APPENDIX 4

Ecological Assessment

Mackas Sand

Ecological Assessment of Sand Extraction Operations from Lot 218 DP 1044608 and Lot 220 DP 1049608, Salt Ash

April 2009

Umwelt
Environmental Consultants

Ecological Assessment of Sand Extraction Operations from Lot 218 DP 1044608 and Lot 220 DP 1049608, Salt Ash

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Mackas Sand

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TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1.0 Introduction

Mackas Sand proposes to extract industrial grade and construction sand resources from Lot 218 and Lot 220, Salt Ash, NSW on behalf of the Worimi Local Aboriginal Land Council (Worimi LALC) (**Figure 1.1**). Umwelt (Australia) Pty Limited (Umwelt) was engaged by Mackas Sand to undertake the necessary environmental assessments associated with the proposed sand extraction (hereafter referred to as 'the project'). The project is being assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and as part of this process, the Director-General of the Department of Planning (DoP) requires that the Environmental Assessment consider the impacts of the project on ecology. This assessment has been undertaken in accordance with the Director-General's requirements.

1.1 Overview of the Project

The project will involve the preparation of each site, extraction of sand with front-end loaders, transport operations and progressive site rehabilitation as required. Extracted sand may be processed on-site, through either vibrating screens or a wash plant that may be established on Lot 220, before being taken off-site.

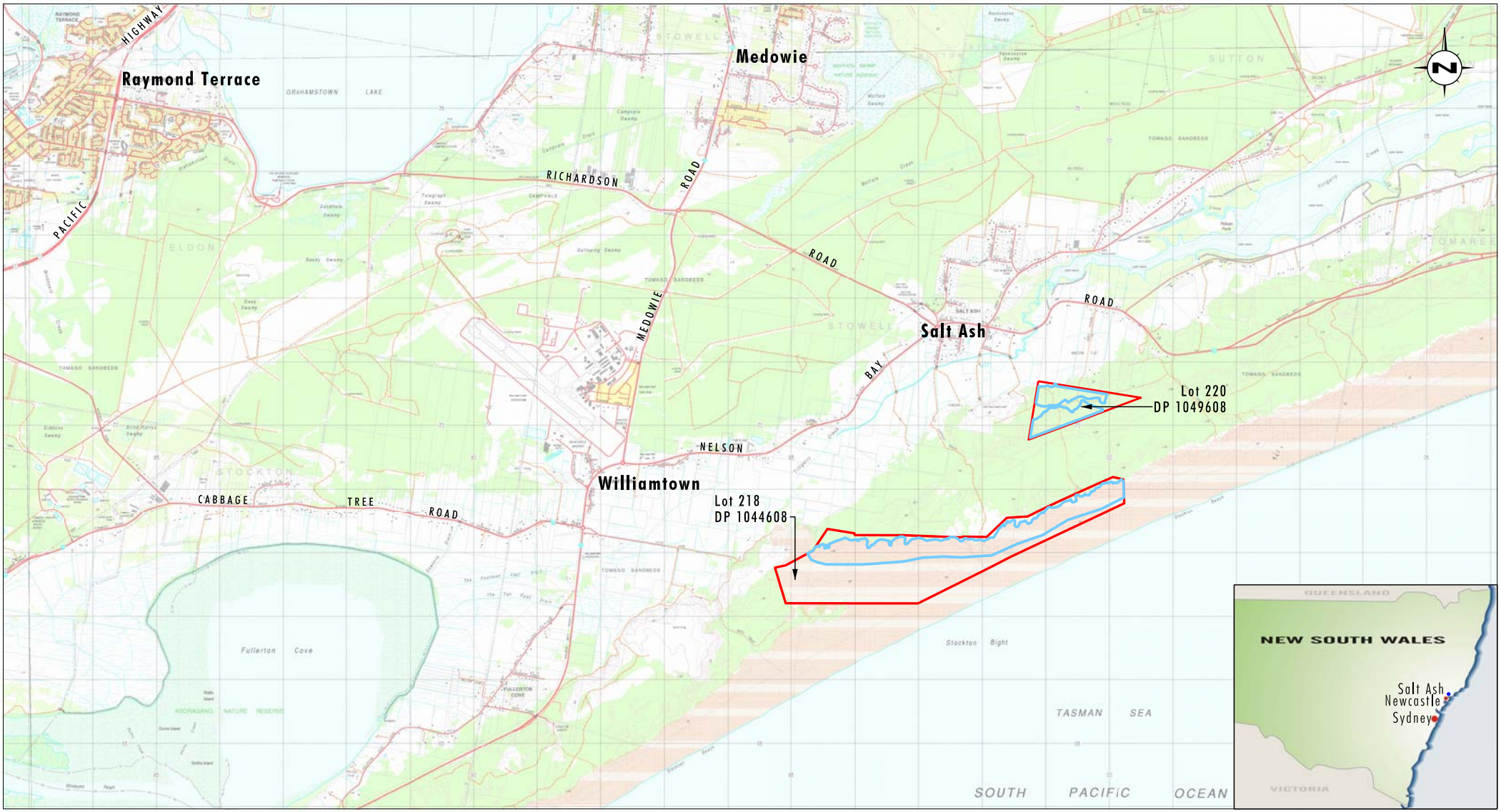
Development of Lot 218 will involve the construction of an access road of approximately 50 metres in length into on Lot 227 in DP 1097995 to provide access and establishment of a strip up to 150 metres wide along the landward margin of the transgressive dune. Up to four front-end loaders will continuously work the strip, allowing for mobile, wind-blown sand to replenish in areas where they are not working. It is estimated that in excess of one million cubic metres of sand is blown into the proposed extraction area per year, potentially giving the operation an indefinite lifespan. Operations within Lot 218 will not involve the removal of any vegetation. The proposed Lot 218 operational area is shown on **Figure 1.2**.

Development of Lot 220 will involve the construction of an access road extending from an existing electricity easement on the north-western boundary of Lot 220, the staged removal of vegetation and topsoil by bulldozer, followed by extraction and loading up to four front-end loaders. It is intended to commence extraction in the north-western portion of Lot 220, leaving a 30 metre vegetated buffer along the boundary of the site. Vegetated buffer areas of 20 metres will be left along the other boundaries of the site. Extraction will be undertaken in the stages shown on **Figure 1.3**. Extracted areas will be progressively rehabilitated by the replacement of topsoil and vegetative debris and the subsequent planting of local native plant species. A wash plant will be established on Lot 220 if a suitable water source is obtained and once a suitable area has been created through sand extraction. No extraction is proposed within the central area of low elevation however it will be necessary to construct two access tracks within this area to connect the proposed extraction areas. The extraction plan is shown on **Figure 1.3**.

It is anticipated that up to 2,000,000 tonnes of sand will be extracted from the combined operations each year, with a maximum of 1,000,000 tonnes coming from either site.

1.2 Project Area

The proposal will be undertaken at the locations shown on **Figure 1.1** being Lot 218 in DP 1044608 and Lot 220 in DP 1049608. The proposal includes the construction of



Source: Department of Lands, 2006

Legend

- Lot Boundaries (218 & 220)
- Proposed Operational Areas

FIGURE 1.1

Locality Plan

Source: Aerial: Google Earth, 2008

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Legend

- Lot 218 Boundary
- Proposed Lot 218 Operational Area
- Site Access
- Proposed Site Access

FIGURE 1.2

Proposed Disturbance Area Lot 218

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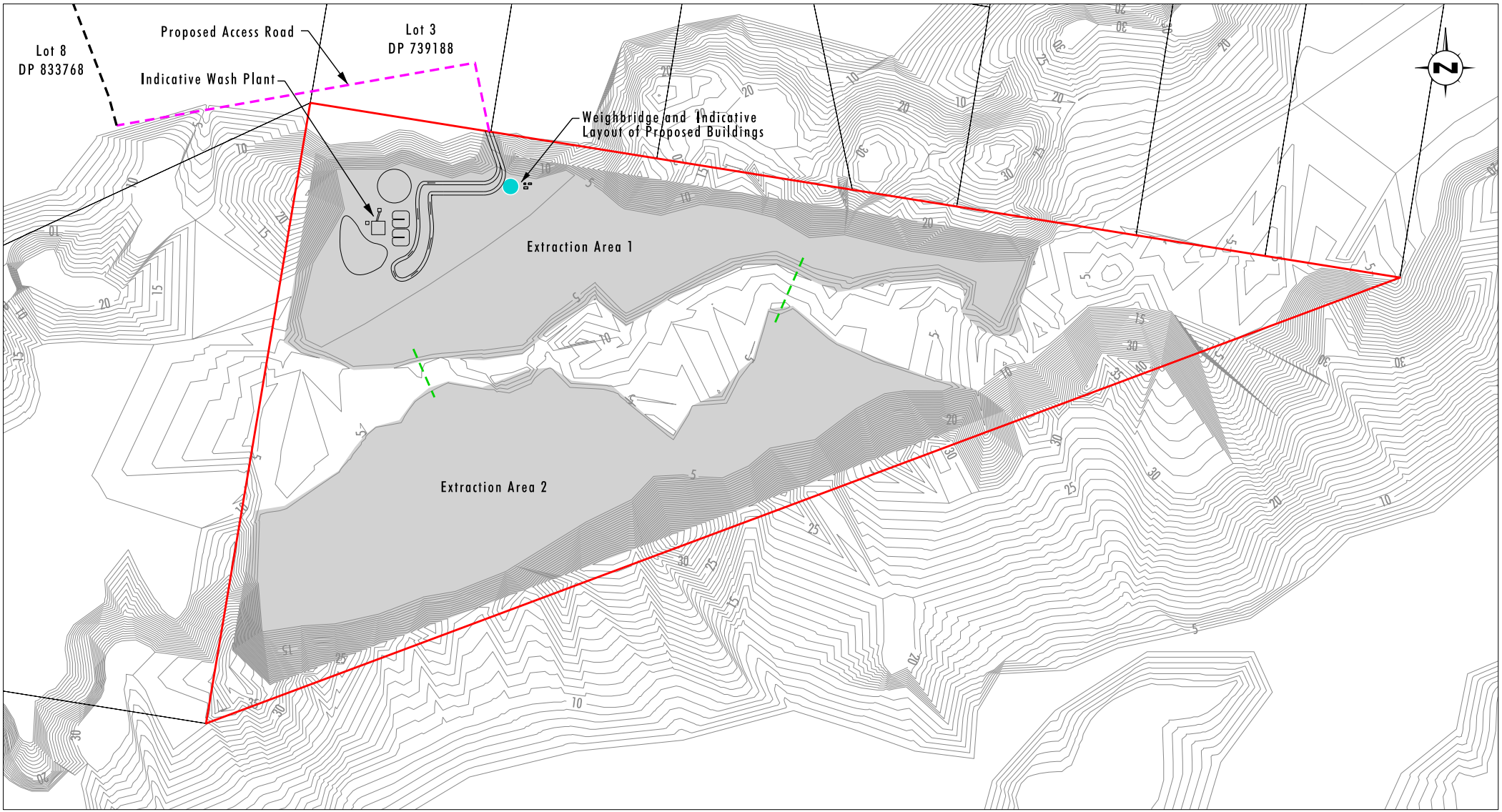

Source: Cadastral: Department of Lands, 2003
Note: Contour Interval 10m

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Legend

- Lot 220 Boundary
- Internal Access Roads
- Proposed Access Road
- Existing Access Road

FIGURE 1.3

Extraction Plan for Lot 220

unsealed access roads on Lot 8 in DP 833768, Lot 3 in DP 739188 and Lot 227 in DP 1097995, Salt Ash.

The sites form part of the Stockton Bight dune system and are located approximately 20 to 25 kilometres to the north-east of Newcastle, near Salt Ash.

Lot 218 has a total area of approximately 412 hectares, although only approximately 150 hectares of the site will be affected by the proposal. The site primarily consists of unvegetated outer mobile dunes. Vegetated dunes within a Water Reserve adjoin the site to the north, while mobile dunes within Crown Reserve 91676 adjoin the site to the south. A sand quarry adjoins the site to the north-west. Ecological surveys have not been undertaken on Lot 218 as the project will not involve the removal of any vegetation at that site.

Lot 220 (the project area) has an area of approximately 76 hectares and adjoins an existing sand extraction operation immediately to the west, operated by Unimin (formerly ACI). An area of approximately 28.6 hectares will be left undisturbed at this site (as shown in **Figure 1.3**). An existing Mackas Sand operation is also located approximately 750 metres to the west. Rural land holdings adjoin the site to the north and the Worimi Conservation Lands are located to the east and south.

1.3 Ecological Assessment Overview

Umwelt undertook an ecological assessment of the project area in 2003, mapping the vegetation of site as Coastal Sand Apple – Blackbutt Forest. The project area provides known habitat for threatened fauna species and potential habitat for a variety of other flora and fauna. An additional survey was undertaken adjacent to the project area in 2004 for a potential access route to Lot 218, which surveyed similar proximate habitats.

This report draws on the previous ecological surveys undertaken in 2003 and 2004 with additional ecological surveys undertaken as part of this project (documented in **Section 3**). Targeted flora and fauna surveys were undertaken across the project area in July and August 2008. These targeted surveys included ground-truthing the vegetation community mapping prepared for the previous assessment, threatened flora species survey, an assessment of the current condition of the project area and an updated fauna survey and habitat assessment.

1.4 Purpose of the Document

This ecological assessment was prepared by Umwelt to assess the potential impact of the project on native flora and fauna species, populations and ecological communities occurring in the project area.

The objectives of the ecological assessment were to:

- record the flora and fauna within the project area;
- identify any threatened flora and fauna species, endangered populations, threatened ecological communities (TECs), or their habitats, listed under the *Threatened Species Conservation* [TSC] *Act 1995* (NSW), the *Fisheries Management Act 1994* (FM Act) and the *Environment Protection and Biodiversity Conservation* [EPBC] *Act 1999* (Commonwealth);

- assess the impact that the project would have on any threatened flora and fauna species, endangered populations, TECs, or their habitats, recorded in the project area; and
- provide management recommendations to mitigate ecological impacts associated with the project.

2.0 Background and Literature Review

A review of previous documents and reports relevant to the project was undertaken. This included regional and sub-regional vegetation mapping reports, site-specific surveys completed within the project area, ecological surveys undertaken in the vicinity of the project area and also relevant ecological database searches. The information obtained was used to inform survey design, and was also used to assist in the assessment of potentially occurring threatened species, endangered populations and TECs. Relevant documents are discussed below, focussing on the key findings of each assessment.

2.1 Vegetation of the Tomago and Tomaree Sandbeds, Port Stephens NSW (Driscoll and Bell 2006)

The Vegetation of the Tomago and Tomaree Sandbeds, Port Stephens, New South Wales (Driscoll and Bell 2006) was commissioned by the Hunter Water Corporation. The aim of the report was to identify and map groundwater-dependent ecosystems (GDEs) on the Tomago and Tomaree sandbeds to assist in the management of water extraction from aquifers.

This report provides the most comprehensive vegetation mapping in the local area. The project occurs south-east of the Driscoll and Bell (2006) study area, however some mapped vegetation communities extend as far south as the project area. The characteristics of the vegetation communities in the current project area were compared to vegetation community descriptions from Driscoll and Bell (2006). Based on this, the vegetation communities in the project area resemble two community descriptions, Tomago Blackbutt-Apple-Bloodwood Forest and Anna Bay Blackbutt-Apple-Bloodwood Forest.

2.2 Lower Hunter and Central Coast Regional Environmental Management Strategy Vegetation Mapping

The Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) Vegetation Mapping (NPWS 2000 and House 2003) is a broad-based vegetation mapping system for the Lower Hunter and Central Coast regions incorporating seven local government areas (LGAs), from Port Stephens to Gosford and west to Cessnock. The aim of this report was to provide cross tenure maps of the distribution of vascular plant communities in the Lower Hunter and Central Coast regions.

The characteristics of the vegetation communities in the current project area were compared to LHCCREMS vegetation community descriptions. The vegetation community mapped within the project area is Coastal Sand Apple – Blackbutt Forest (Map Unit 33).

2.3 Draft Flora and Fauna Assessment for Proposed Rezoning of Lot 218, Stockton Bight (Umwelt 2004)

The Draft Flora and Fauna Assessment for Proposed Rezoning of Lot 218 at Stockton Bight report (Umwelt 2004) was commissioned in 2004. This draft report was prepared to meet the flora and fauna assessment requirements for Port Stephens Council as a component of a rezoning application of the site.

Surveys identified 39 fauna species, including the koala (*Phascolarctos cinereus*), squirrel glider (*Petaurus norfolcensis*), eastern pygmy possum (*Cercartetus nanus*), powerful owl (*Ninox strenua*), Goulds wattled bat (*Chalinolobus gouldii*) and little forest bat (*Vespadelus vulturnus*). A total of 25 flora species were recorded within the Coastal Sands Apple – Blackbutt Forest and Swamp Mahogany Paperbark Forest communities which were mapped within Lot 218, outside of the proposed operational area.

The report provides valuable information for determining the likelihood of threatened flora and fauna occurring within, and surrounding, the project area. Results from this report were used to assist in determining the potential impacts the project, particularly on threatened species.

2.4 Ecological Database Searches

Prior to the field surveys in 2003 and 2008, a search of the Department of Environment and Climate Change (DECC) Atlas of NSW Wildlife database (or the former NPWS version in 2003) was undertaken to identify threatened species, endangered populations and TECs that have been previously recorded within a 10 kilometre radius of the project area. Similarly, the Department of the Environment, Water, Heritage and the Arts (DEWHA) Protected Matters database was searched to identify Commonwealth listed flora and fauna species and ecological communities whose range falls within the project area, and/or have been previously recorded within a 10 kilometre radius. The data obtained from these two database searches were used to compile a list of threatened species, populations and TECs potentially occurring within the project area. A comparison between habitat requirements for each of these species and the habitat types present within the project area was undertaken to determine the likelihood of TSC and EPBC listed flora and fauna species occurring.

3.0 Methods

The ecological surveys undertaken as part of this assessment were conducted by Umwelt on 24 February to 28 February 2003 and 30 March 2003 with additional surveys conducted on 16 July and 6 August 2008. The 2003 baseline survey methodology and additional 2008 survey methodology are described in **Sections 3.1** and **Section 3.2**. A summary of the survey effort is provided in **Section 3.3**. All surveys were conducted by two Umwelt ecologists. The aims of the field surveys were to:

- describe the vegetation communities and fauna habitat types present within the project area;
- describe the health and condition of the vegetation and habitats of the project area;
- obtain information on the general floristics and fauna species diversity of the project area;
- identify threatened flora and fauna species, populations or TECs or their habitats occurring within or having potential to occur within the project area; and
- accrue sufficient information to enable an accurate assessment of the impacts of the proposed development on the ecological values of the project area.

3.1 Flora Survey

3.1.1 2003 Flora Survey

Eight stratified meander transects, covering approximately 150 metres each, were conducted to determine species composition, level of disturbance and any threatened flora species occurring in the project area. Transects were also used to ground-truth the preliminary mapping phase.

Four 20 metre x 20 metre quadrats were sampled in selected areas within the project area allowing an accurate assessment of community structure and composition to be undertaken. At each quadrat, 45 to 60 minutes was spent searching for all vascular flora species present within the quadrat. Species within the plot were assigned a cover-abundance value to reflect their relative cover and abundance in the plot. A modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927, with selected modifications sourced from Poore 1955 and Austin et al. 2000) was used to estimate cover-abundances of all plant species within each quadrat. **Table 3.1** shows the cover-abundance categories used.

Table 3.1 - Modified Braun-Blanquet Crown Cover-Abundance Scale

Class	Cover-abundance*	Notes
1	Few individuals (less than 5% cover)	Herbs, sedges and grasses: <5 individuals Shrubs and small trees: <5 individuals
2	Many individuals (less than 5% cover)	Herbs, sedges and grasses: 5 or more individuals Shrubs and small trees: 5 or more individuals Medium-large overhanging tree
3	5 – less than 20% cover	

Table 3.1 - Modified Braun-Blanquet Crown Cover-Abundance Scale (cont)

Class	Cover-abundance*	Notes
4	20 – less than 50% cover	
5	50 – less than 75% cover	
6	75 – 100% cover	

Note: * Modified Braun-Blanquet scale (Poore 1955; Austin et al. 2000)

Information was also gathered on the condition of the remnant vegetation at each of the quadrats. Features indicating the general health of the vegetation within the plot were recorded, including: evidence of natural regeneration; occurrence and abundance of weeds; and evidence of disturbance and feral animals.

3.1.2 2008 Flora Survey

Additional flora surveys were conducted in 2008 to update the 2003 flora survey findings and included additional searches for threatened flora species. Six stratified meander transects were sampled across the project area, recording all flora species and specifically targeting threatened species including the winter-flowering *Diuris arenaria* and *D. praecox*. Known local populations of *Diuris arenaria* and *D. praecox* were assessed to determine whether the species were flowering prior to the conduct of surveys.

The location of the flora survey transects are shown on **Figure 3.1**.

3.1.3 Plant Identification and Taxonomic Review

All vascular plants recorded or collected were identified using keys and nomenclature from Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Recent changes to nomenclature and classification were incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2008), the on-line plant name database maintained by the National Herbarium of New South Wales.

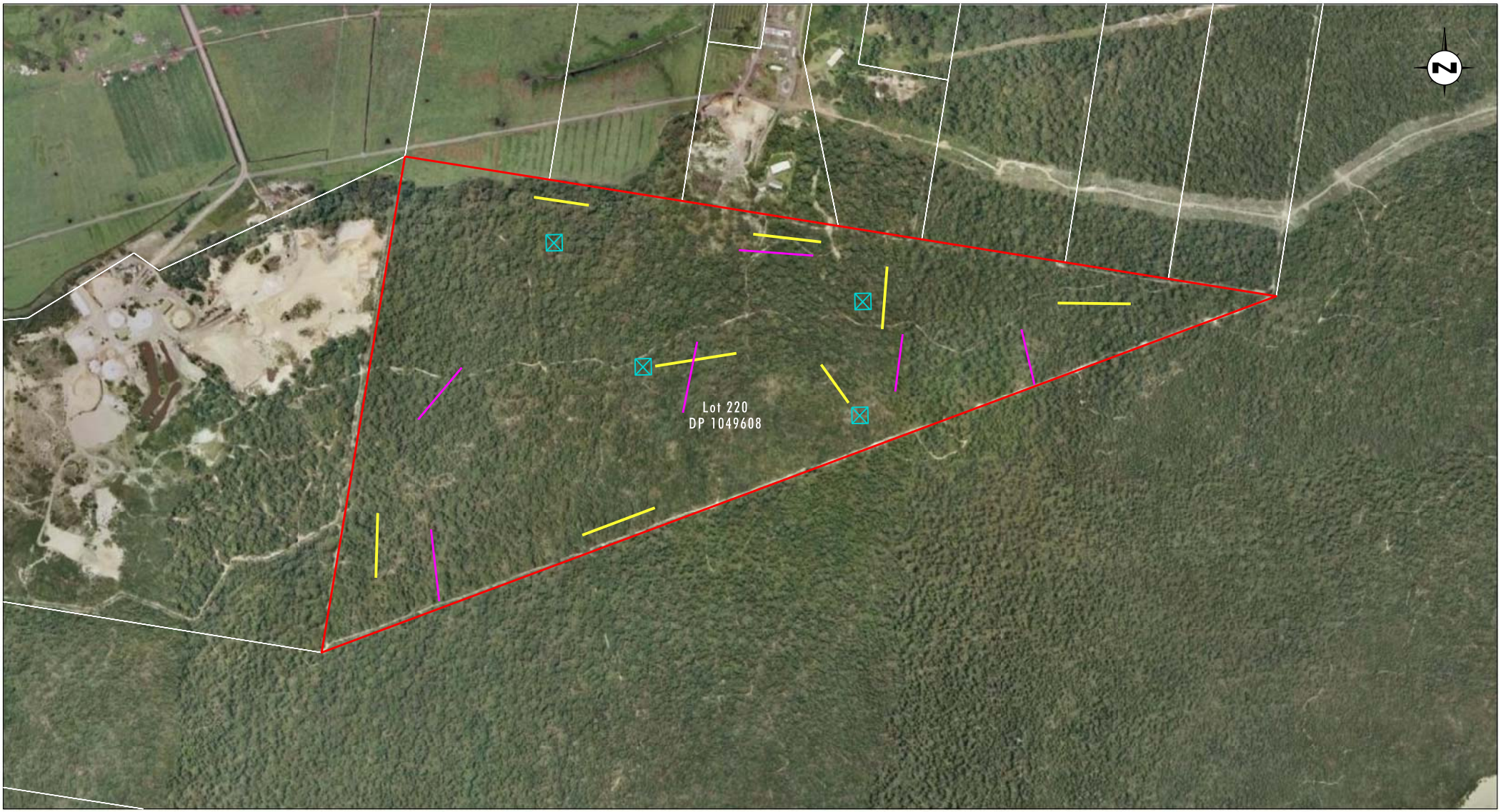
Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide common names. Where the identity of a specimen was unknown or uncertain, it was lodged with the National Herbarium of New South Wales at the Royal Botanic Gardens Sydney.

3.2 Fauna Survey

3.2.1 Habitat Assessment

Habitat assessments were undertaken at four locations throughout the study area during each of the 2003 and 2008 surveys (eight locations in total). Locations for the habitat assessments were selected intuitively, choosing a range of sites throughout the relatively homogenous habitat of the project area. The assessments targeted the identification of potential habitat and resources for threatened fauna species. Observations of the following habitat features were made throughout the project area:

- evidence of fire;
- nature of and extent of erosion;



Source: Aerial: Google Earth 2008

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Legend

- Lot 220 Boundary
- Vegetation Quadrat (2003)
- Walking Transect (2003)
- Targeted Threatened Species and Vegetation Transect (2008)

FIGURE 3.1

Flora Survey Methodology

- extent of weed species;
- presence of feral animals;
- type of ground cover (e.g. litter, rock, soil);
- ground fauna resources;
- wet soaks/drainage lines;
- degree of dieback;
- presence of mistletoe;
- structure and floristics of vegetation cover; and
- number of habitat trees.

3.2.2 2003 Fauna Survey

3.2.2.1 Fauna Trapping

Ground fauna trapping was undertaken at four survey sites over three consecutive nights. Each trapping survey site comprised 15 terrestrial Elliott A traps baited with a peanut butter, honey and oat mix and three wire cage traps baited with fish-based cat food.

One arboreal Elliot B transect and two arboreal hair funnels transects of 10 traps each were sampled in the central portion of the site with traps baited with the standard peanut butter, honey and oat bait and sprayed nearby (on the tree trunk in the case of arboreal traps) with a concentrated honey water solution. Traps were set at intervals of 10 to 20 metres. Hair samples were analysed by Barbara Triggs, a recognised expert in hair analysis.

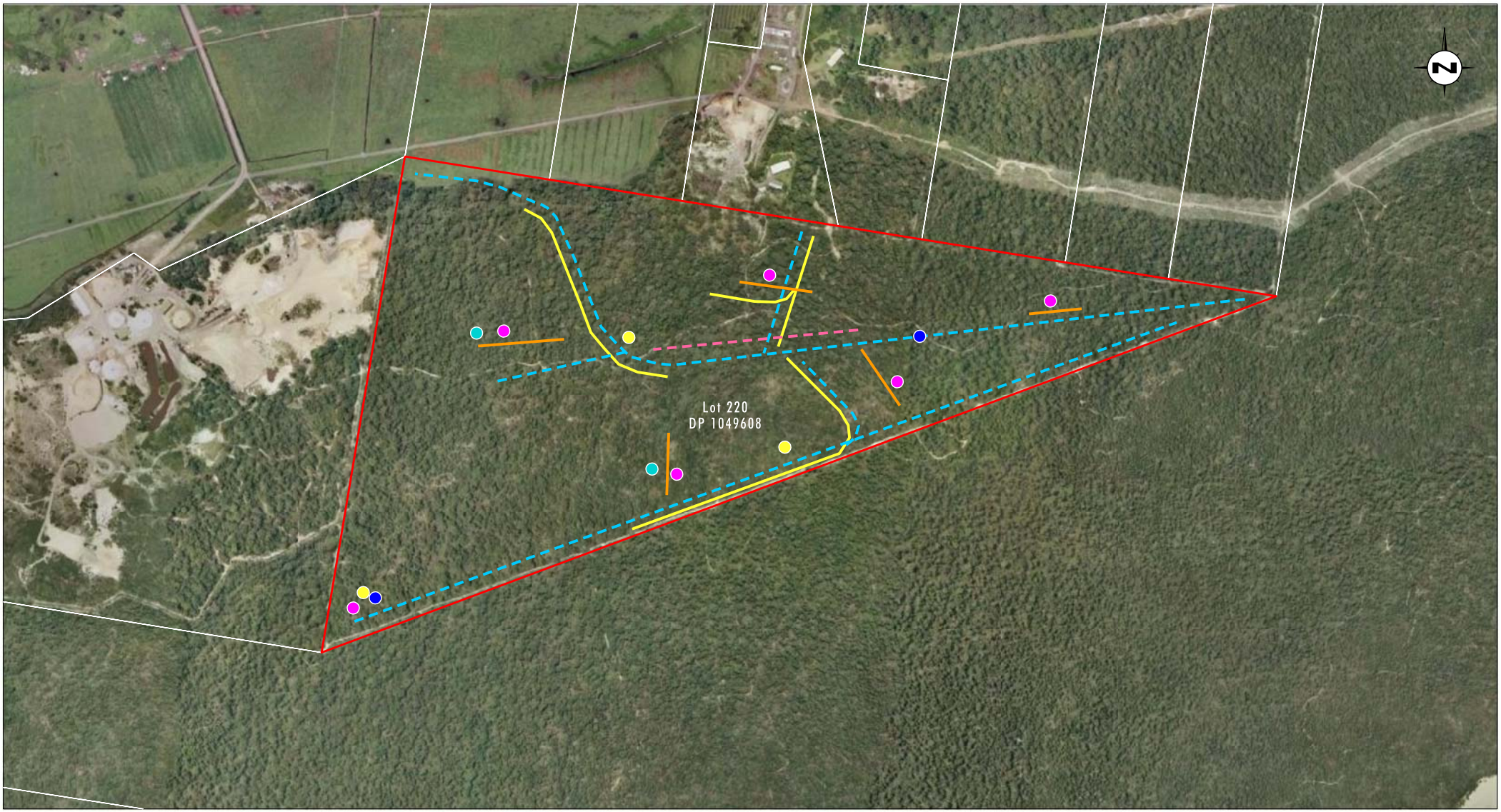
Table 3.2 indicates the total trapping effort over the four survey sites during the three nights of fauna trapping. The location of the trapping transects is shown on **Figure 3.2**.

Table 3.2 – Total Number of Mammal Traps Used During the Survey Effort

Trap Type	Trap Nights
Elliot class ‘A’ 60	180
Elliot class ‘B’ 10	30
Cage traps 5	15
Hair funnels 20	60
Total Trap Nights	**285**

3.2.2.2 Spotlighting Survey

Spotlighting surveys targeted nocturnal birds, mammals and herptofauna along four transects. Spotlighting was conducted on foot using 50 watt Lightforce hand-held spotlights. Spotlighting was undertaken generally between 8.00 pm and midnight. Opportunistic spotlighting was also undertaken from a slow-moving vehicle while travelling between sites at night. A total of 18 person hours of spotlighting was undertaken.



Source: Aerial: Google Earth 2008

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Legend

- Lot 220 Boundary
- Fixed Point Anabat Survey
- Anabat Transect
- Spotlight Survey
- Owl Call Playback
- Diurnal Bird Survey
- Trapline (Elliot 'A')
- Elliot 'B' Transect
- Herpetological Survey

FIGURE 3.2

2003 Fauna Survey Methodology (Umwelt 2003)

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The location of spotlighting transects is shown on **Figure 3.2**.

3.2.2.3 Call Playback Survey

At each of the four survey sites the recorded calls of the powerful owl (*Ninox strenua*), masked owl (*Tyto novaehollandiae*), squirrel glider (*Petaurus norfolcensis*) and koala (*Phascolarctos cinereus*) were played. Each call was played for a minimum of 4 minutes followed by a listening period of 2 minutes before the beginning of the next species call. Calls were broadcast using a 10 watt directional loud hailer. Mammal calls were played before bird calls to prevent the calls of predators (large owls) decreasing the likelihood of prey species (gliders) responding to call playback.

The location of call playback surveys is shown on **Figure 3.2**.

3.2.2.4 Bat Survey

Four micro-bat detection walking transects were conducted at each fauna survey site using an Anabat detector. Each walking transect was 45 minutes in duration with all detected calls recorded to tape for later analysis. Micro-bat echolocation recordings were made using an Anabat Bat Detector and tape recording device. Anabat recordings were analysed by Glenn Hoye of Fly By Night Bat Surveys, a recognised expert in bat call analysis.

A 50 watt hand-held spotlight was used during the survey to locate any mega-bat species present.

The location of anabat and spotlighting transects is shown on **Figure 3.2**.

3.2.2.5 Koala Survey

The Spot Assessment Technique (AKF 1995) was used to assess koala activity within the project area. Searches were made to identify preferred koala food trees and evidence of koala faecal pellets during walking transects and vegetation quadrats (refer to **Figure 3.1** for the location of vegetation quadrats).

State Environmental Planning Policy (SEPP) No. 44 (Koala Habitat Protection)

The project is subject to assessment under State Environmental Planning Policy (SEPP) No. 44 (Koala Habitat Protection) as it lies in an LGA listed in Schedule 1 of the policy. SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas (*Phascolarctos cinereus*), to ensure permanent free-living populations over their present range and to reverse the current trend of population decline. Any development application in an identified LGA, affecting land one hectare or greater, including adjoining lands on the same holding, must be assessed under the policy.

Assessment under SEPP 44 is based on an initial determination of whether the land constitutes potential koala habitat. This is determined by assessing whether the eucalypt species present in Schedule 2 constitutes 15 percent or more of the total number of trees in the upper or lower strata of the tree component. If potential koala habitat is present, the area must be further assessed to determine if the land is core koala habitat.

The species listed in Schedule 2 of the policy are identified in **Table 3.3**.

Table 3.3 – Species Listed in Schedule 2 of SEPP 44

Scientific Name	Common Name
Eucalyptus tereticornis	forest red gum
Eucalyptus microcorys	tallowwood
Eucalyptus punctata	grey gum
Eucalyptus viminalis	ribbon or manna gum
Eucalyptus camaldulensis	river red gum
Eucalyptus haemastoma	broad-leaved scribbly gum
Eucalyptus signata	scribbly gum
Eucalyptus albens	white box
Eucalyptus populnea	bimble box or poplar box
Eucalyptus robusta	swamp mahogany

Four 20 metres by 20 metres vegetation quadrats were sampled during 2003 and a total of 14 meander transects were undertaken during the 2003 and 2008 surveys targeting the species listed in Schedule 2.

3.2.2.6 Diurnal Bird Survey

Diurnal bird surveys were undertaken in periods of high bird activity at six survey sites during the survey period (**Figure 3.2**). Each survey lasted approximately 30 minutes and a total of four person hours of surveying was conducted. Species were identified from characteristic calls and by observation, using 10 x 50 binoculars.

Opportunistic observations were also recorded during other aspects of the field survey, particularly during the checking of the trap lines each morning.

The general locations of diurnal bird surveys are shown on **Figure 3.2**.

3.2.2.7 Herpetofauna Survey

Targeted diurnal searches were conducted for reptile and amphibian species in likely habitat areas throughout the project area. Two diurnal search areas were sampled during the survey period, with the search undertaken by two personnel in each area of approximately 0.25 hectares for 30 minutes, resulting in a total sampling effort of two diurnal person hours. During the search likely microhabitats were examined including beneath rocks and logs, in tree bark, in ground litter and in wet soak areas. The diurnal survey was conducted in the afternoon between 12.00 pm and 12.30 pm.

The general locations of herpetological surveys are shown on **Figure 3.2**.

3.2.2.8 Indirect Evidence of Faunal Presence

Indirect evidence of faunal presence was recorded for each site when detected. Evidence included tracks, scats, scratches, burrows, bones, nests and drays. Scats, as required, were sent away for expert analysis. All opportunistic fauna observations were recorded during all aspects of the field surveys.

3.2.3 2008 Fauna Survey

The following sections document the methods employed for the additional fauna surveys conducted on 16 July and 6 August 2008. Fauna surveys were generally undertaken in accordance with the DEC Draft Threatened Species Survey and Assessment Guidelines (DEC 2004).

3.2.3.1 Fauna Trapping

Fauna trapping was undertaken at two fauna survey sites over 10 nights. Site 1 contained:

- 40 terrestrial hair funnels/tubes (20 meat bait, 20 peanut butter, honey and oats); and
- 10 arboreal hair funnels.

Site 2 contained:

- 20 terrestrial hair funnels/tubes (10 meat bait, 10 peanut butter, honey and oats); and
- 5 arboreal hair funnels.

Table 3.4 indicates the total number of traps nights used during the 2008 survey effort.

Table 3.4 – Total Number of Mammal Traps Used During the Survey Effort

Trap Type	Trap Nights
Terrestrial hair funnels	600
Arboreal hair funnels	150
Total Trap Nights	**750**

A concentrated honey water solution was sprayed on the trunks of trees set with arboreal trees to act as an attractant. Traps were set at intervals of 10 to 15 metres along the trap lines. Hair samples were analysed by Barbara Triggs of 'Dead Finish', a recognised expert in hair analysis.

The location of trapping transects is shown on **Figure 3.3**.

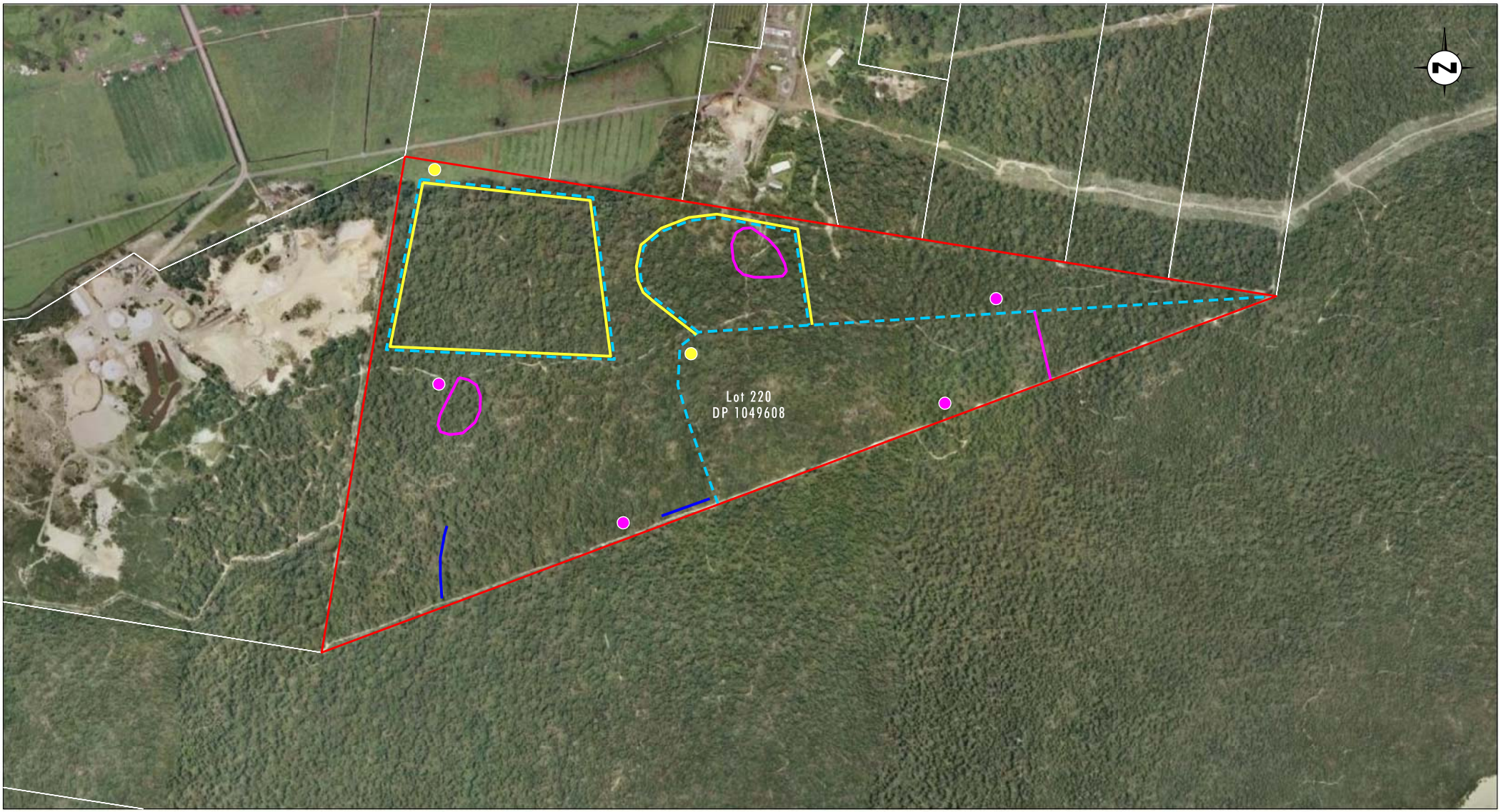
3.2.3.2 Spotlighting Survey

Spotlighting surveys were undertaken throughout the project area targeting nocturnal birds, mammals and herptofauna. Spotlighting was conducted on foot using 30 watt Lightforce hand-held spotlights. A total of six person hours spotlighting was conducted over two nights. Spotlighting was undertaken generally between 6.00 pm and 10.00 pm. Opportunistic spotlighting was undertaken from a slow-moving vehicle while travelling between transects at night.

The location of spotlighting transects is shown on **Figure 3.3**.

3.2.3.3 Call Playback Survey

Call playback surveys were conducted at two locations within the project area. At each of the survey site the recorded calls of the powerful owl (*Ninox strenua*), masked owl (*Tyto*



Source: Aerial: Google Earth 2008

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Legend

- Lot 220 Boundary
- Reptile Survey
- Diurnal Bird Survey
- Hair Tube Transect
- Owl Call Playback
- Spotlighting Transect
- Anabat Transect

FIGURE 3.3

2008 Fauna Survey Methodology

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novaehollandiae), squirrel glider (*Petaurus norfolcensis*) and koala (*Phascolarctos cinereus*) were played. Each call was played for a minimum of 4 minutes followed by a listening period of 2 minutes before the beginning of the next species call. Calls were broadcast using a 10 watt directional loud hailer. Mammal calls were played before bird calls to prevent the calls of predators (large owls) decreasing the likelihood of prey species (gliders) responding to call playback.

The location of call playback surveys is shown on **Figure 3.3**.

3.2.3.4 Bat Survey

Two micro-bat detection walking transects were conducted during spotlighting surveys using an Anabat II detector. Micro-bat echolocation recordings were made using an Anabat II Bat Detector and an Anabat CF Storage ZCAIM. Each walking transect was 45 minutes in duration with all detected calls recorded to the ZCAIM for later analysis. Anabat recordings were analysed by Glenn Hoye of Fly By Night Bat Surveys, a recognised expert in bat call analysis.

The location of anabat transects is shown on **Figure 3.3**.

A 30 watt hand-held spotlight was used during the survey to locate any mega-bat species.

3.2.3.5 Diurnal Bird Survey

Diurnal bird surveys were undertaken at four locations throughout the project area. Species were identified from characteristic calls and by observation, using 10 x 50 binoculars. A total of four person hours of diurnal bird surveys were undertaken during surveys.

Opportunistic observations were also recorded during other aspects of the field survey.

The location of the diurnal bird surveys is shown on **Figure 3.3**.

3.2.3.6 Herpetofauna Survey

Two searches for reptile species were undertaken during meandering transects. During the search likely microhabitats were examined including beneath rocks and logs, in tree bark, in ground litter and in wet soak areas. Opportunistic nocturnal searches for herptofauna were also conducted during spotlighting surveys. Cool conditions during the surveys are considered to have limited the likelihood of reptile identification.

The location of reptile search areas is shown on **Figure 3.3**.

3.2.3.7 Indirect Evidence of Faunal Presence

Indirect evidence of faunal presence was recorded for each site when detected. Evidence included tracks, scats, scratches, burrows, bones, nests and dreys. Scats were collected and sent away for expert analysis. All opportunistic fauna observations were recorded during all aspects of the field surveys.

3.3 Summary of Survey Effort

Table 3.5 provides a summary of the total survey effort in the project area during the 2003 and 2008 survey period.

Table 3.5 – Total Survey Effort during the 2003 and 2008 Survey Periods

	2003 Survey	**2008 Survey**
Vegetation and Threatened Species Survey		
Vegetation Quadrats	4 vegetation quadrats	
flora meander transects	8 meander flora and threatened species transects	6 meander flora and threatened species transects
Fauna Survey		
Diurnal birds	8 x 1 hectare surveys lasting 20-30 minutes	4 x 1 hectare surveys lasting 20-30 minutes
Nocturnal birds	3 owl call playback sessions	2 owl call playback sessions
Small mammal trapping	180 trap nights Elliot 'A' traps	600 hair funnel trap nights
Arboreal mammals	30 trap nights Elliot 'B' traps plus 60 hair funnels; 18 hours spotlighting	150 hair funnel trap nights; 6 person hours spotlighting
Micro-bats	4 Anabat transects (each 45 minutes)	2 Anabat Transects
Mega-bats	18 person hours spotlighting	6 person hours spotlighting
Diurnal reptiles	2 x 1 hectare search areas over 4 days	2 x 1 hectare search areas over 2 days
Nocturnal reptiles	18 person hours spotlighting	Opportunistic; 6 person hours spotlighting
Amphibians	No habitat	No habitat

4.0 Flora Survey Results

4.1 Flora Species Recorded

In total, 41 plant species were recorded within the project area, comprising 22 plant families. Fabaceae (Faboideae) was the most speciose plant family (six species recorded), followed by Fabaceae (Mimosoideae), Myrtaceae and Proteaceae (four recorded in each). A list of all flora species recorded in the project area is in **Attachment 1**.

No introduced flora species were recorded in the project area during the surveys.

4.1.1 Regionally Significant Flora Species

The project area occurs within the Hunter Region, within which there are numerous flora species considered to have conservation significance (Peake et al. 2003). The criteria used to list regionally significant species include:

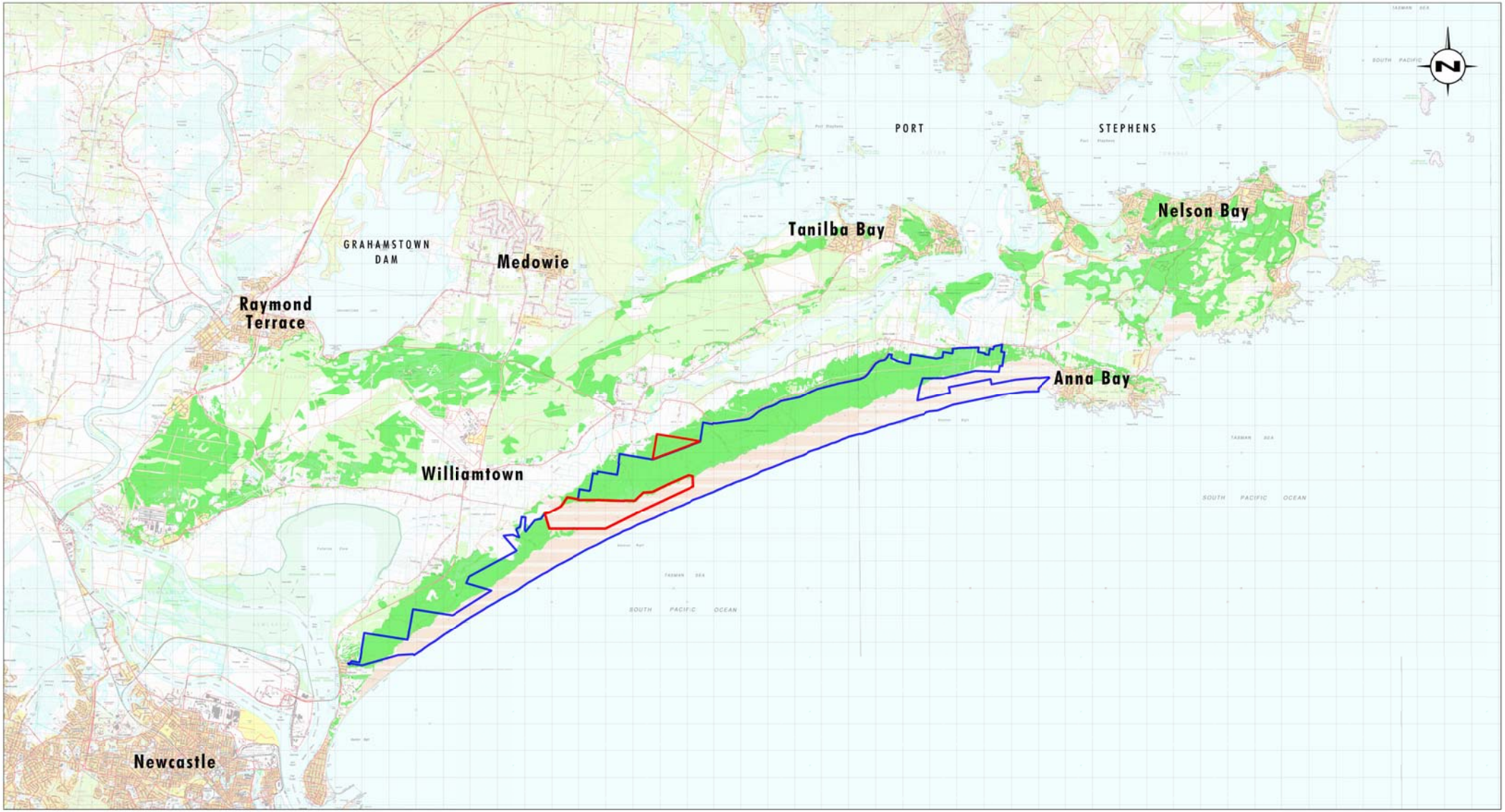
- endemic taxa – known distribution restricted to this region;
- uncommon taxa – less than 50 known populations;
- records close to the limit of the species' geographical range; and
- significant reductions in population size or area occupied.

The Hunter Rare Plants Database (Peake et. al. 2003) provides an extensive list of flora species within the Hunter Region that are considered to be regionally significant. Two regionally significant flora species from this list occur in the project area, comprising coastal rosemary (*Westringia fruticosa*) and blady grass (*Imperata cylindrica* var*. major*). Each of these species is relatively widespread throughout the region and are considered significant due to the Hunter Region being the limit of their distribution.

4.2 Vegetation Communities

4.2.1 Coastal Sand Apple – Blackbutt Forest

One vegetation community was identified throughout the project area; Coastal Sand Apple Blackbutt Forest (**Figure 4.1**). This community is characterised by a dense canopy stratum (>50% canopy cover) of less than 25 metres in height, dominated by blackbutt (*Eucalyptus pilularis*) and smooth-barked apple (*Angophora costata*). A sub-canopy layer is open (<30% canopy cover) to 10 metres height dominated by old man banksia (*Banksia serrata*) and broom-heath (*Monotoca elliptica*). The shrub layer is mostly dense (>50% canopy cover) with some open areas scattered on the upper slopes. The shrub layer is dominated by Sydney golden wattle (*Acacia longifolia*), coastal bearded-heath (*Leucopogon pauciflorus*), bossiaea (*Bossiaea rhombifolia*) and dillwynia (*Dillwynia retorta*). The ground cover is generally dense (>50% canopy cover) consisting of common bracken (*Pteridium esculentum*), kangaroo grass (*Themeda australis*), blady grass (*Imperata cylindrica* var. *major*), raspwort (*Gonocarpus teucrioides*) and flax lily (*Dianella caerulea* var. *producta*). A list of flora species recorded in the project area is provided in **Attachment 1**. No weed species were recorded in the project area during the survey. This community generally consists of a good succession of species in all strata.



Source: Department of Lands (2006), Hunter Councils (2003)

0 2.5 5 10km
1:200 000

Legend

- Lot Boundaries (218 & 220)
- Worimi Conservation Lands
- Coastal Sand Apple Blackbutt Forest

FIGURE 4.1

Coastal Sand Apple Blackbutt Forest

The vegetation community within the project area is similar to the description of two vegetation communities outlined in the Vegetation of the Tomago and Tomaree Sandbeds, Port Stephens, New South Wales (Driscoll and Bell 2006) (**Section 2.1**) which are Tomago Blackbutt-Apple-Bloodwood Forest and Anna Bay Blackbutt-Apple-Bloodwood Forest.

LHCCREMS Vegetation Survey, Classification and Mapping (LHCCREMS 2000) mapped the project area as Coastal Sand Apple-Blackbutt Forest (MU33). The community described in the project area is consistent with the MU33 description.

4.3 Threatened Flora Species, Endangered Populations and Threatened Ecological Communities

No threatened flora species, endangered flora populations or TECs were observed in the project area during the survey.

5.0 Fauna Survey Results

5.1 Fauna Habitat

The project area provides foraging, roosting and nesting habitats for a variety of fauna species. One broad habitat type was identified within the project area: forest on an undulating sandsheet. This coastal forest supports a range of fauna habitat characteristics, due to the undulating nature of the landscape, and therefore provides a range of habitat niches for fauna species.

The canopy in the forest habitat is dominated by smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis*) which provide an abundant range of tree hollows for hollow-dependent and opportunistic fauna, including small and medium sized arboreal mammals, birds and reptiles. Large tree hollows, suitable as nesting and roosting sites for large bird species, including owls and cockatoos, were sparsely recorded due to the lower abundance of large mature overstorey species. The canopy species provide foraging resources for nectarivorous bird and mammal species during the summer months.

The forest habitat provides an understorey layer ranging from open, along the ridge lines, to dense, on the mid and lower slopes. The understorey layer provides a range of flowering species that provide feeding and nesting resources for a variety of small to medium mammals and birds.

The ground cover layer is dense, dominated by blady grass (*Imperata cylindrica* var. *major*), kangaroo grass (*Themeda australis*) and common bracken (*Pteridium esculentum*), which provide refuge for small mammals, birds and reptiles. The project area displays evidence of a frequent fire regime from burnt wood on the ground and trunks of mature trees. Several fallen logs of various sizes were identified which may provide nesting and refuge for medium to small mammals and reptiles. No rocky outcrops were identified within the project area.

Ephemeral drainage lines and dams, which provide aquatic and semi-aquatic habitat, were absent from the project area. The lack of suitable habitats prevents the occurrence of amphibian species and some reptile species.

The Regional Biodiversity Conservation Strategy identified the Coastal Sand Apple Blackbutt Forest occurring along the Stockton Bight dune system from Stockton to Anna Bay as regionally significant habitat and as a regionally significant habitat linkage (House 2003). This category includes the best connected bushland in the region and these habitat areas have been identified to ensure that large contiguous and often pristine areas of bushland are protected. Typically these areas represent the most viable and often the most diverse bushland in the region (House 2003).

5.1.1 Koala Habitat Assessment

The vegetation community of the project area was assessed according to Schedule 2 of SEPP 44, and it was found that none of the listed species occur. As a result, the site is not considered to provide potential koala habitat as defined by SEPP 44.

However, surveys in adjacent habitats (Umwelt 2004) identified a koala and the Port Stephens Koala Plan of Management (CKPoM) identifies the site as providing supplementary koala habitat, which is important to the long-term management of koalas in Port Stephens. The site is located within the Fullerton Cove/Stockton Bight Koala Management Unit (KMU).

5.2 Fauna Species Recorded

A total of 50 fauna species were recorded in the project area during fauna surveys undertaken in 2003 and 2008.

A total of 42 fauna species were recorded in the study area in 2003, including one introduced mammal species. The diversity of species recorded was considered to be low and not representative of the full range of species that are known to potentially occur in Coastal Sand Apple Blackbutt Forest. The low diversity within the project area was attributed to the bush fire which burnt through the project area in November 2002 and resulted in modification of the fauna habitat within the project area.

An additional eight species were recorded during updated surveys in 2008 that were not previously recorded. The post-fire regeneration of the site provides suitable habitat for a wider range of species, indicative of the range of species that are expected to occur.

A list of all species recorded in the project area is provided in **Attachment 2**.

5.2.1 Birds

A total of 29 bird species were recorded within the project area during the 2003 and 2008 survey effort.

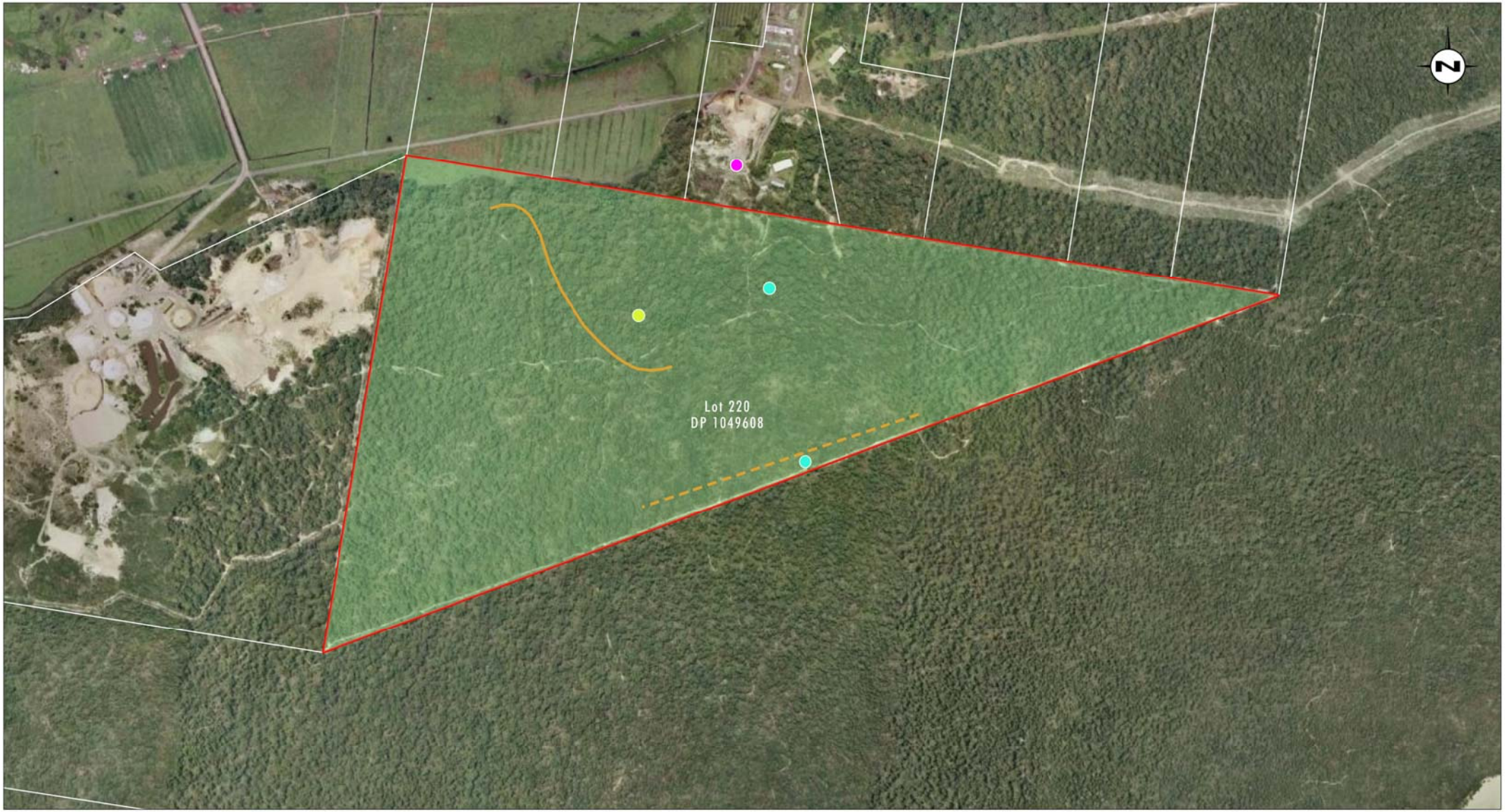
A relatively low bird species diversity was recorded within the 2003 survey during early morning and evening surveys, with only 21 species recorded. The low diversity can be attributed to the regenerating nature of the site after fire, and the lack of habitat diversity within the project area. The most abundant species recorded were the yellow-faced honeyeater (*Lichenostomus chrysops*), scarlet honeyeater (*Myzomela sanguinolenta*) and grey fantail (*Rhipidura fuliginosa*). Other species recorded include the little wattlebird (*Anthochaera chrysoptera*), rufous whistler (*Pachycephala rufivenris*) and white-throated treecreeper (*Cormobates leucophaeus*).

A total of 20 species were recorded during 2008 surveys with the species recorded typical of those associated with coastal forest habitats, such as the rainbow lorikeet (*Trichoglossus haematodus*), scaly-breasted lorikeet (*Trichoglossus chlorolepidotus*), common koel (*Eudynamis scolopacea*), superb fairy wren (*Malurus cyaneus*) and white-bellied sea-eagle (*Haliaeetus leucogaster*). Eight new species were recorded during 2008 survey including the migratory silvereye (*Zosterops lateralis*) and common koel (*Eudynamis scolopacea*). A lack of winter-flowering plant species reduced the diversity of species expected to occur in the project area at this time.

No nocturnal birds were recorded during surveys, however a tentative record of the powerful owl (*Ninox strenua*) was made adjacent to the site in 2004 (Umwelt 2004), and surveys in 2002 adjacent to the site identified a pair of masked owls (*Tyto novaehollandiae*) adjacent to the northern boundary of the site (ERM 2002) (**Figure 5.1**).

5.2.2 Mammals

A total of 16 mammal species were recorded within the project area. The squirrel glider (*Petaurus norfolcensis*) was recorded during spotlighting during the 2003 and 2008 surveys. Two individuals were recorded in an *Acacia irrorata* subsp*. irrorata* tree, a known squirrel glider resource, while the other was recorded in a mature smooth-barked apple (*Angophora costata*) tree. The common brushtail possum (*Trichosurus vulpecula*) was recorded in high



Source: Aerial: Google Earth 2008

0 100 250 500m
1:10 000

Legend

- Lot 220 Boundary
- squirrel glider (2003)
- squirrel glider (2008)
- Approximate Location of masked owl (ERM, 2002)
- Transect recording of common bentwing-bat
- Transect recording of greater broad-nosed bat
- Coastal Sand Apple Blackbutt Forest

FIGURE 5.1

Vegetation Communities and Threatened Species Locations

File Name (A4): R08_V1/1646_086.dgn

numbers during 2003 with 17 individuals recorded during spotlighting and one individual trapped in 2003. One common brushtail possum was recorded in 2008. Two common ringtail possums (*Psuedocheirus peregrinus*) were recorded in each of the 2003 and 2008 surveys.

Ground fauna surveys identified the brown antechinus (*Antechinus stuartii)*) as the most commonly occurring species, with 14 identified in Elliot 'A' traps and one in an Elliot 'B' trap set in an *Angophora costata*. Hair tube analysis in 2008 identified a total of 52 *Antechinus stuartii* records, indicating a large resident population. One New Holland mouse (*Pseudomys novaehollandiae*) was trapped in an Elliot 'A' trap in 2003 and diggings and tracks consistent with bandicoots were identified widely across the project area in both 2003 and 2008. The project area is also expected to provide habitat for the bush rat (*Rattus fuscipes*).

The project area was also identified as habitat for the dingo (*Canis lupis dingo*), echidna (*Tachyglossus aculeatus*), swamp wallaby (*Wallabia bicolor*) and the eastern grey kangaroo (*Macropus giganteus*) which were recorded by scat and track analysis.

A total of five micro-bats were recorded foraging within the project area, including Goulds wattled bat (*Chalinolobus gouldii*) and little forest bat (*Vespadelus vulturnus*). The area is expected to provide habitat for further species. The eastern bentwing-bat (*Miniopterus shreibersii oceanensis*) and greater broad-nosed bat (*Scoteanax ruepellii*), listed as vulnerable species under the TSC Act, were also recorded in the project area in 2003 (**Figure 5.1**).

The project area provides an extensive area of habitat for two mega-bat species, the little red flying-fox (*Pteropus scapulatus*) and the threatened grey-headed flying-fox (*Pteropus poliocephalis*). The exact number of grey-headed flying-foxes occurring at the site during surveys could not be established due to the difficulty of estimating population sizes of flying-foxes, and the entire project area providing flowering eucalypts for foraging at the time of surveys. In 2003 it was estimated that the entire project area provided known habitat for the grey-headed flying fox and therefore the location of the species is not shown on **Figure 5.1**.

5.2.3 Reptiles

Searches of the project area identified three reptile species: the green tree snake (*Dendrelaphis punctulata*), garden skink (*Lampropholis guichenoti*) and lace monitor (*Varanus varius*). In addition, tracks of a large snake were identified during the initial site inspection following the fire when the vast proportion the ground cover occurring in the area had been burnt. These tracks were attributed to the diamond python (*Morelia spilota*), due primarily to the size of the tracks. Potential reptile habitat was identified throughout the project area, such as fallen logs and deep leaf litter, indicating that the project area is likely to provide habitat for further reptile species.

No reptile species were recorded in the project area during the 2008 surveys with the winter timing expected to have significantly reduced the likelihood of identifying the full range of reptile species utilising the project area.

5.2.4 Amphibians

No amphibian species were recorded within the project area. Suitable habitat, such as dams and wet soaks, do not occur within the study area due to the presence of well-drained sandy soils. The common eastern froglet (*Crinia signifera*) was identified adjacent to the project area in an ephemeral water body. Amphibian species may utilise the perimeter of the project

area as a corridor to suitable habitat however the project area does not support habitat for any resident populations of amphibian species.

5.2.5 Aquatic Species

Aquatic species and habitat was not recorded during field surveys.

5.3 Threatened Fauna Species and Endangered Fauna Populations

Four threatened fauna species were identified in the project area and an additional four species were recorded in proximate habitat in previous surveys. No endangered fauna populations were identified in the project area and are none are known to occur in adjacent areas. Threatened species known or expected to occur in the project area include:

- **squirrel glider (*Petaurus norfolcensis*)**: recorded in three locations within the project area during spotlighting surveys in 2003 and 2008. The habitat throughout the project area provides high quality nesting and food resources for this species;

- **grey-headed flying-fox (*Pteropus poliocephalus*):** identified widely across the project area during the 2003 survey. Mature flowering canopy species provide feeding resources for this species. No diurnal roost sites were identified in the project area;

- **greater broad-nosed bat (*Scoteanax rueppellii*)**: recorded in 2003 during the Anabat echolocation transects. The greater broad-nosed bat appears to prefer moist environments such as gullies in coastal forests and is also known to occur in wet and dry sclerophyll forests and open woodland (Churchill 1998). The greater broad-nosed bat roost in hollows in tree trunks and branches and has also been found to roost in the roofs of old buildings (Churchill 1998). The project area is expected to provide foraging and roosting habitat for this species;

- **eastern bentwing-bat (*Miniopterus schreibersii oceanensis*):** recorded in 2003 during Anabat echolocation transects. The eastern bentwing-bat appears to use a variety of habitat type, including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998). The eastern bentwing-bat generally roosts in caves but they are also known to use man-made habitats such as mine adits and road culverts (Churchill 1998). The project area is expected to provide foraging habitat for this species;

- **powerful owl (*Ninox strenua*)**: recorded to the south-west of the project area (Umwelt 2004). Scattered large hollows provide potential nesting resources for this species within the project area and the abundance of possums provide potential food resources. The project area is expected to form part of an extensive foraging habitat for this species;

- **koala (*Phascolarctos cinereus*)**: recorded to the south-west of the project area (Umwelt 2004). Blackbutt (*Eucalyptus pilularis*), known to occur throughout the project area, is considered a tree species that may be important to koalas in Port Stephens LGA (PSC 2002). The project area has potential to be used as a corridor between preferred habitats however it is unlikely that the project area would support a resident population of the species due to the lack of preferred koala feed trees. The CKPoM identifies the project area as supplementary Koala habitat (CKPoM, 2002);

- **eastern pygmy-possum (*Cercartetus nanus*)**: recorded to the south-west of the project area (Umwelt 2004). This species is found in a wide range of habitats, including coastal woodland, feeding primarily on nectar and pollen from banksias, eucalypts and bottlebrushes. Winter surveys were unlikely to detect the species. This species has not been recorded as part of the ecological surveys for this report however it is considered highly likely that this species may occur throughout the project area; and

- **masked owl (*Tyto novaehollandiae*):** a pair of masked owls were recorded to the north of the project area in 2002. Surveys in 2003 and 2008 failed to identify the species and roost trees were not identified. The species may utilise the project area as part of an extensive foraging range, however the species does prefer to hunt in open areas.

6.0 Impact Assessment

6.1 Proposed Site Disturbance

6.1.1 Lot 218

Development of Lot 218 will involve the construction of a 50 metre access road over mobile sand on Lot 227 in DP 1097995 and establishment of an extraction area up to 150 metres wide along the landward margin of the transgressive dune (as shown on **Figure 1.2**). The operational area shown in **Figure 1.2** includes a buffer of approximately 100 metres to allow for sand to fall into the extraction area from the surrounding dunes.

There will be no removal of vegetation or fauna habitat associated with Lot 218 and there will be no ecological impact beyond the extraction boundary. The impact assessment provided below does not consider impacts on ecology associated with the development of Lot 218 as the ecological impacts are likely to be negligible.

6.1.2 Lot 220

Development of Lot 220 will occur progressively in accordance with the extraction plan outlined in **Figure 1.3**. Initially, vegetation will be cleared and topsoil stripped by a bulldozer. Cleared vegetation and topsoil will be stored on-site for use in rehabilitation (outlined in Section 2.3.10 of the main text). Vegetation would be cleared in accordance with the management measures outlined below.

Approximately 48 hectares of vegetation would be removed progressively from Lot 220 with ongoing revegetation and rehabilitation of the site occurring as the operation progresses.

6.2 Impact Mitigation Measures

6.2.1 Protection and Management of Arboreal Habitat

Mackas Sand will implement a detailed pre-clearance survey and clearing procedure to ensure the minimisation of impacts on arboreal fauna species and habitat. This procedure will be implemented for all vegetation clearing required as part of the project.

Trees will be cleared in accordance with the procedure described below. Where possible, salvaged micro-habitats (tree hollows, logs etc.) will be retained for use in rehabilitation once re-established vegetation is suitably mature. The identification of tree hollows is to be undertaken by an appropriately qualified and experienced ecologist, during pre-clearance inspections.

The following pre-clearance survey and clearing procedure aims to minimise the potential for impact on native fauna species (including threatened species), as a result of the clearing of hollow-bearing trees:

- Within the area of clearing, hollow-bearing trees and other habitat structures such as stags, logs and stumps will be clearly marked by an appropriately qualified and experienced person to prevent accidental clearing.

- Vegetation surrounding the marked habitat structures will be cleared and the marked structures left undisturbed for a period of 24 hours.
- Marked hollow-bearing trees will be shaken prior to felling using a bulldozer and then left for a short period to allow any fauna using the hollows to be observed.
- Hollow-bearing trees will be slowly pushed over using a bulldozer, with care taken to avoid damage to hollows.
- Immediately following tree felling each of the identified hollows will be examined for fauna by a suitably qualified and experienced person.
- Where practical, felled trees will be left for a 24-hour period prior to removal in order to allow species to move in to adjoining vegetation of their own volition.
- Nocturnal species which do not immediately move into adjoining vegetation will be captured and kept in a warm, dark and quiet place prior to release within the same vegetation community from which it was captured at night.
- Captured nocturnal animals will be released on the evening of capture and will not be held for extended periods of time.
- Suitable hollows and other habitat structures (including logs, stumps and stags) appropriate for relocation to areas not intended for future development or for use in rehabilitation, will be selected by the appropriately qualified and experienced person.
- Hollows intended for re-erection will be removed and then capped with marine plywood or other suitable material.
- Logs, stumps, stags and hollows intended for ground habitat will be cut into sections, as required and stockpiled for use in rehabilitation.
- In the event that injured fauna are identified, species will be immediately taken to the nearest veterinarian or certified wildlife carer for treatment.

6.2.2 Timing of Clearing

The timing of clearing operations will be designed to reduce the potential impact on breeding species, particularly the squirrel glider and threatened micro-bats. Clearing will (where possible) avoid the winter months when micro-bats and the eastern pygmy possum are in a state of torpor and squirrel gliders begin to breed.

6.2.3 Replacement of Arboreal Habitat

Salvaged tree hollows and logs will be stockpiled and used in site rehabilitation. Once rehabilitation is structurally mature, salvaged tree hollows will be replaced in similar densities to those in unaffected vegetation on the site. Salvaged logs and branches will be spread following topsoil spreading to enhance ground fauna characteristics.

Nest boxes will be used in lieu of salvaged tree hollows if appropriate, as determined as part of the rehabilitation management of the site.

6.3 Rehabilitation

A rehabilitation plan for Lot 218 is not included as part of this proposal, as operations at that site may occur indefinitely due to the natural movement of sand into the extraction area. If the site was decommissioned, the natural progression of sand will re-establish the mobile dune.

Rehabilitation will be undertaken progressively at Lot 220, as discussed in Section 2.3.4 of the main text.

The objectives of rehabilitation for Lot 220 will be to:

- achieve a final landform that is consistent with the surrounding topography and natural landscape;
- ensure that rehabilitation is undertaken progressively; and
- replace the pre-existing vegetation community within the limits of best practice rehabilitation techniques and the post-extraction environment.

Rehabilitation at this site will consist of:

- reducing steep batters to blend with the surrounding topography;
- returning stripped topsoil and vegetation to disturbed areas;
- revegetating disturbed areas with local, indigenous species with the goal of re-establishing the Coastal Sand Apple Blackbutt Forest vegetation community across the site; and
- regularly monitoring and maintaining revegetated areas and removing weed species.

Section 7 provides details on how the progressive establishment of the rehabilitation will be monitored.

6.3.1 Biodiversity Offsetting Considerations

It is widely accepted practice that for sites which support at least moderate condition native vegetation and fauna habitat biodiversity offsetting should be provided to ameliorate the impacts of developments. Over the course of the last five to ten years biodiversity offsets have been used in NSW as an effective measure to ameliorate development impacts on biodiversity. While there are no consistent, universally applied guidelines available, it is generally accepted that in principle biodiversity offsets should be:

- located as close as possible to the areas subject to impact, depending on the availability of such areas;
- appropriately monitored and managed for biodiversity outcomes;
- appropriately protected, usually involving at least re-zoning and often involving covenants and other forms of in-perpetuity protection; and
- usually at least as large as the area impacted, and often larger (meaning more frequently than not a minimum 1:1 offset ratio).

Although these principles are not universally employed, it is recognised that they form an appropriate approach around which individual development offsets are assessed.

The project area comprises significant ecological values. The project area is located within an extensive area of Coastal Sand Apple Blackbutt Forest which has been identified as regionally significant habitat (refer to **Section 5.1**) and is known to provide habitat for a range of threatened flora and fauna species. The project area is contiguous with this habitat and is considered to be representative in respect to the species and communities known to occur within the Stockton Bight dune system. The project area does not comprise unique values or areas that are dissimilar to the surrounding coastal dune system.

The determination of an appropriate biodiversity offset is driven by the ecological values present within the project area rather than as an offset ratio. Ratios are often used however to guide biodiversity offsetting requirements and a ratio of 2:1 is generally accepted as an appropriate outcome for the offsetting of ecologically significant areas. If an offsetting ratio of 2:1 was applied, for example, an area of 96 hectares of Coastal Sands Apple Blackbutt Forest would be required as a biodiversity offset for this project.

Worimi LALC owns a significant area of Coastal Sand Apple Blackbutt Forest along Stockton Bight which is managed for its conservation values (**Figure 4.1**). The Worimi Conservation Lands cover an area of 4438 hectares, of which approximately 2180 hectares comprises Coastal Sand Apple Blackbutt Forest. The conservation lands are considered to comprise similar ecological values to the project area. The recently gazetted Worimi Conservation Lands, which includes the 524 hectare Worimi National Park, would adequately compensate for the clearing of 48 hectares of coastal forest. As discussed, this cleared area will be progressively re-established over the life of the project.

6.4 Impact on Flora Species and Vegetation Communities

In terms of general diversity of flora species, the project area appears to be representative of surrounding areas in the locality. Overall, plant species diversity within the project area is considered to be moderate, with a total of 41 species being recorded within one vegetation community, Coastal Sand Apple Blackbutt Forest.

Although the natural vegetation within the project area is of ecological significance due to the high levels of historical clearing in coastal areas, the impact of the project will not be significant. The predicted impact is not expected to result in a significant loss of floristic diversity in the project area, Salt Ash area or the region. The project area is contiguous with Worimi National Conservation Lands which conserves approximately 2180 hectares of Coastal Sand Apple Blackbutt Forest. The conservation lands are situated within an extensive band of Coastal Sand Apple Blackbutt Forest that stretches from Stockton in the south to Tomaree in the north. The loss of vegetation associated with the project represents less than three per cent of this community in the local area.

Threatened flora species known to occur in the local area and region are included in an assessment of significance in Table 1 of **Attachment 3**. The assessment of significance applies a modified seven part test and concludes that the project will not have a significant impact on threatened flora species and TECs.

The loss of a total of 48 hectares of vegetation from within the project area is not expected to have a significant impact on flora species or vegetation communities.

6.5 Impact on Fauna Species and Habitats

It is unlikely that the project will result in a significant loss or deterioration of fauna species and habitat within the local area. The project will result in the loss of approximately 48 hectares of Coastal Sand Apple – Blackbutt Forest which provides habitat for at least 50 locally-occurring fauna species. The habitats proposed to be removed are widely represented and conserved in the local area and region and their removal is not expected impact on connectivity and movement of species throughout the Stockton Bight habitat complex.

The progressive rehabilitation of the project area will ensure that fauna habitat will be returned to the site, albeit in a state of reduced ecological value for a period of time. Rehabilitation will aim to recreate the currently occurring vegetation community and habitats and will include replacement of ground and arboreal mammal resources such as logs and tree hollows. Site rehabilitation and ongoing monitoring requirements are discussed in detail in **Section 7**.

Threatened fauna species known to occur in the local area and region are included in an assessment of significance in Table 1 of **Attachment 3**. The assessment of significance applies a modified seven part test and concludes that the project will not have a significant impact on threatened fauna species and populations.

6.6 Impact on Threatened Species, Endangered Populations and TECS

6.6.1 NSW Legislation

6.6.1.1 *Environmental Planning and Assessment Act 1979*

Sixteen threatened fauna species listed under the TSC Act are considered to have potential habitat in the project area (refer to **Attachment 3**), with the following eight species recorded during surveys in the project area and adjacent habitats:

- squirrel glider (*Petaurus norfolcensis*);
- grey-headed flying-fox (*Pteropus poliocephalus*);
- greater broad-nosed bat (*Scoteanax rueppellii*);
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*);
- powerful owl (*Ninox strenua*);
- koala (*Phascolarctos cinereus*);
- eastern pygmy-possum (*Cercartetus nanus*); and
- masked owl (*Tyto novaehollandiae*)

An assessment of significance was used to determine the potential impact of the project on threatened species, endangered populations and TECs recorded, or considered likely to occur in the project area. The assessment of significance, provided in **Attachment 3**, concludes that the project will not have a significant impact on threatened species,

endangered populations, TECs or their habitats recorded within the project area due primarily to the availability and quality of contiguous habitat.

6.6.1.2 *Fisheries Management Act 1994*

The project area does not contain aquatic habitat for threatened species listed under the FM Act. Further assessment of threatened aquatic species is not required.

6.6.1.3 SEPP 44 Assessment

The vegetation communities in the project area were assessed according to Schedule 2 of SEPP 44, and it was found that none of the listed species occur. As a result, the site is not considered to provide potential koala habitat as defined by SEPP 44 and further assessment under the SEPP is therefore not required.

Although the SEPP 44 assessment shows that the site does not provide potential koala habitat (refer to **Section 5.1.1**), the koala is nevertheless considered to potentially occur within the project area, therefore the impact of the project on the species was assessed further under an assessment of significance provided in **Attachment 3**. This assessment also concluded that the project will not significantly impact the koala.

6.6.2 Commonwealth Legislation

6.6.2.1 *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*

Under the Commonwealth EPBC Act, the approval of the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance (NES). These matters are:

- listed threatened species and communities;
- migratory species protected under international agreements;
- Ramsar wetlands of international importance;
- the Commonwealth marine environment;
- World Heritage properties;
- National Heritage places; and
- nuclear actions.

A search of the DEWHA Protected Matters database identified (discounting fishes and marine species) no threatened ecological communities, 15 threatened species and 16 migratory species considered likely to occur, on the basis of habitat modelling, within a 10 kilometre radius of the project area. Those species with potential habitat in the project area are shown in Table 1 and Table 2 of **Attachment 3**.

One EPBC listed threatened species (grey-headed flying-fox) and two migratory species (sea eagle and whistling kite) were recorded within the project area during surveys. These species are considered in the assessment of significance provided in **Attachment 4**.

The EPBC Act 1999 lists criteria which are used to determine whether an action is likely to have a significant impact on matters of NES. These criteria are addressed in the Assessment of Significance provided in **Attachment 4**. From the assessment of significance, it is concluded that the project will not pose a significant impact on listed threatened species and communities or migratory species listed under the Schedules of the EPBC Act.

7.0 Rehabilitation and Ecological Monitoring

7.1 Rehabilitation Monitoring

In designing a rehabilitation monitoring program, Mackas Sand will select the most appropriate indicators and methods that:

- provide a good indication of the status of the environmental value that the project aims to protect;
- are relatively simple to measure and are reproducible; and
- are cost effective.

Where relevant, the scope of the monitoring program is to cover each phase of the sand extraction operation including:

- pre-extraction baseline surveys;
- rehabilitation; and
- post-rehabilitation.

7.1.1 Pre-extraction Baseline Surveys

Baseline monitoring is to be conducted prior to any site disturbance in the project area. This information will be used to develop suitable rehabilitation criteria and to assess the performance of rehabilitation on site.

A number of monitoring criteria need to be considered when undertaking a pre-extraction baseline monitoring survey. These criteria should be considered throughout all phases of the project. As the objective of the rehabilitation is to returned the site to a native ecosystem, reference/analogue sites are required based on the following criteria:

- analogue sites should occur in natural ecosystems, representative of the goal/target for rehabilitation;
- where possible, analogue sites should occur in areas that have experienced minimal disturbance; and
- analogue sites should be chosen within vegetation communities corresponding to those that are to be rehabilitated along with similar media-plant-climate interactions as those in newly constructed post-extraction landform.

7.1.2 Rehabilitation Surveys

As a minimum, the long-term rehabilitation monitoring will:

- compare results against rehabilitation objectives and targets;
- identify possible trends and continuous improvement;
- link to records of rehabilitation to determine causes and explain results;

- assess effectiveness of environmental controls implemented;
- where necessary, identify modifications required for the monitoring program, rehabilitation practices or areas requiring research;
- compare flora species present against original seed mix and/or analogue sites;
- assess vegetation health;
- assess vegetation structure (upper, mid and lower storey); and
- where applicable, assess native fauna species diversity and the effectiveness of habitat creation for target fauna species.

Where necessary, rehabilitation procedures should be amended accordingly to continually improve rehabilitation standards.

Monitoring for Native Fauna Habitat Establishment

The re-establishment of native fauna habitat is a key objective of site rehabilitation. Monitoring of the following floristic characteristics will provide an indication of habitat re-establishment, which will be supplemented with targeted fauna surveys:

- plant community structural attributes;
- cover, species density, height and structural diversity;
- species richness (the number of plant species present in each structural layer of each vegetation community);
- the presence and abundance of any weed species; and
- assessment of natural regeneration/recruitment of new species.

The monitoring survey will be undertaken within both rehabilitation areas and analogue sites over the life of the project. The number of sites will be determined progressively as sand extraction and rehabilitation progresses over time. Ground fauna and bird diversity and abundance will be monitored to provide data on the re-establishment of native vegetation communities and habitats in the project area.

7.1.3 Post-rehabilitation Monitoring

Following completion of sand extraction operations and rehabilitation in the project area a flora and fauna assessment should be undertaken in accordance with the relevant survey and assessment guidelines to ascertain the effectiveness of rehabilitation in providing vegetation community and fauna species and habitat re-establishment.

7.1.4 Timing of Monitoring

Baseline monitoring of analogue sites will be undertaken prior to commencement of sand extraction operations. It is proposed that monitoring will be undertaken annually for the first three years and then every three years thereafter for the life of the operation.

7.2 Weed Monitoring

Weed control will be conducted in order to ensure that the ecological value of the rehabilitation is not significantly compromised. Weed control measures will include:

- regular site inspections to identify areas of weed infestation and type of weed species;
- development and implementation of an eradication plan applicable to the circumstances, which may include manual removal, spot spraying, boom spraying, aerial spraying or biological control;
- regular contact with neighbouring property owners to attempt to eradicate weed species from the surrounding area;
- minimisation of vegetation disturbance by reducing the number of tracks and using the same access routes;
- minimisation of clearing and other disturbance of vegetation associated with civil works;
- early establishment and maintenance of vigorous grasses and native trees particularly during rehabilitation of overburden dumps; and
- regular maintenance of topsoil stockpiles to eradicate weed infestation.

Bitou bush (*Crysanthemoides monolifera* subsp *chrysanthemoides*) is a highly invasive species occurring in coastal habitats along the NSW coast. This weed has a vigorous growth habitat which results in it smothering native groundcovers and inhibiting regeneration. Mackas Sand will target this species for eradication in areas where it is recorded as well as implement measures (e.g. application of herbicide) to prevent it from establishing in new rehabilitation areas.

If a substantial increase in the density of any known weed species, or the occurrence of a previously unrecorded weed species, is discovered, Mackas Sand will seek advice on the management and control options for that species and endeavour to minimise its impact on native flora and fauna.

7.3 Feral Animal Control

Feral animal control will be undertaken in consultation with the neighbouring landholders. Programs to control feral animals will include the determination of appropriate control practices, consultation with appropriate authority, obtaining appropriate approvals, implementing control practice and undertaking follow-up monitoring and control as required.

If a substantial increase in the density of any known feral fauna species, or the occurrence of a previously unrecorded feral fauna species, is discovered, Mackas Sand will seek expert advice on the management and control options for that species and endeavour to minimise its impact on native flora and fauna.

8.0 References

Allison, F R & Hoye, G A, 2002. Eastern Freetail-bat, in: *The Mammals of Australia* Revised Edition, ed R Strahan, Reed New Holland, Sydney.

Anstis, M, 2002. Tadpoles of South-eastern Australia. Reed New Holland, Sydney.

Austin, M, P, Cawsey, E, M, Baker, B, L, Yialeloglou, M, M, Grice, D, J, and Briggs, S, V, 2000. Predicted Vegetation Cover in the Central Lachlan Region. Final report of the Natural Heritage Trust Project AA 1368.97. CSIRO Wildlife and Ecology, Canberra.

Barker, J, Grigg, G C & Tyler, M J 1995. *A Field Guide to Australian Frogs*. Surrey Beatty & Sons, Sydney.

Bishop, T, 2000. *Field Guide to the Orchids of New South Wales and Victoria. New South Wales*. University Press, Sydney.

Botanic Gardens Trust 2007. *PlantNET* – The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (version 2.0). <http://plantnet.rbgsyd.nsw.gov.au> accessed July 2008.

Braun-Blanquet, J, 1927. *Pflanzensoziologie*. Springer, Vienna.

Churchill, S, 1998. *Australian Bats*. Reed New Holland, Sydney.

Cogger, H, G, 2000. *Reptiles & Amphibians of Australia*. Reed Books, Chatswood.

Cronquist, A, 1981. *An Integrated System of Classification of Flowering Plants*. Columbia University Press, New York.

Debus, S, 2001. *The Birds of Prey of Australia. A Field Guide*. JB Books, Marleston, South Australia.

(DEC) Department of Environment and Conservation, 2004. Threatened Species Survey and Assessment: Guidelines for development and activities (working draft), New South Wales Department or Environment and Conservation, Hurstville, NSW.

(DECC) Department of Environment and Climate Change, 2008. NSW Threatened Species Profiles (accessed July 2008) www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx

Driscoll, C, & Bell, S, 2006. Vegetation of the Tomago and Tomaree sandbeds, Port Stephens, New South Wales. Part 1 – management of groundwater dependent ecosystems. Unpublished Report to Hunter Water Corporation. Eastcoast Flora Survey, September 2006.

Dwyer, P D, 2002. Common Bentwing-bat, in: *The Mammals of Australia* Revised Edition, ed R Strahan, Reed New Holland, Sydney.

Environmental Resources Management. *Electricity Supply Upgrade from Tomago to Tomaree Environmental Impact Statement,* prepared for EnergyAustralia.

Garnett, S, T, and Crowley, G, M, 2000. The Action Plan for Australian Birds. Environment Australia.

Harden, G, J, editor 1992. *Flora of New South Wales. Volume 3*. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Harden, G, J, editor 1993. *Flora of New South Wales. Volume 4*. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Harden, G, J, editor 2000. *Flora of New South Wales. Volume 1*. 2nd edition. New South Wales University Press and Royal Botanic Gardens, Sydney.

Harden, G, J, editor 2002. *Flora of New South Wales. Volume 2*. Revised edition. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Hollands, D, 1991. *Birds of the Night. Owls, Frogmouths and Nightjars of Australia*, Reed Books, Balgowlah, NSW.

Hollands, D, 2003. *Eagles, Hawks and Falcons of Australia*. Bloomings Books Pty Ltd, Melbourne Australia.

House, S, 2003. Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy, Technical Report, Digital Aerial Photo Interpretation and Updated Extant Vegetation Community Map, May 2003. Lower Hunter and Central Coast Regional Environmental Management Strategy, Callaghan, NSW.

Hoye, G.A. and Richards, G.C, 2002. Greater Broad-nosed Bat *Scoteanax rueppellii*. In *The Mammals of Australia*. Ed. R. Strahan. Australian Museum / Reed Publications.

Kavanagh, R, P, 2002. Comparative diets of the Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*) in southeastern Australia, in *Ecology and Conservation of Owls,* eds I Newton, R Kavanagh, J Olsen and I Taylor, CSIRO Publishing, Collingwood Australia.

Menkhorst, P, and Knight, F, 2004. *A field guide to the Mammals of Australia*. Oxford University Press, South Melbourne.

(NPWS) National Parks and Wildlife Service, 2000. Vegetation Survey Classification and Mapping: Lower Hunter and Central Coast Region. Version 1.2. A Project undertaken for the Lower Hunter and Central Coast Regional Environment Management Strategy. Sydney Zone, New South Wales National Parks and Wildlife Service, Hurstville.

(NPWS) National Parks and Wildlife Service, 2003. Draft Recovery Plan for the Koala. New South Wales National Parks and Wildlife Service, Hurstville, NSW.

Peake, T, C, Bell, S, A, J, Tame, T, M, Simpson, J, A, and Curran, T, J, 2003. The Hunter Rare Plants Database: Identification and Listing of Regionally Significant Flora for the Hunter Region, New South Wales. Poster at Ecological Society of Australia Conference, Armidale, December 2003.

Poore, M, E, D, 1955. The use of phytosociological methods in ecological investigations. I. The Braun-Blanquet system. *Journal of Ecology* 42: 216-224.

Port Stephens Council and Australian Koala Foundation (2002). *Port Stephens Council Comprehensive Koala Plan of Management*, Port Stephens Council.

Richards, G.C, 2002. Large-footed Myotis *Myotis adversus*. In *The Mammals of Australia*. Ed, R. Strahan. Australian Museum/Reed Publications.

Robinson, M, 1998. *A Field Guide to Frogs of Australia*. Australian Museum/Reed New Holland, Sydney.

Soderquist, T, 2002. Brush-tailed phascogale, in *The Mammals of Australia* Revised Edition, ed R Strahan, Reed New Holland, Sydney, pp. 104 - 106.

Slater, P, Slater, P, and Slater, R, 1989. *The Slater Field Guide to Australian Birds*. Weldon Publishing, Sydney.

Strahan, R, 2002. *The Mammals of Australia*. Reed New Holland, Sydney.

Swan, G, Shea, G, & Sadlier, R, 2004. *A Field Guide to Reptiles of New South Wales*. Reed New Holland, Sydney.

Tidemann, C R, 2002. Grey-headed flying-fox, in: The Mammals of Australia Revised Edition, ed R Strahan, Reed New Holland, Sydney, pp. 439 - 441.

Turner, V, and Ward, S, J, 2002. Eastern pygmy-possum, in *The Mammals of Australia* Revised Edition, ed R Strahan, Reed New Holland, Sydney, pp. 217 - 218.

Umwelt (Australia) Pty Limited 2003. Flora and Fauna Assessment for Proposed Rezoning of Lot 8 Stockton Bight.

Umwelt (Australia) Pty Limited 2004. Flora and Fauna Assessment for Proposed Rezoning of Lot 218, Stockton Bight – draft report prepared for Worimi Local Aboriginal Land Council.

Weigel, J 1990. *Australian Reptile Park's Guide to Snakes of South-East Australia*. Weigel Postscript.

Wheeler, D, J, B, Jacobs, S, W, L, and Whalley, R, D, B, 2002. *Grasses of New South Wales*, 3rd Edition. The University of New England, Armidale.

Wilson, S, and Swan, G, 2003. *A Complete Guide to Reptiles of Australia*. Reed New Holland, Sydney.

ATTACHMENT 1

Flora Species List

Attachment 1 – Flora Species List

The following list was developed from surveys of the project area detailed in Section 3 of the main report. It includes all species of vascular plants observed in the project area during fieldwork. Not all species are readily detected at any one time of the year, therefore the list will not necessarily include all plant species likely to occur in the project area. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp.	specimens that are identified to genus level only;
?	specimens for which identification was uncertain;
prob.	specimens for which identification was considered highly likely but not definite; and
poss.	specimens for which identification was considered likely but not definite.

The following abbreviations or symbols are used in the list:

asterisk (*)	denotes species not indigenous to the project area;
subsp.	subspecies;
var.	variety;
f.	forma; and
X	hybrid.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2008), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Family	Scientific Name	Common Name	2003	2008
Filicopsida (Ferns)				
Dennstaedtiaceae	*Pteridium esculentum*	bracken	✓	✓
Cycadopsida (Cycads)				
Zamiaceae	*Macrozamia communis*	burrawang	✓	✓
Magnoliopsida (Flowering Plants) – Liliidae (Monocots)				
Lomandraceae	*Lomandra longifolia*	spiny-headed mat-rush	✓	✓
Orchidaceae	*Acianthus fornicatus*	pixie caps		✓
Orchidaceae	*Caladenia catenata*	white caladenia	✓	
Orchidaceae	*Caladenia carnea*	pink caladenia		✓
Phormiaceae	*Dianella caerulea* var. *producta*			✓
Poaceae	*Cymbopogon refractus*	barbed wire grass	✓	
Poaceae	*Imperata cylindrica* var. *major*	blady grass		✓
Poaceae	*Themeda australis*	kangaroo grass	✓	✓
Smilacaceae	*Smilax australis*	sarsaparilla	✓	
Magnoliopsida (Flowering Plants) – Magnoliidae (Dicots)				
Dilleniaceae	*Hibbertia aspera*	rough Guinea flower		✓
Epacridaceae	*Monotoca elliptica*	tree broom-heath		✓
Euphorbiaceae	*Ricinocarpos pinifolius*	wedding bush		✓
Haloragaceae	*Gonocarpus teucrioides*	raspwort	✓	✓
Fabaceae (Faboideae)	*Aotus ericoides*		✓	
Fabaceae (Faboideae)	*Bossiaea rhombifolia*		✓	✓
Fabaceae (Faboideae)	*Dillwynia retorta*		✓	✓
Fabaceae (Faboideae)	*Glycine microphylla*		✓	
Fabaceae (Faboideae)	*Hardenbergia violacea*	false sarsaparilla	✓	✓
Fabaceae (Faboideae)	*Kennedia rubicunda*	red Kennedy pea		✓
Fabaceae (Mimosoideae)	*Acacia irrorata subsp. irrorata*	green wattle	✓	✓
Fabaceae (Mimosoideae)	*Acacia longifolia*			✓
Fabaceae (Mimosoideae)	*Acacia suaveolens*	sweet wattle		✓
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	prickly Moses	✓	✓
Lamiaceae	*Westringia fruticosa*	coastal rosemary	✓	
Lauraceae	*Endiandra sieberi*	hard corkwood		✓
Lobeliaceae	*Lobelia alata*	angled lobelia		✓
Myrtaceae	*Angophora costata*	smooth-barked apple	✓	✓
Myrtaceae	*Eucalyptus pilularis*	blackbutt	✓	✓
Myrtaceae	*Leptospermum* sp.		✓	
Myrtaceae	*Melaleuca quinquenervia*	broad-leaved paperbark	✓	✓
Proteaceae	*Banksia oblongifolia*			✓
Proteaceae	*Banksia serrata*	old-man banksia	✓	✓
Proteaceae	*Hakea* sp.		✓	
Proteaceae	*Persoonia levis*	broad-leaved geebung	✓	✓
Rubiaceae	*Pomax umbellata*			✓
Santalaceae	*Exocarpos cupressiformis*	native cherry	✓	✓
Sapindaceae	*Dodonaea triquetra*	large-leaf hop-bush		✓
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*			✓
Tremandraceae	*Tetratheca ericifolia*			✓

ATTACHMENT 2

Fauna Species List

Attachment 2 – Fauna Species List

The following list was developed from surveys of project area detailed in Section 5 of the main report. It includes all species of vertebrate fauna observed within the project area during fieldwork.

X = Species recorded by Umwelt in the project area.

Any species that could not be identified to the species taxonomic level are denoted in the following manner:

sp.	specimens that are identified to genus level only;
?	specimens for which identification was uncertain;
prob.	specimens for which identification was considered highly likely but not definite; and
poss.	specimens for which identification was considered likely but not definite.

The following abbreviations or symbols are used in the list:

asterisk (*)	denotes species not indigenous to the project area;
subsp.	subspecies;
MAR	Listed marine species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
MIG	Listed migratory species under the EPBC Act;
V	Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act); and
E	Endangered under Schedule 2 of the TSC Act.

Birds recorded were identified using descriptions in Slater et al. (2003) and the scientific and common name nomenclature of Birds Australia. Reptiles recorded were identified using keys and descriptions in Cogger (1994), Swan et al. (2004), Weigel (1990) and Wilson & Swan (2003) and the scientific and common name nomenclature of Cogger (1994).

Amphibians recorded were identified using keys and descriptions in Cogger (1994), Robinson (1998), Anstis (2002) and Barker et al. (1995) and the scientific and common name nomenclature of Cogger (1994). Mammals recorded were identified using keys and descriptions in Strahan (1995), Churchill (1998) and Menkhorst & Knight (2004) and the scientific and common name nomenclature of Strahan (1995) for non-bat species and Churchill (1998) for bats.

Scientific Name	Common Name	Conservation Status		Survey	
		TSC Act	EPBC Act	2003	2008
BIRDS					
Accipitridae					
Haliastur sphenurus	whistling kite		MAR & MIG		X
Haliaeetus leucogaster	white-bellied sea-eagle		MAR & MIG		X
Columbidae					
Ocyphaps lophotes	crested pigeon			X	
Cacatuidae					
Calyptorhynchus funereus	yellow-tailed black-cockatoo			X	X
Psittacidae					
Trichoglossus haematodus	rainbow lorikeet			X	
Trichoglossus chlorolepidotus	scaly-breasted lorikeet			X	
Cuculidae					
Cacomantis flabelliformis	fan-tailed cuckoo		MAR		X
Eudynamis scolopacea	common koel		MAR		X
Halcyonidae					
Dacelo novaeguineae	laughing kookaburra			X	X
Climacteridae					
Corombates leucophaeus	white-throated treecreeper			X	X
Maluridae					
Malurus cyaneus	superb fairy-wren			X	X
Pardalotidae					
Pardalotus punctatus	spotted pardalote				X
Acanthiza pusilla	brown thornbill			X	X
Acanthiza nana	yellow thornbill			X	
Meliphagidae					
Anthochaera chrysoptera	little wattlebird			X	
Philemon corniculatus	noisy friarbird			X	
Lichenostomus chrysops	yellow-faced honeyeater			X	X
Acanthorhynchus tenuirostris	eastern spinebill				X
Myzomela sanguinolenta	scarlet honeyeater			X	
Petroicidae					
Eopsaltria australis	eastern yellow robin			X	X
Cinclosomatidae					
Psophodes olivaceus	eastern whipbird			X	X
Pachycephalidae					
Pachycephala rufiventris	rufous whistler			X	
Colluricincla harmonica	grey shrike-thrush				X
Dicruridae					
Myiagra rubecula	leaden flycatcher			X	
Rhipidura fuliginosa	grey fantail			X	X

Scientific Name	Common Name	Conservation Status		Survey	
		TSC Act	EPBC Act	2003	2008
Campephagidae					
Coracina novaehollandiae	black-faced cuckoo-shrike		MAR		X
Artamidae					
Strepera graculina	pied currawong			X	X
Corvidae					
Corvus coronoides	Australian raven			X	X
Zosteropidae					
Zosterops lateralis	silvereye		MAR	X	X
REPTILES					
Varanidae					
Varanus varius	lace monitor			X	
Scincidae					
Lampropholis guichenoti	garden skink			X	
Boidae					
Morelia spilota ssp. spilota	diamond python			X	
Colubridae					
Dendrelaphis punctulata	green tree snake			X	
AMPHIBIANS					
Myobatrachidae					
Crinia signifera	common eastern froglet			X	
MAMMALS					
Dasyuridae					
Antechinus stuartii	brown antechinus			X	
Peramelidae					
Isoodon macrourus	northern brown bandicoot			Prob.	Prob.
Perameles nasuta	long-nosed bandicoot			Prob.	Prob.
Petauridae					
Petaurus norfolcensis	squirrel glider	V		X	X
Pseudocheiridae					
Pseudocheirus peregrinus	common ringtail possum			X	X
Phalangeridae					
Trichosurus vulpecula	common brushtail possum			X	X
Macropodidae					
Macropus giganteus	eastern grey kangaroo			X	
Pteropodidae					
Pteropus poliocephalus	grey-headed flying-fox	V	V	X	
Pteropus scapulatus	little red flying-fox			X	
Molossidae					
Mormopterus "Species 2"	freetail bat			X	

Scientific Name	Common Name	Conservation Status		Survey	
		TSC Act	EPBC Act	2003	2008
Vespertilionidae					
Miniopterus schreibersii oceanensis	eastern bentwing-bat	V		X	
Chalinolobus gouldii	Goulds wattled bat			X	
Scoteanax rueppellii	greater broad-nosed bat	V		X	
Vespadelus vulturnus	little forest bat			X	X
Muridae					
Pseudomys novaehollandiae	New Holland mouse			X	
Canidae					
*Canis lupus dingo**	dingo			X	

ATTACHMENT 3

Assessment of Significance under the *Environmental Planning and Assessment Act 1979*

Attachment 3 – Assessment of Significance

Environmental Planning and Assessment Act 1979 (EP&A Act) Assessment

Threatened species, endangered populations, or threatened ecological communities (TECs) recorded during surveys and known to occur in the local area are listed in **Tables 1** and **2** below, as are the results of the searches of the Department of Environment and Climate Change (DECC) Atlas of NSW Wildlife and the Department of the Environment Water Heritage and the Arts (DEWHA) Protected Matters Database. These database searches provided lists of species, populations or TECs previously recorded within a 10 kilometre radius of the project area, or with potential habitat within that radius.

Tables 1 and **2** provide information on each threatened species (including specific habitat, distribution and reservation) and provide assessments of the potential impact from the proposed development. Those species considered to have reasonable potential to occur within the project area (based on known distribution and habitat requirements) and with reasonable potential to be significantly impacted by the proposed development are addressed in more detail in the 'Assessment of Significance' following the tables. This assessment of significance takes the form of a modified seven part test in accordance with the *Environmental Planning and Assessment* (EP&A) *Act 1979*, for all species listed under the *Threatened Species Conservation Act* (TSC) *1995* found to have reasonable potential to be impacted by the proposed development. Pelagic species have not been included in this assessment.

All species listed under the *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999* requiring further assessment are considered in a separate assessment provided in Attachment 4.

Table 1 – Threatened Flora Assessment

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
THREATENED FLORA SPECIES						
netted bottle brush *Callistemon linearifolius*	V (TSC)	This species typically grows in dry sclerophyll forest on the coast and adjacent ranges.	Occurs chiefly from the Georges River to the Hawkesbury River.	Karuah NR	The project area is unlikely to provide potential habitat for this species and the species was not recorded during flora surveys. There is no potential for a significant impact on this species.	No
Eucalyptus parramattensis subsp. *decadens*	V (TSC) V (EPBC)	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant.	There are two separate meta-populations of this species. . The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south. The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Abedare in the south. Large aggregations of the sub-species are located in the Tomalpin area	This species is not known from any reservation areas in the region.	This species was not recorded during flora surveys undertaken in potential habitat for the species. This species is not expected to occur. There is no potential for a significant impact on this species.	No

Table 1 – Threatened Flora Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Angophora inopina	V (EPBC)	Habitat for this species typically occurs on the shallow sandy soils of the Narrabeen Group, on exposed ridges and slopes with westerly or northerly aspect. It has also been recorded on shallow alluvial soils in upper catchments and in embedded clay soil lenses with sandstone. This species is known to naturally hybridise with *A. floribunda*, particularly around major drainage lines.	This species has a restricted distribution, being confined to the Wyong, Lake Macquarie and Port Stephens Shires of NSW. Pure forms of this species have been recorded from the Wallarah catchment in the south and north to the Toronto area. Disjunct populations have been identified at Karuah.	Medowie SCA	The project area is unlikely to provide potential habitat for this species and the species was not recorded during flora surveys. There is no potential for a significant impact on this species.	No
leafless tongue-orchid *Cryptostylis hunteriana*	V (EPBC)	This species appears to favour moist soils on the flat coastal plains. Occupies swamp heath, but also sclerophyll forest and woodland, often on sandy soils. Typically found in communities containing *Eucalyptus haemastoma, E. capitellata* and *Corymbia gummifera*.	This species is known to occur in the Karuah Manning and Wyong CMA sub-regions in the Hunter Central Rivers region.	This species is not known from any reservation areas in the region.	The project area is unlikely to provide potential habitat for this species and the species was not recorded during flora surveys. There is no potential for a significant impact on this species.	No

Table 1 – Threatened Flora Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
sand doubletail *Diuris arenaria*	E (TSC)	This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil.	This species is known to occur in the Karuah Manning sub-region of the Hunter/Central Rivers Catchment.	Tomaree NP	This species was not recorded during flora surveys undertaken during the confirmed flowering period for the species. The project area does not provide preferred habitat for this species. There is no potential for a significant impact on this species.	No
rough doubletail *Diuris praecox*	V (TSC) V (EPBC)	Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey.	Occurs between Ourimbah and Nelson Bay.	Glenrock SCA	This species was not recorded during flora surveys undertaken in marginal potential habitat for the species. However potential habitat was identified within the project area.	Yes
Camfields stringybark *Eucalyptus camfieldii*	V (TSC) V (EPBC)	Occurs in poor coastal country in shallow sandy soils and coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace Area south to Waterfall. Localised and scattered distribution includes sites at Norah Head, Peats Ridge, Mt Colah, Elvina Bay Trail, Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park.	This species is not known from any reservation areas in the region.	This species was not recorded during flora surveys undertaken in potential habitat for the species. This species is not expected to occur and further assessment is not required.	No

Table 1 – Threatened Flora Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
knotweed *Persicaria elatior*	V (EPBC)	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	This species has been recorded in south-eastern and northern NSW. In the north it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). This species also occurs in Queensland.	This species is not known from any reservation areas in the region.	The project area is does not provide potential habitat for this species. There is no potential for a significant impact on this species.	No
dwarf kerrawang *Rulingia prostrata*	E (TSC) E (EPBC)	Occurs on sandy, sometimes peaty soils in a wide variety of habitats. Chiefly in gullies along the escarpment south from Picton.	This species is known to occur in the Karuah Manning sub-region of the Hunter/Central Rivers Catchment and a disjunct population occurs on Swamp Mahogany ecotonal forest at Tomago.	This species is not known from any reservation areas in the region.	The project area does not provide potential habitat for this species. There is no potential for a significant impact on this species.	No

Table 1 – Threatened Flora Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
THREATENED ECOLOGICAL COMMUNITIES (TECs)						
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC (TSC)	Occurs on sand dunes and on soil derived from underlying rocks. Stands on headlands exposed to strong wind-action may take the form of dense, wind-pruned thickets. Stands are generally taller in sheltered sites such as hind dunes, although wind-pruning may still occur on their windward sides. Most stands occur within two kilometres of the sea, though are occasionally found further inland within reach of the maritime influence.	Littoral Rainforest occurs only on the coast and is found at locations in the NSW North Coast Bioregion, Sydney Basin Bioregion and South East Corner Bioregion.	Glenrock SCA	This EEC is not present within the project area and there is no potential for a significant impact on this EEC.	No
RAMSAR WETLANDS OF INTERNATIONAL SIGNIFICANCE						
Myall Lakes	EPBC Matter of National Environmental Significance	n/a	Within 10 kilometres of the project area.	Myall Lakes NP	This Ramsar site is not present within the project area and there is no potential for a significant impact on this Ramsar.	No

Table 1 – Threatened Flora Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Hunter Estuary Wetlands	EPBC Matter of National Environmental Significance	n/a	Within 10 kilometres of the project area.	Comprises Kooragang Nature Reserve and Shortland Wetlands.	This Ramsar site is not present within the project area and there is no potential for a significant impact.	No

Key: TSC = *Threatened Species Conservation Act* 1995;
EPBC Act = *Environment Protection and Biodiversity Conservation Act* 1999;
E = Endangered;
V = Vulnerable;
PD = Preliminary Determination;
EEC = Endangered Ecological Community;
CEEC = Critically Endangered Ecological Community;
EP = Endangered Population;
SCA = State Conservation Area; and
NP = National Park.

Table 2 – Threatened Fauna Assessment

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
AMPHIBIANS						
wallum froglet *Crinia tinnula*	V (TSC)	Wallum Froglets are found only in acid paperbark swamps and sedge swamps of the coastal 'wallum' country.	This species is known to occur in the Hunter, Karuah Manning, Wyong and Macleay Hastings subregions of the Hunter/Central Rivers Catchment.	Tomaree NP	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. wallum sedgeland). There is no potential for a significant impact on this species.	No
stuttering barred frog *Mixophyes balbus*	V (EPBC)	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	Occur along the east coast of Australia from southern Queensland to the north-eastern Victoria	Killarney NR Watagans NP	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. rainforest or tall open forest). There is no potential for a significant impact on this species.	No
green and golden bell frog *Litoria aurea*	V (EPBC)	Occurs amongst emergent aquatic or riparian vegetation and amongst vegetation, fallen timber, including grassland, cropland and modified pastures. Breeds in still or slow flowing waterbodies with some vegetation such as *Typha* spp. and *Eleocharis* spp.	NSW North Coast near Brunswick Heads, southwards along the NSW Coast to Victoria where it extends into east Gippsland.	This species is not known from any conservation reserves in the region.	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. wetlands and ponds). There is no potential for a significant impact on this species.	No

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
BIRDS						
Australasian bittern *Botaurus poiciloptilus*	V (TSC)	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleoacharis* spp.).	This species may be found over most of the state except for the far north-west.	Limeburners Creek NR - 1 Lake Innes NR - 2	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. wetlands). There is no potential for a significant impact on this species.	No
black bittern *Ixobrychus flavicollis*	V (TSC)	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland.	This species is not known from any reservation areas in the region.	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. wetlands). There is no potential for a significant impact on this species.	No
black-necked stork *Ephippiorhynchus asiaticus*	E (TSC)	Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.	This species is widespread across coastal northern and eastern Australia, becoming uncommon further south into NSW, and rarely found south of Sydney.	Limeburners Creek NR - 4 Lake Innes NR - 35 Crowdy Bay NP - 7 Myall Lakes NP - 13 Booti Booti NP - 8	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. wetlands). There is no potential for a significant impact on this species.	No

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
osprey *Pandion haliaetus*	V (TSC)	Habitat for this species includes inshore coastal and estuarine waters, and occasionally inland rivers and lakes (Debus 2001). This species feeds mainly on fish, however also takes crustaceans, reptiles, small mammals or birds (Debus 2001). Breeding occurs from July to September and nests are often in dead trees and on headlands and rocky islands (Hollands 2003). Nests are re-used for many years (Hollands 2003), and are usually within one kilometre of the ocean (DECC 2008).	The osprey (*Pandion haliaetus*) has a distribution along the majority of the eastern coastline, however is absent from Tasmania and rare in Victoria (Debus 2001). It is common around the northern coast, especially on rocky shorelines, islands and reefs (DECC 2008). The species is uncommon to rare or absent from closely settled parts of south-eastern Australia.	This species is not known from any conservation reserves in the region.	This species was not recorded within the project area during surveys while woodland habitat provides potential nesting and roosting resources for this species. The large characteristic nest of species was not recorded. There is no potential for a significant impact on this species.	No
pied oystercatcher *Haematopus longirostris*	V (TSC)	Favours intertidal flats of inlets and bays, open beaches and sandbanks.	This species is thinly scattered along the entire coast of NSW.	Limeburners Creek NR - 2 Crowdy Bay NP - 2 Myall Lakes NP - 10 Darawank NR - 2 Booti Booti NP - 19	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. open beaches and coastal rock platforms). There is no potential for a significant impact on this species.	No

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
glossy black-cockatoo *Calyptorhynchus lathami*	V (TSC)	Habitat for this species includes forests on low-nutrient soils, specifically those containing key *Allocasuarina* feed species. They will also eat seeds from eucalypts, angophoras, acacias, cypress pine and hakeas, as well as eating insect larvae. Breeding occurs in autumn and winter, with large hollows required.	The glossy black-cockatoo has a sparse distribution along the east coast and adjacent inland areas from western Victoria to Rockhampton in Queensland. In NSW, it has been recorded as far inland as Cobar and Griffith.	This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP, and Mount Royal NP.	This species was not recorded during surveys. Potential nesting and roosting trees for this species are present within the project area in scattered preferred feeding trees (such as *Allocasuarina littoralis*) are present throughout the project area.	Yes
grey-crowned babbler *Pomatostomus temporalis temporalis*	V (TSC)	Open box-gum woodlands on the slopes. Box-cypress-pine and open box woodlands on alluvial plains. Also found in acacia shrubland and adjoining areas. Feeds on invertebrates; forage on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses (DECC 2008). Occupy territories from 1 to 50 hectares.	Occurs throughout northern and south-eastern Australia. In NSW, this species occurs on the western slopes of the Great Dividing Range and on the western plains reaching as far west as Louth and Hay. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW.	This species is known to occur in Belford NP, Goulburn River NP, Wollemi NP, Yengo NP and it is also known to occur in Belford NP.	This species was not recorded within the project area during surveys. The Survey Area does not contain preferred habitat features for this species. There is no potential for a significant impact on this species.	No

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
brown treecreeper (eastern subsp.) *Climacteris picumnus victoriae*	V (TSC)	Typical habitat for this species includes drier forests, woodlands and scrubs with fallen branches; river red gums on watercourses and around lake-shores; paddocks with standing dead timber; and margins of denser wooded areas. This species prefers areas without a dense understorey.	This species occurs over central NSW, west of the Great Dividing Range and sparsely scattered to the east of the divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys.	This species is known to occur in Goulburn River NP, Wollemi NP and Yengo NP.	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species. There is no potential for a significant impact on this species.	No
swift parrot *Lathamus discolor*	E (TSC) E (EPBC)	This species often visits box-ironbark forests, feeding on nectar and lerps. This species occupy areas where winter-flowering eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Preferred winter-flowering resources include swamp mahogany (*Eucalyptus robusta*), spotted gum (*Corymbia maculata*), red bloodwood (*C. gummifera*), Mugga ironbark (*E. sideroxylon*), and white box (*E. albens*).	In NSW this species has been recorded from the western slopes region along the inland slopes of the Great Dividing Range, as well as forests along the coastal plains from southern to northern NSW.	This species is known to occur in Wollemi NP.	This species was not recorded within the project area during surveys. However, the woodland habitat may provide habitat during movement of this species between preferred habitats.	Yes

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
regent honeyeater *Xanthomyza phrygia*	E (TSC) E (EPBC)	Generally occurs in temperate eucalypt woodlands and open forests of south eastern Australia. It is commonly recorded from box-ironbark eucalypt associations, wet lowland coastal forests dominated by swamp mahogany, spotted gum and riverine casuarina woodlands. Key foraging species (typically winter-flowering species in the Hunter Valley) include mugga ironbark (*Eucalyptus sideroxylon*), yellow box (*E. melliodora*), Blakelys red gum (*Eucalyptus blakelyi*), white box (*E. albens*) and swamp mahogany (*E. robusta*).	Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland.	This species is known to occur in Goulburn River NP, Wollemi NP and Yengo NP.	This species was not recorded within the project area during surveys. The woodland habitat does not provide preferred feeding or nesting habitat for this species. There is no potential for a significant impact on this species.	No
masked owl *Tyto novaehollandiae*	V (TSC)	This species is generally recorded from open forest habitat with sparse mid-storey but patches of dense, low ground cover. It is also recorded from ecotones between wet and dry eucalypt forest, along minor drainage lines and near boundaries between forest and cleared land.	The masked owl occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea.	This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP.	This species was not recorded within the project area during surveys. A pair of masked owls was recorded adjacent to the northern boundary of the site in 2002 (ERM 2003). The potential habitats present within the project area would only account for a very minor component of the habitat range for any individual of this species within the local area.	Yes

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
powerful owl *Ninox strenua*	V (TSC)	The powerful owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. It generally requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation.	The powerful owl occurs in eastern Australia, mostly on the coastal side of the Great Dividing Range, from south western Victoria to Bowen in Queensland.	This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP.	This species was not recorded within the project area during surveys. The species has been tentatively recorded in adjacent habitats (Umwelt, 2004). The potential habitats present within the project area would only account for a very minor component of the habitat range for any individual of this species within the local area.	Yes
MAMMALS						
spotted-tailed quoll *Dasyurus maculatus*	V (TSC) E (EPBC)	Habitat for this species is highly varied, ranging from sclerophyll forest, woodlands, coastal heathlands and rainforests. Records exist from open country, grazing lands and rocky outcrops. Suitable den sites including hollow logs, tree hollows, rocky outcrops or caves.	In NSW the spotted-tailed quoll occurs on both sides of the Great Dividing Range, with the highest densities occurring in the north east of the state. It occurs from the coast to the snowline and inland to the Murray River.	This species is known to occur in Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP.	This species was not recorded within the project area during surveys. Potential habitat was identified in the project area.	Yes

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
brush-tailed phascogale *Phascogale tapoatafa*	V (TSC)	Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.	This species has a patchy distribution around the coast of Australia. In NSW it is more frequently found in forest on the Great Dividing Range in the north-east and south-east of the State. There are also a few records from central NSW.	Cotton-Bimbang NP - 1 Limeburners Creek NR - 1 Werrikimbe NP - 2 Talawahl NR - 2 Khappinghat NR - 3	This species was not recorded within the project area during surveys however the woodland habitat provides potential nesting and roosting resources for this species.	Yes
koala *Phascolarctos cinereus*	V (TSC)	This species inhabits eucalypt forest and woodland, with suitability influenced by tree species and age, soil fertility, climate, rainfall and fragmentation patterns. The species is known to feed on a large number of eucalypt and non-eucalypt species, however it tends to specialise on a small number in different areas. *Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis, E. microcorys, E. robusta, E. albens, E. camaldulensis* and *E populnea* are some preferred species.	The koala has a fragmented distribution throughout eastern Australia, with the majority of records from NSW occurring on the central and north coasts, as well as some areas further west. It is known to occur along inland rivers on the western side of the Great Dividing Range.	This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP.	This species was recorded to the north-east of the project area during surveys. The site is identified as Supplementary Koala Habitat by the Port Stephens Council CKPoM. The species was not recorded in the project area, however, the site may form part of a movement corridor for the species.	Yes

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
eastern pygmy possum (*Cercartetus nanus*)	V (TSC)	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest.	This species is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pillaga, Dubbo, Parkes and Wagga Wagga on the western slopes.	This species is not known from any reservation areas in the region.	This species was not recorded within the project area during surveys, however the eastern pygmy possum has been identified in areas adjacent to the site in 2004.	Yes
squirrel glider *Petaurus norfolcensis*	V (TSC)	Inhabits a variety of mature or old growth habitats, including box, box-ironbark woodlands, river red gum forest, and blackbutt-bloodwood forest with heath understorey. It prefers mixed species stands with a shrub or acacia mid-storey, and requires abundant tree hollows for refuge and nest sites.	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria.	This species is known to occur in Wollemi NP, Yengo NP and Mount Royal NP.	This species was recorded within the project area during surveys. The woodland habitat provides nesting and roosting resources for this species.	Yes

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
long-nosed potoroo *Potorous tridactylus*	V (TSC) V (EPBC)	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	This species is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania, including some of the Bass Strait islands. In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range.	Cotton-Bimbang NP - 4 Werrikimbe NP - 2	This species was not recorded within the project area during surveys. This species is not known to occur in the area and is significantly isolated from areas known to be occupied by this species. There is no potential for a significant impact on this species.	No
grey-headed flying-fox *Pteropus poliocephalus*	V (TSC) V (EPBC)	This species occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Grey-headed flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria.	This species is known to occur in Wollemi NP, Yengo NP and Barrington Tops NP.	This species was recorded during surveys. The woodland habitats provide foraging resources for this species.	Yes

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
eastern freetail-bat *Mormopterus norfolkensis*	V (TSC)	This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures.	The eastern freetail-bat is found along the east coast from south Queensland to southern NSW.	This species is known to occur in Wollemi NP, Yengo NP and Barrington Tops NP.	This species was not recorded during surveys. However, the woodland habitats provide potential foraging resources for this species.	Yes
Little bentwing-bat *Miniopterus australis*	V (TSC)	Prefers moist eucalypt forest, rainforest or dense coastal banksia scrub. This species roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Occurs in coastal north-eastern NSW and eastern Queensland.	Medowie SCA - 2	This species was not recorded during surveys. However, the woodland habitats provide potential foraging resources for this species.	Yes
eastern bentwing-bat *Miniopterus schreibersii oceanensis*	V (TSC)	This species hunts in forested areas and uses caves as the primary roosting habitat, but also uses derelict mines, storm-water tunnels, buildings and other man-made structures. It forms discrete populations centered on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	Eastern bentwing-bats occur along the east and north-west coasts of Australia.	This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP.	This species was recorded during surveys. The woodland habitats provide foraging resources for this species.	Yes

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
greater broad-nosed bat *Scoteanax rueppellii*	V (TSC)	The greater broad-nosed bat appears to prefer moist environments such as moist gullies in coastal forests, or rainforest. They have also been found in gullies associated with wet and dry sclerophyll forests and open woodland. It roosts in hollows in tree trunks and branches and has also been found to roost in the roofs of old buildings.	The greater broad-nosed bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however it does not occur at altitudes above 500 metres.	The species is known to occur in Wollemi NP, Yengo NP and Barrington Tops NP.	This species was recorded during surveys. The woodland habitats provide foraging resources for this species.	Yes
yellow-bellied sheathtail-bat *Saccolaimus flaviventris*	V (TSC)	This species forages for insects, flies high and fast over the forest canopy, but lower in more open country. It forages in most habitats across its very wide range, with and without trees; and appears to defend an aerial territory. It roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to use mammal burrows.	The yellow-bellied sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes.	The species is known to occur in Wollemi NP.	This species was not recorded during surveys. However, the woodland habitats provide potential foraging resources for this species.	Yes

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
large-footed myotis *Myotis adversus*	V (TSC)	This species generally roosts in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. It forages over streams and pools catching insects and small fish by raking its feet across the water surface.	The large-footed myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 kilometres inland, except along major rivers.	The species is known to occur in Wollemi NP.	There are no potential foraging habitats for this species within the project area (i.e. streams and pools). As such, there is no potential for a significant impact on this species.	No
large-eared pied bat *Chalinolobus dwyeri*	V (EPBC) V TSC	The large-eared pied bat is generally found in a variety of drier habitats, including dry sclerophyll forests and woodlands, however, it probably tolerates a wide range of habitats. It tends to roost in the twilight zones of mines and caves, generally in colonies or common groups.	This species has a distribution from south western Queensland to NSW from the coast to the western slopes of the Great Dividing Range.	The species is known to occur in Goulburn River NP, Wollemi NP and Yengo NP.	This species was not recorded during surveys. However, the woodland habitats provide potential foraging resources for this species.	Yes

Table 2 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Endangered Population (EP)						
Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	EP (TSC)	Occur in open forest, woodland, coastal heath, coastal dunes, wetland areas, tea tree plantations and open farmland, and occasionally in littoral rainforest.	Previously widespread on the NSW north coast, but now largely restricted to coastal and near coastal areas between Evans Head and Red Rock and west to the Bungawalbin area. There have also been some recent records from the Port Stephens area.	Medowie SCA - 1	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species and there is no connectivity to known populations of this species. There is no potential for a significant impact on emu populations.	No

Key: TSC = *Threatened Species Conservation Act* 1995;
EPBC Act = *Environment Protection and Biodiversity Conservation Act* 1999;
E = Endangered; and
V = Vulnerable.
NP = National Park

Assessment of Significance under the *Threatened Species Conservation Act 1995*

Under Part 3A of the *Environmental Planning and Assessment Act 1979*, Section 5A of the Act relating to impacts on threatened species is not application. Part 3A does, however, require an assessment of significance relating to impacts on threatened species. An assessment that applies the key aspects of the Section 5A assessment that are relevant at regional and State levels has been conducted.

No endangered populations or threatened ecological communities (TEC) listed under the TSC Act have been recorded or are considered likely to occur in the project area. A total of 21 threatened flora and fauna and species listed under the TSC Act have been recorded or are considered likely to occur in the project area. An assessment of significance relating to the potential impacts of proposed developments on listed threatened species (identified in **Tables 1** and **2**) has been conducted below. Listed threatened flora and fauna species include:

Threatened Flora Species

- rough doubletail *Diuris praecox* – Vulnerable Species;

Threatened Fauna Species

- glossy black-cockatoo *Calyptorhynchus lathami* – Vulnerable Species;
- swift parrot *Lathamus discolour* – Endangered Species;
- masked owl *Tyto novaehollandiae* – Vulnerable Species;
- powerful owl *Ninox strenua* – Vulnerable Species;
- brush-tailed phascogale *Phascogale tapoatafa* – Vulnerable Species;
- spotted-tailed quoll *Dasyurus maculates* - Vulnerable Species;
- koala Phascolarctos cinereus – Vulnerable Species;
- eastern pygmy possum– *Cercartetus nanus* – Vulnerable Species;
- squirrel glider *Petaurus norfolcensis* – Vulnerable Species;
- grey-headed flying-fox *Pteropus poliocephalus* – Vulnerable Species;
- yellow-bellied sheathtail-bat *Saccolaimus flaviventris* – Vulnerable Species;
- eastern freetail-bat *Mormopterus norfolkensis* – Vulnerable Species;
- Little bentwing-bat *Miniopterus australis* – Vulnerable Species;
- eastern bentwing-bat *Miniopterus schreibersii oceanensis* – Vulnerable Species;

- large-eared pied bat *Chalinolobus dwyeri* – Vulnerable Species; and
- greater broad-nosed bat *Scoteanax rueppellii* – Vulnerable Species.

Threatened Flora Species

Rough Doubletail – *Diuris praecox*

The rough doubletail (Diuris praecox) was not identified within the project area during the surveys conducted during the confirmed flowering period for the species.

a) Whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such the viability of the population is likely to be significantly compromised.

Rough doubletail (Diuris praecox) is a small ground orchid known to occur from Ourimbah and Nelson Bay in New South Wales. Rough doubletail grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey existing as subterranean tubers most of the year. It produces leaves and flowering stems in winter (Bishop 2000).

Rough doubletail was not recorded during surveys effort despite surveys being conducted during known flowering period of this species. Potential habitat for this species exists within the woodland communities excess the project area. The project will result in the removal of approximately 48 hectares of marginal potential habitat for this species. The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of potential habitat for this species. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the rough doubletail.

Threatened Fauna Species

Glossy black-cockatoo – *Calyptorhynchus lathami*

The glossy black-cockatoo (*Calyptorhynchus lathami*) was not identified within the project area during the surveys, however *Allocasuarina littoralis*, a known food resource for the species, was recorded throughout the community.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The glossy black-cockatoo (*Calyptorhynchus lathami*) is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina (DECC 2008). An isolated population exists on Kangaroo Island, South Australia. It inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 metres in which stands of she-oak species, particularly black sheoak (*Allocasuarina littoralis*), forest sheoak (*Allocasuarina torulosa*) or drooping sheoak (*Allocasuarina verticillata*) occur (DECC 2008). In the Riverina area, it inhabits open woodlands dominated by belah (*Casuarina cristata*) (DECC 2008). It is usually seen in pairs or small groups feeding quietly in sheoaks. It feeds almost exclusively on the seeds of several species of sheoak (*Casuarina* and *Allocasuarina* species), shredding the cones with the massive bill (DECC 2008). This species can be highly selective in its choice of food trees, choosing *Allocasuarina* species that produce seeds with a high nutrient value. They will also eat seeds from eucalypts, angophoras, acacias, cypress pine and hakeas, as well as eating insect larvae (DECC 2008). This species is dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August.

The project will require the removal of approximately 48 hectares of potential habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the glossy black-cockatoo and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area and provides an extensive area of known habitat for this species. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and

Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the glossy black cockatoo.

Swift parrot – *Lathamus discolor*

The swift parrot (*Lathamus discolor*) was not identified within the project area during surveys. Winter flowering *Banksia serrata* occurred throughout the project area which provides a potential foraging resource for the species.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The swift parrot (*Lathamus discolor*) breeds in Tasmania during spring and summer, migrating in the autumn and winter months (mainly May to August) to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. It has been recorded from the western slopes region along the inland slopes of the Great Dividing Range, as well as forests along the coastal plains from southern to northern NSW) (DECC 2008). On the mainland the species occurs in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as swamp mahogany (*Eucalyptus robusta*), spotted gum (*Corymbia maculata*), red bloodwood (*Corymbia gummifera*), mugga ironbark (*Eucalyptus sideroxylon*), and white box (*Eucalyptus albens*) (DECC 2008). They commonly use lerp infested trees including grey box (*Eucalyptus microcarpa*), grey box (*Eucalyptus moluccana*) and blackbutt (*Eucalyptus pilularis*). Of such species, larger trees bearing more flowers are selected (DECC 2008). This species is known to return to home foraging sites on a cyclic basis depending on food availability (DECC 2008)). Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian blue gum (*Eucalyptus globulus*).

The project will require the removal of approximately 48 hectares of potential habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the glossy black-cockatoo and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area provides potential foraging habitat for this species in the form of flowering *Banksia serrata* and budding eucalypts. This species does not breed on mainland Australia. This is a highly mobile, migratory species, which is likely to make use of habitat within a number of vegetated areas within the region. It is considered that there is not a local viable population of this species centred within the project area.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area and provides an extensive area of known habitat for this species. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it

is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the swift parrot.

Powerful owl – *Ninox strenua*

The powerful owl (*Ninox strenua*) was not identified within the project area during surveys. However, a tentative identification of the species was made in adjacent habitats in 2004 (Umwelt, 2004).

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The powerful owl (*Ninox strenua*) occurs in eastern Australia, mostly on the coastal side of the Great Dividing Range, from south western Victoria to Bowen in Queensland (Garnett & Crowley 2000). In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains. It is now uncommon throughout its range where it occurs at low densities (DECC 2008). This species inhabits a variety of woodland and open forest habitats, including relatively urbanised sites. The powerful owl requires large tracts of forest or woodland habitat but can also occur in fragmented or urban landscapes (DECC 2008). It roosts by day in dense vegetation comprising species such as turpentine (*Syncarpia glomulifera* subsp. *glomulifera*), black sheoak (*Allocasuarina littoralis*), blackwood (*Acacia melanoxylon*), rough-barked apple (*Angorphora floribunda*), cherry ballart (*Exocarpus cupressiformis*) and a number of eucalypt species (DECC 2008). As most prey species require hollows and a shrub layer, these are important habitat components for the owl. This species will defend a large home range of between 800 and 1000 hectares (Kavanagh 2002). This species feeds mainly on a variety of arboreal marsupials, supplementing with large diurnal birds. It takes few or no ground dwelling mammals (Kavanagh 2002). Nests are made in large hollows (at least 0.5 metre deep), in large eucalypts (diameter at breast height of 80-240 centimetres) that are at least 150 years old (DECC 2008). Such trees are usually near riparian zone forest and usually minor drainage lines. Powerful owls show high nest tree fidelity in successive breeding seasons (Kavanagh 2002). Nesting occurs from late autumn to mid-winter, but is slightly earlier in north-eastern NSW (late summer - mid autumn) (DECC 2008). Pairs are monogamous nesting for life (DECC 2008). The pair is most vocal when nesting (Debus 1995).

The project area is considered to provide a small number of adequate tree hollows for nesting and the entire site is considered to provide potential foraging habitat. The species did not respond to call playback techniques, conducted during the breeding season for the species. The site is not considered to provide breeding habitat for this species. The project would not result in a significant impact on the potential foraging habitat, potential roosting habitat, or potential nesting habitat of the powerful owl. A significant area of suitable vegetation occurs adjacent to the project area and the retention of vegetation on site will ensure that prey species, and potentially roosting and nesting trees remain within the local area. The development would therefore not result in disruption to the life cycle of the owl species in the project area and does not place the species at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The proposed development would not act as a barrier to the movement of any potentially occurring individuals. The site is currently bound by rural land and sand dunes to the north, an existing industrial sand extraction operation to the west and Worimi National Park to the south and east. This species is highly mobile, and therefore this ability to disperse to adjacent habitat would be unaffected by the proposed development. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the powerful owl.

Masked owl – *Tyto novaehollandiae*

The masked owl (*Tyto novaehollandiae*) was not identified within the project area during surveys. Surveys undertaken in 2002 (ERM 2002) identified a pair of masked owls adjacent to the northern boundary of the site. The site provides potential nesting habitat and marginal foraging habitat for the species.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The masked owl typically inhabits dry open sclerophyll forest, woodland, and farmlands with large trees. The masked owl hunts by night in open areas including clearings and open plains, preying on mammals including Antechinus and brushtail possums, birds, reptiles and insects (Hollands, 1991). The masked owl roosts by day in tree hollows and thick foliage, and nests in a large hollow of a living or dead tree. The nesting tree is often isolated, either standing alone, or standing higher than the surrounding trees (Hollands, 1991). Therefore the project area provides potential foraging habitat, and a small number of large trees suitable for nesting and roosting for the Masked Owl.

The project area contains marginal habitat for the masked owl with the dense nature of the understorey limiting the likelihood of the species occurring. The project would not result in a

significant impact on the potential foraging habitat, potential roosting habitat, or potential nesting habitat of the masked owl. A significant area of suitable vegetation occurs adjacent to the project area and the retention of vegetation on site will ensure that prey species, and potentially roosting and nesting trees remain within the local area. The development would therefore not result in disruption to the life cycle of the masked owl in the project area and does not place the species at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the masked owl.

Brush-tailed phascogale – *Phascogale tapoatafa tapoatafa*

The brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*) was not identified within the project area during the surveys.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*) has a patchy distribution around the coast of Australia. In NSW it is more frequently found in forest on the Great Dividing Range in the north-east and south-east of the State. There are also a few records from central NSW (DECC 2008). This southern subspecies occurs from Rockhampton in Queensland to the Mt Lofty Ranges in South Australia (DECC 2008). It prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, scleromorphic shrubs or leaf litter (DECC 2008). They have also been recorded from heathland, swamps, rainforest and wet sclerophyll forest. They are agile climbers, foraging for invertebrates and arthropods (as well as nectar) generally on rough-barked trees of 25 centimetres DBH or higher, where available (DECC 2008). Nests are made in hollow tree limbs, rotten stumps and sometimes birds' nests, and a number of these are used in rotation (Soderquist 2002). Female home ranges span 20-70 hectares, while males can occupy twice the area (Soderquist 2002). Dispersal occurs in mid-summer with young males moving many kilometres while females settle in nearby vacant territories or share the maternal home range (Soderquist 2002). Breeding occurs between May and June. Males die soon after the mating season whereas females can live for up to three years but generally only produce one litter (DECC 2008).

The project will require the removal of approximately 48 hectares of potential but not preferred habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on arboreal species,

including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the Brush-tailed phascogale.

Spotted-tailed quoll – *Dasyurus maculatus*

The spotted-tailed quoll (*Dasyurus maculates*) was not identified within the project area during surveys

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The spotted-tailed quoll (*Dasyurus maculates*) has not been recorded in the project area, although the area is considered to provide potential habitat for the species. The species utilises a variety of habitats including sclerophyll forest and woodlands, coastal heathlands and rainforests. Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas. The species habitat requirements include suitable den sites (such as hollow logs, tree hollows, rock outcrops or caves) and an abundance of food (such as birds and small mammals). Individuals also require large areas of relatively intact vegetation through which to forage (DECC 2008).

The project will require the removal of approximately 48 hectares of potential habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on fauna species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species.

Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Koala – *Phascolarctos cinereus*

The koala (*Phascolarctos cinereus*) was recorded during nocturnal surveys within the project area and has been recorded in adjacent habitats in 2004 (Umwelt, 2004). The project area is considered to provide secondary habitat and connectivity between preferred habitats.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The koala (*Phascolarctos cinereus*) has a fragmented distribution throughout eastern Australia, with the majority of records from NSW occurring on the central and north coasts, as well as some areas further west (DECC 2008i. It is known to occur along inland rivers on the western side of the Great Dividing Range (NPWS 2003). This species inhabits eucalypt forest and woodland, with suitability influenced by tree species and age, soil fertility, climate, rainfall and fragmentation patterns (DECC 2008). This species will feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species (NPWS 2003). Home ranges vary considerably according to habitat quality, with an average of 10 to 15 hectares in the Pilliga State Forest to an average of 80 to 90 hectares in the Port Stephens area (NPWS 2003). Young are generally produced in summer, remaining with the mother for up to three years (NPWS 2003). Koalas spend most of their time in trees, but will descend and traverse open ground to move between trees (DECC 2008).

The project will require the removal of approximately 48 hectares of secondary habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the koala and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is

likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the koala.

Eastern pygmy possum – *Cercartetus nanus*

The eastern pygmy possum (*Cercartetus nanus*) was recorded in adjacent habitats in 2004 (Umwelt, 2004). Winter 2008 surveys were unlikely to record this species due to the behaviour of the species in winter months when it frequently spends time in torpor. The species is considered likely to occur across the project area.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The eastern pygmy-possum (*Cercartetus nanus*) occurs in the south-eastern corner of mainland Australia and in Tasmania. In NSW it extents from the coast inland as far as the Pillaga, Dubbo, Parkes and Wagga Wagga on the western slopes (DECC 2008). This species is found in a variety of habitat types, ranging from rainforest, through sclerophyll forest to tree heaths (Turner & Ward 2002). They feed primarily on nectar and pollen from banksias, eucalypts and bottlebrushes. Insects, seeds and fruits are also eaten (Turner & Ward 2002). Male home ranges are estimated at 0.68 hectares, while females' ranges are smaller at 0.35 hectares (Turner & Ward 2002). It frequently spends time in torpor especially in winter, with body curled, ears folded and internal temperature close to the surroundings (DECC 2008). This species is highly elusive and notoriously difficult to detect during survey. Breeding occurs any time the year, providing there is adequate food supply (Turner & Ward 2002), however most births occur between late spring and early autumn (DECC 2008). Nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks (DECC 2008). This species appears to be mainly solitary, each individual using several nests. They are agile climbers, but can be caught on the ground in traps, pitfalls or postholes. They are generally nocturnal.

The project will require the removal of approximately 48 hectares of habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the eastern pygmy-possum and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the eastern pygmy possum.

Squirrel glider (*Petaurus norfolcensis*)

The squirrel glider (*Petaurus norfolcensis*) was recorded during nocturnal surveys within the project area during 2003 and 2008 and the species has been recorded in adjacent habitats (Umwelt, 2004). Three individual were recorded and the entire Lot 220 is considered to provide known habitat for the species.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The squirrel glider inhabits mature or old growth box, box-ironbark woodlands and river red gum forests west of the Great Dividing Range and blackbutt-bloodwood forest with heath understorey in coastal areas. The squirrel glider prefers mixed species stands with a shrub or acacia midstorey. The squirrel glider requires an abundance of tree hollows for refuge and nest sites (DECC 2008).

The project will require the removal of approximately 48 hectares of high quality habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the squirrel glider and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area and provides an extensive area of known habitat for this species. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it

is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the squirrel glider.

Grey-headed flying-fox – *Pteropus poliocephalus*

The grey-headed flying fox (*Pteropus poliocephalus*) was recorded widely during nocturnal surveys conducted in the project area in 2003. Mature fruiting canopy species in this area provide feeding resources for this species. No diurnal roost sites were identified in the project area during surveys.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The grey-headed flying fox species has generally been recorded within 200 kilometres of the eastern coast, from Bundaberg in Queensland, through NSW and south to eastern Victoria. Regular movements are made over the Great Dividing Range to the western slopes of NSW and Queensland. This species is known to occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops (DECC 2008). Grey-headed flying-foxes feed on a variety of flowering and fruiting plants, including native figs and palms, blossoms from eucalypts, angophoras, tea-trees and banksias (Tidemann 2002). This species will travel up to 50 kilometres a night to forage and it plays an important role in seed dispersal (DEC 2008). Camp sites are usually formed in gullies, usually in vegetation with a dense canopy and not far from water (Tidemann 2002). Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring (DEC 2008). Single camps may have tens of thousands of animals. Most births occur in September or October (Churchill 1998).

The project will require the removal of approximately 48 hectares of known habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the grey-headed flying fox and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species.

Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the grey-headed flying fox.

Yellow-bellied sheathtail bat – *Saccolaimus flaviventris*

The yellow-bellied sheathtail bat (*Saccolaimus flaviventris*) was not identified within the project area during the survey effort.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*) is wide ranging throughout tropical Australia, with records extending into south eastern areas (Churchill 1998). In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes (DECC 2008). The species has been recorded from a wide variety of habitats, from wet and dry sclerophyll forest, open woodland, *Acacia* shrubland, mallee, grasslands and deserts (Churchill 1998). In eucalypt forests this species forages above the canopy, however ventures lower when in open country (Richards 2002). This species is generally solitary, however may form small groups around spring (Churchill 1998). Roosting is generally recorded from tree hollows and buildings, however the species may use mammal burrows in treeless areas (DECC 2008). When foraging for insects, these bats fly high and fast over the forest canopy, but lower in more open country. It forages in most habitats across its very wide range, with and without trees and appears to defend an aerial territory (DECC 2008). Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn (DECC 2008). A single young is born between December and March (Churchill 1998).

The project will require the removal of approximately 48 hectares of potential habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the yellow-bellied sheathtail-bat and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of potential habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Eastern freetail-bat – *Mormopterus norfolkensis*

The eastern freetail-bat (*Mormopterus norfolkensis*) was not recorded during Anabat echolocation surveys in the project area, however this species has been recorded in adjacent habitats (Umwelt, 2004). The project area is considered to provide habitat for this species.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

This species has a distribution along the east coast of NSW from south of Sydney north into south east Queensland, near Brisbane (Churchill 1998). Most records are from dry eucalypt forest and woodland east of the Great Dividing Range (DECC 2008). This species has also been recorded over a rocky river in rainforest and wet sclerophyll forest (Churchill 1998).

Generally only solitary animals are recorded (Allison & Hoye 2002). This species generally roosts in tree hollows, however have been recorded from roofs, under bark and the metal caps of telegraph poles (Churchill 1998). They generally forage above the forest canopy, over water and also on the ground.

The project will require the removal of approximately 48 hectares of known habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the eastern freetail-bat and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is

likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the eastern freetail-bat.

Little bentwing-bat – *Miniopterus australis*

The little bentwing-bat (*Mormopterus australis*) was not identified within the project area during surveys, however the site provides potential foraging habitat for this species.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The little bentwing-bat (*Mormopterus australis*) occurs from Cape York to northern New South Wales, where it is confined to subtropical areas (Dwyer 2002). Habitat for this species includes well-timbered areas of rainforest, wet and dry sclerophyll forest, *Melaleuca* swamps and coastal forests (Churchill 1998). This is a cave-dwelling species, congregating in maternity colonies in summer and dispersing over winter (Churchill 1998). This species will hibernate over winter in the southern parts of their range (Churchill 1998). Little bentwing-bats are often found roosting with the Eastern Bentwing-bat (Dwyer 2002). A single young is born in December (Churchill 1998).

The project will require the removal of approximately 48 hectares of potential habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the little bentwing-bat and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be

modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of potential habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the little bentwing-bat.

Eastern bentwing-bat (*Miniopterus schreibersii oceanensis*)

The eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) was identified within the project area during the 2003 survey.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

This species has an eastern distribution from Cape York along the coastal side of the Great Dividing Range, and into the southern tip of South Australia (Churchill 1998). Habitat varies widely, from rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998). It is generally a cave-dwelling species, congregating in maternity caves with very specific temperature and humidity ranges (DECC 2008). During the non-breeding season, this species will disperse to satellite caves, generally within 300 kilometres (Churchill 1998). Breeding or roosting colonies can number from 100 to 150,000 individuals (DECC 2008).The eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) hibernates over winter in the southern parts of its range (Churchill 1998). It has been recorded roosting in a variety of man-made structures including buildings and culverts (Dwyer 2002), as well as derelict mines and storm-water tunnels. A single young is born in December (Churchill 1998). The species hunts in forested areas, catching moths and other flying insects above the tree tops.

The project will require the removal of approximately 48 hectares of known habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the eastern bentwing-bat and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be

modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the eastern bentwing-bat.

Large-eared pied bat – *Chalinolobus dwyeri*

The large-eared pied bat (*Chalinolobus dwyeri*) was not identified within the project area during surveys, however the project area provides potential foraging habitat for the species.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The large-eared pied bat (*Chalinolobus dwyeri*) is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands (DECC 2008). It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes (DECC 2008). It has been recorded frequenting low to mid-elevation dry open forest and woodland close roosting habitat (DECC 2008). It is found in well-timbered areas containing gullies, and is likely to tolerate a wide range of habitats (Hoye & Dwyer 2002). This species tends to roost in the twilight zones of mines and caves, generally in colonies or common groups (Churchill 1998), and is likely to hibernate through the coolest months (DECC 2008). Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years (DECC 2008). Females give birth (generally to twins) in November (Churchill 1998). The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy.

The project will require the removal of approximately 48 hectares of potential foraging habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the large-eared pied bat and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of potential foraging will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the large-eared pied bat.

Greater broad-nosed bat – *Scoteanax rueppellii*

The greater broad-nosed bat (*Scoteanax rueppellii*) was identified within the project area during surveys in 2003.

a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

The greater broad-nosed bat (*Scoteanax rueppellii*) is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however it does not occur at altitudes above 500 metres (DECC 2008). This species occurs in moist gullies and river systems draining the Great Dividing Range, as well as a variety of woodland, forest and rainforest habitats (Hoye & Richards 2002). It has been recorded roosting in hollow tree trunks and branches, as well as old buildings (Churchill 1998). This species forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 metres. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow flying insects; this species has been known to eat other bat species (DECC 2008). Little is known of the reproductive cycle of the species, however, females congregate at maternity sites, located in suitable trees, where they appear to exclude males for the birth and raising of the single young in January (Hoye & Richards 2002).

The project will require the removal of approximately 48 hectares of known habitat for this species. The project includes a number of impact mitigation measures that have been designed to mitigate and manage the impact on the greater broad-nosed bat and other species, including: pre-clearance inspections; clearing procedures; staged clearing; and site rehabilitation.

The project area is well connected to intact high quality habitat of Worimi National Park. This conservation area is contiguous with the project area. Habitat retained on Lot 220 will remain connected to this conservation area thereby reducing the impact on this species. Due to the areas of available connected habitat within the project area as well as in the wider Stockton Bight area, and the highly mobile nature of this species and the range of impact mitigation measures identified, it is considered unlikely that the lifecycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.

b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.

The project area is located along the northern edge of Worimi National Park adjacent to cleared agricultural land. The predicted impacts from the proposed development will not isolate core areas of habitat for this species and connectivity will be maintained through the project area. The predicted disturbance area is located within Coastal Sand Apple Blackbutt Forest which covers an approximate 2000 hectare area along the Stockton, Tomago and Tomaree peninsular (NPWS 2000). A significant area of known habitat will not be isolated from currently interconnecting or proximate areas as a result of the project.

Conclusion

The project will not have a significant impact on the greater broad-nosed bat.

Key Threatening Processes

A number of Key Threatening Processes (KTP) listed under the Schedules of TSC Act and EPBC Act, are relevant to the proposed development. No KTP were identified under the *Fisheries Management Act 1994*. A discussion of the implications of the relevant KTP under each Act is detailed below.

Threatened Species Conservation Act Listed KTP

- **Invasion of native plant communities by bitou bush and boneseed**

The invasion of native plant communities by bitou bush and boneseed contributes greatly to the loss of biodiversity along the NSW coast. The rapid colonisation of this species poses potential risk if disturbed areas are not monitored and maintained. The proposed development will require the removal of approximately 48 hectares of native vegetation. A comprehensive rehabilitation strategy focusing on monitoring and maintenance of rehabilitation areas from the invasion of bitou bush and bone seed will reduce the potential risk of invasion.

- **Invasion, establishment and spread of *Lantana camara***

The invasion, establishment and spread of lantana (*Lantana camara*) contributes greatly to the loss of biodiversity throughout NSW coast and ranges. The rapid colonisation of this species poses potential risk if disturbed areas are not monitored and maintained. The proposed development will require the removal of approximately 48 hectares of native vegetation. A comprehensive rehabilitation strategy focusing on monitoring and maintenance of rehabilitation areas from the invasion of lantana will reduce the potential risk of invasion.

- **Clearing of native vegetation**

The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The proposed development will involve the clearing of approximately 48 hectares of native vegetation. The loss of vegetation associated with the project represents approximately three per cent of this community in the local area.

- **Loss of Hollow-bearing Trees**

The loss of hollow-bearing trees is a major threat to native vertebrate fauna, in particular threatened species, throughout NSW. Hollow bearing trees provide nesting, roosting and foraging resources for a range of native fauna. Many fauna species are known to select hollows with specific characteristics highlighting the value of a range of hollow-bearing trees in an area. The impact and mitigation of the removal of hollow-bearing trees is outlined in **Section 6.2** of the report.

- **Removal of dead wood and dead trees**

Dead wood and dead trees provide valuable nesting, roosting and foraging resources for a range of native fauna. The removal of dead wood and dead trees results is a significant loss of habitat for native fauna. The proposed development will involve the clearing of approximately 48 hectares of native vegetation. The loss of vegetation associated with the project represents approximately four per cent of this community in the local area.

Environment Protection and Biodiversity Conservation Act 1999

- **Land clearance**

The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The proposed development will involve the clearing of approximately 48 hectares of native vegetation. The loss of vegetation associated with the project represents approximately four per cent of this community in the local area.

Conclusion

The impacts of the proposed development has been compensated through existing biodiversity offsets area of Worimi National Park, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development. While there is potential risk of affecting some of these KTP, there are no significant implications for the proposed development.

Critical Habitat

No critical habitat listed under the TSC Act or EPBC Act was identified in the project area.

Significance Assessment Conclusion

The proposed project will not result in a significant impact on any TSC Act or EPBC listed threatened species, endangered populations or ecologically endangered communities.

ATTACHMENT 4

Assessment of Significance under the *Environment Protection and Biodiversity Conservation Act 1999*

Attachment 4 – Assessment of Significance under the *Environment Protection and Biodiversity Conservation Act 1999*

A search of the Department of the Environment, Heritage, Water and the Arts (DEWHA) Protected Matters Database (July 18 2008) identified (discounting fishes and marine species) 15 EPBC Act listed threatened species and 16 migratory species known to occur or considered likely to occur, on the basis of habitat modelling, within 10 kilometres of the project area.

Of the 15 threatened species identified from the DEWHA database search, five were found to have potential to occur within the project area: swift parrot (*Lathamus discolor*), large-eared pied bat (*Chalinolobus dwyeri*), spotted-tailed quoll (*Dasyurus maculatus*), grey-headed flying-fox (*Pteropus poliocephalus*) and rough doubletail *(Diuris praecox*).

Of the 16 migratory species identified from the DEWHA database search, three species were found to have moderate potential to occur within the project area, the black-faced monarch (*Monarcha melanopsis*), satin flycatcher (*Myiagra cyanoleuca*) and rufous fantail (*Rhipidura rufifrons*), while the remaining 13 species have very low to low potential to occur.

An assessment of the potential impacts of the proposed development is provided below for threatened and migratory species identified from the DEWHA database search. The assessment is based on the removal of approximately 48 hectares of Coastal Sand Apple – Blackbutt Forest and the impact mitigation measures identified in Section 6 of the main report.

The aim of this assessment is to determine whether the proposed development is likely to have a significant impact on any EPBC Act Matters of National Environmental Significance (MNES). In this instance, MNES with potential to occur within the project area include:

- listed threatened species (including endangered and vulnerable species); and
- listed migratory species.

Each category is addressed separately below.

Endangered

The following EPBC Act listed Endangered species are considered in this assessment:

- swift parrot (*Lathamus discolor*); and
- spotted-tailed quoll (*Dasyurus maculatus*).

An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for these species.

In this case, a *population* means:

- a geographically distinct regional population, or collection of local populations; or
- a regional population, or collection of local populations, that occurs within a particular bioregion.

The two species listed above were not recorded in the project area, however have potential to occur. The species are known to occur in the locality. The project area does not contain a geographically distinct regional population, or collection of local populations for these species, and does not contain a regional population, or collection of local populations of this species that occur within the NSW North Coast Bioregion.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a *population*; or**

No populations of swift parrot (*Lathamus discolor*) or spotted-tailed quoll (*Dasyurus maculatus*) were recorded within the project area. The proposed project will not lead to a decrease in the size of a *population* (as defined above) of any of these endangered species.

- **reduce the area of occupancy of the species; or**

No populations of swift parrot (*Lathamus discolor*) or spotted-tailed quoll (*Dasyurus maculatus*) were recorded within the project area. The proposed project has potential to modify the area of potential habitat for these endangered species, however will not lead to a significant reduction. Substantial areas of similar potential habitats for these species are protected within the adjacent Worimi National Park.

- **fragment an existing *population* into two or more populations; or**

No populations of swift parrot (*Lathamus discolor*) or spotted-tailed quoll (*Dasyurus maculatus*) were recorded within the project area. The proposed project will not fragment an existing population of any endangered species into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

No populations of swift parrot (*Lathamus discolor*) or spotted-tailed quoll (*Dasyurus maculatus*) were recorded within the project area. The proposed project will not adversely affect habitat critical to the survival of these endangered species.

- **disrupt the breeding cycle of a population; or**

No populations of swift parrot (*Lathamus discolor*) or spotted-tailed quoll (*Dasyurus maculatus*) were recorded within the project area. The proposed project will not disrupt the breeding cycle of any population of any endangered species.

- **modify, destroy, remove isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

No populations of swift parrot (*Lathamus discolor*) or spotted-tailed quoll (*Dasyurus maculatus*) were recorded within the project area. The proposed project will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that these endangered species is likely to decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat; or**

No populations of swift parrot (*Lathamus discolor*) or spotted-tailed quoll (*Dasyurus maculatus*) were recorded within the project area. The proposed project will not result in invasive species that are harmful to these endangered species becoming established in their habitat.

- **interfere with the recovery of the species.**

No populations of swift parrot (*Lathamus discolor*) or spotted-tailed quoll (*Dasyurus maculatus*) were recorded within the project area. The proposed project will not interfere with the recovery of these species.

Vulnerable Species

The following EPBC Act listed vulnerable species are considered in this assessment:

- large-eared pied bat (*Chalinolobus dwyeri*);
- grey-headed flying-fox (*Pteropus poliocephalus*); and
- rough doubletail (*Diuris praecox*).

An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for these species.

In this case, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity; and/or**
- **populations that are near the limit of the species range.**

There are no species for which the project area supports an important population based on the DEWHA definition.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of an *important population* of a species; or**

The proposed development will require the removal of approximately 48 hectares of potential habitat for the large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus poliocephalus*) and rough doubletail (*Diuris praecox*). Based on the known habitats within the project area, and ecological knowledge of the local area, the population of these potentially occurring species are not likely to comprise an important population according to the above criteria.

Given the large adjacent area of similar habitat, Worimi National Park, the proposed project will not result in a long-term decrease in an important population of any vulnerable species.

- **reduce the area of occupancy of an *important population*; or**

The proposed project will result in the removal of approximately 48 hectares of potential habitat for the large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus poliocephalus*) and rough doubletail (*Diuris praecox*). The project area does not comprise an important population for these species.

The proposed project will not result in the reduction in the area of occupancy of an important population of these species.

- **fragment an existing important population into two or more populations; or**

The proposed project will not result in the fragmentation of potential habitats for large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus poliocephalus*) and rough doubletail (*Diuris praecox*).

The proposed project will not result in the fragmentation of an existing important population into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

The project area does not contain habitat critical to the survival of large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus poliocephalus*) or rough doubletail (*Diuris praecox*). The proposed project will not result in any adverse affect on habitat critical to the survival of these species.

- **disrupt the breeding cycle of an important population; or**

The proposed project does not comprise an action that would disrupt the breeding cycle of large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus poliocephalus*) or rough doubletail (*Diuris praecox*). The project area does not support an important population of these species.

The proposed project will not disrupt the breeding cycle of an important population of these species.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

The proposed project involves the disturbance to approximately 48 hectares of potential habitat for large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus poliocephalus*) and rough doubletail (*Diuris praecox*). However, it is unlikely that this loss would be to the extent that the species is likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or**

The project area currently supports a minimal proportion of introduced species that impact biodiversity values. The proposed development is unlikely to result in a notable increase in the extent or abundance of introduced species within the potential habitats for vulnerable species.

- **interfere substantially with the recovery of the species.**

The proposed project will involve the disturbance to approximately 48 hectares of potential habitat for large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus*

poliocephalus) and rough doubletail (*Diuris praecox*). Significant areas of similar habitats occur within the local area. The habitats of the project area are not vital for the recovery of large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus poliocephalus*) and rough doubletail (*Diuris praecox*).

The proposed project will not interfere substantially with the recovery of these species.

Migratory Species

The following EPBC Act listed migratory species were recorded in the project area and are considered in this assessment:

- sea eagle (*Haliaeetus leucogaster*); and
- whistling kite (*Haliastur sphenurus*).

An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for these species.

An area of *important habitat* is:

- **habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; or**
- **habitat utilised by a migratory species which is at the limit of the species range; or**
- **habitat within an area where the species is declining.**

The project area is not considered to comprise important habitat for any of the listed migratory species, based on the DEWHA criteria described above.

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- **substantially modify (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;**

The project area is not likely to support an important population of any migratory species. The proposed development will require disturbance to 48 hectares of potential habitat for the above listed migratory species. Given the highly mobile nature of these species, and the widespread occurrence of similar habitats within the locality, the proposed project would not substantially modify, destroy or isolate any areas of habitats for these species.

- **result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or**

The project area currently supports minimal introduced species impacting on the biodiversity values. The proposed development is unlikely to result in a notable increase in the extent or abundance of any of these introduced species within the potential habitats for migratory species.

- **seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species**

The proposed project will require the disturbance to approximately 48 hectares of potential migratory species habitat. The project area is not expected to support an important population of any migratory species due to the extent of similar habitat surrounding the project area. There are substantial areas of quality habitats for these species elsewhere within the local area.

As such, the proposed project will not seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

Conclusion

The proposed project will not result in a significant impact on any EPBC Act listed threatened, vulnerable or migratory species.