedly chased a koala, under the Companion Animals Act 1998.
- Undertake an investigation into the number of unregistered dogs in areas where dogs are having an impact on koalas.
- In each proposed new subdivision, investigate the application of section 88e of the Conveyancing Act in the context of dog control.

iv) Exercise Areas

- Council include, as part of its current review of dog exercise areas, the substitution of more suitable areas in place of those exercise areas which conflict with koala habitat. The location of these exercise areas should be widely promoted to the community. This policy should be periodically reviewed in the future, particularly where it relates to koalas and:
- Council should consult more with the Tilligerry community regarding dog exercise areas
- Council ensure that all public reserves are effectively signposted regarding dog exercise provisions.

v) Education

- Council publicise any successful prosecutions against dog owners with respect to offences that relate to koalas;
- A media campaign which will include pamphlet drops to inform the public in identified problem areas. These campaigns should occur annually during the koala breeding season;
- Community groups such as the Hunter Koala Preservation Society, the Native Animal Trust Fund and others continue to highlight the problem of dog attacks through the media, schools and information booths;
- The Native Animal Trust Fund and the Hunter Koala Preservation Society continue to maintain a register of reported dog attacks on koalas for provision to the CKPoM Steering Committee every six months; and
- The Port Stephens Council Animal Management Committee develop suitable educational material after securing funding under the provisions of the Companion Animals Act 1998 and liaise with the CKPoM Steering Committee concerning the design of educational literature and programs aimed to promote responsible dog ownership.

vi) Local Companion Animals Management Plans

- The following special conditions are considered to be appropriate for areas identified as Preferred Koala Habitat in conjunction with the development of Local Companion Animals Management Plans for the Port Stephens LGA:
 - * Designation of public places which contain Preferred Koala Habitat as “Wildlife Protection Areas”, where dogs are prohibited as provided under s. 14 (1) (h) of the Companion Animals Act 1998; and
 - * As part of a public awareness campaign, owners of dogs be encouraged to, upon becoming aware of the presence of a koala on their property, restrain or confine the dog to protect the koala until it has left the premises.
- Educational material to include information on the most suitable breeds of dogs to keep in relation to koalas

10. Feral Animal Management

10.1 Synopsis

There are a number of feral animal species that are known to occur within the Port Stephens LGA, some of which have the potential to impact significantly on koalas. Feral dogs are known to prey on koalas in the Port Stephens LGA and are considered capable of taking even large, healthy adult koalas. Foxes and, to a lesser extent, feral cats are considered to have the potential to take small, old, or otherwise debilitated koalas.

Each of the principal land management agencies and interest groups within the Port Stephens LGA participate in the Port Stephens Vertebrate Pest Animal Management Committee. This committee is responsible for identifying problems relating to the management of feral animals (particularly vertebrate pests) in the Port Stephens LGA and coordinating the appropriate response by the relevant land management agency. Staff and students from the University of Newcastle undertake research to assist the committee with the identification of problem areas and to monitor the effectiveness of the management strategies that are implemented. The committee is currently finalising a draft Vertebrate Pest Animal Management Plan, which addresses a range of issues relating to vertebrate pest management, including the impact of such species on koalas.

Issues relating to feral animals and their impact on koalas are discussed in greater detail in chapter 10 of the CKPoM Resource Document.

10.2 Actions

- i) All principal land management agencies and organisations within the Port Stephens Local Government Area continue to contribute to and support the initiatives of the Port Stephens Vertebrate Pest Animal Management Committee;
- ii) The Port Stephens Vertebrate Pest Animal Management Plan identify and address koala-specific feral animal management issues; and
- iii) The Port Stephens Vertebrate Pest Animal Management Committee continue to actively encourage the involvement of the University of Newcastle with feral animal research projects.
- iv) Chicken farmers who are providing a supplementary source of food for feral animals in the form of chicken carcasses be encouraged to dispose of these carcasses through alternative processes

11. Bushfires

11.1 Synopsis

Bushfires represent a significant threat to koalas within the Port Stephens LGA, as evidenced by the January 1994 bushfires, which resulted in the death of 46 koalas and injured 53. High intensity fires, such as those in January 1994, are likely to kill or injure koalas; while frequent, low intensity fires (as are often employed for hazard reduction) may have long-term impacts on koala habitat and the plant and animal communities that occur in association with koala habitat. A summary of principles for managing fire and koala habitat are contained in Appendix 10. Further information on issues relating to bushfire hazard reduction and koalas can also be found within Chapter 11 of the CKPoM Resource Document. Therefore, it is important that potential impacts on koalas and koala habitat by bushfires are properly addressed. The appropriate means to do this is via fire management planning, such as bushfire risk management plans prepared under the *Rural Fires Act 1997*.

The Port Stephens Bushfire Management Committee was established under the *Rural Fires Act 1997* and consists of, among others, representatives of land management and emergency service agencies. This committee is responsible for the preparation of the Port Stephens Bushfire Risk Management Plan and Plan of Operations. The *Rural Fires Act 1997* provides for the consideration of impacts on fauna and flora in bushfire risk management plans and plans of operations.

Licensed fauna welfare organisations play an important role in mitigating the impact of bushfires on fauna such as koalas by rescuing and rehabilitating fauna affected by fire. Research into the impact of bushfires on koalas and their habitat, such as that conducted by the NSW National Parks and Wildlife Service following the January 1994 bushfires is also essential to help develop appropriate management strategies.

11.2 Actions

- i) Port Stephens Council and the NSW National Parks and Wildlife Service (NPWS) encourage and promote appropriate ongoing research into the effects of bushfire on koalas and koala habitat and incorporate the results of the research by NPWS on the impact of bushfires on the koala population on the Tomago Sandbeds after it is published into fire management plans;
- ii) Koalas and koala habitat, particularly areas of Preferred and Supplementary Koala Habitat and vegetated Habitat Buffers and Habitat Linking Areas as identified in the Port Stephens Council CKPoM, be thoroughly considered in any Plan of Operations and/or Bush Fire Risk Management Plan prepared by the Bush Fire Management Committee in accordance with the *Rural Fires Act 1997*;
- iii) CKPoM Steering Committee liaise with the Bushfire Management Committee regarding proposals by public authorities to undertake hazard reduction burns, and encourage private landowners to consult with it, in order to assist in determining if

koalas or koala habitat are likely to be significantly affected by proposed hazard reduction activities

- iv) Land management agencies and the NSW Rural Fire Service co-operate with the local wildlife carer groups and the NSW National Parks and Wildlife Service concerning fauna welfare issues following bushfires;
- v) Land management agencies seek to ensure that any hazard reduction burns undertaken in areas known to support koalas are maintained at low intensity or managed and supervised by the land owner or manager responsible for the hazard reduction burn, in such a way as to minimise risk to resident koalas.
- vi) Port Stephens Council, in conjunction with the CKPoM Steering Committee, investigate the possibility of establishing a research program concerning potential longer term impacts of hazard reduction burning on koala habitat. This research would contribute to the development of fire management strategies that best meet the objectives of minimising the risk to koalas while conserving koala habitat and associated plant and animal communities: and
- vii) Port Stephens Council and the CKPoM Steering Committee investigate the potential for using satellite imagery as a means of mapping the extent and intensity of bushfires and for monitoring post-fire regrowth and report findings to the CKPoM Steering Committee described in section 18.1 of this CKPoM.
- viii) Port Stephens Council to assist Rural Fire Service in conducting community education in respect to the processes required to undertake Hazard Reduction Burns.
- ix) Assist where possible the Bushfire Management Committee in encouraging the sharing of resources for fire fighting.

12. Koala Welfare

12.1 Synopsis

Carers and carer groups in NSW require a licence from the NPWS (Wildlife Licensing Unit, NPWS, PO Box 1967, Hurstville NSW 2220). All issues concerning 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 in Chapter 12 of the CKPoM Resource Document complete and unabridged and should be referred to when dealing with all issues relating to koala welfare in Port Stephens LGA.

The Native Animal Trust Fund (NATF), the Australian Wildlife Hospital (AWH) and recently, the Hunter Koala Preservation Society (HKPS) hold licenses issued by the National Parks and Wildlife Service to care for sick, injured, orphaned or otherwise distressed koalas in the Port Stephens LGA. Koala carers in the Port Stephens area are supported by a number of local veterinary surgeons who have developed expertise in the assessment and treatment of sick, injured or orphaned koalas. These local veterinarians assist the koala carers in providing expert assessment and treatment of koalas.

Licensed koala welfare groups make a significant contribution to the conservation of koalas in the Port Stephens LGA, as well as collecting and maintaining important information that will assist with monitoring the ongoing status of the local koala population and the efficacy of this CKPoM.

12.2 Actions

- The CKPoM Steering Committee investigate the establishment of Koala Conservation Areas

13. Education

13.1 Synopsis

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

Chapter 13 of the CKPoM Resource Document provides a more detailed discussion of the education program.

13.2 Actions

- i) Information Brochures
 - That Port Stephens Council, in consultation with the CKPoM Steering Committee, the Australian Koala Foundation, the National Parks and Wildlife Service, the Hunter Koala Preservation Society, the Native Animal Trust Fund and the Tilligerry Habitat Association, modify and reprint one or both of the brochures prepared by the Tilligerry Habitat Association and the Hunter Koala Preservation Society (see Appendix 6 of the CKPoM Resource Document). This brochure should be made available through relevant agencies and organisations including Council and National Parks and Wildlife Service offices, Tourist Centres, Veterinary Clinics, and environment groups. This and other appropriate information should also be periodically distributed with the Port Stephens Council Rates notices.
 - That Port Stephens Council, in conjunction with the CKPoM Steering Committee, prepare a brochure listing recommended tree species, appropriate for planting to restore koala habitat. The brochure should provide relevant horticultural information and be distributed to nurseries throughout the Port Stephens LGA, as well as being made available in association with the general information brochure.

- The Health and Environment Newsletter produced by Port Stephens Council be used to inform the public of the timing of the koala breeding season, the need for responsible dog ownership and responsible driving when travelling on roads near koala habitat, the results of trials of ameliorative measures and of updates on the status of the Port Stephens koala population.

ii) Environmental Education

- Port Stephens Council, in consultation with CKPoM Steering Committee prepare a trial education program for presentation to school and community groups, dealing with issues such as general koala biology, behaviour and habitat requirements of koalas, the importance of responsible pet ownership, and appropriate action if an injured, sick, distressed or dead koala or other native animal is found. Council's Road Safety Officer could also become involved in an Educational Strategy of this nature. Should this program prove successful, it should be conducted annually and linked to relevant existing programs, such as 'Learnscape' (tree planting) and 'Naturewatch' (monitoring);
- The Department of Education should be contacted to ensure that the proposed education program is compatible with the existing Environmental Education Curriculum;
- The National Parks and Wildlife Service should be consulted regarding any technical and scientific aspects of the program and to provide guest presentations if required;
- Councillors and Council staff, including planners and outdoor staff be educated in relation to koala conservation issues and actions;
- Developers and consultants be educated in areas such as new legislative and policy directions, through information brochures linked to the development application process and Council's Development Assessment Panel;
- Information be provided to the community on the economic benefits of conserving koalas and their habitat;
- Low key advertising be used to foster a local identity for Port Stephens as a place which conserves Koalas and their habitat; and
- Port Stephens Council should contact local bus companies regarding advertisements on buses encouraging drivers to slow down when driving along roads where koalas have been hit. Bus routes along 'Black Spots' or 'Conflict Areas' should be targeted in particular.

iii) Telephone Hold

- That Port Stephens Council and the National Parks and Wildlife Service investigate the provision of recorded information on hold

lines on their respective telephone systems, to include information about koalas and other environmental matters.

iv) Liaison with the Media

- Animal welfare groups and/or the CKPoM Steering Committee should develop formal systems to ensure relevant koala information is regularly provided to the local media. A co-ordinator should be appointed to liaise with a local newspaper with a view to providing a series of regular, koala feature articles on behalf of these groups.
- The National Parks and Wildlife Service investigate the possibility of providing regular articles in a local newspaper focusing on koalas and other local environmental issues.

v) Electronic media

- Information on koalas and their habitat be made available through electronic media including the Internet and e-mail.

vi) Extension programmes

- Council support the development of a regional advisory extension service such as a 'Land for Wildlife' Scheme

vii Community Consultation

- Greater levels of consultation need to be undertaken with the community in relation to new planning policies and instruments such as LEP 1999 and the CKPoM

14. Tourism

14.1 Synopsis

Port Stephens is a very popular tourist destination, with visitors injecting approximately \$152 million into the local economy in 1996/1997. Tourism in Port Stephens includes 'nature-based tourism', which is tourism that relies on the natural environment, but makes no provision for its long term management; and 'eco-tourism' which also relies on the natural environment, but, importantly, does provide for its long-term management and ensures that it is ecologically sustainable.

Port Stephens Tourism Limited controls the private sector of tourism in Port Stephens. This body represents an avenue for the implementation of recommendations in the Port Stephens Council CKPoM that pertain to tourism.

It has been estimated that the koala contributes \$1.1 billion per annum to the Australian tourist industry and accounts for 9000 industry jobs (Hundloe and Hamilton 1997). This indicates the significance of the koala to the tourist industry.

There is a need to identify locations in the Port Stephens LGA that are suitable for koala-based eco-tourism and to monitor the impact of tourism activities on koalas and koala habitat. The CKPoM Steering Committee (described in section 18.1 of this CKPoM) should be given this responsibility.

Tourism based on koalas and koala habitat has the potential to aid the implementation of the Port Stephens Council CKPoM, by helping to raise public awareness via education programs that are run in conjunction with tourist activities and by contributing funds towards the implementation of the CKPoM.

Chapter 14 of the CKPoM Resource Document provides a more detailed discussion of issues relating to koalas and tourism in the Port Stephens LGA.

Actions

- i) A base-line study of ecotourism potential and environmentally suitable areas be undertaken as a joint Port Stephens Council and National Parks and Wildlife Service project. Partial funding for this project could be sought under the Commonwealth Department of Tourism's National Eco-tourism and Grants Program.
- ii) The CKPoM Steering Committee identify a suitable trial area and develop guidelines for the conduct of sustainable koala-based tourism that will help to ensure appropriate management of the environment and protect the welfare of koalas
- iii) The Eco-tourism Committee of Port Stephens Tourism be further developed in terms of its representation and objectives, and become the main body for the development and monitoring of nature and eco-tourism based activities in Port Stephens
- iv) Port Stephens Tourism Limited encourage all members engaged in nature based and eco-tourism activities to seek accreditation under the National Eco-tourism Accreditation Scheme and locally developed

standards. Local standards should be developed in consultation with the CKPoM Steering Committee, where they relate to koala-based tourism;

- v) There should be a licensing system for local eco-tourism operators and no operator should be licensed before first being accredited under the National Eco-tourism Accreditation Scheme;
- vi) That a formal mechanism be established to monitor the environmental impacts of any koala-based tourism activities;
- vii) The Eco-tourism Committee develop a uniform interpretative and directional signage system for the various accredited koala based tourism activities, along with recommendations for funding this system;
- viii) That eco-tourism be combined with other aspects of tourism to present a wide-ranging and appealing prospect to promote tourism in Port Stephens; and
- ix) Tourism activity be used as a source of revenue to manage the natural environment of the Port Stephens LGA. A proportion of the economic benefits of koala-based tourism should be directed to the ongoing protection and management of koala habitat.

15. Funding

15.1 Synopsis

Successful implementation of the Port Stephens Council CKPoM will require appropriate levels of funding or in-kind support 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.

Funding could be obtained from a number of different State and Commonwealth government schemes, such as the Environmental Trust Grants, the Natural Heritage Trust and the Eco-tourism Grants Program. Port Stephens Council lodged an application in the 1999/2000 round of the Natural Heritage Trust, to fund koala habitat restoration projects throughout the LGA. Other options for funding include calls for donations from the public to fund koala management. This could be facilitated by airing such requests in conjunction with documentaries that focus on koalas in Port Stephens.

The CKPoM Steering Committee described in section 18.1 of the Port Stephens Council CKPoM and chapter 18 of the CKPoM Resource Document should be responsible for securing funding for management actions that require funds to be implemented.

Potential funding options are explored more fully in chapter 15 of the CKPoM Resource Document.

15.2 Actions

- i) That the CKPoM Steering Committee, recommended in the Implementation Chapter of the CKPoM Resource Document, be responsible for costing, coordinating and seeking funding from appropriate sources to implement recommendations requiring financial input.
- ii) That the CKPoM Steering Committee request media productions on koalas in the Port Stephens to include information on avenues for public donations for koala management.

16. Research

16.1 Synopsis

Koala habitat management, koala population management and land-use planning should be guided wherever possible by the outcomes of relevant scientific research. 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.

The research chapter (chapter 16 of the CKPoM Resource Document) aims to encourage and facilitate koala research focusing on topics where current information is lacking and to ensure that research findings are applied to koala management practice and decision making.

In accordance with this aim, the CKPoM Steering Committee (as identified in sections 18.1 and 18.2 of this CKPoM and the Implementation chapter of the CKPoM Resource Document) will establish, maintain and promote a prioritised list of relevant koala research projects for the LGA. This list will be derived from the recommended research projects contained in the National Koala Strategy (ANZECC 1998).

16.2 Actions

- i) The CKPoM Steering Committee formally approach the University of Newcastle for representation on the Committee when considering koala research projects and other relevant issues;
- ii) The CKPoM Steering Committee identify and prioritise potential koala research projects in terms of application to koala habitat and population management within the Port Stephens LGA as well as implementation and monitoring of the CKPoM. The identification of potential research projects should be accompanied by investigation of possible funding sources;
- iii) The CKPoM Steering Committee identify and promote potential final year or postgraduate University student research projects from the list derived as a result of ii) above;
- iv) The CKPoM Steering Committee liaise with those undertaking koala research in order to facilitate the involvement of interested volunteers in any suitable research projects;
- v) The CKPoM Steering Committee maintain a register of completed, ongoing and proposed future koala research projects within the Port Stephens LGA. This register is to be kept at the Port Stephens Council Chambers and maintained by Council;

- vi) The CKPoM Steering Committee maintain a reference library at the Port Stephens Council Chambers of all reports concerning koala-related research undertaken within Port Stephens LGA;
- vii) The Native Animal Trust Fund and the Hunter Koala Preservation Society continue to maintain databases for all reported koala sightings. The CKPoM Steering Committee will liaise with both organisations with a view to formalising a complementary approach to these independent databases. The data bases should be presented to the NSW National Parks and Wildlife Service on a six monthly basis in a form suitable for entry onto the 'Atlas of NSW Wildlife', as well as to Port Stephens Council; and
- viii) The CKPoM Steering Committee should incorporate the results of relevant research into the CKPoM when they become available.

17. Monitoring Program

17.1 Synopsis

An ongoing monitoring program will be commenced in conjunction with adoption of the Port Stephens Council 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 outcomes have been achieved and to quantify the success or failure of the measures specified within the CKPoM. These performance indicators are presented in section 1.2 of this CKPoM. The monitoring program will also include a procedure to be followed should the CKPoM fail to meet the identified performance indicators. It is intended that the Port Stephens Council CKPoM will be reviewed annually with the potential for amendment of the measures employed where necessary.

The monitoring program will aim to provide periodic updates 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.

A report on the findings of the monitoring program should be presented to the CKPoM Steering Committee (see section 18.1 of this CKPoM for details of this committee) on an annual basis and the results included in Council's annual State of the Environment Report.

Chapter 17 of the CKPoM Resource Document provides details of the proposed monitoring program.

17.2 Actions

i) Koala Habitat Monitoring

- Port Stephens Council and the CKPoM Steering Committee continue to refine the mapping of koala habitat within the Local Government Area with input from the community and consultation with landowners, and taking into account any information from Development Applications and rezoning applications.
- CKPoM Steering Committee will purchase the latest available satellite imagery for the Port Stephens LGA in early-2000 and at four year intervals after that to coincide with Council's Comprehensive State of the Environment Reporting;
- The CKPoM Steering Committee will assist Council to interpret these images to determine changes in the extent of each category of koala habitat associated with habitat clearance or habitat restoration in the Port Stephens LGA;
- The CKPoM Steering Committee will establish and maintain a register of habitat clearing activities and habitat restoration projects to be included in the annual reports to the CKPoM Steering Committee;

- The CKPoM Steering Committee will establish and maintain a register of potential discrepancies in the LGA-wide Vegetation Map and will, as time and resources permit, investigate these and revise the Vegetation Map where necessary; and
- The CKPoM Steering Committee will co-ordinate revision to the LGA-wide Vegetation Map and the Koala Habitat Planning Map where necessary.

ii) Koala Population Monitoring

- The CKPoM Steering Committee will co-ordinate a phone-in census that will be conducted each year on a specific weekend in spring. Assistance will be provided by volunteers from the Native Animal Trust Fund and the Hunter Koala Preservation Society;
- The CKPoM Steering Committee will co-ordinate annual transect-based searches of designated sites throughout the Port Stephens LGA. Assistance in conducting these searches will be sought from a variety of community groups and the Hunter District NPWS;
- The Hunter Koala Preservation Society will continue to maintain a record of koala sightings through its Koala Watch Program to be used as part of the LGA-wide monitoring program;
- The CKPoM Steering Committee will establish and monitor a series of sites throughout the LGA using the AKF Spot Assessment Technique; and
- The CKPoM Steering Committee will collate existing research results on koala faecal pellet longevity and determine if any additional research is required.

iii) Population Viability Analysis

- The CKPoM Steering Committee will investigate the potential for undertaking a Population Viability Analysis for the Port Stephens koala population and for using this process as a formal component of the monitoring program.

iv) Threatening Processes

- The Native Animal Trust Fund and the Hunter Koala Preservation Society continue to maintain their koala databases with this information utilised by the AKF Field Biologist in the annual reporting on the threatening processes impacting the Port Stephens koala population;
- Council's Rangers maintain a register on any cases involving domestic dog attacks on koalas;

v) Funding

- The CKPoM Steering Committee seek the necessary funding, assistance, resources and sponsorship to implement the monitoring program.

vi) Reporting

- The CKPoM Steering Committee present the findings of the ongoing monitoring program to the annually; and
- Council incorporate updates on the status of the koala within the Port Stephens LGA and the actions taken to implement the recommendations of the Port Stephens Council CKPoM into their annual State of the Environment reports.

vii) Review and Amendment

- The CKPoM Steering Committee shall review the Port Stephens Council CKPoM every 12 months. This will include review of the Performance Indicators, the monitoring program, and the extent to which the plan's recommendations have been implemented; and
- Any proposed amendments to the Port Stephens Council CKPoM will be determined by the CKPoM Steering Committee in consultation with the General Manager of Port Stephens Council and the Director-General of the NSW National Parks and Wildlife Service. Amendments to the CKPoM will be approved by both Port Stephens Council and the Director-General of the Department of Urban Affairs and Planning, before being formally adopted.

18. Implementation

18.1 Synopsis

A number of organisations have contributed to the preparation of the Port Stephens Council CKPoM and the CKPoM Resource Document. These include Port Stephens Council, the Australian Koala Foundation, and the NSW National Parks and Wildlife Service along with numerous individuals and organisations from the local community. It is considered essential to provide for the ongoing involvement of these organisations and individuals for the effective implementation and updating of the CKPoM Resource Document and the Port Stephens Council CKPoM.

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 Native Animal Trust Fund (NATF), the Hunter Koala Preservation Society (HKPS), Australian Wildlife Hospital, and three 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.

The CKPoM Steering Committee should convene immediately following formal endorsement and adoption of the Port Stephens Council CKPoM and should periodically review the CKPoM and provide for its revision where necessary. Further details of this committee and its role are provided in chapter 18 of the CKPoM Resource Document.

18.2 Actions

- i) That a CKPoM Steering Committee be established. Core members will include a Councillor to chair the Committee, an Officer from each of Port Stephens Council, the NSW National Parks and Wildlife Service and the Australian Koala Foundation, together with a representative from each of the Native Animal Trust Fund, the Hunter Koala Preservation Society, Australian Wildlife Hospital, and a minimum of three local landholders;
- ii) That representatives from other agencies and organisations be called upon by the CKPoM Steering Committee to participate as required;
- iii) The core CKPoM Steering Committee shall meet quarterly in the first year and as often as considered necessary by the Committee thereafter;
- iv) Port Stephens Council will provide the CKPoM Steering Committee with administrative support; and
- v) The CKPoM Steering Committee shall produce an Annual Report which details progress on implementation of the CKPoM, outlines

current research projects and provides a review of any additional action that may be required. The first Annual Report is to be submitted to Port Stephens Council and the Director General of the Department of Urban Affairs and Planning for public exhibition twelve months after the first CKPoM Steering Committee meeting.

19. Action Plan

The following Action Plan lists each of the actions recommended in the Port Stephens Council CKPoM, the organisation/s responsible for its implementation and the nominal priority of each action. There is scope to provide a completion date for each action, although this is currently left blank. It is suggested that the completion dates are determined by the CKPoM Steering Committee following the final adoption of the Port Stephens Council CKPoM by Council and the Director General of Urban Affairs and Planning. The following abbreviations are used in the Action Plan table:

LEP	Local Environment Plan
DA	Development Application
VCA	Voluntary Conservation Agreement
REP	Regional Environmental Plan
SEPP 44	State Environmental Planning Policy 44
PS	Port Stephens
PSC	Port Stephens Council
NPWS	National Parks & Wildlife Service
DUAP	Department of Urban Affairs and Planning
AKF	Australian Koala Foundation
HWC	Hunter Water Corporation
SF of NSW	State Forests of New South Wales
DLWC	Department of Land & Water Conservation
NATF	Native Animal Trust Fund
HKPS	Hunter Koala Preservation Society
RTA	Roads and Traffic Authority
PSVPAMC	Port Stephens Vertebrate Pest Animal Management Committee
PSBFMC	Port Stephens Bushfire Management Committee
THA	Tilligerry Habitat Association
AWH	Australian Wildlife Hospital

Relevant chapter	Action	Responsible organisation	Priority	Completion Date
4	Habitat Conservation Measures			
	Rezone koala habitat on public land to Environmental Protection	PSC	H	
	Amend LEP Amendment Policy to include performance criteria for rezoning requests	PSC	H	
	Prepare amending clause of the LEP to activate provisions of CKPoM	PSC	H	
	Implement performance criteria for development applications	PSC	H	
	PKH, SKH, HLA & HB identified as a constraint in the Urban Settlement Strategy	PSC		
	Investigate the potential application of incentives-based measures	PSC	H	
	Investigate options for amendments to Council's Tree Management Policy	PSC	M	
	PSC incorporate provisions of the CKPoM into PoMs for land in its control	PSC	M	
	PSC demonstrate best practice management of koala habitat in all developments	PSC	H	
	NPWS assist with any future review of CKPoM or preparation of guidelines and standards	NPWS	H	
	NPWS discuss with landholders options for conservation, including VCAs	NPWS	H	
	NPWS investigate establishment of conservation reserves, particularly on Tomago Sandbeds	NPWS	H	
	NPWS provide advice to government agencies and landholders regarding koala conservation	NPWS	M	
	NPWS consider relevant aspects of this CKPoM for inclusion in state-wide Koala Recovery Plan	NPWS	H	
	HWC be requested to refer to CKPoM when undertaking self-determination (Part V) assessments on HWC land	HWC, Steering Committee	M	
	SF of NSW be requested to refer to this CKPoM when undertaking koala surveys	SF of NSW, NPWS	M	
	DLWC be requested to refer to this CKPoM when undertaking Crown Land assessments	DLWC	H	
	DLWC be requested to incorporate the provisions of this CKPoM in future Regional Vegetation Management Plans	DLWC	H	
	Dept. of Defence be requested to adopt standards of this CKPoM	Dept. of Defence	M	
5	Development Assessment			
	Council advertise in the local newspaper all development applications that are lodged in Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Buffers & Habitat Linking Areas	PSC		
	Council expand the information provided on section 149 certificates to reflect the presence of koala habitat.	PSC		

6	SWOT Analyses			
7	Habitat Restoration			
	Priority areas for koala habitat restoration identified on the basis of specified criteria	PSC, Steering Committee	H	
	One PSC officer be made responsible for overall co-ordination of community revegetation works and consult with CKPoM Steering Committee regarding koala habitat restoration program	PSC, Steering Committee	H	
	PoMs provide for the restoration of priority areas for koala habitat restoration	PSC	M	
	Nursery stock to be used for restoration programs be propagated from local provenance seed	PSC, AKF, community groups	M	
	Council to increase its enforcement of the Noxious Weeds Act and management of environmental weeds	PSC		
	Habitat Restoration Activities will take into account bushfire management principles	PSC		
8	Traffic Management			
	Fatality signs along Lemon Tree Passage Road updated annually	PSC, NATF, HKPS	L-M	
	PSC install Koala Warning signs and Injured Native Wildlife sign at black spots	PSC	H	
	Following community consultation approach RTA re trial of Koala Speed Zones at selected black spots	, PSC	H	
	PSC install speed advisory signs at blacks spots where Koala Speed Zones are not trialed	PSC	H	
	PSC regularly slash roadside clear zones at black spots	PSC	H	
	Promote research on application of underpasses and overpasses, exclusion fencing and koala crossings	Steering Committee	M	
	Seek funding to implement any of the above measures that merit application	PSC	M	
	Approach local energy supplier re installation of street lighting at koala crossings	PSC	M	
	Investigate additional safety measures at black spots such as wide white edge lines on the road	Steering Committee		
	Promote further research on the need for fencing along roads in koala traffic black spot areas	Steering Committee		
	PSC and RTA install Koala Warning signs and Injured Native Wildlife sign at conflict areas	PSC, RTA	H	
	PSC regularly slash roadside clear zones at conflict areas	PSC	M	
	Trial the use of car whistles	Steering Committee		
	Approach RTA to extend exclusion fencing on the Raymond Terrace Bypass to the north if necessary following release of their Koala Monitoring Report	PSC	H	

	Review problem areas as part of monitoring program	Steering Committee	M	
	Establish awareness campaign	PSC	H	
9	Dog Management			
	Where evidence available, PSC prosecute owner of any dog that attacks a koala	PSC	H	
	PSC direct additional resources for dog control	PSC	H	
	PSC rangers conduct additional night patrols during koala breeding season	PSC	H	
	PSC Ordinance Officers to work split shifts to enable greater availability for dog control	PSC		
	Where appropriate, PSC declare a dog to be dangerous where it has attacked a koala	PSC	H	
	Undertake an investigation into the number of unregistered dogs in areas where dogs are impacting on koalas	PSC		
	In each proposed new subdiivision, investigate the application of section 88e of the Conveyancing Act in the context of dog control	PSC		
	PSC provide more appropriate dog exercise areas as part of its current policy review	PSC,	H	
	PSC should consult more with the Tilligerry community regarding dog exercise areas	PSC		
	PSC ensure all public reserves are appropriately signposted	PSC	M	
	PSC publicise any successful prosecutions of dog owners	PSC	M	
	Media campaign including pamphlet drops in identified problem areas	PSC	M	
	Community groups participate in school and public education	NATF, HKPS, others	H	
	NATF and HKPS maintain register of reported dog attacks and provide to PSC	NATF, HKPS	H	
	Animal Management Committee develop suitable educational material	Committee, PSC		
	Special conditions relating to koala habitat be included in Local Companion Animal Plans	PSC		
	Educational material should include information on the most suitable breeds of dogs to keep in relation to koalas	Steering Committee		
10	Feral Animal Management			
	Land management agencies continue to contribute to and support PS VPA MC	All land management agencies	H	
	PS VPA Management Plan identify and address impacts of feral animals on koalas	PS VPA MC.	H	
	University of Newcastle continue to conduct research on feral animals	PS VPA MC, University		
	Chicken farmers who are providing a supplementary source of food for feral animals be encouraged	PSC		

	to dispose of these carcasses through alternative processes			
11	Bushfires			
	NPWS promote ongoing research into effects of bushfires on koalas and koala habitat	NPWS	H	
	Koala habitat is addressed in Port Stephens Bushfire Risk Management Plan	, PS BF MC	H	
	Steering Committee liaise with the Bushfire Management Committee regarding proposals by public authorities to undertake hazard reduction burns, and encourage private landholders to consult with it, in order to assist in determining if koalas or koala habitat are likely to be significantly affected by proposed hazard reduction activities.	Steering Committee	H	
	Land Management agencies and NSW Rural Fire Service cooperate with NPWS and local wildlife carer groups re fauna welfare during bushfire	Land Management Agencies, NPWS, local wildlife carer groups	H	
	Land Management Agencies seek to ensure that any hazard reduction burns in areas known to support koalas are maintained at low intensity or managed and supervised by the land owner or manager responsible for the hazard reduction burn in a manner to minimise risk to resident koalas	Land Management Agencies	H	
	PSC and CKPoM Steering Committee promote research on long term impacts of hazard reduction burns on koala habitat	PSC, Steering Committee	M	
	PSC and CKPoM Steering Committee investigate the potential use of satellite imagery to examine extent of bushfires	PSC, Steering Committee	M	
	PSC to assist Rural Fire Service in conducting community education in respect to the processes required to undertake Hazard Reduction Burns.	PSC		
	Assist where possible the Bushfire Management Committee in encouraging the sharing of resources for fire fighting.	PSC		
12	Koala Welfare			
	The CKPoM Steering Committee investigate the establishment of Koala Conservation Areas	CKPoM Steering Committee		
13	Education			
	Modify and reprint education brochure	PSC, AKF, NPWS, HKPS, NATF, THA, Steering Committee	H	
	Prepare brochure on recommended tree species for planting	PSC, Steering	H	

		Committee		
	Use Health and Environment Newsletter to deliver information on koala issues to the public	PSC,	H	
	Develop trial education program for schools and community groups	PSC, Steering Committee	H	
	Contact Department of Education re above program	PSC	M	
	NPWS consulted re scientific aspects of above program	PSC, NPWS	M	
	Councillors and Council staff be educated in relation to koala conservation issues	PSC, AKF, NPWS	H	
	Developers and consultants informed of new legislative and policy directions	PSC	H	
	Community informed of economic benefits of conserving koalas and their habitat	PSC	M	
	Low key advertising used to foster identity of PS as a place which conserves koalas and their habitat	PSC	L	
	Contact bus companies re advertisements on buses	PSC	M	
	PSC and NPWS investigate provision of recorded information on telephone hold lines	PSC, NPWS	L	
	Wildlife carer groups & / or the CKPoM Steering Committee coordinate provision of koala information to media	Carer groups, Steering Committee	M	
	NPWS investigate provision of regular articles on koalas in local newspaper	NPWS	M	
	Information on koala conservation be made available via electronic media	PSC, NPWS, AKF	H	
	PSC support the development of a regional extension service such as 'Land for Wildlife'	PSC		
	More consultation needs to be undertaken with community in respect to new planning policies and instruments	PSC	H	
14	Tourism			
	PSC and NPWS undertake a study of eco-tourism potential and locate suitable tourism areas	PSC, NPWS	H	
	CKPoM Steering Committee identify trial area and develop koala-based tourism guidelines	Steering Committee	H	
	Eco-tourism Committee of Port Stephens Tourism Ltd be further developed	PS Tourism Ltd	M	
	Port Stephens Tourism Ltd encourage members to seek relevant accreditation	PS Tourism Ltd	M	
	Develop licensing system for local eco-tourism operators	PS Tourism Ltd	M	
	Establish a formal mechanism to monitor impacts of tourism	Steering Committee, PSC		
	Develop uniform interpretative and directional signs	PS Tourism Ltd	M	
	Eco-tourism combined with other forms of tourism	PSC, PS Tourism Ltd	L	
	Tourism be used a source of revenue to fund koala conservation projects	PSC, PS Tourism Ltd	H	

15	Funding			
	CKPoM Steering Committee responsible for costing and securing funding for implementation	Steering Committee	H	
	CKPoM Steering Committee request media to include information for public donations	Steering Committee	M	
16	Research			
	CKPoM Steering Committee approach Uni of Newcastle to meet with the Committee when relevant	Steering Committee	M	
	CKPoM Steering Committee prioritise potential koala research projects	Steering Committee	H	
	CKPoM Steering Committee promote research projects to Universities	Steering Committee	H	
	CKPoM Steering Committee facilitate the involvement of volunteers in research projects	Steering Committee	M	
	CKPoM Steering Committee maintain a register of completed, ongoing and proposed research projects	Steering Committee, PSC, AKF	M	
	CKPoM Steering Committee maintain a reference library, including research reports	Steering Committee	M	
	NATF and HKPS maintain koala databases, CKPoM Steering Committee liaise to integrate these data bases	NATF, HKPS, AKF	H	
	CKPoM Steering Committee incorporate results of relevant research into the CKPoM	Steering Committee	H	
17	Monitoring Program			
	PSC and the CKPoM Steering Committee continue to refine the mapping of koala habitat	PSC, Steering Committee	H	
	CKPoM Steering Committee will purchase latest satellite imagery	Steering Committee	H	
	CKPoM Steering Committee interpret these images to ascertain changes in koala habitat	Steering Committee	H	
	CKPoM Steering Committee to maintain register of habitat clearing activities	Steering Committee	H	
	CKPoM Steering Committee to maintain register of discrepancies in the Vegetation Map and investigate and revise where possible	Steering Committee	H	
	CKPoM Steering Committee coordinate revision of Vegetation Map and Koala Habitat Planning Map	Steering Committee	H	
	CKPoM Steering Committee coordinate annual phone-in census	Steering Committee	H	
	CKPoM Steering Committee coordinate annual transect-based surveys, NPWS to assist	Steering Committee, NPWS	H	
	HKPS maintain record of koala sightings through its Koala Watch program	HKPS	H	
	CKPoM Steering Committee monitor koala habitat utilisation using Spot Assessment Technique	Steering Committee	H	
	CKPoM Steering Committee to collate existing research on koala faecal pellet longevity and determine if additional research is required	Steering Committee	L	

	CKPoM Steering Committee investigate potential use of Population Viability Analysis in monitoring program	Steering Committee	M	
	NATF and HKPS maintain their koala databases and provide data for monitoring program	NATF, HKPS	H	
	PSC rangers maintain register on cases involving domestic dog attack on koalas	PSC	M	
	CKPoM Steering Committee seek necessary funding to implement monitoring program	Steering Committee	H	
	CKPoM Steering Committee present annual reports on ongoing monitoring program	Steering Committee	H	
	PSC include updates on status of koala in annual State of Environment reports	PSC	H	
	CKPoM Steering Committee review the PS CKPoM every 12 months	Steering Committee	H	
	CKPoM Steering Committee, PSC and NPWS determine the need for amendments to the CKPoM and forward these to PSC and DUAP for formal approval	Steering Committee, PSC, NPWS	H	
18	Implementation			
	Establish core CKPoM Steering Committee	PSC, AKF, NPWS, DUAP, NATF, HKPS, landholder groups, AWH	H	
	Invite other organisations where necessary	Steering Committee	M	
	CKPoM Steering Committee meet quarterly in the first year and then as often as necessary	Steering Committee	H	
	CKPoM Steering Committee produce an annual report on the progress of the CKPoM	Steering Committee	H	

20. Glossary of Terms

Preferred Koala Habitat: identified by Lunney *et al.* (1998) as the most important category of koala habitat in the Port Stephens LGA and hence should be afforded the highest level of protection. Includes all Koala Habitat Atlas (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 Koala Habitat Atlas Marginal Habitat and middle ranking Community based survey categories C & D overlap. Along with PKH is also important to the long term conservation of koalas in Port Stephens (Lunney *et al.* 1998) and thus also requires protection, albeit with less restrictions on development than Preferred Koala Habitat.

Marginal Koala Habitat: where Koala Habitat Atlas Marginal Habitat and the lowest Community based survey category E overlap (This is essentially all forested areas which are neither Preferred or Supplementary Koala Habitat)

Habitat Linking Area: 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 home ranges within higher quality habitat.

Habitat Buffer: Can contribute to the long-term survival of Preferred Koala Habitat by ensuring incompatible development or land use does not occur on land immediately adjacent to Preferred Koala Habitat. Habitat Buffers may also afford protection to Preferred Koala Habitat by minimising the detrimental impact of “edge effects” such as nutrient impacts, wind damage and weed invasion. Habitat Buffers also provide for the likely extension of significant koala activity beyond Preferred Koala Habitat. Even Habitat Buffers that extend over Mainly Cleared Land and which contain only scattered trees can perform this latter function. Hence, all Habitat Buffers should also be afforded the highest level of protection and considered for possible restoration where appropriate. The ecological criteria for determining the size of habitat buffers is contained in Appendix 9.

Low impact development: Development that maximises the retention and minimises degradation of native vegetation, and in particular koala habitat. Such developments will be consistent with the objectives of the ‘Performance Criteria for Development Applications’ contained in the Port Stephens Council CKPoM. Low impact developments will also minimise recognised threats to koalas which include dogs, bushfires, traffic, feral animals, and habitat fragmentation (including barriers to koala movement).

Building / Development Envelope & Associated works: that area of land that contains the proposed building or development and its associated works (eg. pools, septic tank transpiration area, driveways, roads, & parking & fire fuel reduction zones).

Agriculture: means the cultivation of crops, and the keeping and breeding of livestock, bees, worms or poultry and other birds, and the like, for commercial purposes, but does not include an intensive agricultural pursuit, intensive agriculture, or clearing activities.

Intensive Agriculture: means any form of agriculture or horticulture which:

- a) involves the confinement in an area with watering and feeding facilities where the animals are completely hand or mechanically fed for the purpose of production: or
- b) requires particular treatment or practices for the management of liquid or solid wastes to prevent the pollution of any part of the environment: or
- c) requires separation from surrounding land uses to minimise the risk of land use conflict for any other reason

Rezoning request: Any amendment to the Port Stephens Council Local Environmental Plan. (eg. requesting a change in land use zone for a particular parcel of land).

Development Application: means an application for consent under Part 4 of the *Environmental Planning & Assessment Act 1979* to carry out development but does not include an application for a complying development certificate .

Fuel reduction zone: area of reduced fire fuel between a building or development and bushland from which bushfires traditionally approach. The fuel reduction zone can include existing fuel free zones such as roadways, rivers or bare ground. The characteristics of a home or development site will determine the appropriate fuel reduction zone for a particular property.

Feral Animal: An animal established in the wild after escape or release from human custody.

21. Abbreviations

CKPoM	Comprehensive Koala Plan of Management
SEPP 44	State Environmental Planning Policy 44 – Koala Habitat Protection
PSC	Port Stephens Council
DUAP	Department of Urban Affairs and Planning
NPWS	National Parks & Wildlife Service
PKH	Preferred Koala Habitat
SKH	Supplementary Koala Habitat
MKH	Marginal Koala Habitat
HB	Habitat Buffer
HLA	Habitat Linking Area
LEP	Local Environmental Plan
KMU	Koala Management Unit
HWC	Hunter Water Corporation
LGA	Local Government Area
S.W.O.T.	Strengths. Weaknesses. Opportunities. Threats.
HKPS	Hunter Koala Preservation Society
NATF	Native Animal Trust Fund
DA	Development Application
RTA	Roads and Traffic Authority
AKF	Australian Koala Foundation
SF	State Forests of NSW
WLALC	Worimi Local Aboriginal Land Council
PSFC	Port Stephens Fire Control
KHA	Koala Habitat Atlas
AWH	Australian Wildlife Hospital

22. References

Australian New Zealand Environment and Conservation Council (1998) National Koala Conservation Strategy. Australian New Zealand Environment and Conservation Council (ANZECC), Environment Australia, Canberra.

Callaghan, J., Leathley, S. and Lunney, D. (1994) *Port Stephens Koala Management Plan. Draft for public discussion. 27 September 1994.* NSW National Parks and Wildlife Service and Port Stephens Council.

Hundloe, T. and Hamilton C. (1997) Koalas and Tourism: an economic evaluation. Commissioned by the Australian Koala Foundation. Discussion Paper #13. Australia Institute and the University of Queensland, Canberra.

Knott, T. Lunney, D., Coburn, D. and Callaghan, J. (1998) An ecological history of Koala habitat in Port Stephens Shire and the Lower Hunter on the Central Coast of New South Wales, 1801-1998. *Pacific Conservation Biology* 4: 354-68

Lunney, D., Phillips, S., Callaghan, J. and Coburn, D. (1998). Determining the distribution of koala habitat across a Shire as a basis for conservation: a case study from Port Stephens, New South Wales. *Pacific Conservation Biology* 4: 186-96

Phillips, S. and Callaghan, J. (1995) *The Spot Assessment Technique for Determining the Significance of Habitat Utilisation by Koalas.* pp 66-70 In Proceedings of a Conference on the Status of the Koala in 1995. Australian Koala Foundation, Brisbane.

Phillips, S., Callaghan, J. and Thompson, V. (1996) *The Koala Habitat Atlas - Project No.6: Port Stephens Local Government Area.* Australian Koala Foundation, Brisbane.

Walker J. and Hopkins, M.S. (1990) Vegetation. In *Australian soil and land survey field handbook.* Second edition (McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S.). Inkata Press, Melbourne.

Appendix 1

Justification for rezoning of selected public land to Environmental Protection to protect Koala Habitat

The following is the general justification for rezoning Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Linking Areas and Habitat Buffers on public land to Environmental Protection to protect koala habitat.

Rezoning koala habitat on public land to Environmental Protection provides a high degree of certainty. It provides a clear indication to future public land managers that such areas contain important koala habitat and need to be managed accordingly. The current land use zone is likely to be one of the first things considered by public land managers, so they can see if the permissible uses of that land are consistent with their future plans. While prospective managers of public land which contains koala habitat (but which is zoned other than Environmental Protection) should be made aware of the development controls that apply to the koala habitat as specified by the CKPoM, it will be a much clearer message if the land is zoned Environmental Protection. In this way it will provide clear guidance to agencies that manage public land of the importance of such land as koala habitat.

Rezoning koala habitat on public land to Environmental Protection is a pro-active means of protecting koala habitat; whereas the other proposed regulatory measures (performance criteria for rezoning requests, the amending clause of the LEP and the performance criteria for development applications) are reactive measures, in that they are not activated until there is a rezoning request or development application. By rezoning land to Environmental Protection now, there will be less need to deal with rezoning requests in the future.

Furthermore, rezoning koala habitat on public land to Environmental Protection represents an open and clear approach to protecting koala habitat, in that it provides for a separate phase of public exhibition and consultation (in addition to that related to the public exhibition of the CKPoM). The objectives of Environmental Protection zones (especially the proposed 7(a) zone) are also more consistent with the intention to set the land aside for koala habitat protection than the objectives of other land use zones.

In summary, rezoning koala habitat on public land to Environmental Protection represents a pro-active and transparent means of protecting koala habitat.

Appendix 2

Performance Criteria for Rezoning Requests

These Performance Criteria for rezoning requests 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 & 5. 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 presented in Appendix 6 of this CKPoM.

Appendix 3

Proposed amending clause of the Port Stephens LEP

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

PORT STEPHENS LOCAL ENVIRONMENTAL PLAN (DRAFT AMENDMENT No. #)

I, the Minister for Urban Affairs and Planning, in pursuance of section 70 of the Environmental Planning and Assessment Act 1979, make the local environmental plan set out hereunder.

Minister for Urban Affairs and Planning

Sydney, 1999.

Citation

1. This plan may be cited as Port Stephens Local Environmental Plan (Amendment No.#).

Land to which this plan applies

2. This plan applies to all land within the local government area of Port Stephens.

Objectives

3. This plan aims to amend Port Stephens Local Environmental Plan in order to activate the provisions of the Port Stephens Council Comprehensive Koala Plan of Management and thereby ensure the long term sustainability of the local koala population.

Relationship to other environmental planning instruments

4. This plan amends Port Stephens Local Environmental Plan in the manner shown in clause 5.

Amendment of Port Stephens Local Environmental Plan

5. Port Stephens Local Environmental Plan 1987 is amended by inserting the following clause:

Port Stephens Council Comprehensive Koala Plan of Management

- (1) This clause applies to all land within the Port Stephens Local Government Area.
 - (2) All development applications within the Port Stephens Local Government Area must comply with the provisions of the Port Stephens Council Comprehensive Koala Plan of Management. Compliance with the provisions of the Port Stephens Council Comprehensive Koala Plan of Management will constitute compliance with the provisions of State Environmental Planning Policy No. 44 – Koala Habitat Protection.
-

Appendix 4

Performance Criteria for development applications (excluding development applications proposing agricultural activities)

Regulation of development via the assessment of development applications represents an important means by which koala habitat can be protected and effectively managed. All development applications in the Port Stephens LGA will be required to comply with the provisions of this appendix of the Port Stephens Council CKPoM to comply with State Environmental Planning Policy No. 44 – Koala Habitat Protection. This requirement is activated by the proposed amending clause of the Port Stephens LEP (Appendix 3).

The general aims and objectives of these performance criteria are as follows:

- 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.

All Development Applications (excluding development applications proposing agricultural activities) in the Port Stephens LGA must demonstrate that they are consistent with the above objectives. All subdivisions must demonstrate that their design is consistent with the above objectives.

The performance criteria contained in this appendix require an understanding of koala habitat types within the Port Stephens LGA. The distribution of the following habitat categories are shown on the CKPoM map entitled “Koala Habitat Planning Map”. Hard copies of this map are available from the offices of Port Stephens Council, free of charge.

The performance criteria listed below apply to the following categories of koala habitat:

Preferred Koala Habitat was identified by Lunney *et al.* (1998) as the most important category of koala habitat in the Port Stephens LGA and hence should be afforded the highest level of protection.

Supplementary Koala Habitat is also important to the long term conservation of koalas in Port Stephens (Lunney *et al.* 1998) and thus also requires protection, albeit with less restrictions on development than Preferred Koala Habitat.

Habitat Buffers (as determined by the ecological criteria contained in Appendix 9) can contribute to the long-term survival of Preferred Koala Habitat by ensuring incompatible development or land use does not occur on land immediately adjacent to Preferred Koala Habitat. Habitat Buffers may also afford protection to Preferred Koala Habitat by minimising the detrimental impact of “edge effects” such as nutrient impacts, wind damage and weed invasion. Habitat Buffers also provide for the likely extension of significant koala activity beyond Preferred Koala Habitat. Even Habitat Buffers that extend over Mainly Cleared Land and which contain only scattered trees can perform this latter function. Hence, all Habitat Buffers should also be afforded the highest level of protection and considered for possible restoration where appropriate.

Habitat Linking Areas may provide opportunities for the successful movement of koalas between breeding populations or into areas of vacant habitat. They may also provide for the establishment of koala home range areas, depending upon their size and the quality of habitat they contain. Habitat Linking Areas which overlap with Mainly Cleared Land may still perform such functions. Development may be permitted in Habitat Linking Areas provided it does not compromise the safe use of such areas by koalas. Habitat Linking Areas are to be subject to the same criteria as Supplementary Koala Habitat.

Performance criteria

The following criteria (a-h) apply to all developments (excluding development applications proposing agricultural activities) proposed on sites that contain or are adjacent to Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas. For the purposes of these criteria, 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) of these criteria **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 including fire fuel reduction zones **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 Appendix 6) 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*), and hybrids of any of these species. An additional list of tree species that may be important to koalas based on anecdotal evidence is included in Appendix 8
- 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 all 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 Appendix 6.
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.

Appendix 5

Performance Criteria for Development Applications proposing agricultural activities.

Regulation of agricultural activities (as defined in the Glossary of Terms) via the assessment of development applications where these are required in accordance with the Port Stephens Council LEP, represents an important means by which koala habitat can be protected and effectively managed. Under certain circumstances (eg. particular land use zones including 1(a), 1(c1), 1(c2), 1(c2), 1(c4), 1(c5), 1(d), 1(g)) the Port Stephens LEP does not require a Development Application to be lodged for agricultural activities. However if clearing is required to undertake the agricultural activity in these zones, development consent is required from Council, and where the extent of clearing proposed exceeds 2 hectares in area, consent is also required from the Department of Land & Water Conservation.

In instances where a DA is required to undertake an agricultural activity (eg. where clearing is proposed), it will be required to comply with the provisions of this appendix of the Port Stephens Council CKPoM to comply with State Environmental Planning Policy No. 44 – Koala Habitat Protection. This requirement is activated by the proposed amending clause of the Port Stephens LEP (Appendix 3).

The general aims and objectives of these performance criteria are as follows:

1. To ensure that the koala population in the Port Stephens LGA is sustainable over the long-term.
2. To protect koala habitat areas from any agricultural activities requiring a DA which would compromise habitat quality or integrity.
3. To ensure that any agricultural activity requiring a DA proposed within or adjacent to koala habitat areas occurs in an environmentally sensitive manner.
4. To ensure that acceptable levels of investigation are undertaken, considered and accepted prior to any agricultural activity requiring a DA in or adjacent to koala habitat areas.
5. To encourage koala habitat rehabilitation and restoration.
6. Maintain interconnection between areas of Preferred and Supplementary Koala Habitat and minimise threats to safe koala movements between such areas.
7. To ensure that agricultural activities requiring a DA do not further fragment habitat areas either through the removal of habitat or habitat links or through the imposition of significant threats to koalas.
8. To provide guidelines and standards to minimise impacts on koalas during and after agricultural activities which require a DA.
9. To provide readily understandable advice to proponents preparing development applications for agricultural activities that require a DA and for Council officers involved in the assessment of those applications.

All Development Applications proposing agricultural activities in the Port Stephens LGA must demonstrate that they are consistent with the above objectives, and conform to the requirements of section 79c of the *Environmental Planning and Assessment Act 1979*.

The performance criteria contained in this appendix require an understanding of koala habitat types within the Port Stephens LGA. The distribution of the following habitat categories are shown on the CKPoM map entitled "Koala Habitat Planning Map". Hard copies of this map are available from the offices of Port Stephens Council, free of charge.

The performance criteria for Development Applications proposing agricultural activities apply to the following categories of koala habitat:

Preferred Koala Habitat was identified by Lunney *et al.* (1998) as the most important category of koala habitat in the Port Stephens LGA and hence should be afforded the highest level of protection.

Supplementary Koala Habitat is also important to the long term conservation of koalas in Port Stephens (Lunney *et al.* 1998) and thus also requires protection, albeit with less restrictions on development than Preferred Koala Habitat.

Habitat Buffers (as determined by the ecological criteria contained in Appendix 9) can contribute to the long-term survival of Preferred Koala Habitat by ensuring incompatible development or land use does not occur on land immediately adjacent to Preferred Koala Habitat. Habitat Buffers may also afford protection to Preferred Koala Habitat by minimising the detrimental impact of "edge effects" such as nutrient impacts, wind damage and weed invasion. Habitat Buffers also provide for the likely extension of significant koala activity beyond Preferred Koala Habitat. Even Habitat Buffers that extend over Mainly Cleared Land and which contain only scattered trees can perform this latter function. Hence, all Habitat Buffers should also be afforded the highest level of protection and considered for possible restoration where appropriate.

Habitat Linking Areas may provide opportunities for the successful movement of koalas between breeding populations or into areas of vacant habitat. They may also provide for the establishment of koala home range areas, depending upon their size and the quality of habitat they contain. Habitat Linking Areas which overlap with Mainly Cleared Land may still perform such functions. Development may be permitted in Habitat Linking Areas provided it does not compromise the safe use of such areas by koalas. Habitat Linking Areas are to be subject to the same criteria as Supplementary Koala Habitat.

Performance Criteria for Development Applications Proposing Agricultural Activities

The following criteria (a – f) apply to all Development Applications proposing agricultural activities proposed on sites that contain or are adjacent to Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas. For the purposes of these criteria, 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) below of the performance criteria for Development Applications proposing agricultural activities **only if** the proponent can demonstrate:

1. That the agricultural activity **cannot** be located or undertaken 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 agricultural activity **minimises** the need to remove vegetation as per 1 above;
3. That koala survey methods (as per the Guidelines for Koala Habitat Assessment in Appendix 6) have been used to determine the most appropriate location for the agricultural activity (so as to minimise the impact on koala habitat and any koala populations that might occur as a result of the activity).

The performance criteria for Development Applications Proposing Agricultural Activities are as follows:

Proposed 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 the 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*), and hybrids of any of these species. An additional list of tree species that may be important to koalas based on anecdotal evidence is included in Appendix 8;
- 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 1-3 of the waive clause for Development Applications Proposing Agricultural Activities), 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. Suitable fencing for agricultural activities could include:
 - open post and rail or post and wire. If a barbed wire fence is required to contain livestock there should not be barbed wire

on the bottom strand, it must be plain wire and be a minimum of 200mm above the ground.

Information to Accompany Development Applications Proposing Agricultural Activities

The following information must be submitted with all 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 Appendix 6.
2. Clear details concerning which vegetation is to be cleared or disturbed and that which is to be retained.
3. Proposed measures to restore or rehabilitate koala habitat, including measures which will result in the net gain of koala habitat.
4. Proposed measures to allow the safe movement of koalas across the site including fence construction details where fencing is proposed.
5. Proposed measures to mitigate the impacts on koalas by dogs. This must include measures that reduce the likelihood of farm dogs straying into koala habitat.

The following information must be submitted with Development Applications proposing agricultural activities on **sites that are adjacent to** Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas.

1. Proposed measures to mitigate the impacts by dogs on koalas which occupy adjacent habitat. This must include measures that reduce the likelihood of farm dogs straying into koala habitat.

Appendix 6

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 4. 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. **Preliminary assessment.** 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.

(^{*}Note: 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 & 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 8 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 1000m² 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.

Appendix 7

Principles for the effective design and construction of koala underpasses and overpasses

The impact of collisions between koalas and motor vehicles on koala populations is well documented (see Chapter 8 Traffic Management of the CKPoM Resource Document), and represents a significant threat to koalas in the Port Stephens LGA and elsewhere. Two possible measures that could ameliorate this impact, by allowing koalas to potentially safely traverse a road, are underpasses and overpasses. Underpasses are structures built under a road to facilitate the movement of fauna between habitat on either side. Overpasses aim to fulfil the same function by providing the means for fauna to move safely above the road. Both underpasses and overpasses are likely to be most effective when used in conjunction with exclusion fencing, which aims to prevent fauna from crossing the roadway itself. This appendix provides basic principles recommended for the design and construction of koala underpasses and overpasses. It should be pointed out that while the use of koala and other fauna underpasses is currently being trialed in several locations in NSW, there are few examples of koala overpasses being employed.

Road alignment

The best way to minimise likely collisions between koalas and motor vehicles is to ensure new road alignments do not further fragment koala habitat, especially Preferred Koala Habitat, nor existing koala populations. Obviously, this measure can only be applied to proposed new roads or to road realignments. Future road proposals should take into account relevant information regarding the location of koala habitat by referring to the Koala Habitat Planning Map (Figure 1) and by applying the Guidelines for Koala Habitat Assessments (Appendix 6), information regarding existing koala populations, existing koala records and by conducting relevant field surveys.

Principle: *The design of future roads and road realignments should take into account information regarding the location of koala habitat and koala populations and should not further fragment koala habitat, particularly Preferred Koala Habitat, nor existing koala populations.*

Potential provision of Underpasses or Overpasses

If a proposed road cannot be located in such a way that it will not fragment koala habitat or existing koala populations (or in the case of proposed upgrading or realignment of an existing roadway), it will be necessary to investigate the potential application of measures such as underpasses or overpasses. Due to the costs associated with such measures, their potential application will need to be assessed on the basis of the features of the surrounding habitat and the local koala population and other fauna species, as well as the nature of the roadway in terms of traffic speeds and volume (both at the present time and in the future). It is important to realise that the location of underpasses and overpasses, as well as size and other design features, is likely to significantly influence their effectiveness.

A variety of methods could be employed to firstly assess the need and, secondly, to determine the most appropriate locations for underpass or overpass structures. These include:

- A radio-tracking program of resident koalas in the vicinity of the road works. Such a study should ascertain whether the home ranges of any

koalas overlap with the proposed road and, if so, where regular crossings are likely to occur;

- Faecal pellet-based field surveys, which could be used to survey for the presence of a resident koala population and to investigate patterns of habitat utilisation by koalas in the vicinity of the proposed road works;
- Information on the distribution of koala habitat in the vicinity of the proposed road works. For instance, the presence of Preferred Koala Habitat or preferred koala food trees may indicate areas where koalas are most likely to cross the path of a proposed road; and
- Review records of koala and other fauna road fatalities or injuries that may have been maintained for the general area by local koala welfare organisations or the National Parks and Wildlife Service.

Another matter that would need to be taken into account when determining the appropriate location for underpasses or overpasses is the principal objectives for providing the structures. The first two dot points above would provide information on the best location to facilitate the continued use of existing home range areas occupied by members of the local koala population, but may not effectively contribute to facilitating dispersal of sub-adult koalas, with subsequent long term exchange of genetic material between breeding groups that may occupy habitat over some distance on either side of the proposed road. The last two dot points may help locate structures so as to best provide for potential use by dispersing sub-adult koalas.

Basic design criteria for underpasses and overpasses

Where the need and suitability for koala road crossing measures has been established, a number of design features will need to be considered in order to increase the likelihood of effective use by koalas and other fauna, and to take into account the case-by-case features of the particular area and roadway. When considering the best design for underpasses and overpasses it is necessary to also address the design, impact and maintenance of associated exclusion fencing.

Design of underpasses

The following principles should be employed when designing underpasses:

- Design underpasses to be as large as possible. In their study of three fauna underpasses on the F3 freeway, AMBS (1997) found that the larger the underpass, the greater range of species tended to use it. In a radio-tracking and monitoring study in the Tweed Shire, Callaghan and Phillips (1998) recorded that a 3m x 3m box culvert was most used by koalas as well as a range of other local fauna species, while a 2.1m x 1.5m underpass received less use, and a nearby 0.9m x 0.6m culvert was never used by koalas and was only used on a few occasions by small mammals as well as a cat and a dog;
- Design underpasses to be of a size which allows the skyline, or at least adjoining habitat, to be seen from either end (AMBS 1997);
- Design an underpass so that dry passage is provided for animals, for example, by raising one cell of a multi-cell culvert (AMBS 1997);
- If underpasses are longer than a standard two-lane carriage-way, incorporate structures which may allow koalas to escape from predators, such as wooden posts with a top rail;
- A wooden post should ideally be positioned near the underpass entrances to allow koalas to escape above ground if chased by dogs. Such structures should have a cross member near the top to allow a koala to sit comfortably; and
- Additional planting of preferred koala food trees near to the entrances may improve the chances that they will be effectively located by koalas.

Design of overpasses

Overpass structures could be provided to link either side of embankments where the roadway passes through a cutting, with banks on both sides of the roadway. Such structures would need to be of sturdy construction and should be as wide as possible in order to increase the likelihood of effective use by koalas and other fauna species. Such structures might be combined with pedestrian access across roadways in some cases.

The last three dot points for koala underpasses also apply to design criteria for fauna overpasses.

Design of exclusion fencing

Exclusion fencing is a crucial component of a fauna underpass or overpass, as it is required to prevent koalas from crossing the roadway itself and to direct koalas towards any underpass or overpass structures provided. For either an underpass or an overpass to function effectively, the exclusion fencing must be well-designed and maintained. Basic design criteria for exclusion fencing include:

- Exclusion fencing must be well-constructed. In particular, it should be designed in such a way as to direct koalas towards the underpass structures and it should not be constructed immediately adjacent to any trees which could allow a koala to climb and jump over the fencing. Tree guards, comprised of sheet metal wrapped loosely around the tree trunk, can be used for established trees, rather than removing them if the fence cannot be aligned away from them;
- Suitable designs are available from work conducted in conjunction with a number of other studies for sections of the Pacific Highway in northern NSW; and
- Exclusion fencing must be regularly inspected and effectively maintained as part of an established road maintenance program.

Making use of other structures

Other structures such as bridges or underpass structures provided to cater for very low traffic volumes and low speeds, may also function to varying degrees as fauna underpasses. For this to occur:

- Such structures should be set back from the waterbody or vehicle access to allow additional space for koalas and other fauna to cross;
- If designed to cater for traffic flow, traffic speeds must be very low and the approaches should ideally be well lighted; and
- These areas should also be planted out with koala food trees where possible.

Potential long-term impacts on koalas and other fauna

A number of additional factors need to be carefully addressed when giving consideration to the potential provision of fauna underpasses, overpasses and associated exclusion fencing. These factors include the potential long-term effects on koalas and other fauna species should the structures fail to function effectively at a population level. In such circumstances the exclusion fencing may well have a detrimental long-term effect on fauna populations by providing a further barrier to dispersal. It may be appropriate to leave a plain wire mesh section at the base of the exclusion fencing in order to allow smaller fauna, that are perhaps less likely to

successfully use fauna underpasses, to pass through the fencing and potentially cross the roadway.

It seems reasonable to suggest that aside from the more obvious impacts of fauna injuries and fatalities, roads carrying high traffic speeds and volumes (in particular) could essentially act as barriers to fauna dispersion in their own right. A common sense approach and careful consideration will be necessary when determining when and where to provide fauna underpasses, overpasses and exclusion fencing.

Research and monitoring

With some exceptions, for instance, the radio-tracking of koalas by Ishta Consultants to assess the impacts of the Raymond Terrace bypass and a radio-tracking and monitoring study by the Australian Koala Foundation to monitor a road realignment in the Tweed Shire in northern NSW, there has been relatively little research undertaken to establish the efficacy of koala underpasses and even less research to assess the effectiveness of koala overpasses. The Roads and Traffic Authority of NSW recently commissioned a long term study to assess the efficacy of a range of measures aimed at ameliorating the impact of the Pacific Highway realignment at several locations on the North Coast of NSW, but the results of this study will not be available for some time.

Because of this lack of information, it is crucial that underpasses and overpasses be adequately monitored to gauge their effectiveness and to permit future design modification where warranted. Monitoring programs may include: radio-tracking studies, use of videos and sand-traps within underpasses, follow-up faecal pellet-based surveys, koala counts, community-based surveys, regular searches of the roadway and road verges for road kills and liaison with the local koala welfare groups. An appropriate monitoring program would need to be designed on the basis of the nature of the road and traffic, available funds and resources and the overall objectives for the study. Monitoring programs should preferably be long term in order to establish the likely effectiveness of such measures over time at a population level.

As further information is made available from current and future research and monitoring programs, the above design principles should be amended accordingly.

References

AMBS (1997) Fauna usage of three underpasses beneath the F3 Freeway between Sydney and Newcastle. Report prepared by Australian Museum Business Services for the Roads and Traffic Authority.

Callaghan, J. and Phillips, S. (1998) Monitoring of impacts on koalas associated with the upgrading and part realignment of Old Bogangar Road. 2nd Report prepared by the Australian Koala Foundation for Tweed Shire Council.

Appendix 8

Tree species that may be important to koalas in the Port Stephens Local Government Area as identified by anecdotal evidence (source: Callaghan et al, 1994)

Grey Gum (*Eucalyptus punctata*)

Scribbly Gum (*Eucalyptus haemastoma* or *E. signata*)

Brown Stringybark (*Eucalyptus capitellata*)

White Mahogany (*Eucalyptus acmenioides*)

Red Mahogany (*Eucalyptus resinifera*)

Tallowood (*Eucalyptus microcorys*)

Sydney Blue Gum (*Eucalyptus saligna*)

Sydney Peppermint (*Eucalyptus piperita*)

Blackbutt (*Eucalyptus pilularis*)

Spotted Gum (*Eucalyptus maculata*)

Grey Ironbark (*Eucalyptus paniculata*)

Narrow-leaved Red Ironbark (*Eucalyptus crebra*)

Broad – leaved White Mahogany (*Eucalyptus umbra*)

Flooded Gum (*Eucalyptus grandis*)

Small – leaved Peppermint (*Eucalyptus nicholii*)

Red Bloodwood (*Eucalyptus gumnifera*)

Smooth Barked Apple (*Angophora costata*)

Broad – leaved Paperbark (*Melaleuca quinquinerva*)

Swamp She-oak (*Casuarina glauca*)

Appendix 9

Ecological Criteria for the establishment of Habitat Buffers for Preferred Koala Habitat

At its meeting on 1st June 2000, the CKPoM Consultative Committee recommended that the width of Habitat Buffers should be determined on a case-by-case basis, rather than 100m Habitat Buffers being applied to all Preferred Koala Habitat throughout the Port Stephens LGA. The CKPoM Consultative Committee also determined that ecological criteria should be developed to guide the specification of Habitat Buffer width. This appendix explains the purpose of Habitat Buffers, discusses issues relevant to their application and specifies the ecological criteria that must be used to determine the width of Habitat Buffers on a case-by-case basis.

The Aim of Habitat Buffers

The Habitat Buffers proposed for all Preferred Koala Habitat seek to fulfil two main objectives:

1. To protect Preferred Koala Habitat from the detrimental impact of “edge effects”; and
2. To provide for the likely extension of significant koala activity beyond Preferred Koala Habitat.

Issues relevant to each of these objectives are discussed below.

Edge Effects

What are edge effects?

Widespread clearing of native vegetation, as has occurred in the Port Stephens Local Government Area (LGA) for agricultural and urban development (Knott *et al.* 1998), causes fragmentation of the landscape, which leaves a series of patches of remnant vegetation surrounded by an environment of different vegetation and/or land use (Saunders *et al.* 1991). This surrounding environment imposes a range of different physical, microclimatic and biological conditions on these patches of remnant vegetation (Saunders *et al.* 1991; Murcia 1995). Because these altered conditions are often most apparent at the abrupt transition between the remnant vegetation and the surrounding environment (the edge), they have become known as “edge effects” (Murcia 1995).

Murcia (1995) identifies both abiotic (non-living) and biological edge effects. Abiotic edge effects are those that relate to changed environmental conditions within the remnant and include changes to: air moisture, air temperature, solar radiation levels, soil moisture, soil temperature and chemical composition (such as nutrient inputs). Other abiotic edge effects include changes to wind speed and pattern (Saunders *et al.* 1991). Biological edge effects involve changes in species abundance and distribution, either directly due to changed environmental conditions at the edge, or indirectly, through changes in species interactions, such as predation, herbivory, parasitism, competition, and biotic seed pollination and seed dispersal (Murcia 1995). It is also recognised that many edge effects, both abiotic and biological, are likely to interact (Murcia 1995). While in the past forest edges were considered to be beneficial, particularly to game animals (Wilcove *et al.* 1986; Sisk and Margules 1993), it is now well understood that edge effects are detrimental to a wide range of

flora and fauna (Janzen 1986; Lovejoy *et al.* 1986; Wilcove *et al.* 1986; Laurance 1991; Saunders *et al.* 1991; Sisk and Margules 1993, Murcia 1995; Laurance 2000).

Predation of koalas and other fauna species by vertebrate predators, particularly roaming domestic and feral dogs, are also potentially influenced by edge effects. May (1997) reported that whilst the vast majority of research on edge-related predation has been undertaken in the northern hemisphere and has tended to focus on the incidence of predation on nests, some studies had indicated that levels of predation were higher within edge environments than within the interior of remnants. Although not yet quantified by research, it seems reasonable to assume that koalas are likely to be more vulnerable to predation by dogs near to the edge of habitat remnants, particularly where the area beyond the edge has been heavily degraded or contains trees at low density.

Edge effects have been reported as impacting specifically on koala habitat. Increased run-off from adjacent urban areas has been implicated in the dieback of koala food trees in the Pittwater area of Sydney (Smith and Smith 1990). Also, increased nutrient inputs from adjacent urban areas, together with altered fire regimes, are facilitating the invasion of rainforest species into koala habitat, which is likely to inhibit recruitment of eucalypt species (Smith and Smith 1990).

Clearly, native vegetation (such as koala habitat) needs to be protected from such edge effects. This can be achieved by retaining or replanting vegetation to function as a buffer, which acts to move the edge of the remnant, and hence detrimental edge effects, further out (Hobbs 1993). The scope for mitigation of the impact of edge effects through retention and restoration of adjacent vegetation is also recognised by Lovejoy *et al.* (1986), Laurance and Yensen (1991), Sisk and Margules (1993), Matlack (1993; 1994), Margules *et al.* (1995), Gascon *et al.* (1999), Laurance (1999) and Mesquita *et al.* (1999).

How wide will buffers need to be?

Determination of the buffer width required to protect Preferred Koala Habitat from adverse edge effects requires a consideration of the distance to which edge effects penetrate into a remnant (Hobbs 1993). However, it is widely recognised (Laurance and Yensen 1991; Hobbs 1993; Murcia 1995; Fox *et al.* 1997; Laurance 2000) that edge effects vary considerably in the distances of penetration, depending on such things as, the type of edge effect measured, the vegetation community being studied, the characteristics of the surrounding environment (e.g. pastures, crops, urban areas, or regrowth forest) and the age of the remnant edge (time since edge was created).

Examples of the distance to which edge effects have been reported to penetrate into remnants include:

- high levels of canopy damage up to 150m and detectable levels of disturbance up to 500m inside remnant tropical rainforest in NE Queensland (Laurance 1991);
- altered microclimatic variables up to 50m and changes in floristic composition up to 40m from the edge of temperate forest in the USA (Matlack 1993; 1994);
- changes in floristic composition up to 16m inside remnant temperate rainforest in NSW (Fox *et al.* 1997);
- higher proportions of exotic plant species and higher mean basal area of the native weed *Pittosporum undulatum* within 30m of suburban edges in dry sclerophyll forest and woodland on the Hornsby Plateau, NSW (Rose and Fairweather 1997; Rose 1997);

- increased phosphorous levels up to 20m into dry sclerophyll woodland in Western Australia (Scougall *et al.* 1993); and
- increased nest predation up to 600m inside a temperate forest in the USA (Wilcove *et al.* 1986).

The impacts of edge effects on remnant vegetation can also be exacerbated by incursions by livestock (Scougall *et al.* 1993; Fox *et al.* 1997).

In her seminal review of studies on edge effects, Murcia (1995) reported that most edge effects had disappeared over the first 50m into a remnant. A more recent review (Laurance 2000), concluded that most empirical studies of edge effects reported distances of penetration less than 150m. However, edge effects are also thought to occur over much larger scales, such as 1-5km (Janzen 1986; Skole and Tucker 1993). Several recent studies reviewed by Laurance (2000) were presented as support for edge effects penetrating up to 10km into remnants under some circumstances.

This great variation in the reported distance of penetration of edge effects, itself confounded by deficiencies in many studies (such as poor experimental design, lack of consistency in methodology and oversimplification of the perception of edges and edge effects), has meant that studies are generally only site-specific and has precluded the development of a universal theory on edge effects (Murcia 1995). Therefore, determination of an appropriate buffer width to effectively ameliorate edge effects on Preferred Koala Habitat in the Port Stephens LGA would require studies aimed at assessing the impact of different types of edge effects on vegetation communities in the area. Such studies would need to be well-designed, preferably long term, and would need to sample the range of edge effects, vegetation communities, ages since edge creation, orientation (aspect) of the edge, and type of land use in the surrounding environment in the LGA (Murcia 1995). While one study aimed at investigating the effects of habitat fragmentation on flora and invertebrate fauna following sand mining on the Tomago Sandbeds, which includes an examination of both abiotic and biological edge effects, is currently in progress (K. Ross, University of New South Wales, pers. comm.), there are no published studies of edge effects on vegetation communities in the Port Stephens LGA.

The type of research required to properly assess the buffer width required to protect Preferred Koala Habitat from edge effects is well beyond the scope (particularly time and resources) of most flora and fauna assessments prepared to accompany a development application. Hence, it is inappropriate to require flora and fauna consultants to separately assess the likely impact of edge effects of a given development and to specify a suitable minimum buffer width required to protect Preferred Koala Habitat. In lieu of this, it will be necessary to specify a minimum buffer width which must be applied to all patches of Preferred Koala Habitat.

Such an approach is supported by the concept of Ecologically Sustainable Development (ESD), which is enshrined in both Commonwealth and State legislation, and, in particular, that component of ESD known as the Precautionary Principle. As defined in the *Protection of the Environment Administration Act (NSW) 1991* (s. 6(2)), the Precautionary Principle states:

that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the context of specifying a minimum width of Habitat Buffer to protect Preferred Koala Habitat from detrimental edge effects, the Precautionary Principle would apply as follows. It is well established by the scientific literature that edge effects have a deleterious impact on a variety of species and ecological communities; hence, it is necessary to apply Habitat Buffers to protect Preferred Koala Habitat from such impacts. However, precise information on the distance of penetration of edge effects, particularly for the types of vegetation communities that occur in the Port Stephens LGA, is currently lacking. In the absence of well-designed, long-term studies to determine an appropriate buffer width for Preferred Koala Habitat in the Port Stephens LGA, together with the fact that such studies are well beyond the scope of works and resources of consultants conducting flora and fauna assessments, it is appropriate to specify a minimum buffer width to be applied in all instances.

There are several examples of the use of buffer areas in NSW legislation and environmental planning instruments. For instance, the Greater Metropolitan Regional Environmental Plan (REP) No. 2 – Georges River Catchment 1999 applies planning controls, including prohibitions on certain types of development, for buffer zones within 40m of the Georges River and its tributaries. This REP also specifies that where certain types of development adjoin such buffer zones, the retention or restoration of remnant vegetation within the adjacent buffer is required. State Environmental Planning Policy No. 26 – Littoral Rainforests incorporates the concept of a buffer applying to land within 100m of the outer edge of a mapped littoral rainforest. The Liverpool City Council Development Control Plan No. 8 – Natural Assets (1999) requires buffers of native vegetation of between 20m and 50m width adjacent to natural waterbodies and wetlands. Other environmental planning instruments which incorporate buffer areas include the Kiama Local Environmental Plan (LEP) 1996 and the Singleton LEP 1996.

Given that the most comprehensive review of edge effects to date (Murcia 1995) noted that most edge effects were reported to have disappeared within 50m of the remnant edge, it has been determined to apply this as the **minimum width of all Habitat Buffers on Preferred Koala Habitat in the Port Stephens LGA**. However, this buffer width should be reviewed in the future as further information on edge effects on remnant vegetation in the Port Stephens LGA becomes available.

A minimum buffer width of 50m is considered to have a reasonable likelihood of ameliorating many of the adverse edge effects likely to impact on koala habitat in the Port Stephens LGA. However, as noted by Murcia (1995), there is an urgent need for further studies on edge effects, as it may well be that much of the information to date underestimates the distance to which edge effects penetrate into remnant vegetation; a concern more recently supported by Laurance (2000).

Extension of Significant Koala Activity

The second objective of Buffers on Preferred Koala Habitat is to provide for the likely extension of significant koala activity. Here significant koala activity relates to terminology defined by Phillips and Callaghan (1995). Koala activity levels can be quantified by application of a standard faecal-pellet based survey methodology, such as the Spot Assessment Technique (Phillips and Callaghan 1995), and represents the overall proportion (percentage) of the trees surveyed in a spot assessment plot under which one or more faecal pellets were recorded within a one metre search catchment around the base of each tree. Phillips and Callaghan (1995) define an activity level of 30% as representing the critical level of significance and consider activity levels greater than or equal to 30% to be indicative of habitat utilised by members of a stable aggregation of koalas.

During the field survey component of the Draft Port Stephens Council CKPoM (Phillips *et al.* 2000), the Australian Koala Foundation conducted a number of transects leading out from patches of Preferred Koala Habitat to determine the extent to which significant koala activity extended beyond the boundary of Preferred Koala Habitat. The results of these surveys (AKF unpublished data) were used to determine appropriate buffer widths for the Draft Port Stephens Council CKPoM (1999).

Unlike the level of research required to determine the distance of penetration of specific edge effects, a suitable approach to determine the extent of significant koala activity at a specific site is far more achievable. Hence, it is considered appropriate for this to be undertaken by flora and fauna consultants on a case-by-case basis to help determine an appropriate buffer width for a specific proposed development, beyond the designated minimum width necessary to protect the habitat.

Ecological Criteria for the case-by-case assessment of the potential need to extend the Habitat Buffer width beyond the 50m minimum

The following process must be undertaken to determine the appropriate width for Habitat Buffers on Preferred Koala Habitat for any development application or rezoning request that applies to land either containing or immediately adjacent to Preferred Koala Habitat. For the purposes of these Ecological Criteria, there is a formal requirement to apply Habitat Buffers (including the 50m minimum buffer) **only** to those patches of Preferred Koala Habitat which:

- a) have an area of 0.5 hectares or greater; and
- b) contain vegetation which would be considered to be of a woodland, open forest or closed forest structural formation class (i.e. having greater than or equal to 10% projective foliage cover *sensu* Specht *et al.* 1974, or a crown separation ratio of less than or equal to 1 *sensu* Walker and Hopkins 1990).

1. A minimum buffer of 50m is to be applied to all patches of Preferred Koala Habitat to help protect against detrimental edge effects. The minimum buffers will apply in all cases, including instances where they overlap with predominantly cleared land ;
2. Faecal-pellet based surveys are to be undertaken **beyond** the minimum buffer of 50m to establish the full width of the Habitat Buffer. These surveys will take the form of transect-based surveys out from the edge of the 50m buffer. Each transect will be comprised of adjoining 20m x 20m quadrats, perpendicular to the buffer edge. Each quadrat should be assessed according to the methodology of Phillips and Callaghan (1995) to determine the koala activity level. These assessments must be undertaken by persons with appropriate qualifications and experience in koala survey.

The purpose of these assessments is to establish the extent of significant koala activity beyond the minimum 50m buffer. Assessments should be continued along each transect until activity levels less than 30% are recorded, or the 50m buffer boundary for adjacent Preferred Koala Habitat or an adjoining property of different land ownership is reached. For the purpose of identifying the point at which activity levels fall below 30%, a transect should not be discontinued at a quadrat that includes less than 10 trees, irrespective of the activity level.

Where a patch of Preferred Koala Habitat is surrounded by predominantly cleared land containing no trees or only scattered trees, no transects will be required and only the minimum 50m buffer will apply.

There are two options available to determine the appropriate additional habitat buffer for a given patch of Preferred Koala Habitat. Option a) relies on the determination of an average additional buffer width which is to be applied consistently around an entire patch of Preferred Koala Habitat. Option b) allows for the differential application of additional activity buffers around a given patch of Preferred Koala Habitat, based on the differential use of adjoining vegetation associations. The details of each of these methods are provided below.

Option a

There is to be an absolute minimum of 2 transects per patch of Preferred Koala Habitat, and at least one transect for each vegetation association adjoining the outer edge of the compulsory minimum 50m Habitat Buffer (i.e. the starting point of the transects). Therefore, a patch of Preferred Koala Habitat with one vegetation association adjoining the outer edge of the compulsory minimum 50m Habitat Buffer within the study area would require at least two transects; a patch with two adjoining vegetation associations would require at least two transects, one in each association; a patch with three adjoining associations would require at least three transects; a patch with four adjoining associations would require at least four; and so on. Transects should be spaced in such a way to ensure that adjacent transects are at no point closer than 50m apart. Where possible, transects should also be orientated in the direction of the nearest known patches of Preferred Koala Habitat. Consultants are also encouraged to undertake a greater number of transects than the minimum specified where it is considered appropriate.

The additional buffer width (to be added to the minimum 50m) shall be determined as the mean distance of extension of significant koala activity from each patch of Preferred Koala Habitat. For instance, if, for a given patch, significant koala activity is recorded from only the first 20m x 20m quadrat in one transect and from the first two 20m x 20m quadrats in the second transect, the extension of significant koala activity will be considered to be 20m for one transect and 40m for the other. Therefore, the additional buffer width with respect to that patch of Preferred Koala Habitat would be 30m. In this instance, the total buffer width for the patch of Preferred Koala Habitat would be 80m, comprised of the 50m minimum buffer to protect from edge effects, plus the additional 30m to capture the extension of significant koala activity.

Option b

This option, in addition to being consistent with the methods described above, will require an absolute minimum of 4 transects per patch of Preferred Koala Habitat and at least 2 transects per adjoining vegetation association. The extent of the additional buffer will be determined based on the average distance of extension of significant koala activity in each adjoining vegetation association (as calculated by means similar to that described for a whole patch in Option a) and should be applied consistently within each adjoining vegetation association.

All results from these assessments are to be presented in a report to accompany the development application or rezoning request.

References

Fox, B.J., Taylor, J.E., Fox, M.D. and Williams, C. (1997) Vegetation changes across edges of rainforest remnants. *Biological Conservation* **82**: 1-13

Gascon, C., Lovejoy, T.E., Bierregaard jr, R.O., Malcolm, J.R., Stouffer, P.C., Vasconcelos, H.L., Laurance, W.F., Zimmerman, B., Tocher, M. and Borges, S. (1999) Matrix habitat and species richness in tropical forest remnants. *Biological Conservation* **91**: 223-229

- Hobbs, R.J. (1993) Can revegetation assist in the conservation of biodiversity in agricultural areas? *Pacific Conservation Biology* **1**: 29-38
- Janzen, D.H. (1986) The eternal external threat. Pp 286-303 in *Conservation Biology: The Science of Scarcity and Diversity*. (M.E. Soulé ed.) Sinauer Associates, Massachusetts.
- Knott, T. Lunney, D., Coburn, D. and Callaghan, J. (1998) An ecological history of Koala habitat in Port Stephens Shire and the Lower Hunter on the Central Coast of New South Wales, 1801-1998. *Pacific Conservation Biology* **4**: 354-68
- Laurance, W.F. (1991) Edge effects in tropical forest fragments: application of a model for the design of nature reserves. *Biological Conservation* **57**: 205-219
- Laurance, W.F. (1999) Introduction and synthesis. *Biological Conservation* **91**: 101-107
- Laurance, W.F. (2000) Do edge effects occur over large spatial scales? *Trends in Ecology and Evolution* **15**: 134-135
- Laurance, W.F. and Yensen, E. (1991) Predicting the impacts of edge effects in fragmented habitats. *Biological Conservation* **55**: 77-92
- Lovejoy, T.E., Bierregaard jr, R.O., Rylands, A.B., Malcolm, J.R., Quintela, C.E., Harper, L.H., Brown jr, K.S., Powell, A.H., Powell, G.V.N., Schubart, H.O.R. and Hays, M.B. (1986) Edge and other effects of isolation on Amazon Forest fragments. Pp 257-285 in *Conservation Biology: The Science of Scarcity and Diversity*. (M.E. Soulé ed.) Sinauer Associates, Massachusetts.
- Margules, C.R., Davies, K.F., Meyers, J.A. and Milkovits, G.A. (1995) The responses of some selected arthropods and the frog *Crinia signifera* to habitat fragmentation. Pp 94-103 in *Conserving Biodiversity: Threats and Solutions*. R.A. Bradstock, T.D. Auld, D.A. Keith, R.T. Kingsford, D. Lunney and D.P. Sivertsen (eds.). Surrey Beatty and Sons, Chipping Norton.
- Matlack, G.R. (1993) Microenvironment variation within and among forest edge sites in the eastern United States. *Biological Conservation* **66**: 185-194
- Matlack, G.R. (1994) Vegetation dynamics of the forest edge – trends in space and successional time. *Journal of Ecology* **82**: 113-123.
- May, S. (1997) The Threat of Feral Predators to Native Forest Fauna-Implications for Forest Management (Forest Issue 3). NSW National Parks and Wildlife Service, Hurstville.
- Mesquita, R.C.G., Delamonica, P. and Laurance, W.F. (1999) Effects of surrounding vegetation on edge-related tree mortality in Amazonian forest fragments. *Biological Conservation* **91**: 129-134
- Murcia, C. (1995) Edge effects in fragmented forests: implications for conservation. *Trends in Ecology and Evolution* **10**: 58-62
- Phillips, S. and Callaghan, J. (1995) *The Spot Assessment Technique for Determining the Significance of Habitat Utilisation by Koalas*. pp 66-70 In Proceedings of a Conference on the Status of the Koala in 1995. Australian Koala Foundation, Brisbane.

- Phillips, S., Callaghan, J. and Thompson, V. (2000). The tree species preferences of koalas (*Phascolarctos cinereus*) inhabiting forest and woodland communities on Quaternary deposits in the Port Stephens area, New South Wales. *Wildlife Research* **27**: 1-10
- Rose, S. (1997) Influence of suburban edges on invasion of *Pittosporum undulatum* into the bushland of northern Sydney, Australia. *Australian Journal of Ecology* **22**: 89-99
- Rose, S. and Fairweather, P.G. (1997) Changes in floristic composition of urban bushland invaded by *Pittosporum undulatum* in northern Sydney, Australia. *Australian Journal of Botany* **45**: 123-149.
- Saunders, D.A., Hobbs, R.J. and Margules, C.R. (1991) Biological consequences of ecosystem fragmentation: a review. *Conservation Biology* **5**: 18-32
- Scougall, S.A., Majer, J.D. and Hobbs, R.J. (1993) Edge effects in grazed and ungrazed Western Australian wheatbelt remnants in relation to ecosystem reconstruction. Pp. 57-69 in *Nature Conservation 3: Reconstruction of Fragmented Ecosystems, Global and Regional Perspectives* ed. by D.A. Saunders, R.J. Hobbs and P.R. Ehrlich. Surrey Beatty and Sons, Chipping Norton.
- Sisk, T.D. and Margules, C.R. (1993) Habitat edges and restoration: methods for quantifying edge effects and predicting the results of restoration efforts. Pp 57-69 in *Nature Conservation 3: Reconstruction of Fragmented Ecosystems, Global and Regional Perspectives* ed. by D.A. Saunders, R.J. Hobbs and P.R. Ehrlich. Surrey Beatty and Sons, Chipping Norton.
- Skole, D. and Tucker, C. (1993) Tropical deforestation and habitat fragmentation in the Amazon: satellite data from 1978 to 1988. *Science* **260**: 1905-1910
- Smith, P. and Smith, J. (1990) Decline of the urban Koala (*Phascolarctos cinereus*) population in Warringah Shire, Sydney. *Australian Zoologist* **26**: 109-129
- Specht, R.L., Roe, E.M. and Boughton, V.H. (1974). Conservation of major plant communities in Australia and Papua New Guinea. *Australian Journal of Botany*. Supplementary Series No. 7.
- Walker J. and Hopkins, M.S. (1990) Vegetation. In *Australian soil and land survey field handbook*. Second edition (McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S.). Inkata Press, Melbourne.
- Wilcove, D.S., McLellan, C.H. and Dobson, A.P. (1986) Habitat fragmentation in the temperate zone. Pp 237-256 in *Conservation Biology: The Science of Scarcity and Diversity*. (M.E. Soulé ed.) Sinauer Associates, Massachusetts.

Appendix 10

Fire Management Principles for the Conservation of Koalas and Koala Habitat

This appendix outlines a series of fire management principles that should be employed by agencies and landholders when undertaking bushfire management in or adjacent to Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Buffers and Habitat Linking Areas. These principles are based on the discussion in Chapter 11 Bushfires of the CKPoM Resource Document. It should be noted that bushfire management must take into account not only the imperative to conserve threatened species, such as koalas, and their habitat, but also the need to protect human life and property.

High intensity fires

High intensity (or 'hot') fires, particularly those which affect the tree canopy, are likely to kill or injure koalas and cause short-term damage to their habitat. The effects of such fires are exacerbated when koala habitat is fragmented, which inhibits potential re-colonisation of burnt and regenerating habitat by koalas from adjacent areas.

Principle: *Fire management strategies should aim to minimise the likelihood of high intensity fires, such as canopy fires, occurring within koala habitat.*

High frequency fires

High frequency wild fires and recurrent hazard reduction burns may cause long-term changes to koala habitat by inhibiting the recruitment of preferred koala food trees and other essential habitat trees. High frequency fires are widely understood to adversely affect many plant and animal communities and are likely to similarly affect those associated with koala habitat. The detrimental impact of high frequency fires, including recurrent hazard reduction burns, is acknowledged and should be avoided. However, the need for effective fuel management practices including hazard reduction burns where necessary to minimise the likelihood of high intensity fires, is also recognised and supported. The optimal balance should be sought between these two potentially contradictory factors.

Principle: *While hazard reduction burns are a necessary component of many bushfire management strategies, wherever possible they should be carried out at intervals which avoid high frequency burns within koala habitat. The relevant scientific literature should be consulted to help determine appropriate intervals between hazard reduction burns.*

Research

There is a pressing need for further research to examine the responses of koala habitat and associated plant and animal communities to different fire regimes, including regimes of high frequency fires, such as recurrent hazard reduction burns. Such research should aim to determine the range of fire regimes suitable to satisfy the multiple objectives of conserving koalas, koala habitat and associated plant and animal communities, while protecting human life and property. Research should also be carried out on possible alternatives to hazard reduction burns. The findings of future research should be incorporated into revisions of this CKPoM and the Port Stephens Bushfire Risk Management Plan.

Principle: *The findings of future research on the responses of koala habitat and associated plant and animal communities to different fire regimes should be used to refine these fire management principles and other relevant plans.*