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Our Ref: 25331:MD

25 November 2008

POSTFOX PTY LTD
C/ DEWITT CONSULTING
PO BOX 850
CHARLESTOWN NSW 2290

ATTENTION: DAVID HUMPHRIS

Dear Sir,

**RE: ECOLOGICAL ASSESSMENT PROPOSED SUBDIVISION
MORISSET PARK ROAD, MORISSET PARK**

This letter has been prepared in relation to the ecological assessment previously carried out on land at Lot 9 DP 244002 and Lot 358 DP 755242, Morisset Park Road, Morisset Park

The concept plan upon which the ecological assessment of significance was undertaken has been revised due to advice received from the determining authorities and ongoing negotiations. To this end, the retention of vegetation within the western portion will now result.

Based on the information contained within the previous assessment coupled with the revised concept plan it is considered that any ecological constraints and direct or indirect impacts associated with the proposal will not be exacerbated. As such the results and recommendations contained within the initial ecological assessment are equally applicable and thus concurrent under the new concept plan.

If you have any further queries regarding the above please do not hesitate to contact the writer.

HARPER SOMERS O'SULLIVAN PTY LTD


Matthew Doherty
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Ecological Assessment Report

At
Lot 9 DP 244002 and
Lot 358 DP 755242
Morisset Park Road,
Morisset Park NSW

Prepared for
Postfox Pty Ltd
C/- De Witt Consulting
PO Box 850
Charlestown NSW 2290

Job Reference 25331 - August 2008



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<i>PROJECT: ECOLOGICAL ASSESSMENT REPORT – LOT 9 DP 244002 AND LOT 358 DP 755242 MORISSET PARK ROAD, MORISSET PARK</i>	
<i>CLIENT:</i>	<i>POSTFOX PTY LTD C/- DE WITT CONSULTING</i>
<i>OUR REFERENCE:</i>	<i>25331</i>
<i>DATE:</i>	<i>AUGUST 2008</i>
<i>APPROVED BY:</i>	<i>JOHN WHYTE</i>
<i>SIGNATURE:</i>	<i>PER</i> 
<i>CHECKED BY:</i>	<i>SAM BISHOP</i>
<i>SIGNATURE:</i>	

EXECUTIVE SUMMARY

Introduction

RPS Harper Somers O'Sullivan Pty Ltd (RPS HSO) has been commissioned by *Postfox Pty Ltd c/- Dewitt Consulting* to undertake an *Ecological Assessment Report* (EAR) over Lot 9 DP 244002 & Lot 358 DP 755242 Chifley Rd and Morisset Park Rd, Morisset Park, NSW for a proposed 72 Lot Residential Subdivision. The proposal is to be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. Due recognition and consideration of the *Threatened Species Conservation Act 1995*, *Environmental Protection and Biodiversity Conservation Act 1999*, *Fisheries Management Act 1994* has been made throughout this assessment. Assessment of the site under the requirements of State Environmental Planning Policy No. 44 (SEPP 44) – 'Koala Habitat Protection' is included. Director General's Environmental Assessment Requirements (DGEAR's) were issued for the site in June 2008.

This report includes the results of two ecological investigations undertaken within the above mentioned lands, and incorporates the results of both studies. RPS HSO staff carried out these ecological studies in May 2003 and December 2007.

This study is intended to investigate the potential ecological impacts of the proposal as required by the Part 3A DGEAR's. The primary impacts are likely to be associated with the removal of vegetation both in terms of direct impacts upon native stands of vegetation and to a lesser extent, upon habitat for native fauna within and directly adjacent to the site.

Methods

The DGEAR's stipulates that assessment should have due regard to DECC's Threatened Species Assessment Guidelines. These guidelines refer the user to consult the Threatened Biodiversity Survey and Assessment Guidelines – Working Draft (DEC 2004) and any relevant recovery plans and threat abatement plans for ecological assessment. To this end these documents have formed the core basis for ecological assessment over the site. In brief the methods employed to assess the ecological merit of the site involved the following.

- Literature Review
- Preliminary (Desktop) Assessments
- Field Investigations
 - Flora Assessment
 - Plant Identification and Vegetation Mapping
 - Floristic Structure Information
 - Targeted and Significant Flora Surveys
- Fauna Assessment
- Habitat Assessment & Mapping

Results

Flora

Four vegetation assemblages have been delineated on the site, namely Open Eucalypt Forest, Modified Open Eucalypt Forest, Exotic Plantations and Grassland with Scattered Trees. The Open Eucalypt Forest was the most naturally occurring vegetation community and occupied the western portion of the site. The Modified Open Eucalypt assemblage was distributed throughout the eastern and southern sections of the site and exhibited a high level of disturbance associated with past clearing and the establishment of exotic grasses and herbaceous species within the shrub and ground layers. The Grassland with Scattered Trees assemblage dominates the site and constitutes those areas that have been cleared in the past. These areas were predominantly composed of exotic pasture grass species. The Exotic Plantation assemblage occurred as a small strip along the southern section of the site. This community was dominated by plantings of *Pinus elliotii* (Slash Pine).

No threatened flora species were detected within the site despite targeted searches. Four threatened plant species including; Rough Double Tail (*Diurus praecox*), Leafless Tongue Orchid (*Cryptostylis hunteriana*), Tessellated Spider Orchid (*Caladenia tessellata*) and Black-eyed Susan (*Tetracheca juncea*) were assessed as having moderate likelihood of occurrence within the site, specifically within the Open Eucalyptus Forest in the western portion. This was based on characteristics of habitat and on the presence of indicator species, being several non-threatened orchid species. The assessment concluded that whilst there is some potential for their occurrence, habitat lost on this scale through the proposed development would be incrementally small.

One species of flora listed as a species of local conservation significance (Forest Fauna Surveys *et al* 2001) was recorded on site, being *Bossiaea stephensonii*. This species is listed in Appendix 3 of the LMCC Flora and Fauna Survey Guidelines as “Uncommon in the north of the region, not reserved.” The site is not near the north of the region and appears to be locally common in the area (HSO Ecologists pers. obs). Less than 5 plants were observed within the site. These specimens occurred within the Open Eucalypt Forest in the western section of the site. Due to the small number of plants to be removed and the occurrence of larger areas of habitat in the vicinity, it is not believed that the proposal would have a significantly deleterious effect on the regional status of the species.

Habitat

The site contains numerous Eucalypt species which provide suitable habitat for a suite of native fauna. These Eucalypt species provide foraging opportunities for nectivorous, herbivorous and insectivorous species for a range of avifauna and arboreal mammals, especially during flowering periods. Some of these trees also exhibited hollows, ranging from small to large in size, which could be used as a nesting or roosting resource for hollow-dependant birds or mammals.

The Open Eucalypt Forest assemblages provide potential habitat for terrestrial mammals. The ground of the forest floor was found to contain a thick leaf litter layer and fallen logs, giving scope for small reptiles.

The Modified Eucalypt Open Forest provides limited habitat for terrestrial species, leaf litter was sparse to absent and logs were scarce. Avifauna and arboreal mammals are likely to utilise this habitat for nesting and foraging.

The Grassland with Scattered Trees community offers little opportunity for native fauna and would suit only those species tolerant of open spaces. Past and present land-uses including; clearing, underscrubbing, residential dwellings, grazing and proximity to nearby human settlement, all contribute to this lowered ecological value.

The Exotic Plantation, which was dominated by Slash Pines, provides a limited foraging resource for Arboreal and Terrestrial species.

Fauna

The fauna species recorded throughout the site during these investigations are considered typical of the habitats present on the site and within the local area. Species recorded were predominantly restricted to common avifauna and arboreal mammals.

Two threatened fauna species of bat were recorded within the site; Eastern Freetail-bat (*Mormopterus norfolkensis*) and Large Bentwing-bat (*Miniopterus schreibersii*). Both of these species have generalist hunting habitat requirements, utilising a variety of treed habitats. Hunting habitat will be retained under any proposal design and similar habitat occurs in abundance both locally and on a regional scale.

One threatened bird species, Glossy Black Cockatoo (*Calyptorhynchus lathamii*) was recorded within the site. Suitable nesting hollows within Eucalypt trees occur within the site, and the presence of a known feed tree *Allocasuarina littoralis* for this bird highlights a degree of significance of the site for this species.

IMPACTS ON THREATENED FLORA AND FAUNA

The proposal is likely to result in the loss of foraging and nesting habitat for both Glossy Black-Cockatoo (*C. lathamii*) and Squirrel Glider (*P. norfolcensis*). In addition, the proposed development is likely to cause the removal of habitat for threatened bats including; Eastern Freetail-bat (*M. norfolkensis*) and Large Bentwing-bat (*M. schreibersii*).

The potential occurrence of suitable habitat within the site, is likely to result in the loss of habitat for four threatened plant species including; Rough Double Tail (*D. praecox*), Leafless Tongue Orchid (*C. hunteriana*), Tessellated Spider Orchid (*C. tessellata*) and Black-eyed Susan (*T. juncea*). However whilst the removal of this woodland habitat represents a small cumulative loss of potential habitat for the abovementioned threatened species, the site is relatively small on local and regional scales. Therefore it can be considered that the proposed development is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

With regards to the threatened bat species recorded on site, *M. schreibersii* roosts in caves, culverts and similar structures, of which none occur on the site. *M. norfolkensis* roosts predominantly in tree hollows. As such, it is recommended that as many hollow-bearing trees are to be retained where possible within any project design. This should ensure that roosting habitat is maintained for this species on the site. Should any hollow-bearing trees be required to be removed (such as for safety reasons), then it is recommended that a qualified ecologist / consultant be present during tree-felling to recover any potentially displaced animals. Artificial nest-boxes or relocated hollows that have been removed could also be employed to potentially offset the impact of removing any hollow-bearing trees.

SEPP 44 - 'Koala Habitat Protection'

Two species of tree listed in Schedule 2 of the above policy as a 'Koala Feed Tree Species' were found to occur on site, namely *Eucalyptus haemastoma* (Scribbly Gum) and *Eucalyptus racemosa* (Snappy Gum).

E. racemosa occurred as a dominant canopy species within the Open Eucalypt Forest and the Modified Open Eucalypt Forest. Within these assemblages the numbers of this species occurred at a density greater than 15% of the total tree canopy and consequently these parts of the site are considered to constitute 'Potential Koala Habitat' as defined within the SEPP.

Further investigations within areas deemed to constitute 'Potential Koala Habitat' however, revealed no indications of use of these areas by Koalas, as evidenced by either scratches, scats or actual individuals, and hence these areas do not constitute 'Core Koala Habitat'.

EPBC Act 1999

No flora or fauna species listed within the *EP&BC Act 1999* are believed to be present upon the site. Any potentially occurring nationally threatened species have been addressed under State legislation. It is considered that no significant impacts are likely.

Key Thresholds Assessment (Part 3A)

As required by the Draft *Guidelines for Threatened Species Assessment* for Part 3A applications (DEC / DPI 2005), the following assessment of Key Thresholds (four in total) is provided for the proposed development estate upon the site.

Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.

It is considered that the information presented within this document, in particular the recommendations below will avoid or mitigate the impacts upon biodiversity as a result of the proposed development.

Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.

The threatened species, populations and ecological communities considered within the report occurring within the proposed development estate are well represented in the wider locality, and are also represented or have potential habitat within adjacent surrounding lands and therefore it is considered unlikely that the proposal will reduce the long-term viability of a local population of any threatened species or endangered ecological community.

Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.

The threatened species, populations and ecological communities considered within the report occurring within the proposed development estate are well represented in

the wider locality, and are also represented or have potential habitat within adjacent surrounding lands and therefore it is considered unlikely that the proposal will place any threatened species, endangered populations or endangered ecological communities at risk of extinction.

Whether or not the proposal will adversely affect critical habitat.

There is no declared “Critical Habitat” within the site locality, and as such the proposal will not adversely affect any such habitat.

RECOMMENDATIONS

The following recommendations have been outlined to ensure that the ecological impact of the proposed development estate is minimised as far as possible.

Mature trees, particularly those containing hollows should be retained wherever they can be safely retained with regard to public safety. Retention of hollow-bearing trees should be exercised within development areas primarily for the benefit of *M. norfolkensis*, *C. lathamii* and *P. norfolkensis*. This recommendation should also benefit native species in general. The importance of this recommendation should be outlined to future landowners.

Any future landscaping should aim to utilise locally occurring flowering / fruiting native shrubs that would provide potential foraging resources for threatened species and other native species.

Pre-clearing inspections should be undertaken by an ecologist in wooded areas where threatened fauna species have been recorded or are considered likely to occur. This is particularly important in areas where threatened fauna have been noted during recent surveys either breeding or nest-building. No breeding attempts should be disrupted during the course of the project, particularly those undertaken by threatened fauna.

During the construction phase any tree removal within the development area, and in particular where hollow-bearing trees may be removed, all works should be supervised by an ecologist to recover any native fauna that are potentially displaced. Furthermore, where such risks occur, site-specific ecological advice should be sought to minimise impacts during the entire process. A clearing protocol should be adopted for the removal of trees containing suitable habitat hollows as follows (this is considered as a guideline, variations on the methods employed may be required to accommodate site specific factors).

- All hollow bearing trees are to be flagged by an ecologist prior to the commencement of works on site,
- Underscrubbing of the entire site should be carried out by a 4x4 tractor with a slashing deck, this will minimise the establishment of degradation processes and leave a layer of mulch to aid in soil retention in the event of adverse weather. At this time felling of non habitat trees can take place, however a matrix of trees *must* be maintained to allow animal movement into the designated refuge area,
- After a period of one week, clearing of habitat trees should commence. Clearing must be carried out moving from the fringe of the matrix towards the refuge area. Trees should be ‘soft felled’ and inspected immediately by an

ecologist for displaced fauna. All trees must be left for a minimum of two nights prior to being moved to a stockpile, to allow resident fauna to vacate tree hollows,

Note: Clearing should ideally take place outside of the dominant breeding seasons of resident fauna, preferably during late Autumn and Winter.

- Species selection for future landscaping works and seed stock for revegetation should be limited to locally occurring native species to maintain local genetic diversity,
- Appropriate vegetation, habitat and bushfire management plans should be included under an overarching Environmental Management Plan, and
- Where possible, earthworks (and certainly all works in the vicinity of drainage lines) should be undertaken during appropriate (i.e. dry) weather conditions. This will ensure that any potential erosion events will be intercepted and that downstream impacts are minimised within any of the drainage lines. This will help to maintain existing habitat characteristics for native fauna in those areas, including those for threatened species.

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1 INTRODUCTION

RPS Harper Somers O'Sullivan Pty Ltd (RPS HSO) has been commissioned by *Postfox Pty Ltd C/- Dewitt Consulting* to undertake an *Ecological Assessment Report* (EAR) over Lot 9 DP 244002 & Lot 358 DP 755242 Chifley Road and Morisset Park Road, Morisset Park, for a proposed 72 Lot Residential Subdivision. The proposal is to be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. Due recognition and consideration of the *Threatened Species Conservation Act 1995*, *Environmental Protection and Biodiversity Conservation Act 1999*, *Fisheries Management Act 1994* has been made throughout this assessment. Assessment of the site under the requirements of State Environmental Planning Policy No. 44 (SEPP 44) – 'Koala Habitat Protection' is included. Director General's Environmental Assessment Requirements (DGEAR's) were issued for the site in June 2008.

This report includes the results of two ecological investigations undertaken within the above mentioned lands, and incorporated the results of both studies. RPS HSO staff carried out these ecological studies in May 2003 and December 2007.

Due recognition of the Lake Macquarie City Council Flora and Fauna Survey Guidelines (Forest Fauna Surveys Pty. Ltd. & East Coast Flora Surveys, 2001) have been adapted in this survey and assessment process.

1.1 Site Particulars

Locality – Corner of Chifley and Morisset Park Roads, Morisset Park, NSW.

LGA – Lake Macquarie.

Title(s) – Lot 9 DP 244002 and Lot 358 DP755242

Area – 6.4 hectares

Current Zoning – 2 (1) Residential.

Boundaries – The site is bounded to the south by Morisset Park Road, to the east by Chifley Road, to the west by vacant land and to the north by existing residential lots along Frederick Street, Morisset Park.

Current Land Use – One intermittently occupied house on lot 358 and one vacant house on Lot 9.

Topography –The site slopes gently to the north and north-east towards Freshwater Creek which adjoins Lake Petite and eventually drains into Lake Macquarie. The highest point on the site is in the south-western corner, at 25m AHD.

Vegetation – Dominated by cleared areas consisting of pasture and smaller areas of modified Eucalypt Open Forest complexes and exotic plantations.

WARNING

No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.

LEGEND

 Site Boundary



TITLE:
Figure 1-1
Site Location Map

CLIENT:
Postfox Pty Ltd



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SCALE: 1: 5000 at A4 Size DRAWN: J. Whyte APPROVED: S. Bishop

DATUM: MGA Zone 56 (GD94) DATE: 28/8/2008

LAYOUT REF: J:\JOBS\25K\25331 Morisset Park\Draft ... 331

Figure1-1 Site Location_A A4.270808.wor CONTOUR INTERVAL: N/A

JOB REF: 25331

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1.2 Description of the Proposal

The proposal is for a seventy-two (72) Lot residential subdivision application see Appendix E for details.

A Bushfire Threat Assessment (BTA) has been prepared for the site to accompany the residential subdivision development application over land at Lot 9 DP 244002 & Lot 358 DP 755242, corner of Morisset Park Road and Chifley Road, Morisset Park.

The main recommendations of this report include;

- An APZ of 20m between the Forest to the south of the site and any proposed dwelling within the site.
- An APZ of 20m between the Forest to the west of the site and any proposed dwelling within the site.
- The internal road network be constructed to standards outlined in Section 7 of this report.
- Any future dwelling within the site should have due regard to the specific considerations given in the BCA, which makes specific reference to the Australian Standard (AS3959 – 1999) construction of buildings in bushfire prone areas. Refer to Section 8 of this report.
- Any proposed development be linked to the existing mains pressure water supply and that suitable hydrants be clearly marked and provided for the purposes of bushfire protection.
- The responsibility of the maintenance of the proposed APZs is to become the responsibility of the individual lot owner with the exception of the fire-trail that will be the responsibility of the managing body.

1.3 Scope of the Study

This study is intended to investigate the potential ecological impacts of the proposal as required by the Part 3A DGEAR's. The primary impacts are likely to be associated with the removal of vegetation both in terms of direct impacts upon native stands of vegetation and to a lesser extent, upon habitat for native fauna within and directly adjacent to the site.

To ensure completeness, ecological fieldwork and assessment has covered the full extent of the site. These DGEAR's state the 'General' and 'Key' Assessment requirements for investigations are:

General Requirements

The Environmental Assessment (EA) must include:

1. an executive summary;
 - a) a detailed description of the project including the:
 - b) strategic justification for the project;
 - c) alternatives considered;
 - d) various components and stages of the project in detail (and should include infrastructure staging); and
 - e) map indicating the footprint of the proposed work;
2. a thorough site analysis and description of the existing environment;
3. justification of the project, taking into consideration the environmental impacts of the proposal, the suitability of the site and whether or not the project is in the public interest;
4. a consideration of any relevant statutory and non-statutory provisions and identification of any non-compliance with such provisions arising from environmental planning instruments, Regional strategies (including draft Regional Strategies) and Development Control Plans.
5. Consideration of the consistency of the project with the objects of the *Environmental Planning and Assessment Act 1979*.
6. Consideration of impacts, if any, on matters of National Environmental Significance under the Commonwealth Environmental Protection & Biodiversity Conservation Act 1999;
7. An Assessment of the potential impacts of the projects and a draft statement of commitments, outlining environmental management, mitigation and monitoring measures to be implemented to minimise any potential impacts of the project;
8. The Plans and documents outlined in Attachment 2;
9. A signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false or misleading;

10. A Quantity Surveyor's Certificate of Cost to verify the capital investment value of the project; and
11. An assessment of the key issues specified below and table outlining how these issues have been addressed.

Key Issues Flora and Fauna

1. Outline potential impacts on aquatic and terrestrial flora and fauna and their habitats (within the meaning of the *Threatened Species Conservation Act 1995* and the *Fisheries Management Act 1994*). Provide measures for their conservation, where relevant.
2. Outline measures for the conservation of existing wildlife corridor values and/or connective importance of any vegetation on the subject land.
3. Address measures to protect and manage the riparian corridor and adjacent aquatic habitats.

1.4 Definitions

The definitions given below are relevant to the Director-General's requirements:

'development' has the same meaning as in the NSW *Environmental Planning and Assessment Act 1979*.

'activity' has the same meaning as in the NSW *Environmental Planning and Assessment Act 1979*.

'proposal' is the development, activity or action proposed. Other terminology used for the 'proposal' includes the **'current proposal'** or **'development proposal'**.

The **'Site'** refers to the entire land holding, inclusive of development and conservation areas.

The **'Development Estate'** refers to the area(s) scheduled for development.

All other definitions are the same as those contained in the NSW *TSC Act*.

1.5 Qualifications and Licensing

1.5.1 Qualifications

The principal author of this report was John Whyte B.Bio.Sc (Botany & Zoology) of RPS Harper Somers O'Sullivan Pty Ltd, with additional input from Matthew Doherty BLMC, Toby Lambert B.Env, Craig Anderson B.App.Sc (EAM) and Sam Bishop B.Env.Sc. The academic qualifications and professional experience of all RPS HSO ecologists involved in the project are documented in Appendix F.

1.5.2 Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence S10300 (Valid 30 November 2008);
- Animal Research Authority (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2009);
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2010); and
- Certificate of Accreditation of a Corporation as an Animal Research Establishment (Trim File No: 01/1522 & Ref No: AW2001/014) issued by NSW Agriculture (Valid 26 May 2009).

1.6 Certification

As the principal author, I, John Whyte make the following certification:

The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the site.

All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995*, *National Parks and Wildlife Act 1974* and the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes*.

Signature of Principal Author and Certifier:

John Whyte
Ecologist
RPS Harper Somers O'Sullivan

August 2008

2 METHODS

2.1 DGEAR's

The DGEAR's stipulates that assessment should have due regard to DECC's Threatened Species Assessment Guidelines. These guidelines refer the user to consult the *Threatened Biodiversity Survey and Assessment Guidelines – Working Draft* (DEC 2004) and any relevant recovery plans and threat abatement plans for ecological assessment. To this end these documents have formed the core basis for ecological assessment over the site.

For the purposes of continuity and to best represent a holistic survey approach, the guidelines considered as part of the combined survey design and efforts are as follows:

- *The Flora and Fauna Survey Guidelines, Lower Hunter Central Coast Region* (Murray et al 2002);
- *The Flora and Fauna Survey Guidelines of the Lake Macquarie Local Government Area* (July 2001); and
- *Wyong Ground Orchid Survey* Wyong Shire (Gunninah Environmental Consultants, 2003).

A variety of field survey techniques were employed over the course of fieldwork for the assessments to record the full suite of flora species and fauna guilds across the study area. Commonwealth, State and Local Government policies and guidelines underpin the project survey methodology.

Whilst survey work has been undertaken wholly within the bounds of the study area, consideration has been afforded to offsite areas in order to appreciate the environmental context of the locality.

This report includes the results of two ecological investigations undertaken within the sites by RPS HSO ecologists, and incorporates the results of both studies these include:

- Harper Somers O'Sullivan (2007) *Flora and Fauna Assessment Over Land for Proposed Subdivision at Lot 9 DP 244002 and Lot 358 DP 755242 Morisset Park Road, Morisset Park*; and
- HSO (2003) *Flora and Fauna Assessment over Land for Proposed Subdivision at Lot 9 DP 244002 and Portion of Lot 358 DP 755242 Chiefly Road & Morisset Park Road, Morisset Park*.

2.2 Flora Survey

2.2.1 Vegetation Mapping

The following methods were considered:

- Aerial Photograph Interpretation (API) to map the community(s) extent into definable map units,
- Review of previous mapping of the area by *Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS)* (House 2003, NPWS 2000),
- Confirmation of the community type(s) present (dominant species) via undertaking flora reconnaissance identification,
- Map the type and general extent of the community(s) present into definable map units where appropriate, and
- Consideration was given to the potential for the derived vegetation communities to constitute 'Endangered Ecological Communities' as listed within the *TSC Act 1995* and the *EPBC Act 1999*.

2.2.2 General Flora Survey

Flora surveys were carried out across the site on May 5th 2003, December 12th 2007 and the 12th of August 2008 with an emphasis on potentially significant species, as outlined below in section 2.8.3. The flora survey also included the formal consideration of vegetation quadrats within each of the distinctive vegetation assemblages, as well as the casual consideration of the sites in line with methodology such as the "Random Meander Technique" described by Cropper (1993).

The flora survey involved a combination of both formal and informal methodologies to understand the following;

- Vegetation communities within the site;
- Identify community boundaries;
- Record the flora species present; and
- Determine the potential distribution of threatened species.

All species recorded were identified as far as practicable to a species and subspecies (where relevant) level.

Vegetation structure was determined based on Specht *et al.*, (1995) by estimation of the height and projected foliage cover (PFC) within each stratum present. Individual taxon data for each quadrat was recorded using the NPWS species data forms. Species abundances were recorded utilising a modified Braun-Blanquet (1982) cover abundance six ranking scale as follows:

Cover Code	Projected Canopy Cover
1	<5% and uncommon
2	<5% and common
3	6-20%
4	21-50%
5	51-75%
6	76-100%

Notes were made regarding species presence, plant community structure and dominant species, the proportion of exotic species present, impacts that could affect bushland viability and other features of the site that would influence vegetation.

A full list of flora species recorded on site is provided in Appendix B.

2.2.3 Significant Flora Survey

A list of potentially occurring significant flora species from the locality (10km radius) was compiled, which included, threatened species (Endangered or Vulnerable) and EEC listed under the *TSC Act (1995)*, those species listed on the *EPBC Act (1999)*, ROTAP listed flora species (Briggs and Leigh 1996), as well as any other species deemed to be of local importance.

Searches in areas of suitable habitat were made for species of local conservation significance, as listed in Appendix 3 of the *Lake Macquarie City Council Flora and Fauna Survey Guidelines (Forest Fauna Surveys et al 2001)*.

In addition, flora surveys were conducted targeting Black-eyed Susan (*Tetratheca juncea*) and Leafless Tongue Orchid (*Cryptostylis hunteriana*) during the December 2007 surveys.

Based on the environmental units and vegetation communities present, targeted searches were conducted for those species deemed as having potential habitat within the site. Targeted searches were undertaken throughout the site for these species and flora species which were recorded within a 10 km radius of the site during the survey period. Refer to Table 2-1.

Table 2-1: Threatened Flora Species Survey Techniques Analysis

Threatened Flora Species	TSC listed	EPBC listed	Habitats (But not confined to) Map units REMS	Targeted Survey Notes (LHCC Flora and Fauna Survey Guidelines 2002)	Flowering Period (Best time to Survey) in Months of the Year															
					J	F	M	A	M	J	J	A	S	O	N	D				
<i>Acacia bynoeana</i>	E	V	26, 30, 31, 48	Rm, Safr.																
<i>Angophora inopina</i>	V	V	15,30,31,40,42,43,48	Rm, Safr.																
<i>Caladenia tessellata</i>	V	V	34	Rm, Sfr. Recently burnt areas of note.																
<i>Callistemon linearifolius</i>	V	-	5, 15, 17, 42	Rm, Safr.																
<i>Cryptostylis hunteriana</i>	V	V	30, 31, 32,33	Rm or Rq, Sfr																
<i>Diuris praecox</i>	V	V	15, 30, 51	Rm, Sfr.																
<i>Eucalyptus camfieldii</i>	V	V	34	Rm, Sfr																
<i>Grevillea parviflora subsp. parviflora</i>	V	V	5, 15, 17, 30	Rm, Sa	Flowers all year															
<i>Melaleuca biconvexa</i>	V	V	6,15,	Rm,Sfr																

- *Cryptostylis hunteriana*
- *Diuris praecox*
- *Eucalyptus camfieldii*
- *Grevillea parviflora* subsp. *parviflora*
- *Melaleuca biconvexa*
- *Rhizanthella slateri*
- *Syzygium paniculatum*
- *Tetratheca juncea*

One species *Caladenia tessellata* (Tessellated Spider Orchid) has not been included within the above list as the surveys were conducted outside seasonal survey requirements for this species.

2.3 Fauna Survey

The fauna survey methodology initially adopted consisted of the production of an Expected Fauna Species List for the area (Appendix D) and an assessment of the potential use of the site by threatened fauna species (as listed under the *TSC Act 1995*) identified from the vicinity of the site. This was completed via literature and database searches with confirmation and supplementation of the Expected Fauna Species List by observation and survey in the area as described below.

2.3.1 Habitat Assessment

An assessment of the relative value of the habitat present on site was undertaken. This assessment focused primarily on the identification of specific habitat types and resources on the site favoured by known threatened species from the region. The assessment also considered the potential value of the site (and surrounds) for all major guilds of native flora and fauna.

The habitat assessment was based on the specific habitat requirements of each threatened fauna species regarding: home range, feeding, roosting, breeding, movement patterns and corridor requirements. Consideration was given to contributing factors including; topography, soil, light and hydrology for threatened flora and assemblages.

Hollow-bearing trees within the site were recorded using a hand-held Trimble Global Positioning System (GPS). The following attributes were also recorded:

- Entrance diameter of hollows;
- Tree species;
- Tree Diameter Breast Height (DBH); and
- Evidence of use (scratches, scats, nesting material, etc)

2.3.2 Terrestrial Mammal Trapping

Terrestrial mammal trapping was undertaken in May 2003 by RPS HSO Ecologists. Small and medium-sized mammals were targeted on the site via the use of Elliott Type 'A' traps (8x10x33cm) and Elliott Type 'B' traps (15x15.5x45cm). Twenty (20) Type 'A' traps and two (2) Type 'B' traps were employed, four separate trap lines.

The traps were placed to sample the areas of the site considered likely to offer any habitat for small and medium sized terrestrial mammals.

The traps were baited with a mixture of rolled oats, honey, peanut butter and vanilla essence. The traps were checked early each morning, and where necessary, reset and rebaited. The traps were left out for three nights, giving a total of sixty-six (66) terrestrial trap nights.

2.3.3 Arboreal Mammal Trapping

Arboreal mammal trapping was undertaken in May 2003 by RPS HSO Ecologists. Arboreal mammal species were targeted within the site via the use of Elliott Type 'B' traps (15x15.5x45cm). Eight (8) traps were placed on bracket-mounted wooden supports attached to suitable trees throughout four trap-lines. Trees targeted were those that had hollows, or were flowering and/or had scratches on the boles.

The traps were baited with a mixture of rolled oats and honey, with a smear of peanut butter and an aniseed ring (sugar-coated sweet). Traps and tree trunk were also sprayed with honey water to help attract mammals to the trap. The traps were checked early each morning, and where necessary, reset and rebaited. The traps were left out for three nights, giving a total of twenty-four (24) arboreal trap nights.

2.3.4 Bat Call Detection

Anabat echolocation surveys were undertaken in May 2005 and December 2007. Bat echolocation calls were recorded using an Anabat II Detector. Emphasis was placed on those areas deemed likely to provide potential hunting sites for bats including; flyways, ecotones, and around well-lit areas.

An Anabat detector was placed on the site for an entire night of overnight remote detection, utilising call activated recording techniques. The Anabat detector was also used for mobile detection during spotlighting on the site from dusk until 8:30pm on one night. The recorded calls were given to a recognised expert in bat species call identification – Glenn Hoye (Fly By Night Bat Surveys) for analysis.

2.3.5 Avifauna Survey

The presence of avifauna on site was undertaken via targeted diurnal and nocturnal surveys as well as incidental observations during all other phases of fieldwork. Targeted surveys were undertaken during the May 2003 and the December 2007 surveys.

For diurnal surveys, emphasis was placed on peak activity periods, i.e. dawn and dusk, to maximise chances of species encountered. Birds were identified by direct observation or by recognition of calls or distinctive features such as nests, feathers, owl regurgitation pellets etc.

For nocturnal surveys, spotlighting attempted to identify any roosting birds, and similar methods were employed as per diurnal surveys. Additionally, pre-recorded calls of *Ninox strenua* (Powerful Owl), *N. connivens* (Barking Owl) and *Tyto novaehollandiae* (Masked Owl) were broadcast through an amplification system designed to project the sound for at least 1km under still night conditions. The calls were repeated in the four compass directions for five minutes from a central position, and replies were listened for five minutes after each broadcast, followed by short periods of spotlighting for owls that may have flown in following the calls.

2.3.6 Herpetofauna Survey

Specific herpetofauna (frog and reptile) searches were carried out in each of the habitat units present. Both diurnal and nocturnal searches were made in areas of appropriate habitat. Such habitat included; areas of thicker vegetation, in ground litter, near and under fallen timber, around piles of refuse, damp areas such as drainage lines and areas of poor infiltration capacity and / or periodic inundation. Searches were also undertaken around the two small dams located within the eastern section of the site. These were carried out during the May 2003 and the December 2007 surveys.

Reptile searches were largely concentrated to the warmest part of the day (early afternoon). Frog searches were largely concentrated to nocturnal survey periods and/or periods of wet weather. Physical frog searches were augmented by call recognition.

2.3.7 Spotlighting

Spotlighting was undertaken on site via the use of 75 Watt hand-held spotlights and torches. This was undertaken within each of the habitat assemblages previously identified, with priority given to those areas that were deemed likely to contain nocturnal species (particularly arboreal and terrestrial mammals). Spotlighting was undertaken concurrently by two persons for a period of 1.5 hours during the survey in May 2003, and during the survey in December 2007, in which spotlighting was undertaken by one person for 1.5 hours. In total, the combined spotlighting effort was 4.5 person hours.

2.3.8 Secondary Indications and Incidental Observations

Opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of resident fauna were noted during field surveys. Such indicators included:

- Distinctive scats left by mammals. Any scats unable to be positively identified in the field were collected for further analysis, and scats of predator species containing fur / bones were sent for analysis if appropriate;
- Scratch marks made by various types of arboreal animals;
- Nests made by various guilds of birds;
- Scats consistent with Koalas;
- Feeding scars on gum trees made by Gliders;
- Chewed *Allocasuarina* cones indicative of past feeding by Black-Cockatoos;
- Chewed fruit remains indicative of past feeding by frugivorous birds such as Fruit-Doves;
- Whitewash, regurgitation pellets and prey remains from Owls; and
- Den sites consistent with those used by Spotted-tailed Quolls.

As previously noted, any other incidental observations of fauna were recorded during all phases of fieldwork.

2.3.9 Survey Effort

Outlined below in Table 2-2 is the survey dates, times, methods employed and weather conditions in which the field surveys were undertaken.

Table 2-2: Survey Dates, Times, Methods & Weather Conditions

DATE	TIME	METHODS	WEATHER CONDITIONS
27/05/03	1230 - 1530	Set traps, diurnal bird and herpetofauna census, secondary indication searches.	Cool, overcast, damp, raining
28/05/03	0830 - 1030	Check traps, diurnal bird and herpetofauna census, secondary indication searches. Flora survey undertaking plot, transect and random meanders throughout the site.	Overcast, cool, slight drizzle of rain.
29/05/03	0830 - 1000 1730 - 2030	Significant tree survey, diurnal bird and herpetofauna census, secondary indication searches, nocturnal spotlighting survey, owl call broadcast.	Overcast, slight drizzle.
30/05/03	0830 - 1130	Collect traps, significant tree survey, diurnal bird and herpetofauna census, secondary indication searches.	Sunny, cool.
12/12/07	1430-1730	Diurnal bird and reptile census, secondary indication searches, random meander vegetation survey, Targeted searches for <i>C. hunteriana</i> and <i>T. juncea</i> , significant tree location confirmation.	mild, sunny, partial cloud moderate breeze
12/12/07	1830-1930	Diurnal/crepuscular bird and frogs census.	cool, slight drizzle of rain, slight breeze.
12/12/07	2000-2140	Nocturnal spotlighting survey, owl calls broadcast, anabat detection.	partial cloud slight breeze,
12/08/08	0930-1600	Significant tree survey, opportunistic flora and fauna survey.	Sunny, cool.

2.3.10 Limitations

Limitations associated with the EAR are presented herewith. The limitations have been taken into account throughout this assessment specifically in relation to threatened species assessments, results and conclusions.

In these instances, a precautionary approach has been adopted; as such 'assumed presence' of known and expected threatened species, populations and ecological communities has been made where relevant to ensure a holistic assessment.

Seasonality

Timing limitations are always encountered during ecological assessment surveys due to the seasonal variations across the broad spectrum of flora and fauna species to be studied.

Most notably, several threatened flora species, particularly cryptic orchids, should be surveyed within their respective flowering periods. One threatened orchid species *Caladenia tessellata* was surveyed for outside this species flowering period this species has potential habitat within the site and could not be comprehensively surveyed. Therefore, this species cannot be discounted as occurring within the site.

Flora and Fauna surveys were carried out during May 2003, December 2007 and August 2008. As such there was less survey work undertaken during times when

certain migratory bird or bat species would have a higher probability for presence on the site and when some reptile and amphibian species might exhibit greater activity.

The flowering and fruiting plant species that attract some nomadic or migratory threatened species, often fruit or flower in cycles spanning a number of years. Furthermore, these resources might only be accessed in some areas during years when resources more accessible to threatened species fail. As a consequence threatened species may be absent from some areas where potential habitat exists for extended periods and this might be the case for certain migratory bird or bat species.

Data Availability & Accuracy

The collated threatened flora and fauna species records provided by the NPWS for the region are known to vary in accuracy and reliability. Traditionally this is due to the reliability of information provided to the NPWS for collation and/or the need to protect specific threatened species locations. For the purposes of this assessment this information has been considered to have an accuracy of ± 1 km.

Threatened flora and fauna records within the region were predominantly sourced from the DECC Atlas of Wildlife Database and a DEWR Protected Matters Search. Other sources such as Birddata and HBOC were also utilised. Limitations are known to exist with regards to these data sources and their accuracy.

Note: Data recorded by RPS HSO during the survey period, has been undertaken with a Trimble GeoXH GPS unit, which is capable of sub-metre accuracy following post processing.

3 RESULTS

3.1.1 LHCCREMS Vegetation Mapping

The regional vegetation community mapping LHCCREMS (NPWS 2000, House 2003), has determined that two vegetation communities are present within the study area, these being:

- Mu 30 - Coastal Plains Smooth-barked Apple Woodland; and
- Mu 31 – Coastal Plains Scribbly Gum Woodland.

The mapping of the vegetation communities produced by LHCCREMS (NPWS 2000; House 2003) relied on aerial photograph interpretation and virtually no ground truthing. It is recognised that this mapping methodology is limited in accuracy, particularly in its application to smaller areas (site specific basis). Field surveys have revealed that Map Unit 30 Coastal Plains Smooth-barked Apple Woodland and Map Unit 31 – Coastal Plains Scribbly Gum Woodland are present within the study area. However, the field inspection revealed that a modified remnant of an intergrade of both these communities exists within the site.

Four distinct communities were delineated; Open Eucalypt Forest and Modified Eucalypt Open Forest. The dominant tree species within these forested parts of the site were: *Eucalyptus racemosa* (Snappy Gum) and *Angophora costata* (Smooth-barked Apple). These two species comprised the majority of actual trees within the site. Scattered individuals of *Allocasuarina littoralis* (Black She Oak), *Corymbia gummifera* (Red Bloodwood), *E. resinifera* (Red Mahogany) and *Syncarpia glomulifera* (Turpentine) also occurred throughout the site.

The site also contained a vegetation community described as Grassland with Scattered Trees. This area consists of low exotic pasture grasses and herbaceous plants with the occasional scattered eucalypt species. A fourth but minor community was identified as Exotic Plantation, located in the southeast section of the site. Vegetation community distribution throughout the site is shown in Figure 3-1.

3.1.2 Delineated Vegetation Communities

API and field inspection revealed that the study area is largely vegetated land. Four vegetation communities were delineated within the site, being:

- **Open Eucalypt Forest** - Integrate between LHCCREMS MU 30 Coastal Plains Smooth-barked Apple Woodland and MU 31 Coastal Plains Scribbly Gum Woodland;
- **Modified Open Eucalypt Forest** - Integrate between LHCCREMS MU 30 Coastal Plains Smooth-barked Apple Woodland and MU 31 Coastal Plains Scribbly Gum Woodland native understorey has been removed;
- **Exotic Plantation**- not equivalent to any LHCCREMS Map units; and
- **Grassland with Scattered Trees** – not equivalent to any LHCCREMS Map units.

The following section provides a brief outline of the dominant floral characteristics of each identified vegetation community. A total of 69 flora species were identified

during the survey period over the site within the quadrats and random meander surveys. A complete list of the flora species identified is provided in Appendix C of this report. Refer to Figure 3-1 for Vegetation Communities and Survey Results.

Open Eucalypt Forest

Description: The Open Eucalypt Forest is an integrade of Map Units 30 and 31 as describe above.

This community occurs within the eastern portion of the study area and occupies approximately 1.17ha. This community exhibits relatively low level of disturbance, the disturbance within the community occurs at the ecotone between adjacent communities which are highly disturbed as a result of this a high occurrence of weed species were found.

Upper-storey: To 16m – 65-70% Projective Foliage Cover (PFC), *Eucalyptus racemosa* (Snappy Gum) and *Angophora costata* (Smooth-barked Apple).

Mid-storey: To 0.7-1.5m - 30% PFC *Dillwynia retorta* (Eggs and Bacon), *Monotoca elliptica* (Tree-broom Heath), *Acacia ulicifolia* (Prickly Mosses) and *Persoonia lanceolata* (Lance-leaved Geebung).

Under-storey: To 0.5-0.7 - 40-60% PFC *Imperata cylindrica* var. *major* (Blady Grass), *Echiniopogon caespitosus* (Tufted Hedgehog Grass), *Lomandra glauca* ssp. *glauca*, *Pteridium esculentum* (Bracken), *Pimelea linifolia* subsp. *linifolia* (Slender Rice Flower), *Lomandra longifolia* (Spiky-headed Mat-rush) and *Dianella caerulea* var. *caerulea* (Flax Lily).

Common climbers: *Glycine microphylla*, *Hardenbergia violacea* (False Sarsparilla) and *Parsonsia straminea* (Common Silkpod).



Modified Open Eucalypt Forest

Description: The Modified Open Eucalypt Forest is an integrade of Map Units 30 and 31 as describe above.

This community occurs within the northern and eastern sections of the site and contained the same upper strata species as the aforementioned community (albeit more sparsely). This community had been greatly modified by the thinning out of the upper strata and removal of the entire understorey and shrub layers. There had also been modification to the ground layer by the associated impacts of the previous land use of agriculture, which included the grazing of goats (local residents, pers. comm). This community occupies approximately 2ha across the study area.

Upper-storey: To 16-24m – 30-50% Projective Foliage Cover (PFC), *Eucalyptus racemosa* (Snappy Gum), *Angophora costata* (Smooth-barked Apple) and *Corymbia gummifera* (Red Bloodwood).

Mid-storey: Nil

Under-storey: To 0.3-0.5 – 70-90% PFC *Pennisetum clandestinum** (Kikuyu), *Eragrostis curvula* (African Love Grass), *Richardia brasiliensis* (Mexican Clover), *Andropogon virginicus** (Whisky Grass), *Tagetes minuta** (Stinking Roger), *Hydrocotyle bonariensis** (Kurnell Curse / Pennywort), *Bidens pilosa* (Cobblers peg), *Senecio madagascariensis* (Fireweed) and *Hypochaeris radicata** (Flatweed).

Occasional climbers: *Hardenbergia violacea* (False Sarsparilla) and *Parsonsia straminea* (Common Silkpod).



Exotic Plantations

Description: This vegetation community occupies a very small strip adjacent to the southern boundary. Very few exotic or native shrub species were found within this community as pine needles suppressed the native shrub and ground layers. This community occupies approximately 0.01ha across the study area.

Upper-storey: To 18m – 30-60% Projective Foliage Cover (PFC), *Pinus elliotti* (Slash Pine) and the occasional *Eucalyptus racemosa* (Snappy Gum) occurring.

Mid-storey: Nil

Understorey: To 0.5m – >10% PFC *Pennisetum clandestinum** (Kikuyu), *Cynodon dactylon* (Common Couch), *Cyperus* sp and *Senecio madagascariensis* (Fireweed).



Grassland with Scattered Trees

Description: This vegetation community occupies the cleared areas of sites 1 contains very few native species. This community consists mainly of exotic grasses and herbaceous weeds and is the result of recent clearing and the establishment of herbaceous species. This community occupies approximately 3.2ha across the study area.

Upper-storey: Scattered individuals *Eucalyptus racemosa* (Snappy Gum), *Angophora costata* (Smooth-barked Apple) and *Corymbia gummifera* (Red Bloodwood).

Mid-storey: Nil






Understorey: To 0.3-0.5m – 70-90% PFC *Pennisetum clandestinum** (Kikuyu), *Eragrostis curvula* (African Love Grass), *Andropogon virginicus** (Whisky Grass), *Tagetes minuta** (Stinking Roger), *Hydrocotyle bonariensis** (Kurnell Curse / Pennywort), *Bidens pilosa* (Cobblers peg), *Senecio madagascariensis* (Fireweed) and *Hypochaeris radicata** (Flatweed).

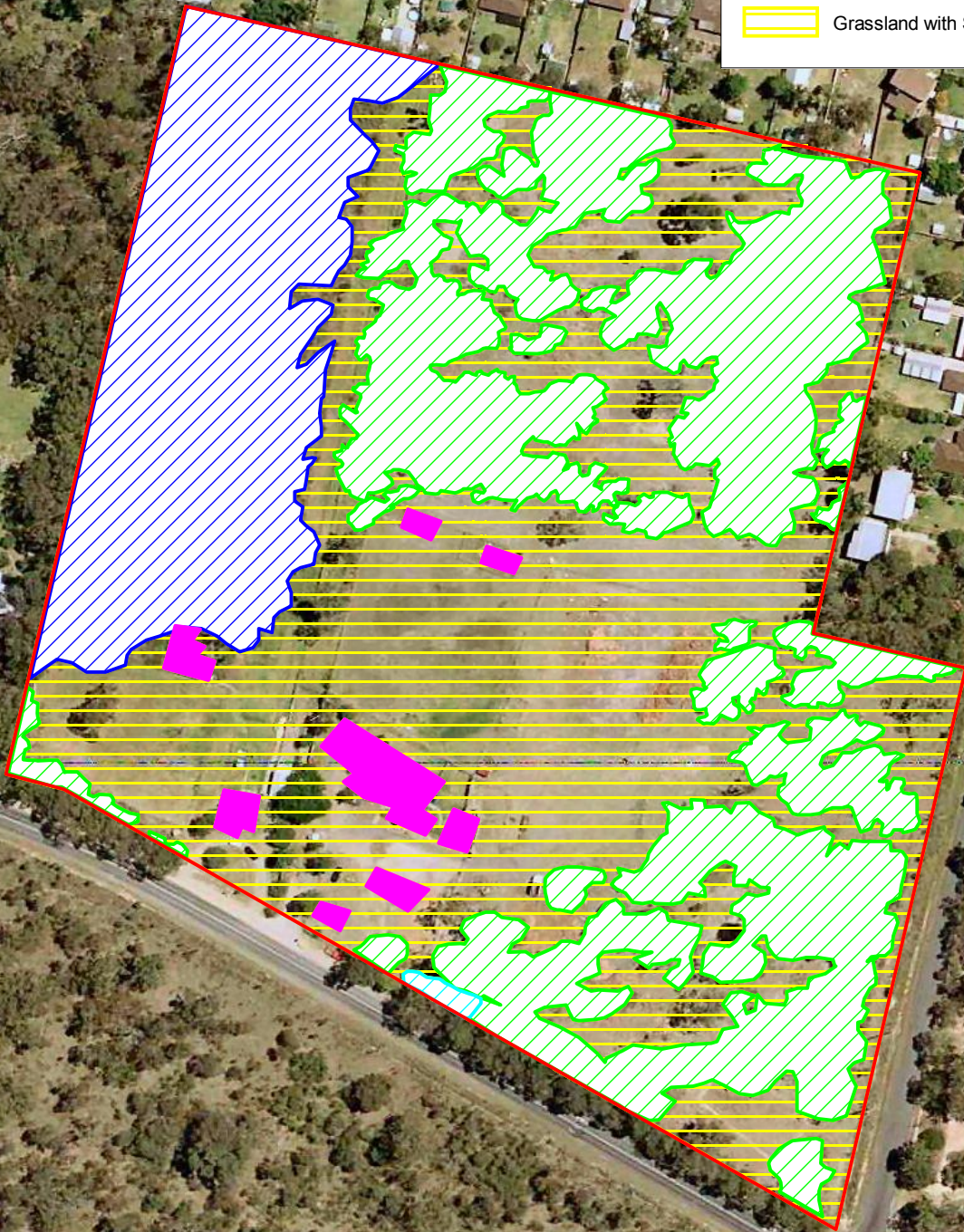


WARNING

No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.
Note that this Vegetation Community Map depicts only a defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries on the ground. Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities.
Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.

LEGEND

-  Site Boundary
-  Exotic Plantations
-  Built Areas
-  Modified Open Eucalypt Forest
-  Open Eucalypt Forest
-  Grassland with Scattered Trees



TITLE:
Figure 3-1
Vegetation Community Map

CLIENT:
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SCALE: 1: 2000 at A4 Size DRAWN: J. Whyte APPROVED: S. Bishop
 DATUM: MGA Zone 56 (GDA 94) DATE: 27/8/2008
 LAYOUT REF: J:\JOBS\25K\25331_Monisset Park\Drafting\25331_Vegetation_Communities_A_A4_270808.wor
 CONTOUR INTERVAL: N/A

JOB REF:
25331

PLANNING SURVEYING ECOLOGY

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T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W: www.hso.com.au ABN 11 093 343 856

3.1.3 Conservation Status of Vegetation Communities

No Endangered Ecological Communities listed under the *TSC Act* (1995) or *EPBC Act* (1999) were recorded/identified within the subject site during the flora surveys.

3.1.4 Regionally Significant Vegetation Communities

No regionally recognised communities listed in the *Lower Hunter and Central Coast Regional biodiversity Strategy* (Payne 1998) occur within the site.

3.1.5 Threatened Flora Search Results

The results of this search indicated numerous threatened flora species have been previously recorded within the locality and/ or have potential habitat within the site. The following species have been recorded within 10 km of the site (DECC Wildlife Atlas 2008):

- *Acaia bynoeana* (Bynoe's Wattle);
- *Angophora inopina* (Charmhaven Apple);
- *Callistemon linearifolius* (Netted Bottle Brush);
- *Cryptostylis hunteriana* (Leafless Tongue Orchid);
- *Diuris praecox* (Rough Double Tail);
- *Eucalyptus camfieldii* (Heart-leaved Stringybark),
- *Eucalyptus parramattensis* subsp. *decadens*;
- *Grevillea parviflora* ssp *parviflora* (Little-flower Grevillea);
- *Melaleuca biconvexa* (Biconvex Paperbark);
- *Syzygium paniculatum* (Magenta Lilly Pilly); and
- *Tetradlea juncea* (Black-eyed Susan).

No threatened flora species were identified within the site during recent or previous field surveys. Several of these threatened flora species are considered to have potential habitat within the site. These species have been assessed further within section 4 of this report.

3.1.6 Regionally Significant Flora Species

No ROTAP listed species were recorded within the site.

One species of flora listed as a species of local conservation significance (Forest Fauna Surveys *et al* 2001) was recorded on site, being *Bossiaea stephensonii*. This species is listed in Appendix 3 of the LMCC Flora and Fauna Survey Guidelines as “*Uncommon in the north of the region, not reserved.*” However, the site is not near the north of the region and less than 5 plants were observed within the site. These specimens occurred within the Open Eucalypt Forest in the western section of the site. Due to the small number of plants to be removed, it is believed that the proposal would not have a significantly deleterious effect on the regional status of the species.

3.2 Fauna

The results of fauna survey work carried out on the site are as follows. A comprehensive list of species expected and recorded during the survey period is also presented in Appendix D.

3.2.1 Terrestrial Mammals

Two (2) introduced species of terrestrial mammal, namely *Rattus norvegicus* (Brown Rat) and *Mus musculus* (House Mouse), were captured in terrestrial traps during the survey period in May 2003. No native terrestrial mammals were trapped during the survey.

3.2.2 Arboreal Mammals

During the survey in December 2007, two (2) *Pseudocheirus peregrinus* (Common Ringtail Possum) and three (3) *Trichosurus vulpecula* (Common Brushtail Possum) were spotlighted within the Open Eucalypt Forest in the western section of the site.

3.2.3 Bats

A number of Microchiropteran bat species were detected within the site during nocturnal surveys with a definite – probable confidence level, including *Miniopterus schreibersii* (Large Bentwing-bat), *Mormopterus norfolkensis* (Eastern Freetail-bat) and *Mormopterus* sp. 2 (Little Freetail-bat). The first two of these are listed as 'Vulnerable' under Schedule 2 of the *TSC Act* (1995). A fourth species was identified with a low level of confidence, being *Chalinolbus gouldii* (Gould's Wattle Bat).

The majority of the site is characterised by modified Open Eucalypt Forest and Open Eucalypt Forest habitat offering suitable foraging and roosting habitat for common native microbat species including a number of threatened species as listed above. The canopy would provide foraging habitat for threatened insectivorous bat species during the warmer months and there is sufficient diversity within canopy tree species to provide continuous blossom resources for common and threatened nectivorous microbat species.

3.2.4 Avifauna

The site displayed a composition of species commonly encountered in similar habitats throughout the region. Species such as *Platycercus eximius* (Eastern Rosella), *Gymnorhina tibicen* (Australian Magpie), *Chenonetta jubata* (Australian Wood Duck) and vocal groups of *Manorina melanocephala* (Noisy Miner) were the most obvious resident birds. Other birds included, *Rhipidura leucophrys* (Willie Wagtail), *Cacatua roseicapilla* (Galah), *Cracticus torquatus* (Grey Butcherbird), *Chrysococcyx basalis* (Horsfield's Bronze-Cuckoo) and *Dacelo novaeguineae* (Laughing Kookaburra). The latter of these were found nesting on the site.

Personal communication with local residents revealed that the site is regularly used by two *Podargus strigoides* (Tawny Frogmouth). Several other species were indicated by personal communication, including *Eurystomus orientalis* (Dollarbird), *Eudynamis scolopacea* (Common Koel) and *Scythrops novaehollandiae* (Channel-billed Cuckoo).

The canopy of the site's wooded habitats contains a diversity of tree species that together offer a year round continuity in blossom resources for a range of nectivorous birds species such as honeyeaters and lorikeets. The canopy also represents abundant foraging opportunities for those birds, which hunt the invertebrate fauna that foliage and flowering trees attract. Understorey strata density varies across the site with the greatest complexity occurring within the non-disturbed Open Forest Eucalypt community. The Open Eucalypt Forest community provides suitable foraging and nesting opportunities for small bird species. The vegetation within the understorey of the Open Eucalypt Forest has been previously underscrubbed and a regenerating understorey is evident.

The Modified Open Eucalypt Forest which has been modified by the thinning out of the upper strata and removal of the entire understorey and shrub layers represents less diverse habitat opportunities for small bird species.

The Grassland with Scattered Trees community which is dominated by exotic grasses provides some foraging opportunities for small bird species.

The Exotic Plantations community provides limited food resources for avifauna within the site.

There are hollows within the site which are sufficient size to represent potential nesting sites for Glossy Black-Cockatoos, but the site has only sparse densities of a single *Allocasuarina* species, being *Allocasuarina littoralis*, which is the almost exclusive feed tree genus for these cockatoos.

The Modified Open Eucalypt Forest and Open Eucalypt Forest contain hollows that are of sufficient size to represent nesting and roosting sites for forest owl species and these habitats provide suitable foraging habitat for Powerful and Masked Owls that have potential to occur within the area.

There are no significant wetland habitats within the site and as such no waterbird species were observed. However, reedbeds occur where the forest canopy does not shade the creek and these provide potential habitat for rail and crane species.




The threatened species *Calyptorhynchus lathami* (Glossy Black-Cockatoo) was recorded within the site during the survey in December 2007. On this occasion, six birds were observed in a Scribbly Gum within the Open Eucalyptus Forest in the western portion of the site, as shown in Figure 3.2. This bird species is listed as Vulnerable on Schedule 2 of the *Threatened Species Act (1995)*.

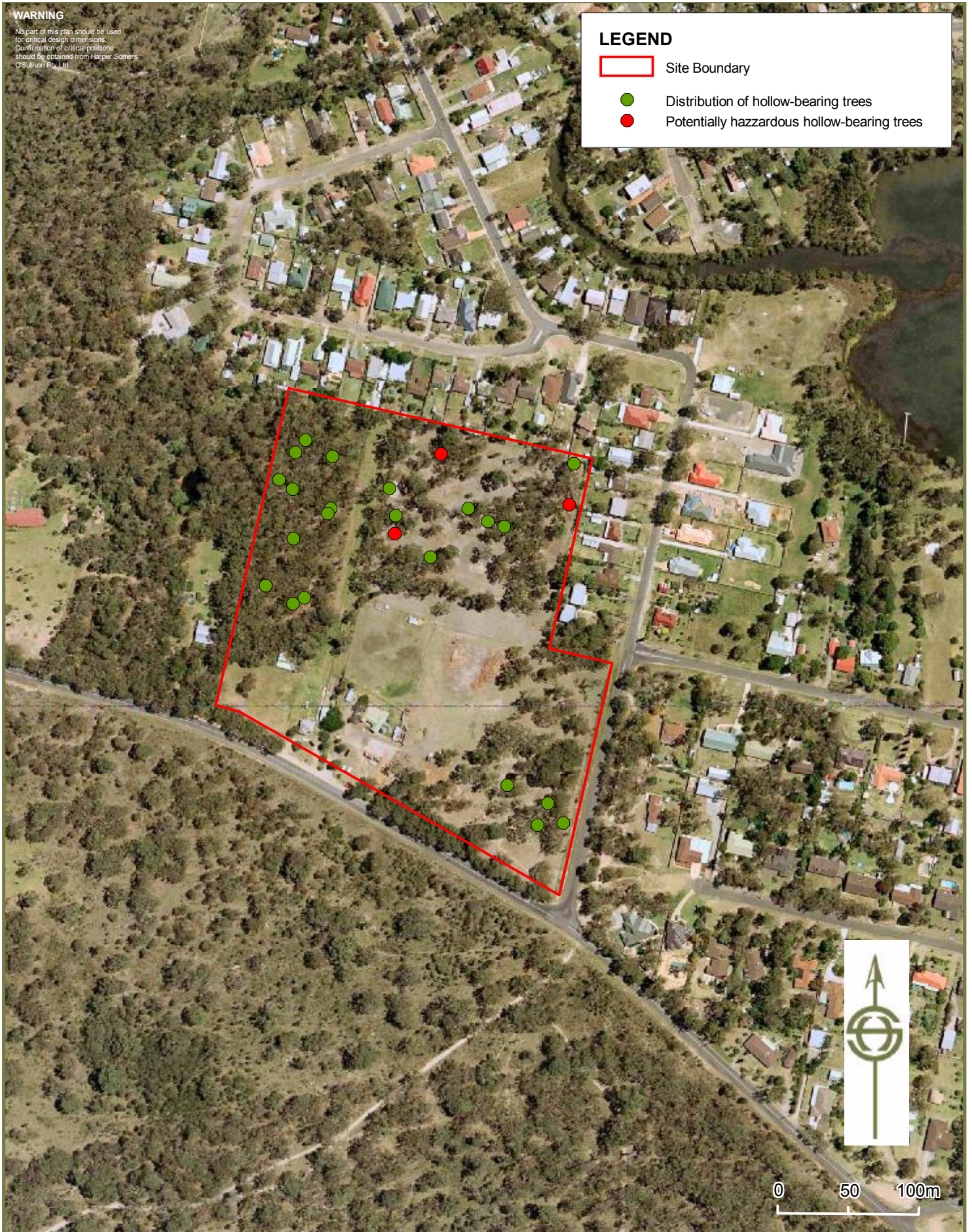
Neither secondary indications nor direct observations of other threatened species of avifauna were recorded on the site during these investigations. With the exception of the Glossy Black Cockatoo, no other avifauna recorded during the survey are considered to be locally or regionally significant.

WARNING

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LEGEND

-  Site Boundary
-  Distribution of hollow-bearing trees
-  Potentially hazardous hollow-bearing trees



TITLE:
Figure 3-2
Distribution of Hollow-Bearing Trees

CLIENT:
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SCALE: 1: 3500 at A4 Size DRAWN: L Steel APPROVED: R Browne-Cooper

DATUM: MGA Zone 56 (GDA 94) DATE: 21/01/2008

LAYOUT REF: J:\068124\24818 - Morisset Park\Drawings\MapInfo\24818.Fig 4-1 Hollow Bearing Trees B-A4.201207.WOR

CONTOUR INTERVAL: N/A

JOB REF: 25331

PLANNING SURVEYING ECOLOGY

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3.2.5 Amphibians

Four common species of frog were heard calling from two small dams within the site including *Crinia signifera* (Common Eastern Froglet), *Litoria fallax* (Dwarf Green Tree Frog) *Litoria tylerii* (Tyler's Tree Frog) and *Litoria peronii* (Peron's Tree Frog). Although only a relatively small number of frogs were observed within the site, onsite habitat provides opportunities to support a wider suite of common frog species.

Although a number of threatened frog species are known to occur within the region, in particular that belonging to the Genus *Crinia*, *Pseudophryne* and *Litoria*, habitat within the site is not suited to these threatened genus. *Pseudophryne australis* occur within Sydney Sandstone habitats to the south of the Hunter and regionally *Crinia tinnula* occurs in swamp woodland and swamp forest communities around Port Stephens and Lake Macquarie. *Litoria brevipalmata* has been recorded on the valley floor in the Cessnock LGA, but onsite habitat is inconsistent with those areas where it has been regionally recorded.

No suitable habitat for *Litoria aurea* (Green and Golden Bell Frog) was observed within the site.

3.2.6 Reptiles

Individuals of *Lampropholis delicata* (Grass Skink) were observed on several occasions within the leaf litter during diurnal surveys throughout the entire site, and *Tiliqua scincoides* (Eastern Blue-tongue Skink) was found beneath sheet iron.

3.2.7 Regionally Significant Fauna Species

Lake Macquarie Flora and Fauna Guidelines (2001) contain a list of regionally significant fauna species occurring across Lower Hunter LGA's, of which five were identified within the site, and are listed as follows:

<i>Falcunculus frontatus</i>	Crested Shrike-tit
<i>Petaurus breviceps</i>	Sugar Glider
<i>Macropus rufogriseus</i>	Red-necked Wallaby
<i>Amphibolurus muricatus</i>	Jacky Lizard
<i>Lymnodynastes tasmaniensis</i>	Spotted Grass Frog

3.3 Habitat Survey

3.3.1 Flora Habitat

The vegetation communities present throughout the site offer a number of suitable habitat types for a moderate array of native flora species.

A number of threatened flora species are known to occur within locality and are considered to have marginal habitat within the site, including; *Diuris praecox* (Newcastle Doubletail), *Caladenia tessellata* (Tessellated Spider Orchid), *Cryptostylis hunteriana* (Leafless Tongue Orchid) and *Tetratheca juncea* (Black-eyed Susan).

One species of flora listed as a species of local conservation significance (Forest Fauna Surveys *et al* 2001) was recorded on site, being *Bossiaea stephensonii*. This species is listed in Appendix 3 of the LMCC Flora and Fauna Survey Guidelines as "Uncommon in the north of the region, not reserved." The site is not near the north of

the region and less than 5 plants were observed within the site. These specimens occurred within the Open Eucalypt Forest in the western section of the site. Due to the small number of plants to be removed, it is not believed that the proposal would have a significantly deleterious effect on the regional status of the species.

3.3.2 Hollow Bearing Tree Survey



A total of 25 hollow-bearing trees were recorded within the site (Figure 3-3). Hollows with the following characteristics were recorded within the site:

- Small cracks and fissures – common;
- Small (2 - 10 cm entrance diameter) – common;
- Medium (11 - 20 cm entrance diameter) – common; and
- Large (greater than 20 cm entrance diameter).

WARNING

No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.

LEGEND

-  Site Boundary
-  Location of threatened Fauna
Glossy Black Cockatoo
(Calyptorhynchus lathami)



TITLE:
Figure 3-3
Location of Threatened Fauna

CLIENT:
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SCALE: 1: 2000 at A4 Size DRAWN: J. Whyte APPROVED: M. Doherty

DATUM: MGA Zone 56 (GDA 94) DATE: 27/08/2008

LAYOUT REF: J:\065\24\24818 - Morisset Park\04 - MapInfo
24818\Fig 4-2 Threatened Fauna A-A4_270808.WOR

CONTOUR INTERVAL: N/A

JOB REF:
25331

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3.3.3 Fauna Habitat

Fauna potentially occurring within the site varies with respect to vegetation quality, density and community form. Eucalypt and other dominant trees flowering times have potential to supply nectar and foraging opportunities for a diversity of species throughout the majority of the year. Dominant tree species and flowering period are contained in Table 4-1 below.

Table 3-1 Development Estate Dominant Tree Species and Flowering Period

Threatened Flora Species	Potential Threatened Fauna Species that May be attracted by Blossom	Flowering Period (Best time to Survey) in Months of the Year											
		J	F	M	A	M	J	J	A	S	O	N	D
<i>Angophora costata</i>	Micro bats (insects), gliders.	Dark	Dark									Light	Dark
<i>Corymbia gummifera</i>	Gliders				Dark	Dark	Dark						
<i>Eucalyptus haemastoma</i>	Gliders			Dark	Dark	Dark	Dark	Dark	Dark	Light	Light	Light	
<i>Eucalyptus racemosa</i>	Gliders							Dark	Dark	Dark	Dark		
<i>Eucalyptus resinifera</i>	Gliders	Dark	Dark							Light	Light	Dark	Dark

Dark shading represents core flowering times for canopy trees as reported in the literature and light shading represents those times when flowering has been noted by RPS HSO ecologists outside these core flowering periods.

Note: The cleared areas occurring within the site are considered to be insignificant in terms of providing habitat for native fauna species aside from providing foraging habitat (such as for hunting bats).

Terrestrial Mammals

Open Forest communities within the site provide suitable habitat for a number of terrestrial mammals, including small marsupials and rodents. Within the Open Eucalypt Forest community the understorey complexity is variable with the most suitable opportunities exist where understorey densities are highest. General densities of understorey vegetation within the site vary from low to moderate.

The Modified Open Eucalypt Forest community is highly disturbed as a result of past clearing activities which have removed most of the shrub and ground layers. Trends observed from the trapping surveys indicate that small mammals such as House Mouse and introduced Rats are present, but not in high densities due to only a moderate complexity of understorey strata within the site.

Arboreal Mammals

The Open Eucalypt Forest within the site contains suitable roosting and foraging eucalypt trees for the threatened species *Petaurus norfolcensis* (Squirrel Glider) and other common arboreal mammal species such as *Trichosurus vulpecula* (Common Brushtail Possum).

Areas of open cleared areas with a low diversity and density of *Eucalyptus* species provide limited habitat for arboreal species.

Avifauna

The Open Eucalypt Forest, Modified Open Eucalypt Forest, Exotic Plantations and Grassland with Scattered Trees communities and the Dams provide suitable foraging resources (e.g. Invertebrate habitat and blossom) and nesting and roosting opportunities for a variety of sedentary and migratory birds.

Hollow-bearing trees, occurring largely within the forest communities, may provide nesting habitat for hollow dependant birds such as Forest Owls, Treecreepers, Parrots, Kingfishers and Woodswallows.

The quality of habitat and structural diversity within wooded habitats and the maturity of much of the trees within the site fulfil habitat needs for a wide diversity of mostly common avifauna.

The presence of winter flowering *Eucalyptus* spp. may offer seasonal habitat to nomadic nectivorous species such as the Swift Parrot and Regent Honeyeater. The low incidence of arboreal mammal habitat and the paucity of this fauna guild during targeted trapping limit the site's suitability for Forest Owl species that may occur locally as some forest owl species are dependent upon arboreal mammals as a primary prey group.

The Dams provide suitable foraging opportunities for wetland avifauna. The Modified Eucalypt Forest and the Grassland with Scattered Trees along the edge of the Open Eucalypt Forest community provides quality hunting and nesting habitat for diurnal raptor avifauna.

The Open Eucalypt Forest within the site contains marginal foraging *Allocasuarina* trees for the threatened species, *Calyptornis lathamii* (Glossy Black-cockatoo) and sub-optimal foraging habitat for the *Tyto novaehollandiae* (Masked Owl) and *Ninox strenua* (Powerful Owl).

Areas of open cleared areas with a low diversity and density of *Eucalyptus* species hold limited habitat for avifauna species.

Bats

The vegetation assemblages within the site provides extensive foraging habitat for a range of microchiropteran bats, due to insect populations they are likely to harbour. The dams provide opportunity for the Large-footed Myotis (*Myotis adversus*) that preferentially hunt over and around such features. Potential roosting sites occur within the Open Eucalypt Forest, Modified Open Eucalypt Forest and Grassland with Scattered Trees all of which contain suitable hollows for roosting Microbats species such as *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail-bat), *Mormopterus norfolkensis* (Eastern Freetail-bat), *Scoteanax rueppellii* (Greater Broad-nosed Bat) which utilise tree hollows.

Canopy trees within the site also offer blossom foraging opportunities for Grey-headed Flying-foxes. This species travels widely to access foraging resources and there are abundant blossom resources within the site for this species to utilise.

Frogs

The Open Eucalypt Forest, Modified Eucalypt Open Forest communities and the Dams provide an array suitable quality foraging, basking and breeding habitat for a diversity of common frog species. The available habitat for breeding within the Modified Open Eucalypt Forest, Grassland with Scattered Trees communities is limited, while small areas of suitable breeding habitat occur within the Open Eucalypt Forest community.

The site does not contain suitable habitat for any threatened frog species recorded within the locality.

Reptiles

Habitat within the site has potential for representing moderate sheltering and foraging opportunities for a diversity of reptile species. This can be attributed to the condition of the understorey strata and the low-moderate incidence of forest debris in the ground cover layer.

4 THREATENED SPECIES AND COMMUNITIES ASSESSMENT

4.1 Identification of Subject Species and Communities

Those threatened flora and fauna species (listed under the *TSC Act 1995* and the *EPBC Act 1999*) that have been gazetted / recorded from within the vicinity of the site have been considered within this assessment. EEC's and Endangered Populations known from the broader area have also been addressed. Each species / community / population is considered for its potential to occur within the study area and the likely level of impact as a result of the overall proposal. This assessment deals with each species / community / population separately and identifies the ecological parameters of significance associated with the overall proposal.

Those species / communities that have been identified as having either a moderate level of impact (or greater) as a result of the proposed development estate or that have been recorded within the site during field investigations have been subject to further assessment within Section 5.2 of this report.

'Species' or 'EEC / Population' – Lists each threatened species / EEC / population known from the vicinity of the site. The status of each threatened species under the *TSC Act 1995* and *EPBC Act 1999* is also provided.

'Habitat Description and Known Populations' or **'Habitat Description and Known Stands / Populations'** – Provides a brief account of the species / community / population and the preferred habitat attributes required for the existence / survival of each species / community / population.

'Chance of Occurrence within Site' – Assesses the likelihood of each species / community / population to occur within the site in terms of the aforementioned habitat description and taking into account local habitat preferences, results of recent field investigations, data gained from various sources and previously gained knowledge via fieldwork undertaken within other ecological assessments in the locality.

'Likely Level of Impact within Development Estate' – Assesses the likely level / significance of impacts to each species / community / population that would result from the proposed development estate, taking into account both short and long-term impacts. This assessment is largely based on the chance of occurrence of each species / community with due recognition to other parameters such as home range, habitat use, connectivity etc. It also considers the scope of the proposal, including the likely 'ecological footprint', duration of construction works, proposed remediation works etc.

Table 4-1 Threatened Species Assessment

Species / Community	Habitat Description	Chance of Occurrence On Site	Likely Level of Impact
Plants			
<i>Acacia bynoeana</i> Bynoe's Wattle (E, V*)	Small, prostrate shrub found in low heath and open woodland, generally on loamy clays and sand. Occurs from the Lower Hunter south to Southern Highlands. Recently found in several locations within the HEZ and other parts of the Cessnock LGA where it has been found growing in Kurri Sand Swamp Woodland (KSSW). Has also been recently recorded as isolated populations within Yellow Bloodwood Woodland and Blue-leaved Stringybark Woodland. Records for this species occur to the south of Morisset and north of Dora Creek in dry forest habitats (Atlas of NSW Wildlife data).	Low This species has been recorded within a 10 km radius of the site and the vegetation within the site contains potential habitat. However, this species was not located within the site, despite targeted searches.	Low Whilst some potentially suitable habitat may be present, this species was not recorded within the site. Any proposed removal of areas with quality native vegetation may be seen as contributing to the incremental decline of potential habitat extent for this species.
<i>Angophora inopina</i> Charmhaven Apple (V, V*)	Small to medium tree found in shallow sandy soils in open woodland, swamp woodland and wet heath. The main occurrences of this species are in the Wyong and Lake Macquarie LGA's (from Charmhaven to Wyee and Morisset, and north to near Toronto), with disjunct populations also in Port Stephens LGA (south of Karuah).	Low This species has been recorded within a 10 km radius of the site and the vegetation within the site contains potential habitat. However, this species was not located within the site, despite targeted searches.	Low Whilst some potentially suitable habitat may be present, this species was not recorded within the site. Any proposed removal of areas with quality native vegetation may be seen as contributing to the incremental decline of potential habitat extent for this species.
<i>Calladenia tessellata</i> Tessellated Spider Orchid (V, V*)	A small terrestrial orchid, which re-grows its single leaf on an annual basis. It is known to occur in grassy woodland and locally it has potential to occur within Coastal Plains Scribbly Gum Woodland. It has been recorded within Munmorah State Recreation Area to the east of the study area. Flowers from September to October and is known to flower particularly after fire.	Moderate This species has been recorded within a 10 km radius of the site and the vegetation within the site contains potential habitat. This species was not located within the site, however flora surveys were conducted outside the flowering period.	Low-Moderate Whilst some potentially suitable habitat may be present, any proposed removal of areas with quality native vegetation may be seen as contributing to the incremental decline of potential habitat extent for this species.
<i>Callistemon linearifolius</i> (V) Nettled Bottle Brush	Shrub that grows in dry sclerophyll forest on the coast and adjacent ranges. Re-sprouting / juvenile specimens difficult to distinguish from other <i>Callistemon</i> species such as <i>C. rigidus</i> or <i>C. linearis</i> without the aid of flowering parts. Records are concentrated on the coast, near Swansea and Catherine Hill Bay east of the study area (Atlas of NSW Wildlife data).	Low This species has been recorded within a 10 km radius of the site and the vegetation within the site contains potential habitat. However, this species was not located within the site, despite targeted searches.	Low Whilst some potentially suitable habitat may be present, this species was not recorded within the site. Any proposed removal of areas with quality native vegetation may be seen as contributing to the incremental decline of potential habitat extent for this species.
<i>Cryptostylis hunteriana</i> Leafless-tongue Orchid (V, V*)	Saprophytic orchid. Grows in swamp heath on sandy soils. It occurs north to the Gibraltar Range and south to Eden. Local records exist near Cams Wharf and to the west of Mannering Park (Atlas of NSW Wildlife data). Flowering occurs between December and February.	Moderate This species has been recorded within a 10 km radius of the site. Potential habitat exists within the site for this species. Target survey in December did not locate this species, however several other non-threatened orchids were located including <i>Cryptostylis subulata</i> and <i>C. erecta</i> . Due to the cryptic nature of this orchid, its occurrence cannot be ruled out.	Low - Moderate Approximately 1.17ha of potential <i>C. hunteriana</i> habitat would be removed as a result of the proposal. This is considered to be a small portion of the available habitat within the local area, particularly considering the large tract of conservation-zoned land within Koopahtoo Aboriginal Reserve to the south of the study area.
<i>Diuris praecox</i> Newcastle Doubletail (V, V*)	Found predominantly in coastal Eucalypt forests on hilltops or slopes. This species has been recorded at a number of dry woodland locations to the east of Lake Macquarie (Atlas of NSW Wildlife data).	Moderate Not located during the survey however the flora surveys were conducted outside the flowering period. The study area contains sub-optimal habitat for <i>D. praecox</i> . Records do exist within 10 km of the study area; however, no records exist west of Lake Macquarie. Due to the near-coastal location of the site, there is at best a moderate chance of occurrence.	Low - Moderate Approximately 1.17ha of potential <i>D. praecox</i> habitat would be removed as a result of the proposal. This is considered to be a small portion of the available habitat within the local area, particularly considering the large tract of conservation-zoned land within Koopahtoo Aboriginal Reserve to the south of the study area.
<i>Eucalyptus camfieldii</i> Camfieldi's Stringybark (V, V*)	Tree or mallee to 10 m high, but often less. Rare and localised, in coastal shrub heath on sandy soils on sandstone, often restricted drainage. Local records exist to the south-east near Moonee (Atlas of NSW Wildlife data).	Low The study area does not constitute optimal coastal habitat and no <i>E. camfieldii</i> records exist west of Lake Macquarie.	Low Unlikely to occur due to the lack of suitable habitat within the site, therefore no impact is expected.

Species / Community	Habitat Description	Chance of Occurrence On Site	Likely Level of Impact
<i>Genoplesium insignis</i> Variable Midge Orchid (E)	Occurs within a restricted distribution between Chain Valley Bay and Wyong in the Wyong LGA. Habitat is described as a <i>Themeda australis</i> ground cover layer with shrubs and <i>Eucalyptus haemastoma</i> , <i>Corymbia gummifera</i> , <i>Angophora costata</i> and <i>Allocasuarina littoralis</i> in the canopy layer. This species has been recorded within Lake Macquarie State Recreation Area to the east of the site. Flowering period is September to October	Low - Moderate The vegetation within the site contains potential habitat for <i>G. insignis</i> . However, this species was not located within the site, despite targeted searches during the flowering period.	Low Whilst some potentially suitable habitat may be present, this species was not recorded within the site. Any proposed removal of areas with quality native vegetation may be seen as contributing to the incremental decline of potential habitat extent for this species.
<i>Grevillea parviflora</i> ssp. <i>parviflora</i> (V, V*)	Occurs in light, clayey soils in woodlands. Most plants appear capable of suckering from a rootstock. Much confusion surrounds the taxonomy of this species and other similar <i>Grevillea</i> taxa (S. Bell pers. comm.), and a NPWS-funded study of the species is currently in progress. Local records exist near Eraring and Morisset (Atlas of NSW Wildlife data).	Low This species has been recorded within a 10 km radius of the site and the vegetation within the site contains potential habitat. However, this species was not located within the site, despite targeted searches.	Low Whilst some potentially suitable habitat may be present, this species was not recorded within the site. Any proposed removal of areas with quality native vegetation may be seen as contributing to the incremental decline of potential habitat extent for this species.
<i>Melaleuca biconvexa</i> Biconvex Paperbark (V, V*)	A shrub to small tree, which grows in poorly drained areas from Jervis Bay to Port Macquarie. Records in the Hunter Region are confined to western Lake Macquarie and local records exist near Cooranbong (Atlas of NSW Wildlife data).	Low This species has been recorded within a 10 km radius of the study area within riparian vegetation that is regularly inundated. The study area does not contain riparian or swamp vegetation.	Low Unlikely to occur due to the lack of suitable habitat within the site, therefore no impact is expected.
<i>Microtis angusii</i> Angus's Onion Orchid (E, E*)	Record from the Terry Hill's district of Sydney. Occurs upon disturbed soil horizons that were originally ridge-top lateritic soils supporting a distinctive open to low open forest community, Duffy's Forest Vegetation Community, which is listed as an EEC. Suspected occurrences in the southern Lake Macquarie hinterland are derived from a tentative record by Bell (1998) in the Lake Macquarie State Recreation area, which occurs to the south of Gwandalan. Flowers from May to October.	Low The vegetation within the site contains habitat that is considered sub-optimal at best to support <i>M. angusii</i> . This species is very rare in the Hunter region and was not located within the site during the May survey, when flowering occurs.	Low Whilst some potentially suitable habitat may be present, this species was not recorded within the site. Any proposed removal of areas with quality native vegetation may be seen as contributing to the incremental decline of potential habitat extent for this species.
<i>Syzygium paniculatum</i> Magenta Lilly Pilly (V, V*)	A shrub to small tree found in sub-tropical and littoral rainforest on sandy soils or sheltered gullies mostly near watercourses. Distribution between Bulahdelah and Jervis Bay. Local records exist near Dora Creek, on Pulbah Island in Lake Macquarie, Caves Beach and Cams Wharf (Atlas of NSW Wildlife data).	Low The study area does not contain rainforest or gully vegetation preferred by <i>S. paniculatum</i> .	Low Unlikely to occur due to the lack of suitable habitat within the site, therefore no impact is expected.
<i>Tetradlea juncea</i> Black-eyed Susan (V, V*)	Occurs in a variety of forested and heathy habitats. Locally found in Open Forests and Woodlands with dense, undisturbed understorey, often in association with <i>Angophora costata</i> / <i>Corymbia gummifera</i> on slopes with south-easterly aspects.	Moderate This species was not recorded within the site during the target survey in December. Although this survey was conducted towards the end of peak flowering period. Suitable habitat exists within the Open Eucalyptus Forest in the western portion of the site. Therefore there is a moderate chance of occurrence.	Low Approximately 1.17ha of potential <i>T. juncea</i> habitat would be removed as a result of the proposal. This is considered to be a small portion of the available habitat within the local area, particularly considering areas of potential habitat on a local and regional scale.
Herpetofauna			
<i>Crinia tinnula</i> Wallum Froglet (V)	Occurs in coastal, low-lying acid Paperbark forest, within the 'wallum country' (often on sandy soils). Regional records for this species are confined to three main areas; Lake Macquarie, Central Coast and Medowie and Port Stephens (DEC 2005). Local records exist less than 2 km to the southwest of the study area near Yarrowonga Park (Atlas of NSW Wildlife data).	Low Within the wider locality <i>C. tinnula</i> has been recorded within poorly draining open forest habitats with heathy understoreys and Swamp Sclerophyll Forests where paperbarks are often present. The site is characterised by open woodland, which is not suitable habitat for this species.	Low Due to the distinct lack of preferred habitat within the site, it is considered unlikely that will be affected by the proposal.
<i>Litoria aurea</i> Green and Golden Bell Frog (E, V*)	Inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. Thought to be displaced from more established sites by other frog species, thus explaining its existence on disturbed sites.	Low-Moderate The site contains two small ponds that could be considered as potential habitat for this species. Several other <i>Litoria</i> frog species were heard calling from these ponds during the December survey, however this species was not recorded.	Low Due to the lack of recorded occurrence of this species, and the small size of potential habitat occurring within the site, there is considered to be a low chance of potential impact caused by the proposed development.

Species / Community	Habitat Description	Chance of Occurrence On Site	Likely Level of Impact
<i>Litoria brevipalmata</i> Green-thighed Frog (V)	Occurs in a range of habitats in areas where surface water gathers after rains. Males congregate around temporary pools that form after very heavy rains. Recorded approximately 10 km to the west of the site, in Olney State Forest (Atlas of NSW Wildlife data).	Low-Moderate Whilst the habitat of the Green-thighed Frog is varied, the study area offered few opportunities for large temporary pools of water to form after rain. It is considered unlikely that this species would utilise the study area.	Low Unlikely to occur due to the lack of suitable habitat within the site, therefore low potential impact is expected.
<i>Pseudophryne australis</i> Red-crowned Toadlet (V)	Generally restricted to Hawkesbury Sandstone where it may be found beside temporary creeks, gutters and soaks and under rocks and logs. Breeds in deep leaf litter inundated with heavy rain (Robinson, M, 1996). Records from the Hunter Region exist in Olney State Forest (DEC).	Low Records for this species occur in the sandy forests occurring on weathered tops of the Watagan Range. Habitat within the site contrasts markedly with known habitats.	Low Unlikely to occur due to the lack of suitable habitat within the site, therefore low potential impact is expected.
Avifauna			
<i>Ptilinopus regina</i> Rose-crowned Fruit-Dove (V)	Generally lives in rainforest, though it also frequents brushes of coastal districts as well as forests and mangroves. Recorded less than 5 km to the south-east of the study area near Gwandalan (Atlas of NSW Wildlife data).	Low The study area does not contain rainforest vegetation and contained few fruiting tree and shrub species likely to be utilised by Rose-crowned Fruit Dove.	Low Unlikely to occur due to the lack of suitable habitat within the site, therefore low potential for impact is expected.
<i>Ptilinopus superbus</i> Superb Fruit-Dove (V)	This species is quite common in north-eastern rainforest, forest and mangroves north of Cardwell, Qld; becoming uncommon nomads or non-breeding migrants further south to the Hunter River. Mainly inhabits rainforest but will feed in adjacent mangroves or Eucalypt forest, venturing into coastal areas seasonally. Feeds on figs or other fruit and berry-bearing trees.	Low The study area does not contain rainforest vegetation and contained few fruiting tree and shrub species likely to be utilised by Rose-crowned Fruit Dove.	Low Unlikely to occur due to the lack of suitable habitat within the site, therefore low potential for impact is expected.
<i>Charadrius mongolus</i> Lesser Sand Plover (V, M*)	When in Australia, this migratory species inhabits sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats. Prey includes molluscs, worms, crustaceans and insects.	Low Whilst the species may occasionally fly over the study area, the study area does not contain estuarine habitats occupied by this species.	Low Unlikely to occur due to the lack of suitable habitat within the site, therefore no impact is expected.
<i>Climacteris picumnus</i> subsp. <i>victoriae</i> . Brown Treecreeper (V)	The eastern subspecies of the Brown Treecreeper, <i>Climacteris picumnus</i> ssp. <i>victoriae</i> , is distributed through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Range. Within the Lower Hunter Valley, this species is known from Werakata National Park, Rothbury, the HEZ and Ellalong (Atlas of NSW Wildlife 2005; authors pers. obs.). Frequents drier forests and woodlands, particularly open woodland lacking a dense understorey, but also grasslands where there are sufficient logs, stumps and dead trees nearby. The species sleeps inside hollow branches or trunks of trees, both living and dead, sometimes at great heights, and sometimes using old nest sites (Noske, 1982). This species appears unable to maintain viable populations in remnants less than 200ha and its abundance decreases as remnant size.	Low-Moderate Not recorded during the survey. The open woodland within the site contains potential foraging and nesting habitat however given the lack of ground debris through most of the woodland, and paucity of local records, the chance of occurrence within the site is considered moderate at best.	Low Unlikely to occur due to the lack of suitable habitat within the site, therefore no impact is expected.
<i>Ephippiorhynchus asiaticus</i> Black-necked Stork (E)	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. It has also been recorded on farm dams and sewage treatment ponds.	Low Whilst the species may occasionally fly over the study area, the study area does not contain wetland habitats occupied by this species.	Low Unlikely to occur due to the lack of suitable habitat within the site, therefore no impact is expected.
<i>Ixobrychus flavicollis</i> Black Bittern (V)	Solitary species, living near water (estuarine to brackish) in mangroves and other trees which need to form only a narrow fringe of cover. A riparian species that occasionally ventures into the open within estuarine habitats.	Low Whilst the species may occasionally fly over the study area, the study area does not contain wetland habitats occupied by this species.	Low Unlikely to occur due to the lack of suitable habitat within the site, therefore no impact is expected.
<i>Pandion haliaetus</i> Osprey (V, M*)	Requires water bodies for fishing in close proximity (usually <1km) to suitably tall nesting site such as dead tree, power pole etc. Recorded from various sites around Lake Macquarie, Port Stephens and the Hunter River Estuary. Mostly an accidental species in inland / freshwater wetland habitats.	Moderate No nests or individual birds were recorded during the survey, although this species is known from the local area and suitably sized nesting and feeding trees occur within the site. This species is known to hunt within the adjacent Lake Macquarie which is approximately 500m to the south and east of the site. Therefore it is considered that there is at least a moderate chance that it occurs within the site	Low Whilst there is potential nesting and feeding habitat within the site. There are large areas of suitable hunting and nesting habitat within the local and regional areas.

Species / Community	Habitat Description	Chance of Occurrence On Site	Likely Level of Impact
<i>Lophoictinia isura</i> Square-tailed Kite (V)	Inhabits open forests and woodlands, particularly those on fertile soils with abundant passerines. They may also range in nearby open habitats but not into extensive treeless regions. This species is notably absent from alpine regions and small isolated remnant woodlands in large open areas. A record exists to the west near Martinsville, approximately 10 km from the study area (Atlas of NSW Wildlife data).	Low Not recorded during the survey. Whilst this species has been recorded within 10 km of the study area and habitat exists within the study area., this species is rarely recorded locally and its occurrence locally is somewhat sporadic. At best, the site represents a small area of marginal low quality hunting habitat.	Low Potential habitat exists within the study area; however, similar habitat exists in adjacent large tracts of vegetation to the south of the study area. The habitat to be removed is considered to be a small portion of the available habitat in the local area. As such it is considered unlikely that the proposal would adversely affect the species.
<i>Callocephalon fimbriatum</i> Gang-Gang Cockatoo (V)	Found in the summer months in tall mountain forests and woodlands, and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Within the Hunter Region this species occurs in the Watagan Mountains and adjacent areas. Local records exist to the west near Cooranbong and to the north near Rathmines (Atlas of NSW Wildlife data).	Low-Moderate In the local area, at this altitude, this species is generally found within dry-sclerophyll forests in winter. It is possible that it might visit the site infrequently. Breeding occurs within mountainous areas to the west and as such the study area does not offer breeding habitat for the species.	Low The species is considered likely to occur within the study area infrequently. The proposal would require the removal of a relatively small portion (3.17ha) of habitat for the species in the local area and breeding is not likely to occur within the study area. As such it is considered unlikely that the proposal would adversely affect the species.
<i>Calyptorhynchus lathamii</i> Glossy Black-Cockatoo (V)	Occurs in forests and woodlands where it forages predominantly on <i>Allocasuarina</i> cones. Requires large Eucalypt tree hollows for nesting. A number of local records exist around Lake Macquarie (Atlas of NSW Wildlife data).	High This species was recorded during the fauna survey in December 2007 when about six individuals were observed within a Eucalyptus tree in the Open Eucalypt Forest habitat in the western portion of the site. The presence of Black Oak (<i>Allocasuarina littoralis</i>) within the site is a potential food source for this species. Some large hollows that may represent potential nesting habitat were also recorded within the study area.	Moderate Whilst the site offers some feeding and nesting opportunities, conservation-zoned vegetation to the south of the study area is considered likely to offer a large area of similar habitat. However given the confirmed occurrence of this species within the site, it is considered that it should be subject to further assessment.
<i>Lathamus discolor</i> Swift Parrot (E, E*)	On the mainland this species frequents Eucalypt forests and woodlands with large trees having high nectar production during winter. Mainland winter foraging sites often vary from year to year. Nests only in Tasmania, but regularly visits the Hunter Region in winter.	Low - Moderate This species visits the local area from late Autumn to late winter. It feeds on the blossoms of winter-flowering eucalypts and leps occurring on the leaves. Red Bloodwood and Scribbly Gum within the site are likely to provide marginal winter flowering foraging resources for the Swift Parrot.	Low The removal of approximately 3.17ha habitat containing marginal winter flowering foraging resources is considered to be a small portion of the habitat available to the species in the local area. As such it is considered unlikely that the proposal would adversely affect the species.
<i>Ninox connivens</i> Barking Owl (V)	Occurs mainly in dry sclerophyll woodland. Nests in large Eucalypt hollows, and roosts in hollows or thick vegetation. Hunts a range of prey species including birds and both terrestrial and arboreal mammals. A record exists less than 3 km to the south at Sweetwater (Atlas of NSW Wildlife data).	Low Not recorded within the site. The site offers suitable habitat for the Barking Owl; however, coastal records of this species are uncommon. There is considered to be a low chance of occurrence of this species.	Low Whilst some potentially suitable habitat is present, the site is not considered likely to be occur in the local area, therefore the likely level of impact is considered low.
<i>Ninox strenua</i> Powerful Owl (V)	Occurs in sclerophyll forests and woodlands where suitable prey species occur (being predominantly arboreal mammals). Requires large hollows, usually in Eucalypt trees, for nesting. Roosts in dense vegetation within such areas. Numerous records exist near Morisset and a record exists less than 3 km to the south at Sweetwater (Atlas of NSW Wildlife data).	Moderate A number of records for this species occur within the local area and the presence of possums within the site would provide prey for the Powerful Owl. It is considered likely that the site would form a small part of a home-range of a pair of Powerful Owls. Some hollows considered suitable for Powerful Owl nesting (large vertical hollows in tall mature eucalyptus) were observed within the site. Given the close proximity of the site to larger bushland areas to the south and west, it is considered that there is a moderate chance of occurrence of this species.	Low-Moderate Given that the site is relatively small in terms of the home range size requirements of this species, the likely level of impact is considered Low – Moderate.
<i>Tyto novaehollandiae</i> Masked Owl (V)	Found in a range of habitats, locally within sclerophyll forests and woodlands where appropriate / preferred prey species occur (being predominantly terrestrial mammals). Requires large Eucalypt hollows for nesting and prefers to roost in these hollows as well. A number of Masked Owl records exist within 10 km of the study area including near Gwandalan (Atlas of NSW Wildlife data).	Moderate The site contains hollow-bearing trees suitable for nesting, and prey species for the Masked Owl. Whilst the site is relatively small in terms of the requirements for an individual, this site may be part of a larger home range. Given the close proximity of the site to larger bushland areas to the south and west, it is considered that there is a moderate chance of occurrence of this species.	Low - Moderate Given that the site is relatively small in terms of the home range size requirements of this specie, the likely level of impact is considered Low – Moderate.

Species / Community	Habitat Description	Chance of Occurrence On Site	Likely Level of Impact
<i>Xanthomyza phrygia</i> Regent Honeyeater (E, E*)	Nomadic honeyeater that disperses to non-breeding areas, including the coast, in winter, where flowering trees are sought. Within the region, mostly recorded in Box-Ironbark Eucalypt associations along creek flats, river valleys and foothills. Nests mainly west of the divide, although more easterly breeding attempts have occurred at Quorrobolong in the lower Hunter Valley. Uses Swamp Mahogany blossom in the Lake Macquarie LGA intermittently.	Low Not recorded during the survey. This species only uses coastal habitats on an intermittent basis when western blossom is in low abundance. Records for this species occur within 10km of the site, but they may have been made at a time when winter flowering <i>Eucalyptus</i> sp. occurred in higher densities within the vicinity. The Red Bloodwood within the site are not considered of sufficient extent to attract this species on more than an incidental basis.	Low This species is unlikely to be threatened by the proposed development due to minimal habitat opportunity.
Mammals			
<i>Dasyurus maculatus</i> Spotted-tailed Quoll (V, V*)	Found in a variety of forested habitats. This species creates a den in fallen hollow logs or among rocky outcrops. Generally does not occur in otherwise suitable habitats that are in close proximity to urban development. Hunter Region records are largely confined to the surrounding ranges; however, some records do exist locally at Gwandalan, near Rathmines and Eraring (Atlas of NSW Wildlife data).	Low The site contains potential foraging woodland habitat for this species although it lacks large fallen hollow trees required for dens. This species is known to avoid areas of human habitation and potential habitat within the vicinity is adjacent to urban areas.	Low Unlikely to occur based on the proximity of the site to human habitation and the low tolerance of this species to human disturbance. Therefore no significant impact is expected.
<i>Petaurus norfolcensis</i> Squirrel Glider (V)	Occurs in Eucalypt forests and woodlands where it feeds on sap exudates and blossoms. In these areas tree hollows are utilised for nesting sites. Also requires winter foraging resources when the availability of normal food resources may be limited, such as winter-flowering shrub and small tree species. Numerous local records exist within 10 km of the study area, with one less than 3 km to the south near Sweetwater (Atlas of NSW Wildlife data).	Moderate The site is considered potential habitat for Squirrel Glider; however, despite targeted surveys, the species was not recorded. A greater diversity of foraging resources may occur within bushland areas to the south and west of the site. The site is of insufficient area to support gliders, however individuals may utilise woodland areas within the site as part of a home-range. Given the close proximity to larger bushland areas, there is considered to be a moderate likelihood of occurrence.	Low-Moderate Approximately 3.17 ha of potential Squirrel Glider foraging habitat and 25 hollow-bearing trees would be removed as a result of the proposal.
<i>Petaurus australis</i> Yellow-bellied Glider (V)	The Yellow-bellied Glider is distributed along the coast and mountain ranges of eastern Australia from central Queensland to south-east Victorian. Known to occur in a variety of habitats, Yellow-bellied Gliders are usually associated with tall, mature wet eucalypt forest, but are also known from tall dry open forest and mature woodland. The diverse diet of this species is primarily made up of eucalypt nectar, eucalypt sap, honey dew, manna and invertebrates found under decorticating bark and pollen. The shedding of bark by tree species is considered important for the gathering of invertebrates and honeydew. Hollows for nest sites are essential, as are suitable food trees. Den sites are often located in mature, living smooth-barked eucalypts. The species occupies large and exclusive home ranges of approximately 30-65 ha, with little overlap of adjacent groups.	Low Not recorded within the site during the surveys. The site could be considered potential albeit marginal habitat at best. Records within the proximate area are rare for this species. A greater diversity and area of foraging resources may occur within bushland areas to the south and west of the site. The site is of insufficient area to support gliders.	Low Unlikely to occur within the site and therefore low likelihood of potential impact.
<i>Phascolarctos cinereus</i> Koala (V)	Occurs in forests and woodlands where it requires suitable feed trees (particular <i>Eucalyptus</i> spp.) and habitat linkages. Will occasionally cross open areas, although it becomes more vulnerable to predator attack and road mortality during these excursions. Records from the Lower Hunter Region are largely confined to the greater Port Stephens area, the Lake Macquarie hinterland and the Watagan Mountains, with a small number of records from Cessnock LGA (DEC 2005). Local records include mainly historical records from Morisset and Pulbah Island in Lake Macquarie. Two more recent records do exist within 10 km including a record from 1986 at Wangi Point and one from 1996 at Mannering Park (Atlas of NSW Wildlife data).	Low Habitat within the site does represent potential Koala habitat as defined by SEPP 44 due to the occurrence of <i>Eucalyptus haemastoma</i> within the site. However the site cannot be considered to constitute core Koala habitat as defined within SEPP 44 due to the lack of recent records for this species in the vicinity of the study area and despite targeted surveys for the species.	Low Unlikely to occur based on the lack of evidence of the occurrence of this species within the sites. Therefore no significant impact is expected.

Species / Community	Habitat Description	Chance of Occurrence On Site	Likely Level of Impact
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (V, V*)	Forages over a large area for nectar / fruits etc. Roosts in communal base camps situated within wet sclerophyll forests or rainforest. Likely to forage in Eucalypts when flowering.	Moderate-High This species has been observed in the local area and is known to range widely to access the seasonal blossom of <i>Eucalyptus</i> species. It is therefore likely that it would use habitat within the site when resources are available. The site is not known to be used by this species as a roosting camp.	Low-Moderate No roosting habitat (camps) exists within the study area and 3.17ha of foraging habitat that would be removed as a result of the proposal is considered to be a relatively small amount of the habitat available to Grey-headed Flying Fox in the local area. As such the proposal is considered to be unlikely to adversely affect the species.
<i>Miniopterus australis</i> Little Bentwing-bat (V)	Prefers to forage in well-vegetated areas, such as within wet and dry sclerophyll forests and rainforests. Requires caves or similar structures for roosting habitat.	Moderate The site provides foraging habitat for this species, but there are no roosting opportunities within the vicinity of the site. Given the high mobility of this species, there is a moderate chance of it occurring within the site to forage on at least an intermittent basis.	Low-Moderate No roosting habitat (caves and similar) exists within the site. The potential area of foraging habitat that would be removed as a result of the proposal is considered to be relatively small in terms of available foraging habitat on a local and regional basis. As such the proposal is considered to be unlikely to adversely affect the species.
<i>Miniopterus schreibersii</i> Eastern Bentwing-Bat (V)	This species utilises a range of habitats for foraging, including rainforest, wet and dry sclerophyll forests, woodlands and open grasslands. Requires caves or similar structures for roosting habitat.	High This species was recorded active within the site during the survey. The site provides foraging habitat for both this species, but there are no roosting opportunities within the vicinity of the site. Given the high mobility of this species, there is a high chance of this species occurring within the site to forage on at least an intermittent basis.	Low-Moderate No roosting habitat (caves and similar) exists within the site. The potential area of foraging habitat that would be removed as a result of the proposal is considered to be relatively small in terms of available foraging habitat on a local and regional basis. However since this species has been confirmed as using the site to forage, there is at least a moderate likelihood of impact as a result of the proposed development.
<i>Myotis adversus</i> Large-footed Myotis (V)	Usually found near bodies of water, including estuaries, lakes, reservoirs, rivers and large streams, often in close proximity to their roost site. Although usually recorded foraging over wet areas, it also utilises a variety of wooded habitats adjacent to such areas including rainforest, wet and dry sclerophyll forest, woodland, and swamp forest. Roosts in caves, mines and disused railway tunnels.	Moderate The site provides foraging habitat for this species, but there are no roosting opportunities within the vicinity of the site. Given the high mobility of this species, there is a moderate chance of it occurring within the site to forage on at least an intermittent basis.	Low-Moderate No roosting habitat (caves and similar) exists within the site. The potential area of foraging habitat that would be removed as a result of the proposal is considered to be relatively small in terms of available foraging habitat on a local and regional basis. As such the proposal is considered to be unlikely to adversely affect the species.
<i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle (V)	This species is found in a variety of forest types such as open forests, woodlands and wetter sclerophyll forests (usually with trees >20m). This species roosts in tree hollows. Appears to locally favour upland habitats. A limited number of records occur on the central coast and the Lower Hunter Region (Atlas of NSW Wildlife data).	Moderate Although not recorded within the site this species is far ranging in its foraging movements and is likely to use the site on at least an intermittent basis. The site provides foraging habitat for this species and it may roost within tree hollows on the site and within its vicinity.	Low-Moderate The 6.38ha of foraging habitat and roosting habitat that would be removed as a result of the proposal is considered to be a small amount of the habitat available to the species in the local area, particularly considering the conservation-zoned land to the south. As such the proposal is considered to be unlikely to adversely affect the species.
<i>Saccolaimus flaviventris</i> Yellow-bellied Sheath-tail-bat (V)	Range of habitats from rainforest to arid shrubland, roosts in tree-hollows. A limited number of records occur on the central coast and the Lower Hunter Region (Atlas of NSW Wildlife data).	Moderate Although not recorded within the site this species is far ranging in its foraging movements and is likely to use the site on at least an intermittent basis. The site provides foraging habitat for this species and it may roost within tree hollows on the site or within its vicinity.	Low-Moderate The 6.38ha of foraging habitat and roosting habitat that would be removed as a result of the proposal is considered to be a small amount of the habitat available to the species in the local area, particularly considering the conservation-zoned land to the south. As such the proposal is considered to be unlikely to adversely affect the species.
<i>Mormopterus norfolkensis</i> Eastern Freetail-bat (V)	This species forages predominantly in dry forests and woodlands east of the divide. It roosts in tree hollows, under bark and within man-made structures.	High This species was recorded active within the site during the survey. The site provides both foraging and roosting habitat for this species. Therefore there is a moderate chance of its occurrence within the site.	Low-Moderate The 6.38ha of foraging habitat and roosting habitat that would be removed as a result of the proposal is considered to be a small amount of the habitat available to the species in the local area, particularly considering the conservation-zoned land to the south. . However since this species has been confirmed as using the site to forage, there is at least a moderate likelihood of impact as a result of the proposed development.

Species / Community	Habitat Description	Chance of Occurrence On Site	Likely Level of Impact
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat (V)	Forages in moister gullies and wet sclerophyll forests as well as in lightly wooded areas and open spaces / ecotones. This species roosts in tree hollows.	Moderate The site provides both foraging and roosting habitat for this species. Therefore there is a moderate chance of its occurrence within the site.	Moderate The 6.38ha of foraging habitat and roosting habitat that would be removed as a result of the proposal is considered to be a small amount of the habitat available to the species in the local area, particularly considering the conservation-zoned land to the south. As such the proposal is considered to be unlikely to adversely affect the species.
<i>Vespadelus troughtoni</i> Eastern Cave Bat (V)	A cave dweller, known from wet sclerophyll forest and tropical woodlands from the coast and Dividing Range to the drier forests of the semi-arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally in buildings. In all situations, the roost sites are frequently in reasonably well-lit areas. Two records exist within 10 km, one near Toronto to the north of the study area and at Bonnell's Bay, less than 3 km to the south-west of the study area.	Low - Moderate Local records exist for the species and suitable foraging habitat exists within the study area. However, the species is commonly found on the north coast of NSW and local records are considered to represent the occasional presence of the species.	Low -Moderate No roosting habitat (caves and similar) exists within the site. The potential area of foraging habitat that would be removed as a result of the proposal is considered to be relatively small in terms of available foraging habitat on a local and regional basis. As such the proposal is considered to be unlikely to adversely affect the species.
Endangered Populations			
<i>Eucalyptus parramattensis</i> subsp.parramattensis Endangered Population in Wyong and Lake Macquarie LGA's	The current population within Lake Macquarie LGA is 10 individuals and a record exists for this population near Moonee to the east of the study area (Atlas of NSW Wildlife data).	Low No <i>Eucalyptus parramattensis</i> was recorded within the study area during investigations and the Lake Macquarie LGA population is not known to extend to the study area.	Low Unlikely to occur based on the lack of suitable habitat within the site, therefore no significant impact is expected.
Endangered Ecological Communities			
Coastal Saltmarsh in the North Coast Bioregion	Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner occurs in the intertidal zone on the shores of estuaries and lagoons, including when they are intermittently closed along the NSW coast. Classified by the Lower Hunter Central Coast Regional Biodiversity Conservation Strategy (LHCCREMS) as Map Unit (MU) 47a.	Low – The floristic composition and geomorphological characteristics of this Endangered Ecological Community are not present within the site.	Low – The likely level of impact is considered negligible given this community was not found to exist on site.
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bio-regions	Associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influence in some wetlands. They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. Wetlands or parts of wetlands that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants including <i>Paspalum distichum</i> , <i>Leersia hexandra</i> and <i>Carex appressa</i> . Wetlands or parts of wetlands subject to regular inundation and drying may include large emergent sedges over 1 metre tall, such as <i>Baumea articulata</i> , <i>Eleocharis equisetina</i> and <i>Lepironia articulata</i> .	Low – The floristic composition and geomorphological characteristics of this Endangered Ecological Community are not present within the site.	Low – The likely level of impact is considered negligible given this community was not found to exist on site.

Species / Community	Habitat Description	Chance of Occurrence On Site	Likely Level of Impact
River-flat Eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bio-regions	Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include <i>Eucalyptus tereticornis</i> (Forest Red Gum), <i>E. amplifolia</i> (Cabbage Gum), <i>Angophora floribunda</i> (Rough-barked Apple) and <i>A. subvelutina</i> (Broad-leaved Apple). Correlates with LHCCREMS communities - 'Central Hunter Riparian Forest' Map Unit (MU) 13, 'Wollombi Redgum-River Oak Woodland' MU14 and 'Redgum Roughbarked Apple Swamp Forest' MU38.	Low – The floristic composition and geomorphological characteristics of this Endangered Ecological Community are not present within the site.	Low – The likely level of impact is considered negligible given this community was not found to exist on site.
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bio-regions	This community is associated with periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains, typically occurring on grey-black clay-loams and sandy loams. Usually occurring below 20 m altitude.	Low – The floristic composition and geomorphological characteristics of this Endangered Ecological Community are not present within the site.	Low – The likely level of impact is considered negligible given this community was not found to exist on site.
Swamp Sclerophyll Forest on Coastal Floodplains	The community is associated with humic clay or sandy loams on waterlogged or episodically flooded alluvial flats and drainage lines within coastal floodplains. It is generally characterised by an open to dense canopy of eucalypts and / or paperbarks. Canopy heights generally vary from 8m to 25m depending on species composition. In the Hunter Region the canopy often contains <i>Eucalyptus robusta</i> and / or <i>Melaleuca quinquinervia</i> although other plant species, such as <i>Callistemon salignus</i> , <i>Casuarina glauca</i> , <i>Eucalyptus resinifera</i> subsp. <i>hemilampra</i> , <i>Livistona australis</i> may be present. Small trees and shrubs, including <i>Melaleuca</i> sp., <i>Glochidial ferdinandi</i> , <i>Acacia</i> sp. <i>Leptospermum polygalifolium</i> subsp. <i>polygalifolium</i> and <i>Dodanaea triquetra</i> , are often present in the lower strata. Correlates with LHCCREMS Map Unit (MU) 42 'Riparian Melaleuca Swamp Woodland', MU42a – 'Melaleuca Scrub', MU43 – 'Wyong Paperbark Swamp Forest' and MU43a – 'Melaleuca Scrub'.	Low – The floristic composition and geomorphological characteristics of this Endangered Ecological Community are not present within the site.	Low – The likely level of impact is considered negligible given this community was not found to exist on site.

Key: (V) = Vulnerable Species listed under Threatened Species Conservation Act 1995 (TSC Act 1995).
 (E) = Endangered Species listed under TSC Act 1995.
 (V*) = Vulnerable Species listed under Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999).
 (E*) = Endangered Species listed under EPBC Act 1999.
 (CE*) = Critically Endangered Species listed under EPBC Act 1999
 (M*) = Listed as a Migratory species under the EPBC Act 1999

4.2 Assessment on Threatened Species / Communities

4.2.1 FLORA

As per the assessment carried out within Table 4-1, the following species / communities have been deemed appropriate to be applied further detailed assessment due to the likely presence or projected potential levels of impacts likely to result from the proposal.

<i>Diuris praecox</i>	Newcastle Doubletail
<i>Caladenia tessellata</i>	Tessellated Spider Orchid
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid
<i>Tetraloche juncea</i>	Black-eyed Susan

4.2.2 FAUNA

The following species depicted below are considered to have suitable or sub-optimal habitat within the site.

<i>Pandion haliaetus</i>	Osprey
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo
<i>Lathamus discolor</i>	Swift Parrot
<i>Ninox strenua</i>	Powerful Owl
<i>Tyto novaehollandiae</i>	Masked Owl
<i>Petaurus norfolcensis</i>	Squirrel Glider
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox

Hollow Dwelling Bats

<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail Bat
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat

Cave Dwelling Bats

<i>Miniopterus australis</i>	Little Bentwing-bat
<i>Miniopterus schreibersii</i>	Eastern Bentwing-bat
<i>Myotis adversus</i>	Large-footed Myotis
<i>Vespertilio troughtoni</i>	Eastern Cave Bat

4.2.3 Threatened Flora

Cryptostylis hunteriana

Leafless Tongue Orchid

Habitat exists within the western woodland portion of the site, and other *Cryptostylis* species were also recorded. However, the species was not recorded during the field investigations during the flowering period for this species. The area of potential habitat of approximately 1.17ha being removed as a result of the proposal is considered to be a small portion of the available habitat within the local area, particularly considering the conservation-zoned vegetation to the south of the study area. As such the proposal is considered unlikely to cause an adverse effect on the lifecycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Diuris praecox**Newcastle Doubletail**

Habitat exists within the western woodland portion of the site, and other orchids having similar habitat requirements were recorded. However, the species was not recorded during the field investigations during the flowering period for this species. The area of potential habitat of approximately 1.17ha being removed as a result of the proposal is considered to be a small portion of the available habitat within the local area, particularly considering the conservation-zoned vegetation to the south of the study area. As such the proposal is considered unlikely to cause an adverse effect on the lifecycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Caladenia tessellata**Tessellated Spider Orchid**

Habitat exists within the western woodland portion of the site, and other orchids having similar habitat requirements were recorded. However, the species was not recorded during the field investigations during the flowering period for this species. The area of potential habitat of approximately 1.17ha being removed as a result of the proposal is considered to be a small portion of the available habitat within the local area, particularly considering the conservation-zoned vegetation to the south of the study area. As such the proposal is considered unlikely to cause an adverse effect on the lifecycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Tetraloche juncea**Black-eyed Susan**

Suitable habitat exists in the western woodland portion of the site, and the survey undertaken in December 2007 is close to the peak flowering period for this species. The area of potential habitat of approximately 1.17ha being removed as a result of the proposal is considered to be a small portion of the available habitat within the local area, particularly considering the conservation-zoned vegetation to the south of the study area. As such the proposal is considered unlikely to cause an adverse effect on the lifecycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

4.2.4 Threatened Fauna***Pandion haliaetus*****Osprey**

Suitable nesting habitat occurs within the study area and the Osprey is known to forage within Lake Macquarie. However, no nests were observed within the study area and the 3.17ha of potential habitat to be removed as a result of the proposal is considered to be a small portion of the available habitat within the local area, particularly considering the conservation-zoned vegetation to the south of the study area. As such the proposal is considered unlikely to cause an adverse effect on the lifecycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Callocephalon fimbriatum**Gang-Gang Cockatoo**

Potential habitat for the Gang-gang Cockatoo occurs within canopy trees of the study area. However, the species is not known to breed close to the coast in the region and the 3.17ha of potential habitat to be removed as a result of the proposal is

considered to be a small portion of the available habitat within the local area, particularly considering the conservation-zoned vegetation to the south of the study area. As such the proposal is considered unlikely to cause an adverse effect on the lifecycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Calyptorhynchus lathami**Glossy Black-Cockatoo**

The Glossy Black Cockatoo was recorded within the study area and foraging habitat in the form of Allocasuarina trees were scattered throughout the site. The Open Eucalypt Forest and the Modified Eucalypt Forest which make up approximately 3.17ha which is to be removed as a result of the proposal which contains 24 hollow-bearing trees is considered to be a small amount of the foraging and nesting habitat available to the species in the local area. Larger tracts greater than 100ha of quality vegetation exist within Koombahtoo Aboriginal Reserve approximately 30m to the south. As such it is considered unlikely that the proposal would have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction. There may be opportunity to retain some of these hollows within the residential lots.

Lathamus discolor**Swift Parrot**

Potential foraging habitat for this species occurs as winter-flowering *Eucalyptus*. However, the species does not breed locally and the 3.17ha of potential habitat to be removed as a result of the proposal is considered to be a small portion of the available habitat within the local area, particularly considering the conservation-zoned vegetation to the south of the study area. As such the proposal is considered unlikely to cause an adverse effect on the lifecycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Ninox strenua**Powerful Owl**

Due to the presence of arboreal mammals, roosting habitat and a number of records of this species within the local area, the site has the potential to represent part of the home range of individuals of this species. The proposal would remove a small portion (approximately 3.17ha) of the available foraging habitat for the Powerful Owl and its prey species (possums) in the local area. Hollow-bearing trees considered suitable for Powerful Owl nesting sites were recorded within the study area and as such it is considered likely that the study area contains suitable breeding habitat. Considering that the proposal would remove a small portion of the foraging habitat available to the Powerful Owl within the local area and the species is known to persist in suburban areas, it is considered unlikely that the proposal would have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Tyto novaehollandiae**Masked Owl**

Due to the presence of arboreal mammals, roosting habitat and a number of records of this species within the local area, the site has the potential to represent part of the home range of individuals of this species. The proposal would remove a small portion (approximately 3.17ha) of the available foraging habitat for the Masked Owl and its prey species within the local area. Hollow-bearing trees considered suitable for this species nesting sites were recorded within the study area and as such it is considered likely that the study area contains suitable breeding habitat. Considering

that the proposal would remove a small portion of the foraging habitat available to this species within the local area and the species is known to persist in suburban areas, it is considered unlikely that the proposal would have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Petaurus norfolcensis

Squirrel Glider

Squirrel Glider was not recorded within the study area despite targeted trapping and spotlighting surveys. However, suitable foraging and den habitat does exist across the study area and a record exists less than 3 km to the east. The portion of habitat to be removed as a result of the proposal (approximately 3.17ha) is considered to be a small portion of the habitat available to the species within the local area, particularly conservation-zoned land to the south of the study area. It is considered unlikely that the proposal would have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Pteropus poliocephalus

Grey-headed Flying Fox

The Grey-headed Flying Fox is considered to be highly likely to forage on flowering Myrtaceous canopy species within the study area. However, the portion of habitat to be removed as a result of the proposal (approximately 3.17ha) is considered to be a small portion of the habitat available to the species within the local area, particularly considering conservation-zoned land to the south of the study area. Additionally, ornamental plantings in residential development are likely to provide some foraging opportunities for Grey-headed Flying Fox subsequent to development. As such it is considered unlikely that the proposal would have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Hollow Dwelling Bats

Falsistrellus tasmaniensis
Mormopterus norfolkensis
Saccolaimus flaviventris
Scoteanax rueppellii

Eastern False Pipistrelle
Eastern Freetail-bat
Yellow-bellied Sheath-tail Bat
Greater Broad-nosed Bat

M. norfolkensis, was identified within the site during the survey. The other three species *F. tasmaniensis*, *S. flaviventris*, and *S. rueppellii* were considered likely to occur within the study area on at least an occasional basis due to the presence of local records and suitable habitat. The potential foraging habitat for hollow-dwelling microchiropteran bat species and 24 hollow-bearing trees would be removed as a result of the proposal. However, foraging habitat within the study area is considered to represent a small amount of the foraging habitat available to the species' within the local area, particularly considering the conservation-zoned lands to the south of the study area. Additionally, similar hollow-bearing tree are likely to be found within adjacent conservation-zoned lands to the south of the study area. It is considered unlikely that the proposal would have an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction.

Cave Dwelling Bats

Miniopterus australis
Miniopterus schreibersii
Myotis adversus
Vespadelus troughtoni

Little Bentwing-bat
Eastern Bentwing-bat
Large-footed Myotis
Eastern Cave Bat

M. schreibersii was identified within the site during the survey. *M. adversus*, *M. australis*, and *V. troughtoni* were considered likely to occur within the study area on at least an occasional basis due to the presence of local records and suitable habitat. Approximately 6.38ha of foraging habitat for cave-dwelling microchiropteran bat species would be removed as a result of the proposal. However, foraging habitat within the study area is considered to represent a small amount of the foraging habitat available to the species' within the local area, particularly considering the conservation-zoned lands to the south of the study area. Additionally, no cave habitat was identified within the study area and as such no breeding or roosting habitat for cave-roosting species would be affected by the proposal. As such it is considered unlikely that the proposal would have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

4.2.5 Threatened Populations

No populations of any of the species considered for this assessment (that are relevant to this locality) have been identified under Part 2 of Schedule 1 of the *TSC Act 1995*.

4.2.6 Endangered Ecological Communities

No endangered ecological communities were recorded within the site during the surveys of the site. A number of EEC's have been identified as occurring within the locality of the site which have been detailed within Table 4.1. No EEC's are likely to be impacted upon as a result of the proposal.

4.2.7 Habitat Removal

Approximately 1.17ha of woodland habitat that is potentially suitable to support the following flora species would be removed as a result of the proposed development:

<i>Diuris praecox</i>	Newcastle Doubletail
<i>Caladenia tessellate</i>	Tessellated Spider Orchid
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid
<i>Tetratheca juncea</i>	Black-eyed Susan

Approximately 6.38ha of foraging or nesting habitat for all threatened fauna species considered likely to occur would be removed as a result of the proposal. In addition, potential nesting or breeding habitat for the following species would also be removed:

<i>Pandion haliaetus</i>	Osprey (3.17ha)
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (3.17ha)
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (3.17ha)
<i>Ninox strenua</i>	Powerful Owl (3.17ha)
<i>Tyto novaehollandiae</i>	Masked Owl (3.17ha)
<i>Petaurus norfolcensis</i>	Squirrel Glider (3.17ha)

Hollow Dwelling Bats*Falsistrellus tasmaniensis*

Eastern False Pipistrelle (6.38)

Mormopterus norfolkensis

Eastern Freetail-bat (6.38)

Saccolaimus flaviventris

Yellow-bellied Sheath-tail Bat (6.38)

Scoteanax rueppellii

Greater Broad-nosed Bat (6.38)

4.2.8 Habitat Fragmentation

The site is connected to more extensive vegetation to the west and south of the study area, with residential development forming the northern boundary of the site. As such the removal of 6.38ha of vegetation within the site would not fragment or isolate other areas of habitat. However, a small reduction in the overall fragment size would occur as a result of the proposal.

The vegetation within the western portion of site currently forms part of a vegetated corridor which connects vegetation north-south across Morisset Park Road. This corridor will be slightly reduced as a result of the proposal. Threatened fauna species such as Squirrel Gliders which have been recorded within the locality will still be able to traverse across the vegetated corridor to adjacent lands. It is considered that the proposal will not fragment areas of vegetation within the site or restrict fauna movements across vegetated corridors.

4.3 Key Threatening Processes

A Key Threatening Process (KTP) is defined in the TSC Act (1995) as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities. Some can be a threat if it:

- Adversely affects two or more threatened species, populations or ecological communities; or
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

Key Threatening Processes are listed in Schedule 3 of the *TSC Act 1995*. Those potentially applicable to the proposal are as follows:

- Loss of Hollow-bearing trees;
- Clearing of native vegetation;
- Human-caused climate change;
- Infection of native plants by *Phytophthora cinnamomi*;
- Invasion of native plant communities by exotic perennial grasses;
- Removal of dead wood and dead trees;
- Predation by the Feral Cat; and
- *Lantana camara*.

Loss of Hollow-bearing trees

The proposed development will require the removal of 24 hollow-bearing trees as such could contribute to the KTP “Loss of Hollow Bearing Trees”.

Although hollow-dwelling Microchiropteran bats may use hollows on the site for shelter on an intermittent basis the securing of large areas of potential roosting habitat exist within surrounding lands.

Although not recorded Squirrel Gliders potentially occurring within the Development Estate may be adversely affected by the removal of hollow-bearing trees, due to their use of this habitat resource for nesting purposes. However, large areas of suitable habitat for this species exist in the locality of the site.

There are few large hollow-bearing trees occurring within the site of the Development Estate that are suitable for the breeding purposes of forest owl species. The removal of these resources will not likely adversely affect Powerful and Masked Owls that might potentially use the site for breeding purposes. Nevertheless, large areas of suitable breeding habitat for these species occur within the locality of the site.

It is considered that although the proposal is likely to represent a loss of locally occurring hollow-bearing trees, these losses are small and at this scale represents a small cumulative impact and as such it is unlikely to significantly contribute to this process on a regional scale.

Clearing of Native Vegetation

The proposed development will require the removal 6.38ha of native vegetation and as such is considered to contribute to the Key Threatening Process “Clearing of Native Vegetation”. Vegetation that will be removed for the development estate will include native vegetation and disturbed native vegetation.

A number of threatened fauna guilds potentially use these lands for foraging, including, insectivorous Microchiropteran bats, nectivorous species such as flying-foxes, birds and arboreal mammals and forest owls. As such removal of vegetation within the development estate has the potential to impact upon local populations of dependant species. Those threatened species, including potentially occurring species, which may be affected by the proposal include, Squirrel Gliders, Grey-headed Flying-foxes and Microchiropteran bats. It is considered that although the proposal is likely to represent a loss of locally occurring native vegetation, these losses are small in view of larger better quality stands within the locality.

A small area of suitable habitat for threatened flora species, which are considered to potentially to occur will be removed as a result of the proposal.

For all of these species, it is considered that the removal of vegetation from within the site will not represent a significant impact upon locally occurring entities, in light of the much greater areas of similar or higher quality habitat within the locality of the site, although vegetation removal must be viewed as an incremental loss of potential habitat for these species.

Human caused climate change

The proposal is likely to contribute to the Key Threatening Process “Human Caused Climate Change” as a result of clearing vegetation. It is considered that clearing and modification of the landscape would constitute only a minor incremental increase in the effects of this KTP. Thus the extent to which the proposal could contribute to this process is considered unlikely to be significant.

Infection of native plants by *Phytophthora cinnamomi*

Phytophthora cinnamomi is a water mould (like a fungus) that attacks the roots of susceptible plants, in many cases killing the plants. In some native plant

communities, epidemic disease can develop causing death of large numbers of plants.

P. cinnamomi may spread with the movement of infected soil or plant material by people, animals and may be transported by percolating through the soil, in creeks or stormwater runoff. People can also transport the fungus to new areas on dirt adhering to vehicles, items they are carrying or footwear.

Humans have the capacity to spread the fungus long distances and across barriers which sets us apart from the natural mechanisms which normally spread this water mould. Therefore, not a lot can be done to control the natural spread of the water mould or to destroy it, in native plant communities. Due to the use of heavy machinery that will be used for construction of the development estate there is opportunity for the KTP “Infection of native plants by *Phytophthora cinnamomi*”. The transportation of *Phytophthora cinnamomi* from other areas may occur by the movement of soils attached to earth moving machinery. Precautionary measures such as clearing of machinery prior to clearing can help to limit the potential for this KTP to occur, and should be addressed in Environment Management plans generated for site construction activities.

Invasion of native plant communities by exotic perennial grasses

There is opportunity for the KTP “Invasion of native plant communities by exotic perennial grasses” to occur within the site due to the removal of vegetation and the exposing of underlying soils. For the most part, this KTP already occurs within weeds and cleared areas of the site. It is expected that those measures employed to reduce potential sediment and erosional impacts to surrounding areas will contribute to minimising the potential for this KTP to impact upon surrounding lands.

Removal of dead wood and dead trees

During the clearing of vegetation within the site a number of dead trees are likely to be removed and this may represent opportunity for the KTP “Removal of dead trees and dead wood”. Within the development estate land there is a relatively low incidence of these habitat attributes and it is unlikely that this KTP will represent a significant threat to threatened species occurring within the site, provided an ecologist is present during clearing works. Consideration should be given to selective relocation of dead trees and logs.

Predation by feral cats

The increase of industrial development within the area has the potential to increase opportunities for the KTP “Predation by feral cats”. This KTP is unlikely to significantly impact upon local wildlife provided responsible pet ownership is encouraged and adopted.

Lantana camara

There is a small opportunity for *Lantana camara* to establish, due to the removal of canopy vegetation and the exposing of underlying soils. This exotic plant species already occurs within the site in relatively low densities in the eucalypt Forest. It is likely that the development will considerably reduce the incidence of *Lantana* within the development estate. Nevertheless there will still be opportunities for this KTP at the edges of the development without appropriate management. It is expected that

those measures employed to reduce potential sediment and erosional impacts to surrounding areas will contribute to minimising the potential for this KTP.

No other KTP's are believed to be relevant to the current proposal.

4.4 SEPP 44 (Koala Habitat Protection)

This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

4.4.1 First Consideration – Is the Land ‘Potential Koala Habitat’?

Schedule 2 of State Environmental Planning Policy (SEPP) No. 44 – ‘Koala Habitat Protection’ lists 10 tree species that are considered indicators of ‘Potential Koala Habitat’. The presence of any of the species listed on a site proposed for development triggers the requirement for an assessment for ‘Potential Koala Habitat’. SEPP 44 defines potential Koala Habitat as:

“areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component”.

One tree species listed in Schedule 2 of SEPP No. 44 – ‘Koala Habitat Protection’ occurs on site, namely Scribbly Gum (*Eucalyptus haemastoma*). This tree species occurs across the study area within Open *Eucalyptus* Forest community together with other non-Koala feed tree species. Scribbly Gum occurs at a density of greater than 15%. Therefore, the site is considered to constitute ‘Potential Koala Habitat’ as defined by the SEPP.

4.4.2 Second Consideration – Is the Land ‘Core Koala Habitat’?

SEPP 44 defines core Koala habitat as:

“an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.”

Direct searches of Koala within the study area included spotlighting and call playback of Koala vocalisations. Indirect searches for evidence of Koala included searches for scats and scratches on tree trunks, particularly targeting primary browse species. No evidence of Koala was found within the study area and no individuals were observed.

As a result the study area was not considered to constitute core Koala habitat under SEPP 44 and no further provisions of the SEPP 44 apply to the study area.

5 CONSIDERATIONS UNDER THE EP&BC ACT 1999

Considerations have been made to the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999 (EP&BC Act 1999)*. Searches of the Environment Australia On-line Database were undertaken to gather baseline data on the site and general locality. This data, combined with other local knowledge and records, was utilised to assess whether the type of activity proposed on the site will have, or is likely to have a significant impact upon a matter of National Environmental Significance (NES), or on the environment of Commonwealth land*.

- The site is not land owned by the Commonwealth, and hence this portion of the Act is not applicable. The matters of NES and site-specific responses are listed below.
- *World Heritage areas:*

The site is not a World Heritage area, and is not in close proximity to any such area.

- *Wetlands protected by international treaty (the RAMSAR convention):*

The site is not part of any RAMSAR Wetland area, and is not in proximity to any such area.

- *Nationally listed threatened species and ecological communities:*

No Nationally listed threatened species and ecological communities were recorded within the site. All potentially occurring threatened species listed within the *EP&BC Act 1999* have been considered by this proposal specifically in relation to potential impacts under state legislation. All threatened species, whether state or federally listed, that could potentially be affected by the proposed development have been assessed within this report in the Significant Species Assessment Table 4.1. In each case, these species were found unlikely to be significantly affected by any proposed activity within the site.

- *Nationally listed migratory species:*

No listed migratory species were observed during field surveys. It considered highly unlikely that activity on the site would significantly affect populations or habitat availability for any listed migratory species, nor upset migratory patterns.

All nuclear actions:

No type of nuclear activity is proposed for the site.

- *The environment of commonwealth marine areas:*

The proposed activity on the site will not have a significantly adverse effect on any commonwealth marine area.

Conclusion:

Based on the above, it is considered the current proposal will not have a significant impact on any matters of NES under the *EPBC Act (1999)*; hence referral to the DEW is not necessary.

6 KEY THRESHOLDS ASSESSMENT (PART 3A)

As required by the Draft *Guidelines for Threatened Species Assessment* for Part 3A applications (DEC / DPI 2005), the following assessment of Key Thresholds (four in total) is provided for the proposed development estate upon the site.

Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.

It is considered that the information presented within this document, in particular the recommendations below will avoid or mitigate the impacts upon biodiversity as a result of the proposed development.

Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.

The threatened species, populations and ecological communities considered within the report occurring within the proposed development estate are well represented in the wider locality, and are also represented or have potential habitat within adjacent surrounding lands and therefore it is considered unlikely that the proposal will reduce the long-term viability of a local population of any threatened species or endangered ecological community.

Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.

The threatened species, populations and ecological communities considered within the report occurring within the proposed development estate are well represented in the wider locality, and are also represented or have potential habitat within adjacent surrounding lands and therefore it is considered unlikely that the proposal will place any threatened species, endangered populations or endangered ecological communities at risk of extinction.

Whether or not the proposal will adversely affect critical habitat.

There is no declared “Critical Habitat” within the site locality, and as such the proposal will not adversely affect any such habitat.

7 CONCLUSIONS

Flora, fauna and habitat studies have been undertaken over land proposed for subdivision at Lot 9 DP 244002 and Lot 358 DP755242 Chifley Road and Morisset Park Road, Morisset Park.

This report aims to recognise the relevant requirements to assess the proposal under Part 3A of the *Environmental Planning and Assessment Act 1979*. This report includes the results of two ecological investigations undertaken within the above mentioned lands, and incorporated the results of both studies. RPS HSO staff carried out these ecological studies in May 2003 and December 2007. Due recognition and consideration of the *Threatened Species Conservation Act 1995*, *Environmental Protection and Biodiversity Conservation Act 1999*, *Fisheries Management Act 1994* has been made throughout this assessment. Assessment of the site under the requirements of State Environmental Planning Policy No. 44 (SEPP 44) – ‘Koala Habitat Protection’ is included. Director General’s Environmental Assessment Requirements (DGEAR’s) were issued for the site in June 2008.

The site has been found to contain four distinct vegetation assemblages, being Open Eucalypt Forest, Modified Open Eucalypt Forest, Grassland with Scattered Trees and Exotic Plantation. The forest is deemed to provide some viable habitat for a number of native flora and fauna species, including threatened species known from the vicinity of the site.

No threatened flora species were detected within the site despite targeted searches. Four threatened plant species including Rough Double Tail (*Diuris praecox*), Leafless Tongue Orchid (*Cryptostylis hunteriana*), Tessellated Spider Orchid (*Caladenia tessellata*) and Black-eyed Susan (*Tetralthea juncea*) were assessed as having moderate likelihood of occurrence within the site, specifically the Open Eucalyptus Forest in the western portion. This was based on characteristics of habitat and on the presence of indicator species being several non-threatened orchid species. The assessment concluded that whilst there is some potential for their occurrence, habitat lost on this scale through the proposed development would be incrementally small and negligible.

One threatened bird species, Glossy Black Cockatoo (*Calyptorhynchus lathamii*) was recorded within the site. Suitable nesting hollows within *Eucalyptus* trees occur within the site, and the sparse presence of a known feed tree *Allocasuarina littoralis* for this bird highlights a degree of significance of the site for this species. Two threatened bat species were recorded on site, being *Mormopterus norfolkensis* (Eastern Freetail-bat) and *Miniopterus schreibersii* (Large Bentwing-bat). Both of these species have generalist hunting habitat requirements, utilising a variety of treed habitats.

M. norfolkensis, roosts predominantly in tree hollows. As such, it has been recommended that as many hollow-bearing trees be retained as possible within any project design and with regard to public safety. This should ensure that roosting habitat is maintained for this species on the site. Should any hollow-bearing trees be required to be removed (such as for safety reasons), then it is recommended that a qualified ecologist / consultant be present during tree-felling to recover any potentially displaced animals. Artificial nest-boxes or relocated hollows that have been removed could also be employed to potentially offset the impact of removing any hollow-bearing trees.

Therefore, due to the occurrence of suitable foraging and nesting habitat both locally and regionally, the improbability of the development to disrupt local foraging patterns,

the maximum retention of potential roosting and nesting habitat on the site combined with the species high mobility, it is considered unlikely that the proposal would disrupt the life cycle of any viable local population such that a local extinction would occur.

No evidence of the Squirrel Glider (*P. norfolcensis*) was found on site during the fieldwork undertaken. Trees containing suitably-sized hollows exist for this species on the site. Whilst it has been broadly recommended that as many as possible of hollow-bearing trees be retained within development areas, it is possible that the proposal may entail the removal of some of these trees (possibly due to safety reasons). Due to the lack of recent indications of the species on the site, it is considered unlikely that any of these trees contain *P. norfolcensis* individuals or family groups. However, the impact of the removal of hollow-bearing trees could be offset by the recovery of potentially displaced animals that may exist on the site. This would be achieved by having a qualified ecologist present during tree felling operations. Furthermore, there is scope for the employment of next-boxes and/or relocation of removed hollows into retained trees. The containment of domestic pets, particularly at night, should also be encouraged.

With these potential ecological issues noted, a series of recommendations have been provided below, to aid in the reduction of potential impacts associated with the proposal.

Given that the majority of the vegetation is to be removed within the site and that this vegetation is highly disturbed from past clearing and is now currently dominated by herbaceous species and exotic grasses, and that the area of vegetation is relatively small in comparison to larger tracts of vegetation in the close proximity to the site.

It is therefore concluded that the proposed development should not significantly impact upon threatened or regionally significant flora and fauna, ecological communities or populations.

The implementation of the recommendations below should help compensate for the loss of habitat for threatened species as a result of the proposed development.

8 RECOMMENDATIONS

The following recommendations have been outlined to ensure that the ecological impact of the proposed development estate is minimised as far as possible.

Any future landscaping should aim to utilise locally occurring flowering / fruiting native shrubs that would provide potential foraging resources for threatened species and other native species.

During the construction phase, for any tree removal within the development area, and in particular where hollow-bearing trees may be removed. All hollow bearing trees are to be flagged by an ecologist prior to the commencement of works on site, and all works should be supervised by an ecologist to recover any native fauna that are potentially displaced. Furthermore, where such risks occur, site-specific ecological advice should be sought to minimise impacts during the entire process. A clearing protocol should be adopted for the removal of trees containing suitable habitat hollows as follows (this is considered as a guideline, variations on the methods employed may be required to accommodate site specific factors):

Underscrubbing of the entire site should be carried out by a 4x4 tractor with a slashing deck, this will minimise the establishment of degradation processes and leave a layer of mulch to aid in soil retention in the event of adverse weather. At this time felling of non habitat trees can take place, however a matrix of trees *must* be maintained to allow animal movement into the designated refuge area.

After a period of week, clearing of habitat trees should commence. Clearing must be carried out moving from the fringe of the matrix towards the refuge area. Trees should be 'soft felled' and inspected immediately by an ecologist for displaced fauna. All trees must be left for a minimum of two nights prior to being moved to a stockpile, to allow resident fauna to vacate tree hollows.

Note: Clearing should ideally take place outside of the dominant breeding seasons of resident fauna, preferably during late Autumn and Winter.

Species selection for future landscaping works and seed stock for revegetation should be limited to locally occurring native species to maintain local genetic diversity.

Where possible, earthworks (and certainly all works in the vicinity of drainage lines) should be undertaken during appropriate (i.e. dry) weather conditions. This will ensure that any potential erosion events will be intercepted and that downstream impacts are minimised within any of the drainage lines. This will help to maintain existing habitat characteristics for native fauna in those areas, including those for threatened species.

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