Specialist Consultant Studies Compendium

Gunlake Quarries
Gunlake Quarry Project

ENVIRONMENTAL ASSESSMENT

VOLUME IV

Part 7
Ecotone Ecological Consultants Pty Ltd
Flora and Fauna Survey and Ecological Impacts Assessment Report.

Part 8A
Laterals Planning
Review of Environmental Factors.
Proposal for Road Widening and New Road Construction.

Part 8B
Laterals Planning
Flora and Fauna Assessment for Proposed Upgrade of 2.3km of Brayton Road and 1.2km of Red Hills Road north of Marulan.

February 2008

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FLORA AND FAUNA SURVEY AND ECOLOGICAL IMPACTS ASSESSMENT REPORT

PROPOSED HARD ROCK QUARRY, HAUL ROAD AND BYPASS ROADS NEAR MARULAN

Prepared for
Gunlake Quarries

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February 2008

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 Background and Scope

This Flora and Fauna and Ecological Impacts Assessment has been prepared at the request of Ms Val Smith of Valerie Smith & Associates on behalf of Gunlake Quarries. It investigates the proposal to establish a hard rock quarry with associated facilities on a property at Brayton Road, north-west of Marulan. The investigation will also examine a proposed haul road from the quarry site to Brayton Road, and another haul road from Brayton Road near Joarimin Creek Road to the Hume Highway.

The general objectives of this assessment are to:

- describe the existing biological environment of the study area in relation to flora and fauna;
- identify the potential impacts of the proposal for any threatened species, populations or ecological communities that occur or could be likely to occur in the subject site;
- assess the potential impacts of the proposal on the biota of each site by application of the provisions of the relevant NSW and Commonwealth legislation; and
- provide discussion on measures to manage potential impacts and effects of the proposal, using the principles of "avoid, minimise and mitigate" in that order of preference.

The environmental studies have been conducted in three stages:

(a) the first stage being a review of available literature pertaining to the site and surrounding locality and preliminary habitat assessment of the subject site;

(b) the second stage being the completion of targeted field surveys for threatened species regarded as potential subject species, and surveys to investigate the inherent biological attributes of the site; and

(c) the third stage being the assessment of impact of the proposal on flora and fauna in accordance with the relevant NSW and Commonwealth legislation and planning instruments.

Within this report, reference is given to the relevant sections of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); NSW *Threatened Species Conservation Act 1995* (TSC Act); *National Parks and Wildlife Act 1974* (NP&W Act); *Environmental Planning and Assessment Act 1979* (EP&A Act); and subsequent amendments to these. Specific consideration is given to Section 5A of the *EP&A Act*.

For this report,

- the *subject site* is defined as the land area directly affected by the proposed quarry pit and associated facilities including haul and bypass roads. For the purposes of this assessment, the subject site is divided into four separate areas or 'sites':
  - Site 1 – The proposed quarry pit, conveyor, crushing plant, shed and haul road;
  - Site 2 – The proposed bypass road from Brayton Road to Joarimin Creek;
  - Site 3 – The proposed bypass road from Joarimin Creek to Red Hills Road; and
  - Site 4 – The proposed intersection upgrade of Red Hills Road with the Hume Highway.
- the *study area* consists of the subject site plus the immediately surrounding land potentially affected by the proposal; and
- the *study locality* is the area of land within a twenty (20) kilometre radius of the centre of the study area.

1.2 General Description of the Subject Site, Study Area and Locality

Client	Gunlake Quarries
Subject Site	
Location	1. Quarry Pit and associated facilities including Haul Road: Land west of Brayton Road, south of Chapmans Creek crossing, Marulan. 2. Bypass Road: A 20m wide strip of land from Brayton Road west of Joarimin Road intersection to Red Hills Road west of the Hume Highway. 3. Hume Highway / Red Hills Road intersection: Land in the road reserve on the western side of the highway in both directions from the intersection. Map Grid References (AGD66): 225284 6157185 (zone 56) for Moss Vale 8928 1:100000 map sheet; 774937 6157185 (zone 55) for Goulburn 8828 1:100000 map sheet.
Elevation	Approx. 600 - 700m ASL
Current Zoning	Rural 1(a)
Current land use and general condition	The subject site for the quarry pit and haul road consists of cleared grazing land with scattered trees, currently stocked with sheep. The bypass road passes through land of varying land-use including uncleared land with natural or partially cleared and disturbed vegetation, a fruit orchard, cleared grazing land and plantation pine forest. The highway intersection with Red Hills Road consists of disturbed roadside vegetation with remnant trees, planted native species and weeds. At the time of the survey, the vegetation in the pasture areas of the study area was much diminished due to the prevailing drought conditions. Weeds were generally sparse and scattered, with the exception of serrated tussock grass which has invaded pastures and is present at high density.
Significant features	Chapmans Creek with eroded banks and Cabbage Gums etc. Natural small rock outcrops – extensive on ridgetops Pine plantation
Study area	
Bioregion	South Eastern Highlands
Botanical Subregion	Central Tablelands (near boundary with Southern Tablelands)
LGA	Goulburn Mulwaree Council
Surrounding landuse	Rural & grazing, uncleared forest on private land, quarries, forestry (pine) plantation, residential (Marulan town), major transport corridors & infrastructure (Hume Highway including truck inspection station & southern railway), minor commercial (retail) outlets in Marulan town.
Watercourses, Drainage and catchment	The land on which the pit site and haul road are proposed is drained by Chapmans Creek, which flows into Joarimin Creek and thence north into the Wollondilly River. The bypass road land is drained directly by Joarimin Creek to the top of the hill, whilst land to the east of the hill including the highway intersection site is drained by Uringalla Creek, which flows into Paddys River and eventually into the Wollondilly River.
Geology	The geology of the site is predominantly Bindook Porphyry, consisting of quartz feldspar porphyry, dacite, felsite and tuff (Geological Survey of NSW 1970).
Study Locality	
Study Locality Description	The study locality encompasses the town of Marulan and smaller surrounding villages and localities; centred on the watershed between the Wollondilly and Shoalhaven River catchments. The topography consists of flat valleys interspersed by gently undulating hills with a number of peaks over 700m ASL. A steeper, higher range (Cookbundoon Range) occurs in the west of the locality with peaks over 900m. Apart from the residential and commercial areas of Marulan town, land-use of the locality is predominantly based on rural and primary industry pursuits, particularly sheep & cattle grazing, agriculture, forestry and quarrying.

The study locality and subject site locations are shown in **Figure 1**.

1.3 Description of the Proposal

The proposal is for the establishment of a hard rock quarry and processing plant 8km northwest of Marulan and associated haul/access roads. The proposed quarry would operate from 6am to 6pm Monday to Saturday, with processing and haulage expected to be carried out between 9pm Sunday and 6pm Saturday. Part of the proposal includes the future construction (in 3-5 years) of a new haul road running from Brayton Rd (near the Joarimin Rd junction) to Red Hills Rd. The locations of the proposed quarry, processing plant and roads are shown in **Figure 2**.

2.0 FIRST STAGE ECOLOGICAL INVESTIGATION – PRELIMINARY ASSESSMENT

2.1 Review of Local Threatened Species and Other Records

A review of the documented records of the locations of threatened flora and fauna species within the study locality has been undertaken. Threatened species records were accessed from the DEC Atlas of NSW Wildlife Database for the Moss Vale (8928) and Goulburn (8828) 1: 100 000 map sheets (as at 15 December 2006).

2.1.1 Flora

Rare or Threatened Flora

From the review, a total of eleven rare or threatened flora species have previously been recorded within the study locality. These are listed in **Table 1** below. Four of these species are classified as Endangered on Schedule 1, Part 1 of the *TSC Act* and five of the species are classified as Vulnerable on Schedule 2 of the Act. In terms of national listings, one of the species is listed as Endangered by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, and three of the species are listed as Vulnerable under the Act. None of the other species are listed by the Commonwealth Act. All but two of the species are listed under the national database known as ROTAP *Rare or Threatened Australian Plants* (Briggs & Leigh 1996). Of these, two species are listed by ROTAP exclusively, that is, they are not also listed under any legislative provisions.

Table 1. Rare or Threatened Flora previously recorded within the Study Locality

Scientific Name	Status (TSC)	Status (EPBC)	ROTAP Risk Code	Earliest / latest record	Number of records within 20km of site	Number of records within 10km of site	Number of records within 5km of site
Threatened Species							
Baloskion longipes	V	-	3VC-	1994	1	0	0
Carex klaphakei	E1	-	-	1950-1995	2	0	0
Eucalyptus aquatica	V	V	2VCa	1993	1	0	0
Eucalyptus macarthurii	V	-	2RCi	1985-2004	3	2	2
Phyllota humifusa	V	V	2VCa	1939-1985	6	1	0
Pomaderris cotoneaster	E1	E	3ECi	1939-2004	4	1	0
Pomaderris delicata	E1	-	-	2000-2002	2	0	0
Pomaderris pallida	V	V	2VCi	2006	1	0	0
Solanum celatum	E1	-	ECa	1899-1978	5	2	0
ROTAP only species							
Acacia subtilinervis	U	-	3RCa	1956-1997	2	1	1
Grevillea raybrownii	U	-	2KC-	1998	1	0	0

Notes:
225284E 6157185N (zone 56) for Moss Vale 8928 1:100000 map sheet; 774937E 6157185N (zone 55) for Goulburn 8828 1:100000 map sheet [AGD66]
Nomenclature follows Harden (1990-2002) and Harden & Murray (2000) including recent updates from Plant NET.

Status (TSC): refers to the NSW *Threatened Species Conservation Act* 1995 (TSC)
- E1 Schedule 1, Part 1: Endangered Species
- V Schedule 2: Vulnerable Species
- U Unprotected (not listed in Schedule 13 of the NPW Act 1974 or in the TSC Act 1995)

Status (EPBC): refers to the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC)
- E Endangered Species
- V Vulnerable Species

ROTAP Risk Code (Briggs and Leigh 1996)
- 2 Geographic range in Australia less than 100km
- 3 Geographic range in Australia greater than 100km
- E Endangered Species: in serious risk of disappearing from the wild within 10-20 years if present land use and other threats continue to operate
- V Vulnerable Species: not presently endangered, but possibly at risk in future due to continuing depletion or land-use change
- R Rare Species: rare in Australia, but currently without any identifiable threat
- K Poorly known: suspected, but not definitely known to belong to the above or any other conservation status category
- C Reserved: indicates taxon has at least one population within a national park, or other proclaimed conservation reserve or in an area otherwise dedicated for the protection of flora
- a 1000 plants or more are known to occur within a conservation reserve(s)
- i less than 1000 plants are known to occur within a conservation reserve(s)
- - reserved population size is not accurately known

Please note: These records are based on information supplied by the Department of Environment and Conservation and other sources, and may contain errors or omissions.

In addition to the above records from the DEC database, Umwelt (2005) had also recorded *Eucalyptus macarthurii* within the site for the proposed Lynwood Quarry, a few kilometres south-west of the current proposed quarry site. The location given for the DEC record falls within the same site as investigated by Umwelt, but occurs approximately 2 kilometres to the south-west of the location shown on Figure 3.1 of Umwelt (2005).

Endangered Populations of Plants

No listed endangered populations of flora are known to occur within the study locality.

Endangered Ecological Communities

The following Endangered Ecological Communities listed on Schedule 1, Part 3 of the *TSC Act 1995* are known or likely to occur within the area covered by the 8828 and 8928 1: 100 000 map sheets, and could have potential to occur in the study area:

- *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps*
- *White Box Yellow Box Blakely's Red Gum Woodland*

An assessment will be made as to whether these communities could occur in any form within the study area later in the report.

Critical Habitat

No Critical Habitat declared to date occurs within the study locality.

2.1.2 Fauna

Threatened Species

From the DEC Atlas of NSW Wildlife Database, a total of 22 threatened terrestrial fauna species have previously been recorded within the study locality, including 12 bird, nine mammal and one frog species (refer to **Table 2**). Of these, 19 species are currently listed as Vulnerable on Schedule 2 of the *TSC Act* and three species (Regent Honeyeater, Brush-tailed Rock-wallaby and Green and Golden Bell Frog) are listed as Endangered on Schedule 1 of the Act. Five of the species are also listed on the Commonwealth *EPBC Act*. The Large-eared Pied Bat, Brush-tailed Rock-wallaby and Green and Golden Bell Frog are listed as Vulnerable, the Spotted-tailed Quoll is listed as Endangered and the Regent Honeyeater is listed as Endangered and Migratory on the EPBC Act.

An ecological assessment conducted by Umwelt Environmental Consultants (2005) at the nearby Readymix Lynwood Quarry site positively identified three threatened species, the Speckled Warbler, Squirrel Glider and Eastern Bent-wing Bat. In addition, two threatened insectivorous bat species (the East-coast Freetail-bat and Eastern False Pipistrelle) were tentatively identified based on ultrasonic call analysis. Note that all of the Umwelt records may already be included in the DEC Atlas of NSW Wildlife Database.

Table 2. Threatened Fauna previously recorded within the Study Locality (DEC records)

Scientific Name	Common Name	Status (TSC)	Status (EPBC)	Earliest / latest record	Number of records within 20km of site	Number of records within 10km of site	Number of records within 5km of site
Birds							
Botaurus poiciloptilus	Australasian Bittern	V	-	1997	1	0	0
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	1982-2006	15	8	1
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	1997-2006	10	7	0
Climacteris picumnus	Brown Treecreeper	V	-	1997-2004	3	1	1
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	1985	1	1	1
Ninox connivens	Barking Owl	V	-	1986	1	0	0
Ninox strenua	Powerful Owl	V	-	1997-2005	4	2	1
Oxyura australis	Blue-billed Duck	V	-	1989	1	0	0
Pyrrholaemus sagittatus	Speckled Warbler	V	-	2004	1	1	1
Stagonopleura guttata	Diamond Firetail	V	-	1992-2006	3	1	0
Tyto novaehollandiae	Masked Owl	V	-	1998-2004	3	0	0
Xanthomyza phrygia	Regent Honeyeater	E1	E, Mi	1983-2005	3	0	0
Flying Mammals							
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	2006	2	2	0
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	2004	1	1	1
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	1977-2006	8	5	2
Mormopterus norfolkensis	East-coast Freetail-bat	V	-	2004	1	1	1
Non-flying Mammals							
Dasyurus maculatus	Spotted-tailed Quoll	V	E	1992	1	0	0
Petaurus australis	Yellow-bellied Glider	V	-	1994-2004	40	0	0
Petaurus norfolcensis	Squirrel Glider	V	-	2004	1	1	1
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	V	1992-2000	4	1	0
Phascolarctos cinereus	Koala	V	-	1900-2005	103	6	4
Frogs							
Litoria aurea	Green and Golden Bell Frog	E1	V	1975	1	0	0

Notes:
225284E 6157185N (zone 56) for Moss Vale 8928 1:100000 map sheet; 774937E 6157185N (zone 55) for Goulburn 8828 1:100000 map sheet [AGD66]

Status (TSC): refers to the NSW *Threatened Species Conservation Act* 1995 (TSC)
E1 Schedule 1, Part 1: Endangered Species
V Schedule 2: Vulnerable Species

Status (EPBC): refers to the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC)
E Endangered Species
V Vulnerable Species

Please note: These records are based on information supplied by the Department of Environment and Conservation and other sources, and may contain errors or omissions.

Endangered Fauna Populations

No populations of endangered fauna occur in the area covered by the 8828 and 8928 1:100 000 map sheets.

2.1.3 EPBC Act Protected Matters Report

The EPBC Act Protected Matters Search Tool was accessed on the 8th of January 2007 to identify the Protected Matters under the Commonwealth EPBC Act 1999 that occur, may occur or may be relevant within the study locality. This review yielded a report (summarised in **Table 3**) listing the matters that could potentially be relevant under the EPBC Act for activities within the study area. Please note that species or other matters identified from the report as occurring, or having potential to occur within the study locality, may not be relevant to the study area or subject site itself.

Table 3. Summary of Potentially Relevant Matters under the Commonwealth EPBC Act 1999

Protected Matter	Potentially Relevant?	Details
Matters of National Environmental Significance		
World Heritage Properties	Yes	None
National Heritage Places	Yes	None
Wetlands of International Significance (Ramsar sites)	Yes	None
Commonwealth Marine Areas	No	None
Threatened Ecological Communities	Yes	**Two:** Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory. White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.
Threatened Species - Flora	Yes	**Six species:** **Species or species habitat likely to occur within area, as predicted by DEH modelling.** Thick-lipped Spider-orchid *Caladenia tessellata* (V) Plumed Midge-orchid *Genoplesium plumosum* (E) Wingless Raspwort *Haloragis exalata* subsp. *exalata* (V) *Kunzea cambagei* (V) Hoary Sunray *Leucochrysum albicans* var. *tricolor* (E) Austral Toadflax *Thesium australe* (V) The likelihood of any of these species occurring in the study area on the basis of available habitat is assessed in **Table 5** (Section 2.3.1).
Threatened Species – Fauna (Terrestrial Species only)	Yes	**Twelve species:** **Species or species habitat may occur within area, as predicted by DEH habitat modelling.** **Swift Parrot *Lathamus discolor* (E)** Australian Painted Snipe *Rostratula australis* (**V**) **Regent Honeyeater *Xanthomyza phrygia* (E)** Spotted-tail Quoll *Dasyurus maculatus maculatus* (SE mainland population) (**E**) **Large-eared Pied Bat *Chalinolobus dwyeri* (V)** Southern Brown Bandicoot *Isoodon obesulus obesulus* (E) Brush-tailed Rock-wallaby *Petrogale penicillata* (V) Long-nosed Potoroo *Potorous tridactylus tridactylus* (V) Grey-headed Flying-fox *Pteropus poliocephalus* (V) Littlejohn's Tree Frog *Litoria littlejohni* (V) **Species or species habitat likely to occur within area, as predicted by DEH modelling.**

		Giant Burrowing Frog *Heleioporus australiacus* (V) Broad-headed Snake *Hoplocephalus bungaroides* (V) Those species considered most likely to occur based on the available habitat are highlighted in **bold** and listed as potential subject species in **Section 2.4.2**. Threatened fauna species listed in the EPBC Act are addressed in **Section 4.3**.
Migratory Species (Terrestrial Species Only)	Yes	**Nine species:** **Species or species habitat may occur within area, as predicted by DEH modelling.** White-throated Needletail *Hirundapus caudacutus* (Mi) Rainbow Bee-eater *Merops ornatus* (Mi) Regent Honeyeater *Xanthomyza phrygia* (E, Mi) Latham's Snipe *Gallinago hardwickii* (Mi) Painted Snipe *Rostratula benghalensis s. lat.* (Mi) **Species or species habitat likely to occur within area, as predicted by DEH modelling.** White-bellied Sea Eagle *Haliaeetus leucogaster* (Mi) **Breeding may occur within area, as predicted by DEH modeling.** Black-faced Monarch *Monarcha melanopsis* (Mi) Rufous Fantail *Rhipidura rufifrons* (Mi) **Breeding likely to occur within area, as predicted by DEH modelling.** Satin Flycatcher *Myiagra cyanoleuca* (Mi) Listed migratory species are assessed in **Section 4.3**.
Other Matters Protected by the EPBC Act		
Commonwealth Lands	Yes	Two - Commonwealth Lands identified within the study locality do not occur in the vicinity of the study area.
Commonwealth Heritage Places	No	None
Places on the Register of the National Estate	Yes (Natural places only)	Two: Bungonia State Recreation Area NSW Morton National Park (1980 boundary) NSW
Listed Marine Species	No	-
Whales and Other Cetaceans	No	-
Critical Habitats	Yes	None
Commonwealth Reserves	Yes	None
Extra Information		
State and Territory Reserves	Yes	One: Morton National Park, NSW
Other Commonwealth Reserves	Yes	None
Regional Forest Agreements	Yes	Southern RFA, New South Wales

Notes:
V Species listed as **Vulnerable** under the Commonwealth *EPBC Act*.
E Species listed as **Endangered** under the Commonwealth *EPBC Act*.
Mi Species listed as **Migratory** under the Commonwealth *EPBC Act*.
O Species listed under the Commonwealth *EPBC Act* as "overfly marine area".

2.2 General Habitat Assessment of the Study Area

Investigations for the preliminary habitat assessment comprised a site inspection on the 15th January 2007 noting floral and faunal habitat types and features. The possible habitat features investigated and assessed for the study area are listed in **Table 4** below.

From these site assessments it was possible to:

- identify those parts of the study area that contain potentially significant habitats for threatened species and local biodiversity;

- determine the areas of the study area that require detailed field survey;

- identify potential constraints from an ecological perspective within the study area; and

- generate a list of local and regional threatened species regarded as subject species.

Table 4. Summary of habitat features within the study area

Habitat Feature	Habitat Description
1) Overall Type and Structure of Vegetation	a) Riparian floodplain Cabbage Gum/Yellow Box/Argyle Apple woodland; b) Yellow Box/Blakely's Red Gum/Stringybark woodland/open woodland; c) Argyle Apple/Stringybark open forest/woodland; d) White Gum/Argyle Apple woodland; e) Stringybark/Wattle open forest/woodland; f) Radiata Pine/Cultivated Plum Tree plantation/orchard; g) Dams and fringing vegetation; h) Open cleared grassland/derived pasture.
2) Dominant Species	a) *Eucalyptus amplifolia* subsp. *amplifolia* Cabbage Gum, *Eucalyptus melliodora* Yellow Box, *Eucalyptus cinerea* Argyle Apple; b) *Eucalyptus melliodora* Yellow Box, *Eucalyptus blakelyi* Blakely's Red Gum, *Eucalyptus eugenoides* Thin-leaved Stringybark, *Eucalyptus macrorhyncha* Red Stringybark; c) *Eucalyptus cinerea* Argyle Apple, *Eucalyptus eugenoides* Thin-leaved Stringybark, *Eucalyptus macrorhyncha* Red Stringybark; d) *Eucalyptus rossii* White Gum, *Eucalyptus cinerea* Argyle Apple; e) *Eucalyptus eugenoides* Thin-leaved Stringybark, *Eucalyptus macrorhyncha* Red Stringybark, *Acacia mearnsii* Black Wattle; f) *Pinus radiata* Radiata Pine (Site 3), *Prunus domestica* Plum (Site 2); g) Rushes, sedges, etc. with some aquatic vegetation and fringing clumps of introduced shrubs; h) Native and introduced grasses and low groundcovers.
3) Density of Shrub and Ground Cover	a) Disturbed, mostly sparse ground cover of native and introduced grasses & ground covers. Very sparse shrub layer; b) Disturbed, mostly sparse ground cover of native and introduced grasses & ground covers. Mostly very sparse shrub layer; c) Disturbed and very sparse shrub and ground cover; d) Partially disturbed sparse shrub and ground cover; e) Sparse shrub and ground cover (no obvious major current disturbances); f) Sparse (both sites); g) Mostly sparse (fringing vegetation); h) Sparse to moderate.

4) Geology	The geology of the site is predominantly Bindook Porphyry, consisting of quartz feldspar porphyry, dacite, felsite and tuff (Geological Survey of NSW 1970).
5) Aspect and slope	Land within the study area is undulating and includes small hills, creeklines and drainage lines. Water courses within the study area generally flow to the north or northeast, including Chapman's Creek and Joarimin Creek.
6) Presence of: a) Large Mature Trees (>50cms DBH), b) Dead Trees c) Hollow-bearing Trees d) Fallen Timber e) Rock Outcrops f) Wet Areas or Waterbodies	 a) A number of large mature trees occur, scattered throughout the subject site. b) Scattered. c) A number of trees containing small hollows occur throughout the subject site. Some contain medium hollows, though very few large hollows were observed. d) Scattered. e) Some small to large surface rock and boulders in some areas (mostly hilltops and hillsides). f) Chapman's Creek at Site 1 contains some small pools. Joarimin Creek at Site 2 contains some larger pools. A number of dams occur at Sites 1 & 2. Small ephemeral watercourses and drainage lines (dry with occasional small pools) throughout the subject site.
7) Extent of Weed Invasion	The proportion of weed species throughout the subject site ranges from 21% to 42%. Listed noxious weeds include Blackberry, Paterson's Curse, Serrated Tussock, St. Johns Wort and Sweet Briar. Of these, Serrated Tussock is the most significant weed within the subject site, occurring throughout the subject site and is particularly abundant in pasture areas.
8) Assessment of previous and present Land Use and Disturbance Regimes	Much of the land within the subject site has been extensively cleared for pasture. Site 2 retains a good tree cover and while this area may have been subject to past clearing, it is now in relatively good condition. The major current disturbances are grazing, weed invasion and erosion.
9) Extent of connectivity, movement corridors and refugia	Links occur to neighbouring bushland on private land, in particular to the south of Site 1 and east of Site 2. A number of fauna species (eg. birds, kangaroos) would also be able to travel across the cleared pasture lands that dominate the landscape.

2.3 Aquatic Fauna Habitat Assessment

The results of the fish habitat assessment are as follows (addressing NSW Fisheries (1999 & 1998) guidelines for aquatic habitat and fish assessment):

Geomorphology – The study area forms part of the southern Hawkesbury-Nepean Catchment area. All four sites within the subject site eventually drain to the Wollondilly River, which eventually flows into Lake Burragorang and forms part of Sydney's water supply. Site 4 and the pine plantation area drain initially to Uringalla Creek, which flows into Paddy's River and then the Wollondilly River. Site 3 (west of Red Hills Road) and Site 2 both drain to Joarimin Creek which flows into the Wollondilly River. Site 1 drains to Chapmans Creek, which flows into Joarimin Creek and then the Wollondilly River.

Flow Regime – At the time of survey, no flow was evident in any watercourse or drainage line within the subject site. Chapmans Creek lies along the northern boundary of Site 1 and contained only occasional small pools of water at the time of survey. Joarimin Creek lies between Sites 2 & 3 and contained some larger pools of water, though no flow was evident at the time of survey. Both of these creeks and drainage lines within the subject site suffer from moderate to severe erosion.

Water Quality – No water quality testing was undertaken. From observations at the time of survey it was noted that while water quality appeared to vary between different pools, in general any standing water appeared highly discoloured.

Water Depth – At the time of the survey**,** the water depth in all observed pools within the study area was no more than 1 metre and mostly much less than this.

Land Use – Land use within the study area is predominantly devoted to grazing, with a pine plantation at Site 3. Other land uses nearby include quarrying, some areas of native vegetation and Johnniefelds Dam.

Riparian Vegetation – Due to grazing pressure and erosion, riparian vegetation throughout the subject site is quite degraded, with some areas infested with blackberry. In many places (particularly in Site 1), riparian vegetation has been reduced to canopy trees with a very sparse understorey of native and introduced groundcovers and the occasional low shrub (mostly blackberry). **Table 7** contains a detailed description of this community.

In-stream Vegetation – Very little instream vegetation occurs in Chapmans Creek and other drainage lines in Site 1. The larger, permanent pools in Joarimin Creek at Site 2 contain *Typha orientalis* and some sedges and rushes (see **Table 7**).

Presence of Wetlands – Joarimin Creek flows into Johnniefields Dam, which constitutes an artificial wetland. No other wetland areas are known to occur within the study area.

Substrate Type – Predominantly soil with some rocky areas.

Fish Refuge Areas – The Wollondilly River and Johnniefields Dam (associated with the Readymix 'Johnifields' quarry) are the only known potential fish refuge areas nearby.

Potential Spawning Areas – None obvious at time of survey.

Natural and Artificial Barriers to Fish – The ephemeral nature of both creeks and drainage lines within the subject site results in a natural barrier to passage between the more permanent pools outside of periods of water flow.

Likely Presence of Migratory Fish Species – No records of migratory fish species occur within the subject site. It is not expected that the proposed development or associated construction works would negatively impact any species of migratory fish. A list of fish species recorded within the Goulburn Mulwaree Council area has been included as **Appendix 3**.

Aquatic Fauna Present – No survey for aquatic fauna was undertaken. It is expected that some aquatic fauna (eg. freshwater crayfish, aquatic insects) occur in dams and some of the larger pools in creeklines within the subject site (particularly Joarimin Creek). A full species list would only be obtained by conducting a detailed capture and release study. Given the ephemeral nature of creeklines within the subject site and the fact that no threatened species are expected to occur, the undertaking of a full aquatic survey is not considered warranted under the survey guidelines.

2.4 Determination of Local Threatened Flora and Fauna as Subject Species

Potential subject species are defined as those threatened species considered likely to occur in the habitats present within the study area (NPWS 1996). Therefore, such species would be potentially impacted by the proposal.

2.4.1 Threatened Flora

Of the threatened flora species previously recorded or predicted to occur in the study locality, an assessment of the relative likelihood of those species occurring within the study area is provided below in **Table 5**.

Table 5. Assessment of the Potential for Local Rare or Threatened Flora Species to occur within the Study Area

Scientific Name **(Common Name)**	**No. of records within 20 / 10 / 5 km of the study area (date of latest record)**	**Preferred Habitat and comments***	**Likelihood of Occurrence**
Threatened Flora			
Baloskion longipes (Dense Cord-rush)	1 / 0 / 0 (1994)	Commonly found in swamps or depressions in sandy alluvium, sometimes growing with sphagnum moss. Also occurs in swales within tall forest, and in Black Gum (*Eucalyptus aggregata*) Woodland.	**Low to Moderate –** very little suitable habitat is available in the study area – could only occur along Joarimin Creek, or less likely Chapmans Creek.
Caladenia tessellata (Thick-lipped Spider-orchid / Tessellated Spider-orchid)	No records (habitat modelling only)	Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though a population near Braidwood is in low woodland with stony soil. The single leaf regrows each year. Flowers appear between September and November (but apparently generally late September or early October in extant southern populations).	**Low –** although nominally suitable habitat may be available in some parts of the study area, the lack of records reduces its likelihood..
Carex klaphakei (Klaphake's Sedge)	2 / 0 / 0 (1995)	Grows with other native sedges and rushes in swamps on sandstone at altitudes of greater than 600m.	**Low –** could occur along Joarimin Creek but substrate is not sandstone and elevation may be too low.
Eucalyptus aquatica (Broad-leafed Sallee)	1 / 0 / 0 (1993)	Occurs as scattered plants on open, swampy flats.	**Low –** swampy flats are absent from the study area.
Eucalyptus macarthurii (Camden Woollybutt)	3 / 2 / 2 (2004)	Locally frequent, in grassy woodland on relatively fertile soils on broad cold flats. Occurs mainly on private land, often as isolated individuals in, or on the edges of paddocks.	**Moderate –** suitable habitat may be available in the flat areas of the pit and haul road site, and nearby records exist.

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Scientific Name **(Common Name)**	**No. of records within 20 / 10 / 5 km of the study area (date of latest record)**	**Preferred Habitat and comments***	**Likelihood of Occurrence**
Genoplesium plumosum (Plumed Midge-orchid / Tallong Midge-orchid)	No records (habitat modelling only)	Occurs exclusively in heathland, generally dominated by Violet Kunzea (*Kunzea parvifolia*), Common Fringe-myrtle (*Calytrix tetragona*) and parrot-peas (*Dillwynia* spp.). Grows on very shallow soils or within mosses on sandstone conglomerate shelves. Plants exists only as a dormant tuber for much of the year, dying back after flowering and fruiting in late summer or early autumn.	**Low to Moderate –** suitable habitat may exist in the heathy community between Joarimin Creek Road and Brayton Road (dense *Kunzea parvifolia* thickets are present), but the lack of records reduces its likelihood.
Haloragis exalata subsp. *exalata* (Wingless Raspwort / Square Raspwort)	No records (habitat modelling only)	Appears to require protected and shaded damp situations in riparian habitats. Flowering specimens in NSW are recorded from November to January.	**Low –** the only potentially suitable habitat is on the bank of Joarimin Creek, but the lack of records reduces its likelihood.
Leucochrysum albicans var. *tricolor* (Hoary Sunray)	No records (habitat modelling only)	In a wide range of communities and habitats from peaty upland to stony plains.	**Low to Moderate –** Nominally suitable habitat may be present, but the lack of records reduces its likelihood.
Phyllota humifusa	6 / 1 / 0 (1985)	Dry sclerophyll forest (sometimes near swamps) in deep sandy shale soils or gravelly loams over a sandstone substrate. Accompanying trees are often Brittle Gum *Eucalyptus mannifera*, Narrow-leafed Peppermint *E radiata* or Sydney Peppermint *E. piperita*.	**Low –** nominally suitable habitat may be present, but commonly associated eucalypts are all absent.
Pomaderris cotoneaster (Cotoneaster Pomaderris)	4 / 1 / 0 (2004)	Has been recorded in a range of habitats in predominantly forested country including forest with deep, friable soil; amongst rock beside a creek; on rocky forested slopes and in steep gullies between sandstone cliffs. Populations are not apparently influenced by local variations in habitat - it is not obvious why they are only growing where they are.	**Low to Moderate** – due to its presence in a range of habitats and a record within 10 km. Because of the apparent lack of a particular identified habitat type for this species, its likelihood of occurrence in the study area is difficult to assess.
Pomaderris delicata (Delicate Pomaderris)	2 / 0 / 0 (2002)	Known from only two sites. At both sites the Delicate Pomaderris grows in dry open forest dominated by *Eucalyptus sieberi* with a dense she-oak understorey. Soils are shallow and derived from sandstone and siltstone.	**Low** – there is a small chance it could occur in the only area with *Eucalyptus sieberi* in the unformed Crown Road on the ridge top west of Red Hills Road.
Pomaderris pallida (Pale Pomaderris)	1 / 0 / 0 (2006)	Usually grows in shrub communities surrounded by Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*E. macrorhynca*) or *Callitris* spp. woodland.	**Low** – nominally suitable habitat could be present in the areas with Red Stringybark, but records of the species are scant with none occurring nearby.

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Scientific Name **(Common Name)**	**No. of records within 20 / 10 / 5 km of the study area (date of latest record)**	**Preferred Habitat and comments***	**Likelihood of Occurrence**
Solanum celatum	5 / 2 / 0 (1978)	Grows in rainforest clearings, or in wet sclerophyll forests.	**Low** - suitable forest types are absent from the study area.
Thesium australe (Austral Toadflax)	No records (habitat modelling only)	Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (*Themeda australis*). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	**Low** – grassy damp sites are absent from the study area except in the immediate vicinity of Joarimin Creek, and the lack of records reduces its likelihood.
ROTAP only species			
Acacia subtilinervis	2 / 1 / 1 (1997)	Grows in heath and dry sclerophyll forest on rocky outcrops.	**Low to Moderate –** could potentially occur on the rockier ridgetop areas.
Grevillea raybrownii	1 / 0 / 0 (1998)	Grows in dry sclerophyll forest in sandy, gravelly loam derived from sandstone.	**Low –** soil is unsuitable and no nearby records exist.

* compiled primarily from DEC Threatened Species Information: http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx with additional information from Harden (1990, 1992, 1993, 2002); PlantNet http://plantnet.rbgsyd.nsw.gov.au; DEC Atlas of NSW wildlife and Final Determinations for listed species.

Of the locally-occurring rare or threatened flora species, those that have been rated as having at least a low to moderate or better likelihood of occurring in the study area are deemed to be potential subject species and will be subject to specific assessment under section 5A of the *EP&A Act 1979*. No species have a high likelihood of occurring, and only one species, *Eucalyptus macarthurii*, is rated as having a moderate likelihood of occurring. A number of other species, including *Baloskion longipes*, *Genoplesium plumosum*, *Leucochrysum albicans* var. *tricolor* and *Pomaderris cotoneaster* have a lower (low to moderate) likelihood of occurring, usually in very specific or restricted habitat types in the study area only. All these species are considered to be potential subject species in the study area, and will be assessed accordingly under the relevant legislation.

The ROTAP species *Acacia subtilinervis* also has a low to moderate likelihood of occurring in specific habitat types, but this species is not legislatively listed and therefore does not require formal assessment under legislation.

2.4.2 Threatened Fauna

An assessment of the likelihood of the threatened fauna species previously recorded in the study locality, or potentially occurring within the subject site, is provided below in **Table 6**.

Table 6. Assessment of the Potential for Local Threatened Fauna Species to occur within the Study Area

Species	No. of records within 20/10/5 km of the study area (date of latest record)	Habitat Preference	Likely Presence
Birds			
Botaurus poiciloptilus (Australasian Bittern)	1 / 0 / 0 (1997)	Terrestrial and estuarine wetlands. Prefers freshwater wetlands with permanent water and dense vegetation, though will utilise dense saltmarsh and flooded grasslands.	Only very limited marginal habitat occurs within the study area. Not considered a subject species.
Callocephalon fimbriatum (Gang-gang Cockatoo)	15 / 8 / 1 (2006)	Tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter it occurs in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Requires hollow trees for nesting.	Suitable (if fragmented) habitat occurs, including potential nest hollows. Considered a **potential** subject species.
Calyptorhynchus lathami (Glossy Black-Cockatoo)	10 / 7 / 0 (2004)	Coastal woodlands and dry eucalypt forests to open inland woodlands and forested watercourses. Requires particular food trees (She-oaks, particularly *Allocasuarina torulosa*) and large tree hollows for nesting.	Suitable (if fragmented) habitat occurs, including potential nest hollows. Considered a **potential** subject species.
Climacteris picumnus Brown Treecreeper	3 / 1 / 1 (2001)	Eucalypt forests, woodlands, and scrubs of the drier areas, river-edge trees, timbered paddocks. Although occasionally occur on coastal plains and ranges, predominantly found on inland plains and inland slopes of Great Dividing Range.	Some suitable habitat occurs within or near the subject site. This species is, therefore, considered to be a **potential** subject species.
Melanodryas cucullata (Hooded Robin)	-	Prefers open areas adjacent to large blocks of woodland, particularly with areas of dead timber and sparse shrub cover. Also recorded in open forests and *Acacia* shrublands.	No records occur, though some potential habitat exists. Considered a **potential** subject species.
Melithreptus gularis gularis Black-chinned Honeyeater (eastern subspecies)	1 / 1 / 1 (1985)	Eucalypt and Paperbark forest and woodland as well as tree-lined water courses of arid areas. This species appears to prefer the drier habitats of the western slopes and plains.	Only one old record exists, though this species may visit the study area, particularly during peak flowering events. Considered a **potential** subject species.
Neophema pulchella (Turquoise Parrot)	-	Eucalypt woodland and open forest with grassy groundcover or sparse low shrub layer. Feeds on seeds and grasses.	Some suitable potential habitat may occur in less heavily grazed areas. Considered a **potential** subject species.

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Species	No. of records within 20/10/5 km of the study area (date of latest record)	Habitat Preference	Likely Presence
Ninox connivens (Barking Owl)	1 / 0 / 0 (1986)	Open forests, woodlands, dense scrubs, foothills; river red gums, other large trees near watercourses, penetrating otherwise open country; paperbark woodlands. Feeds on a range of vertebrate and invertebrate fauna.	Suitable potential habitat occurs, though only one old record exists. Considered a **potential** subject species.
Ninox strenua (Powerful Owl)	4 / 2 / 1 (2005)	Occurs in open forest and woodland, roosting in dense tree foliage. Prefers well developed tall forest with large tree hollows for nesting. Feeds on possums, gliders, birds and fruit-bats.	Suitable potential foraging habitat occurs, though this species prefers dense gullies for roosting and nesting. Considered a **potential** subject species.
Oxyura australis (Blue-billed Duck)	1 / 0 / 0 (1989)	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. Nests in cumbungi or other dense vegetation.	No suitable nesting habitat and only one old record exists. Only likely to be an occasional vagrant. Not considered a potential subject species.
Pyrrholaemus sagittatus (Speckled Warbler)	1 / 1 / 1 (2004)	Eucalypt woodlands, preferably where ground cover consists of grass, fallen leaves and bark. This species forages on insects and small seeds.	Suitable potential habitat occurs in less heavily grazed areas with a more intact shrub layer. Considered a **potential** subject species.
Stagonopleura guttata (Diamond Firetail)	3 / 1 / 0 (2006)	Open forest with a grassy groundcover, woodland, mallee, acacia scrublands and timber belts along watercourses and roadsides.	Suitable potential habitat occurs in less heavily grazed areas. Considered a **potential** subject species.
Tyto novaehollandiae (Masked Owl)	3 / 0 / 0 (2004)	Predominantly forages for terrestrial prey, such as rats and small rabbits within a mosaic of open woodland/forest habitats and on the edge of cleared land. Roosts and nest in large tree hollows in moist eucalypt forested gullies, although will also roost in dense vegetation and caves.	Suitable potential foraging habitat occurs, though this species prefers dense gullies for roosting and nesting. Considered a **potential** subject species.
Xanthomyza phrygia (Regent Honeyeater)	3 / 0 / 0 (2005)	Box-ironbark eucalypt associations, though uses other woodland types and wet lowland coastal forest in times of food shortage. The wandering nature of this species makes it difficult to assess. Known to frequent areas with densely blossoming winter-flowering trees (eg. Spotted Gum, Red Iron bark, Forest Red Gum and Swamp Mahogany) on an opportunistic basis along the coast and ranges of NSW.	Not known to breed in the area, however some suitable foraging habitat occurs and this species may occasionally visit the study area. Considered a **potential** subject species.
Flying Mammals			
Chalinolobus dwyeri (Large-eared Pied Bat)	2 / 2 / 0 (2006)	Found in dry forests and woodlands in the western slopes and plains in NSW. Primarily roosts in cave entrances.	Suitable potential foraging habitat occurs. Considered a **potential** subject species.

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Species	No. of records within 20/10/5 km of the study area (date of latest record)	Habitat Preference	Likely Presence
Falsistrellus tasmaniensis (Eastern False Pipistrelle)	1 / 1 / 1 (2004)	Tall forest, woodland or heath/ grassland edges. Roosts in hollow trunk of the largest trees and sometimes buildings.	Limited potential foraging and roosting habitat occurs. Considered a **potential** subject species.
Miniopterus schreibersii oceanensis (Eastern Bentwing-bat)	8 / 5 / 2 (2006)	Forages within a variety of habitat types including moist and dry eucalypt forest, woodland, rainforest, heath and open environments, including urban areas. Reliant on suitable roosting/breeding habitat in caves and mine tunnels, though will also roost in stormwater channels, road culverts and other comparable structures (including buildings). Estimated nightly foraging range of 20 kilometres.	Suitable potential foraging habitat occurs. Considered a **potential** subject species.
Mormopterus norfolkensis (East-coast Freetail-bat)	1 / 1 / 1 (2004)	The habitat preference of this species is unclear. It has been predominantly recorded in dry eucalypt forest and woodland, but has been recorded in moist and edge environments. The wing morphology indicates that this species is adapted to the more open habitats. This species primarily roosts in tree hollows, although the roofs of buildings are also used.	Suitable potential foraging and roosting habitat occurs. Considered a **potential** subject species.
Non-flying Mammals			
Dasyurus maculatus (Spotted-tailed Quoll)	1 / 0 / 0 (1992)	Inhabits a variety of habitat types from moist and wet sclerophyll through to dry forests and woodlands on the edge of open grasslands. Requires large hollow logs on the ground for den sites.	Unlikely as habitat is highly fragmented, though may use some more intact forested areas within the study area as a corridor. Considered an **unlikely** subject species.
Petaurus australis (Yellow-bellied Glider)	40 / 0 / 0 (2004)	Habitat is restricted to tall, mature eucalypt forest. The preferred food tree is the Grey Gum *Eucalyptus punctata*.	No preferred food trees occur and no large stands of tall, mature forest occur. Not considered a subject species.
Petaurus norfolcensis (Squirrel Glider)	1 / 1 / 1 (2004)	Usually inhabits dry open sclerophyll forest and woodlands, but has also been observed in moist regenerating forest and moist gullies. This species forages on Acacia gum, Eucalypt sap, nectar, honeydew, manna invertebrates and pollen. Banksias have been identified as being important but are not always present.	Some suitable potential foraging and denning habitat occurs. Considered a **potential** subject species.
Petrogale penicillata (Brush-tailed Rock-wallaby)	4 / 1 / 0 (2000)	Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north.	No suitable habitat occurs. Not considered a subject species.

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Species	No. of records within 20/10/5 km of the study area (date of latest record)	Habitat Preference	Likely Presence
Phascolarctos cinereus (Koala)	103 / 6 / 4 (2005)	Forest and woodland habitats that contain suitable regional eucalypt feed trees. In the locality, *Eucalyptus viminalis* (Ribbon Gum) is a listed food trees in SEPP 44. Additional secondary and supplementary food tree species occur within the locality.	Suitable potential habitat occurs. Considered a **potential** subject species.
Frogs			
Litoria aurea (Green and Golden Bell Frog)	1 / 0 / 0 (1975)	Large ephemeral bodies of water exhibiting well-established fringing vegetation adjacent to open grassland areas for foraging.	Only marginal potential habitat occurs and only one old record exists for the locality. Not considered a subject species.

*****Compiled from: Barrett *et al.* 2003; Churchill 1998; Higgins, 1999; Higgins *et al*, 2001; Simpson and Day 1999; Morcombe, 2000; NPWS, 1999; DEC Website; Strahan, 1995, Swan *et al*. 2004.

Based on the above assessment, 18 of the 24 threatened fauna species known or with potential to occur within the study locality are considered to be possible or likely subject species and these are listed in **Section 2.4.3** below. It should be pointed out that it is highly unlikely that all of the subject fauna species would be resident or regular visitors to the study area. Most of the potential species are woodland birds or bats, and many are highly mobile with a large home range.

2.4.3 Potential Subject Species and Endangered Ecological Communities to be assessed

The following listed species and ecological communities are considered to have potential to occur within the study area and are regarded as potential subject species in this assessment:

Flora

- *Eucalyptus macarthurii* (TSC Act only)
- *Baloskion longipes* (TSC Act only)
- *Genoplesium plumosum*
- *Leucochrysum albicans* var. *tricolor* (EPBC Act only)
- *Pomaderris cotoneaster*

Fauna

- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Brown Treecreeper
- Hooded Robin
- Black-chinned Honeyeater
- Turquoise Parrot
- Barking Owl
- Powerful Owl
- Speckled Warbler
- Diamond Firetail
- Masked Owl
- Regent Honeyeater
- Large-eared Pied Bat
- Eastern False Pipistrelle
- Eastern Bent-wing Bat
- East-coast Freetail-bat
- Squirrel Glider
- Koala

Endangered Ecological Communities

- White Box Yellow Box Blakely's Red Gum Woodland
- Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT (EPBC Act only)

Field survey techniques were designed to adequately target these subject species and ecological communities and are discussed in **Section 3**. The potential impacts on the subject species and communities as a result of the proposed development are presented in **Section 4** of this report.

3.0 SECOND STAGE ECOLOGICAL INVESTIGATION – FIELD SURVEYS

3.1 Floral Investigations

3.1.1 Methodology

A comprehensive flora field survey was undertaken over all four sites within the study area on the 15th and 16th of January 2006. The survey methodology complied with the provisions of DEC's Draft Threatened Biodiversity Survey and Assessment Guidelines (DEC 2004). It involved three components:

- A traverse on foot involving a random meander throughout the subject site to assess the range of floristic variation, vegetation structure, extent of modification, disturbance, weed invasion and condition of the vegetation generally. Particular attention was payed to the remnant patches of native trees and shrubs in each site. All vascular flora species encountered were recorded.
- At least two 400 m^2 quadrats (20 x 20m or 40m x 10m in linear areas such as riparian habitats) were examined within each vegetation community. All vascular flora species were recorded within the quadrat, as well as the physical characteristics of each vegetation community.
- Targeted surveys were carried out for the threatened flora species assessed as being potential subject species in areas of potentially suitable habitat.

Small samples of any other plant species that could not be identified in the field were obtained for further examination and identification.

3.1.2 Results

Vegetation Communities

Eight broad vegetation community types occur in the study area, the last three of which are highly modified or artificial communities:

Natural Communities

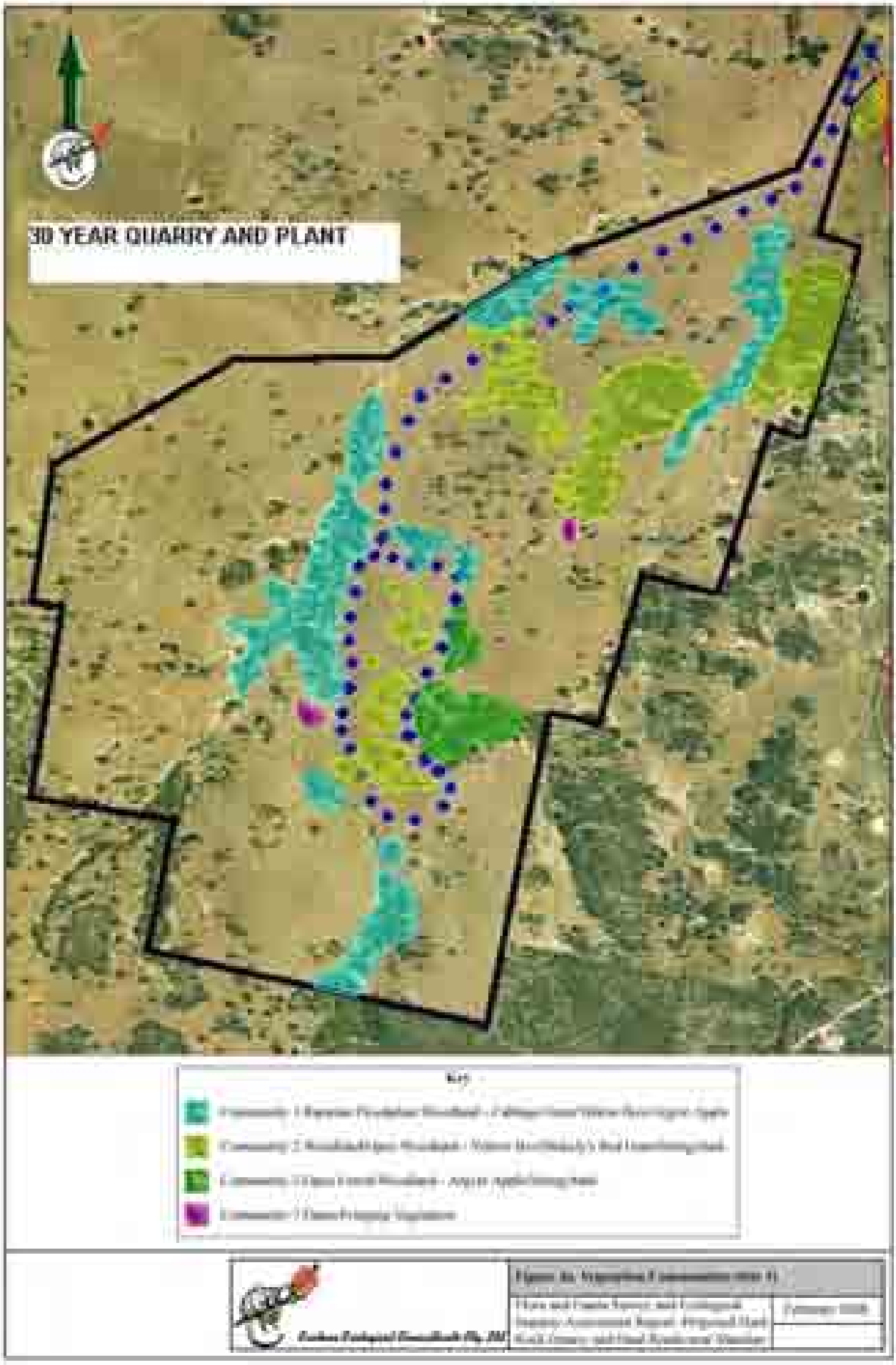
1. Cabbage Gum / Yellow Box / Argyle Apple Riparian Floodplain Woodland
2. Yellow Box / Blakeley's Red Gum / Stringybark Open Woodland
3. Argyle Apple / Stringybark Open Forest / Woodland
4. White Gum / Argyle Apple Woodland
5. Stringybark / Wattle Ridgetop Open Forest

Derived / Artificial Communities

6. Cultivated Pine Plantations and Fruit Orchard
7. Dams with Fringing Vegetation
8. Cleared, open grassland / Derived Pasture with a mix of introduced and native pasture grasses, remnant native flora species and scattered introduced or remnant native trees

Community 8 occupies the bulk of the area in site 1, and a large proportion of the area in site 2. Various communities are dominant in other parts of the study area, as discussed in Table 7.

A description of the structure and floristics of the vegetation communities within the site is given in **Table 7,** and the distribution of the natural vegetation communities in each of the sites is shown in **Figures 3a – 3c.**


30 YEAR QUARRY AND PLANT
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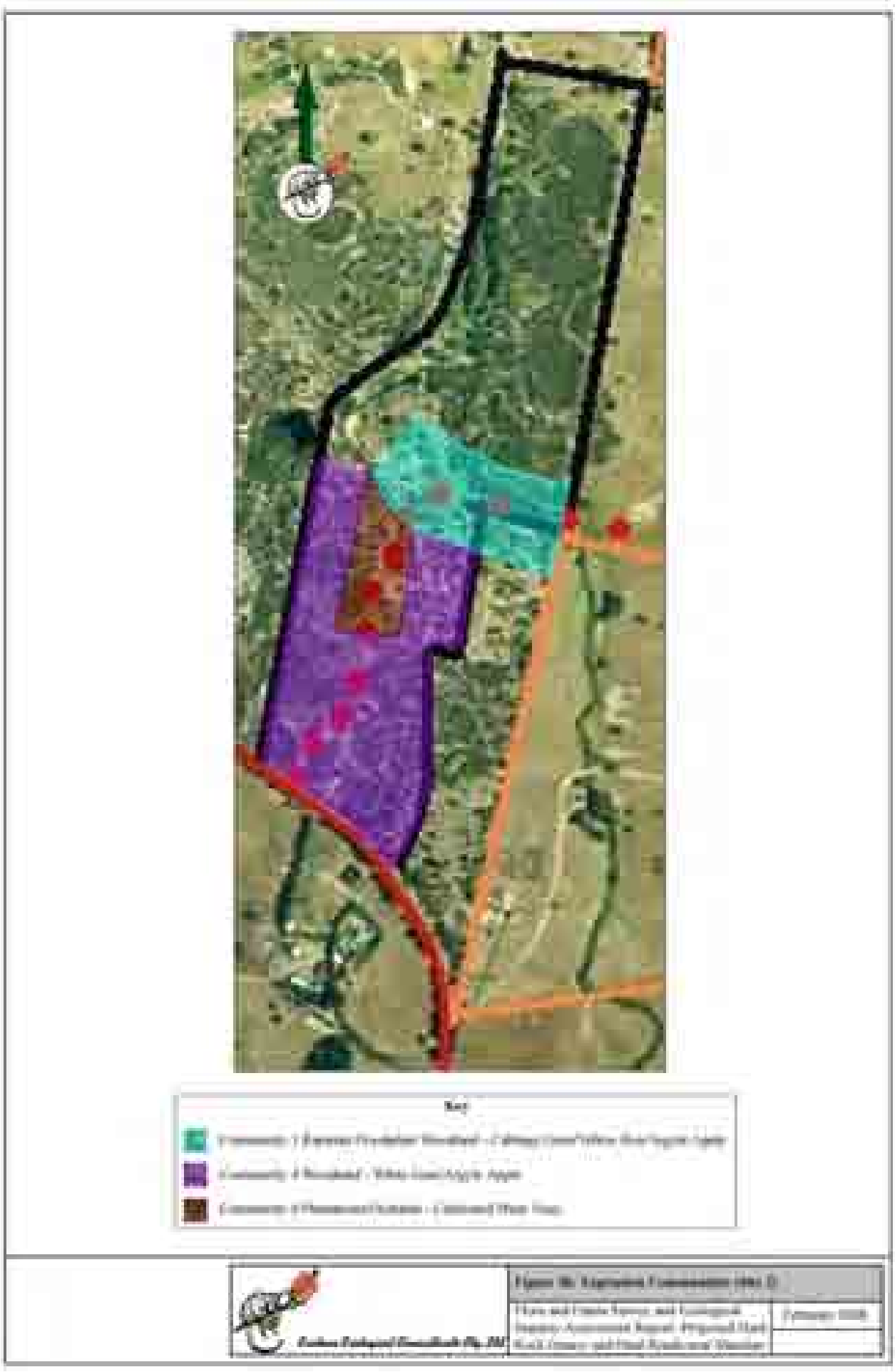
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Table 7. Description of the vegetation communities within the study area

Community 1: RIPARIAN FLOODPLAIN WOODLAND - Cabbage Gum / Yellow Box / Argyle Apple

Stratum	Height	% cover*	Dominant species	Description and Comments
Tree layer	18 - 25 m	15 - 25	*Eucalyptus amplifolia* *E. melliodora* *E. cinerea* *E. viminalis* *E. bridgesiana*	This community occurs along the creeklines and watercourses in both sites 1 and 2. It assumes a different form in the two areas. In site 1 (along Chapmans Creek and tributaries), the creek is generally dry with eroded banks and ephemeral water only. The creek in site 2 (Joarimin Creek) contains permanent water and therefore has a greater number of species (including sedges and rushes) in the creek itself, which are largely absent from site 1. A slightly different assemblage of species also occurs in site 2, with Ribbon Gums present which are absent from site 1. The ground layer in site 1 is much sparser due to the drier conditions and also the presence of grazing, which is absent from site 2. Due to the presence of Yellow Box and various characteristic grass and understorey species, both forms of the community could constitute marginal representations of the Box-Gum Woodland EEC, listed under both the NSW TSC Act and Commonwealth EPBC Act. This is discussed further in the text.
Tall shrub layer	3 - 6 m	0 - 20	*Acacia mearnsii*	
Shrub layer	1 - 2 m	0 - 20	*Rubus fruticosus* *Rosa rubiginosa* *Ozothamnus diosmifolius* *Brachyloma daphnoides* *Lissanthe strigosa*	
Ground layer	0 - 1 m	10 - 50	*Cheilanthes sieberi* *Einadia* spp. *Dichondra repens* *Hibbertia obtusifolia* *Geranium solanderi* *Acetosella vulgaris* *Solanum pungetium* *Nassella trichotoma* *Austrostipa* sp. *Austrodanthonia* sp. *Tricoryne elatior* *Typha orientalis* *Baumea rubiginosa* *Carex berviculmis* *Schoenoplectus validus* *Echinpogon caespitosus*	

*projective canopy foliage cover

Community 2: WOODLAND / OPEN WOODLAND - Yellow Box / Blakelys Red Gum / Stringybark

Stratum	Height	% cover*	Dominant species	Description and Comments
Tree layer	18 - 22 m	5 - 30	*Eucalyptus melliodora* *E. blakelyi* *E. macrorhyncha* *E. eugenioides* *E. cinerea*	This community occurs on the slopes and hilltops in site 1. The community merges into both Communities 1 and 3. It is in a highly modified and disturbed condition, having been cleared to a large extent to create pasture for grazing purposes. As such, it has been reduced to scattered clumps of trees with a modified grassy ground layer. At the time of the survey, the habitat was in a very dry condition due to prolonged drought conditions. Ongoing grazing by sheep had also reduced the ground cover to very sparse levels. Many areas had been reduced to bare earth. The number of flora species detectable was therefore much lower than would normally be expected. A denser ground layer & wattles occur in the small area of the road reserve of Brayton Road where there is no grazing. Due to the presence of Yellow Box, Blakely's Red Gum and various characteristic grass and understorey species, this community has been classified as a highly disturbed patch of the Box-Gum Woodland EEC, listed under both the NSW TSC Act and Commonwealth EPBC Act. This is discussed further in the text.
Shrub layer	0.7 – 1.5 m	0 - 10	*Lissanthe strigosa* *Melichrus urceolatus* *Brachyloma daphnoides*	
Ground layer	0 – 0.7 m	5 - 30	*Cheilanthes sieberi* *Chrysocephalum apiculatum* *Einadia* spp. *Dichondra repens* *Hibbertia obtusifolia* *Geranium solanderi* *Solanum pungetium* *Nassella trichotoma* *Austrostipa* sp. *Austrodanthonia* sp. *Tricoryne elatior* *Echinpogon caespitosus*	

*projective canopy foliage cover

Community 3: OPEN FOREST / WOODLAND – Argyle Apple / Stringybark

Stratum	Height	% cover*	Dominant species	Description and Comments
Tree layer	15 – 18 m	20 - 40	*Eucalyptus cinerea* *E. macrorhyncha* *E. eugenioides*	This community occurs on some rocky flat hilltops in site 1, and grades into Community 2. It is in a partially modified and disturbed condition, but has not been cleared to the same extent as Community 2. It therefore occurs as relatively dense patches of trees, the largest of which occurs to the immediate north of the proposed extraction pit site. As for Community 2, this community was in a very dry condition due to the ongoing drought at the time of the survey, with a much diminished understorey. The trees in the community are shorter and growing in shallower soil than Community 2. Since there are only minor occurrences of Yellow Box and Blakely's Red Gum, this community is regarded as an ecotonal community between the listed Box-Gum Woodland EEC and a pure Argyle Apple / Stringybark community. This is discussed further in the text.
Shrub layer	0.7 – 1.5 m	0 - 10	*Lissanthe strigosa* *Melichrus urceolatus* *Brachyloma daphnoides*	
Ground layer	0 – 0.7 m	5 - 30	*Cheilanthes sieberi* *Chrysocephalum apliculatum* *Dichondra repens* *Hibbertia obtusifolia* *Geranium solanderi* *Solanum pungetium* *Nassella trichotoma* *Austrostipa* sp. *Austrodanthonia* sp. *Tricoryne elatior* *Echinpogon caespitosus*	

*projective canopy foliage cover

Community 4: WOODLAND – White Gum / Argyle Apple

Stratum	Height	% cover*	Dominant species	Description and Comments
Tree layer	16 – 20 m	15- 30	*Eucalyptus rossii* *E. cinerea* *E. bridgesiana*	This community is confined to site 2, and occurs on shallow, sandy soil on the slope above the floodplain of Joarimin Creek up to Brayton Road. The community is in a partially modified and disturbed condition, but is not currently grazed. It appears to have been cleared in the past and is now in an advanced regrowth condition, but contains a greater diversity of flora species than vegetation in site 1. However, possibly due to the prevailing drought conditions, the community has a sparse shrub and ground layer. The community merges partly into a plantation of fruit trees (Community 6) and partly into the riparian vegetation by Joarimin Creek (Community 1) at its downslope (northern) end. This community is not considered to be a listed Endangered Ecological Community under any of the relevant legislation.
Small tree layer	5 – 6 m	0 - 15	*Allocasuarina littoralis* *Acacia mearnsii*	
Shrub layer	0.7 – 2 m	5 - 20	*Kunzea parvifolia* *Acacia brownii* *A. obtusata* *Lissanthe strigosa* *Melichrus urceolatus* *Brachyloma daphnoides* *Leptospermum trinervium* *Xanthorrhoea concava*	
Ground layer	0 – 0.7 m	5 - 25	*Cheilanthes sieberi* *Chrysocephalum apliculatum* *Dichondra repens* *Hibbertia obtusifolia* *Nassella trichotoma* *Austrostipa scabra*. *Podolobium scandens* *Austrodanthonia* sp. *Microlaena stipoides* *Tricoryne elatior* *Lomandra obliqua* *Echinpogon caespitosus*	

*projective canopy foliage cover

Community 5: RIDGETOP OPEN FOREST / WOODLAND – Stringybark / Wattle

Stratum	Height	% cover*	Dominant species	Description and Comments
Tree layer	18– 22 m	20 - 35	*Eucalyptus macrorhyncha* *E. eugenioides* *E. sieberi*	This community is restricted to site 3 on the high ridgetop and associated slopes of the eastern part of the proposed bypass road, west of Red Hills Road. It occurs on rocky conglomerate and granite soil, and consists mainly of stringybarks with a naturally very sparse shrub and ground layer due to the poor, stony soil. It is not currently grazed or subject to other major disturbances. As such, it is generally in reasonable condition but may have been subject to past clearing or other disturbances in parts. The community varies in species composition from west to east – it includes a thicket of wattles (*Acacia mearnsii*) at the western end near the bottom of the slope where the soil is richer, and a grove of Silvertop Ash (*Eucalyptus sieberi*) near the eastern end at Red Hills Road on the flat hilltop below highest point of the ridge. The community also merges into a pine plantation (Community 6) at this end. This community is not considered to be a listed Endangered Ecological Community under any of the relevant legislation.
Small Tree layer	6 – 8 m	0 - 30	*Acacia mearnsii*	
Shrub layer	0.7 – 1.5 m	5 - 10	*Olearia viscidula* *Stypandra glauca* *Acacia brownii* *Ozothamnus diosmifolius*	
Ground layer	0 – 0.7 m	5 - 15	*Pomax umbellata* *Lepidosperma gunnii* *Goodenia hederacea* *Cheilanthes sieberi* *Hibbertia obtusifolia* *Pteridium esculentum* *Solanum pungetium* *Nassella trichotoma* *Austrostipa scabra* *Microlaeana stipoides*	

*projective canopy foliage cover

Community 6: PLANTATIONS / ORCHARDS – Radiata Pine / Cultivated Plum Trees

This community is technically two separate communities, but they are both artificial plantations of fairly uniform structure and highly simplified floristic composition. The community occurs as a derelict fruit tree plantation in site 2, immediately upstream from Joarimin Creek. It abuts with Community 1downslope and Community 4 on the upslope side. The community occurs as a pine plantation in site 3, along the northern side of the unformed Crown Road and along most of Red Hills Road. The community has no intrinsic conservation value.	

Community 7: DAMS / FRINGING VEGETATION

This community is restricted to very specific small areas mainly in site 1 plus one location in site 2. It consists of artificially constructed dams, usually spring fed and therefore containing water in spite of the dry conditions. Minor strips of fringing vegetation in the form of sedges and rushes occur at the water's edge. Clumps of Sweet Briar or Blackberries often occur near the water's edge. Some aquatic vegetation (Ferny Azolla etc.) occurs in the water itself.	

Community 8: OPEN CLEARED GRASSLAND / DERIVED PASTURE

This community occupies the bulk of the area of site 1, and the middle section of the proposed bypass road in site 3. It is the community in which most of the disturbance for the proposed pit, conveyor, crusher, shed and haul road will occur. The community consists of derived open pasture and is treeless due to past clearing, apart from the occasional paddock tree. The community is dominated by a mix of native and exotic pasture grasses and scattered shrub, herb and forb species. A notable species within this community is the noxious grass, Serrated Tussock (the clumps in the photo to the right). This community is not considered to constitute the EEC *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* as listed on the Commonwealth EPBC Act. This is discussed further in the text.	

Floral Diversity

Because of the combination of past clearing, ongoing disturbances (such as grazing) within the study area and an extended severe drought at the time of the survey, the vegetation was much simplified compared to its original condition and was characterised by very low total species richness. A total of 103 flora species from 42 families was identified and recorded from all sites (1-4). The breakdown of species diversity and other characteristics in each site is given below in Table 8.

Table 8. Species Richness and Categories in each Study Site

	Total - all sites	Site			
		1	2	3	4
No. of Species	103	42	68	28	24
Families	42	22	27	16	14
Ferns	3	2	1	2	1
Pines	1	0	0	1	1
Dicotyledons	66	26	45	18	19
Monocotyledons	32	14	22	7	3
No. exotic	32	11	19	6	10
% exotic	31%	26%	28%	21%	42%

The greatest species richness was in site 2, which contained a variety of habitat types and was not disturbed by ongoing grazing. Site 4 had the lowest species richness (partly because of its small size) and the highest percentage of exotic species. Site 3 had low species richness because of the stony nature of the habitat and consequent sparse understorey, but it also had the lowest percentage of exotic species. In spite of the paucity of ground cover, site 1 had a moderate species richness due to its large size and diversity of eucalypt species.

A list of all flora species recorded and identified from within the study area is included as **Appendix 1**.

Condition of the Vegetation and Presence of Weeds

The vegetation of most of the study area has been transformed by the high levels of past clearing, grazing, plantations and/or other disturbances. As noted above, site 4 has the highest proportion of exotic flora species (almost half due to the presence of roadside weeds and disturbed nature of the roadside habitat. Sites 1, 2 and 3 are similar in the proportions of weed species present, ranging from 21% to 31%. Most of the weed species are herbaceous and not present at particularly high densities, but some species of woody weed are present.

Four of the species recorded in the study area are declared Noxious Weeds in the control area of Goulburn Mulwaree Council. These, together with their relevant control classes, are:

- Blackberry (*Rubus fruticosus* sp. aggr.) – Class 4
- Paterson's Curse (*Echium plantagineum*) – Class 4
- Serrated Tussock (*Nassella trichotoma*) – Class 4
- St. Johns Wort (*Hypericum perforatum*) – Class 3
- Sweet Briar (*Rosa rubiginosa*) – Class 4

Explanations of the relevant control categories area as follows:

Class 3: The plant must be fully and continuously suppressed and destroyed.
Class 4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. Additionally for Blackberry and Serrated Tussock: the plant may not be sold, propagated or knowingly distributed.

In the case of Class 4 weeds, the local control authority is Goulburn Mulwaree Council. To address the requirements under the Act, Council has adopted the following Policies:

- Management Plan for the Enforcement of Class 4 Noxious Weeds
- Noxious Weed Management Program Guidelines

These policies and all the required information for management of the Class 4 weeds in the study area are available from the Goulburn Mulwaree Shire Council website at http://www.goulburn.nsw.gov.au/environment/3959/3963.html.

By far the most significant and potentially serious noxious weed present within the study area is Serrated Tussock, which was present at high abundance particularly in the pasture areas (Community 8) in the study area. It was most prevalent in site 1, but also occurred in other communities in sites 1, 2 and 3, where it was more scattered. Smaller thickets of Blackberry and Sweet Briar also occurred throughout the study area of sites 1, 2 and 3. St John's Wort was confined to site 4 (amongst the roadside weeds by the highway). Paterson's Curse was only present in trace quantities in site 2, near the creek.

Apart from declared noxious species, common environmental weed species within the study area included mainly exotic pasture grass species and minor occurrences of herbaceous pasture and roadside weed species.

Threatened or Significant Flora Species

One threatened flora species listed only under the Commonwealth EPBC Act (but not the NSW TSC Act) was recorded in site 2: Hoary Sunray (*Leucochrysum albicans* var. *tricolor*) which is listed as Endangered on the Act. A specimen of the plant sent to the Royal Botanic Gardens, Sydney was identified under the name *Leucochrysum albicans* subsp. *albicans* var. *tricolor.* Apparently, the contracted name used in the EPBC Act listing is an accepted alternative to the full name (Joy Everett, Royal Botanic Gardens, Sydney; *pers. comm.*). A small population of the species was recorded by the side of Joarimin Creek Road near Brayton Road in Community 4, and in amongst the rubble of the old tip site.

No additional threatened species or rare species on the ROTAP database were found to occur in the study area. None are considered to have a high likelihood of occurring given the nature of the habitat available.

Endangered Ecological Communities

One Endangered Ecological Community (EEC) is considered to occur in the study area. Based on the structure, habitat types and dominant flora species, Vegetation Communities 1 and 2 would qualify as modified versions of the EEC *White Box Yellow Box Blakeley's Red Gum Woodland* (Box Gum Woodland) as listed by the NSW TSC Act, and the equivalent EEC *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* as listed by the Commonwealth EPBC Act.

According to the Final Determination for *White Box Yellow Box Blakeley's Red Gum Woodland* as listed under the NSW TSC Act (NSW Scientific Committee 2002a), 18 of the 95 species listed as characterising the community (19%) are present in the study area. This percentage is probably lower than it normally would be. Because of the extreme dry conditions at the time of the survey, many species that would normally be expected to be detectable when conditions are more favourable are likely to have died down to the rootstock, underground regeneration organs or seed bank in the soil. In addition, numbers or percentages of characteristic species present is not sufficient in itself to determine whether an EEC is present or not, but it is a starting point to decide on likely EEC presence together with other indications including habitat, soil type and physical characteristics.

To assist in this assessment, the NPWS Identification Guidelines for the EEC were consulted. Working through the key provided to determine whether the EEC is present or not yielded a positive result, via the following steps:

1. The site is within one of the stated bioregions (South Eastern Highlands): YES → Go to 2
2. There are native species in the understorey, and the site is likely to respond to assisted natural regeneration: YES → Go to 3
3. The site has trees: YES → Go to 4
4. White Box, Yellow Box or Blakely's Red Gum, or a combination of these species, are or were present: YES - Yellow Box and Blakely's Red Gum are present, but not White Box → Go to 5.
5. The site is predominantly grassy: YES →**The site is Box-Gum Woodland**. (Note – sites may only be grassy because the shrubs have been cleared for grazing, but in this case a number of species of native grasses are present, and shrubs are sparse in areas that are not currently grazed, including the road reserve by Brayton Road).

The equivalent community as listed by the Commonwealth EPBC Act (*White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*) is also present on the site according to the listing advice and information sheet (DEH 2006) for the EEC. The community is listed as Critically Endangered under the Act. Application of the flowchart provided to determine whether the EEC is present or not yielded a positive result (at least for Community 2), via the following steps:

1. Is, or was previously, at least one of the most common overstorey species White Box, Yellow Box, or Blakeley's Red Gum?: YES, Yellow Box and Blakeley's Red Gum are the most common overstorey species in Community 2 (White Box is absent), but only occasionally present in Community 1, which therefore may not technically qualify as the EEC under the EPBC Act → Go to 2
2. Does the patch have a predominantly native understorey?: YES → Go to 3. (Note – although the pasture in site 1 was highly modified and the introduced grass Serrated Tussock had invaded and was abundant in the understorey, the pasture nevertheless consisted of more native than exotic grass species and shrubs/herbs/forbs)
3. Is the patch 0.1 ha or greater in size?: YES → Go to 4
4. Are there 12 or more native understorey species present (excluding grasses)? There must be at least one important species (Important species are designated as such in a list provided). YES, as demonstrated in the following table.

	Site 1	Site 2
Total no. of native species (excluding grasses) present	15	24
No. of important species present	1	3

Therefore, the patch is the listed ecological community.

More rigid criteria to determine if the EEC is present are applied under the EPBC Act than the TSC Act, therefore Community 1 may not qualify under the Act because although Yellow Box and sometimes Blakeley's Red Gum are present, they are almost invariably not the most common overstorey species. The TSC Act merely requires the key overstorey species to be present rather than common.

In summary, Community 2 does qualify as the EEC under both the TSC Act and EPBC Act according to the respective stated criteria of each Act, but it occurs in a highly modified and disturbed form. Community 1 represents a marginal variant of the EEC according to the TSC Act, but probably does not technically qualify under the EPBC Act. It is probably best classified as an ecotonal community with Community 2, and would provide a buffer to the EEC. Likewise, Community 3 contains some elements of the EEC particularly in regard to understorey species, but is also best described as an ecotonal community between the listed EEC and a Stringybark community.

The only other EEC with potential to be present in the study area is *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* as listed by the Commonwealth EPBC Act. An equivalent community is not listed under the NSW TSC Act. The study area falls within the area shown on a map produced by Environment Australia (now DEW, ex-DEH) in which the ecological community is likely to occur. According to the listing advice for the EEC (DEH 2005), the ecological community is dominated by moderately tall to tall (25 cm to 1 m) dense to open tussock grasses with up to 70% of species being forbs. The community may be treeless or may contain up to 10% cover of trees, shrubs or sedges. In the Southern Tablelands the community occurs between altitudes of 560 to 1200 metres in valleys influenced by cold air drainage and in broad plains. The community is generally dominated by native tussock grasses, particularly Kangaroo Grass (*Themeda australis*), Wallaby Grasses (*Austrodanthonia* spp.) and Spear Grasses (*Autrostipa* spp.).

Defining the ecological community is fraught with difficulty because of the naturally dynamic and diverse nature of grasslands, but to qualify the listed community must be dominated by native grasses (Baines 2006). Although the open pasture (Community 8) within sites 1 and 2 of the study area meets many of the above general criteria, the pasture is considered to be an artificially cleared community, and is therefore a derived grassland community rather than a natural one. Prior to tree and shrub clearing for pasture improvement, the community would most likely have consisted of the woodland to open forest communities typical of Communities 2, 3 and 4. The altitude of the study area is also at the lower end of the range in which the community is found, and the community contains a high proportion of introduced grass species. It is therefore concluded that *Natural Temperate Grassland of the Southern Tablelands* is not present within the study area, and no further consideration of the EEC is required.

Overall Significance of the Vegetation

As discussed above, the major significance of the vegetation in the study area is that it includes modified remnants of White Box Yellow Box Blakely's Red Gum Woodland (Box Gum

Woodland) which is listed under both the NSW TSC Act 1995 as an Endangered Ecological Community, and the Commonwealth EPBC Act 1999 as a Critically Endangered Ecological Community. The community is more narrowly defined under the EPBC Act and occupies a lesser area of the site. It mainly occurs in site 1 of the study area.

Remnants of the endangered community together with other common vegetation types form interrupted corridors through the site that connect with uncleared vegetation on adjoining land mainly to the south and east of site 1. The vegetation remnants are more intact in sites 2 and 3 and provide more continuous corridors. The main ecological function of the remnant vegetation in all areas is as complete or partial corridors that provide connectivity both for movement of fauna and for exchange of genetic material between native flora species locally. This would tend to reduce the risk of local flora and fauna populations becoming isolated.

At least one threatened flora species also occurs in the study area. Hoary Sunray (*Leucochrysum albicans* var. *tricolor*), which is listed only on the EPBC Act, was recorded in site 2.

Since the land beyond the vegetation remnants in the study area has been so highly cleared and modified for farming, grazing, housing and other purposes, the vegetation in these remnants may also represent a refuge in the local area of many native flora and fauna species.

3.2 Faunal Investigations

3.2.1 Methodology

Fauna field surveys were undertaken within the study area on 15th – 19th January 2007. The survey methodologies used are in general compliance with the provisions of DEC's Draft Threatened Biodiversity Survey and Assessment Guidelines (DEC 2004). The field survey methodologies used are as follows:

- trapping for ground-dwelling and arboreal mammals
- hair tubes
- diurnal bird census
- diurnal reptile census
- koala scat search
- dusk hollow watch
- nocturnal call playback
- spotlighting
- hand searches for frogs
- harp traps
- ultrasonic bat call detection
- habitat tree census
- opportunistic observations

The locations of all traplines, hairtube lines, Anabat recorders and harp traps are shown in **Figure 4**.

Trapping for ground-dwelling and arboreal mammals

Trapping was undertaken within the subject site between the 15th and 19th of January 2007. All traps were checked for captures early each morning. Four lines of tree traps (three lines at Site 1 and one line at Site 2) were set up on the 15th January for a period of four nights. Three lines of ground traps (two lines at Site 1 and one line at Site 2) were set up on the 16th January for a period of three nights. Details of the traps used are as follows:

- Tree Traps – for each line, 5 to 10 large Elliott traps (46 x 15 x 15cm) were baited with peanut butter and rolled oat balls and candied honey wrapped in paper towel. Each trap was mounted on a platform attached to a selected tree at approximately three metres above the ground. Each day, a honey/water mixture was sprayed on the trunk of the tree above each trap.
- Ground Traps – for each line, 6 to 10 medium Elliott traps (33 x 10 x 9cm) were baited with peanut butter and rolled oat balls. These were placed on the ground approximately 15m apart.

In order to provide shade and shelter, all traps were covered with plastic, all ground traps were covered with shade material (either shade cloth or bark/leaves and placed in a shady position) and all tree traps were positioned out of the morning sun. Dry bedding material (usually dry leaves) was placed in all Elliott traps.

Hair Tubes

Four lines of hair tubes were laid out on 15th January 2007 for a period of four nights. Three lines were set up in Site 1 and one line in Site 2. For each line, 5 to 8 hair tubes were set out on the ground approximately 15m apart. Each line comprised a mix of small (4cm diameter) and medium (10cm diameter) hair tubes. Each small hair tube was baited with a mixture of peanut butter and rolled oats and contained two strips of double-sided tape (affixed to the roof of each tube) designed to collect hairs from any mammal that might investigate the tube. The large tubes were set up similarly with double-sided tape and were baited with a mixture of cat food, peanut butter and rolled oats. When positioning hair tubes an effort was made to put them where animals would be likely to come across them (eg. near or within obvious runways).

Diurnal Bird Census

A total of three diurnal bird surveys were undertaken at Sites 1, 2 & 3 during the survey period. Each survey was conducted early in the morning by one observer for a period of 20 minutes. All birds positively identified either by direct visual observation or by their characteristic call during this period were recorded.

Diurnal Reptile Census

A reptile survey was undertaken at Site 2 on the 17th January 2007 by one observer for a period of one hour. All reptiles positively identified during this period were recorded.

Koala Scat Search

Three koala scat searches (two at Site 1 and one at Site 2) were undertaken by one observer during the survey period. At each area, the ground at the base of 20 trees was searched thoroughly for koala scats. Any other evidence of koala activity (eg. scratches on tree) was also recorded.

Dusk Hollow Watch

A dusk watch of trees with potential fauna habitat hollows was undertaken at Sites 2 and 3 on 18th January 2007. Any faunal activity observed during the period starting before dusk and ending after dark was noted. Each observer also carried an anabat recorder in order to help determine whether insectivorous bats might be using the observed hollows. The dusk hollow watch was followed by a brief spotlighting session.

Nocturnal Call Playback

The playback of pre-recorded calls of threatened nocturnal fauna species, targeting the Squirrel Glider, Koala, Powerful Owl, Masked Owl and Barking Owl, was carried out at three locations (two at Site 1 and one at Site 2) on three separate nights during the survey period. Each call was played (amplified by the use of a loud hailer) for a total of 5 minutes, followed by a 5 minute listening period, with the last listening period followed by 5 minutes of spotlighting.

Spotlighting

Evening surveys for nocturnal fauna were conducted on the 15th, 16th and 18th January 2007. Spotlighting was undertaken for all fauna groups, with two surveys undertaken at Site 1, one at Site 2 and one at Site 3. Spotlighting was conducted on foot for a period of 45 minutes using Makita hand-held torches and 50Watt hand-held spotlights. Any vocal animals were also identified by their characteristic calls.

Hand searches for Frogs

Targeted searches for frogs were undertaken at dams and at pools within creeklines in the study area. Each survey involved identifying any vocal frog species by their unique call as well as a search for frogs under rocks, by the edge of the water, on floating vegetation, in fringing grass or other vegetation, under logs and other debris. Surveys were undertaken during the evening by two people. The duration of each survey varied depending on the size of the waterbody and extent of fringing vegetation.

Harp Traps

Harp trapping for insectivorous bats was carried out at six different locations within Site 1 during the survey period. Each harp trap was left in place for 1 to 3 nights and checked early each morning for captures. Any captured bats are identified to species level and either released immediately or held through the day and released after sunset. Care was taken not to release bats during the day if predatory birds such as the Grey Butcherbird, Pied Currawong or Kookaburra, were present.

Ultrasonic Bat Call Detection

Insectivorous bats were surveyed using two CFZCAIM detectors on the 15th-19th January 2007. In total, eight static locations were surveyed, with additional ultrasonic bat call detection surveys undertaken during selected dusk hollow watch, spotlighting and owl call playback surveys. The detectors were either left in one location all night or hand-held during other activities. Bats emit ultrasonic calls as a method of navigating and searching for food. These calls are often at a higher frequency than calls audible to the human ear. In order to make the calls audible, bat detectors convert the call to a lower frequency. These calls are recorded and later analysed with a computer package Anabat 6, to identify the species recorded. Ultrasonic call detectors have proved useful for

recording species that are difficult to capture. However, owing to variations in call strength and frequency within and between species and the difficulty in identifying short or poor quality calls, the identity of species recorded by a bat detector cannot always be guaranteed. Some bats are difficult to detect due to their quiet calls (e.g. *Nyctophilus* sp., *Kerivoula papuensis*) and bats with extremely similar calls are sometimes difficult to differentiate (e.g. *Miniopterus schreibersii oceanensis* and *Vespadelus darlingtoni*). Therefore, bat detectors cannot always provide positive species identification.

Habitat Tree Census

A census of potential habitat trees was undertaken within the proposed quarry and haul route areas at Site 1 and general observations of any habitat trees noted within the wider subject site were recorded. A GPS reading (usually to within 5-10m accuracy using WGS84) of each potential habitat tree was recorded as were all habitat characteristics (such as presence, size and number of hollows observed).

Opportunistic Observations

All fauna observed or heard during the field surveys was recorded. Characteristic signs, tracks, trails and other indirect evidence of fauna species from all fauna groups were also recorded.

3.2.2 Results

A total of 88 fauna species, comprising 84 native and four introduced species, were positively identified within the study area during the current survey. In addition, two probable identifications and two possible identifications of insectivorous bat species were made using ultrasonic call analysis. A list of all species recorded in the study area during this survey is presented in **Appendix 2.**

Mammals

During the survey period 20 mammal species were positively recorded in the study area, comprising 17 native and three introduced species. In addition to these, two insectivorous bats were given a probable identification (*Mormopterus sp. 4 (Adams et al)* Southern Freetail-bat and *Falsistrellus tasmaniensis* Eastern False Pipistrelle) and two were given a tentative (possible) identification (*Myotis macropus* Southern Myotis and *Scotorepens greyii* Little Broad-nosed Bat).

No animals were caught using tree or ground Elliott traps, though seven species of insectivorous bat were caught using harp traps. Evidence of wombat activity was observed throughout the subject site and Sugar Gliders were seen or heard during most spotlighting and call playback sessions. While the Sugar Glider is similar in appearance and behaviour to the threatened Squirrel Glider the two species can be differentiated in the field by an experienced observer. During the field survey Sugar Gliders were identified by their smaller size, rounder face shape, less bushy tail and distinctive call. Field survey staff are confident of the identification of all individual gliders observed or heard during the field survey. Other commonly recorded mammals included Grey Kangaroos and Rabbits. Insectivorous bats made up half of the mammal species recorded within the study area – these were recorded throughout the subject site.

In terms of threatened mammals species, one threatened insectivorous bat was positively identified, ***Miniopterus schreibersii oceanensis*** **Eastern Bent-wing Bat**, listed as **Vulnerable** on the TSC Act. In addition, ***Falsistrellus tasmaniensis*** **Eastern False Pipistrelle** was given a probable

identification and ***Myotis macropus*** **Southern Myotis** was given a tentative (possible) identification based on ultrasonic call analysis. Both of these species are listed as **Vulnerable** on the TSC Act.

Reptiles

Six species of reptile were recorded during the survey period. These were *Amphibolurus muricatus* Jacky Lizard, *Egernia cunninghami* Cunningham's Skink, *Hemiergis decresiensis* Three-toed Skink, *Lampropholis guichenoti* Garden Skink, *Tiliqua scincoides* Eastern Blue-tongued Lizard and *Pseudechis porphyriacus* Red-bellied Black Snake. All of these reptiles were recorded at Sites 1 and 2, except the Red-bellied Black Snake which was only recorded at Site 1. No reptiles were recorded at Sites 3 or 4, though this is likely to be more a reflection of relative survey effort and it is expected that at least some of these reptile species would occur at all sites within the subject site.

Frogs

Seven species of frog were recorded at dams and pools of water within creeklines in the subject site. These were *Crinia parinsignifera* Plains Froglet, *Crinia signifera* Common Eastern Froglet, *Limnodynastes peronii* Striped Marsh Frog, *Limnodynastes tasmaniensis* Spotted Grass Frog, *Uperoleia fusca* Dusky Toadlet, *Uperoleia laevigata* Red-groined Toadlet and *Litoria peronii* Peron's Tree Frog. No specific frog searches were undertaken at Sites 3 or 4 due to the lack of standing water at these sites and no frogs were recorded at either of these two sites.

Birds

A total of 65 bird species were recorded within the study area during the survey period, comprising 64 native and one introduced species. Many of the bird species were recorded in areas where the trees remain, with the introduced Common Starling tending to dominate open areas within the subject site. One threatened bird species, ***Chthonicola sagittata*** **Speckled Warbler**, was recorded within the subject site. Two individuals of this species were recorded foraging in introduced shrubs (plum trees) in the old tip area at Site 2. The Speckled Warbler is listed as **Vulnerable** on the TSC Act.

Fauna Diversity

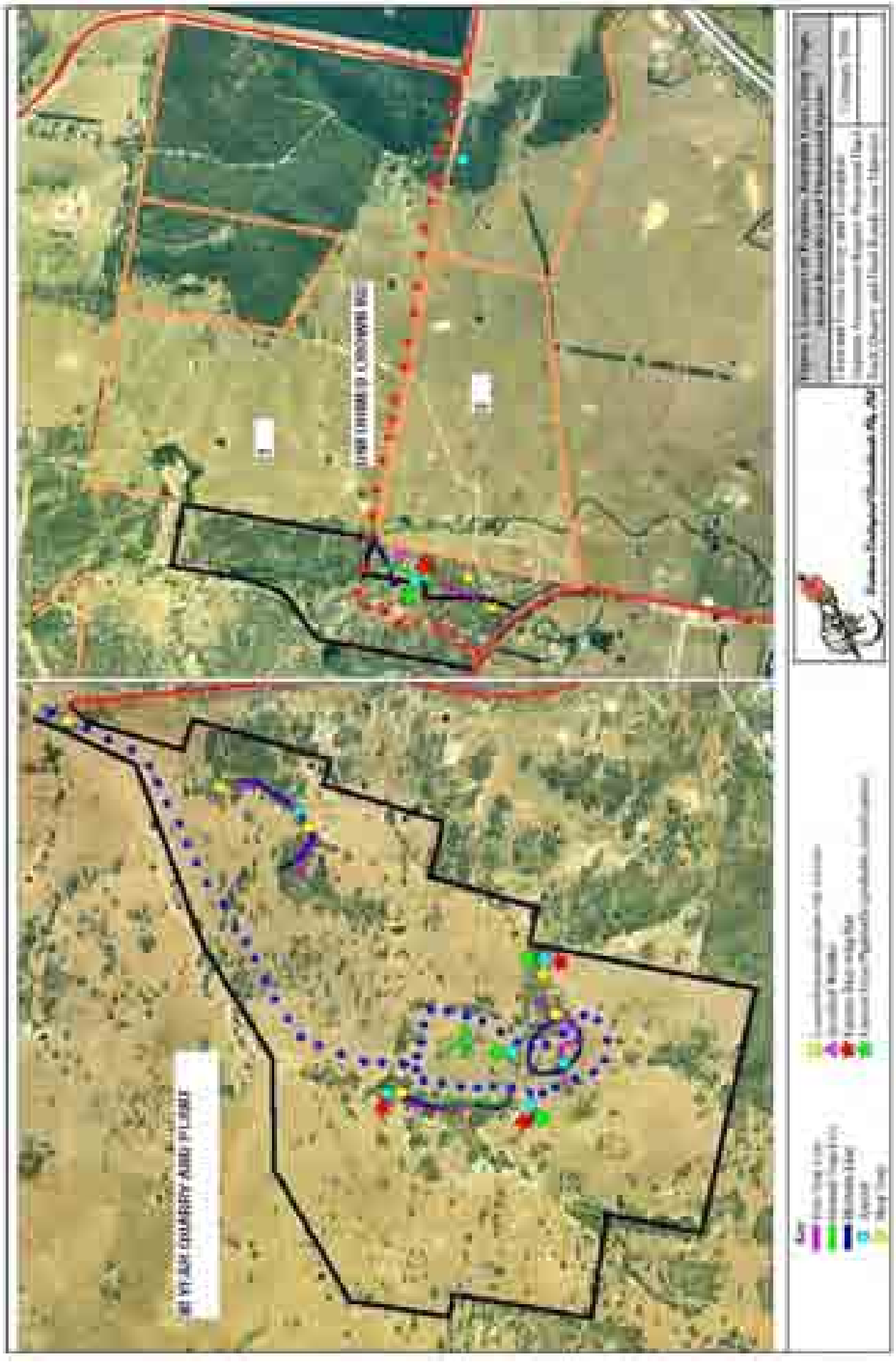
Fauna diversity within the study area was found to be high despite the level of past clearing, grazing pressure and drought conditions. Considering the short time frame of the field survey, it is expected that other common fauna species would be recorded were further survey work to be undertaken within the area. Any regeneration of native vegetation within the site (particularly of the understorey) due to a decrease in grazing pressure and adequate rains in the area would increase the quality of fauna habitat available, particularly for ground dwelling or ground foraging animals.

Significant Fauna Species

Two threatened fauna species, (***Pyrrholaemus sagittatus*** **Speckled Warbler** and ***Miniopterus schreibersii oceanensis*** **Eastern Bent-wing Bat**), were positively recorded within the subject site during the survey period. In addition to these, *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) was given a probable identification and *Myotis macropus* (Southern Myotis) given a tentative (possible) identification based on ultrasonic call analysis. All of these species are listed as **Vulnerable** on the TSC Act. Other threatened species have potential to occur or occasionally visit

the subject site, in particular some of the more nomadic bird species such as the Black-chinned Honeyeater, Regent Honeyeater, and Swift Parrot, which may visit during peak flowering periods.

A '7-part' test of significance will be applied in **Section 4** of this report to all the above threatened species and the remaining potential subject species. Assessment under the federal *EPBC Act* will also be undertaken.



3.2.3 Habitat Trees

Site 1 - Brayton Road Main Project Site:

A total of 43 habitat trees were recorded within the subject site, most with small hollows. **Table 9** below lists the grid references for habitat trees recorded within Site 1 with potential to be affected by the proposed development. Approximate locations for these habitat trees are shown in **Figure 5**. From the table and figure a total of 23 hollow-bearing trees are considered likely to be removed as they lie within areas expected to be cleared for the quarry and associated infrastructure. Eight hollow-bearing trees are located on the edge of the planned works area and it is uncertain whether these will require removal. Twelve of the surveyed hollow-bearing trees are unlikely to require removal. There may be some scope to reduce the number of hollow-bearing trees removed by slightly modifying the location of site offices, fencing or other elements of the project.

Table 9. Habitat Trees recorded within Site 1

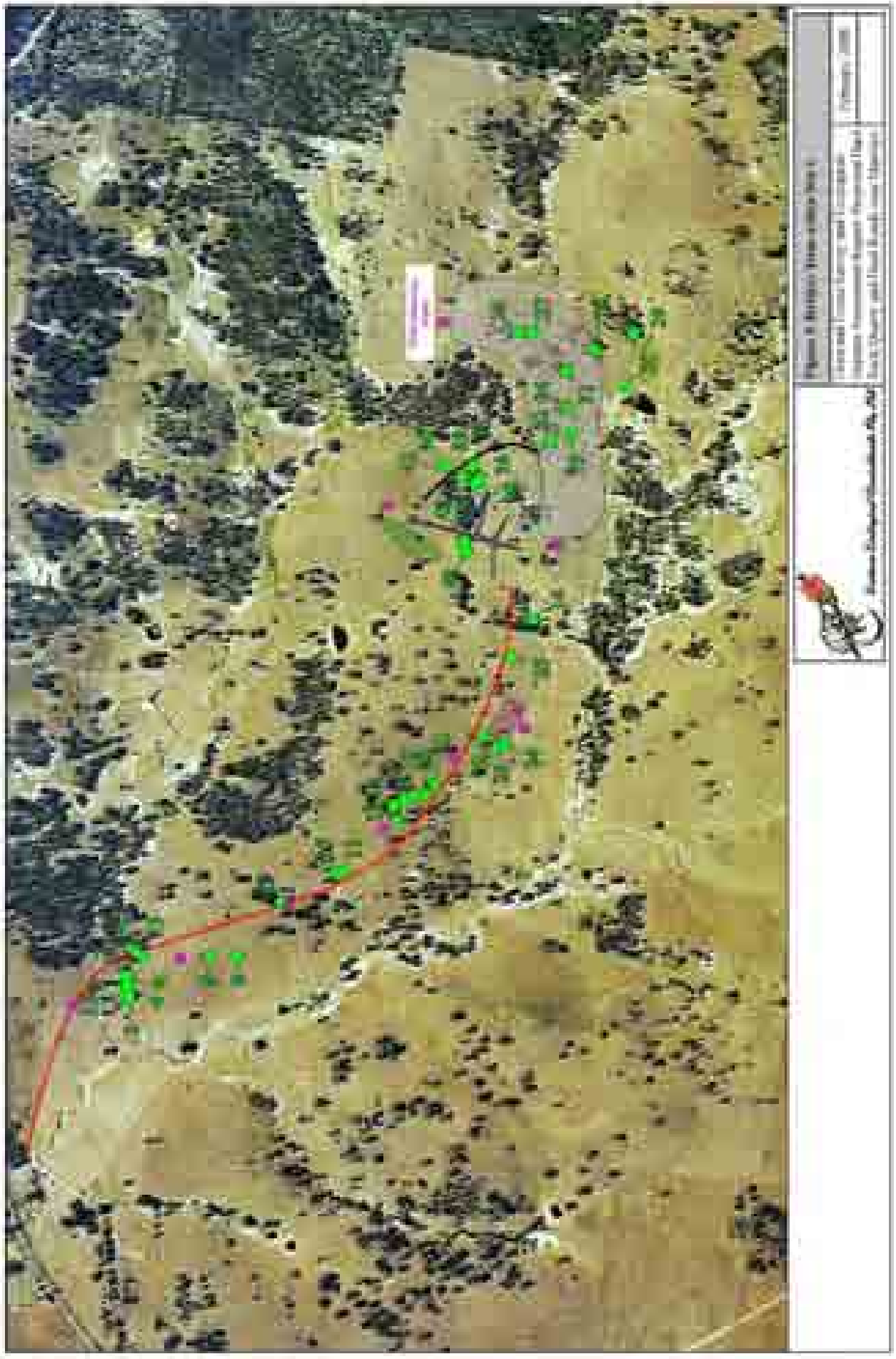
Tree No.	Species	dbh (cm)	Small Hollows	Medium Hollows	Large Hollows	Easting (WGS84)	Northing (WGS84)	Removed?
1	Blakely's Red Gum	55	trunk			772734	6160322	Possibly
2	Dead Stag	130	pos. spouts	3+ spouts & trunk	1 spout	772725	6160309	Possibly
3	Red Stringybark	130	pos. spouts			772716	6160315	Possibly
4	Yellow Box	65	pos. spouts			772715	6160291	Likely
5	Dead Stag	20/15	4 spouts & cracks (hollow inside)			772719	6160289	Likely
6	Yellow Box	80	pos. spouts			772716	6160282	Likely
7	Yellow Box	70	pos. spouts			772719	6160269	Likely
8	Red Stringybark	150	5+ spouts & cracks & worked trunk hollow			772550	6160233	Likely
9	Red Stringybark	110	trunk & pos. spouts			772495	6160238	Unlikely
10	Red Stringybark	35	trunk			772287	6160076	Unlikely
11	Red Stringybark	120	cracks & pos trunk	pos spouts		772273	6160071	Unlikely
12	Red Stringybark	130	pos. spouts & cracks			772164	6159944	Unlikely
13	Red Stringybark	35	trunk & pos. cracks			772143	6159932	Unlikely
14	Blakely's Red Gum	30/50	1 spout			771866	6159576	Possibly
15	Red Stringybark	80	1			772687	6160230	Unlikely
16	Red Stringybark	75	1	1		772701	6160219	Unlikely
17	Red Stringybark	70	3 pos.	1		772401	6160132	Unlikely
18	Red Stringybark	65	2	1		772157	6159972	Unlikely
19	Red Stringybark	85	1 pos.			772125	6159927	Unlikely
20	Red Stringybark	65	2	1		772099	6159923	Likely
21	Red Stringybark	90		1		772079	6159905	Likely
22	Red Stringybark	85	2-3 at base			771979	6159807	Possibly
23	Dead Stag	55	2-3 crevices under bark			771949	6159832	Possibly
24	Red Stringybark	75	1 at base			771934	6159825	Possibly
25	Red Stringybark	70		1		771912	6159651	Likely
26	Red Stringybark	80	2 pos.			771870	6158995	Likely
27	Dead Stag	40/25	2			771839	6158999	Likely
28	Red Stringybark	85	4 pos.	1		771717	6159038	Possibly
29	Dead Stag	80	10+	3+	1	771636	6159007	Unlikely

30	Dead Stag	45			1	771659	6159110	Unlikely
31	Dead Stag	60	1 pos.			771774	6159080	Likely
32	Dead Stag	110	5+	4+	1	771814	6159216	Likely
33	Red Stringybark	50		1		771771	6159206	Likely
34	Dead Stag	75	4+	1		771772	6159153	Likely
35	Yellow Box	20/20/15/15	1			771971	6159264	Likely
36	Dead Stag	15/15	2 pos.			771963	6159291	Likely
37	Dead Stag	65	1-2 pos.			771968	6159300	Likely
38	Dead Stag	15	1			771968	6159300	Likely
39	Dead Stag	45	1	1		771993	6159289	Likely
40	Dead Stag	75	5+		1	772027	6159262	Likely
41	Dead Stag	85	1 (sugar glider may get in)			772027	6159262	Likely
42	Apple Box	100	2+			771998	6159415	Likely
43	Apple Box	55	2+ pos.			771993	6159437	Likely

Prior to clearing activities, these identified hollow-bearing trees should be marked and an experienced fauna handler should be present when the trees are removed. As hollow logs and fallen trees provide habitat for a range of fauna species, felled hollow bearing trees should be retained on site and left as fallen timber.

Sites 2, 3 & 4 - Haul Road (Joarimin Road/Red Hills Road/Hume Highway):

As the exact route alignment for the haul road has not been finalised, the number of hollow-bearing trees likely to be affected cannot be determined at this stage. However from the field survey it appears that few hollow-bearing trees occur along the approximate haul road alignment and Gunlake should be able to design a route that will minimise mature tree loss along the haul road. At the detailed planning stage the trees that may be affected will need to be assessed in the field.



4.0 ASSESSMENT OF THE PROPOSAL

4.1 Overview of Potential Impacts Associated with the Proposal

The proposed hard rock quarry and associated haul and bypass roads at Marulan are likely to result in the loss of some woodland vegetation within the subject site, including the loss of some hollow-bearing trees.

Within the main project area an estimated 8.8 hectares of vegetation would be impacted by the quarry, associated buildings, irrigation areas and access road. One endangered ecological community, *White Box Yellow Box Blakely's Red Gum Woodland* (Box-Gum Woodland), was recorded and approximately 7.8 hectares of this community are expected to be cleared or otherwise affected. No threatened flora species were recorded within the study area and none are likely to be affected as a result of the proposal.

In terms of threatened fauna, the most likely impact is an increased risk of road death or injury from increased vehicle activity within the area. For some hollow-reliant species (eg. threatened microbats, Squirrel Glider), there is the potential for some roosting or breeding hollows to be lost as some hollow-bearing trees are likely to be removed. It is uncertain what impacts may result from increased noise, dust and night-time light from the proposed quarry, though some species may move away from the works and road areas.

Although overall impacts on threatened species are likely to be minimal for most of the identified subject species and ecological communities, an assessment of impact under the provisions of Section 5A of the *Environmental Planning and Assessment Act* 1979 and the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 is presented below.

4.2 Threatened Species Assessment (Section 5A of the EP&A Act 1979)

The *Threatened Species Conservation Act*, (TSC Act), was gazetted in late 1995 and aims to conserve threatened species, populations and ecological communities of animals and plants. Specific objectives of the *Act* are to: -

a) conserve biological diversity and promote ecologically sustainable development;

b) prevent the extinction and promote the recovery of threatened species, populations and ecological communities that are endangered;

c) protect critical habitat of those threatened species, populations and ecological communities;

d) eliminate or manage certain processes that threaten the survival or evolutionary development of those threatened species, populations and ecological communities;

e) ensure that the impact of threatening actions are properly assessed; and

f) encourage the conservation of threatened species, populations and ecological communities by the adoption of measures involving co-operative management.

Section 5A of the *Environmental Planning & Assessment Act 1979*, (EP&A Act), aims to improve the standard of consideration and protection afforded to threatened species, populations and communities, and their habitats in the planning process. The outcome of any threatened species assessment should be that developments and activities are undertaken in an environmentally sensitive manner, and that appropriate measures are undertaken to minimise adverse effects on threatened species or their habitats.

Under the *Threatened Species Conservation Amendment Act 2002*, Section 5A of the *EP&A Act* has been amended. This has also affected the *TSC Act 1995* and the *Fisheries Management Act 1994*. An essential outcome of the amendments is that as of late 2005, the previous "eight-part test" has been replaced with a set of revised factors now known as the "seven-part test".

The basic intent of the revised factors remains the same, the main change in emphasis being more towards impacts and losses at the local rather than the regional level. Additionally, recovery planning and threat abatement planning is explicitly considered in one of the factors. As with the previous eight-part test, the seven-part test should not be treated as a "pass or fail" test, but rather as a tool to assist in determining whether further assessment (such as a Species Impact Statement) might need to be undertaken.

Determining authorities have an obligation under the *EP&A Act* to consider whether a proposal is likely to significantly affect threatened species, populations or ecological communities, or their habitats. In this regard, the determining authority must take into account the seven-part test.

Discussions of species and ecological communities investigated under the provisions of Section 5A have been detailed below.

4.2.1 Threatened Flora and Endangered Ecological Communities

No threatened flora species listed by the NSW TSC Act were recorded within the study area, but there is a small chance that one or more of the potential subject species could nevertheless be present, given the large size of the study area and the severe drought conditions at the time of the survey. One or two species (e.g., *Genoplesium plumosum*, the Tallong Midge Orchid which dies back after flowering) may simply not have been detectable, considering the condition of the habitat and diminished nature of the ground layer. As a purely precautionary measure, the 7-part test will be applied to these species.

One endangered ecological community (EEC) listed by the TSC Act was identified as occurring within the study area. *White Box Yellow Box Blakely's Red Gum Woodland* (Box-Gum Woodland) was recorded within three of the four sites. The proposed quarry and associated roads would remove and/or disturb some habitat for this EEC. Therefore, potential impacts on the EEC will be addressed in the 7-part test which is presented below.

(a) *in the case of a threatened species, whether the action proposed is likely to have an adverse affect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

Eucalyptus macarthurii
This eucalypt was not recorded during field surveys. It occurs in grassy woodland on relatively fertile soils on broad cold flats, such habitat possibly being available along the flat areas of sites 1, 2 and 3.Even if it did occur in any of the areas affected by the proposal, the loss involved would be that of individuals rather than significant parts of local populations. This would be unlikely to be sufficient to place a local population of the species at risk of extinction.

Baloskion longipes
This rush was not recorded during the field surveys and could only occur in creeklines containing relatively permanent water, such as Joarimin Creek in site 2. The proposed bypass road in this area would be restricted to the floodplain by the creek (except at the creek crossing) and therefore even if present, the species would

be unlikely to be affected to the extent that a local population of the species would be placed at risk of extinction.

Genoplesium plumosum

This species is a small midge orchid, that flowers and fruits in late summer or early autumn and then dies back. It can only be reliably detected when flowering. It can be difficult to survey as flowering is highly dependent on seasonal conditions and can vary from year to year (sometimes even failing to flower in any given year). To date, it has only been found within 3 km of the village of Tallong (NPWS 2002). Since it is known to occur in heathland usually dominated by Violet Kunzea (*Kunzea parvifolia*), there is a small chance it could occur in Community 4 (site 2) where dense stands of Violet Kunzea occur that were relatively widespread. It was not detected during the field survey which was conducted in mid-summer, but the species may not have been flowering due to the extremely dry conditions. Observations on flowering to date suggest that the species is most likely to flower 4-6 weeks after good autumn rain; however, it may not necessarily flower every year even after good rain (NPWS 2002). Nevertheless, the minimal amount of potential habitat that would be affected compared to the area of remaining habitat would suggest that construction of the bypass road would be unlikely to adversely affect the life cycle of any local population of the species such that it were placed at risk of extinction.

The DECC Queanbeyan office was contacted for further advice regarding the issue of further survey work for this species. Allison Treweek from the office received advice from John Briggs who is a specialist on this species. John Briggs is of the opinion that unless any potential habitat for the species is on sandstone, then the species is extremely unlikely to occur. If this is the case, then DECC's position according to Allison Treweek is that further surveys for the species are unnecessary. The only potential habitat area for the species was in the far western end of the proposed haul road alignment, where a dense stand of the commonly associated species violet kunzea (*Kunzea parvifolia*) occurs. This area is not on sandstone, therefore the species is considered unlikely to occur. Accordingly, it is not proposed to conduct further survey work for the species.

Pomaderris cotoneaster

This species was not recorded in the study area during the field surveys. Potential habitat for the species is difficult to predict since the species has been recorded in a range of habitat types, although it appears to favour rocky habitats in forest on slopes or in gullies, sometimes beside creeks. The species could occur in the rocky habitat of site 3 or by the creek in site 2. As with the other potential subject species, the proposal at most could remove individuals rather than significant portions of habitat for this species. Therefore, the species would be unlikely to be affected to the extent that a local population of the species would be placed at risk of extinction.

(b) ***in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species likely to be placed at risk of extinction.***

There are no endangered populations of flora relevant to the study area. No assessment under this part is required.

(c) ***in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

- **(i)** ***is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
- **(ii)** ***is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

(i) Box Gum Woodland occurs at least in modified form in many parts of the study locality, and was identified as occurring within the study area during the current surveys. The EEC is deemed to correspond to Communities 1 and 2 from this study. Within site 1, the EEC occurs as disturbed remnants, mainly along the creeklines and as smaller patches with little if any natural understorey on the slopes above the drainage lines. Within the main project site (Site 1), the proposal would remove or modify up to approximately 7.8 hectares

of Box Gum Woodland, most of which occurs in highly disturbed and degraded condition. In site 2, the proposed bypass road would remove a strip of remnant, highly modified EEC covering an area of approximately 0.5 hectares on the floodplain of Joarimin Creek, however this figure may vary slightly since the exact alignment of the road has not yet been determined. No occurrences of the EEC would be affected in site 3. In site 4, the slip lane proposal would affect a narrow strip of highly modified EEC on the verge of the Hume Highway. The EEC at this location is partly artificial due to planted roadside vegetation and a high proportion of roadside weeds.

The DECC Queanbeyan office was contacted for further advice regarding this issue, particularly as to how DECC exactly defines 'local' and 'regional' in this instance. According to Allison Treweek from the office, 'local' should be considered to be an area within a 5 kilometre radius of the centre of the subject site. 'Regional' refers to the bioregion in which the subject site occurs according to the national IBRA bioregionalisation system. In this case the region is defined as the entire South Eastern Highlands bioregion.

In order to ascertain the extent of the EEC that occurs in the local area as defined, the mapping for the vegetation community type that constitutes the EEC locally in the relevant area was obtained from the DECC threatened species website for the White Box Yellow Box Blakely's Red Gum EEC:

http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx

Most of the area within a 5 km radius of the centre of the quarry site is shown as supporting Southern Tableland Grassy Woodlands to a land cover of less than 1%. Therefore, on this basis up to 79 ha. of the EEC is predicted to occur within a 5 kilometre radius of the site. Since at least 37 ha. of the EEC (18 ha of Community 1 plus19 ha of Community 2) were mapped within the study area alone, the predicted figure of 79 ha for the EEC within a 5 kilometre radius is likely to be an underestimate. As a result of the proposal, up to 7.8 ha of EEC would be affected. On this basis, up to 21% of the EEC would be removed or modified from within the quarry site, and up to 10% within a 5 kilometre radius (although this figure is probably an overestimate as discussed).

In terms of regional loss, the northern half of the South Eastern Highlands bioregion contains large areas supporting Box Gum Woodland with land cover of between 1 and 50%. Much of the remainder of the bioregion supports remnants of the EEC with land cover similar to that of the local area. Box Gum Woodland occurs in approximately half the area of the bioregion as a whole. The total area of Box Gum Woodland in the bioregion would probably amount to thousands of hectares. The loss or modification of up to 7.8 ha. of the EEC from the quarry site plus up to 0.5 ha from the haul road site would be insignificant in the regional context.

It should also be appreciated that the EEC is in poor condition throughout the study area. The above estimates of areas of the EEC that would be removed or modified include patches in which the tree layer has been substantially thinned and the shrub layer entirely removed. All areas of the EEC are subject to ongoing grazing and include a significant component of weeds and exotic species, notably serrated tussock grass. Given the small area of the EEC to be removed in all sites relative to the total area that would remain within the sites and particularly within the study locality, it is concluded that the proposal would not affect the EEC to the extent that its local occurrence was likely to be placed at risk of extinction.

(ii) Direct modification would occur to approximately 7.8 hectares of Box Gum Woodland within the main project site (Site 1) and small, modified patches of the ecological community in Sites 2 and 4. In some cases, this would be limited to the removal of individual trees only. The bulk of the remainder of the EEC within the study area would be completely unaffected by the proposal and particular areas of habitat would be reserved and protected from disturbance as part of compensatory habitat for the areas lost. However, indirect impacts could occur on areas of retained habitat for the EEC proximate to the operational areas that might result in modifications to the composition of some retained areas of the community in time. Such modifications would be most likely to occur at the edges of retained habitat and could include weed invasion, runoff and possible increased physical intrusions into the habitat. Removal of grazing could also result in increased weed invasion, if this were to occur. However, such areas are likely to be minor compared to the total area of remaining habitat in the study area overall. Suggestions as to how to reduce the impacts are

given in the Recommendations. Given the proportion of the EEC that would be directly or indirectly affected, the proposal is unlikely to modify the composition of the EEC to the extent that its local occurrence is likely to be placed at risk of extinction.

(d) ***in relation to the habitat of a threatened species, population or ecological community:***
- **(i)** ***the extent to which habitat is likely to be removed or modified as a result of the action proposed, and***
- **(ii)** ***whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and***
- **(iii)** ***the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

Endangered Ecological Community

The occupied habitat of the Box Gum Woodland is deemed to comprise the areas of remnant trees and woodland made up by Communities 1 and 2 as shown in **Figures 3a - c**. On this basis:

(i) The proposal is likely to remove or modify up to approximately 7.8 hectares of the remnant EEC in site 1, approximately 0.5 hectares of the EEC in site 2 and a small strip of highly modified, partly artificial EEC in site 4. In all cases, the extent of the habitat to be removed represents a small proportion of the total habitat for the ecological community in the study area.
(ii) In all sites, removal or modification to the EEC would occur at the current edges of its habitat. Therefore, no other areas of habitat would become more fragmented or isolated from other areas of habitat than is already the case. The remnants have already been isolated from other extant areas by past clearing.
(iii) The habitat that would be removed or modified is already highly disturbed and degraded to a significant degree. These limited areas of degraded and disturbed habitat carry little importance to the survival of the ecological community within the study locality.

Threatened Species

(i) No known habitat for any of the threatened subject flora species is likely to be modified or removed as a result of the action proposed.
(ii) No areas of known habitat for the threatened subject flora species would become fragmented or isolated from other areas of habitat as a result of the action proposed.
(iii) As above, therefore not applicable.

(e) ***whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).***

No areas of designated critical habitat so far identified under the provisions of the *Threatened Species Conservation Act* 1995 apply to the study area.

(f) ***whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan..***

No draft recovery plans for Box Gum Woodland or three of the four threatened flora species have been prepared to date. An Approved Recovery Plan for the Tallong Midge Orchid (*Geneoplesium plumosum*) has been prepared (NPWS 2002). The objectives of the plan relate to further survey work to establish the full distribution of the species, and management and monitoring of known sites to facilitate its recovery. Since the subject site is unlikely to contain occupied habitat of the species, the action proposed (construction of a bypass road) would not be inconsistent with the objectives or actions of the recovery plan. A targeted seasonal survey for the species prior to construction of the bypass road in site 2 would further support the assumption that the species is absent from the subject site.

No draft or final threat abatement plans for key threatening processes potentially relevant to activities associated with the proposal have been prepared to date.

(g) ***whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.***

To date, thirty (30) key threatening processes have been finally determined under the provisions of the *TSC Act*. Those that are potentially most relevant to the current proposal are discussed below.

1. Clearing of native vegetation

According to calculations carried out as a result of overlaying a plan of the proposal components over the mapped vegetation communities from the assessment report, we estimate that up to 8.8 hectares of native vegetation in total would be impacted by the quarry, associated buildings, irrigation areas and access road. The breakdown of vegetation from each community that would be impacted is given in the following table.

Vegetation Community	**Area Impacted (ha)**	**EEC?**
1 – Riparian Floodplain Woodland	1.6	Yes
2 – Yellow Box / Red Gum Open Woodland / Woodland	6.2	Yes
3 – Argyle Apple / Stringybark Open Forest / Woodland	1.0	No
Total	8.8	-

The exact area of natural vegetation that would be impacted in the By-pass road site cannot be calculated at this stage, since the exact route alignment has not been finalised. However, a 20m strip of land was studied for the entire length of the proposed By-pass road in order to cover any variation in the location of the proposed 8m road formation. When the By-pass road is required at Stage 2, a final route will be designed to minimise the amount of vegetation that would be affected, taking particular care to avoid mature and habitat trees. As with the quarry site, most of the natural vegetation in the haul road site is partly cleared and disturbed. The vast majority of the intended route passes through cleared pasture, pine plantation, an abandoned orchard, an existing road or along an existing vehicle track though remnant vegetation near Brayton Road.

2. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

The quarry pit and ancillary facilities would not alter the natural flow regimes of rivers and streams or their floodplains directly, provided that silt from the quarry site is prevented from entering the creek. The creeks through site 1 are ephemeral and mostly contained within shallow channels. The system in this site was completely dry at the time of the survey. The only other watercourse that could potentially be affected is Joarimin Creek in site 2, which would need to be spanned at one point for the bypass road. The flow regime associated with this creek would not be affected provided an adequately sized culvert is constructed to accommodate maximum flow rates during floods.

3. Invasion of native plant communities by exotic perennial grasses

A number of species of exotic perennial grasses occur in the study area and could have detrimental effects on native species biodiversity. Most notably, Serrated Tussock (*Nassella trichotoma*) is specifically mentioned by the Final Determination for the threatening process (NSW Scientific Committee 2003) as being one of the species that invades and may dominate native plant communities competing with, and displacing, many native species. Serrated Tussock was widespread and abundant in the pasture areas particularly of site 1, but also occurred in sites 2 and 3.Toowoomba Canary Grass (*Phalaris aquatica*) is also noted by the Final Determination as having the potential to invade smaller areas of native plant communities. This species was neither widespread nor abundant within the study area, being restricted to the creekside in site 2. It would be beneficial to control exotic perennial grasses within the study area and also take steps to minimise the likelihood of further exotic grass seeds or propagules being imported into the site on machinery or equipment. Further details are given in the Recommendations section.

4. Infection of native plants by Phytophthora cinnamomi

Eucalyptus macrorhyncha and *Melichrus urceolatus*, both common and widespread species within sites 1, 2 and 3 of the study area, are listed by the Final Determination for the threatening process (NSW Scientific Committee 2002b) as a species "not currently threatened but known, or strongly suspected, to be susceptible to infection by *Phytophthora cinnamomi* and killed by its presence". Spores of the root-rot fungus *P. cinnamomi* could be introduced to the site on machinery or equipment that has been in a contaminated area, or in soil or fill imported to the site. There should be no need to import fill into the site. Protocols should be established to ensure that machinery (or fill) brought in from off-site is certified to be free from the disease, or decontaminated before being allowed into the site.

5. Other threatening processes

Apart from the above threatening processes, the fact-sheet for the Box-Gum Woodland listing (NPWS 2002b) includes Competition and grazing by the European rabbit, Predation by the European Red Fox and Predation by the feral cat as processes that may impact on or occur in Box-Gum Woodland. The density and activity of European rabbits is unlikely to increase significantly as a result of the proposed quarry and roads. The impacts of predation from feral cats and foxes are unlikely to increase as a result of the proposal.

In conclusion, the proposed quarry, ancillary facilities or roads are not expected to significantly increase the incidence of designated key threatening processes listed on Schedule 3 of the *TSC Act*, or any other threatening processes, if they are appropriately managed. Such management would mainly include minimising indirect disturbances to the EEC during construction and operation of the quarry, providing adequate and well-designed culverts over the creek and watercourse crossings during road construction and taking simple steps to avoid introduction of weeds, including exotic perennial grasses. Full details are given in the Recommendations section.

Conclusions from the seven-part test for threatened flora species and the Endangered Ecological Community: No threatened flora species are considered likely to be affected by the proposal. In the unlikely event that any are, it has been concluded that the impact would not be significant. Because of its limited scale in relation to areas of similar or better quality habitat that would be retained, the minor loss of modified and degraded vegetation resulting from the proposal is unlikely to have a significant effect on the EEC that currently occurs in the study area or on the conservation of flora in the area in general.

4.2.2 Threatened Fauna

Two threatened fauna species, ***Pyrrholaemus sagittatus*** **Speckled Warbler** and ***Miniopterus schreibersii oceanensis*** **Eastern Bent-wing Bat** were positively identified within the subject site during the field survey. In addition to these, *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) was given a probable identification and *Myotis macropus* (Southern Myotis) given a tentative (possible) identification based on ultrasonic call analysis. The Southern Myotis was not initially considered a potential subject species based on the available habitat and lack of records within the study locality. However, given that a possible call was recorded during the survey, this species will now be assessed as a potential subject species. In total, 19 species are known or considered to have potential to occur within the subject site. These subject species are therefore assessed below using the 7-part test.

(a) ***in the case of a threatened species, whether the action proposed is likely to have an adverse affect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.***

Gang-gang Cockatoo *Callocephalon fimbriatum* – Vulnerable (TSC Act)

The Gang-gang Cockatoo is generally found in tall mountain forests and woodlands during summer, moving to lower altitude open eucalypt forests and woodlands in winter. This species relies on the

presence of hollow-bearing trees for nesting. No Gang-gang Cockatoos were recorded during the field survey, though a number of records occur within the locality. The proposed development is likely to result in the loss or modification of some marginal potential habitat for the Gang-gang Cockatoo and the removal of two dead stags containing potentially suitable nest hollows from within the main project site (Site 1). In addition, some potential habitat and hollow-bearing trees may be removed from within Sites 2, 3 and 4 depending on the final alignment for the haul road.

Given the degraded nature of habitat within the study area, it is unlikely that the area to be removed constitutes key habitat for the Gang-gang Cockatoo and the proposed development is considered highly unlikely to have an adverse affect on the life cycle of the species such that a viable local population of the species would be placed at risk of extinction. However, in the unlikely event that a nest tree is discovered in the area to be cleared, the removal of that tree could potentially have a significant impact on the local population of that species, particularly if eggs or young are destroyed.

Glossy Black-Cockatoo *Calyptorhynchus lathami* – Vulnerable (TSC Act)

The Glossy Black-Cockatoo occurs mainly in open forests and woodlands of the coast and Great Dividing Range up to 1000m. It relies on hollow-bearing trees for nesting and particular she-oak species for food. One preferred food tree species, *Allocasuarina littoralis* (Black She-oak), was recorded within the study area during the field survey. *Allocasuarina littoralis* was only recorded at Site 2 (Joarimin Creek Road). This is the most likely area within the subject site that the Glossy Black-cockatoo would visit, in order to take advantage of the available foraging resource.

No Glossy Black-Cockatoos were recorded during the field survey however records of this species do occur within the locality. The nearest records are from timbered areas east of Marulan and in Morton National Park. The proposed development is likely to result in the loss or modification of some marginal potential habitat for the Glossy Black-Cockatoo and the removal of two dead stags containing potentially suitable nest hollows from within the main project site (Site 1). In addition, some potential habitat and hollow-bearing trees may be removed from within Sites 2, 3 and 4 depending on the final alignment for the haul road. As with the Gang-gang Cockatoo, given the degraded nature of habitat within the subject site, it is unlikely that this area constitutes key habitat for this species and the proposed development is considered highly unlikely to have an adverse affect on the life cycle of the species such that a viable local population of the species would be placed at risk of extinction. However, in the unlikely event that a nest tree is discovered in the area to be cleared, the removal of that tree could potentially have a significant impact on the local population of that species, particularly if eggs or young are destroyed.

Woodland Birds – Brown Treecreeper *Climacteris picumnus*, Black-chinned Honeyeater *Melithreptus gularis gularis*, Turquoise Parrot *Neophema pulchella*, Hooded Robin *Melanodryas cucullata*, Diamond Firetail *Stagonopleura guttata*, Speckled Warbler *Pyrrholaemus sagittatus* – all Vulnerable (TSC Act)

The eastern form of the **Brown Treecreeper** prefers dry open woodland habitats, mainly on the western slopes of the Great Dividing Range, with a patchy distribution to the east of the Divide. It is an insectivorous species, mainly feeding on ants, beetles and larvae, and forages on tree trunks or on the ground. They nest in tree hollows, with a pair or small family group frequenting a permanent territory. Viable populations are thought to require a minimum patch size of 200ha of suitable habitat. While not recorded within the subject site during the field survey, records for this species exist within the locality. The most likely area within the subject site for this species to occur is in the Stringybark Ridgetop Open Forest/Woodland community at Site 3.

In NSW, the **Black-chinned Honeyeater** prefers woodlands with box-ironbark associations and prefers larger remnants (greater than 200ha in area (DEC website). This species was not recorded during the field survey, though one nearby record exists. Some degraded potential habitat does occur within the subject site and may present opportunistic foraging opportunities for the Black-chinned Honeyeater. If a local population occurs, it is expected that this species would only visit the subject site occasionally during peak flowering periods.

The **Turquoise Parrot** inhabits eucalypt woodlands and open forests with a low shrubby understorey and grassy groundcover layer and usually nests in hollows less than two metres from the ground. It feeds primarily on native and introduced grass seeds and requires habitat with a nearby water source. The Turquoise Parrot was not recorded during field survey work, and no records occur for the locality. However, given more rain and less intensive grazing, potential habitat (including potential nest hollows) for the Turquoise Parrot could be found within the subject site.

Hooded Robins prefer drier habitats throughout their range and the adults are generally sedentary in pairs or small family groups. Usually prefers open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. This species requires structurally diverse habitats including mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses (DEC website). This species builds its small cup nest in a tree fork or crevice 0.5-5m above the ground (Morcombe, 2000). The Hooded Robin was not recorded during field survey work and no records exist within the locality. Given that the ground layer throughout much of the subject site is highly degraded due to grazing pressure and drought, it is unlikely that the subject site represents significant habitat for this species.

The **Speckled Warbler** is a sedentary species with a home range that varies from 6-12 hectares. This species appears to prefer woodland areas where ground cover consists of grass, fallen leaves and bark. The Speckled Warbler congregates in small family groups and constructs dome shaped nests, camouflaged under a tuft of grass beneath fallen branches or base of a small shrub (Readers Digest, 1979; DEC website, 2006). Two Speckled Warblers were observed foraging amongst introduced shrubs (plum trees) at Site 2. The native shrub layer throughout the subject site is very sparse and these introduced shrubs seem to provide important shelter and foraging habitat for the Speckled Warbler.

The **Diamond Firetail** usually gathers in small flocks of 20-30. This species inhabits open forests with a grassy groundcover, woodlands, mallee, acacia scrublands and timber belts along watercourses and roadsides. Diamond Firetails build a horizontal nest in dense foliage of a tree, shrub or mistletoe clump (Morcombe, 2000). This species forages on the ground for seeds, green leaves and insects. Given the degraded nature of the ground vegetation, it is unlikely that the subject site represents significant habitat for this species. However, given rain and a decrease in grazing pressure, this area could potentially contain suitable habitat for the Diamond Firetail. This species was not recorded during the current survey, though records exist for the locality.

Throughout much of the subject site, grazing pressure and drought have resulted in a severely degraded ground vegetation layer. Given that most of the above woodland bird species forage on the ground or prefer a more diverse vegetation structure, much of the subject site represents only very poor habitat for these species. The Black-chinned Honeyeater has different foraging requirements and has potential to visit the subject site to take advantage of flowering eucalypts (particularly as this species is generally locally nomadic and has a large home range). For the five ground foraging species, the best habitat currently available within the subject site appears to be at Sites 2 and 3 however the shrub and ground vegetation at Site 3 is still quite sparse along the spur and hill top.

The proposed development is likely to result in the loss or modification of some known and potential habitat for threatened woodland birds, particularly along the proposed access road route between Brayton Rd and Red Hills Rd. While neither species was recorded during the field survey, the Brown Treecreeper and Turquoise Parrot both utilise tree hollows for nesting and shelter purposes and the proposal could result in the loss of trees containing potentially suitable nest hollows for these two species. However given the lack of records and marginal nature of the habitat, the proposal is considered unlikely to place either species at risk of local extinction. In the unlikely event that a nest tree was to be removed during the breeding season, this could potentially result in the loss of eggs or nestlings and possibly adult birds.

The only threatened woodland bird recorded during the field survey was the Speckled Warbler. Two individuals were observed foraging in introduced shrubs at Site 2 (at the old tip site at the end of

Joarimin Rd). The proposed haul road through this area would result in the fragmentation of speckled warbler habitat in this area and increased traffic associated with the road would lead to an increased risk of death due to vehicle strike. According to David Olsen (pers. comm.), this road would have a speed limit of 80km/h with an average of 80 vehicle movements in a 24 hour period, increasing in peak times to 120 vehicle movements with the possible addition of 5 vehicles per day from local traffic. In peak periods this would result in an approximate maximum of 60 vehicle movements during daylight hours, or roughly five vehicles per hour. Given the T-intersection with Brayton Road and relatively sharp bend within 500 metres it is unlikely that traffic will be travelling at the permissible speed along the section of road that passes through Speckled Warbler habitat.

The Speckled Warbler is known to be susceptible to local extinction in vegetation remnants of less than 100 hectares. Based on aerial photography of the region, the vegetation remnant that includes the Joarimin Road site covers a minimum of 170 hectares (excluding vegetation south of Brayton Road). While the proposal would result in some loss of habitat along the road area and lead to increased traffic and risk of road death in the area, it is not expected that the proposed development will have such an impact that the local population of Speckled Warbler would be placed at risk of extinction. A number of mitigative measures may assist in minimising impacts on the Speckled Warbler. These recommendations are listed in **Section 6**.

Owls – Barking Owl *Ninox connivens*, Powerful Owl *Ninox strenua* and Masked Owl *Tyto Novaehollandiae* – all Vulnerable (TSC Act)

Three species of threatened owl (Barking Owl, Powerful Owl and Masked Owl) have some potential to utilise the study area for foraging purposes. None of these species are likely to roost or nest within the study area. The Masked Owl and Powerful Owl prefer large tree hollows in moist gullies for nesting, while Barking Owl nest trees are generally found near a watercourse or wetland. None of these species were recorded during the field survey, though some records occur within the study locality.

The subject site represents marginal potential foraging habitat for all three species and some potentially suitable nest sites occur in hollow-bearing trees throughout the site. The proposal is expected to result in the loss of some marginal foraging habitat for these species and the removal of two dead stags containing large hollow potentially suitable for nesting from within the main project site (Site 1). In addition, some potential habitat and hollow-bearing trees may be removed from within Sites 2, 3 and 4 depending on the final alignment for the haul road. However, no nest sites were recorded and it is considered unlikely that any would be affected by the proposed development. It is considered that the proposal is highly unlikely to impact upon the life cycle of the Barking Owl, Powerful Owl or Masked Owl to such an extent that a local population would be placed at risk of extinction. In the unlikely event that one of these owl species is discovered to be nesting within the area to be cleared, then the removal of that nest tree could potentially have a significant impact on the local population of the species, particularly if it is removed during the breeding season.

Regent Honeyeater *Xanthomyza phrygia* – Endangered (TSC Act); Endangered & Migratory (EPBC Act)

The Regent Honeyeater was not recorded during the field survey, though a few records exist for the locality. However given the migratory/nomadic nature of this species it may occasionally visit the study area on an opportunistic basis, particularly during peak flowering periods. No known breeding areas for this species occur in the locality. A number of potential food-source trees (in particular winter-flowering species) are likely to be removed as a result of the proposed development, though this is not expected to impact on the life cycle of the Regent Honeyeater.

Hollow-roosting Bats – Eastern False Pipistrelle *Falsistrellus tasmaniensis* and East-coast Freetail-bat *Mormopterus norfolkensis*

No threatened hollow-roosting bat species were positively identified within the subject site, however a probable identification of *Falsistrellus tasmaniensis* Eastern False Pipistrelle was made using ultrasonic call analysis. Both the east-coast freetail-bat and eastern false pipistrelle are reliant upon hollow-bearing

trees for roosting and breeding purposes and are most likely to use small and medium-sized hollows, although they will also roost behind exfoliating bark. The study area contains potentially suitable roost sites and also provides potential foraging habitat for these two hollow-roosting bat species.

Within the main project area (Site 1), the proposed development is likely to result in the removal of up to 31 trees containing potentially suitable roost sites for hollow-roosting bat species and some potential foraging habitat is likely to be removed or modified. In addition, some potential habitat and hollow-bearing trees may be removed from within Sites 2, 3 and 4 depending on the final alignment for the haul road. Both of these bat species exhibit a large home range and are likely to utilise a variety of roosts within that range. Given that the bulk of hollow-bearing trees will be retained within the site, it is considered unlikely that the loss of potential roost trees associated with the proposal would result in a local population of either species being placed at risk of extinction. However in the unlikely event that a maternity roost is destroyed during the breeding season, this could have a significant impact on the local population of that species. Individual bats could also be killed if a roost tree is removed during winter when bats are in torpor.

Cave-roosting Bats – Eastern Bentwing-bat *Miniopterus schreibersii oceanensis* – Vulnerable (TSC Act) and Large-eared Pied Bat *Chalinolobus dwyeri* – Vulnerable (TSC & EPBC Act)

The Eastern Bentwing-bat was positively identified within the subject site using ultrasonic call analysis. No other threatened cave-roosting bats were recorded within the subject site and no suitable potential roost sites were recorded. It is expected that any cave-roosting bat species would visit the area for foraging purposes only. Although the proposed development is expected to result in the modification or loss of some potential foraging area, it is unknown to what extent this would impact upon the ability of cave-roosting microbat species to forage within the subject site. Given the expected large foraging ranges of these species, it is considered highly unlikely that the proposed development would have a negative impact upon the life cycle of any species of threatened cave-roosting bat.

Southern Myotis *Myotis macropus* – Vulnerable (TSC Act)

Two possible calls of the Southern Myotis were recorded at Site 3, though these calls were of poor quality and were unable to be positively identified. The Southern Myotis has a strong affinity to open water, including farm dams, where it flies low over the water, feeding on flying insects as well insect larvae and small fish, raked from the water surface. Within the locality, there are a number of waterbodies (eg. dams, pools within waterways) that may provide foraging habitat for this species. As this species usually roost over or near water within caves and man made structures, such as tunnels, buildings, culverts and bridges, as well as tree hollows, it is highly unlikely that the species roosts within the subject site. It is highly unlikely that the proposed development would impact the life cycle of the Southern Myotis to such an extent that a local population would be placed at risk of extinction.

Squirrel Glider *Petaurus norfolcensis* – Vulnerable (TSC Act)

The Squirrel Glider was not recorded during this survey, though one record exists for the locality. This species usually inhabits dry open sclerophyll forest and woodland but there have been recent observations in moist regenerating forest and moist gullies. Although requiring nesting hollows, this species is not dependent on mature forest as sightings have been made in Eucalyptus plantations and forest remnants (Ray Williams, Ecotone Ecological Consultants, pers. obs.). It is possible that disused Ringtail Possum dreys and birds nests are used in the absence of an abundance of suitable hollows.

The majority of hollow-bearing trees within the subject site are expected to be retained as part of the proposed development, though up to nine trees or dead stags containing potentially suitable hollows may be removed from within the main project site (Site 1). Some potential foraging habitat is also expected to be lost and/or modified from within Site 1. In addition, some potential habitat and hollow-bearing trees may be removed from within Sites 2, 3 and 4 depending on the final alignment for the haul road. However, given the degraded nature of habitat in the areas likely to be cleared and the fact that most

habitat trees will be retained, it is considered highly unlikely that the life cycle of the Squirrel Glider would be impacted to such an extent that a local population would be placed at risk of extinction.

Koala *Phascolarctos cinereus* – Vulnerable (TSC Act)

Distributed from about Townsville, Queensland to the Victorian / South Australian border, from the coast to the western slopes and plains in New South Wales, this species is rare in the north and south of its range. The Koala is a foliovore, feeding on some Eucalypt species. It is often sighted in younger trees, which may have leaves of a higher palatability and nutrient value. One preferred food species listed under SEPP 44 (*Eucalyptus viminalis* Ribbon Gum) occurs within the subject site, though only a few individual trees of this species were observed, all near Joarimin Creek at Site 2. Four secondary food tree species and one supplementary species were also recorded within the subject site (NPWS 2003a).

No evidence of koala activity was recorded during the field survey, though a large number of records exist for the locality. Most of the nearby records are from Bungonia State Recreation Area and Morton National Park. Koalas may occasionally visit or travel through the subject site however it is highly unlikely that the subject site supports a viable koala population. As such, it is considered highly unlikely that the proposed development will impact the life cycle of the Koala to such an extent that a viable local population is placed at risk of extinction.

(b) ***in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species likely to be placed at risk of extinction.***

Not applicable

(c) ***in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not Applicable

(d) ***in relation to the habitat of a threatened species, population or ecological community:***

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii)whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Gang-gang Cockatoo *Callocephalon fimbriatum* – Vulnerable (TSC Act)

(i) No known habitat is likely to be removed however an area of marginal quality potential habitat is expected to be lost in the proposed quarry area and along the proposed access road routes. Two dead stags containing potentially suitable nest hollows are likely to be removed from the main project area (Site 1) and others within Sites 2, 3 and 4 may require removal depending on the final alignment of the haul road.

(ii) No habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposal.

(iii) This species was not recorded during the field survey, though a number of records of this species exist for the locality. While some potential habitat is likely to be removed, the degraded nature of this habitat indicates that it is not key habitat for the Gang-gang Cockatoo and therefore unlikely to be important to the long-term survival of the species in the locality.

However, in the unlikely event that a nest tree is discovered in the area to be cleared, the removal of that tree could potentially have a significant impact on the local population of that species, particularly if eggs or young are destroyed.

Glossy Black-Cockatoo *Calyptorhynchus lathami* – Vulnerable (TSC Act)

(i) No known habitat is likely to be removed however an area of marginal quality potential habitat is expected to be lost along the proposed access road route in Site 2 (near Joarimin Creek Road). Two dead stags containing potentially suitable nest hollows are likely to be removed from the main project area (Site 1) and others within Sites 2, 3 and 4 may require removal depending on the final alignment of the haul road. Some potential food trees may also be removed.

(ii) No habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposal.

(iii) This species was not recorded during the field survey, though a number of records of this species exist for the locality. While some marginal potential habitat is likely to be removed, this is considered unlikely to be important to the long-term survival of the species in the locality. However, in the unlikely event that a nest tree is discovered in the area to be cleared, the removal of that tree could potentially have a significant impact on the local population of that species, particularly if eggs or young are destroyed.

Woodland Birds – Brown Treecreeper *Climacteris picumnus*, Black-chinned Honeyeater *Melithreptus gularis gularis*, Turquoise Parrot *Neophema pulchella*, Hooded Robin *Melanodryas cucullata*, Diamond Firetail *Stagonopleura guttata*, Speckled Warbler *Pyrrholaemus sagittatus* – all Vulnerable (TSC Act)

(i) Some known and potential habitat for these threatened woodland birds is likely to be removed and/or modified by the proposed development. Two Speckled Warblers were observed foraging in introduced shrubs at Site 2. While these shrubs are not expected to be affected by the proposed development, the construction of an access road near this area is likely to remove some Speckled Warbler habitat. The Black-chinned Honeyeater was not recorded during the survey, though may occasionally visit the subject site during flowering events. Some flowering trees with potential to be used by this species are likely to be removed as a result of the proposed development. Depending on the final alignment of the proposed haul road, a number of trees containing potentially suitable nest hollows for the Brown Treecreeper and Turquoise Parrot could be lost. For the remaining threatened woodland bird species, the proposed development will result in the loss of potential habitat in the proposed quarry area and along the proposed access road routes. At present this potential habitat is fairly marginal due to grazing pressure and the effects of drought, but in good years may be utilised by some of these species.

(ii) The known Speckled Warbler habitat at Site 2 is likely to become fragmented as a result of the proposed access road construction in this area. The increase in traffic associated with this proposed road is likely to lead to increased risk of road death for Speckled Warblers in the area. None of the other threatened woodland birds were recorded during the field survey, though if any of these do occur, similar impacts could be expected as a result of the proposed access roads and associated increased traffic throughout the study area.

(iii) The main impact on woodland birds is expected to be an increased risk of road death due to increased traffic in the area along the proposed access roads. A number of hollow-bearing trees containing potentially suitable nesting hollows for the Brown Treecreeper and Turquoise Parrot could also be lost. In addition, the proposed development is expected to contribute to the cumulative loss of habitat affecting threatened woodland birds in NSW. However, in most areas, habitat within the subject site is moderately to highly degraded and the extent of habitat to be removed or modified is not expected to be important to the long-term survival of any population of threatened woodland bird in the locality. As the proposed quarry and access road areas constitute a relatively small area of land compared to the total subject site, there would be scope to rehabilitate some of this area to increase the extent and quality of habitat available to threatened woodland birds in the area. In the unlikely event that a nest tree for the Brown Treecreeper or Turquoise Parrot was to be removed during the breeding season, this could potentially result in the loss of eggs or nestlings and possibly adult birds.

Owls – Barking Owl *Ninox connivens*, Powerful Owl *Ninox strenua* and Masked Owl *Tyto Novaehollandiae* – all Vulnerable (TSC Act)

(i) No known nest sites are likely to be affected. Two dead stags containing potentially suitable nesting hollows are likely to be removed from within the main project site (Site 1). In addition, some hollow-bearing trees may be removed from within Sites 2, 3 and 4, depending on the final alignment for the haul road. Some marginal quality potential foraging habitat is likely to be removed and/or modified as a result of the proposal.

(ii) No habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposal.

(iii) Given the marginal, degraded nature of potential foraging habitat within the subject site and the large home range of these species, the amount of potential foraging habitat to be removed as a result of the proposal is considered highly unlikely to impact the long-term survival of the Barking Owl, Powerful Owl or Masked Owl in the locality. In the unlikely event that one of these owl species is discovered to be nesting within the area to be cleared, then the removal of that nest tree could potentially have a significant impact on the local population of the species, particularly if it is removed during the breeding season.

Regent Honeyeater *Xanthomyza phrygia* – Endangered (TSC Act); Endangered & Migratory (EPBC Act)

(i) Some potential food trees are expected to be removed as part of the proposal (mainly in Site 1 in the proposed quarry area).

(ii) No habitat for this species is likely to become fragmented or isolated from other areas of habitat as a result of the proposal.

(iii) The minimal extent of potential foraging habitat likely to be removed as a result of the proposal is highly unlikely to be important to the long-term survival of the Regent Honeyeater in the locality.

Hollow-roosting Bats – Eastern False Pipistrelle *Falsistrellus tasmaniensis* and East-coast Freetail-bat *Mormopterus norfolkensis*

(i) It is uncertain whether any roost trees will require removal as a result of the proposed development, though up to 31 trees containing potentially suitable roost hollows are expected to be removed from the main project area (Site 1) and others elsewhere in the site may require removal depending on the final alignment of the haul road. The whole subject site represents potential foraging habitat for these species and some of this is expected to be removed or modified in the proposed quarry area and along the proposed access roads.

(ii) No habitat for these species is likely to become further fragmented or isolated from other areas of habitat as a result of the proposal.

(iii) Given the large foraging range of these species, the amount of potential habitat to be removed as a result of the proposal is considered unlikely to impact the long-term survival of threatened tree-roosting microbat species in the locality. However, if a maternity roost is discovered within the area to be cleared, the removal of that roost tree may significantly impact the local population, particularly if the tree is removed during the breeding season.

Cave-roosting Bats – Eastern Bentwing-bat *Miniopterus schreibersii oceanensis* – Vulnerable (TSC Act) and Large-eared Pied Bat *Chalinolobus dwyeri* – Vulnerable (TSC & EPBC Act)

(i) No roosting habitat is expected to be removed or modified. The whole subject site represents potential foraging habitat for these species and some of this is expected to be removed or modified in the proposed quarry area and along the proposed access roads.

(ii) No habitat for these species is likely to become further fragmented or isolated from other areas of habitat as a result of the proposal.

(iii) Given the large foraging range of these species, the amount of potential habitat to be removed as a result of the proposal is considered unlikely to impact the long-term survival of threatened cave-roosting microbat species in the locality.

Southern Myotis *Myotis macropus* – Vulnerable (TSC Act)

(i) No known or potential habitat for the Southern Myotis is expected to be removed or modified as a result of the proposed development.
(ii) No habitat is likely to become further fragmented or isolated from other areas of habitat as a result of the proposal.
(iii) n.a.

Squirrel Glider *Petaurus norfolcensis* – Vulnerable (TSC Act)

(i) The study area represents marginal potential foraging habitat for the Squirrel Glider and provides some potential roost sites in hollow-bearing trees throughout the subject site. Some of this potential habitat is expected to be lost in the proposed quarry area and along the proposed access road routes. Up to nine trees containing potentially suitable roost hollows are expected to be removed from the main project area (Site 1) and others elsewhere in the site may require removal depending on the final alignment of the proposed haul road.
(ii) No habitat is likely to become further fragmented or isolated from other areas of habitat as a result of the proposal.
(iii) No roost sites were identified within the subject site and it is unlikely that any will be affected by the proposal, though the loss of potential roost hollows does contribute to the cumulative loss of habitat affecting this species. The extent of vegetation likely to be removed as a result of the proposal is considered unlikely to be important to the long-term survival of the species in the locality.

Koala *Phascolarctos cinereus* – Vulnerable (TSC Act)

(i) A large number of records exist for the locality, though no evidence of Koala activity was recorded during the field survey. One preferred food tree species listed under SEPP 44 (*Eucalyptus viminalis* Ribbon Gum) was recorded, though this was limited to a few trees at Site 2 near Joarimin Creek and these are unlikely to be affected by the proposed development. Some marginal potential foraging habitat containing secondary food tree species is likely to be removed in the proposed quarry area and along the proposed access road routes.
(ii) The construction of the proposed quarry and associated access roads would lead to increased traffic in the study area and is likely to result in an increased risk of road death or injury for any Koalas passing through or visiting the area.
(iii) Given the degraded nature and marginal quality of habitat within the site, it is considered unlikely that the extent of habitat to be removed or fragmented is important to the long-term survival of the species in the locality.

(e) ***whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).***

No areas of designated critical habitat so far identified under the provisions of the *Threatened Species Conservation Act* 1995 apply to the study area.

(f) ***whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.***

Two draft recovery plans, one final recovery plan and one threat abatement plan are considered potentially relevant to this proposal. Two subject species (Koala and Barking Owl) are the subject of draft Recovery Plans and two subject species (Powerful Owl and Masked Owl) are the subject of a final Recovery Plan prepared by the NSW Department of Environment and Conservation. One

potentially relevant threat abatement plan (Predation by the Red Fox *Vulpes vulpes*) has been approved by the NSW Department of Environment and Conservation. No recovery plans have been prepared for the remaining subject species.

Draft Recovery Plan for the Koala *Phascolarctos cinereus* (NPWS 2003a)

The main objectives of the draft Koala recovery plan are to reverse the decline of the Koala in NSW, to protect, manage and restore Koala habitat and to maintain healthy breeding populations of the species throughout their current range. The proposed development is unlikely to have a significant impact upon the local population of the Koala and the proposed action is considered not inconsistent with the objectives of this draft recovery plan.

Draft Recovery Plan for the Barking Owl *Ninox connivens* (NPWS 2003b)

The main objective of the draft Barking Owl recovery plan is "*to recover the species to a position of viability in nature in NSW*" (NPWS 2003b). Within the plan, Specific Objective 3 (Undertake threat abatement and mitigation) is most relevant to the current proposal as it deals with mitigative measures to prevent the loss and degradation of Barking Owl habitat. As vegetation within the subject site does not represent known or significant potential habitat for the Barking Owl, the action proposed is considered not inconsistent with the objectives of this draft recovery plan.

Recovery Plan for the Large Forest Owls: Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*) (DEC, 2005)

The main objective of the plan is to ensure that these three species of threatened owl persist in the wild in NSW in each region where they currently occur. Two specific objectives within the recovery plan have potential relevance to the current proposal. Objective 1 deals with minimising the loss and fragmentation of habitat and Objective 2 deals with minimising the impacts of development on large forest owl habitat. As vegetation within the subject site does not represent known or significant potential habitat for the Masked Owl or Powerful Owl, the action proposed is considered not inconsistent with the objectives of this draft recovery plan.

NSW Threat Abatement Plan – Predation by the Red Fox (*Vulpes vulpes*) (NPWS 2001)

The plan has four specific objectives:

i) to ensure that fox control programs for conservation purposes in NSW focus on threatened species most likely to be impacted by fox predation
ii) to ensure that fox control programs effectively minimise the impacts of fox predation on threatened species
iii) to validate the priority species ranking (outlined in the plan) and measure the effectiveness of control programs
iv) provide support for the implementation of the plan

The plan ranks the likelihood of red fox predation impacting a threatened species population. Of those subject species given a sensitivity rating within the plan, none are given a high priority ranking. Of those subject species that were not yet listed as threatened when this threat abatement plan was written, most are expected to have a low priority ranking according to the plan. One species, the Speckled Warbler, may achieve a high sensitivity rating as it is a ground-nesting bird. However, as the study area is not identified as a high priority area for fox control under the threat abatement plan, the proposed action is not considered inconsistent with the objectives of this threat abatement plan.

(iii) ***whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.***

To date, thirty (30) key threatening processes have been finally determined under the provisions of the *TSC Act.* Those that are potentially most relevant to the current proposal and the subject fauna species are discussed below. In addition to these, one proposed key threatening process (Loss of Hollow-bearing trees) is considered potentially relevant and is also discussed below.

1 Clearing of native vegetation

The proposal is likely to result in the clearing or modification of approximately nine hectares of native vegetation within Site 1. The exact area to be cleared as a result of the proposed haul road within Sites 2, 3 & 4 cannot be calculated at this stage as the exact route alignment has not been finalised. The proposed development is therefore expected to contribute to this key threatening process. This could be ameliorated through rehabilitation and regeneration of native vegetation elsewhere in the subject site.

2. Competition and grazing by the feral European rabbit

The feral European rabbit was recorded within the study area during the field survey. It is highly unlikely that the proposal will encourage the feral rabbit population within the subject site.

3. Competition from feral honeybees

Competition from feral honeybees has the potential to impact upon a number of threatened fauna species, particularly hollow-reliant species (such as tree-roosting microbats, owls, parrots, possums and gliders). Feral honeybees also compete with native animals (eg. honeyeaters, native bees) for nectar and pollen resources. It is likely that feral honeybees already occur and utilise tree hollows within the subject site. Should a hive be disturbed or destroyed during vegetation clearing within the site, that hive may take over another hollow within the study area, potentially displacing another occupant. However, it is considered that the proposal will not significantly increase the impact of this key threatening process within the subject site.

4. Human caused climate change

Some vegetation is likely to be lost as a result of the proposed development. This is likely to result in increased greenhouse gas emissions from the breakdown of vegetative material and loss of soil organic matter. On a global scale, this is expected to represent only a tiny fraction of greenhouse gas emissions however it would contribute to the cumulative impacts of greenhouse gas emissions resulting in human caused climate change. The rehabilitation and regeneration of native vegetation elsewhere within the subject site would help mitigate this impact.

5. Infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations

Psittacine Circoviral Disease (PCD) affects parrots and their allies and has the potential to seriously impact populations where numbers have already been severely reduced (eg. endangered species). It is unknown whether PCD is present in wild parrot populations within the locality. The proposed development is not expected to contribute to an increase the incidence of PCD within the locality.

6. Infection of frogs by amphibian chytrid causing the disease chytridiomycosis

Chytridiomycosis is a fatal disease known to affect frog populations around the world. It has the potential to affect all frog species and poses a particular risk to those species already under stress from other threatening processes. The proposed development is unlikely to increase the incidence of chytridiomycosis within the locality providing appropriate preventative measures are taken when working within the site. This would include the cleaning and drying of machinery, tools, boots, etc. when moving from one work area to another if any work is being undertaken near of within any waterbody or creekline.

7. Invasion of native plant communities by exotic perennial grasses
The invasion of native plant communities by exotic perennial grasses can lead to native groundcover species being outcompeted with the result that the groundcover is dominated by these exotic grasses. Two invasive exotic perennial grasses listed in the final determination were recorded within the subject site, *Nassella trichotoma* (Serrated Tussock) and *Phalaris aquatica* (Toowoomba Canary Grass). This key threatening process is particularly relevant to threatened ground foraging bird species that feed on native grass seeds, including *Chthonicola sagittata* (Speckled Warbler) and *Stagonopleura guttata* (Diamond Firetail). The Speckled Warbler was recorded within the study area at Site 2. While the proposed development may increase edge effects along the proposed access roads and quarry area, it is not expected to significantly increase the incidence of this key threatening process within the study area.

8. Predation by feral cats
This key threatening process is potentially relevant for the ground foraging threatened woodland birds (in particular the Speckled Warbler), but is also relevant to small ground-dwelling mammals and possibly tree roosting microbats within the study area. The proposed development is unlikely to increase the abundance of feral cats in the local area.

9. Predation by the European Red Fox
This key threatening process is potentially relevant for the ground foraging threatened woodland birds (in particular the Speckled Warbler), but is also relevant to small ground-dwelling mammals within the study area. The proposal is highly unlikely to increase the abundance of the Red Fox in the local area.

10. Removal of dead wood and dead trees
This key threatening process is potentially relevant for a number of threatened species known or with potential to occur within the subject site. Some dead trees may be removed as a result of the proposed development, though this is considered unlikely to significantly increase the incidence of this key threatening process in the local area. It is recommended that all fallen timber and dead wood be retained within the subject site.

11. Loss of Hollow-bearing Trees – preliminary determination (pending finalisation)
This key threatening process is potentially relevant for a number of hollow-reliant threatened species known or with potential to occur within the subject site (eg. parrots, owls, gliders, microbats etc.). Hollows tend to form in large, mature eucalypts, with large hollows rarely forming in trees less than 200 years old and provide shelter and nesting habitat for a wide range of species. Most of the hollow-bearing trees within the site are expected to be retained. However, within the main project area (Site 1) up to 31 hollow-bearing trees may be lost and some others may require removal from within Sites 2, 3 and 4, depending on the final alignment of the haul road.

The DECC Queanbeyan office was contacted for further advice regarding this issue and according to Allison Treweek, the two hollow-reliant species of most concern were the gang-gang cockatoo and the eastern false pipistrelle. In order to minimise potential impacts on these two species, an experienced fauna handler should be present when hollow-bearing trees are removed and the recommended timing for tree removal is between March and May inclusive or September.

If clearing operations are unable to be timed so as to avoid the main spring/summer breeding period and winter months when bats enter torpor, then a number of mitigative measures could assist in reducing impacts on hollow-reliant fauna. These include pre-clearing surveys of those hollow-bearing likely to be removed and the presence of an experienced fauna handler during clearing operations. In addition, felling trees in sections or laying them down gently would minimise the risk fauna being injured. If a nest or maternity roost is discovered during clearing operations, this tree should be left standing until an ecologist has reviewed the situation.

Conclusions from the seven-part test for fauna: The proposal has the potential to have a minor impact on local biodiversity and threatened species assessed in this ‘7-part test’. The main impact is

likely to be the increased vulnerability of the Speckled Warbler and other fauna to road death or injury due to increased vehicle activity in the study area.

One potential impact that could affect hollow-reliant fauna would be the loss of habitat associated with the removal of hollow-bearing trees. Up to 31 habitat trees within the proposed quarry area may require removal and others elsewhere within the site may also be removed. Given that the bulk of hollow-bearing trees within the study area are expected to be retained, this is considered unlikely to place any threatened fauna species at risk of local extinction. However in the unlikely event that a maternity roost or nest tree for a threatened species is discovered, this could potentially have a significant impact on the local population, particularly if the tree is removed during the breeding season.

Potential indirect impacts from increased noise, dust and night-time light could result in some species moving further away from the works and road areas.

While some potential impacts have been identified through the seven-part test, none of the predicted impacts is considered likely to place any local population of a threatened fauna species at risk of extinction. The general conclusions indicate that the proposal is unlikely to significantly impact upon any local population of threatened species or any endangered population, ecological community or their habitats.

4.3 Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act was gazetted in 2000 and replaced several earlier Commonwealth statutes. This Act focuses Commonwealth interests on matters of national environmental significance including integrated biodiversity conservation and the management of important protected areas. The Act also establishes a streamlined environmental assessment and approvals process.

The matters of national environmental significance (NES) as identified in the Act which require assessment and approval to be addressed by the Commonwealth include:

- World Heritage properties
- National Heritage places
- Ramsar wetlands
- Nationally threatened species and ecological communities (Part 13, Division 1, Subdivision A of the EPBC Act)
- Migratory species
- Commonwealth Marine areas
- Nuclear actions (including uranium mining)

The assessment and approval process applies to any action that has, will have or is likely to have a significant impact on a matter of NES. An ‘action’ is defined as a project, development, undertaking or an activity or series of activities.

The only matters of NES that could be relevant in the case of the proposed action are nationally threatened species and ecological communities, and migratory species.

Threatened Species

The relevant criteria given in the administrative guidelines for the Act to determine whether the action will or is likely to have a significant impact on a nationally threatened species are as follows:

Critically endangered and endangered species

Criteria

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- lead to a long-term decrease in the size of a population, or
- reduce the area of occupancy of the species, or
- fragment an existing population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of a population, or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- 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
- interfere with the recovery of the species.

** Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

Vulnerable species

Criteria

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- lead to a long-term decrease in the size of an important population[#] of a species, or
- reduce the area of occupancy of an important population, or
- fragment an existing important population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of an important population, or
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat*, or
- interferes substantially with the recovery of the species.

[#]An important population is one 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,*
- *populations that are necessary for maintaining genetic diversity, and/or*
- *populations that are near the limit of the species range.*

**Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.*

Flora

One threatened flora species listed exclusively as Endangered under the EPBC Act (*Leucochrysum albicans* var. *tricolor* - Hoary Sunray) was recorded in parts of site 2 and confirmed by the Royal Botanic Gardens. The species appeared to be restricted to the eastern parts of site 2; including alongside the access road to the old tip site (Joarimin Creek Road) not far from the gate into the site and in cleared and disturbed land that once formed part of the tip itself, in the eastern part of the property. The species appeared to be restricted to more open areas and was **not** recorded within the proposed alignment for the bypass road. Therefore, provided that the proposed bypass road follows the alignment currently proposed, the local population of the species is not expected to be adversely affected. It is possible that the proposed road could remove some individuals that were not detected during the survey, or individuals that may become established within the proposed alignment, in the time before the road is constructed. The action proposed is unlikely to have a significant impact upon this species provided that disturbances are confined to the proposed alignment itself and

reasonable measures are taken to prevent invasive species becoming established in habitat adjacent to the known occupied habitat for the species.

Fauna - Threatened and Migratory

No threatened or migratory fauna listed in the EPBC Act were recorded during the field survey. With regard to threatened fauna, potential habitat occurs within the subject site for three species listed in the EPBC Act, *Lathamus discolor* (Swift Parrot), *Xanthomyza phrygia* (Regent Honeyeater) and *Chalinolobus dwyeri* (Large-eared Pied Bat). None of these species were recorded during the field survey.

The Endangered Swift Parrot and Regent Honeyeater may forage within the study area on an occasional opportunistic basis, particularly during peak flowering periods. Potential foraging habitat exists for the Vulnerable Large-eared Pied Bat, though no suitable roosting habitat exists as this species roosts in caves, culverts and other similar structures. None of these species will be significantly impacted upon based on the criteria for endangered and vulnerable species.

With regards to migratory species, three have potential to pass through or occasionally forage within the study area. These are *Hirundopus caudacutus* (White-throated Needletail), *Merops ornatus* (Rainbow Bee-eater) and *Xanthomyza phrygia* (Regent Honeyeater). None of these species are expected to breed within the study area. The proposal is not expected to have any impact on the ability of listed migratory species to travel across the landscape or to breed within the locality.

Threatened Ecological Communities

The relevant criteria given in the administrative guidelines for the Act to determine whether the action will or is likely to have a significant impact on a nationally threatened ecological community are as follows:

Critically endangered and endangered ecological communities

Criteria

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered ecological community if it does, will, or is likely to:

- lead to a long-term adverse affect on an ecological community, or
- reduce the extent of a community, or
- fragment an occurrence of the community, or
- adversely affect habitat critical to the survival of an ecological community, or
- modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the community's survival, or
- result in invasive species that are harmful to the critically endangered or endangered community becoming established in an occurrence of the community*, or
- interfere with the recovery of an ecological community

**Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.*

One threatened ecological community listed under the Act was identified as occurring within the study area. *White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands* (formerly 'Grassy White Box Woodlands') is the equivalent threatened community to the *White Box Yellow Box Blakely's Red Gum* EEC as listed under the NSW TSC Act 1995. The EEC is listed as Critically Endangered under the EPBC Act 1999. However, the Commonwealth definition only includes remnants that are in relatively good condition to qualify for the EEC. On the basis of the list of criteria given in the listing information for the EEC, it has been determined in section 3.1 of this report that Community 2 generally corresponds to the EEC but not Community 1.

Therefore the EEC as listed by the EPBC Act is more restricted in distribution than the equivalent community listed by the TSC Act. By reference to the above criteria, it is concluded that the removal of small, fragmented areas of remnant trees and shrubs constituting the community in the study area would not result in a significant impact on the critically endangered ecological community, Therefore, no further assessment in relation to threatened flora or ecological communities is required pursuant to the EPBC Act.

Key Threatening Processes

To date, 17 key threatening processes have been listed under the EPBC Act, most of which are equivalent to key threatening processes listed under the NSW TSC Act. Those that may be most relevant to the quarry proposal include:

- Land Clearance
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)
- Competition and land degradation by feral Rabbits
- Predation by feral Cats
- Predation by the European Red Fox (*Vulpes vulpes*)
- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases

The equivalent key threatening processes have already been assessed as part of the NSW EP&A Act section 5A assessment process, and found to be either insignificant or readily manageable within the context of the quarry proposal. See section 4.2.

No other Matters of NES or other matters protected by the EPBC Act are directly relevant to the study area. Therefore the specific assessment process under the provisions of the *EPBC Act* 1999 is not required for the proposed development, since it does not constitute an action that is likely to have an impact on any Matter of National Environmental Significance.

4.4 Native Vegetation Act 2003

The remnant areas of vegetation within the study area are defined according to the recently-enacted *Native Vegetation Act 2003* (NV Act) as “Remnant Vegetation”. Remnant vegetation is defined under the Act as any native vegetation in a rural area that is not regrowth. Regrowth vegetation is defined under the Act as any vegetation (of any layer) that has regrown since 1990. Since the areas of natural vegetation within the study area are either uncleared or would have regrown from past clearing that is likely to have occurred prior to 1990, none of the areas of vegetation within the subject site are classified as regrowth.

Normally, approval to clear any quantity of remnant vegetation within a site under the *Native Vegetation Act 2003* on a rural-zoned property would be required from the NSW Department of Natural Resources and managed by the relevant Catchment Management Authority (in this case the Hawkesbury Nepean Catchment Management Authority). The previous exemption for minimal clearing of 2 hectares per year per landholding under the superseded *Native Vegetation Conservation Act 1997* no longer applies.

In order to effectively manage native vegetation within the subject site, under the *Native Vegetation Act 2003* and the *Native Vegetation Regulation 2005*, a Property Vegetation Plan (PVP) may be prepared in consultation with the Hawkesbury Nepean Catchment Management Authority (CMA). This could include a provision to offset vegetation cleared as a result of the proposed development, through revegetation or regeneration of native vegetation elsewhere within the subject site. Any

offset areas should replace an equivalent or greater area of the vegetation type that will be lost. Based on the field survey work and location of remnant bushland within the study locality, suitable offset areas within the subject site include drainage lines, water courses and linkages between remnant stands of vegetation (including links to native vegetation on adjacent properties). These are recommendations only and any PVP for the area must be prepared in consultation with the Hawkesbury Nepean Catchment Management Authority. The local CMA should be contacted to ascertain requirements for the proposal under the NV Act 2003.

4.5 Rivers and Foreshores Improvement Act 1948

The *Rivers and Foreshores Improvement Act 1948* is gradually being replaced by the *Water Management Act 2000*. However until that happens in full, the *Rivers and Foreshores Improvement Act 1948* still applies. Under the Act, a Part 3A permit would be required for specified activities in protected waters or protected land within the subject site. 'Protected waters' includes all clearly defined drainage lines, and 'protected land' is defined as the bank, bed and shore of the protected waters, plus adjacent land within 40 metres of the top of the bank. A Part 3A permit is required for activities involving the excavation or removal of material from protected land or any activity which might obstruct or detrimentally affect the flow of protected waters.

This would apply to Chapman's Creek and Joarimin Creek and any major tributaries within the subject site, including all land within 40 metres of the top of the stream bank. It may also apply to land further than 40 metres from the water body, if an activity poses a threat to protected waters or protected land.

Advice about the need in principle to obtain Part 3A permits should be obtained in the first instance from the local Department of Natural Resources (previously DIPNR and DLWC) office. On receipt of development consent from Council, proponents may need to submit a Part 3A permit application to the Department of Natural Resources.

4.6 SEPP 44 – Koala Habitat Protection

SEPP 44 was implemented on the 13th of February, 1995, with the reasoning that the current known distribution of the Koala in NSW is fragmented, with most colonies appearing to be small and isolated. Many of these populations are in locations that are under increased pressure from habitat loss or modification, predation and exposure to drought, disease and bushfire. These facts are the reason for the Koala being listed as 'Vulnerable' in Schedule 2 of the Threatened Species Conservation Act, 1995.

Prior to a Development Application for bushland areas being approved, the following considerations need to be assessed:

a) identification of "potential Koala Habitats" within the proposed development area; if the total tree cover contains 15% or more of the koala food tree species listed in Schedule 2 of SEPP 44 then it is deemed to be "potential" koala habitat;
b) identification of "core Koala habitat" within the development area. "Core Koala habitat" is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (females with young), recent sightings and historical records of a Koala population;
c) identification of "core Koala habitat" will require that a plan of management must accompany the DA application;
d) if the rezoning of lands, other than to environmental protection, involves potential of core Koala habitat then the Director of planning may require a local environmental study be carried out.

The Mulwaree LGA is listed in Schedule 1 of SEPP 44, therefore it applies to this proposal.

In order to decide whether the subject land represents "potential" or "core" Koala habitat as defined under SEPP44, a visual assessment of the percentage of Koala food tree species present on the

subject land was carried out. Koala food tree species were identified as those listed in Schedule 2 of SEPP 44. Only one listed preferred food tree species (*Eucalyptus viminalis* Ribbon Gum) was recorded within the study area. Within the study area this species is restricted to a few individuals at Site 2 near Joarimin Creek. These few trees do not constitute 15% or more of the total tree cover, therefore the area does not constitute "potential" Koala habitat as defined in SEPP 44.

While the study area does not constitute "potential" Koala habitat based on the SEPP 44 assessment, the Draft Recovery Plan for the Koala *Phascolarctos cinereus* (NPWS 2003a) lists secondary food tree species and supplementary species used by Koalas in the Central and Southern Tablelands. Of these, the following species were recorded within the study area during the field survey:

Secondary Food Tree Species

Eucalyptus cinerea (Argyle Apple)	Sites 1, 2 & 4
Eucalyptus blakelyi (Blakely's Red Gum)	Sites 1, 2 & 4
Eucalyptus bridgesiana (Apple Box)	Site 2
Eucalyptus melliodora (Yellow Box)	Sites 1, 2 & 4

Supplementary Species

Eucalyptus macrorhyncha (Red Stringybark)	Sites 1, 2 & 3

Due to the presence of these species, searches were undertaken for any evidence of Koala activity at three different quadrats within the subject site and Koala calls were played as part of the nocturnal call playback surveys. No Koala scats or any other evidence of Koala activity was observed during the call playback surveys, Koala scat searches or opportunistically throughout the survey period. While some records of koalas occur within a five kilometre radius of the subject site, most of the records within the locality come from Morton National Park, Bungonia State Recreation Area and other large tracts of bushland. The results of the field survey and a review of Koala records within the study locality indicate that no resident population of Koalas occurs within the study area.

4.7 Mulwaree LEP

Section 41 of the Mulwaree Shire Council Local Environmental Plan 1995 (Mulwaree LEP) relates to tree clearing and is considered relevant to this assessment as the proposed development is expected to result in the removal of some native vegetation. The specific requirements of Section 41 are given below:

"(4) The Council must not consent to the clearing of any such land unless:
- (a) in the opinion of the Council, the clearing will be carried out in a manner which minimises:
  - (i) the risk of soil erosion or other land degradation, and
  - (ii) the risk of water pollution through increased nutrients, siltation, sedimentation or otherwise, and
  - (iii) the destruction of significant vegetation communities, and
  - (iv) the impact on the visual and scenic amenity of the area, and
  - (v) the impact to karst systems in the locality, and
- (b) the area to be cleared does not exceed one hectare and is not within 30 metres of a watercourse, and
- (c) the potential impacts on threatened species, endangered ecological communities and habitat linkages for wildlife have been minimised, and
- (d) an Aboriginal cultural heritage survey has been conducted and the clearing will not impact on Aboriginal sites.

(5) The consent of the Council is not required by this plan for:
(a) clearing that is reasonably necessary for the carrying out of development for the purpose of:
(i) a permanent fence; or
(ii) an access trail up to 10 metres wide; or
(iii) a cut line for stock movement up to 20 metres wide; or
(iv) a firebreak up to 30 metres wide; or
(v) a road up to 20 metres wide; or
(vi) a telephone, power, gas or water line, but only if the land cleared is not more than 30 metres wide; or
(vii) a drain up to 20 metres wide to a dam, a bore drain or an irrigation channel; or
(b) clearing consisting of lopping trees to provide stock feed in times of drought, provided that the method and extent of the lopping ensures the survival and continued health of the trees; or
(c) clearing the regrowth of trees which are less than 3 metres in height on any land which:
(i) was lawfully cleared before the commencement of this clause as inserted by *Mulwaree Local Environmental Plan 1995 (Amendment No 7)*; or
(ii) has been cleared in compliance with this clause; or
(d) clearing consisting of pruning trees for the purpose of their regeneration or ornamental shaping; or
(e) clearing consisting of removing trees which are dangerous; or
(f) bush fire management in accordance with the *Rural Fires Act 1997;* or
(g) clearing to enable the establishment or continuation of horticulture approved by the Council on land within Zone No 7(b) or 7(b1).

(6) Nothing in this clause restricts or otherwise affects clearing that is carried out in accordance with a consent required by the *Native Vegetation Conservation Act 1997*."

Point 4 (c) is considered the most relevant to this assessment. As the proposed development is unlikely to have a significant impact on any threatened species, populations or endangered ecological communities, the proposal appears to meet the requirements of the Mulwaree LEP with regards to flora and fauna.

4.8 Groundwater Dependent Ecosystems

A number of dams occur within the study area, including spring-fed dams. If drawn-down impacts result in the complete drying out of a spring-fed dam within the study area, this would result in the loss of that groundwater dependent ecosystem. Although these dams have been artificially created, native flora and fauna species have come to be reliant upon the habitat they provide. If the proposal were to result in the loss of one or more of these dams, it is recommended that compensatory habitat be created elsewhere within the study area, however according to the groundwater assessment by Larry Cook and Associates Pty Ltd only minor groundwater impacts are expected. Therefore there are unlikely to be any substantial impacts on groundwater dependent ecosystems as a result of the proposal.

5.0 CONCLUSIONS

An assessment of the potential impacts on flora and fauna as a result of the proposed hard rock quarry and haul roads at Marulan has been made based on a combination of literature review and field survey. The resulting information has been used to address the requirements of Section 5A of the *Environmental Planning and Assessment Act 1979*, the *Environment Protection & Biodiversity Conservation Act 1999, Native Vegetation Act 2003, Rivers and Foreshores Improvement Act 1948* and SEPP 44. In terms of compliance with Local Government planning, the proposed development appears consistent with the Mulwaree Shire Council LEP 1995.

One threatened flora species listed by the EPBC Act, but not the TSC Act, was positively recorded within the study area. The Hoary Sunray (*Leucochrysum albicans* var. *tricolor*) is listed as Endangered under the EPBC Act, and was recorded in site 2, but not within the alignment of the proposed bypass road. It is not expected to be impacted by the proposal.

Remnants of vegetation along the watercourses and slopes in sites 1 and 2 and in the road verge in site 4 have been identified as highly disturbed and modified forms of the endangered ecological community (EEC) *White Box Yellow Box Blakeley's Red Gum Woodland* (Box Gum Woodland) as listed under the NSW *TSC Act 1995*. These areas correspond to vegetation communities 1 and 2 from this study. However, given the different listing criteria, a more restricted area of remnants meets the definition of the equivalent *White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands* ecological community which is listed as Critically Endangered under the Commonwealth *EPBC Act 1999*. The Commonwealth-listed ecological community generally corresponds to Community 2 only of this study. The current quarry, haul and bypass roads proposal would result in the removal of a minor proportion of the total occurrence of the EEC in the study area and entire study locality, and possible indirect ongoing disturbances to the community during the operational phase of the quarry. However, assessment of the likely impacts on the EEC under the NSW and Commonwealth assessment provisions concluded that overall these are not considered to be significant, and recommendations have been made to ameliorate the effects of these impacts in the next section.

Two threatened fauna species, the Eastern Bent-wing Bat and Speckled Warbler, were positively identified within the subject site during the survey period. In addition, a probable identification of the Eastern False Pipistrelle and a possible identification of the Southern Myotis were made using ultrasonic call analysis. A number of other threatened fauna species have potential to occur or occasionally visit the subject site on an opportunistic basis. Potential impacts on all listed threatened fauna species have been addressed in **Section 4.2.3**. The main impacts of the proposed quarry and haul roads are expected to be an increased risk of injury or death from being hit by a vehicle, the loss of some known or potential habitat (in particular the removal of hollow-bearing trees) and the potential for some threatened species to move away from the proposed development area due to increased noise, dust and night-time light. These potential impacts are not expected to significantly impact any population of threatened fauna species. The overall conclusion from the 'seven-part test' for threatened fauna is that there is unlikely to be any significant impact on any local population of threatened fauna in the area.

Other issues associated with the proposed quarry include minor vegetation removal and potential further degradation of ephemeral creeklines in the area. Vegetation clearing would be required as a result of the proposed development. At Site 1 the bulk of clearing would take place at the proposed quarry site, though some trees along the access road route may also require removal. At Sites 2, 3 and 4 vegetation along the proposed haul road route would require removal. While no known roost or nest sites for any threatened fauna species are expected to be affected, it is recommended that

6.0 RECOMMENDATIONS

In order to maximise conservation of local flora and fauna and to ameliorate impacts of the proposal on the local natural environment (including potential habitat for threatened or significant species or ecological communities), it is recommended that the following steps be taken within the subject site:

- Given the significance of the vegetation communities and fauna in the watercourse areas in sites 1 and 2, as wide a buffer as possible should be maintained between the top of the creek bank and the edge of the proposed quarry pit, haul road or bypass roads (except where creek crossings are required).

- Habitat trees should be retained if possible. As some habitat trees are likely to require removal, this should be timed so as to avoid the breeding season of hollow-reliant threatened fauna. In addition, tree removal should not take place in winter as hollow-roosting bats enter torpor at this time of year. Ideally habitat trees should be removed between March and May inclusive or September. If clearing operations are unable to be timed so as to avoid the main spring/summer breeding period and winter months when bats enter torpor, then a number of mitigative measures could assist in reducing impacts on hollow-reliant fauna. These include pre-clearing surveys of those hollow-bearing likely to be removed and the presence of an experienced fauna handler during clearing operations. In addition, felling trees in sections or laying them down gently would minimise the risk fauna being injured. If a nest or maternity roost is discovered during clearing operations, this tree should be left standing until an ecologist has reviewed the situation.

- For any habitat trees being removed during tree-felling operations, an experienced wildlife handler should be in attendance in order to rescue injured or displaced wildlife.

- At the detailed planning stage for the proposed haul road, habitat trees that may be affected will need to be assessed in the field.

- As Speckled Warblers were observed foraging in introduced shrubs and small trees at Site 2, it is recommended that these be retained. Active regeneration of degraded habitat would assist in improving the quality of Speckled Warbler habitat, however it is important to retain the existing exotic shrubs and small trees until suitable replacement native habitat is in place as these currently provide important habitat for the Speckled Warbler. A number of suitable replacement native shrub species were recorded within the site, including *Ozothamnus diosmifolius* Ball Everlasting, *Brachyloma daphnoides* Daphne Heath, *Melichrus urceolatus* Urn Heath, *Acacia brownii* Heath Wattle, *Acacia mearnsii* Black Wattle, *Acacia obtusata*, *Kunzea parvifolia* Violet Kunzea, *Leptospermum polygalifolium* Lemon-scented Tea-tree and *Leptospermum trinervium* Paperbark Tea-tree.

- Replanting existing cleared areas at the Brayton Road main project site with suitable vegetation would assist in extending Speckled Warbler habitat in the general area. This could be linked to the planned riparian vegetation establishment areas and would be most beneficial in the south-eastern corner, or elsewhere within the site where the replanting areas would connect to existing vegetation off-site.

- It is recommended that grazing be excluded from within the Joarimin Road site to allow for the natural regeneration of Speckled Warbler habitat.

- The Speckled Warbler lays its eggs sometime between August and January in a nest that it builds on the ground amongst fallen branches or litter, or at the base of a low, dense plant. Any works activities within Site 2 (in particular vegetation clearing) should take place out of the breeding season for the Speckled Warbler so as to avoid destroying any nest sites containing eggs or chicks. If a nest containing eggs or chicks is discovered during clearing operations, it and the surrounding vegetation should be left until the young are fully mobile and capable of fending for themselves.

- Appropriate sediment and erosion control measures should be implemented for the duration of construction and quarrying operations in all affected parts of the study area. In particular, steps should be taken (silt fences, cut-off drains, detention basins etc.) to prevent silt and sediment from the quarry or roads from entering the watercourses.

- At the old tip site in Site 2, a number of 'junk' piles of concrete, tin, etc. provide excellent habitat for a range of reptile species. It is recommended that these be retained.

- In order to improve flora and fauna habitat quality within the subject site, it is recommended that grazing be excluded from areas identified for regeneration (ie. fenced off).

- It is recommended that offset areas equal to (or preferably greater than) the area of vegetation to be cleared be set aside for regeneration (this may include rehabilitation and/or revegetation works).

- A vegetation and weed management strategy should be prepared detailing ongoing vegetation restoration and weed control activities within the remnant areas of woodland vegetation that would be used as compensatory areas. However it is important that all shrubs, including dead plants, be left in situ until suitable replacement native shrubs grow up, as they provide important shelter for the Speckled Warbler and other small birds.

- Rehabilitation efforts should concentrate on the areas identified as forming part of the EEC in the study area. Assisted natural regeneration of the vegetation is the preferred approach wherever practical. However, if artificial plantings are to be used, only native species currently occurring on the subject site (see Appendix 1) or local species listed as occurring within the EEC according to the Final Determination (NSW Scientific Committee 2002a) should be used.

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8.0 APPENDICES

Appendix 1. Flora Species Recorded in the Study Area

The following is a list of all flora species recorded within the study area. Please note that this list may be not fully comprehensive, and should be regarded as an indication of the flora present. A period of some years is often needed to identify all species present in an area, particularly for cryptic or seasonally detectable species (such as orchids and small grass-like herbs).

Notes:

* indicates an exotic or introduced native species
R indicates locally indigenous species that are potentially suitable for revegetation or replanting works

Nomenclature follows Harden (1990, 1992, 1993, 2002), Harden & Murray (2000) and subsequent recent revisions.

Study Site
1 – Quarry and Haul Road site, Brayton Road
2 – Bypass Road in old tip site - Joarimin Creek Road area
3 – Bypass Road along unformed Crown road west of Red Hills Road
4 – Junction of Red Hills Road with Hume Highway

CLASS / FAMILY / *Scientific Name*		**Common Name**	**Site**			
			1	**2**	**3**	**4**
CLASS FILICOPSIDA (Ferns)						
ADIANTACEAE						
Cheilanthes sieberi subsp. *sieberi*	R	Mulga Fern	1	2	3	
AZOLLACEAE						
Azolla pinnata	R	Ferny Azolla	1			
DENNSTAEDTIACEAE						
Pteridium esculentum		Bracken			3	4
CLASS CONIFEROPSIDA (Conifers)						
PINACEAE						
*Pinus radiata**		Radiata Pine			3	4
CLASS MAGNOLIOPSIDA (Flowering Plants)						
Subclass Magnoliidae (Dicotyledons)						
AMYGDALACEAE						
*Prunus domestica**		Plum		2		
APIACEAE						
*Foeniculum vulgare**		Fennel				4
ASTERACEAE						
Chrysocephalum apiculatum		Yellow Buttons	1	2		
*Cirsium vulgare**		Spear Thistle	1	2		4
Conyza sp.*		Fleabane		2		
*Hypochaeris radicata**		Flatweed/Catsear	1	2	3	
***Leucochrysum albicans* var. *tricolor* EPBC Act - E**		**Hoary Sunray**		**2**		
Olearia viscidula	R	Wallaby Weed / Viscid Daisy Bush			3	
Ozothamnus diosmifolius	R	Ball Everlasting/Pill Flower/Rice Flower		2	3	

BORAGINACEAE						
*Echium plantagineum** (Noxious Class 4)		Paterson's Curse		2		
BRASSICACEAE						
*Hirschfeldia incana**		Hairy Brassica / Buchan Weed		2		
CASUARINACEAE						
Allocasuarina littoralis	R	Black She-oak		2		4
CHENOPODIACEAE						
Einadia hastata	R	Saloop				4
Einadia nutans subsp. *nutans*		Climbing Saltbush	1	2		
Einadia trigonos		Fishweed		2		
CLUSIACEAE						
*Hypericum perforatum** (Noxious Class 3)		St. John's Wort				4
CONVOLVULACEAE						
Dichondra repens	R	Kidney Weed	1	2		
DILLENIACEAE						
Hibbertia circumdans?		A Guinea Flower			3	
Hibbertia obtusifolia	R	Hoary Guinea Flower	1	2	3	
ERICACEAE - Subfamily Styphelioideae						
Brachyloma daphnoides	R	Daphne Heath		2		
Lissanthe strigosa	R	Peach Heath	1	2		
Melichrus urceolatus	R	Urn Heath	1	2		
FABACEAE - Subfamily Faboideae						
Hardenbergia violacea	R	False Sarsaparilla				4
*Lotus uliginosus**		Bird's Foot Trefoil	1			
Podolobium scandens	R	Netted Shaggy Pea		2		
FABACEAE - Subfamily Mimosoideae						
Acacia brownii	R	Heath Wattle		2	3	
Acacia falciformis	R	Broad-leaved Hickory			3	4
Acacia mearnsii		Black Wattle	1	2	3	4
Acacia obtusata	R	-		2		
GENTIANACEAE						
*Centaurium erythraea**		Common Centaury		2		
GERIANACEAE						
Geranium solanderi var. *solanderi*		Cutleaf Cranesbill	1	2	3	
GOODENIACEAE						
Goodenia hederacea var. *hederacea*	R	Ivy Goodenia/Forest Goodenia			3	
LAMIACEAE						
Prunella vulgaris		Self Heal/Meadow Mint	1			
LORANTHACEAE						
Amyema pendulum subsp. *pendulum*		A Mistletoe	1			
MALACEAE						
*Cotoneaster glaucophyllus**		Cotoneaster		2		
MALVACEAE						
*Malva parviflora**?		Small-flowered Mallow	1			
*Modiola caroliniana**		Redflower Mallow		2		
MYRTACEAE						
Angophora melanoxylon (planted)		Coolabah Apple				4

Eucalyptus amplifolia subsp. *amplifolia*		Cabbage Gum	1	2		
Eucalyptus blakelyi	R	Blakely's Red Gum	1	2		4
Eucalyptus bridgesiana	R	Apple Box / Apple Gum		2		
Eucalyptus cinerea		Argyle Apple	1	2		4
Eucalyptus eugenioides	R	Thin-leaved Stringybark	1	2	3	
Eucalyptus macrorhyncha		Red Stringybark	1	2	3	
Eucalyptus melliodora		Yellow Box	1	2		4
Eucalyptus rossii		White Gum / Inland Scribbly Gum		2		4
Eucalyptus sieberi	R	Silver Top Ash			3	
Eucalyptus viminalis	R	Ribbon Gum		2		
Kunzea parvifolia	R	Violet Kunzea / Small-leaved Kunzea		2		4
Leptospermum polygalifolium subsp. *polygalifolium*	R	Lemon-scented Tea-tree / Tantoon		2		4
Leptospermum trinervium	R	Paperbark Tea-tree		2		
OXALIDACEAE						
Oxalis exilis		A Wood Sorrell				4
PLANTAGINACEAE						
*Plantago coronopus**		Buck's-horn Plantain		2		
*Plantago lanceolata**		Common Plantain	1	2		4
PLANTANACEAE						
Plantanus sp.*		Plane Tree				4
POLYGONACEAE						
*Acetosella vulgaris**		Sheep Sorrell		2		
Rumex brownii		Swamp Dock		2		
Rumex sp.		A Dock	1			
PRIMULACEAE						
*Anagallis arvensis**		Pimpernel				4
ROSACEAE						
Acaena novae zelandiae		Bidgee Widgee / Biddy Widdy		2		
*Rosa rubiginosa** (Noxious Class 4)		Sweet Briar	1	2	3	
Rubus fruticosus species aggregate* (Noxious Class 4)		Blackberry	1	2	3	
RUBIACEAE						
Pomax umbellata	R	Pomax			3	
SCROPHULARIACEAE						
*Verbascum virgatum**		Twiggy Mullein			3	
SOLANACEAE						
Solanum pungetium		Eastern Nightshade	1	2	3	
VERBENACEAE						
*Verbena bonariensis**		Purpletop	1			
Subclass Liliidae (Monocotyledons)						
ANTHERICACEAE						
Tricoryne elatior	R	Yellow Rush-lily		2		
CYPERACEAE						
Baumea rubiginosa	R	Soft Twig-rush		2		
Carex breviculmis	R	Short-stem Sedge	1			
Lepidosperma gunnii	R	A Rapier-sedge			3	
Lepidosperma laterale	R	Flat Sword-sedge			3	
Schoenoplectus validus	R	River Club-rush		2		
JUNCACEAE						
Juncus sarophorus	R	A Rush	1			

Juncus usitatus	R	Common Rush	1	2		
LOMANDRACEAE						
Lomandra filiformis subsp. *coriacea*	R	Wattle Mat-rush	1			
Lomandra multiflora subsp. *multiflora*	R	Many-flowered Mat-rush		2		
Lomandra obliqua	R	Fish Bones		2		
PHORMIACEAE						
Stypandra glauca	R	Nodding Blue Lily			3	
POACEAE						
Austrodanthonia sp.	R	Wallaby Grass	1	2		
Austrostipa scabra		A Speargrass			3	
Austrostipa sp.		A Speargrass	1	2		
*Briza maxima**		Quaking Grass	1			
*Briza minor**		Shivery Grass		2		
*Cynodon dactylon**		Couch		2		
Dichelachne micrantha	R	Shorthair Plumegrass	1	2		
Echinopogon caespitosus var. *caespitosus*	R	Hedgehog Grass	1	2		
Eragrostis brownii	R	Brown's Love Grass		2		
Microlaena stipoides	R	Weeping Grass		2	3	
*Nassella trichotoma** (Noxious Class 4)	R	Serrated Tussock / Yass Tussock	1	2	3	
Panicum effusum		Hairy Panic / Poison Panic	1	2		
Panicum sp.		A Panic	1			
Panicum maximum var. *maximum**		Guinea Grass				4
*Paspalum dilatatum**		Paspalum	1	2		4
*Phalaris aquatica**		Toowoomba Canary Grass		2		
*Poa annua**		Winter Grass		2		4
Poa sieberiana		Snowgrass	1	2		
TYPHACEAE						
Typha orientalis	R	Bullrush/Cumbungi		2		
XANTHORRHOEACEAE						
Xanthorrhoea concava	R	A Grass-tree		2	3	

Appendix 2. Fauna recorded within the Study Area

Notes:

Approximate Centre of Subject Site (GDA94):
Map Grid 56 225284E 6157185N (Moss Vale 1:100000 map sheet)
Map Grid 55 774937E 6157185N (Goulburn 8828 1:100000 map sheet)

* indicates introduced species (not native to the area)
[1] indicates number of captures, not necessarily number of individuals
Bold indicates a threatened species
V - Vulnerable, E – Endangered, M- Migratory

Observation types:

O	observed	W	Heard	H	Hair, feathers or skin
F	tracks/scratchings	P	scat	E	Nest/roost
T	Trapped or netted	Y	Bone or teeth	Z	In raptor/owl pellet
K	Dead	X	In scat	R	Road kill
M	Miscellaneous	U	Ultrasonic call	d	Definite identification
p	Probable identification	po	Possible identification		

Mammals

Family / Scientific Name	Common Name	TSC Act	NPWS code	Site 1 Main Area (proposed quarry, plant & road)	Site 2 Joarimin Ck Rd (proposed road)	Sites 3 & 4 Open Pasture & Pine Plantation (proposed road)	Opportunistic (off-site)
Family: *TACHYGLOSSIDAE*							
Tachyglossus aculeatus	Short-beaked Echidna		1003	1 (O)			
Family: *VOMBATIDAE*							
Vombatus ursinus	Common Wombat		1165	1+ (O/P/F)	1+ (O/P)	2 (O/F)	
Family: *PETAURIDAE*							
Petaurus breviceps	Sugar Glider		1138	1 (O/W)	2 (O/W)	3 (O)	
Family: *PSEUDOCHEIRIDAE*							
Pseudocheirus peregrinus	Common Ringtail Possum		1129			2 (O)	
Family: *PHALANGERIDAE*							
Trichosurus vulpecula	Common Brushtail Possum		1113		1 (O)		
Family: *MACROPODIDAE*							
Macropus giganteus	Eastern Grey Kangaroo		1265	3 (O)	2 (O)	3 (O)	
Macropus robustus	Common Wallaroo		1266			1 (O)	
Wallabia bicolor	Swamp Wallaby		1242				1 (O)

Family / Scientific Name	Common Name	TSC Act	NPWS code	Site 1 Main Area (proposed quarry, plant & road)	Site 2 Joarimin Ck Rd (proposed road)	Sites 3 & 4 Open Pasture & Pine Plantation (proposed road)	Opportunistic (off-site)
Family: *MOLOSSIDAE*							
Mormopterus sp. 4 (Adams et al)	Southern Freetail-bat		9044	Up	Up		
Tadarida australis	White-striped Freetail-bat		1324	4+ (W,Ud)	2 (W,Ud)	3 (W)	
Family: *VESPERTILIONIDAE*							
Miniopterus schreibersii oceanensis	**Eastern Bent-wing Bat**	**V**	**1341**	Ud	Ud	Ud	
Nyctophilus sp.	–		–	Ud	Ud	Ud	
Nyctophilus geoffroyi	Lesser Long-eared Bat		1335	6[1] (T)			
Chalinolobus gouldii	Gould's Wattled Bat		1349	1[1] (T,Ud)	Ud	Ud	
Chalinolobus morio	Chocolate Wattled Bat		1351	2[1] (T,Ud)	Ud	Ud	
Falsistrellus tasmaniensis	**Eastern False Pipistrelle**	**V**	**1372**	Up	Up	Upo	
Myotis macropus	**Southern Myotis**	**V**	**1357**			Upo	
Scotorepens greyii	Little Broad-nosed Bat		1362		Upo		
Scotorepens orion	Eastern Broad-nosed Bat		1365	1[1] (T,Up)	Upo	Upo	
Vespadelus darlingtoni	Large Forest Bat		1022	10[1] (T,Ud)	Ud	Ud	
Vespadelus regulus	Southern Forest Bat		1378	7[1] (T,Ud)	Up	Up	
Vespadelus vulturnus	Little Forest Bat		1379	10[1] (T,Ud)	Ud	Ud	
Family: *CANIDAE*							
Vulpes vulpes *	Fox		1532	2 (O)	1 (O)		
Family: *LEPORIDAE*							
Oryctolagus cuniculus *	Rabbit		1510	3 (O)	5+ (O)	2 (O)	
Lepus capensis *	Brown Hare		1511		1 (O)		

Reptiles

Family / Scientific Name	Common Name	TSC Act	NPWS code	Site 1 Main Area (proposed quarry, plant & road)	Site 2 Joarimin Ck Rd (proposed road)	Sites 3 & 4 Open Pasture & Pine Plantation (proposed road)	Opportunistic (off-site)
Family: *AGAMIDAE*							
Amphibolurus muricatus	Jacky Lizard		2194	10+ (O)	7+ (O)		

Family / Scientific Name	Common Name	TSC Act	NPWS code	Site 1 Main Area (proposed quarry, plant & road)	Site 2 Joarimin Ck Rd (proposed road)	Sites 3 & 4 Open Pasture & Pine Plantation (proposed road)	Opportunistic (off-site)
Family: *SCINCIDAE*							
Egernia cunninghami	Cunningham's Skink		2408	1 (O)	3 (O)		
Hemiergis decresiensis	Three-toed Skink		2441		2 (O)		
Lampropholis guichenoti	Garden Skink		2451	1+ (O)	4+ (O)		
Tiliqua scincoides	Eastern Blue-tongued Lizard		2580	1 (O)	1 (O)		
Family: *ELAPIDAE*							
Pseudechis porphyriacus	Red-bellied Black Snake		2693	1 (O)			

Frogs

Family / Scientific Name	Common Name	TSC Act	NPWS code	Site 1 Main Area (proposed quarry, plant & road)	Site 2 Joarimin Ck Rd (proposed road)	Sites 3 & 4 Open Pasture & Pine Plantation (proposed road)	Opportunistic (off-site)
Family: *MYOBATRACHIDAE*							
Crinia parinsignifera	Plains Froglet		3131	1+ (O/W)	4 (O/W)		
Crinia signifera	Common Eastern Froglet		3134	3+ (O/W)			
Limnodynastes peronii	Striped Marsh Frog		3061	3 (W)			
Limnodynastes tasmaniensis	Spotted Grass Frog		3063	2 (O/W)	8+ (O/W)		
Uperoleia fusca	Dusky Toadlet		3035	1 (O)			
Uperoleia laevigata	Red-groined Toadlet		3158	2 (O/W)	1+ (O/W)		
Family: *HYLIDAE*							
Litoria peronii	Peron's Tree Frog		3204	2 (W)	4 (W)		

Birds

Family / Scientific Name	Common Name	TSC Act	NPWS code	Site 1 Main Area (proposed quarry, plant & road)	Site 2 Joarimin Ck Rd (proposed road)	Sites 3 & 4 Open Pasture & Pine Plantation (proposed road)	Opportunistic (off-site)
Family: *ANATIDAE*							
Chenonetta jubata	Australian Wood Duck		202	2 (O)			
Anas superciliosa	Pacific Black Duck		208	4 (O)			
Family: *PODICIPEDIDAE*							
Tachybaptus novaehollandiae	Australasian Grebe		61	2 (O)			
Family: *ARDEIDAE*							
Egretta novaehollandiae	White-faced Heron		188	1 (O)			
Family: *THRESKIORNITHIDAE*							
Threskiornis spinicollis	Straw-necked Ibis		180	2 (O)			
Family: *ACCIPITRIDAE*							
Hieraeetus morphnoides	Little Eagle		225		1 (O)		
Family: *FALCONIDAE*							
Falco berigora	Brown Falcon		239	2 (O)	1 (O)		
Falco longipennis	Australian Hobby		235		1 (O)		
Falco cenchroides	Nankeen Kestrel		240	1 (O)	1 (O)	3 (O)	
Family: *CHARADRIIDAE*							
Vanellus miles	Masked Lapwing		133	2 (W)			
Family: *COLUMBIDAE*							
Phaps chalcoptera	Common Bronzewing		34	2 (O)			
Ocyphaps lophotes	Crested Pigeon		43	4 (O)	2 (O/W)		
Family: *CACATUIDAE*							
Eolophus roseicapillus	Galah		273	2 (O)	1 (O)		
Cacatua galerita	Sulphur-crested Cockatoo		269	1 (W)			
Family: *PSITTACIDAE*							
Glossopsitta concinna	Musk Lorikeet		258	2+ (O/W)			
Glossopsitta pusilla	Little Lorikeet		260	10 (O/W)	1 (W)		
Platycercus elegans	Crimson Rosella		282		2 (O)	2 (O/W)	
Platycercus eximius	Eastern Rosella		288	4 (O/W)	7 (O/W)		

Family / Scientific Name	Common Name	TSC Act	NPWS code	Site 1 Main Area (proposed quarry, plant & road)	Site 2 Joarimin Ck Rd (proposed road)	Sites 3 & 4 Open Pasture & Pine Plantation (proposed road)	Opportunistic (off-site)
Psephotus haematonotus	Red-rumped Parrot		295	8+ (O/W)			
Family: *PODARGIDAE*							
Podargus strigoides	Tawny Frogmouth		313	1 (W)	1 (O/W)		
Family: *AEGOTHELIDAE*							
Aegotheles cristatus	Australian Owlet-nightjar		317	2 (W)	2 (W)	1 (W)	
Family: *ALCEDINIDAE*							
Dacelo novaeguineae	Laughing Kookaburra		322	1 (O)	1 (O/W)	2 (W)	
Family: *CORACIIDAE*							
Eurystomus orientalis	Dollarbird		318		1 (O/W)		
Family: *CLIMACTERIDAE*							
Cormobates leucophaeus	White-throated Treecreeper		558		1 (W)	3 (W)	
Family: *MALURIDAE*							
Malurus cyaneus	Superb Fairy-wren		529		5+ (O/W)		
Malurus lamberti	Variegated Fairy-wren		536	5 (O/W)			
Family: *PARDALOTIDAE*							
Pardalotus punctatus	Spotted Pardalote		565	5+ (O/W)	1 (W)	1 (W)	
Pardalotus striatus	Striated Pardalote		976	2+ (W)	1 (W)		
Chthonicola sagittata	**Speckled Warbler**	**V**	**504**		**2 (O)**		
Smicrornis brevirostris	Weebill		465	2 (O/W)	2 (O/W)		
Gerygone fusca	Western Gerygone		463	1 (O/W)	1 (W)		
Gerygone olivacea	White-throated Gerygone		453	1 (W)			
Acanthiza pusilla	Brown Thornbill		475		1+ (O)	3 (W)	
Acanthiza reguloides	Buff-rumped Thornbill		484		1+ (O)	5+ (W)	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill		486	5 (O)			
Acanthiza lineata	Striated Thornbill		470	5 (O/W)	1+ (O)	4+ (O/W)	
Aphelocephala leucopsis	Southern Whiteface		466	1 (O)			
Family: *MELIPHAGIDAE*							
Anthochaera carunculata	Red Wattlebird		638	1 (W)			

Family / Scientific Name	Common Name	TSC Act	NPWS code	Site 1 Main Area (proposed quarry, plant & road)	Site 2 Joarimin Ck Rd (proposed road)	Sites 3 & 4 Open Pasture & Pine Plantation (proposed road)	Opportunistic (off-site)
Philemon corniculatus	Noisy Friarbird		645	5+ (O)		2+ (O/W)	
Manorina melanocephala	Noisy Miner		634	10+ (O/W)	8+ (O/W)		
Melithreptus brevirostris	Brown-headed Honeyeater		583			1 (W)	
Family: *PETROICIDAE*							
Petroica multicolor	Scarlet Robin		380			1 (W)	
Petroica goodenovii	Red-capped Robin		381			1 (W)	
Eopsaltria australis	Eastern Yellow Robin		392			1 (W)	
Family: *NEOSITTIDAE*							
Daphoenositta chrysoptera	Varied Sitella		549			2 (W)	
Family: *PACHYCEPHALIDAE*							
Pachycephala rufiventris	Rufous Whistler		401	1 (W)	1 (W)	1 (W)	
Colluricincla harmonica	Grey Shrike-thrush		408			2 (W)	
Family: *DICRURIDAE*							
Grallina cyanoleuca	Magpie-lark		415	3 (W)	2 (O/W)	1 (W)	
Rhipidura fuliginosa	Grey Fantail		361	1 (W)		1 (O/W)	
Rhipidura leucophrys	Willie Wagtail		364	1 (O/W)	1 (O/W)		
Family: *CAMPEPHAGIDAE*							
Coracina novaehollandiae	Black-faced Cuckoo-shrike		424	2 (O)	2 (O)		
Lalage sueurii	White-winged Triller		430	2 (O)			
Family: *ARTAMIDAE*							
Artamus superciliosus	White-browed Woodswallow		545	20+ (O)			
Artamus cyanopterus	Dusky Woodswallow		547	15+ (O)	5 (O)		
Cracticus torquatus	Grey Butcherbird		702	2 (W)	2 (O/W)		
Gymnorhina tibicen	Australian Magpie		705	1 (W)	3 (O/W)	2 (W)	
Strepera graculina	Pied Currawong		694		1 (W)	1 (W)	
Strepera versicolor	Grey Currawong		697			1 (W)	
Family: *CORVIDAE*							
Corvus coronoides	Australian Raven		930	2 (W)	3 (O/W)	3 (W)	

Family / Scientific Name	Common Name	TSC Act	NPWS code	Site 1 Main Area (proposed quarry, plant & road)	Site 2 Joarimin Ck Rd (proposed road)	Sites 3 & 4 Open Pasture & Pine Plantation (proposed road)	Opportunistic (off-site)
Family: *CORCORACIDAE*							
Corcorax melanorhamphos	White-winged Chough		693	5 (O)	3+ (W)	6+ (O/W)	
Family: *MOTACILLIDAE*							
Anthus novaeseelandiae	Richard's Pipit		647	2 (O)			
Family: *DICAEIDAE*							
Dicaeum hirundinaceum	Mistletoebird		564			1 (W)	
Family: *HIRUNDINIDAE*							
Hirundo neoxena	Welcome Swallow		357	4 (O/E)			
Hirundo ariel	Fairy Martin		360	5+ (O/E)			
Family: *STURNIDAE*							
Sturnus vulgaris *	Common Starling		999	50+ (O)	20+ (O)	20+ (O/W)	

Appendix 3. Fish Species recorded in Goulburn-Mulwaree Council Area

Fish recorded in Goulburn Mulwaree Council Area, July 1955 to June 2004

Scientific Name	Common Name
Anguilla australis	Shortfinned Eel
Anguilla reinhardtii	Longfinned Eel
Bidyanus bidyanus	Silver Perch
Galaxias olidus	Mountain Galaxias
Gobiomorphis australis	Striped Gudgeon
Gobiomorphus coxii	Cox's Gudgeon
Hypseleotris galii	Fire-tailed Gudgeon
Leipotherapon unicolor	Spangled Perch
Macquaria australasica	Macquarie Perch
Macquaria novemaculaeata	Australian Bass
Notesthes robusta	Bullrout
Philypnodon grandiceps	Flathead Gudgeon
Potamalosa richmondia	Freshwater Herring
Prototroctes maraena	Southern Grayling
Pseudaphritis urvillii	Congolli
Retropinna semoni	Australian Smelt
Tandanus tandanus	Freshwater Catfish

(Source: Goulburn Mulwaree State of the Environment Report, 2004)

habitat trees be retained within the site wherever possible as they provide potential shelter and breeding habitat for a wide range of fauna species.

The potential impacts on flora and fauna within the study area could be mitigated by provision of compensatory habitat to offset the vegetation cleared or disturbed. This should include appropriate rehabilitation, regeneration and revegetation of suitable areas within the subject site. The implementation of an appropriate and effective vegetation management plan could be extremely valuable in assisting to improve ecological values within the subject site.

Appendix 4. Project Personnel and Relevant Licenses

REPORT COMPONENT	STUDY TEAM MEMBERS	QUALIFICATIONS
Overall Project Management, Flora Field Surveys, Flora Descriptions, Report Writing	Stefan Rose	B.Sc (Biol. Sci), M.Env.Stud., MAIBiol, MECA
Analysis of Bat Detector Tapes	Ray Williams	Biol. Tech. Cert., MECA
Fauna Field Surveys, Report Writing, Figures	Jenny Lewis	B.Sc (Res. & Env. Mgt.), TAFE Cert II (Conserv. & Land Mgt. Nat. Area Rest.)
Fauna Field Surveys, Analysis of Bat Detector Tapes	Narawan Williams	TAFE Cert II (Conserv. & Land Mgt. Nat. Area Rest.)
Literature Review	Amy Rowles	B.Sc. (Hons)

Relevant licences held by Ecotone Ecological Consultants

TYPE	FOR	LICENCE NO	NAME	DATE VALID TO	ORGANISATION	LOCATION
Animal Research Authority	Vertebrate Fauna Surveys	AW94/082	Brian Wilson	15-Nov-07	Animal care and ethics committee of the Director-General of NSW Agriculture	NSW
Certificate of Approval	Vertebrate Fauna Surveys	DG's ACEC 94/082	Brian Wilson	15-Nov-08		
Licence to	Access NPWS Wildlife Atlas Data Base	CON93002	Brian Wilson	30-June-08	NSW Department of Environment and Conservation	
Scientific Licence	Harm/ trap/ release: protected fauna; pick/ hold: native flora	S10555	Brian Wilson Stefan Rose Jenny Lewis Amy Williams Narawan Williams Anne Williams	30-Jun-08		
	As above plus bat banding	S10556	Ray Williams	31-Aug-08		

Specialist Consultant Studies Compendium

Gunlake Quarries
Gunlake Quarry Project

ENVIRONMENTAL ASSESSMENT

VOLUME IV

Part 8A
Laterals Planning
Review of Environmental Factors.
Proposal for Road Widening and New Road Construction.

February 2008

REVIEW OF ENVIRONMENTAL FACTORS

Under PART 5
ENVIRONMENTAL PLANNING AND ASSESSMENT ACT
1979

PROPOSAL FOR ROAD UPGRADING

Product Transport Route for proposed Hard Rock Quarry
Marulan
Goulburn Mulwaree Local Government Area

Prepared by:
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October 2007 Reference No. 7048/2

CONTENTS

1 .0 INTRODUCTION

This Review of Environmental Factors (REF) has been conducted by Laterals for Gunlake Quarries, a division of Rollers Australia. It reviews the environmental factors that may be impacted by the prosed upgrade of a section of Brayton Road and a section of Red Hills Road Marulan.

These roads are part of the proposed product transport route for a new quarry being proposed by Gunlake Quarries.

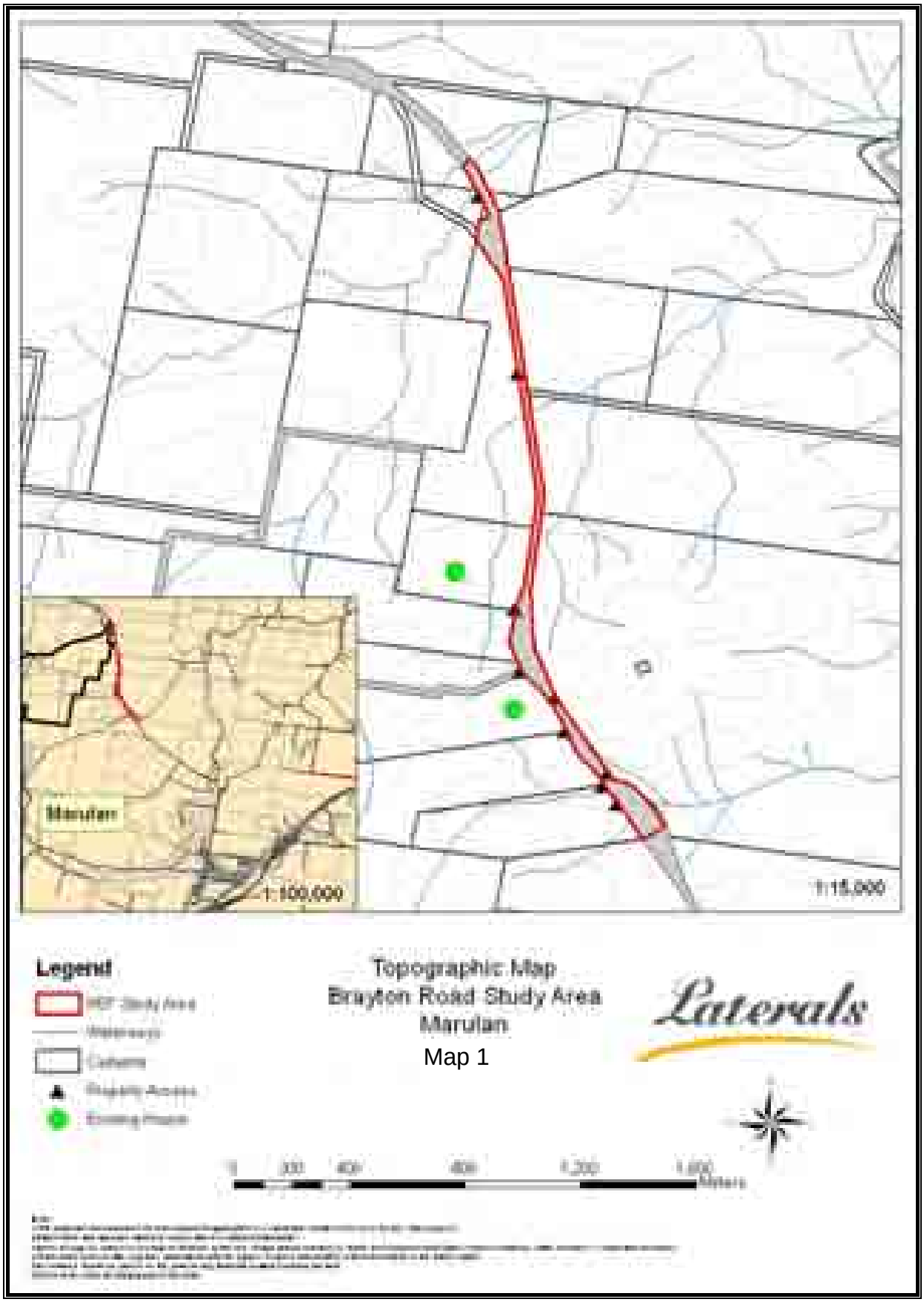
The REF is an assessment for the potential environmental impacts of the proposed road works and it identifies the environmental management and mitigation measures that shall be implemented at the time of works and maintained after works have been completed ensuring no unacceptable levels of impact occur. The review is carried out in accordance with the requirements of Part 5 of the Environmental Planning and Assessment Act 1979 and Environmental Planning and Assessment Regulations 2000. It is understood it will form part of a Project Application under Part 3A of the EP&A Act.

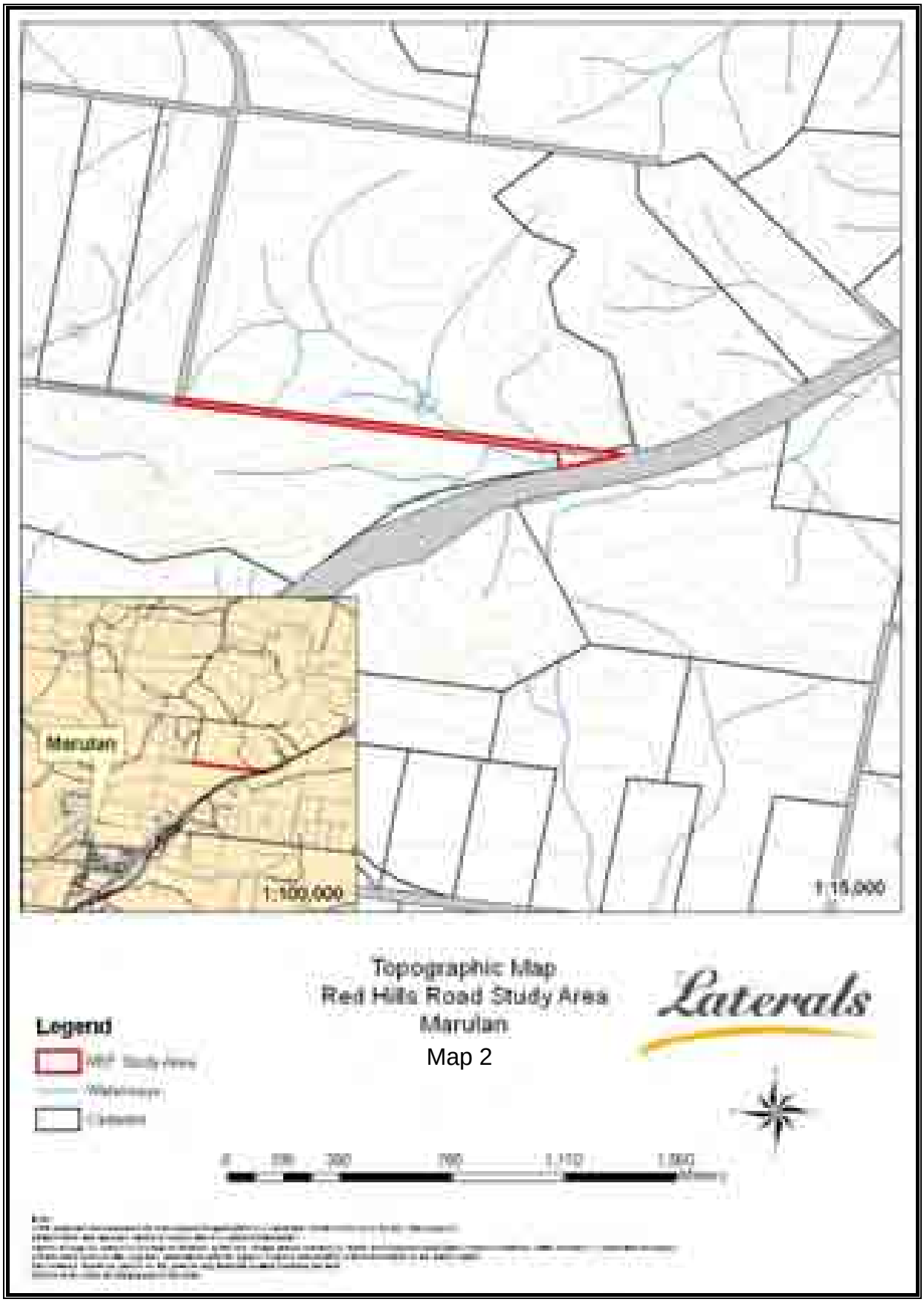
This review does not assess the design of the road to be constructed. The upgrade is proposed to be constructed by contractors with consideration for environmental impacts and the mitigation measures recommended within the REF.

1.1 Locality

Brayton and Red Hills Roads are located to the north and northeast of Marulan respectively as detailed in Maps 1 & 2 below.

The district has a long history of agriculture and extractive industry. Despite past impacts to native vegetation, remnants of native vegetation are widespread in this area and scatted intermittently along these sections of road.


Marulan
1:100,000
1:15,000
Legend
Topographic Map
Brayton Road Study Area
Marulan
Map 1
Laterals


Marulan
1:100,000
1:15,000
Topographic Map
Red Hills Road Study Area
Marulan
Map 2
Legend

1.2 Outline of Project

It is proposed to upgrade the travel and width of sections of Brayton and Red Hills Roads as indicated in above maps.

This upgrade has been considered necessary to cater for additional heavy vehicle traffic that will use these sections of road as a haul route for a proposed new quarry on Brayton Road. This will also involve construction of road between Brayton Road and Red Hills Road. The impact of this activity has been assessed separately and is not a part of this REF.

1.2.1.1 Activities

Activities will include:

1. Site preparation, including works compounds and temporary erosion and sediment controls.
2. Tree clearance and earthworks, including excavation of cuttings and fill placement for embankments and stockpiling of soils, gravel and road surface metal.
3. Drainage, including the installation of under road drainage pipes, the extension of existing under road drainage pipes, and the construction of longitudinal drains along the roadside with appropriate mitre drains.
4. Pavement construction, including preparing and placing base and sub-base courses and the placing of the bitumen seal surface.
5. Post construction works, including soil stabilisation, maintenance of erosion and sediment controls, rehabilitation of erosion and sediment controls in the event of failure, placement of reserved topsoils and revegetation with grasses, tree planting in areas for rehabilitation, pavement marking and advisory signs as necessary for a local road, rehabilitation of the works compound and removal of any oil or other accidental chemical spills and the general clean up of the activity area.

1.2.1.2 Work compounds and Stockpile Sites

The compounds are used to store construction materials, machinery and oils and other chemicals that are typically used during road construction.

Vacant land is most likely to be used for the works compound and stockpile sites. At present the sites are not identified. Care should be taken to ensure that the site takes into consideration the potential for environmental impact, including vegetation (especially hollow trees), power and telephone services, dams and existing drainage, and proximity to residences. Controls need to be designed to prevent contamination of any dam or drainage line by runoff from the compounds, and dust and noise controls.

In determining and approving the location of the works compound the following general criteria would need to be complied with:

- Be in areas already cleared of native vegetation, such as the construction zone or agricultural paddocks. They should be established where native vegetation disturbance is minimal or weeds dominate, and requiring minimal or no clearing of native vegetation. No trees or large shrubs should be

removed for the establishment of the works compound or stockpile sites if they are located outside the construction zone.

- Not be located in areas subject to floods.
- Not be established on highly erodible soils unless it is unavoidable. In these circumstances, appropriate soil-specific erosion control measures need to be developed and implemented.
- Be provided with erosion and sediment controls prior to occupation.
- Drainage controls including diversion drains and perimeter banks, and the bunding of liquid storage areas should be installed prior to the compounds being occupied and should be maintained and renewed as necessary during the construction period to ensure their effectiveness.
- Be located as far away from any natural watercourse as practicable.
- Not unduly interfere with the agricultural or other economic activities in the area.
- Be as far away from nearby residences so as to cause the least interference from dust and noise impact on the residence.
- Be restored at the completion of the occupation.
- Preference should be given to re-occupying previously established works compound sites, stockpile sites or other highly disturbed areas.
- Concrete trucks should not be allowed to wash out concrete residue at the site.
- The works compound should be securely fenced against theft and vandalism if considered necessary by the Quarry Manager.
- Plant and machinery should be secured against theft and unauthorised use when not in use.
- All chemicals stored on-site should be stored in a lockable storage shed/ temporary building with a floor. The shed would be surrounded by an earth bund that is able to contain at least 110% of the volume of the largest container stored in it.
- Materials for the cleaning up of any chemical spills such as hydrocarbon absorbent booms (for use in waterways) and loose absorbent material would be kept at the works compound. Fire extinguishers of a type appropriate to the materials stored at the compound would also be kept on site.
- No fuels would be stored at the works compound. Plant and equipment should be refuelled from refuelling trucks on-site, or at the Contractor's main depot off-site. Refuelling and other machinery maintenance would be undertaken in specially designated bunded areas designed to enable any spilled fuels and oils to be contained on-site and cleaned up.

1.2.1.3 Equipment

Typical equipment to be used for road construction activities include, medium-heavy tractor dozers, compactors and rollers, excavators, front-end loaders, trucks, graders, water carts and backhoes.

1.2.1.4 Methods

The methods to be employed in the project would follow standard road construction practices. No need for any non-standard construction methods have been identified.

There is no identified need for on-site concrete batching plants or mobile bitumen plants. Base and sub base construction materials are to be sourced from the road site and existing suppliers.

1.2.1.5 Working hours

The working hours of the project are specified as 7am to 6pm Monday to Friday (excluding Public holidays) and 8am to 1pm Saturdays. No work is proposed to be carried out on a Sunday or on Public holidays. Any extension of these working hours for extenuating circumstances may only be approved by the Quarry Manager and potentially affected landowners and residents are to be advised by a letter box drop or site visit at least 2 days prior to the work occurring.

1.2.1.6 Contractors

Contractors will employ their specific construction techniques but are expected to comply with the design requirements for the road and the need to employ environmental mitigation measures as identified in this report and other laws normally applying within the state. This will include an assurance that landowners adjoining the road works are not inconvenienced and works do not cause unreasonable interruption to farm management practices or other existing operations.

1.2.2 Need of Project

The proposed upgrade of these sections of Brayton and Red Hills Roads is needed to provide improved safety and efficiency associated with the road and the additional traffic that will use the road as a result of the proposed new quarry and any potential future development.

1.2.3 Options Considered

To “Do nothing” would result in accelerated deterioration of the existing road condition as a result of additional heavy vehicle traffic resulting in an inappropriate burden on rate payers and road users as well as causing an unacceptable environmental impact.

Having regard to the above considerations it was decided that the works proposed on the road would provide for improved road safety, transport movement and environmental improvements.

1.3 Justification and Need of Project

Justification of the project, beyond the above considerations of strategies, objectives and needs is in relation to the potential for the project to be carried out without significant environmental impact and to take mitigation measures to provide for a neutral or beneficial impact on the environment.

The following sections address this justification need and provide recommendations for environmental mitigation measures to be employed for the project. With these measures employed satisfactorily the project is considered justifiable.

2.0 PLANNING CONTEXT

2.1 MULWAREE LOCAL ENVIRONMENTAL PLAN 1995

Under Mulwaree Local Environmental Plan 1995 the road is zoned 1(a) General Rural.

In accordance with that plan and provisions of the Environmental Planning and Assessment Model Provisions 1980 (Schedule 1) the proposal for its length of Brayton and Red Hills Road (public roads not classified under the Roads Act 1993) is permissible without development consent but subject to the assessment provisions of Part 5 of the Environmental Planning and Assessment Act 1979 and Environmental Planning & Assessment Regulations 2000.

The proposal is also exempt in accordance with the provisions of clause 15 (subclauses 1 (a) (i) and (iii) of Schedule 1 of State Environmental Planning Policy (Infrastructure) 2006, now considered to be imminent after public exhibition concluded on 25th May 2007.

State Environmental Planning Policy No 4 – Development Without consent and Miscellaneous Exempt and Complying Development 1981

The proposal is not identified in accordance with the provisions of clause 11C of State Environmental Planning Policy No 4 – Development Without consent and Miscellaneous Exempt and Complying Development 1981 and accordingly remains exempt under the Environmental Planning and Assessment Model Provisions 1980 (Schedule 1).

2.2 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The Environmental Planning & Assessment Act 1979 provides for the environmental assessment of development and activities within Parts 4 and 5. Part 4 provides for Local Environmental Plan's to specify permissible development within zones and details the matters to be considered for a development.

The overarching environmental assessment object of the Environmental Planning & Assessment Act 1979 contained in section 5 are:

The objects of this Act are:

(a) to encourage:
- *(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,*
- *(ii) the promotion and co-ordination of the orderly and economic use and development of land,*
- *(iii) the protection, provision and co-ordination of communication and utility services,*
- *(iv) the provision of land for public purposes,*
- *(v) the provision and co-ordination of community services and facilities, and*
- *(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and*
- *(vii) ecologically sustainable development, and*
- *(viii) the provision and maintenance of affordable housing, and*

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and

(c) *to provide increased opportunity for public involvement and participation in environmental planning and assessment.*

As the proposal to upgrade the roads does not require development consent under Mulwaree Local Environmental Plan 1995 under normal circumstances environmental assessment would need to be undertaken in accordance with Part V of the Environmental Planning and Assessment Act 1979. The proposed upgrading is a component of a larger proposal subject of a Project Application under Part 3A of the EP&A Act. In assessing the impact of this component we have met the requirements under Part 5. This will ensure that it has been assessed adequately for a Part 3A assessment.

Under Section 111 the developer has a duty to consider environmental impact in the following terms

(1) For the purpose of attaining the objects of this Act relating to the protection and enhancement of the environment, a determining authority in its consideration of an activity shall, notwithstanding any other provisions of this Act or the provisions of any other Act or of any instrument made under this or any other Act, examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity.

(2) Without limiting subsection (1), a determining authority shall consider the effect of an activity on:

(a) any conservation agreement entered into under the National Parks and Wildlife Act 1974 and applying to the whole or part of the land to which the activity relates, and

(b) any plan of management adopted under that Act for the conservation area to which the agreement relates, and

(c) any joint management agreement entered into under the Threatened Species Conservation Act 1995, and

(d) any biobanking agreement entered into under Part 7A of the Threatened Species Conservation Act 1995 that applies to the whole or part of the land to which the activity relates.

(3) Without limiting subsection (1), a determining authority shall consider the effect of an activity on any wilderness area (within the meaning of the Wilderness Act 1987) in the locality in which the activity is intended to be carried on.

(4) Without limiting subsection (1), a determining authority must consider the effect of an activity on:

(a) critical habitat, and

(b) in the case of threatened species, populations and ecological communities, and their habitats, whether there is likely to be a significant effect on those species, populations or ecological communities, or those habitats, and

(c) any other protected fauna or protected native plants within the meaning of the National Parks and Wildlife Act 1974.

Note. *If a biobanking statement has been issued in respect of a development under Part 7A of the Threatened Species Conservation Act 1995, the determining authority is not required to consider the impact of the activity on biodiversity values.*

Subsequently the assessment would need to be carried out in accordance with section 228 of the Environmental Planning and Assessment Regulations 2000 the assessment criteria of which are listed in section 7 below.

2.3 ENVIRONMENTAL PLANNING AND ASSESSMENT REGULATIONS 2000 – DESIGNATED DEVELOPMENT

Under the provisions of the Environmental Planning & Assessment Regulations 2000 (Schedule 3) there is no component of the works pertaining to the proposed haul route that is specifically identified as designated development. With the proposed haul route now being part of the overall project it is, as a whole, a designated development for an extractive industry.

2.4 STATE ENVIRONMENTAL PLANNING POLICY (MAJOR PROJECTS) 2005

Under the provisions of State Environmental Planning Policy (Major Projects) 2005 the road upgrade proposal is not identified as a major infrastructure project. However, it is a component of a larger project that is classified as a Major Project (ie the Gunlake Quarry Project).

2.5 STATE ENVIRONMENTAL PLANNING POLICY NO 44 – KOALA HABITAT PROTECTION

State Environmental Planning Policy No 44 – Koala Habitat Protection applies to the Goulburn Mulwaree Council Area. The policy provides for Koala habitat protection in NSW and aims to help conserve populations of the species. The policy defines core Koala habitat as areas of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population; potential Koala habitat as areas of native vegetation where the tree species listed in Schedule 2 of the policy constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

The Flora and Fauna Assessment attached and discussed below consider this matter.

2.6 ROADS ACT 1993

The haul route passes along Brayton Road and then Red Hills Road to an intersection with the Hume Highway. Section 138 of the Roads Act 1993 requires a proponent to obtain consent for works from the appropriate roads authority. In this proposal the Council and the Roads & Traffic Authority are the identified consent authorities.

2.7 NATIVE VEGETATION ACT 2003

The Native Vegetation Act 2003 (Section 25) provides for exclusions from clearing for an activity assessed under Part 5 of the Environmental Planning and Assessment Act 1979, in the following terms.

> *(g) any clearing that is, or is part of, an activity carried out by a determining authority within the meaning of Part 5 of the EPA Act if the determining authority has complied with that Part,*
> *(h) any clearing that is, or is part of, an activity carried out in accordance with an approval of a determining authority within the meaning of Part 5 of the EPA Act if the determining authority has complied with that Part,*
> *(o) any clearing that involves the removal or lopping of any tree or other vegetation in accordance with section 88 of the Roads Act 1993,*
> *(p) any clearing carried out in accordance with a consent under Division 3 of Part 9 of the Roads Act 1993,*

(q) any clearing carried out in accordance with a permit under Part 3A of the Rivers and Foreshores Improvement Act 1948,
(s) any clearing carried out in accordance with a licence, permit, authority or approval under the Water Act 1912 or the Water Management Act 2000.

Section 88 of the Roads Act 1993 states that "*A roads authority may, despite any other Act or law to the contrary, remove or lop any tree or other vegetation that is on or overhanging a public road if, in its opinion, it is necessary to do so for the purpose of carrying out road work or removing a traffic hazard".*

The general terms of the above references to the Native Vegetation Act 2003 indicate that the Council is exempt from the need to obtain consent for clearing under the Native Vegetation Act 2003. This REF refers to a proposal that will necessitate the clearing of vegetation as a result and part of a designated development that is a Major Project. In this situation it is assumed that, whether Council or the proponent carries out the work it is an exempted activity.

2.8 THREATENED SPECIES CONSERVATION ACT 1995

The Threatened Species Conservation Act 1995 applies to the land. The Act provides for the conservation of biological diversity, promotion of ecologically sustainable development and protection of critical habitat of threatened species, populations and ecological communities that are endangered. The Act aims to prevent the extinction and promote the recovery, eliminate processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities, ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed, and encourage the conservation of threatened species, populations and ecological communities by the adoption of measures involving co-operative management.

The Flora and Fauna Assessment attached and discussed below considers this matter.

2.9 FISHERIES MANAGEMENT ACT 1994

The Fisheries Management Act 1994 applies to the land. The Act aims to conserve, develop and share the fishery resources of the state for the benefit of present and future generations and in particular to conserve fish stocks and key fish habitats, conserve threatened species, populations and ecological communities of fish and marine vegetation, promote ecologically sustainable development, including the conservation of biological diversity, promote viable commercial fishing and aquaculture industries, promote quality recreational fishing opportunities, appropriately share fisheries resources between the users of those resources, and provide social and economic benefits for the wider community of New South Wales.

The proposed road works do cross intermittent waterways as shown of the attached map but it does not cross any significant waterways above a class 4 waterway, and are not identified as containing any potential 'habitat' due mainly to the existing constructed roads over those waterways and no plans to interfere with the flow of waters of fish existing fish movement capabilities during time of flow.

2.10 PROTECTION OF THE ENVIRONMENT OPERATIONS ACT 1997

Under the provisions of the Protection of the Environment Operations Act 1997 (Schedule 1) there is no component of the works that is identified as 'scheduled development'.

2.11 RIVERS AND FORESHORES IMPROVEMENTS ACT 1948

The Rivers and Foreshores Improvements Act 1948 applies to the land. Under Part 3A of the Act a person requires a permit to excavate within 40 metres of a waterway, remove material from protected land or do anything to obstruct or detrimentally affect the flow of protected waters or which is likely to do so, and extends to include.

> *(a) the removal of dead or growing timber, or other vegetation or aquatic plants, or of silt, shingle, soil, sand, gravel, stone, rock or other matter or thing whatsoever, from the bed, banks or foreshore of any tidal waters or coastal lake or lagoon, or from the water or the bed or banks of a river or from any adjoining, adjacent or nearby lands,*
> *(b) changing or preventing the changing of the course of a river,*
> *(c) preventing the erosion of the bed or banks of a river or of adjoining, adjacent or nearby lands by the waters of a river,*
> *(d) preventing the siltation of the course of a river where such work is confined to the bed or banks of a river and adjoining, adjacent or nearby lands,*
> *(e) preventing the flooding of land by the waters of a river,*
> *(f) deepening, widening, straightening, or improving the course of a river,*
> *(g) preventing the inflow of sea water or saline water into the course of a river, or*
> *(h) preventing the erosion of lands by tidal waters or by the waters of any coastal lake or lagoon.*

There are waterways crossing the proposed road works and within 40 metres of the proposed road works that could be identified as a 'river' under the Act. There is no land identified as protected land associated with the haul route.

For the several minor waterway crossings that the road crosses specific erosion controls are required, these are covered in chapter 4 section 4.2 Water of this report.

2.12 DRINKING WATER CATCHMENTS REGIONAL ENVIRONMENTAL PLAN No 1

The Drinking Water Catchments Regional Environmental Plan No 1 applies to the haul route. The Plan aims to create healthy water catchments that will deliver high quality water while sustaining diverse and prosperous communities, to provide the statutory components in Sustaining the Catchments that, together with the nonstatutory components in Sustaining the Catchments, will achieve the initial aim, and to achieve the water quality management goals of improving water quality in degraded areas and critical locations where water quality is not suitable for the relevant environmental values, and maintaining or improving water quality where it is currently suitable for the relevant environmental values.

In particular Section 8 refers to the achievement of water quality objectives, Section 24 relates to the consideration of Strategic land and Water Capability Assessments, and Sections 25, 26 and 27 specify the need to achieve Neutral or Beneficial Impact on water quality. Concurrence of the Chief Executive of the Sydney Catchment Authority is required in accordance with Section 28.

2.13 ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The Environmental Protection and Biodiversity Conservation Act 1999 specifies that approval is required from the Commonwealth Minister for the Environment for actions that have, will have or are likely to have a significant impact on a matter of "national environmental significance".

The Act identifies six matters of national environmental significance; these are:

i. declared World Heritage Areas,
ii. declared RAMSAR wetlands,
iii. listed threatened species and ecological communities,
iv. listed migratory species,
v. nuclear actions, and
vi. the environment of Commonwealth marine areas.

The Flora and Fauna Assessment attached and discussed below considers this matter.

2.14 RURAL FIRES ACT 2000

The Rural Fires Act 1997 applies to the haul route. The Act provides for the prevention, mitigation and suppression of bush and other fires in local government areas (or parts of areas) and other parts of the State constituted as rural fire districts; and for the co-ordination of bush fire fighting and bush fire prevention throughout the State, the protection of persons from injury or death, and property from damage, arising from fires, the protection of the environment, having regard to the principles of ecologically sustainable development described in Section 6 (2) of the *Protection of the Environment Administration Act 1991.*

3.0 CONSULTATIONS

3.1 Landowners and Community

Gunlake Quarries have been in close consultation with nearby residents and Marulan businesses throughout the planning process for their proposed quarry. During the construction phase of the road works the Quarry Manager will keep nearby residents informed of proposed scheduling and interruptions of road works.

3.2 Heritage Assessment

A preliminary archaeological assessment has been undertaken by *Australian Archaeological Survey Consultants* for Gunlake Quarries for this project. This assessment has considered in depth the indigenous and non-indigenous cultural impacts of the proposed quarry and Haul road. In addition to this survey Laterals have undertaken a brief heritage assessment of the areas of direct impact by proposed road widening and Pejar Local Aboriginal Land Council have been invited to contribute to this REF and searched the study area for items of significance to their people.

3.3 Government Authorities

Throughout the planning process for this project, Gunlake Quarries have been in consultation with the following Government Authorities in relation to their proposed quarry and associated product transport routes;

1. Department of Natural Resources, in relation to waterway and protected land matters.
2. Department of Lands
3. Department of Planning
4. Department of Environment & Climate Change, in relation to flora and fauna and heritage matters,
5. Department of Primary Industries,
6. NSW Roads and Traffic Authority,
7. Goulburn Mulwaree Council.

4.0 ENVIRONMENTAL ASSESSMENT, IMPACTS AND MANAGEMENT

4.1 Air

The proposed road improvements will result in better traffic movement reducing exhaust emissions and allowing for small localised improvements to air quality.

During construction the movement of vehicles and plant would create additional dust impacts.

The movements of plant and vehicles between work sites and the site of the works compound will produce additional potential dust impacts on nearby residences. Dust suppression measures such as providing a temporary blue metal overlay or temporary sealing of the access track into the compound, or damping with water should be implemented to minimise or eliminate the potential additional dust impacts. Impacts should be assessed during the construction and appropriate dust suppression measures implemented if and when required.

Air quality may also be temporarily affected by the use of un-maintained machinery and equipment that can result in high levels of diesel particulate matter being produced. The proper maintenance of vehicles will assist in keeping this matter to a minimum.

Most potential airborne dust would be easily prevented or suppressed by keeping haul roads damp and soil stockpiles covered. Exhaust fumes would be minimised by ensuring all plant and machinery is fitted with properly functioning and maintained exhaust systems.

To minimise or eliminate potential adverse impacts on air quality, the following controls and measures should be implemented:

- Areas of exposed soil are limited to those areas being worked at any one time.
- All areas of exposed soil be stabilised as soon as possible, and progressively stabilised as work areas are completed.
- All loads of soil or other potential dust generating materials transported by vehicles should be covered during transportation.
- The tailgates of all vehicles are kept securely closed during transportation.
- Dust is suppressed as necessary during construction by spraying exposed soil with water from a water cart which would be maintained on-site.
- Specific dust suppression measures should be implemented around the works compound site as necessary if it is located close to any residence.
- Dust producing activities should be avoided on high wind days.
- Soil stockpiles are kept covered or planted with cover crops until they are to be used.
- Haul roads and site compounds be topped with gravel or kept moist.
- Cleared timber or other materials not be burned.
- Mud spilt or tracked by construction equipment onto the sealed section of road or other sealed roads should be regularly cleaned.
- All plant and equipment be maintained in accordance with the manufacturers' specifications to ensure they operate efficiently and do not produce excessive exhaust emissions.

4.2 Water

The road works occur wholly within the Sydney Catchment Authority Area. The Red Hills Road area drains into the Shoalhaven Catchment and the Brayton Road area to the Wollondilly Catchment. The Drinking Water Catchments REP No. 1 requires that activities in the Sydney Catchment Authority Area do not negatively impact the quality of receiving waters.

The drainage of the study area is illustrated on the topographic maps on pages 7 & 8 of this report. Road works will occur within 40 metres of the top bank of first and second order streams along Brayton and Red Hills Roads and a third order stream near the entrance to the proposed Gunlake Quarries quarry. Consequently a permit issued under Part 3A of the Rivers and Foreshores Improvement Act 1948 will be required. Work is required near streams but no temporary or permanent blockages to the channel would be needed. Where scour is currently occurring at pipe or culvert outlets, the need for scour protection needs to be investigated and installed if required.

Water to be used on the site would be brought in by water cart or drawn from farm dams or bores where available.

Quantitative water quality data is not available for the Creeks associated with the site. The most significant pollutants entering the watercourses emanating from the road is sediment from the gravel road surface and localised runoff of hydrocarbons and heavy metals from road transport.

The widening of the road is not expected to have any long-term impact on water quality in the area if the recommendations of this REF are implemented.

During the construction phase, the greatest potential for water pollution would be due to sediment laden runoff entering the waterways. There is also a risk of oil spillage from broken hydraulic lines on plant and equipment. However, given the ephemeral nature of the creeks, and the erosion and sediment controls and measures to be implemented, as well as best work practices, the likelihood of water pollutants moving far from the worksite is low.

An Environmental Management Plan incorporating erosion and sediment controls should be developed for the works. The Environmental Management Plans must comply with Roads & Traffic Authority requirements.

The following controls and measures are recommended:

- The erosion and sediment control measures adopted in the Environmental Management Plan be implemented to ensure a neutral impact on surface and ground water quality.
- Where stream bed scour is currently occurring at culvert outlets, the need for scour protection will be investigated and installed if required.
- Plant and equipment be inspected regularly to ensure there are no leakages of fuel, oil or hydraulic fluid.
- An environmental emergency plan for pollutant spillages form part of the erosion and sediment controls in the Environmental Management Plan.
- An appropriate spill containment kit would be kept on site at all times.

4.3 Geology and Soils

4.3.1 Landform

The Bindook Road landform consists of Undulating low hills on Devonian Bindook Porphyry, occurring in the Canyonleigh Hills physiographic region. Easily identified by the sub-angular porphyry rock outcrop common on upper slopes and crests. Moderate grazing land with high erosion problems - including some severe gullying and localised high saline water tables. The Bindook Road 'variant a' landform consists of a variant of the Bindook Road (bo) soil landscape, featuring steeper hills and stony ridgelines with higher percentages of rock outcrop than the parent landscape, and occurs within the Canyonleigh Hills physiographic region. Elevation varies from between 600m and 850m. The slope ranges from 3-12%.

4.3.2 Geology

In reference to the Goulburn 1:250,000 Geographical Map Sheet, the site consists of the Bindook Porphyry. Most of the rocks are porphyritic with quartz and feldspar set in a greenish to black groundmass. Soils have formed *in situ* and from alluvial-colluvial material derived from parent rock.

4.3.3 Soils

The site occurs on the boundary of two soil landscape units mapped on the Goulburn 1:250,000 Soil Landscape map sheet (Hird 1991) and the SCA Soil Landscape mapping (SCA/DLWC 2002). These are:

- Bindook Road Soil Landscape and
- Bindook Road 'variant a' Soil Landscape.

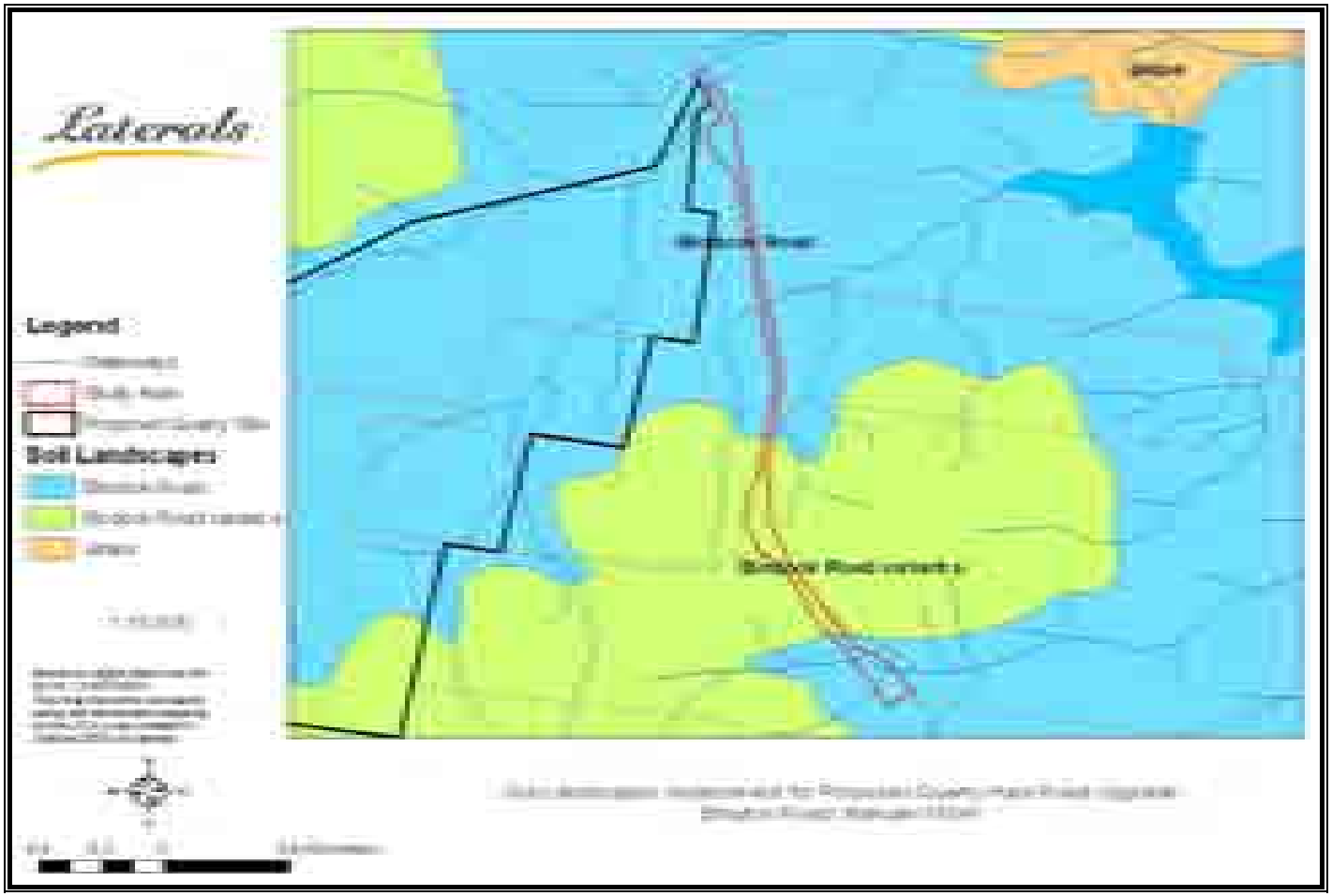
The characteristics of the soils in the study area in terms of potential erosion issues are given in the Table 1 below.

Table 1; Characteristics of soil landscapes.

	Bindook Road	Bindook Road 'variant a'
Erodibility (Topsoil)	High	High
Erosion Hazard (Subsoil)	High	High
Erosion Hazard (non-concentrated flows)	Low	Low

The Bindook Road Soil Landscape Unit occurs on the northern end of the proposed upgrade. The Bindook Road 'variant a' Soil Landscape Unit occurs on the southern end of the proposed upgrade.
For soil test results with regards to the soils agricultural suitability and structure refer to (Morse & Chapple 2007).

4.3.4 Soils



Soil Landscapes across the site (SCA/DLWC, 2002).

4.4 Noise and Vibration

4.4.1 Operational Traffic Noise

The site is located in a rural area where background noise levels are generally low and the greatest noise and vibration source is likely to be from local traffic.

No noise measurements have been undertaken for this report since the road works are generally contained within the existing road alignment. The Environmental Management Plan should identify the location of the nearest residences and ensure that noise criteria are not exceeded in accordance with Department of Environment & Climate Change guidelines referred to below.

4.4.2 Road Transportation Noise Assessment Criteria

A separate noise assessment of other sections of the saleable products transport route has been undertaken by Heggies Pty Ltd (Specialist Consultant Study Compendium Part 4). They concluded that even under “worst case” conditions, quarry traffic noise levels will clearly comply with the DECC’s daytime and night-time traffic noise criteria

The Department of Environment and Climate Change's (DECC) publication *"Environmental Criteria for Road Traffic Noise"* (May 1999) provides the assessment criteria for road traffic noise in NSW. Tables 1 and 2 of the *Criteria* contain classifications and noise goals for various road developments.

Brayton Road and Red Hills Roads are considered to be "Local Roads" as defined by the *Criteria*. The applicable road traffic noise criteria for this project are therefore as shown in Table 2 below;

Table 2; DECC Road traffic noise criteria for “redevelopment of an existing local road” (from DECC 1999)

Type of Development	**Criteria**	
Redevelopment of an existing local road	DAY (7 am – 10 pm) NIGHT(10 pm – 7 am)	LAeq (1 hour) 60dB(A) LAeq (1 hour) 55 dB(A)
	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2 dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through medium-term and long-term strategies, such as regulation of exhaust noise from in-service vehicles; limitations on exhaust brake use; restricted access for sensitive areas or during sensitive times to low-noise vehicles; improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards; and alternative methods of freight haulage.	

It is unlikely that the existing noise levels at any existing dwelling exceeds the noise levels of LAeq(1 hour) 60dB(A) day and LAeq(1 hour) 55 dB(A) night, given the redevelopment of the road given the better road travel, alignment and width.

A halving of the distance between a noise source and a receiver generally results in a 3dB(A) increase in noise level for line sources in a noise reflective environment (Hassall, Zaveri and Phil, 1979). That is, if the road is moved closer to a residence by halving the distance, a

noise increase of 3dB(A) occurs. In rural areas, where noise attenuation occurs due to the sound absorptive qualities of the ground, the increase is generally less than 3dB(A). Generally, the realignment of the road does not move the road significantly closer to any existing dwelling. The future traffic noise levels should therefore not exceed the DECC noise level criteria of no more than a 2 dB(A) increase over existing noise levels.

4.4.3 Construction Noise

The construction period for the Proposal is anticipated to be up to 8 weeks. However, this may not be continuous, depending on contractor and proponent scheduling. Construction noise would affect residents close to the alignment.

The Roads and Traffic Authority adopts the construction noise control criteria of the NSW Department of Environment and Climate Change. The Department of conservation & Climate Change noise Criteria recognises that high construction noise levels are likely to be accepted by local residents due to the usually short term duration of construction activities.

The construction noise level restrictions set by the Department of conservation & Climate Change are:

- For a cumulative construction noise exposure period of up to four weeks, the $L_{A10\ (15\ minutes)}$, emitted by the works to specific residences should not exceed the LAM background level by more than 20 dB(A). (That is, the construction noise level occurring for 10% of the time (L_{A10}), measured for 15 minutes, should not exceed the background noise level that occurs during 90% of the day (L_{A90}). by more than 20 decibels.)
- For a cumulative construction noise exposure period of between four weeks and twenty-six weeks, the emitted L_{A10} noise level should not exceed the L_{A90} level by more than 10 dB(A).
- For a cumulative construction noise exposure period greater than twenty-six weeks, the emitted L_{A10} noise level should not exceed the L_{A90} level by more than 5 dB(A).

The applicable construction noise criteria for this proposal would therefore be an L L_{A10} noise level of no more than 10dB(A) above the background L_{A90} level.

It is unlikely that construction noise levels at buildings on properties adjoining the road will be unacceptably due to their distance from the road. To minimise any potential noise complaints, noisy plant should be parked overnight at work sites that are not located in close proximity of the close dwelling houses to avoid the noise associated with movements, and with starting up in the morning. Plant should be parked off the road in areas cleared for the work, and work in close proximity to dwelling houses should be carried out in the shortest possible time.

Best practice work methods should be adopted to ensure that potential impacts are minimised. The local residents potentially affected by construction noise should be advised of any expected short-term high noise levels, and a noise management plan should be devised in consultation with them if they are concerned. In addition, a procedure for dealing with complaints would also be developed and specified in the Environmental Management Plan for the Proposal. The types of methods that could be used for controlling construction noise and vibration include:

Source controls

- **Scheduling**
  Perform noisy work during less sensitive time periods where possible when working near the residence.

- **Equipment restrictions**
  Ensure equipment has quality mufflers installed and is regularly maintained to manufacturer's specifications.
- **Substitute methods**
  Use quieter and less vibration emitting construction methods where possible.
- **Site access**
  Vehicle movements outside construction hours, including loading and unloading operations, should be minimised and avoided where possible.
- **Reversing alarms**
  Consider alternatives, such as manually adjustable or ambient noise sensitive types ("smart" reversing alarms). Alternative site management strategies can be developed, in accordance with the *Occupational Health and Safety Plan,* with the concurrence of the Occupational Health and Safety Officer.

Path controls

- **Noise barriers**
  Locate equipment to take advantage of the noise barriers provided by existing site features and structures, such as embankments and storage sheds.
- **Increased distance**
  Locate noisy plant as far away from noise-sensitive receptors as possible.
- **Site access**
  Select and locate site access roads as far away as possible from noise-sensitive areas.

Receptor controls

- **Consultation**
  Community consultation, information, participation and complaint responses are essential aspects of all construction noise management programs. They typically involve:
  - ✶ A community information program before construction and/or high risk activities is commenced. This usually involves a leaflet distribution and direct discussions and negotiations with affected residents, explaining the type, time and duration of expected noise emissions.
  - ✶ The involvement of affected residents in the development of acceptable noise management strategies.
  - ✶ A nominated community liaison officer with a contact telephone number.
  - ✶ A complaints hotline. Complaints should be included in a complaints register.
  - ✶ Timely responses to complaints, providing information on planned actions and progress towards the resolution of concerns

4.4.4 Construction Vibration

The proposal has the potential to generate high vibration levels through the use of vibratory rollers for compacting fill and pavement base materials.

In terms of vibration from construction machinery, the general principles applied to determining safe vibration levels stipulate that residences located 20m from road construction work may experience vibration levels up to 3mm/sec when vibratory rollers are being used. While this is below the level considered to be potentially damaging to architectural structures (DIN 4150, 1986), it is likely to be above a level that may cause adverse comment from residents.

Given that the nearest residence is located about 100m from the closest part of the work, vibrations from vibratory rollers are unlikely to cause discomfort to the residents. However, if a complaint regarding noise or vibration is received, adjustments to work practices should be undertaken as required to try to eliminate the source of the excessive noise or vibration.

The following controls and measures should be implemented to ensure that construction noise and vibration are kept to the minimum.

- Work compounds, parking areas, equipment and material stockpiles should be located as far away from dwellings as possible.
- If the works compound is located near a residence, strategies should be implemented in consultation with the residents to minimise construction noise and vibration.
- The residents of the nearby dwellings should be advised of any potential high noise or vibration producing activities at least one week prior to that activity occurring, and a Noise and Vibration Management Plan should be devised in consultation with them if they are concerned.
- The residents should be notified in advance of any proposed work outside of normal working hours that is likely to be noisy or to produce high vibration levels.
- A procedure for dealing with complaints should be developed and specified in the Environmental Management Plan for the Project.
- Vibration from construction should be kept to the minimum practically achievable.
- If a complaint is received, adjustments to work practices should be undertaken as required to try to eliminate the source of the excessive noise or vibration.

4.5 Flora and Fauna

A full Flora and Fauna Assessment has been prepared by Laterals Environmental to accompany this Review of Environmental Factors and is attached.

The Flora and Fauna Assessment has surveyed the study area for flora and fauna and conducted a habitat assessment to ascertain the range of species that are likely to use this site and includes a threatened species assessment for the study area.

The study area supports scattered low open forest with frequent cleared areas, a variety of locally common plants occur as well as frequent exotic species. Several other habitat components occur and terrestrial habitat is generally good. While this corridor does support several useful habitat components, the wider landscape is similarly vegetated and supports better arboreal habitat, course woody debris simple rock habitats and understorey plants occur in the study area.

While removal of small patches of native vegetation is an essential part of the proposed road widening the design is able to retain the most important pockets of remnant habitat along the road route. In all, the whole project will result in a minimal impact on flora and fauna.

It is highly unlikely that this proposal will have a significant impact in any way on any identified threatened or migratory species identified under either the NSW Threatened Species Conservation Act 1995 or the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999.

Any potential impacts on flora and fauna of this project are to be mitigated to a satisfactory level of impact by implementing the safeguards provided by the Flora and Fauna Assessment

4.6 Waste Minimisation and Management

The NSW State Government is committed to ensuring the responsible management of waste that cannot be avoided and to providing opportunities for promoting the reuse of such waste through appropriate measures. In undertaking this commitment, the Roads & Traffic Authority follows the Resource Management Hierarchy principles embodied in the *Waste Avoidance 8,*

Resource Recovery Act 2001 (WARR *Act).* The Resource Management Hierarchy principles of the WARR Act are as follows:

- Avoid unnecessary resource consumption as a priority;
- Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling, and energy recovery); and,
- Disposal is undertaken as a last resort.

Resource consumption in this project should be minimised to avoid adverse environmental effects and economic outlay.

Few materials are likely to be able to be reused as the project is limited to road widening. Removed topsoil should be stockpiled and respread over areas to be revegetated. The largest component of recyclable material would be cleared timber much of which can remain on the site as habitat or chipped and left on disturbed soil to aide soil conservation and plant regeneration.

Other waste reduction measures, such as the recycling of packaging, should be included as part of a Waste Management Plan incorporated into the Environmental Management Plan. The Waste Management Plan should, if necessary, address transportation and disposal arrangements for waste produced from the site.

Appropriate receptacles should be provided for un-recyclable waste material at the works compound, and their contents disposed of off-site at a suitably licensed waste management facility on a regular basis and secured against vandalism. The disposal of chemical, fuel and lubricant containers, solid and liquid wastes should be in accordance with the requirements of the Department of Environment and Climate Change and the Local Council.

If contaminated waste is generated, the appropriate Department of Environment & Climate Change licences and approvals should be obtained for its disposal. The operators of the proposed disposal site should be notified in advance regarding any contaminated waste.

The following controls and measures are recommended:

- A Resource and Waste Management Plan (RWMP) would be prepared in accordance with the Resource Management Hierarchy established under the *Waste Avoidance & Resource Recovery Act 2001.*
- Waste produced at the site will be minimised, reused or recycled wherever possible.
- Unavoidable wastes would be disposed of in an appropriate manner at a licensed waste disposal facility, as addressed in the Waste Management Plan.
- Waste material would be classified in accordance with the Department of Environment & Climate Change's Environmental Guidelines: Assessment. Classification and Management of Liquid and Non-Liquid Wastes.
- Waste oil should be sent to approved recyclers.
- Topsoil would be stockpiled and used in the stabilisation and rehabilitation of the works site.
- Vegetation removed (including stumps) can either be chipped on site using a mobile chipper or left for fauna use. Any chipped material should be used on site for stabilisation and rehabilitation works, or if too great a volume is produced, sold to landscape suppliers or made available to local residents for garden use.
- Portable, self-contained toilet and washroom facilities should be provided at the work site and should be regularly emptied and serviced by the contractor providing them.
- Putrescible and other waste not able to be recycled should be regularly collected and disposed of at a licensed landfill or other disposal site in the area.

- Cleared vegetation or other materials should not be burned.
- Secure rubbish bins with heavy lids should be provided within the site compound. These should be regularly emptied.
- The work site should be left in a tidy and rubbish free state at the end of each working shift and upon completion of the works.
- Contaminated materials should be disposed of at a licensed disposal site in accordance with the appropriate DECC licences and approvals.

4.7 Archaeological and Heritage

A preliminary Archaeological Assessment for the proposed quarry for which this haul Road is intended to service has been undertaken by Australian Archaeological Survey Consultants P/L. This report presents the findings of research into archaeological and historic heritage on the proposed quarry site and most of the associated haul roads including Red Hills Road. However the section of Brayton Road that this REF deals with has not been specifically investigated.

In order to supplement this assessment the Local Aboriginal Land Council (LALC), Pejar LALC, undertook an assessment of aboriginal archaeological significance along both sides of the existing road on the 18th of November 2007.

The result of this investigation was that no items or sites of significance to the Aboriginal community are likely to be at risk of being significantly impacted upon by the proposed works.

This REF recommends the implementation of their recommendations and the recommendations provided by the Archaeological Assessment referred to above.

4.8 Socio-economic Considerations

4.8.1 Social Considerations

The local community of the area comprises adjacent rural property owners, residents of townships, and road users in general. Local residents and regular road users could be affected by the changing visual nature of the area, dust, potential construction noise and vibration and inconvenience due to traffic interruptions. Adverse community effects during the construction and operation of the new alignment will include:

- construction noise and vibration at the dwellings closest to the alignment (considered above),
- airborne dust impacts (considered above),
- inconvenience with regard to property access during construction (considered above),
- minor traffic delays during construction.

Traffic delays can be minimised and managed in accordance with the Council's and Roads & Traffic Authority's traffic management guidelines.

Any change in the extent of the project or land acquisitions may have an impact on the environment (ecological, social and economic) that has not been assessed in this Review of Environmental Factors. As the Review of Environmental Factors under Part 5 of the Environmental Planning and Assessment Act 1979 is a continuous process any change must also be assessed.

No adverse changes to community cohesion or interaction is expected to occur as a result of the construction works, however the Quarry Manager needs to be vigilant of circumstances and make adjustments as necessary, especially in emergency situations.

4.8.2 Economic Considerations

As discussed in the strategies and objectives of the project the widening of these sections of Brayton and Red Hills Roads will only improve prosperity, road safety, transport links and the development ability within the region. A cumulative economic benefit to the region is therefore anticipated as a result of the proposed works.

Apart from the inconvenience associated with the road works discussed above it is not expected that there will be any lasting adverse impact on agricultural or other economic activities of the area.

The proposal will result in improved road safety and generally reduce the costs associated with road use and maintenance and a reduction in off-site environmental impacts.

4.8.3 Land use Effects

The main land uses in the area include extractive industry, grazing/cropping and rural dwellers (to a lesser extent). The road works as proposed are not expected to result in any significant change to land uses in the district.

4.8.4 Property Effects

Property acquisition has not been indicated as necessary as part of this project however 9 accesses exist on this section of Brayton Road and 1 on this section of Red Hills Road, any of these accesses or associated boundary fences may be interrupted by the proposal.

Having regard to properties generally the following measures are recommended:

- All accesses and fences are to be reinstated to the same or a higher standard than currently exists.
- Vehicular access to all existing gateways will remain clear and accessible.
- No closure of property access is anticipated. If the temporary closure of one of the access gates (not the driveways to dwellings) becomes necessary to assist in the prompt construction of the work, the temporary closure is discussed with the affected landowners.

4.8.5 Pedestrian and Cyclist Provisions

Pedestrian and cyclist numbers in the area are expected to be very low given the isolated rural setting.

The new road formation is designed for vehicular traffic but the widening will provide additional width beyond the traffic lanes and thus significantly safer conditions for cyclists than is currently the situation. The Proposal would also provide dust-free walking and cycling conditions as a result of the road sealing.

4.9 Visual Assessment and Landscape Considerations

Brayton and Red Hills Roads are located within a rural setting, with patchy remnant vegetation along the roadside. Views are obtained of the surrounding farmland and the vegetation is visible from the adjoining farmland and in the case of Red Hills Road from part of the Hume Highway. The area is considered to have a relatively high visual quality for most of its length but it is generally consistent with the surrounding visual landscape.

The proposed road works will involve some clearing which will alter the visual appearance of the landscape. It is important to ensure that only the clearing necessary is carried out and

that the surface environment is left in a condition that enables the natural re-establishment of native species to replace any significant loss of trees, or as otherwise indicated in the attached Flora and Fauna Assessment.

4.10 Infrastructure and Utilities

Overhead power lines and underground Telstra cables cross the existing road. The Quarry Manager should consult with Country Energy and Telstra prior to commencing work to confirm the location and any extent of utility disruption. Any such disruption should be kept to a minimum. Any associated infrastructure that will be impacted by the works shall be reinstated as part of the project. i.e. signs indicating the location of underground cables.

Additional infrastructure and activities associated with the proposal are anticipated to be the establishment of the works compound and stockpile sites. This has been discussed above. No side track is anticipated as part of the works. A mobile concrete or bitumen batch plant is not required.

4.11 Demand on Resources

The largest quantities of materials required for construction are expected to be select fill, base and sub-base materials for the road embankments, bitumen and aggregate for the road seal, and fuels and oils for the construction machinery and equipment.

All of the other materials required can be obtained from existing suppliers in the region or from the developers own supplies. This Proposal should require relatively small amounts of materials and is not expected to cause a supply shortage of any of these materials in the region.

4.12 Identification and Consideration of Protection of the Environment Policies

The *Protection of the Environment Operations Act 1997* requires that any relevant Protection of the Environment Policies are considered when a consent authority is determining a development application under the *Environmental Planning and Assessment Act 1979.*

At the time of preparation of this Review of Environmental Factors no Protection of the Environment Policies are available for the proposed works.

4.13 Matters of National Environmental Significance

To fulfil the requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999,* matters of National Environmental Significance are addressed below.

World Heritage Properties: No declared World Heritage property included in the World Heritage list or declared by the Commonwealth Minister for the Environment will be directly or indirectly impacted upon by the Proposal.

Wetlands of International importance: No wetland of international importance designated under the Ramsar Convention or declared by the Commonwealth Minister for the Environment will be directly or indirectly impacted upon by the Proposal.

Threatened Species and Ecological Communities: No Commonwealth listed threatened species, ecological communities, populations or habitats would be significantly affected by the Proposal. Refer to Flora and Fauna Assessment.

Commonwealth Listed Migratory Species: The Proposal would not impact on the lifecycle or habitat of any internationally protected migratory species. No roosting or breeding sites would be removed by the Proposal, and no colonies of migratory species would be affected. Refer to Flora and Fauna Assessment.

Nuclear Actions: No component of the Proposal constitutes a nuclear action.

5.0 SUMMARY OF ENVIRONMENTAL MANAGEMENT AND MITIGATION MEASURES

From the above environmental assessment and consideration of impacts and mitigation measures the following is a summary of the management and mitigation measures considered appropriate for the conduct of the proposed road works

5.1 Air

To minimise or eliminate potential adverse impacts on air quality, the following controls and measures are recommended:

- Areas of exposed soil are limited to those areas being worked at any one time.
- All areas of exposed soil be stabilised as soon as possible, and progressively stabilised as work areas are completed.
- All loads of soil or other potential dust generating materials transported by vehicles should be covered during transportation.
- The tailgates of all vehicles are kept securely closed during transportation.
- Dust is suppressed as necessary during construction by spraying exposed soil with water from a water cart which would be maintained on-site.
- Specific dust suppression measures should be implemented around the works compound site as necessary if it is located close to any residence.
- Dust producing activities should be avoided on high wind days.
- Soil stockpiles are kept covered or planted with cover crops until they are to be used.
- Haul roads and site compounds be topped with gravel or kept moist.
- Cleared timber or other materials not be burned.
- Mud spilt or tracked by construction equipment onto the sealed section of road or other sealed roads should be regularly cleaned.
- All plant and equipment be maintained in accordance with the manufacturers' specifications to ensure they operate efficiently and do not produce excessive exhaust emissions.

5.2 Water, Geology and Soils

To minimise or eliminate potential adverse impacts on water quality, the following controls and measures are recommended:

- The erosion and sediment control measures adopted in the Environmental Management Plan be implemented to ensure a neutral impact on surface and ground water quality.
- Where stream bed scour is currently occurring at culvert outlets, the need for scour protection would be investigated and installed if required.
- Plant and equipment be inspected regularly to ensure there are no leakages of fuel, oil or hydraulic fluid.
- An environmental emergency plan for pollutant spillages form part of the erosion and sediment controls in the Environmental Management Plan.
- An appropriate spill containment kit would be kept on site at all times.

<u>Pre-construction</u>

- Earthworks and erosion and sediment controls should be designed in accordance with the publications *Managing Urban Stormwater: Soils and Construction* (Department of Housing, 1998) and *Managing Urban Stormwater: Treatment Techniques* (NSW EPA,

1998). Soil Conservation Service and other guidelines would also be used as appropriate.

- A project-specific Erosion and Sediment Control Plan is prepared as part of the Environmental Management Plan for the project.
- Project management and supervision of the design and installation of erosion and sediment control is conducted by a suitably qualified person.
- Existing drainage lines and watercourses are to be identified prior to the commencement of construction activities to enable the design of the most appropriate erosion and sediment controls.
- Silt fences and barriers are placed in drainage swales at appropriate intervals to deposit sediment in runoff before it leaves the construction site, or otherwise as necessary on adjoining land with landowner permission.
- Filter fabric and straw bale silt fences are installed along the downslope side of all construction areas.

Construction

- The Quarry Manager should monitor conditions of activity at regular intervals and on a daily basis during wet weather, including the maintenance of erosion and sediment control structures, to ensure compliance with design or extenuating circumstances.
- As much as practicable, work is scheduled to occur in the low rainfall period and periods of low flows in watercourses.
- Soil and fill stockpiles are covered by waterproof material or sown with a cover crop to prevent erosion by wind and rain. They are surrounded by sediment control fencing.
- The area disturbed at any one time is limited to the area being actively worked. The active area is confined to the minimum necessary for safe and effective construction activities.
- Catch drains are used to divert clean water around the construction site where necessary.
- The amount of vegetation removed or disturbed for any purpose is minimised.
- All disturbed areas are promptly stabilised and revegetated as work in those areas is completed.
- Perimeter fences and other temporary drainage works and controls are to be installed before land disturbance of any form takes place.
- Any sediment barriers or fences in creek channels are designed so as not to result in the complete block to water passage along the drainage swales during water flow conditions.
- Catch drains and diversion drains are formed and lined where necessary to divert Stormwater around the construction area. Their design capacity is based on a 1:10 year storm event.
- Runoff flow is dispersed where possible rather than concentrated.
- Regular inspections of all erosion and sediment controls is undertaken to ensure their continued effectiveness. Inspections identify where replacement or maintenance of the control structures are required. Sediment is be cleared from any temporary sediment traps and basins installed for the works when they have collected 50-60% of their capacity.
- The replacement or maintenance of erosion and sediment control structures is undertaken as soon as possible after the detection of any problem.

Post-construction

- Temporary erosion and sediment control structures are checked and maintained to ensure their continued effectiveness after the completion of the work until disturbed areas are adequately vegetated or otherwise stabilised against soil erosion.
- On completion of the works stockpiled topsoil is placed over exposed soil areas and seeded with a fast germinating, sterile cover crop to protect against erosion.

5.3 Noise and Vibration

To minimise or eliminate potential adverse impacts in relation to noise and vibration, the following controls and measures are recommended:

- Work compounds, parking areas, equipment and material stockpiles should be located as far away from dwellings as possible.
- The residents of the nearby dwellings should be advised of any potential high noise or vibration producing activities at least one week prior to that activity occurring, and a noise and vibration management plan should devised in consultation with them if they are concerned.
- The residents should be notified in advance of any proposed work outside of normal working hours that is likely to be noisy or to produce high vibration levels.
- A procedure for dealing with complaints should be developed and specified in the Environmental Management Plan for the Project.
- Vibration from construction should be kept to the minimum practically achievable.
- If a complaint is received, adjustments to work practices should be undertaken as required to try to eliminate the source of the excessive noise or vibration.
- work in close proximity to dwelling houses should be carried out in the shortest possible time.

5.4 Flora and Fauna

To minimise or eliminate potential adverse impacts on flora and fauna and to ensure that the project does not have a negative impact on biodiversity the following controls and measures are recommended:

- Soil disturbance shall not be more than is required to undertake the project, vehicle, plant and stockpile impacts shall be restricted to areas already devoid of vegetation.
- An environmental management plan that incorporates erosion and sediment control measures for the site will be prepared prior to soil being disturbed.
- Disturbed banks and batters shall be rehabilitated by the addition of topsoil and sowing and maintenance of suitable species as soon as is practical to avoid the establishment of weed species in accordance with an erosion and sediment control plan.
- Vegetation removal shall be undertaken so as to minimise impact to vegetation that will be retained.
- Where possible dead hollow wood will be retained or added as terrestrial habitat to the road reserve at a density no greater than one to two logs per ten metres.
- Works and stockpile compounds will be in areas already cleared of native vegetation, such as the construction zone or agricultural paddocks. They will be established where native vegetation disturbance is minimal or weeds dominate, and requiring no clearing of native vegetation. No trees or large shrubs will be removed for the establishment of the works compound or stockpile sites if they are located outside the construction zone.
- Topsoil that is stripped from the construction areas should be stockpiled and spread over disturbed areas prior to seeding or planting of rehabilitation grasses and trees.
- Weeds should be removed and taken to an approved waste management facility.
- The area to be disturbed for construction should be kept to a minimum.
- Tree felling should be undertaken so that minimal damage occurs to trees intended for retention.
- Excess timber logs may be made available to local residents for fire wood, while the rest of the vegetation (including stumps) can either be chipped on site using a mobile chipper or fractured and left for fauna use.

- Chipped native vegetation should be used where available to protect exposed areas and excess sold as landscape supplies.
- Cleared vegetation or other materials should not be burned.
- Areas of the road reserve disturbed by works will be rehabilitated using locally occurring native plants.

5.5 Waste Minimisation and Management

To minimise and manage waste, the following controls and measures are recommended:

- A Resource and Waste Management Plan (RWMP) would be prepared in accordance with the Resource Management Hierarchy established under the *Waste Avoidance & Resource Recovery Act 2001.*
- Waste produced at the site would be minimised, reused or recycled wherever possible.
- Unavoidable wastes would be disposed of in an appropriate manner at a licensed waste disposal facility, as addressed in the Waste Management Plan.
- Waste material would be classified in accordance with the Department of Environment & Climate Change's Environmental Guidelines: Assessment. Classification and Management of Liquid and Non-Liquid Wastes.
- Where feasible, waste suitable for recycling would be done so in accordance with the NSW Government's Waste Reduction and Purchasing Policy.
- Waste oil would be sent to approved recyclers.
- Topsoil would be stockpiled and used in the stabilisation and rehabilitation of the works site.
- Portable, self-contained toilet and washroom facilities should be provided at the work site and should be regularly emptied and serviced by the contractor providing them.
- Putrescible and other waste not able to be recycled should be regularly collected and disposed of at a licensed landfill or other disposal site in the area.
- Secure rubbish bins with heavy lids should be provided within the site compound. These should be regularly emptied.
- The work site should be left in a tidy and rubbish free state at the end of each working shift and upon completion of the works.
- Contaminated materials should be disposed of at a licensed disposal site in accordance with the appropriate DECC licences and approvals.

5.6 Heritage

A preliminary archaeological assessment has been undertaken by *Australian Archaeological Survey Consultants* for Gunlake Quarries for this project, and an on site survey specific to indigenous cultural resources is being undertaken by the Pejar Local Aboriginal Land Council.

It is recommended that;

- Site disturbance does not commence until the Pejar Local Aboriginal Land Council have completed their assessment and provided recommendations.
- The Pejar Local Aboriginal Land Council recommendations should be implemented with consideration of the DECCs requirements for disturbing sites of cultural significance.
- The recommendations including general recommendations of Australian Archaeological Survey Consultants preliminary Archaeological Assessment should be implemented.

5.7 Socio-economic Considerations

To aid in the management of socioeconomic impact the following measures are recommended:

- All accesses and fences are reinstated to the same or a higher standard than currently exists.
- Land is purchased under the terms of the *Land Acquisition (Just Terms Compensation) Act 1991.*
- No closure of property access will occur. If the temporary closure of one of the access gates (not the driveways to dwellings) would assist in the prompt construction of the work, the temporary closure will be discussed with the affected landowners).

5.8 Visual Assessment and Landscape Considerations

- Retain a surface environment in a condition that enables the natural re-establishment of native species to replace any significant loss of trees.

5.9 Infrastructure and Utilities

Works and stockpile compounds

In determining and approving the location of the works compound the following general criteria are recommended:

- Be in areas already cleared of native vegetation, such as the construction zone or agricultural paddocks. They should be established where native vegetation disturbance is minimal or weeds dominate, and requiring minimal or no clearing of native vegetation. No trees or large shrubs should be removed for the establishment of the works compound or stockpile sites if they are located outside the construction zone.
- Not be located in areas subject to floods or potentially liable to flooding
- Not be established on highly erodible soils unless it is unavoidable. In these circumstances, appropriate soil-specific erosion control measures need to be developed and implemented.
- Be provided with erosion and sediment controls prior to occupation.
- Drainage controls including diversion drains and perimeter banks, and the bunding of liquid storage areas should be installed prior to the compounds being occupied and should be maintained and renewed as necessary during the construction period to ensure their effectiveness.
- Be located as far away from any natural watercourse as practicable.
- Not unduly interfere with the agricultural or other economic activities in the area.
- Be as far away from nearby residences so as to cause the least interference from dust and noise impact on the residence.
- Be restored at the completion of the occupation.
- Preference should be given to re-occupying previously established works compound sites, stockpile sites or other highly disturbed areas.
- Concrete trucks should not be allowed to wash out concrete residue at the site.
- The works compound should be securely fenced against theft and vandalism if considered necessary by the Quarry Manager.
- Plant and machinery should be secured against theft and unauthorised use when not in use.

- All chemicals stored on-site should be stored in a lockable storage shed with a floor. The shed would be surrounded by an earth bund that is able to contain at least 110% of the volume of the largest container stored in it.
- Materials for the cleaning up of any chemical spills such as hydrocarbon absorbent booms (for use in waterways) and loose absorbent material would be kept at the works compound. Fire extinguishers of a type appropriate to the materials stored at the compound would also be kept on site.
- No fuels would be stored at the works compound. Plant and equipment should be refuelled from refuelling trucks on-site, or at the Contractor's main depot off-site. Refuelling and other machinery maintenance would be undertaken in specially designated bunded areas designed to enable any spilled fuels and oils to be contained on-site and cleaned up.
- Specially designated areas should be used for the washing of any concrete machinery and tools. Concrete trucks should not be allowed to wash out concrete residue at the site. They should be directed to wash-out trucks at their depots.
- All works sites are to be rehabilitated at the completion of the work.
- A suitable area is available at ch660 – ch700 that will require some vegetation removal, undertaken conservatively and rehabilitated after the project this will be appropriate.

Stockpiles

- Stockpiles are located away from any drainage lines.
- Stockpiles of top soil, fill or excavated material is placed on level ground or on ground that does not exceed a slope of 8% with appropriate sediment containment.
- The stockpiles are no more than 1.5 metres in height, with a level top.
- If stockpiles are required to be located on sloping ground a diversion drain or straw bale barrier is placed along their upslope to prevent water erosion.
- Temporary silt control fences are erected around the base of all stockpiles.
- Stockpiles do not cover any part of the trunks of trees that are to be retained.

5.10 Associated Activities

Construction measures and activities – contractors

To manage the use of contractors the following measures are recommended:

- Comply with the design requirements for the road.
- Employ environmental mitigation measures as identified in this report and other laws normally applying within the state as required for the extent of the works contracted.
- Assure that landowners adjoining the road works are not inconvenienced and works do not cause unreasonable interruption to farm management practices. Safe and convenient access is to be provided to properties for vehicles at all times.
- Obtain all necessary approvals and licenses for relevant authorities and compliance with all requirements within approvals and licenses.
- Construction material for the road is to be obtained from the road works site and existing suppliers and no new extractive industry is to be established for the works.
- All temporary traffic control measures are to be undertaken in accordance with the traffic management guidelines identified by the Council or RTA.

Construction measures and activities – working hours

The following working hours are recommended:

- 7am to 6pm Monday to Friday (excluding Public holidays)
- 8am to 1pm Saturdays
- No work on Sundays or Public holidays
- Any extension of these working hours for extenuating circumstances may only be approved by the Quarry Manager and potentially affected landowners and residents are to be advised by a letter box drop or site visit at least 2 days prior to the work occurring.

Complaint management

The following measures are recommended for the management of complaints:

- The residents are notified in advance of any proposed work outside of normal working hours that is likely to be noisy or to produce high vibration levels.
- A procedure for dealing with complaints is developed and specified in the Environmental Management Plan for the Proposal. This should include a register of complaints, date and time received, name and details and action taken.
- Vibration from construction is kept to the minimum practically achievable.
- If a complaint is received, adjustments to work practices are undertaken as required to try to eliminate the source of the excessive noise or vibration.

6.0 OUTCOMES AND JUSTIFICATION

From the assessment of the biophysical, socio-economic and legislative environment above it is concluded that there is likely to be no significant impact on the environment if the proposed road upgrade takes place as proposed. Recommendations are provided to mitigate and/or overcome any potential for impact which if employed will result in no adverse long term environmental effects.

The principles of Ecologically Sustainable Development (ESD) aim to sustain and conserve natural resources, and it is NSW Government policy that ESD principles must be considered in the planning decisions. This is reflected in giving consideration to environmental resources on which it is often difficult to place monetary values such as air, flora, fauna, hydrology, soils and public health.

The development meets the justification measures of ESD and satisfies object (a) (vii) of section 5 of the Environmental Planning & Assessment Act 1979

Ecologically Sustainable Development (ESD) is defined under the Protection of the Environment Administration Act 1991 to "require the effective integration of economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:

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

In the application of the precautionary principle, public and private decisions should be guided by:

(i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) An assessment of the risk-weighted consequences of various options,

(b) Inter-generational equity – namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) Conservation of biological diversity and ecological integrity – namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) Improved valuation, pricing and incentive mechanisms – namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) Polluter pays – that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

In relation to the above definition:

(a) <u>The precautionary principle</u>

The proposed activity does not pose a serious or irreversible threat to the environment. The evaluation of options and the assessment of the preferred option have concentrated on avoiding where practicable serious or irreversible damage to the environment.

(b) Inter-generational equity

The proposed development will not permanently distract from the present health, diversity and productivity of the locality. The Proposal would provide long term improvements to traffic flow and the safety of Brayton and Red Hills Roads. It would not jeopardise the availability of resources or options for other transport systems for future generations.

(c) Conservation of biological diversity and ecological integrity

The management of the flora and fauna as recommended and the ability for the site to regenerate if left in a suitable natural state will provide for the conservation of biological diversity and ecological integrity as much as is practicable having regard to the rural setting. The Proposal should not result in the loss of any biodiversity at the local or regional level.

Specific environmental control measures should be incorporated into an Environmental Management Plan that ensures their implementation and maintenance throughout the construction and post-construction rehabilitation stages of the Proposal.

(d) Improved valuation, pricing and incentive mechanisms

The design of the reconstruction of the road, and the implementation of the above recommendations in an Environmental Management Plan, amounts to the costs associated with protecting the environment. This assessment is the first step in that process.

The criteria used in the option evaluation process focused on a range of environmental and community factors, as well as using economic, traffic and engineering considerations. This approach has ensured that appropriate values have been attached to all environmental factors considered and assessed.

The *National Strategy for ESD* (Commonwealth of Australia, 1992) provides guidance as to what should be addressed when considering the ecological sustainability of a proposed development. The *National Strategy for ESD* lists three core objectives and seven guiding principles to be considered in a balanced approach. The core objectives are:

- to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- to provide for equity within and between generations; and
- to protect biological diversity and maintain essential ecological processes and life-support systems.

These core objectives of ESD have been considered throughout the environmental assessment process from the consideration of preliminary concept designs to the detailed assessment of all specialist environmental studies undertaken during the preparation of the Review of Environmental Factors. This Review of Environmental Factors details the necessary mitigation measures that should ensure the four principles of ESD are maintained. This is illustrated in section 7 below.

7.0 CONSIDERATION OF ENVIRONMENTAL FACTORS

The Environmental Planning and Assessment Act 1979 specifies the matters to consider (in clause 111) concerning an activity. The Environmental Planning and Assessment Regulation 2000 specifies (in clause 228) the factors that must be taken into account concerning the impact on the environment (for any kind of activity where no guidelines are in force) for the purposes of Part 5 of the Environmental Planning and Assessment Act 1979.

The factors to be taken into account when consideration is being given to the likely impact of an activity on the environment are included in the following tables

State Legislation

Factor	**Assessment**	**Impact** Not Applicable, Negative, Positive or Nil impact
Section 111 of the Environmental Planning and Assessment Act 1979		
(1) For the purpose of attaining the objects of this Act relating to the protection and enhancement of the environment, a determining authority in its consideration of an activity shall, notwithstanding any other provisions of this Act or the provisions of any other Act or of any instrument made under this or any other Act, examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity.		
(2) Without limiting subsection (1), a determining authority shall consider the effect of an activity on:		
(a) any conservation agreement entered into under the National Parks and Wildlife Act 1974 and applying to the whole or part of the land to which the activity relates, and	There are no relevant known conservation agreements.	**Not Applicable**
(b) any plan of management adopted under that Act for the conservation area to which the agreement relates, and	**Not Applicable**	**Not Applicable**
(c) any joint management agreement entered into under the Threatened Species Conservation Act 1995, and	**Not Applicable**	**Not Applicable**
(d) any biobanking agreement entered into under Part 7A of the Threatened Species Conservation Act 1995 that applies to the whole or part of the land to which the activity relates.	There are no known biobanking agreements.	**Not Applicable**
(3) Without limiting subsection (1), a determining authority shall consider the effect of an activity on any wilderness area (within the	The land is not located in any wilderness area.	**Not Applicable**

meaning of the Wilderness Act 1987) in the locality in which the activity is intended to be carried on.		
(4) Without limiting subsection (1), a determining authority must consider the effect of an activity on:		
(a) critical habitat, and	There is no critical habitat identified for the area.	**Not Applicable**
(b) in the case of threatened species, populations and ecological communities, and their habitats, whether there is likely to be a significant effect on those species, populations or ecological communities, or those habitats, and	The Flora and Fauna Assessment is attached and contains recommendations for management. The assessment concludes that there will be no impact	**Nil,** the potential for impact is manageable.
(c) any other protected fauna or protected native plants within the meaning of the National Parks and Wildlife Act 1974.	The Flora and Fauna Assessment is attached and contains recommendations for management where impact potential has been identified.	**Nil,** the potential for impact is manageable.
Section 228 of the Environmental Planning and Assessment Regulations 2000		
Any environmental impact on a community?	The proposal should have positive long term benefits to road safety through road widening and improved road geometry. Negative impacts on the community are anticipated to be short term and include minor traffic delays and temporary changes to accesses.	**Positive**
Any transformation of a locality?	The proposal involves minor works that would result in a short-term aesthetic transformation of the locality as a result of the clearing of vegetation. No permanent transformation would occur as a result of the works.	**Nil**
Any environmental impact on the ecosystems of the locality?	The Flora and Fauna Assessment is attached and contains recommendations for management.	**Nil,** the potential for impact is manageable.
Any reduction in aesthetic, recreational, scientific or	The proposal involves the removal of native vegetation	**Negative,** manageable

other environmental quality or value of a locality?	that would result in a minor short to medium-term effect on the existing aesthetic quality of the locality.	
Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special values for present or future generations?	See Heritage and Archaeological study for this site.	**Negligible**, manageable. See Archaeological Assessment associated with this project.
Any impact on the habitat of any protected fauna (within the meaning of the National Parks and Wildlife Act, 1974)?	The Flora and Fauna Assessment is attached and contains recommendations for management.	**Nil,** the potential for impact is manageable.
Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air	The Flora and Fauna Assessment is attached and contains recommendations for management.	**Nil,** the potential for impact is manageable.
Any long term effects on the environment?	The proposal should result in long term benefits to road safety and road conditions with managed visual and flora and fauna impacts.	**Positive**
Any degradation of the quality of the environment?	As long as the works are undertaken with appropriate erosion control, no adverse effect to the quality of the environment is anticipated. While the removal of the native vegetation will result in a change to the aesthetic quality of the locality, this should not be a permanent change and should be ameliorated by the management recommendations.	**Nil.**
Any risk to the safety of the environment?	Cumulative benefits in terms of road safety and the cost effectiveness of roads in this area would be expected to occur as a result of these works.	**Nil**
Any risk in the range of beneficial uses of the environment?	The proposal involves minor works and should not alter the range of existing or potential future uses of the environment	**Nil**

Any pollution of the environment?	As long as these works are undertaken in accordance with the above management recommendations no pollution of the environment should occur. The improvement to road condition and durability will reduce the frequency of maintenance and the potential for chemical spills as a result of vehicle accidents.	**Positive**
Any environmental problems associated with the disposal of waste?	All waste should be disposed of in accordance with the Waste Avoidance & Resource Recovery Act 2001 (WARR Act) as well as Department of Environment & Climate Change requirements. No environmental problems are anticipated in the disposal of any of the waste to be generated.	**Nil**
Any increased demands on resources, natural or otherwise which are, or likely to become in short supply?	The works are minor in nature and should not lead to an increased demand on any resources that are in short supply.	**Nil**
Any cumulative environmental effect with other existing or likely future activities?	All road works involve risks to safety, including to construction crews through proximity to vehicles and machinery, to motorists through altered road conditions, and environmental hazards such as chemical spills. These risks are normal to road construction and should be minimised through the implementation of standards and safety measures. The activity and materials used are not anticipated to cause any exceptional risk to the safety of the environment. The end result is expected to be improved traffic safety for the community and travelling public.	**Positive**

Commonwealth Legislation: Matters of National Environmental Significance

Factor	Assessment	Impact Not Applicable, Negative, Positive or Nil impact
Any environmental impact on a World Heritage Property?	No declared World Heritage property included in the World Heritage list or declared by the Commonwealth Minister for the Environment would be directly or indirectly impacted upon by the proposal.	**Nil**
Any Impact on wetlands of International Importance?	No wetland of international importance designated under the Ramsar Convention or declared by the Commonwealth Minister for the Environment would be directly or indirectly impacted upon by the proposal.	**Nil**
Any environmental impact on Commonwealth listed threatened species or ecological communities?	Remnants of the Endangered Ecological Community White Box, Yellow Box Blakely's Red Gum grassy woodlands occurs on this site	**Nil,** the potential for impact is manageable.
Any environmental impact on Commonwealth listed migratory species?	No internationally protected migratory species were identified as being likely to occur on this site.	**Nil**
Does any part of the proposal involve a nuclear action?	No part of the proposal involves a nuclear action.	**Not Applicable**
Any environmental impact on a Commonwealth marine area?	The site is not near any marine environment.	**Not Applicable**
In addition, any direct or indirect effect on Commonwealth land?	There is no identified Commonwealth land adjoining the proposal.	**Not Applicable**
Additionally - any impact on a site listed under the National Heritage List?	Of those sites currently listed Australia-wide none would be affected.	**Nil**

7.0 CONCLUSION

The Review of Environmental Factors has assessed to the fullest extent possible all matters affecting or likely to affect the environment by reason of the road upgrading *activity* in accordance with the Environmental Planning and Assessment Act 1979 and relevant legislation, including whether there is likely to be a significant effect on threatened species, populations and ecological communities and their habitats, and heritage and archaeological matters.

Accordingly it is concluded that there is no significant effect on threatened species, populations and ecological communities and their habitats, and heritage and archaeological matters.

In this regard the recommendations for environmental management above are submitted for incorporation into an environmental management plan for the road works component of the proposed development.

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Specialist Consultant Studies Compendium

Gunlake Quarries
Gunlake Quarry Project

ENVIRONMENTAL ASSESSMENT

VOLUME IV

Part 8B
Laterals Planning
Flora and Fauna Assessment for Proposed Upgrade of 2.3km of Brayton Road and 1.2km of Red Hills Road north of Marulan.

February 2008

Flora and Fauna Assessment

For proposed upgrade of
2.3km's of Brayton Road and
1.2km's of Red Hills Road north of Marulan.

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OCTOBER 2007

Reference No: 7048 / 1

Contents

1) Summary

This Flora and Fauna Assessment has been prepared to accompany a Review of Environmental Factors (REF), for the rehabilitation of a 2.3km section of Brayton Road at 'Gunlake Quarry' and a 1.2km section of Red Hills Road north of Marulan.

It addresses flora and fauna conservation issues with particular respect to legislative requirements under the *NSW Threatened Species Conservation Act 1995* and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999.*

Results

Flora

A full list of flora identified on each site is provided in Appendix A.

The Brayton Road site is dominated by native vegetation with a mixture of native grassland and eucalypt forest along the entire length of roadside. Exotic species are also present given previous disturbances though are a minor component of the vegetation. The site contains a high diversity of species and is also valuable structurally – with an overstorey, shrubby understorey and grassy ground layer still intact. This site supports remnants of the Endangered Ecological Community (EEC) White Box/Yellow Box/Blakely's Red Gum Woodland or Box/Gum Woodland as it is also known. No rare or threatened flora species was recorded on this site at the time of the assessment.

Red Hills Road section has considerably less native vegetation and a greater portion of common exotic flora typical of roadsides in the area. There are large infestations of Blackberry *Rubus sp.* towards the eastern end and there is almost no native overstorey component. This site also lacks a shrubby understorey component but is dominated by a mixture of native and exotic grasses and forbs. No rare or threatened flora species was recorded on this site at the time of the assessment.

Fauna

A limited number of fauna species were recorded at both sites – partially due to conditions at the time of the survey, the time of day and the limited habitat at the Red Hills Road site.

Small woodland birds were reasonably common at both sites while there was also evidence of mammals including Eastern Grey Kangaroos *Macropus giganteus* and Common Wombat *Vombatus ursinus* at both sites. There were digs from a Short Beaked Echidna *Tachyglossus aculeata* on Brayton Road though they are likely to occur at both sites on an occasional basis. No rare or threatened fauna was recorded on either site during this assessment.

2) Introduction

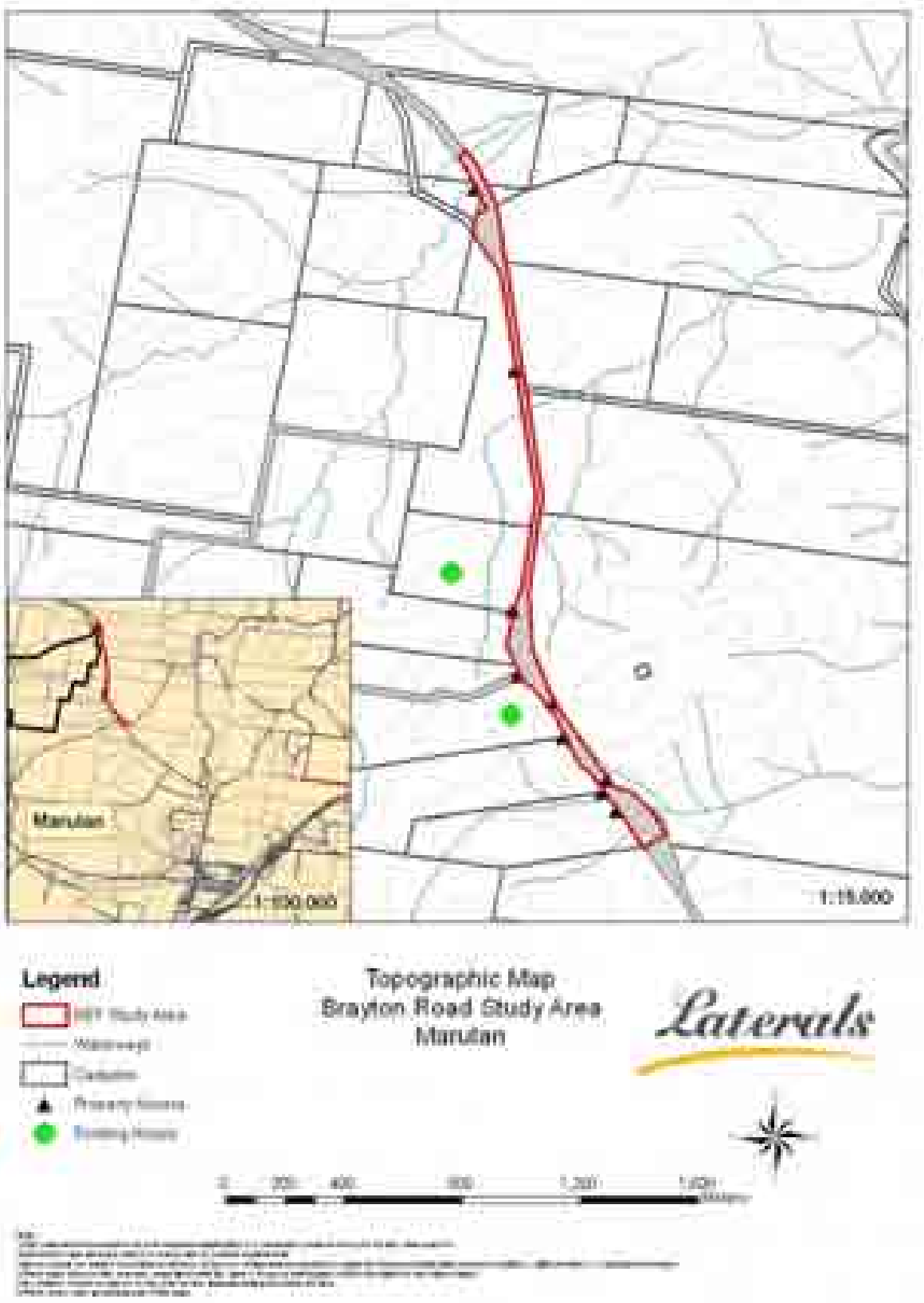
This report has been prepared by Laterals Environmental for 'Gunlake Quarries' to assess the impact on flora and fauna and recommend impact mitigation measures for a proposal to rehabilitate a 2.3km section of Brayton Road and a 1.2km section of Red Hills Road to the west and north of Marulan.

It is the role of a Flora and Fauna Assessment to consider the impact of the proposed activity on any protected plants and animals as defined by the National Parks and Wildlife Act 1974 (NPW Act), with particular consideration for flora, fauna and ecological communities listed as threatened under the *NSW Threatened Species Conservation Act 1995 (TSC Act).* For any species of plant, animal and any endangered ecological community listed under the TSC Act that occurs on the site, nearby or is considered to have a reasonable potential to use the site, an 'Assessment of Significance' has been prepared and included in this report.

Flora, fauna, migratory species and ecological communities listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* have also been considered as a component of this assessment.

It is important to note that not all species that occur on, or use this site could be identified without an extended survey period of several seasons and over numerous site visits, such a survey is beyond the scope of this report.

Details of the study area are illustrated on the maps on the following pages.


Marulan
1:150,000
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Legend
Topographic Map
Brayton Road Study Area
Marulan
Laterals


Aerial Photograph
Brayton Road Study area
Marulan
Legend
Laterals


Marulan
1:150,000
1:15,000
Topographic Map
Red Hills Road Study Area
Marulan
Laterals
Legend

Aerial Photograph
Red Hills Road Study area
Marulan

Legend

Laterals

3) The Proposal

Description of Study Area

The study areas are located approximately 4km west of the township of Marulan on the Brayton Road extending for 2.3kms, and approximately 3km north of Marulan on Red Hills Road for approximately 1.2kms. Both sites contain a mixture of native and exotic flora however the Brayton Road site is predominantly native with good species and structural diversity. The Red Hills Road site has been subject to greater disturbance and as such species and structural diversity is limited and there is a greater exotic component.

Both sites are gently undulating and include drainage areas for road runoff and grazing by cattle was evident on both sites at the time of this assessment. The Brayton Road site is surrounded by reasonably undisturbed, shrubby eucalypt forest while the Red Hills Road site is bordered on the northern side by a Pine plantation and on the southern side by a cleared and heavily grazed paddock.

Proposed Action

The proposal is to undertake rehabilitation works along both sections of road to a width of approximately 7 metres. There will also be temporary stockpile sites for aggregate, plant and machinery and the roads will be re-sealed on completion.

4) Relevant Legislation

Threatened Species Conservation Act 1995

The *NSW Threatened Species Conservation Act 1995 (TSC Act)* protects threatened species, populations and ecological communities listed under the schedules of this Act.

An "Assessment of Significance" is the first step in considering potential impacts of a proposal on threatened species as required by the *Environmental Planning and Assessment Act 1979.* This flora and fauna assessment has listed threatened species and ecological communities with the greatest likelihood of occurring on the site or being impacted by the proposal in any way with consideration of the ecology of the species, past recordings of species and habitat available on the site. For each species and ecological community considered to have potential to occur on the site an Assessment of Significance has been prepared. When a significant impact on a species is likely, preparation of a "Species Impact Statement" is required.

The Assessment of Significance should not be considered a "pass or fail" test but a structure allowing the undertaking of a qualitative analysis of the likely impacts and ultimately whether further assessment needs to be undertaken through a Species Impact Statement. All factors as described in the 'factors of assessment' below must be considered and an overall conclusion must be drawn from all factors in combination. Where there is any doubt regarding the likely impacts, or where detailed information is not available, a species impact statement will be prepared.

Factors of Assessment

The following factors of assessment must be considered for all threatened species, populations and ecological communities identified as users or potential users of the proposed development site.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

NSW Fisheries Management Act 1994

Similarly to the TSC Act, the *Fisheries Management Act (FM Act)* protects fish and marine vegetation, endangered populations and ecological communities by a listing process. Any potentially occurring animals or communities listed under this Act have been considered in this document alongside those listed under the TSC Act and an Assessment of Significance prepared where necessary.

Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* specifies that approval is required from the Commonwealth Minister for the Environment for actions that have, will have or are likely to have a significant impact on a matter of "national environmental significance".

The Act identifies seven matters of national environmental significance being;

1) World Heritage properties
2) National heritage places
3) Wetlands of international importance (Ramsar wetlands)
4) Threatened species and ecological communities
5) Migratory species
6) Commonwealth marine areas
7) Nuclear actions (including uranium mining)

This Flora and Fauna assessment considers the proposals potential for impact on any of these matters.

One **endangered ecological community** *(White Box/Yellow Box/Blakely's Red Gum Grassy Woodland)* was recorded from several locations within the Brayton Road study area. Approximately 25 species which are considered 'important' as a component of this community under this act were recorded on sites during this survey.

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

- reduce the extent of an ecological community;
- fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- adversely affect habitat critical to the survival of an ecological community;
- modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;
- cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;
- cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

~ assisting invasive species, that are harmful to the listed ecological community, to become established; or
~ causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or

- interfere with the recovery of an ecological community.

The proposed road works are unlikely to result in any of the above impacts to the extent that that the long-term viability of this community on site would be compromised. There may be some thinning or removal of small trees or understorey components within the areas occupied by this EEC however the remnants located have been subject to similar levels of disturbance since the initial construction of the Brayton Road through general maintenance works and the like. The current proposal will have minimal impact on this EEC given the extent of previous impacts.

State Environmental Planning Policy No 44—Koala Habitat Protection

SEPP 44 provides for Koala habitat protection in NSW and aims to help conserve populations of the species. The policy defines potential Koala habitat as areas of native vegetation where the tree species listed in Schedule 2 of the policy constitute at least 15% of the total number of trees in the upper or lower strata of the tree component of a site.

Schedule 2 species;

- *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)

None of the above species were recorded on either site or comprise more than 15% of the vegetation on or near these sites, as such it cannot be considered Koala habitat under this SEPP.

5) Ecological Communities and Habitats

Methods of Assessment

This site was inspected on several occasions in September and October 2007. Ground truthing and the use of aerial photography allowed for ecological communities to be inspected and notes made about their composition and condition.

Results

The Brayton Road site is dominated by native vegetation and has a high diversity of species as well as being valuable structurally. The main community present is shrubby eucalypt forest dominated by species such as Apple Box *E. bridgesiana,* Purple Kunzea *Kunzea parvifolia,* and Dogwood *Jacksonia scoparia* with a grassy ground layer beneath. The ground layer contains a mixture of native grasses and wildflowers. Along drainage lines there are small patches of Cabbage Gum *E. amplifolia* and Argyle Apple *E. cinerea* with a predominantly grassy understorey. This community persists along the northern side of the road for short distances at a time. There are also remnants of the endangered ecological community (EEC) White Box/Yellow Box/ Blakely's Red Gum Woodland (Box/Gum Woodland) on both sides of the road in several locations.

The Red Hills Road site has been heavily modified compared to the Brayton Road site and consists of a predominantly grassy community comprised of both native and exotic species. There are a small number of native trees and shrubs along this length and the area is adjoined on the northern side by a Radiata Pine *Pinus radiata* plantation.

6) Flora

Methods of Assessment

Flora was surveyed by traversing both sides of the roads on foot. Notes were made of individual plant species and key habitat types.

Results

A full list of the flora identified on these sites is included as Appendix 1.

The Brayton Road site contains a high diversity of species and has a native overstorey, shrubby understorey and grassy ground layer all in good condition. This site contains Yellow Box *E. melliodora* and Apple Box *E. bridgesiana* in reasonable numbers as well as many other understorey species which are considered an ‘important’ component of the Box/Gum Woodland EEC under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). While a number of ‘important’ species were identified no threatened flora was recorded for the site during the assessment. Several small patches of Argyle Apple *E. cinerea* dominated forest also occur within this study area.

The Red Hills Road site has been affected by clearing for agriculture, the initial road construction and the planting of a Radiata Pine plot in the past. As such the area contains a greater proportion of exotic species than the other site. Some native grasses, shrubs and few trees persist despite previous disturbances.

Species of Significance

No rare or threatened flora species were recorded on either site during this assessment. A full list of flora occurring on these sites is provided in Appendix A.

The threatened species assessment table in Appendix C provides a summary of threatened flora known to occur in the district. Where it is considered that one of these species has potential at least to occur on either site an Assessment of Significance for that species has been prepared.

7) Fauna

Methods of Assessment

Three surveys for fauna were conducted on this site in September and October 2007.

Mammals – tracks, scats and scratch marks in soil were observed to gain an understanding of mammals using the site. A nocturnal survey was not undertaken in this instance considering the locations of previous recordings of threatened nocturnal fauna and habitat types present/absent from this site.

Reptiles – searches were undertaken during the several day inspections. Key habitat areas were surveyed thoroughly by turning over loose rocks and timber where possible to determine their presence.

Amphibians – searches were undertaken for these species during the day, under ground debris such as logs and rocks and in the vicinity of potential habitat areas.

Avifauna - were surveyed during the several day visits. Calls were useful in determining species present where a visual identification was not possible. The use of binoculars assisted in the accurate identification of some species.

Results

A full list of fauna identified on these sites is provided in Appendix B.

A variety of fauna habitats in good condition were recorded along this section of Brayton Road however only a small number of fauna species were actually sighted or observed to use this area during the assessment. Common species such as Eastern Grey Kangaroos *Macropus giganteus, Common* Wombat *Vombatus ursinus* and the Short Beaked Echidna *Tachyglossus aculeata* were recorded from scats, tracks and digs found at the site. A variety of common woodland birds were also recorded. No reptiles were sighted and only one amphibian was heard during the assessment though at least several common species are likely to occur on this site. Cattle were observed to have grazed at least the eastern portion of this site a short time prior to this survey.

At Red Hills Road limited habitat was the likely cause for a small number of fauna being recorded. The northern side of the road is dominated by a pine plantation and the southern side has been almost entirely cleared of trees and shrubs for the purpose of grazing stock. Mixed native and exotic grassland persists. Fauna associated with these habitats were scarce at the time of the assessment with only a small number of common birds and one Common Wombat being recorded. No amphibians or reptiles were heard or sighted although they are likely to occur here.

Species of Significance

No fauna species of significance was identified on either site during this assessment.

The threatened species assessment table in Appendix C provides a summary compiled by the NSW DECC of threatened fauna known to occur in the district. This list, as well as known local observations and habitat suitability have been used to determine species that must be considered with an Assessment of Significance.

8) Endangered Populations

Endangered populations are listed under the *NSW Threatened Species Conservation Act 1995.*

No endangered populations were identified on these sites or are considered likely to occur on these sites.

9) Endangered Ecological communities

Endangered Ecological Communities are listed under the *NSW Threatened Species Conservation Act 1995* and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999. .*

Remnants of the EEC White Box/Yellow Box/ Blakely's Red Gum Woodland (Grassy Woodland) or Box/Gum Woodland as it is also known were recorded in small patches along the Brayton Road study area. Yellow Box *E. melliodora,* Apple Box *E. bridgesiana* and Blakely's Red Gum *E. blakelyi* as well as a range of native grasses and forbs were identified as components of this EEC. Approximately 25 species considered to be 'important' components of this EEC under the EPBC Act were noted in the study area.

10) Assessments of Significance

Following a threatened species assessment at this site – provided in Appendix C of this report, it has been deemed necessary for the following vulnerable and endangered species to be considered by an Assessment of Significance.

- *Pyrrholaemus sagittatus* Speckled Warbler
- *Callocephalon fimbriatum* Gang Gang Cockatoo
- *Calyptorhynchus lathami* Glossy Black Cockatoo
- *Climacteris picumnus* Brown Treecreeper
- *Stagonopleura guttata* Diamond Firetail

1. Pyrrholaemus sagittatus (Speckled Warbler) ~ Vulnerable

This is a small, well-camouflaged and very heavily streaked ground-dwelling bird. It is grey brown above with dark streaks and it has a black crown distinctively streaked with buff. The underparts are pale and also heavily streaked.

This species inhabits eucalypt dominated communities with a grassy ground layer and sparse shrubs. The canopy is usually open and eucalypt regeneration is common feature. This species requires large, undisturbed areas of suitable habitat to persist and breed successfully.

Threats to this species include fragmentation of habitat through clearing for agriculture and development, grazing, fire and the simplification of understorey structure, removal of firewood and ground debris, predation by feral cats, dogs, foxes and non native birds and the already small size of existing populations making them highly susceptible to stochastic events and disease.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

This species is considered a potential visitor to the Brayton Road site only. The proposal will involve the removal of some potential habitat along the length of the study area, including small trees, shrubs and grassy understorey to allow for rehabilitation works. Areas likely to be altered have already undergone some previous disturbances and as such habitat is not ideal. The proposal is highly unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not Applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not Applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not Applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

A quantity of potential habitat (which has already been modified by previous road works) including small trees, shrubs and grasses will be altered or removed as a result of this proposal. This will not exceed a width of 7m in any one area, excluding temporary stockpile sites and will often already include the width of the existing road.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The clearing required to allow for this proposal will not fragment or isolate to a greater than existing extent any areas of known habitat for this species from other areas of potential habitat in the area.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The habitat that will be removed by this proposal is not considered important to the survival of this species. Adequate areas of similar habitat occur nearby and will not be disturbed as a result of this proposal. Habitat that may be altered by this proposal has already undergone some modifications as a result of the initial construction of Brayton Road.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat, either directly or indirectly.

Critical habitat has not been declared for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No draft or final recovery plan is currently available for the Speckled Warbler.

Assessment

It is considered that the proposed works will not impact significantly on any Speckled Warbler populations that may be associated with this site. While some potential habitat (consisting of both native and exotic flora) will be removed to allow for works, the overall impact on this species is likely to be negligible. There is an abundance of similar habitat to that which will be removed on nearby properties and outside of the immediate works areas that will not be altered by the proposal.

2. Callocephalon fimbriatum (Gang Gang Cockatoo) ~ Vulnerable

These birds are primarily slate grey, males have a scarlet head and wispy crest, females have a grey head and crest with the feathers on the underbelly edged in salmon (DEC 2005). They range in size from 32-37 cm, with a wingspan of 62-76 cm.

This species is generally found in tall mountain forests and woodlands (particularly heavily timbered and mature wet sclerophyll forests) in the summer months. In winter months it may also be found in drier, more open eucalypt forests and woodlands. It may also be found in urban areas (DEC 2005).

The distribution of this species runs from Southern Victoria through southern and central eastern NSW. It is also found in the ACT. It is rare at the fringes of its distribution with known occurrences as far north as Coffs Harbour and as far west as Mudgee (DEC 2005).

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

This species is considered a potential visitor to both sites. The proposal will involve the removal of some potential habitat along the length of the study area to allow for rehabilitation works. Areas likely to be altered have already undergone some previous disturbances and as such habitat is not ideal – in that trees are small and do not contain hollows. The proposal is highly unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not Applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not Applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not Applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

A quantity of potential habitat (which has already been modified by previous road works) will be altered or removed as a result of this proposal. This will not exceed a width of 7m in any one area, excluding temporary stockpile sites and will often already include the width of the existing road. No hollow bearing trees will be removed.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The clearing required to allow for this proposal will not fragment or isolate to a greater than existing extent any areas of known habitat for this species from other areas of potential habitat in the area.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The habitat that will be removed by this proposal is not considered important to the survival of this species. Adequate areas of similar habitat occur nearby and will not be disturbed as a result of this proposal. Habitat that may be altered by this proposal has already undergone some modifications as a result of the initial construction of these roads.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat, either directly or indirectly.

Critical habitat has not been declared for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No draft or final recovery plan is currently available for the Gang Gang Cockatoo.

Assessment

It is considered that the proposed works will not impact significantly on any Gang Gang populations that may be associated with this site. While some potential habitat (consisting of both native and exotic flora) will be removed to allow for works, the overall impact on this species is likely to be negligible. There is an abundance of similar habitat to that which will be removed on nearby properties and outside of the immediate works areas that will not be altered by the proposal.

3. Calyptorhynchus lathami (Glossy Black Cockatoo) ~ Vulnerable

The Glossy Black-cockatoo is a dusky brown to black cockatoo with a massive, bulbous bill and a broad red band through the tail. The red in the tail is barred black and edged with yellow (DEC 2005). The female usually has irregular pale-yellow markings on the head and neck and yellow flecks on the underparts and wing (DEC 2005). They are smaller than other black cockatoos (totalling about 50 cm in length) with a smaller crest (DEC 2005).

The species inhabits open forest and woodlands or the coast and Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur (DEC 2005). In the Riverina area the species inhabits open woodlands dominated by Belah (*Casuarina cristata*).

The Glossy Black-cockatoo feeds almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* spp.), shredding the cones with its massive bill (DEC 2005). The species is dependant on large hollow-bearing eucalypts for nest sites (DEC 2005).

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

This species is considered a potential (though unlikely) visitor to the Brayton Road site. The proposal will involve the removal of some vegetation in the area however no large hollow bearing trees will be involved and there were no feed trees located on site. The proposal is highly unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not Applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not Applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not Applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

A quantity of potential habitat occurs within the road reserve however there are no large hollow bearing trees present in close proximity to the existing road that may be affected by the proposal. Only small trees, shrubs and grassy ground layer will be altered or removed to allow for works. This will not exceed a width of 7m in any one area, excluding temporary stockpile sites and will often already include the width of the existing road. No feed trees will be affected as there were none located within the works area.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The clearing required to allow for this proposal will not fragment or isolate to a greater than existing extent any areas of known habitat for this species from other areas of potential habitat in the area.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The habitat that will be removed by this proposal is not considered important to the survival of this species. Adequate areas of similar habitat occur nearby and will not be disturbed as a result of this proposal. Habitat that may be altered by this proposal has already undergone some modifications as a result of the initial construction of these roads.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat, either directly or indirectly.

Critical habitat has not been declared for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No draft or final recovery plan is currently available for the Glossy Black Cockatoo.

Assessment

It is considered that the proposed works will not impact significantly on any Glossy Black Cockatoo populations that may be associated with this site. While some potential habitat (consisting of both native and exotic flora) will be removed to allow for works, the overall impact on this species is likely to be negligible. There is an abundance of similar habitat to that which will be removed on nearby properties and outside of the immediate works areas that will not be altered by the proposal.

4. Climacteris picumnus (Brown Treecreeper) ~ Vulnerable

This is Australia's largest treecreeper. It is a grey to brown bird with black streaking and black bars on the under-tail. Pale buff bands across the flight feathers are obvious in flight. It is a woodland species that has declined significantly with the loss of large areas of woodland throughout its range – particularly with the decline of the endangered ecological community White Box/Yellow Box/ Blakely's Red Gum Woodland in this region.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

This species is considered a potential visitor to the Brayton Road site only. The proposal will involve the removal of some potential habitat along the length of the study area to allow for rehabilitation works. Areas likely to be altered have already undergone some previous disturbances and as such habitat is not ideal. Trees containing hollows and fallen timber were scarce within the study area and unlikely to be removed. The proposal is highly unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not Applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not Applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not Applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

A quantity of potential habitat (which has already been modified by previous road works) will be altered or removed as a result of this proposal. This will not exceed a width of 7m in any one area, excluding temporary stockpile sites and will often already include the width of the existing road. No hollow bearing trees or fallen timber this species may utilise will be removed to allow for works.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The clearing required to allow for this proposal will not fragment or isolate to a greater than existing extent any areas of known habitat for this species from other areas of potential habitat in the area.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The habitat that will be removed by this proposal is not considered important to the survival of this species. Adequate areas of similar habitat occur nearby and will not be disturbed as a result of this proposal. Habitat that may be altered by this proposal has already undergone some modifications as a result of the initial construction of the road.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat, either directly or indirectly.

Critical habitat has not been declared for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No draft or final recovery plan is currently available for the Brown Treecreeper.

Assessment

It is considered that the proposed works will not impact significantly on any Brown Treecreeper populations that may be associated with this site. While some potential habitat (consisting of both native and exotic flora) will be removed to allow for works, the overall impact on this species is likely to be negligible. There is an abundance of similar habitat to that which will be removed on nearby properties and outside of the immediate works areas that will not be altered by the proposal.

5. Stagonopleura guttata (Diamond Firetail) ~ Vulnerable

This is a small brown bird with grey head, and a lighter ventral surface. Both sexes have a distinct crimson tail and eye-ring with a white diamond pattern on the black chest-flank band. This species is usually seen in small flocks and tends to nest in loosely scattered colonies, though throughout autumn and winter, much larger flocks may form (Morcombe 2002).

This species relies on grass seed, feeding exclusively on the ground and prefers to inhabit areas which have a grassy ground layer in open forest, woodland, mallee, acacia scrublands and timber belts along water courses and roadsides.

Threats to this species include habitat degradation, particularly overgrazing of grassy understorey and an increased abundance of predators such as the Pied Currawong and Australian Raven which may have increased nest predation in fragmented woodland remnants.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

This species is considered a likely visitor to the Brayton Road site and a potential visitor to the Red Hills Road site. The proposal will involve the removal of some potential habitat along the length of the both study areas (though primarily along Brayton Road) to allow for rehabilitation works. Areas likely to be altered have already undergone some previous disturbances and as such habitat is not ideal. The proposal is highly unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not Applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not Applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not Applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

A quantity of potential habitat (which has already been modified by previous road works) will be altered or removed as a result of this proposal. This will not exceed a width of 7m in any one area, excluding temporary stockpile sites and will often already include the width of the existing road.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The clearing required to allow for this proposal will not fragment or isolate to a greater than existing extent any areas of known habitat for this species from other areas of potential habitat in the area.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The habitat that will be removed by this proposal is not considered important to the survival of this species. Adequate areas of similar habitat occur nearby and will not be disturbed as a result of this proposal. This species is often recorded in modified landscapes.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat, either directly or indirectly.

Critical habitat has not been declared for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No draft or final recovery plan is currently available for the Diamond Firetail.

Assessment

It is considered that the proposed works will not impact significantly on any Diamond Firetail populations that may be associated with these sites. While some potential habitat (consisting entirely of exotic flora) will be removed to allow for works, the overall impact on this species is likely to be negligible. Diamond Firetails are often observed within modified landscapes in the region and there is an abundance of similar habitat to that which will be removed adjacent to the proposed works area and on nearby properties.

6. Box/Gum Woodland (White Box/Yellow Box/Blakely's Red Gum Woodland) ~ Endangered Ecological Community

Box Gum Woodland is generally characterised by the presence or prior occurrence of Yellow Box *E. melliodora,* White Box *E. albens* and Blakely's Red Gum *E. blakelyi* and often has a predominantly grassy understorey though shrubs may be locally common. Species diversity is high and remnants are of significant conservation value as the extent of this EEC has been reduced to less than 4% of its pre-European extent in NSW.

This EEC persists on fertile lowlands within its range and often in areas highly sought after for grazing and agricultural production throughout south-eastern Australia.

Threats to this EEC include clearing of remnants to allow for farming activities, alterations to the floristic structure of this EEC by grazing, clearing or fire which can reduce species diversity and introduce weeds to the EEC and removal of specific habitat components such as fallen timber and rocks for use as firewood or in gardens.

Assessment:

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

The proposed works are likely to involve the removal of small areas of this EEC along the Brayton Road study area – including small trees, shrubs and grassy ground layer components that have already been affected by the existing road and maintenance works for many years. This proposal is not likely to affect the extent of the EEC such that its local occurrence is likely to be placed at risk of extinction.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The proposed works will not substantially or adversely modify the composition of the EEC to the extent that it would be place at risk of extinction locally. Only a small quantity of young trees, shrubs and grassland associated with this EEC will need to be altered or removed to allow for this proposal.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

It is likely a small number of trees as well as components of the understorey which comprise this EEC will need to be removed to allow for works in several locations along Brayton Road. No large or hollow bearing trees are likely to be involved and in most cases the vegetation involved will already have been affected by the initial road construction and maintenance activities. No significant habitat will be affected by the proposal.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

No area of this EEC is likely to become fragmented or isolated from other areas of this EEC as a result of this proposal.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The small areas of this EEC that are likely to be removed to allow for works are not significant in terms of ensuring the survival of this EEC

in the area. In most cases components of this EEC to be altered or removed have already undergone disturbances or are regeneration from previous disturbances at the site.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat, either directly or indirectly.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

To date, there has been no official recovery plan or threat abatement plan prepared for this EEC.

Assessment:

The proposed works will have little impact on the remnants of this EEC on site. No large, hollow bearing or significant seed trees will be removed and there will be little alteration to the understorey component in most areas. There was ample regeneration of this EEC observed at the time of this survey to suggest it is viable on site despite such disturbances.

11) Impact Assessment

Ecological Communities and Habitats

The proposed rehabilitation works will not impact significantly on any communities or habitats associated with these sites. Remnants of the Box/Gum Woodland EEC will be affected to a minor extent by the removal or thinning of small trees mostly and modification to the understorey component in some areas. This will not affect the long term viability of the EEC in the area.

Flora

No threatened flora species was located on either site during this assessment or are expected to occur there. A number of 'important' species were recorded that form part of the Box/Gum Woodland EEC though are not listed as threatened under the EPBC Act 1999. The proposal will not impact significantly on other flora at either site given the extent and nature of previous disturbances.

Fauna

Few fauna species were recorded over both sites during this assessment. No threatened fauna was actually located on either site though several species are considered potential visitors. The impact on fauna of this proposal is likely to be negligible given no hollow bearing trees will need to be removed and all other fauna recorded in the area are highly mobile. An abundance of similar habitat to that which may be altered by the proposal will remain on site and adjacent properties.

12) Safeguards

The following impact mitigation measures are recommended for adoption to reduce the likelihood of any negative impacts on the flora and fauna associated with this site both in the short and long term.

1. Soil disturbance shall not be more than is required to undertake the project and vehicle, plant and stockpile impacts shall be restricted to areas already devoid of vegetation.
2. An environmental management plan that incorporates erosion and sediment control measures for the site will be prepared prior to soil being disturbed.
3. Disturbed banks and batters shall be rehabilitated by the addition of topsoil and sowing and maintenance of suitable species as soon as is practical to avoid the establishment of weed species in accordance with an erosion and sediment control plan.
4. Vegetation removal shall be undertaken so as to minimise impact to vegetation that will be retained.
5. Where possible, dead hollow wood will be retained or added as terrestrial habitat to the road reserve at a density no greater than one to two logs per ten metres.
6. Works and stockpile compounds will be in areas already cleared of native vegetation, such as the construction zone or agricultural paddocks. They will be established where native vegetation disturbance is minimal or weeds dominate, and require no clearing of native vegetation. No trees or large shrubs will be removed for the establishment of the works compound or stockpile sites if they are located outside the construction zone.
7. Topsoil that is stripped from the construction areas should be stockpiled and spread over disturbed areas prior to seeding or planting of rehabilitation grasses and trees.
8. Weeds should be removed and taken to an approved waste management facility.
9. The area to be disturbed for construction should be kept to a minimum.
10. Tree felling should be undertaken so that no accidental damage occurs to other retained trees.
11. Chipped native vegetation should be used where available to protect exposed areas.

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14) Appendix A; Flora Recorded on Site

Brayton Road Section:

**** Indicates exotic or non-provenance species***

Botanical Name	Common Name	Comments
Acacia decurrens	Early Black Wattle	Common
Acacia parramattensis	Parramatta Green Wattle	Scattered
Acacia terminalis	Sunshine Wattle	Scattered
Acaema ovina	Sheep's Bur	Common
*Arctotheca calendula**	Cape Weed	Common
Aristida ramosa	Purple Wire Grass	Common
Astroloma humifusum	Cranberry Heath	Common
Austrodanthonia sp.	Wallaby Grass	Common
Austrostipa sp.	Spear Grass	Common
*Avena sp.**	Wild Oats	Scattered
Bossiaea prostrata	Bush Pea	Common
*Brassica sp.**	Brassica	Scattered
*Briza maxima**	Quaking Grass	Scattered
*Briza minor**	Shivery Grass	Common
*Capsella bursapastoris**	Shepherd's Purse	Common
Carex appressa	Tall Sedge	Scattered
Cassinia aculeata	Sifton Bush	Common
Cassinia arcuata	Dolly Bush	Scattered
*Centaurium erythraea**	Common Centaury	Scattered
Cheilanthes spp.	Rock Fern	Scattered
*Chloris truncata**	Windmill Grass	Common
Chrysocephalum apiculatum	Yellow Buttons	Scattered
*Cirsium vulgare**	Spear Thistle	Scattered
Clematis sp.	Clematis	Scattered
Convolvulus erubescens	Australian Bindweed	Scattered
Cymbonotus preissianus	Austral Bears Ear	Common
*Cynodon dactylon**	Common Couch	Common
*Cystisus scoparia**	Broome	Scattered
*Dactylis glomerata**	Cocksfoot	Scattered
Daviesia leptophylla	Leafy Bitter Pea	Common
Daviesia ulicifolia	Gorse Bitter-pea	Common
Dianella revoluta	Black-anthered Flax Lily	Scattered
Dichelachne sp.	Plume Grass	Scattered
Dichondra repens	Kidney Weed	Scattered
Dillwynia sp.	Bush Pea	Common
Drosera peltata	Pale Sundew	Scattered
*Echium plantagineum**	Patterson's Curse	Scattered
Eucalyptus amplifolia	Cabbage Gum	Common
Eucalyptus blakelyi	Blakely's Red Gum	Common
Eucalyptus bridgesiana	Apple Box	Common
Eucalyptus cinerea	Argyle Apple	Common
Eucalyptus mannifera	Brittle Gum	Common
Eucalyptus melliodora	Yellow Box	Scattered
Exocarpus cupressiformis	Native Cherry	Scattered
Geranium solanderi	Native Geranium	Common
Glycine clandestina	Twining Glycine	Scattered
Gompholobium heugelii	Pale Wedge-pea	Scattered

Botanical Name	Common Name	Comments
Gonocarpus tetragynous	Common Raspwort	Common
Goodenia hederacea	Ivy Goodenia	Common
Hardenbergia violaceae	Native Sarsparilla	Common
*Holcus lanatus**	Yorkshire Fog	Common
*Hordeum leporinum**	Barley Grass	Scattered
Hydrocotyle laxiflora	Stinking Pennywort	Scattered
*Hypericum perforatum**	St John's Wort	Common
*Hypochoeris radicata**	Flatweed	Common
Indigofera australis	Native Indigo	Scattered
Jacksonia scoparia	Dog Wood	Common
Juncus sp.	Rush	Common
Kunzea parvifolia	Purple Kunzea	Common
Lepidosperma laterale	Variable Sword Sedge	Scattered
Leptorhynchos squamatus	Scaly Buttons	Common
Leptospermum multicaule	Dog Tangle	Scattered
Lissanthe strigosa	Peach Heath	Common
*Lolium perenne**	Perennial Ryegrass	Common
Lomandra filiformis	Wattle Mat-rush	Common
Lomandra longifolia	Spiny Mat-rush	Scattered
Lomandra multiflora	Many-flowered Mat-rush	Scattered
Luzula densiflora	Woodrush	Scattered
Microlaena stipoides	Weeping Grass	Common
*Nassella neesiana**	Chillean Needle Grass	Scattered
*Nassella trichotoma**	Serrated Tussock	Scattered
*Oenothera stricta**	Common Evening Primrose	Scattered
Olearia microphylla	Small Leafed Daisy Bush	Scattered
Olearia viscidula	Wallaby Weed	Scattered
Oxalis perenans	Grassland Wood Sorrel	Common
*Parentucellia latifolia**	Common Bartsia	Scattered
*Paspalum dilatatum**	Paspalum	Common
*Petrorhagia nanteuilii**	Proliferous Pink	Common
*Phalaris aquatica**	Phalaris	Scattered
*Pinus radiata**	Radiata Pine	Scattered
*Plantago lanceolata**	Ribwort Plantain	Common
Plantago varia	Variable Plantain	Common
Poa labillardieri	River Tussock	Scattered
Poranthora microphylla	Small Poranthora	Common
*Romulus rosea**	Onion Grass	Common
*Rosa rubignosa**	Briar Rose	Scattered
*Rubus sp.**	Blackberry	Common
Rumex acetocella	Sorrel	Common
*Silybum marianum**	Variegated Thistle	Scattered
Stylidium graminifolium	Grass Triggerplant	Scattered
Stypandra glauca	Nodding Blue Lily	Scattered
Themeda australis	Kangaroo Grass	Scattered
*Tolpis umbellata**	Yellow Hawkweed	Scattered
Triptilodiscus pygmaeus	Austral Sunray	Common
Vittadinia cuneata	Fuzzy New Holland Daisy	Scattered
Wahlenbergia sp.	Bluebell	Common

Red Hills Road Section:

**** Indicates exotic or non-provenance species***

Botanical Name	Common Name	Comments
Acacia brownii	Prickly Moses	Scattered
Acacia decurrens	Early Black Wattle	Common
*Arctotheca calendula**	Cape Weed	Common
Aristida ramosa	Purple Wire Grass	Common
Austrodanthonia sp.	Wallaby Grass	Common
Austrostipa sp.	Spear Grass	Common
*Briza minor**	Shivery Grass	Scattered
Davesia leptophylla	Leafy Bitter-pea	Scattered
*Echium plantagineum**	Patterson's Curse	Scattered
Eucalyptus amplifolia	Cabbage Gum	Common
Eucalyptus sieberi	Silvertop Ash	Scattered
Hibbertia obtusifolia	Grey Guinea Flower	Scattered
Holcus lanatus	Yorkshire Fog	Common
*Hypochoeris radicata**	Flat Weed	Common
Juncus sp.	Rush	Scattered
Kunzea parvifolia	Purple Kunzea	Scattered
Lepidosperma laterale	Variable Sword Sedge	Scattered
Lomandra filiformis	Wattle Mat-rush	Common
Lomandra longifolia	Spiny Mat-rush	Scattered
Lomandra multiflora	Many-flowered Mat-rush	Scattered
Microlaena stipoides	Weeping Grass	Common
Pimelea curviflora	Curved Rice-flower	Scattered
*Pinus radiata**	Radiata Pine	Scattered
Plantago lanceolata	Ribwort plantain	Common
Poa labillardieri	River Tussock	Common
Pteridium esculentum	Bracken Fern	Common
*Rubus sp.**	Blackberry	Common
Rumex acetocella	Sorrel	Common
Stypandra glauca	Nodding Blue-lily	Scattered
Themeda australis	Kangaroo Grass	Scattered

15) Appendix B; Fauna Recorded on Site

Brayton Road and Red Hills Road Sections:

Zoological Name	Common Name	Introduced?	Comments
Crinia signifera	Common Eastern Froglet	-	Heard
Pogona barbata	Bearded Dragon	-	One located (dead)
Macropus giganteus	Eastern Grey Kangaroo	-	Sighted
Tachyglossus aculeata	Short Beaked Echidna	-	Digs located
Vombatus ursinus	Common Wombat	-	One located (dead)
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	Common
Acridotheres tristris	Common Myna	Y	Few Sighted
Cacatua roseicapilla	Galah	-	Common
Coracina novaehollandiae	Black-faced Cuckoo Shrike	-	Common
Dacelo novaeguineae	Laughing Kookaburra	-	Common
Grallina cyanoleuca	Magpie Lark	-	Heard
Gymnorhina tibicen	Australian Magpie	-	Common
Pardalotus punctata	Spotted Pardalote	-	Common
Platycercus elegans elegans	Crimson Rosella	-	Common
Platycercus eximus	Eastern Rosella	-	Heard
Rhipidura leucophrys	Willie Wagtail	-	Sighted

16) Appendix C; Threatened Species Assessment

This table identifies NSW threatened species previously recorded within a reasonable distance of this site considering the biology of the species. Species identified on site, that occupy habitat types identified on this site or that could otherwise be affected by the development of this site have been addressed by way of an 'Assessment of Significance' as required by the NSW TSC Act 1995. This assessment considers the ecology of the species, habitat available on site, the continuity of the site with other potential habitat areas, records of existing populations as well as the mobility of the individual species.

* V = Vulnerable (Threatened Species Conservation Act 1995), E1 = Endangered (TSC Act 1995)
** V = Vulnerable (Environment Protection and Biodiversity Conservation Act 1999), E = Endangered (EPBC Act 1999)

Flora	Species Name	NSW Conservation Status *	National Conservation Status**	Potential to Occur on Site
1	*Eucalyptus macarthurii* Camden Woollybutt	V	-	This species has been recorded approximately 6km south of the Brayton Road study area. This species was not recorded on either site and as such will not be affected by the proposal.
2	*Kunzea cambagei* Cambage Kunzea	V	V	This species has been recorded approximately 10km northwest of the Brayton Road study area. This species was not recorded on either site despite a thorough on ground survey and so is highly unlikely to be affected by the proposal.
3	*Solanum celatum* Solanum celatum	E	-	This species has been recorded approximately 8km southeast of the Brayton Road study area. This species was not recorded on either site despite a thorough on ground survey and so is highly unlikely to be affected by the proposal.

Amphibia	Species Name	NSW Conservation Status *	National Conservation Status**	Potential to Occur on Site
	N/A	-	-	-

Reptilia	Species Name	NSW Conservation Status *	National Conservation Status**	Potential to Occur on Site
	N/A	-	-	-

Aves	Species Name	NSW Conservation Status *	National Conservation Status**	Potential to Occur on Site
4	*Pyrrholaemus sagittatus* Speckled Warbler	V	-	This species has been recorded approximately 6km southwest of the Brayton Road study area. Potential habitat occurs on site to support this species and is likely to be altered as a result of the proposal. **An Assessment of Significance has been completed.**
5	*Oxyura australis* Blue Billed Duck	V	-	This species has been recorded approximately 10km east of the Brayton Road study area. This species was not recorded on either site during the assessment and these sites do not provide suitable habitat for the species. It is highly unlikely the species would be affected by the proposal.

Aves	Species Name	NSW Conservation Status *	National Conservation Status**	Potential to Occur on Site
6	*Botaurus poiciloptilus* Australasian Bittern	V	-	This species has been recorded approximately 6km south of the Brayton Road study area. This species was not recorded on either site during this assessment and these sites do not provide suitable habitat for the species. It is highly unlikely this species would be affected by the proposal.
7	*Callocephalon fimbriatum* Gang-gang Cockatoo	V	-	This species has been recorded approximately 2km north and 2km southeast of the Brayton Road study area. This species was not recorded on either site during this assessment however both sites contain or are immediately adjacent to habitat this species is likely to utilise that may be altered as a result of the proposal. **An Assessment of Significance has been completed.**
8	*Calyptorhynchus lathami* Glossy Black Cockatoo	V	E	This species has been recorded approximately 6km southeast of the Brayton Road study area. It was not recorded on either site during this assessment however both sites contain or are immediately adjacent to habitat this species is likely to utilise that may be altered as a result of the proposal. **An Assessment of Significance has been completed.**

Aves	Species Name	NSW Conservation Status *	National Conservation Status**	Potential to Occur on Site
9	*Climacteris picumnus* Brown Treecreeper	V	-	This species has been recorded approximately 3km southeast of the Brayton Road study area. It was not recorded on either site at the time of this assessment however potential habitat does occur on the Brayton Road site that may be altered as a result of the proposal. **An Assessment of Significance has been completed.**
10	Diamond Firetail *Stagonopleura guttata*	V	-	This species has been recorded approximately 8km northeast and 6km southeast of the Brayton Road study area. This species was not recorded on either site during this assessment although potential habitat does occur on site and may be affected by the proposal. **An Assessment of Significance has been completed.**
11	*Melithreptus gularis* Black-chinned Honeyeater	V	-	This species has been recorded approximately 4km south of the Brayton Road study area. This species was not located on either site during this assessment and these sites do not contain suitable habitat. It is highly unlikely that this species would be affected by the proposal.
12	*Ninox strenua* Powerful Owl	V	-	This species has been recorded approximately 4km east and 8km northeast of the Brayton Road study area. This species was not recorded on either site during this assessment and no significant habitat – being large, hollow bearing trees are likely to be removed to allow for works. It is highly unlikely this species will be affected by the proposal.

Mammalia	Species Name	Conservation Status (NSW)*	National Conservation Status**	Potential to Occur on Site
13	*Petrogale penicillata* Brush-tailed Rock Wallaby	E	V	This species has been recorded approximately 5km northeast of the Brayton Road study area. It was not recorded on either site during this assessment as there was no suitable habitat present. It is highly unlikely this species will be affected by the proposal.
14	*Mormopterus norfolkensis* Eastern Freetail-bat	V	-	This species has been recorded approximately 6km south of the Brayton Road study area. It was not recorded on either site during this assessment and while there is potential habitat present at the Brayton Road site, habitat to be affected by the proposal is unlikely to be important to the species. It is highly unlikely that this species will be affected by the proposal.
15	*Petaurus norfolcensis* Squirrel Glider	V	-	This species has been recorded approximately 5km south of the Brayton Road study area. It was not recorded on either site during this assessment. Habitat occurring on both sites is not considered suitable for this species. It is highly unlikely this species will be affected by the proposal.
16	*Phascolarctos cinereus* Koala	V	-	This species has been recorded approximately 4km south of the Brayton Road study area. It was not recorded on either site during this assessment and there was no suitable habitat present. It is highly unlikely this species will be affected by the proposal.
17	*Chalinolobus dwyeri* Large-eared Pied-bat	V	V	This species has been recorded approximately 10km east of the Brayton Road study area. Habitat on both sites is not considered suitable for this species. It is highly unlikely it would be affected by the proposal.

Mammalia	Species Name	Conservation Status (NSW)*	National Conservation Status**	Potential to Occur on Site
18	*Falsistrellus tasmaniensis* Eastern False Pipistrelle	V	-	This species has been recorded approximately 4.5km south of the Brayton Road study area. It was not located on either site during this assessment and habitat that may be altered by the proposal is unlikely to be important to the species. It is highly unlikely this species will be affected by the proposal.
19	*Miniopterus schreibersii oceanensis* Eastern Bentwing-bat	V	-	This species has been recorded approximately 5km southeast of the Brayton Road study area and 5km north of the Red Hills Road site. It was not recorded on either site during this assessment and there was no suitable habitat present. It is highly unlikely this species will be affected by the proposal.
20	*Myotis adversus* Large-footed Myotis	V	-	This species has been recorded approximately 7km east of the Brayton Road study area. It was not recorded on either site during this assessment Habitat on both of these sites is not considered suitable for this species and as such it is highly unlikely to be affected by the proposal.
21	*Scoteanax rueppellii* Greater Broad-nosed Bat	V	-	This species has been recorded approximately 7km northeast of the Brayton Road study area. It was not recorded on either site during this assessment though some potential habitat was located on the Brayton Road site. Potential habitat that may be altered by works is unlikely to be important to the species. As such, the species is highly unlikely to be affected by the proposal.