

Attachment 1.9

Property Vegetation Management Plan

PROPERTY VEGETATION MANAGEMENT PLAN

BARRO GROUP – MOUNT COTTON EXTRACTIVE INDUSTRY, ENVIRONMENTALLY RELEVANT ACTIVITIES AND ASSOCIATED ACTIVITIES

Prepared for:
Barro Group Pty Ltd

Date:
20 December 2010

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Figure 1 **Property Vegetation Management Plan (PVMP)** *(Ref. DWG No.987_178)*

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1. Project Description

1.1 Introduction

Groundwork Plus has been commissioned by Barro Group Pty Ltd to prepare a Property Vegetation Management Plan (PVMP) in accordance with the Vegetation Management Act 1999.

This PVMP accompanies the Integrated Development Assessment System (IDAS) Form 11 – Clearing Native Vegetation, as the site is mapped as containing remnant vegetation on the Regional Ecosystem Maps.

1.2 Scope of Report

This report addresses the vegetation proposed to be removed associated with the extension to the existing extractive industry operations occurring on site (refer **FIGURE 1 – PROPERTY VEGETATION MANAGEMENT PLAN**).

1.3 Background

Barro Group Pty Ltd (Barro) proposes to extend existing quarry operations at the Mount Cotton Quarry to land adjacent to the existing operations (Lot 162 S31962, Lot 238 S31474 and Lot 370 S311071) while maintaining and utilising existing ancillary facilities (including crushing and screening plant, stockpile areas, access road, workshop, fuel storage, water storages, weighbridge, amenities, office buildings and ancillary facilities) at the current quarry site (Lots 1 and 17 RP108970).

Given the history of this matter, out of an abundance of caution, land comprising that part of Greenhide (California) Creek located between Lot 162 SP31962 and Lot 238 SP218968 (the boundary watercourse), which is the property of the State has also been included in the land the subject of the application, even though no works are proposed on this land, as has the unformed road bisecting and adjoining Lot 17 RP 108970, Lot 370 S311071 and Lot 162 S31962 (the unformed road), even though it will only be used for traversing by quarry traffic.

The existing quarry was established in the 1960's and is an important source of materials for building and construction in the Redland City and the surrounding areas and provides local employment and training opportunities. Barro's Mount Cotton Quarry is an identified Key Resource Area (KRA 71).

1.4 Description of the Proposal

The applicant proposes to extend quarry operations to Lot 162 S31962, Lot 238 S31474 and Lot 370 S311071 while maintaining and utilising existing ancillary facilities (including crushing and screening plant, stockpile areas, workshop, fuel storage, water storages, weighbridge, amenities, office buildings and ancillary facilities) at the current quarry site (Lots 1 and 17 RP108970). Given the history of this matter, out of an abundance of caution, land comprising that part of Greenhide (California) Creek located between Lot 162 SP31962 and Lot 238 SP218968 (the boundary watercourse), which is the property of the State has also been included in the land the subject of the application, even though no works are proposed on this land, as has the unformed road bisecting and adjoining Lot 17 RP 108970, Lot 370 S311071 and Lot 162 S31962 (the unformed road), even though it will only be used for traversing by quarry traffic.

The proposal is for a Material Change of Use for Extractive Industry and associated activities.

Extractive Industry is market driven and the material is extracted on site on an 'as needed' basis in line with construction and infrastructure project requirements. The proposal seeks to increase the overall capacity of the site to extract valuable hard rock resources from a location that is already used for extractive industry.

1.4 Regional Ecosystem Mapping

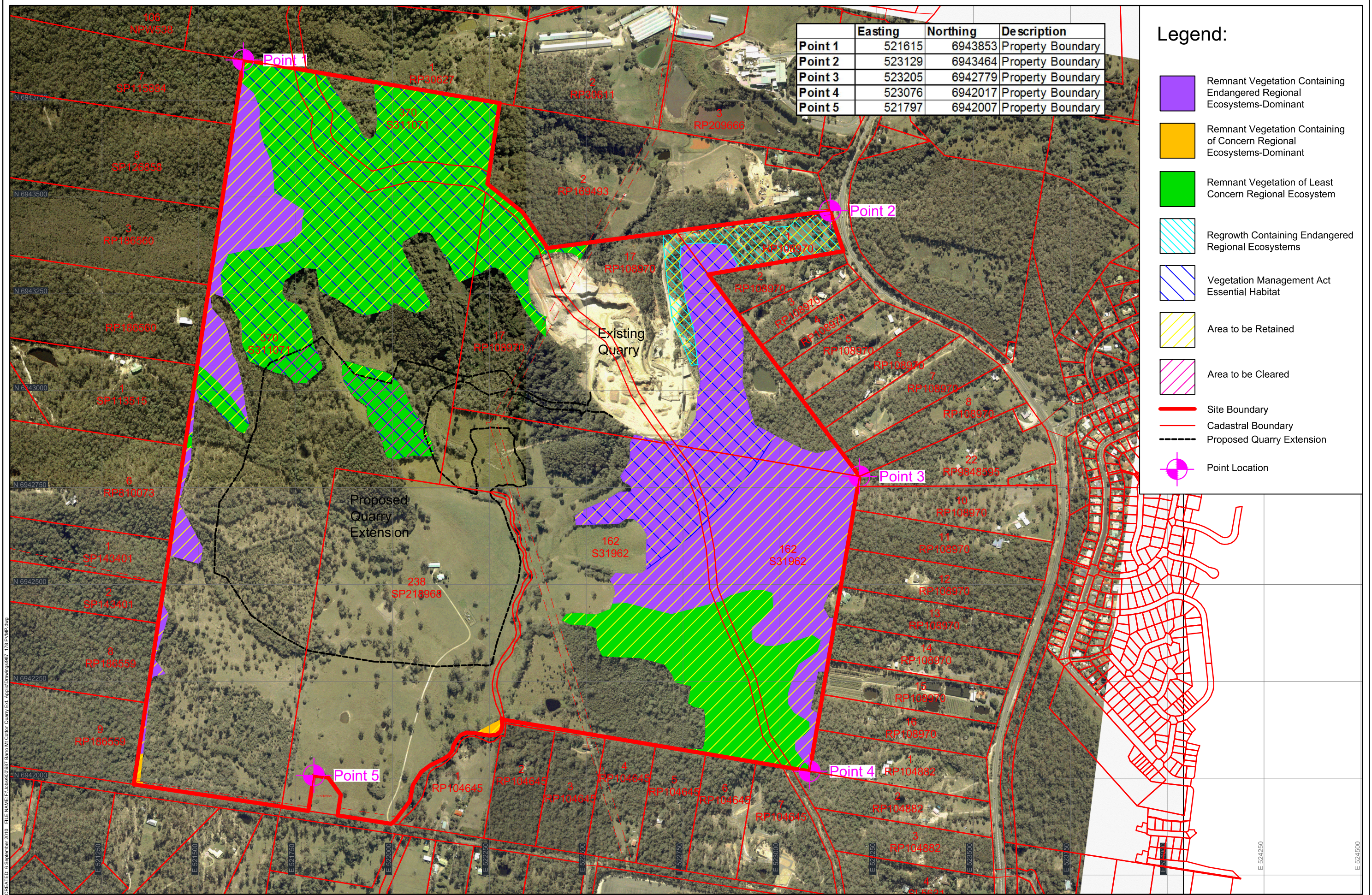
The Department of Environment and Resource Management (DERM) Regional Ecosystem Mapping shows the site as comprising 'Endangered Regional Ecosystems – Dominant' and 'Of Concern Regional Ecosystems – Least Concern'. Portions of the Least Concern Regional Ecosystems, in proximity to the quarry extension area, are identified as containing Essential Habitats 12.11.5 and 12.11.3 (*Macadamia tetraphylla*).

Biodiversity Assessment and Management Pty Ltd (BAAM) have prepared a Vegetation Offset Rehabilitation Management Plan in respect of the site (refer **ATTACHMENT 1 – VEGETATION OFFSET REHABILITATION MANAGEMENT PLAN**). In addition, Michael Olsen of Landscape Assessment, Management and Rehabilitation Pty Ltd (refer **ATTACHMENT 2 – FLORA AND ITS VALUES**) has assessed the on site vegetation values. The assessment undertaken by BAAM includes a full assessment of the proposed vegetation removal against 'Part Xa: Requirements for Clearing for an Extractive Industry in a Key Resource Area' under the *Regional Vegetation Management Code for South East Queensland Bioregion*.

The site is subject to an existing Property Map of Assessable Vegetation (PMAV) over the extent of the existing quarry and much of the proposed extension area (refer **ATTACHMENT 3 – PROPERTY MAP OF ASSESSABLE VEGETATION**). The area subject to extractive industry will require some clearing of vegetation that is classified remnant 'least concern'. The area of remnant 'least concern' regional ecosystem proposed to be cleared is shown on **FIGURE 1 – PROPERTY VEGETATION MANAGEMENT PLAN**. The proposed quarry development area does not require the removal any vegetation shown as 'dominant' on the Regional Ecosystem Mapping.

Whilst some remnant 'least concern' vegetation containing Essential Habitat is proposed to be cleared to provide for extraction, clearing is designed in a manner that is consistent with the relevant sections of the *Regional Vegetation Management Code for South East Queensland Bioregion* (refer **ATTACHMENT 1 – VEGETATION OFFSET REHABILITATION MANAGEMENT PLAN**).

figures



	Easting	Northing	Description
Point 1	521615	6943853	Property Boundary
Point 2	523129	6943464	Property Boundary
Point 3	523205	6942779	Property Boundary
Point 4	523076	6942017	Property Boundary
Point 5	521797	6942007	Property Boundary

Legend:

- Remnant Vegetation Containing Endangered Regional Ecosystems-Dominant
- Remnant Vegetation Containing of Concern Regional Ecosystems-Dominant
- Remnant Vegetation of Least Concern Regional Ecosystem
- Regrowth Containing Endangered Regional Ecosystems
- Vegetation Management Act Essential Habitat
- Area to be Retained
- Area to be Cleared
- Site Boundary
- Cadastral Boundary
- Proposed Quarry Extension
- Point Location

CREATED: 8 September 2010 FILE NAME: F:\Jobs\9000987 Barro Mt Cotton Quarry Ext. App\DC\Drawings\987_178_PVMP.dwg
 PHOTOGRAPHY: F:\Jobs\9000987 Barro Mt Cotton Quarry Ext. App\DC\Drawings\987_178_PVMP.dwg

REV	DESCRIPTION	DATE	BY

Data Sources:
 Photography: [Blank]
 Topography: [Blank]
 Cadastral: [Blank]
 Ecosystem: [Blank]
 Other: [Blank]

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Legend:

PROJECT: **Mt Cotton Quarry**

CLIENT: **Barro Group**

TITLE: **Property Vegetation Management Plan**

SCALE: 1:9000

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attachments

Attachment 1

Vegetation Offset Rehabilitation Management Plan



VEGETATION CODE ASSESSMENT AND OFFSET REHABILITATION MANAGEMENT PLAN

Mount Cotton Quarry

Report prepared
for
Barro Group Pty Ltd



**Biodiversity
Assessment**

AND MANAGEMENT PTY LTD

FAUNA AND HABITAT SPECIALISTS

Document Control Sheet

File Number: 0241-001-4

Project Manager: Adrian Caneris

Client: Barro Group Pty Ltd

Project Title: Vegetation Code Assessment and Offset Rehabilitation Management Plan, Mount Cotton Quarry extension

Project Author/s: Olivia Woosnam, Adrian Caneris

Project Summary: The aim of this report is to provide rehabilitation management recommendations to restore remnant vegetation as part of an offset to obtain approval to clear remnant vegetation RE 12.11.3 and RE 12.11.5 for the extension of Mount Cotton Quarry.

Revision/ Checking History Track

Version	Date of Issue	Checked by	Issued by
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0241-001-4 Version 1	02/12/2010	Olivia Woosnam	Olivia Woosnam

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Purpose of Report

Biodiversity Assessment and Management Pty Ltd has produced this report in its capacity as consultants for and on the request of Barro Group Pty Ltd (the "**Client**") for the sole purpose of providing a Vegetation Offset Rehabilitation Management Plan for the proposed vegetation offset area associated with Mount Cotton quarry extension (the "**Specified Purpose**"). This information and any recommendations in this report are particular to the Specified Purpose and are based on facts, matters and circumstances particular to the subject matter of the report and the Specified Purpose at the time of production. This report is not to be used, nor is it suitable, for any purpose other than the Specified Purpose. Biodiversity Assessment and Management Pty Ltd disclaims all liability for any loss and/or damage whatsoever arising either directly or indirectly as a result of any application, use or reliance upon the report for any purpose other than the Specified Purpose.

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Signed on behalf of
Biodiversity Assessment and Management Pty Ltd

Date: 02 December 2010



Managing Director

VEGETATION CODE ASSESSMENT AND OFFSET REHABILITATION MANAGEMENT PLAN MOUNT COTTON QUARRY EXTENSION

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List of Abbreviations

BAAM	Biodiversity Assessment and Management	
DERM	Queensland Department of Environment and Resource Management	
LP Act	Queensland <i>Land Protection (Pest and Stock Route) Management Act 2002</i>	
NC Act	Queensland <i>Nature Conservation Act 1992</i>	
PMAV	Property Maps of Assessable Vegetation	
VM Act	Queensland <i>Vegetation Management Act 1999</i>	
RE	Regional Ecosystem	

1.0 REGIONAL VEGETATION MANAGEMENT CODE FOR SOUTH EAST QUEENSLAND BIOREGION (VERSION 2)

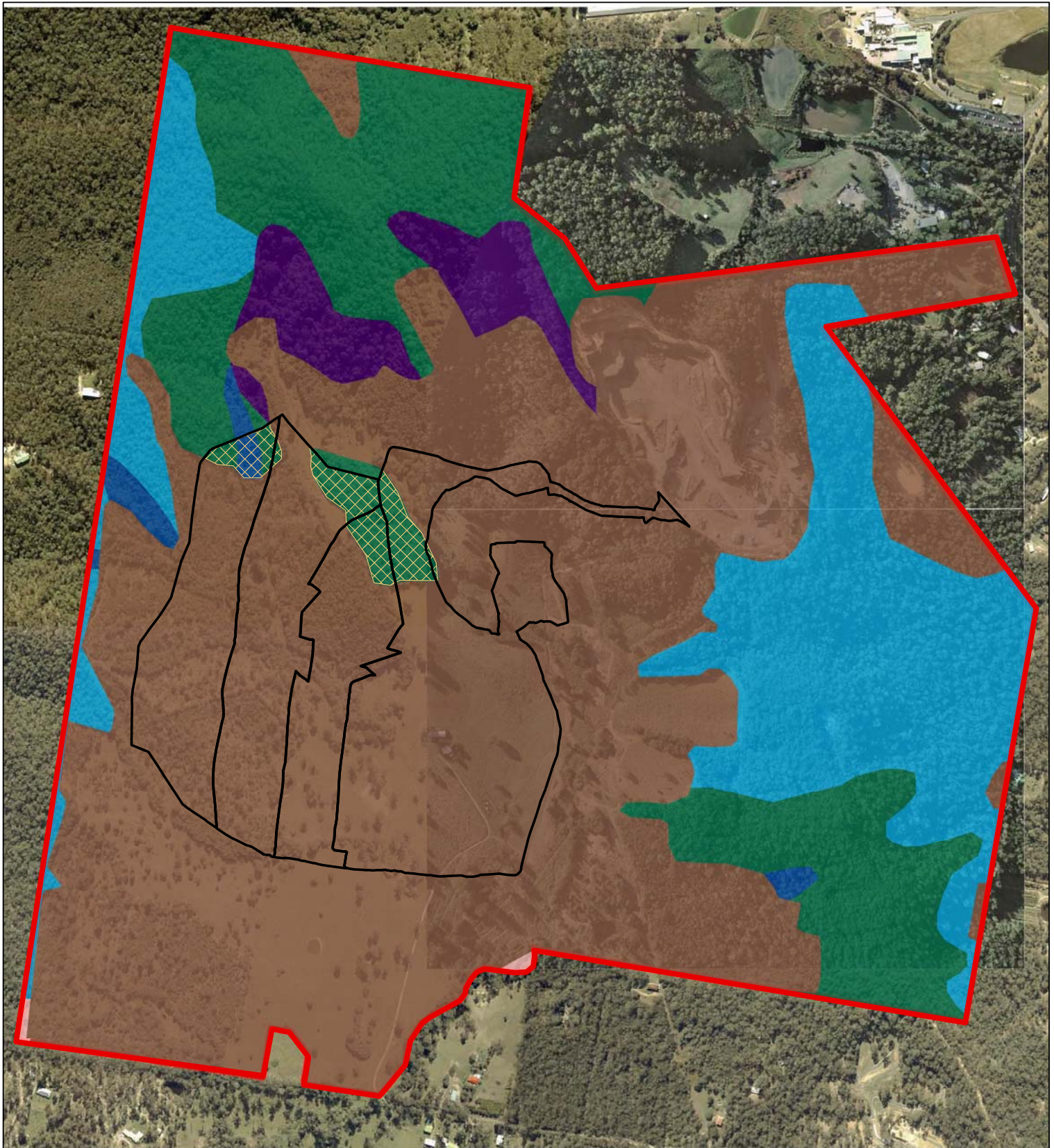
By virtue of Schedule 7 of the *Sustainable Planning Regulation 2009*, the Chief Executive of the Queensland Department of Environment and Resource Management (DERM) is a concurrence agency for this development application and its referral jurisdiction is the purpose of the Queensland *Vegetation Management Act 1999* (VM Act). The purpose of the VM Act is relevantly stated to be achieved by providing codes for the clearing of vegetation. In this regard, the current applicable code for clearing vegetation is the Regional Vegetation Management Code for South East Queensland Bioregion – version 2 dated 6 November 2009.

The following table is an assessment of the proposed development against ‘Part Xa: Requirement• for clearing for an extractive industry in a Key Resource Area’ under the Regional Vegetation Management Code for South East Queensland Bioregion – version 2.

PERFORMANCE CRITERIA	SOLUTION
<p>PR Xa.1: Limits to clearing for an extractive industry To regulate the clearing of vegetation in a way that conserves remnant vegetation that are regional ecosystems, prevents the loss of biodiversity, maintains ecological processes and does not cause land degradation – subject to the limitations required to meet P Xa.2 to PR Xa.10 – clearing is limited to the extent that is necessary for –</p> <ul style="list-style-type: none"> a) dredging material from the bed of any waters; and b) extracting, from a pit or quarry, rock, sand, clay, gravel, loam or other material; and c) screening, washing, grinding, milling, sizing or separating material extracted from a pit or quarry; and d) carrying out work that is the natural and ordinary consequence of carrying out work mentioned in subparagraphs (a), (b) and (c). 	<p>Through quarry design, clearing of remnant vegetation that are remnant regional ecosystems is limited to the extent that is necessary for (b), (c) and (d).</p> <p>There are approximately 97ha of vegetation that are mapped regional ecosystems (REs) on the subject site (Figure 1.1). The proposed development will remove 3.7ha of remnant vegetation, or less than 4% of the total amount of mapped remnant vegetation within the subject site.</p> <p>Removed remnant vegetation is proposed to be offset on the subject site: 12.8ha of land that is currently mapped non-remnant is proposed to be managed, restored and protected from future clearing (Figures 2 and 3) in association with a conservation agreement under the <i>Nature Conservation Act 1992</i> (NC Act). These areas will be managed to achieve remnant status. These proposed offset areas are currently mapped as Category X on the Property Map of Assessable Vegetation (Figure 4).</p>
<p>PR Xa.2: Clearing is staged To regulate the clearing of vegetation in a way that prevents the loss of biodiversity, conserves remnant vegetation that are regional ecosystems, maintains ecological processes and does not cause land degradation – clearing –</p> <ul style="list-style-type: none"> a) is staged in line with operational needs that restricts clearing to the current operational area; and b) is limited to the area from which material will be extracted within the term of the development approval; and c) cannot occur until all required permits are obtained. 	<p>In line with operational needs, clearing will occur in four stages, will be limited to the area from which material will be extracted within the term of the development approval, and will not occur until all required permits are approved.</p>

PERFORMANCE CRITERIA	SOLUTION
<p>PR Xa.3: Wetlands To regulate clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes – <u>maintain the current extent of assessable vegetation</u> associated with any natural <u>significant wetland</u> and/or natural <u>wetland</u> to provide –</p> <ul style="list-style-type: none"> a) water quality by filtering sediments, nutrients and other pollutants; and b) aquatic habitat; and c) terrestrial habitat. 	<p>There are no mapped wetlands within the subject site.</p>
<p>PR Xa.4: Watercourses To regulate the clearing of vegetation in a way that does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes – <u>maintain the current extent of assessable vegetation</u> associated with any <u>watercourses</u> to provide –</p> <ul style="list-style-type: none"> a) bank stability by protecting against bank erosion; and b) water quality by filtering sediments, nutrients and other pollutants; and c) aquatic habitat; and d) terrestrial habitat. 	<p>Vegetation associated with a stream order 1 on the Vegetation Management Watercourse map will be removed (vegetation associated with RE 12.11.3, Figure 5).</p> <p>The proposed offset for the watercourse will:</p> <ul style="list-style-type: none"> - be of the same broad vegetation group; - restore an area to its pre-clearing RE12.11.3 status (Figure 6); and - will be a regional ecosystem associated with a watercourse that has the same stream order as the watercourse proposed for clearing.
<p>PR Xa.5: Connectivity To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes – areas of <u>mapped remnant vegetation</u> are –</p> <ul style="list-style-type: none"> a) of sufficient size and configured in a way to maintain ecosystem functioning; and b) of sufficient size and configured in a way to remain in the landscape in spite of any threatening processes; and c) located on the lot(s) that are the subject of the application to maintain connectivity to <u>mapped remnant vegetation</u> on adjacent properties. 	<p>The proposed development will require removal of less than 4% of the total amount of mapped remnant vegetation within the subject site. All removed remnant vegetation will be offset on site such that the extent of remnant vegetation within the subject site will be increased. The offset proposed is at a ratio greater than 3ha offset for every 1ha cleared.</p> <p>Most of the remnant vegetation to be removed comprises an isolated patch of mapped remnant vegetation containing the Not of Concern RE12.11.5 (Olsen 2010). The areas of mapped remnant vegetation on the balance of the site are considered to be of sufficient size and configured in a way to maintain ecosystem functioning as they are located in areas contiguous to existing remnant vegetation both within the subject site and on adjoining properties. The remaining areas of mapped remnant vegetation on the site are of sufficient size and configured in a way to remain in the landscape in spite of any threatening processes and to maintain connectivity to mapped remnant vegetation on adjacent properties.</p> <p>All three proposed offset sites are:</p> <ul style="list-style-type: none"> - of the same broad vegetation group as that of the remnant vegetation being removed (Figure 6);

PERFORMANCE CRITERIA	SOLUTION
	<ul style="list-style-type: none"> - located in an identified ecological corridor (Figure 7); and - adjacent to existing mapped remnant vegetation on the lots that are the subject of this application (Figure 3). <p>The proposed offset locations will improve connectivity and will prevent any loss of biodiversity. The location and size of these offsets will ensure maintenance and enhancement of ecological processes.</p>
<p>PR Xa.6: Salinity To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes – clearing does not contribute to –</p> <ul style="list-style-type: none"> a) waterlogging; or b) the <u>salinisation of groundwater, surface water or soil.</u> 	<p>The Site Environmental Management Plan includes a Stormwater Quality Management Plan which has been prepared to control drainage, minimise erosion and trap sediment occurring as a result of land disturbance necessary for extractive operations, in accordance with best practice site management procedures and Australia & New Zealand standards and guidelines.</p>
<p>PR Xa.7: Conserving remnant vegetation that are <i>endangered</i> regional ecosystems and of <i>concern</i> regional ecosystems To regulate the clearing of vegetation in a way that conserves remnant vegetation that are <i>endangered</i> regional ecosystems and of <i>concern</i> regional ecosystems – <u>maintain the current extent</u> of <i>endangered</i> regional ecosystems and of <i>concern</i> regional ecosystems.</p>	<p>The two regional ecosystems to be cleared (RE 12.11.3 and 12.11.5) are <i>not of concern</i> under the <i>Vegetation Management Act 1999</i>. No <i>endangered</i> or of <i>concern</i> regional ecosystems will be removed.</p>
<p>PR Xa.8: Essential habitat To regulate the clearing of vegetation in a way that prevents the loss of biodiversity – <u>maintain the current extent</u> of <u>essential habitat</u>.</p>	<p>The remnant vegetation to be cleared is mapped as essential habitat for the Macadamia Nut <i>Macadamia tetraphylla</i> (Figure 8).</p> <p>The proposed offset sites will increase the extent of remnant vegetation on the subject site by a ratio greater than 3ha offset for every 1ha of remnant vegetation cleared.</p>
<p>PR Xa.9: Conservation status thresholds To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and conserves remnant vegetation that are regional ecosystems – <u>maintain the current extent</u> of regional ecosystems listed in Table 2.</p>	<p>None of the regional ecosystems to be cleared are included in Table 2.</p>
<p>PR Xa.10: Acid sulfate soils To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes – clearing activities do not result in disturbance of acid sulfate soils or changes to the hydrology of the location that will either –</p> <ul style="list-style-type: none"> a) aerate horizons containing iron sulfides; or b) mobilise acid and/or metals. 	<p>No acid sulfate soils are recorded for the subject site on the Queensland Department of Mines and Energy Interactive Resources and Tenure Map (accessed September 2010).</p>



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Legend

Site Boundary
 Proposed Quarry Extension
 Remnant Vegetation to be offset

DERM Regional Ecosystems:


<ul style="list-style-type: none"> 12.11.10/12.11.3 12.11.23/12.11.5 12.11.3 	<ul style="list-style-type: none"> 12.11.5 12.3.11 Non-remnant
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Figure 1

Remnant Vegetation to be offset

Vegetation Code Assessment & Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010





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Legend




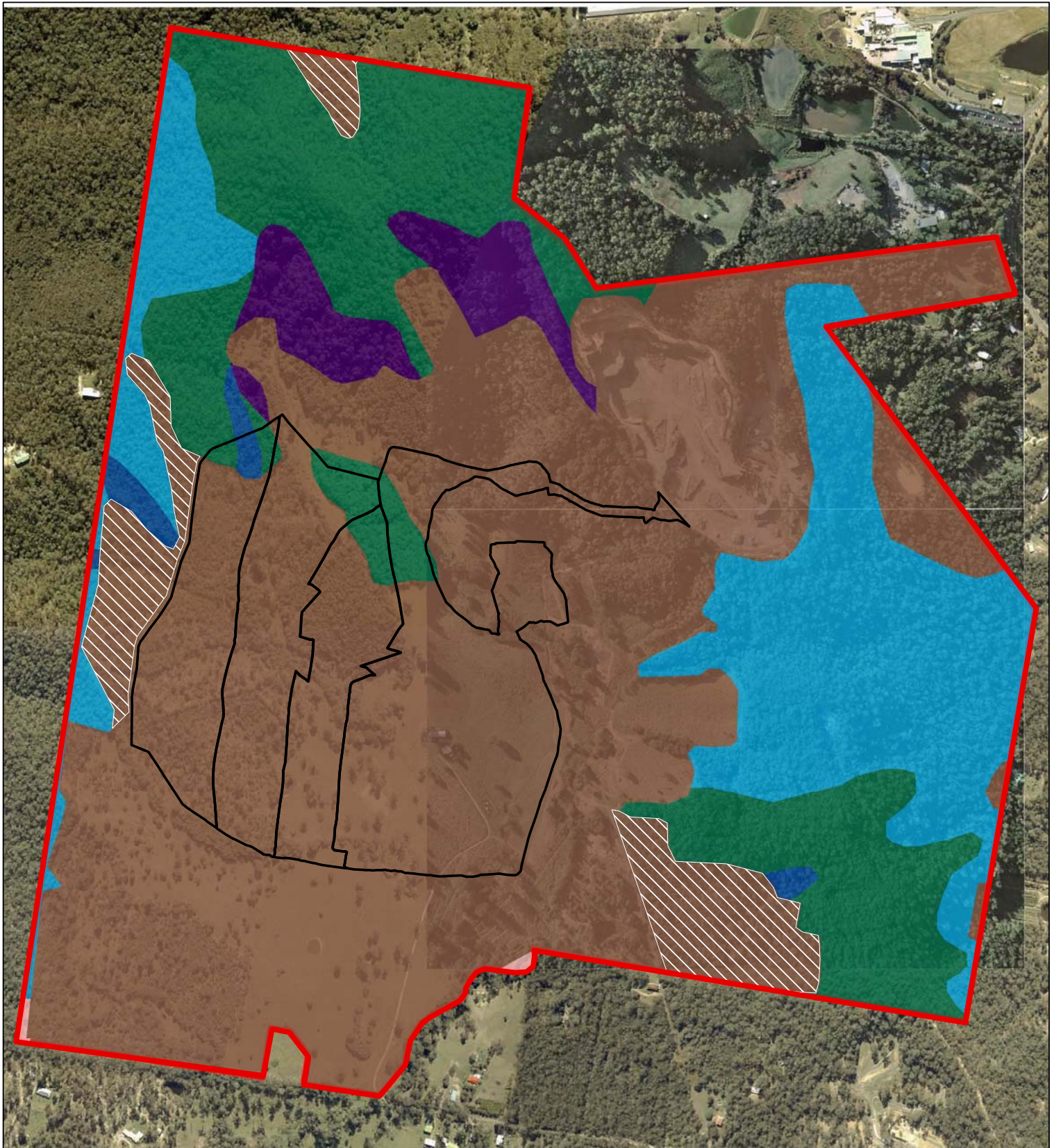
-  Site Boundary
-  Proposed Quarry Extension
-  Proposed Vegetation Offset Areas

Figure 2

Aerial Views of the Proposed Vegetation Offset Areas

Vegetation Code Assessment and Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010





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Legend

Site Boundary

Proposed Quarry Extension

Vegetation Offset:

Vegetation Offset Areas

Regional Ecosystems:

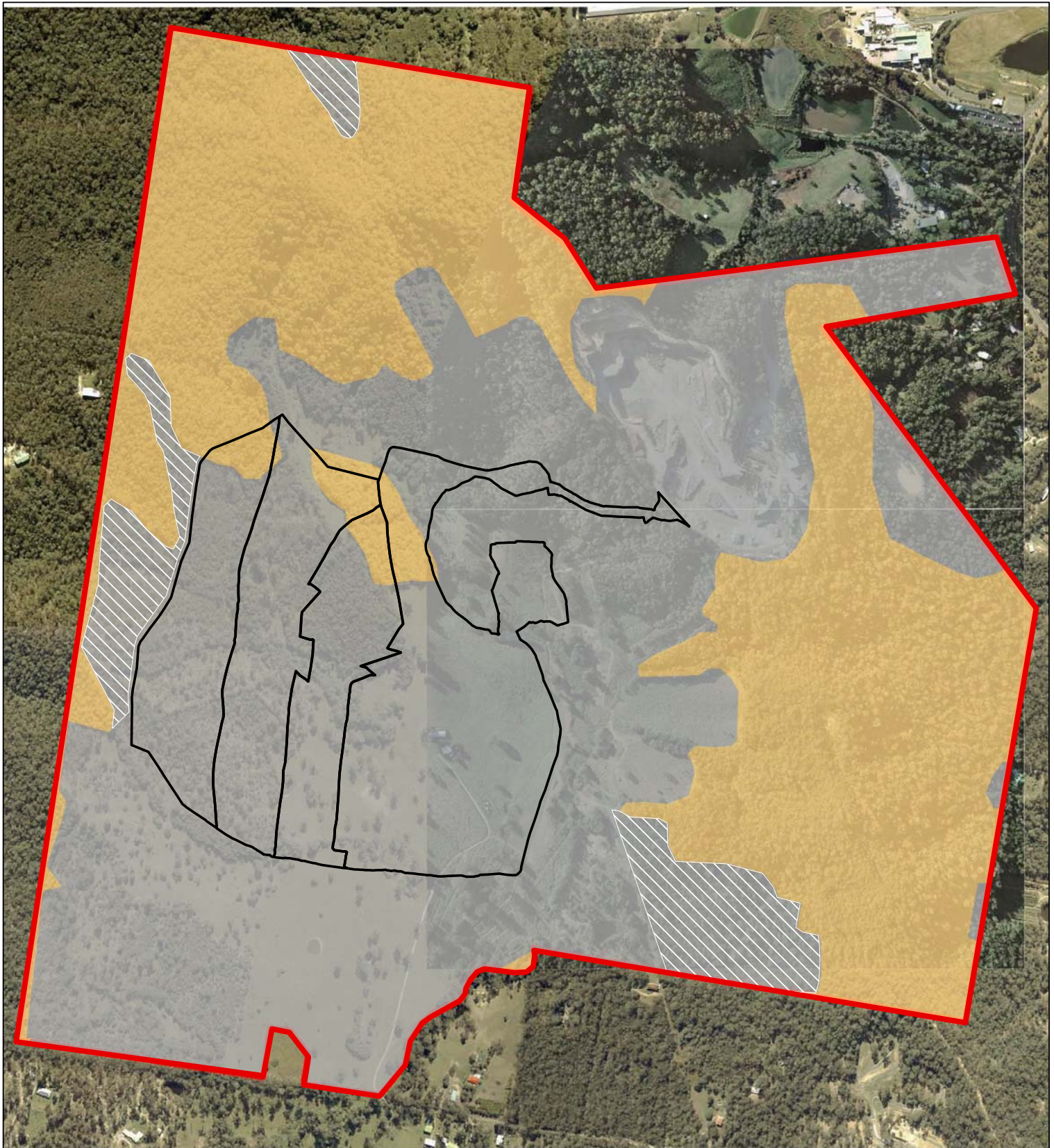
	12.11.10/12.11.3		12.11.5
	12.11.23/12.11.5		12.3.11
	12.11.3		Non-remnant

0 200 400 Meters

Figure 3
DERM Regional Ecosystems and Vegetation Offset

Vegetation Code Assessment & Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010



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0 200 400 Meters

Legend

-  Site Boundary
-  Proposed Quarry Extension

Vegetation Offset :

-  Vegetation Offset Areas

PMAV Category Area



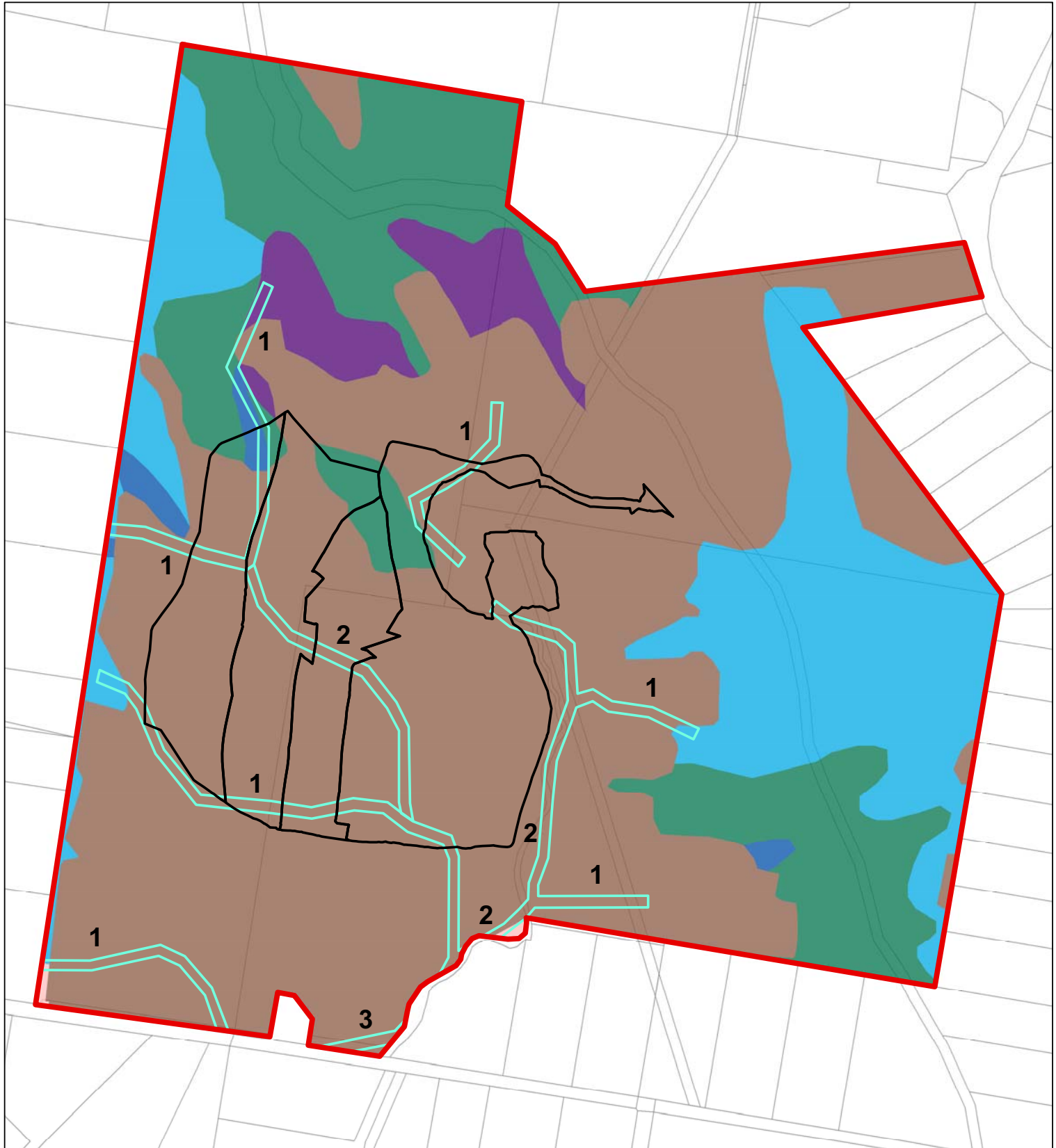
-  Category X area
-  Area that is the subject to other PMAVs or, if no PMAV exists, a regional ecosystem map, remnant map or regrowth vegetation map

Figure 4
PMAV and
Vegetation Offset

Vegetation Code Assessment & Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010

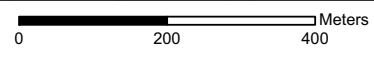




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Legend

- Site Boundary
- Proposed Quarry Extension
- Cadastral Boundaries
- 1 Stream & Order



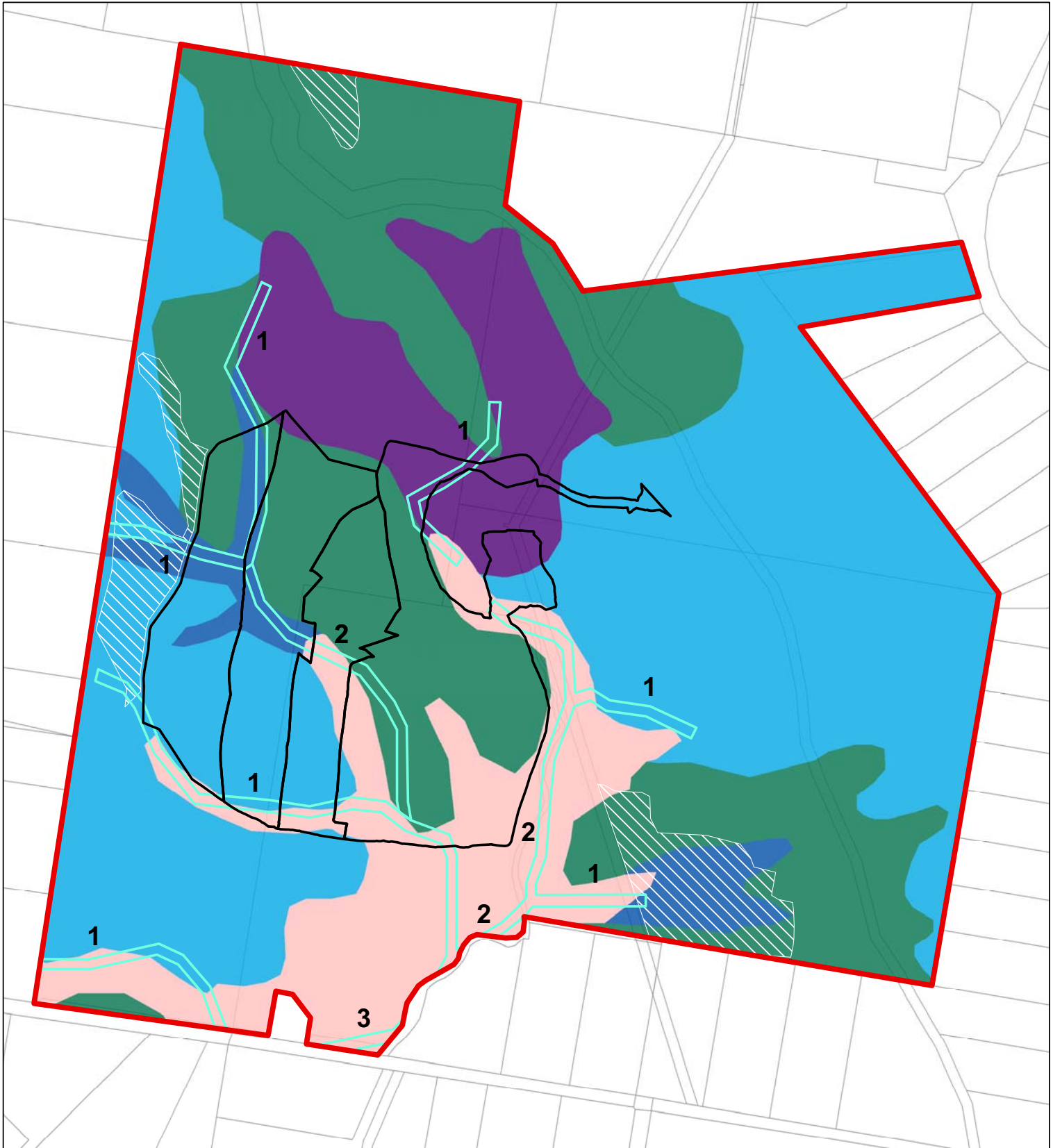
Regional Ecosystems :

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> 12.11.10/12.11.3 12.11.23/12.11.5 12.11.3 | <ul style="list-style-type: none"> 12.11.5 12.3.11 Non remnant |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 5
Watercourses and DERM Regional Ecosystems

Vegetation Code Assessment & Offset Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010





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Legend


- Site Boundary
- Proposed Quarry Extension
- Cadastral Boundaries
- 1 Stream & Order
- Vegetation Offset Areas

Meters
0 195 390

Pre-clearing Regional Ecosystems :

	12.11.10/12.11.3		12.11.5
	12.11.23/12.11.5		12.3.11
	12.11.3		

Figure 6
Watercourses, Pre-clearing Regional Ecosystems and Vegetation Offset
 Vegetation Code Assessment & Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010







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Image courtesy of Google Earth Pro 2010

Legend

-  Site Boundary
-  Regional Corridor

Offset Sites:

-  Vegetation Offset Sites
-  Koala Offset Sites

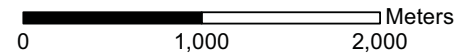
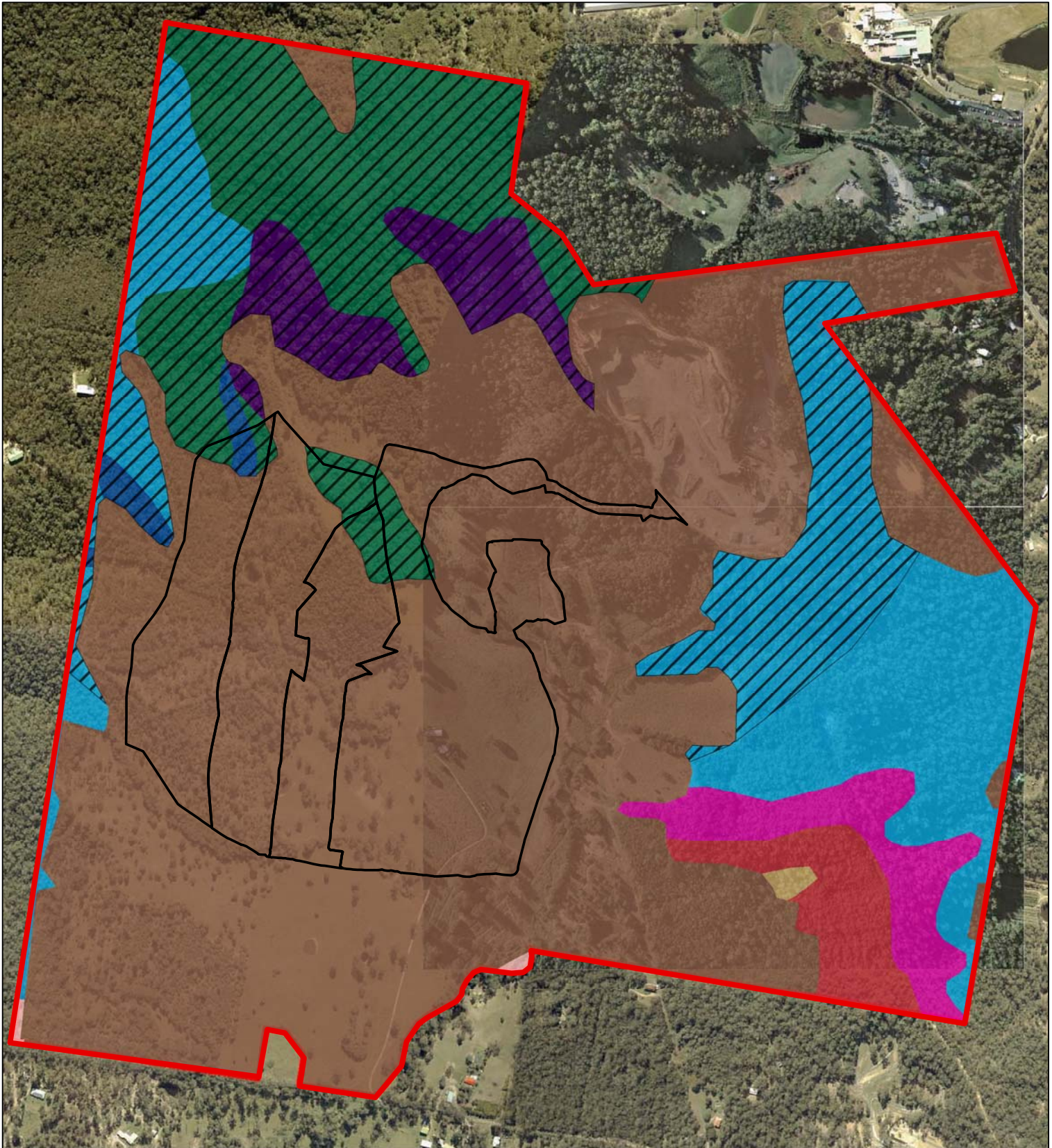


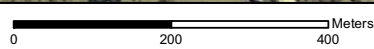
Figure 7
Offset Sites and
Regional Corridors
(BPA Mapping v.1.3)

Vegetation Code Assessment and
 Offset Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010






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 Image courtesy of Google Earth Pro 2010



- Legend**
- Site boundary
 - Proposed Quarry Extension
 - Essential Habitat *Macadamia tetraphylla*

- Regional Ecosystems:**
- | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> 12.11.5e 12.3.11 12.11.3 12.11.3a 12.11.5a | <ul style="list-style-type: none"> 12.11.5a/12.11.5k 12.11.23/12.11.5a/12.11.5k 12.11.10/12.11.3a Non-remnant |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 8
DERM
Essential Habitat and
Regional Ecosystems
 Vegetation Code Assessment & Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010



2.0 VEGETATION OFFSET REHABILITATION MANAGEMENT PLAN

2.1 PURPOSE OF THE PLAN

This Vegetation Offset Rehabilitation Management Plan has been prepared by Biodiversity Assessment and Management Pty Ltd (BAAM) for Barro Group Pty Ltd for the purpose providing rehabilitation guidance on vegetation offsets. This plan provides information to mitigate the loss of remnant vegetation Regional Ecosystems (RE) 12.11.5 and 12.11.3 that will require removal as a result of the extension of Mt Cotton Quarry.

2.2 SUBJECT SITE

The subject site is located at 1513 Mt Cotton Road, Mount Cotton, Redland City Council government area, and comprises five (5) lots known as Lot 370 on S311071, Lot 238 on SP218968, Lot 162 on S31962, Lot 17 on RP108970 and Lot 1 on RP108970.

It is understood that the development application also includes the unformed road bisecting and adjoining Lot 17, Lot 370 and Lot 162 and that part of Greenhide (California) Creek located between Lot 238 and Lot 162, although no physical works are proposed in these areas.

2.3 PROPOSED OFFSET FOR REMNANT VEGETATION

As part of the proposed quarry extension, approximately 3.7 ha of remnant vegetation will require removal (**Figure 1**) that is currently mapped as RE 12.11.5 and 12.11.3.

The proposed offset consists of three areas approximately 12.8ha in total (**Figure 2**). All three areas are located within the subject site and are no further than 600m away from the vegetation to be cleared. Two offset areas are located on Lot 370 on S311071 and one offset area is located on Lot 162 on S31962.

The rehabilitation of these three offset areas is the focus of this Vegetation Offset Rehabilitation Management Plan.

2.4 VEGETATION OFFSET REHABILITATION MANAGEMENT PLAN OBJECTIVES

The objectives of this management plan are to provide:

- A map indicating the vegetation to be offset;
- Maps indicating the location of the proposed offset areas; and
- General advice regarding weed eradication and control.

2.5 LOCATION OF OFFSET AREAS AND DESCRIPTION OF EXTANT VEGETATION

All three offset areas are located within the subject site.

These areas are currently not mapped as remnant vegetation under the provisions of the *Queensland Vegetation Management Act 1999* (VM Act).

All offset areas are currently mapped as Category X area under the DERM Property Maps of Assessable Vegetation (PMAV) (**Figure 4**).

The proposed offset areas are approximately 12.8 ha in total and all three areas are located directly adjacent to mature remnant vegetation communities of the same broad vegetation group (**Figure 3**), i.e. Eucalypt/Corymbia open-forest on metasedimentary rocks (landzone 11).

Vegetation within the proposed offset areas is dominated by *Corymbia citriodora*, *Lophostemon confertus*, *Eucalyptus propinqua* and *E. siderophloia*, species characteristic of the ecologically dominant layers of remnant vegetation to be cleared. These offset areas are progressing toward remnant status and mainly require only weed management to ensure remnant status is reached in a timely manner.

However, weeds listed under the provisions of the *Queensland Land Protection (Pest and Stock Route) Management Act 2002* (LP Act) are well represented throughout the subject site (LAMR 2010), and are/may be present within the proposed offset areas. Declared weed species present include:

- Lantana *Lantana camara* and *L. montevidensis* (Class 3);

- Singapore Daisy *Sphagneticola trilobata* (Class 3);
- African Tulip Tree *Spathodea campanulata* (Class 3);
- Water Hyacinth *Eichhornia crassipes* (Class 2); and
- Fireweed *Senecio madagascariensis* (Class 2).

The control of these pest plants is required to ensure progression to remnant status and is the primary focus of this management plan.

2.6 REHABILITATION AND MANAGEMENT OF OFFSET AREAS

2.6.1 Weed Management

Weed eradication/control within the offset areas will ensure that the offsets meets the performance requirements as outlined in **Section 3.1** and that the management intent of the offset areas is achieved. Several weed species are known to occur within the proposed offset area (LAMR 2010). Of the exotic species known, five have been declared under the provisions of the LP Act (**Section 2.1**).

The immediate and complete removal of all weed species within the offset areas can have negative effects on ecosystem function and stability and create management issues that are impractical to maintain. The progressive removal of weed species is recommended.

Ecosystem altering weeds such as smothering legumes and lantana prevent effective regeneration by smothering juveniles and preventing recruitment. These weed should be removed as a matter of priority.

The ecological significance of *Lantana camara* to some native fauna is being increasingly appreciated and care in its management on the site should bear this in mind. It is a weed that only requires management when it retards or deflects natural processes e.g. when it develops a dominant patch > 100m² in extent or > 10 individuals per 100m² – whichever is the lesser (M. Olsen pers. com.).

Infestations of smothering weeds should be controlled when infestation reach greater than 10m².

Woody weeds such as the African Tulip Tree replace endemic canopy species hindering regeneration.

Removal of woody weeds, using direct injection or ring barking, is recommended leaving dead individuals in place. This prevents too much mechanical disturbance and allows stability of soils on slopes to be maintained. Complete removal of woody weeds should be achieved within three years of implementation of this plan.

In order to control weeds in offset areas, where infestation is relatively limited the Quarry Manager will ensure that herbicide usage will be appropriate and specifically designed for use near riparian areas (e.g. Roundup Bioactive[®]) be applied⁽¹⁾.

Alternatively, manual removal of individual plants may be undertaken to ensure complete and immediate success is achieved.

Alternative methods of weed control that may be used within the offset areas to control exotic species are provided in **Appendix 1**.

2.6.2 Revegetation

Given the intact nature of the vegetation canopy within the offset areas, there is no revegetation requirement for these areas.

As stated previously (**Section 2.1**), native vegetation communities at these locations are analogous to the remnant vegetation to be removed. While the height (age) of the canopy does not yet meet RE criteria (i.e. greater than 70% of the original canopy height), species densities approximate those that are naturally found within RE 12.11.3 and 12.11.5.

2.7 MONITORING

Monitoring and evaluation of the weed control program within the offset areas and assessment of the offsets' analogies to RE 12.11.3 and RE 12.11.5 are to be undertaken at regular intervals.

A consistent, integrated monitoring and management approach will ensure that recommended weed removal techniques are effective and allow for modification of any methods that fail to meet performance requirements.

It is essential that the occurrence and spread of weeds within the offset areas is continually

¹ All herbicide use is to be undertaken according to the manufacturer's instructions.

monitored and managed in order to keep abreast of any new infestations and/or other emerging issues.

The Quarry Manager will ensure that an experienced botanist/ecologist assess the abundance and plot the location of significant weed infestations on a twice yearly basis. This information is to be used to assess the success of the weed management program. Photo monitoring points are to be established that clearly depict each management area in north, south, east, west directions. Photographs are to be clearly time-marked with an indication of the viewing direction.

In addition, the offset areas are to be assessed for their analogy to RE 12.11.3 and RE12.11.5 on an annual basis. This is to be in the form of assessment of the canopy cover and height along a 100m transect. Full RE status will be achieved when the offsets have achieved 50% of the canopy cover and 70% of the height of the pre-clearing vegetation type (**Figure 6**) and when the offsets are dominated by species characteristic of RE 12.11.3 and/or 12.11.5. A census of species adjacent to each transect (i.e. 5m either side) is also to be undertaken during the sampling period.

The Quarry Manager will ensure that Barro Group appoint person/persons to undertake the role of data management (including analysing, interpreting and maintaining the database). The data should then be presented in a form that clearly shows the results of each monitoring event. It is a requirement that this data is supplied to DERM during reporting events (**Section 2.9**).

2.8 PERFORMANCE REQUIREMENTS PRIOR TO INCLUSION UNDER THE VM ACT

Prior to formal mapping as an RE, the offset areas must achieve remnant status under the provisions of the VM Act (i.e. must have at least 50% of the canopy cover and 70% of the height of the pre-clearing vegetation type).

In order to measure progress towards remnant status, reference sites must be selected for comparison. In the case of the proposed offset, the remnant vegetation adjacent to the offset sites (**Figure 3**) would serve as suitable references.

In addition, where possible no weeds listed under the provisions of the LP Act should be present within the offset areas. However, minor infestations of some exotic taxa are the

norm even in conservation reserves throughout the region (LAMR 2010). As a minimum requirement, pest plants should not pose a significant threat to native taxa.

2.9 REPORTING

It is a requirement that reporting related to the success and rehabilitation of the offset area be supplied to DERM by the 30th of June every two years. As a minimum, reporting is to include the following information:

- Name and contact details of proponent (i.e. Barro Group Pty Ltd);
- Lot on Plan property description and postal address;
- Data collected from transects, outlining species present, average canopy cover and height of vegetation. All data should be correctly labelled with date, location, GPS points for end points of transect and any other observations;
- An overview of the progress of the management area in achieving the management outcomes and how any risks or threats have impacted on the area;
- An indication of any risks or potential threats that have become apparent to the management area since the development of the management plan, and activities to be undertaken to manage these threats and/or risks; and
- Where the proponent is proposing that the management outcomes have been achieved and the report is being submitted as the final report, the proponent must provide evidence that all management outcomes have been achieved in full (i.e. the site is free of declared weed species and has reached remnant status under the provisions of the VM Act).

3.0 GENERAL ADVICE

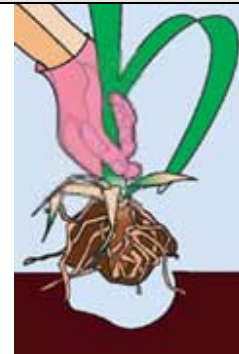


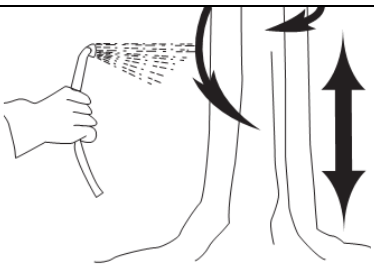
Any major proposed changes to the Vegetation Offset Rehabilitation Management Plan, including changes to the management protocols, are to be approved by DERM. Management of the offset areas will be maintained until vegetation contained within has achieved remnant status of the same broad vegetation group as the remnant vegetation cleared, as defined under the

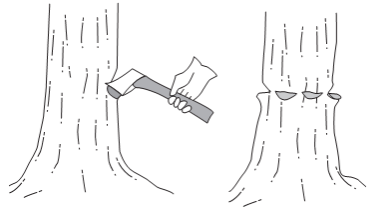

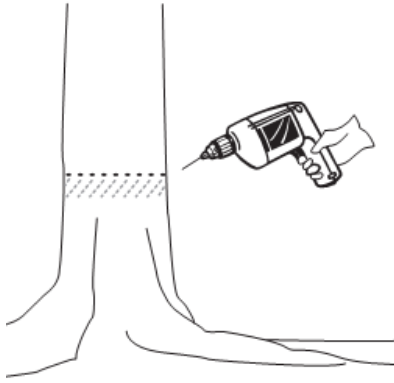
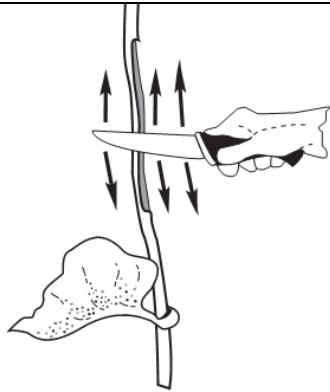
provisions of the VM Act. Regular and frequent monitoring of the weed control program should be undertaken to ensure weed infestations are controlled and that extant native vegetation is well maintained and healthy.


4.0 REFERENCES

LAMR, M (2010). Flora and its values. Report prepared for Barro Group Pty Ltd. September 2010.

APPENDIX 1
WEED CONTROL METHODS

Method	Illustration
<p>Hand Weeding</p> <ul style="list-style-type: none"> • Hand-pulling is a relatively gentle control method for seedlings, herbs and grasses. • Hand-pulling is best carried out when the soil is damp, when the root systems are more easily dislodged and less damage is done to the soil structure. • A number of weeds can be easily hand-weeded from the bush, particularly young plants that have not developed an extensive root system. • This method of control can be very effective when dealing with small populations of environmental weeds. • Attempt to prevent seed dispersal whilst had weeding • Plants with the potential to regrow from discarded material should be carefully bagged and removed. 	
<p>Dig out plants with tougher root systems: This technique is useful for species that grow from a solid central crown below ground level:</p> <ul style="list-style-type: none"> • Insert a long knife or narrow trowel into the soil outside the root system. • Gently loosen the soil, work around the roots and then work the plant out gently. • Plants without seed that will not re-sprout can be left to rot. • Attempt to prevent seed dispersal whilst had digging out weeds • Plants with the potential to regrow from discarded material should be carefully bagged and removed. 	
<p>Spraying Foliar spraying is the use of herbicide diluted with water or diesel at a specific rate, and sprayed over the foliage to the point of runoff (until every leaf is wetted but not dripping). This method is most suited to shrubs, grasses and dense vines less than 6 m. Advantages include quickness and economy. Disadvantages include the potential for spray drift and off-target damage.</p> <p>Boom or Blanket spraying: using a boom spray from a tractor or 4-wheel drive vehicle can be used to treat large areas completely infested with weeds, especially with selective herbicides. Indicating the location of areas to avoid before spraying may decrease the chance of overspray.</p> <p>Spot spraying: Smaller infestations can be sprayed using a backpack / knapsack spray unit or quad mounted spray-pack. This technique can target individual plants and is useful for on-going or follow-up maintenance...</p>	
<p>Stump Spray Basal bark spraying is suitable for thin-barked woody weeds and undesirable trees. Basal bark spraying is also an effective way to treat saplings, regrowth and multi-stemmed shrubs and trees. This method involves mixing an oil soluble herbicide in diesel and spraying the full circumference of the trunk or stem of the plant.</p> <p>It is important to cover the entire circumference of the trunk on every stem arising from the ground to a height of around 30 cm.</p>	

Method	Illustration
<p>Chipping method Useful for killing trees and shrubs to be left <i>in situ</i> to naturally decay:</p> <ul style="list-style-type: none"> shallow cuts are made just under the bark into the living tissue below the lowest branch; herbicide applied with a squeeze bottle immediately (within 30 seconds) into the exposed cut surface; continue cuts around the trunk at the same level, with 5cm gaps between each cut. Generally 1 part Glyphosate to 1.5 parts of water is suitable to achieve a kill with most species 	
<p>Tree Spearing Tree spearing uses a specifically designed tree spear and technique. Useful for killing trees and shrubs to be left <i>in situ</i> to naturally decay</p> <ul style="list-style-type: none"> The spear is thrust into the tree at an angle of 30° to 40° from the vertical, Apply the appropriate herbicide amount into the cut. Repeat the process, forming a row of cut approximately 50 mm apart. 	
<p>Tree injection Useful for killing trees and shrubs >5cm in circumference to be left <i>in situ</i> to naturally decay:</p> <ul style="list-style-type: none"> holes are drilled at a downward angle into the tree's sapwood at 5cm spaces; if a "Side Winder" or similar device is not employed herbicide is then applied immediately (within 30 seconds) into each hole small with a squeeze bottle. drill to make downward-angled holes into the sapwood approximately 5 cm apart. The placement of herbicide into the hole is usually made using a backpack reservoir and syringe that can deliver measured doses of herbicide solution. Best results are achieved with plants, which are actively growing. Generally 1 part Glyphosate to 1.5 parts of water is suitable to achieve a kill with most species. 	
<p>Scraping the stem method This method is used for plants with aerial tubers:</p> <ul style="list-style-type: none"> a sharp knife is employed to lightly scrape a section of stem (approximately 10-30 cm) removing bark and exposing the living tissue; Apply herbicide immediately (within 30 seconds) to the exposed soft underlying green tissue with a small squeeze bottle. With some woody weeds you can peel away the bark surface and paint the exposed wood or spray it with herbicide. Generally 1 part Glyphosate to 1.5 parts of water is suitable to achieve a kill with most species 	

Method	Illustration
<p>Cut stump method</p> <p>This method is ideal for woody plants and vines without aerial tubers:</p> <ul style="list-style-type: none"> • cut the stem close to the ground, if possible below the lowest branch; • apply herbicide immediately (< 10seconds for water-based and 1 minute for diesel soluble herbicides) using a small squeeze bottle or spray pack to the cut surface. • Generally 1 part Glyphosate to 1.5 parts of water is suitable to achieve a kill with most species • Two operators working as a team can use this method effectively • It is a good idea to use a brightly coloured dye in the solution to mark the stumps that have been treated <p>This method has the appeal of removing the weed immediately, and is used mainly for trees and woody weeds. Warning: Many species will sucker if treated by this method.</p>	 <p>The illustration shows a hand holding a spray nozzle, directing a stream of herbicide onto the top surface of a cut tree stump. The stump has several roots extending downwards into the ground.</p>

Attachment 2

Flora and Its Values

FLORA AND ITS VALUES

MOUNT COTTON QUARRY EXTENSION

REDLAND CITY COUNCIL



Frontispiece: Open forest (Least Concern regional ecosystem 12.11.5) dominated by *Corymbia citriodora* that comprises the majority of the remnant and regrowth vegetation on the slopes and crests of the site.

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DESCRIPTION OF THE STUDY AREA

It is proposed to extend the current operations as the Mount Cotton Quarry Extension adjacent to Mount Cotton Road. Rural and rural residential lands border the site with remnant vegetation occupying some of the higher crests and slopes. This proposed quarry extension will involve impacts upon a small isolated patch and some limited sections of the edges of the remnant native vegetation on the site and other flora in the environs of the proposed footprint. This impact will be on mapped remnant regional ecosystems (Version 6.0, current certified mapping), but the majority of the observed remnant regional ecosystem to be impacted by the proposed footprint accords with the circumscription of the least concern remnant regional ecosystem 12.11.5 (See Frontispiece). Other documentation will define the precise nature of the proposed works and associated Property Vegetation Management Plan (being prepared by Groundworks Plus) and offset documentation to compensate for the proposed clearing of the mapped remnant least concern regional ecosystems (being prepared by BAAM). Published topographic maps were utilised for location purposes in the field. Existing vegetation and regional ecosystem (RE) mapping and data (DERM website, 2010) was accessed to form the basis for analyses and discussions within this report along with analysis of Herbrecks data on rare and threatened flora purchased from the Queensland Herbarium. This information was enhanced by foot traverses of the study area over a number of years.

Most of the study area was historically cleared or utilised extensively for grazing and logging prior to the regrowth developing over parts of the site. This regrowth has developed to the point where parts of the study area are covered by remnant vegetation as prescribed within the *Vegetation Management Act 1999*. Open forests and woodlands dominate these regrowth and remnant areas on metasediments with only limited areas of vine forest regrowth/remnant vegetation in some of the steeper gullies draining from the crests in the north of the property.

The drainage from these gullies flows ultimately into California Creek, although the current crest that is the site of existing quarrying operations forms the catchment divide between Native Dog and California Creeks. These streams flow into the Logan River. The low-lying portions of the site where there has been some development of alluvium have long been cleared and continue to be utilised for grazing purposes. None of the vegetation on the

alluvium appears to have regenerated to the point where it could be considered as remnant vegetation as defined within the *Vegetation Management Act 1999*.

The remnant vegetation of the site exhibits extensive evidence of past timber harvesting practices, clearing and impacts of artificial fire regimes. The landscape features of the site are clearly visible on the published 1:25,000 topographic map sheet of the study area (Beenleigh 9542-42) and the Google image of the site (Plate 1 below).

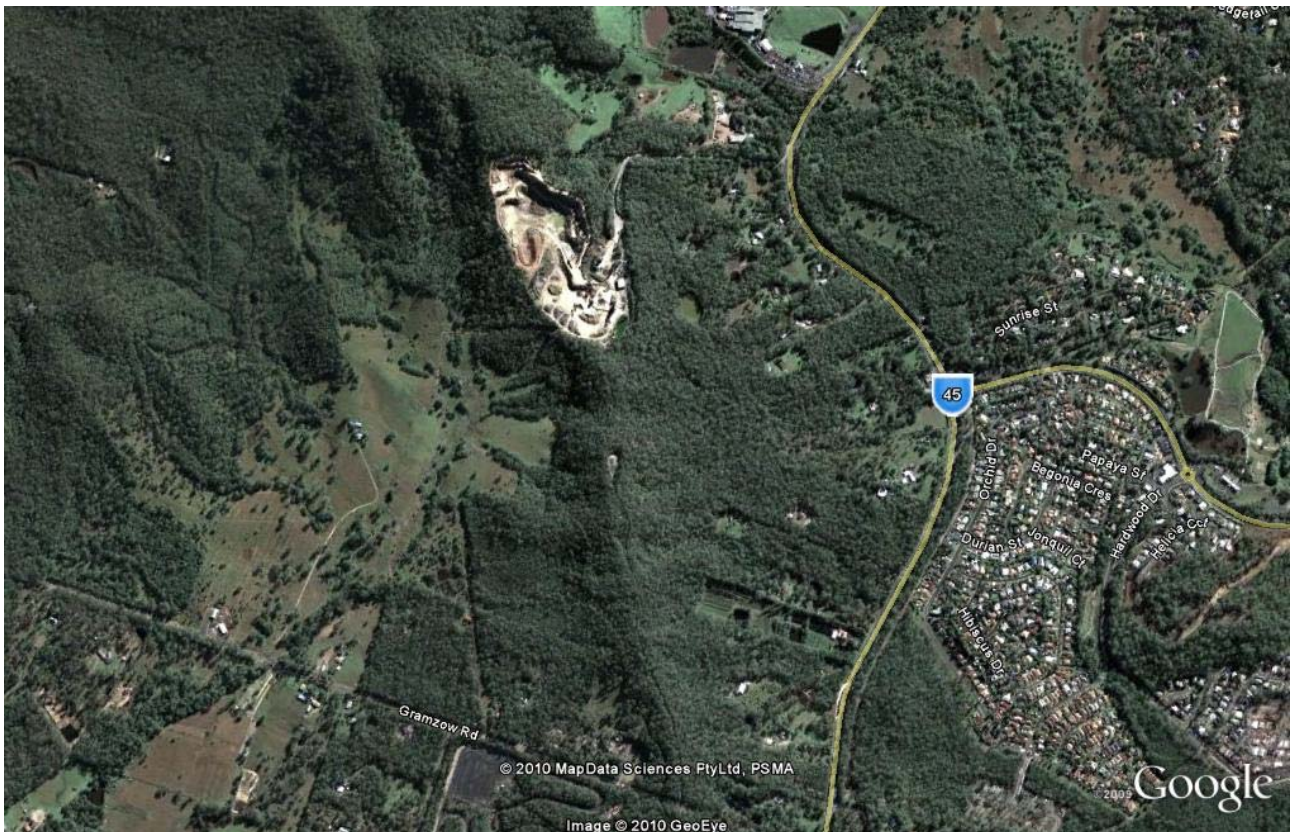


Plate 1 – Google Image of the study area with the existing quarry works clearly visible.

FLORA OF THE STUDY AREA

As stated above, a mosaic of cleared lands, regrowth and remnant native vegetation occurs across the site. The remnant forest has been logged and cleared in the past, with more recent fire related land degradation and weed impacts in evidence during field surveys.

Some elements of the landscaping in the existing rural residential areas adjacent contain a number of serious environmental weeds that are spreading into nearby regrowth and remnant vegetation e.g. *Corymbia torelliana*, *Jacaranda mimosifolia*, *Lantana* spp., *Nephrolepis cordifolia*, *Ochna serrulata*, *Schefflera actinophylla*, *Spathodea campanulata*, *Sphagneticola trilobata* and *Syagrus romanzoffianum*. Several of these taxa are listed as Class 3 environmental weeds on the *Land Protection (Pest and Stock Route Management) Act 2002*. Two Class 2 plants listed under this legislation were observed in the grazed portion of the subject land – Water Hyacinth (*Eichhornia crassipes*) and Fireweed (*Senecio madagascariensis*) – the latter in much reduced population density and abundance in 2009 and 2010. The *Land Protection (Pest and Stock Route Management) Act 2002* states “landowners must take reasonable steps to keep land free of Class 2 pests”. An effective spray program and removal of grazing impacts once quarrying operations have commenced will effectively deal with both of these Class 2 plants. It is considered that grazing should be re-introduced until such time as the expanded quarry works commence in order to best reduce the exotic pasture growth that has occurred with the removal of stock in recent times.

The regrowth and remnant areas have a higher proportional representation of native taxa than the nearby residential areas, but the structural and floristic integrity of these areas testifies to their physical characteristics that minimise the invasion of agricultural weeds in all but the most substantially disturbed areas.

The low nutrient status, shallow soils and low water availability reduce the density and diversity of most weed taxa, although *Lantana camara* and *L. montevidensis* was still extensively represented across the study area with *Ochna serrulata* dominant in some parts of the vine forest regrowth. The relative lack of dense weed infestations on the site may be due to the higher nutrient status of other areas with a greater density and proliferation of weeds due to the influence in such areas of the higher nutrient status of the

substrate and greater effluent and stormwater related nutrient inputs. The greatest density and diversity of exotic flora was associated with the limited alluvial areas where grazing pressure has been reduced recently and exotic pasture species have, as a consequence of the removal of stock, become denser and more abundant.

The remnant vegetation is comprised primarily of dry woodland and open forest of the crests and slopes with some weed dominated regenerating vine forest in the upper parts of the steep gullies in the northern part of the site. The majority of the site is located on metasedimentary rocks (land zone 11). Soil depth, topography and drainage are the major determinants of the natural patterning of the vegetation of the site, although human related disturbance regimes (particularly logging, grazing and artificial fire regimes followed by weed infestations in some areas) have altered the relative displacement, viability and integrity of this mosaic. The most substantive impact in this regard is the incursion of weeds into this community following the impact of these artificial disturbances.

Standard references relevant to the study area or region that have been employed for the taxa listed in this report are as follows: Queensland Herbarium, 2002; Royal Botanic Gardens, 1993; Sharpe, 1986; Simon, 1993; and, Stanley & Ross, 1983. Further nomenclatural changes have been incorporated via regular, personal communication with staff at the Queensland Herbarium. As there is no standard or commonly and universally accepted reference work for plant common names, all taxa mentioned in this report will be referred simply by their currently published scientific names at the time of report preparation.

LEGISLATION AND OTHER RELEVANT MATTERS

STATE LEGISLATION

VEGETATION MANAGEMENT ACT 1999

On the certified map for this region (Version 6.0, November 2009), a number of regional ecosystems are represented in the polygon that includes this site. Pertinent to this discussion is the definition of remnant vegetation given in the *Vegetation Management Act 1999*:

“the vegetation, part of which forms the predominant canopy of the vegetation–

- (a) covering more than 50% of the undisturbed predominant canopy; and
- (b) averaging more than 70% of the vegetation’s undisturbed height; and
- (c) composed of species characteristic of the vegetation’s undisturbed predominant canopy.”

Status and circumscriptions for the following regional ecosystems was obtained by reference to Young and Dilleward (1999) in Sattler and Williams (1999) and DERM data (2010). Concurrence between the certified map and recent field observations is poor across parts of the study area, due primarily to scale and related interpretation constraints of the certified map. The two main regional ecosystems depicted on the certified map are the Least Concern remnant regional ecosystems 12.11.3, 12.11.5 and 12.11.10, a small copse of the Of Concern remnant regional ecosystem 12.3.11 in the southern part of the site and mapped areas of heterogeneous polygons containing the Endangered remnant regional ecosystem 12.11.23.

As seen in the joint expert reports (Appendices 3A and 3B) there is no endangered remnant (or regrowth) regional ecosystem 12.11.23 that will be impacted by the proposed operations. The attributes of the regional ecosystems present on the site are given in Table 1. There is some vine forest developing in the steeper parts of the gully on the northern parts of the site. It is considered that there are no patches of either remnant or regrowth endangered regional ecosystem 12.11.23 proximal to the proposed footprint of the quarry expansion area. Those parts of the site with remnant vegetation coverage

(mapped or otherwise) are dominated by the Least Concern remnant regional ecosystems 12.11.3, 12.11.5 and 12.11.10.

The major disparity between the certified map and the recent field observations is the extent of the mapped remnant and regrowth endangered regional ecosystem 12.11.23 dominated by *Eucalyptus pilularis* with *E. racemosa* a common co-associate in the Venman area west of the subject site. This vegetation type certainly occurs close to the subject land to the west in the Venman Bushland Reserve Conservation Park and near the Mount Cotton Driver Training Centre surrounding Lakeside Drive to the southeast. The dominant remnant and vegetation of the dry open forests and woodlands of the crests and slopes of the site is that of regional ecosystem 12.11.5 with *Corymbia citriodora* abundant in the canopy (See Frontispiece). Regrowth vegetation of this community (and that of regional ecosystems 12.11.3 and 12.11.10) is dominated by *Acacia disparrima* and not taxa characteristic of regrowth regional ecosystem 12.11.23.

Table 1 – Status of Regional Ecosystems mapped within the study area.

<p>12.3.11 – Of Concern under the <i>Vegetation Management Act 1999</i></p> <ul style="list-style-type: none"> Open-forest to woodland of <i>Eucalyptus tereticornis</i>, <i>E. siderophloia</i> and <i>Corymbia intermedia</i>. <i>Corymbia tessellaris</i>, <i>Lophostemon suaveolens</i> and <i>Melaleuca quinquenervia</i> frequently occur and often form a low tree layer. Other species present in scattered patches or low densities include <i>Angophora leiocarpa</i>, <i>E. exserta</i>, <i>E. grandis</i>, <i>C. trachyphloia</i>, <i>C. citriodora</i>, <i>E. latisinensis</i>, <i>E. tindaliae</i>, <i>E. racemosa</i>, <i>Melaleuca sieberi</i> and <i>M. viridiflora</i>. <i>E. seeana</i> may be present south of Landsborough. Occurs on Quaternary alluvial plains and drainage lines along coastal lowlands. Rainfall usually exceeds 1000mm/y.
<p>12.11.3 – Least Concern under the <i>Vegetation Management Act 1999</i></p> <ul style="list-style-type: none"> Open-forest generally with <i>Eucalyptus siderophloia</i> and <i>E. propinqua</i> ± <i>E. microcorys</i>, <i>Lophostemon confertus</i>, <i>Corymbia intermedia</i>, <i>E. biturbinata</i>, <i>E. acmenoides</i>, <i>E. tereticornis</i>, <i>E. moluccana</i>, <i>Angophora leiocarpa</i>, <i>Syncarpia verecunda</i> with vine forest species and <i>E. grandis</i> or <i>E. saligna</i> in gullies. <i>Eucalyptus pilularis</i> and <i>E. tindaliae</i> sometimes present e.g. mid D'Aguilar Range, Conondale Range. Occurs predominantly on hills and ranges of Palaeozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.
<p>12.11.5 – Least Concern under the <i>Vegetation Management Act 1999</i></p> <ul style="list-style-type: none"> Open-forest complex in which spotted gum is a relatively common species. Canopy trees include <i>Corymbia citriodora</i>, <i>Eucalyptus siderophloia</i> or <i>E. crebra</i> (sub coastal ranges), <i>E. major</i> and/or <i>E. longirostrata</i> and <i>E. acmenoides</i> or <i>E. portuensis</i> and/or <i>E. carnea</i> and/or <i>E. eugenioides</i>. Other species that may be present and abundant locally include <i>Corymbia henryi</i>, <i>C. intermedia</i>, <i>C. trachyphloia</i>, <i>Eucalyptus tereticornis</i>, <i>E. propinqua</i>, <i>E. biturbinata</i>, <i>E. moluccana</i>, <i>E. melliodora</i>, <i>E. fibrosa</i> subsp. <i>Fibrosa</i> and <i>Angophora leiocarpa</i>. <i>Lophostemon confertus</i> often present in gullies and as a sub canopy or understorey tree. Mixed understorey of grasses, shrubs and ferns. Occurs on hills and ranges of Palaeozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.
<p>12.11.10 – Least Concern under the <i>Vegetation Management Act 1999</i></p> <ul style="list-style-type: none"> Notophyll and notophyll/microphyll vine forest ± <i>Araucaria cunninghamii</i>. Characteristic species include <i>Argyrodendron trifoliolatum</i>, <i>Argyrodendron</i> sp. (Kin Kin W. D. Francis AQ 81198), <i>Choricarpia subargentea</i>, <i>Dissiliaria baloghioides</i>, <i>Brachychiton discolor</i>, <i>Beilschmiedia obtusifolia</i>, <i>Diospyros pentamera</i>, <i>Grevillea robusta</i>, <i>Gmelina leichhardtii</i> and <i>Ficus macrophylla</i> forma <i>macrophylla</i>. Occurs on Palaeozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.

Table 1 cont'd.

12.11.23 – Endangered under the <i>Vegetation Management Act 1999</i>
<ul style="list-style-type: none"><i>Eucalyptus pilularis</i> open forest. Other canopy species include <i>E. microcorys</i>, <i>Corymbia intermedia</i>, <i>Angophora woodsiana</i>, <i>E. tindaliae</i> and <i>E. carnea</i>. <i>E. racemosa</i> subsp. <i>racemosa</i> and <i>Corymbia trachyphloia</i> are prominent in the Venman area whilst <i>C. gummifera</i> and <i>E. resinifera</i> are prominent in the Nerang area. Occurs on low coastal Paleozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics (Neranleigh-Fernvale beds).

Figures 1 and 2 depict the current certified mapping (remnant and regrowth) for the study area (Version 6.0 downloaded from the DERM website).

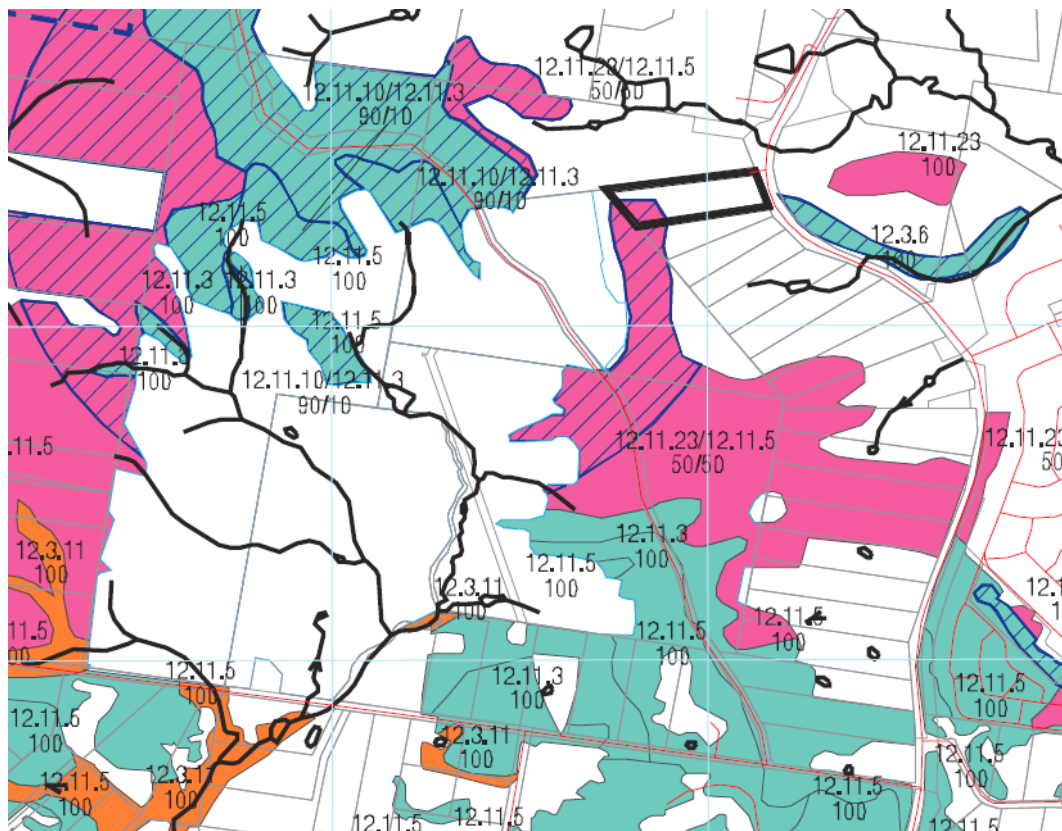


Figure 1 – Current certified mapping of the study area (Version 6.0 – remnant coverage).

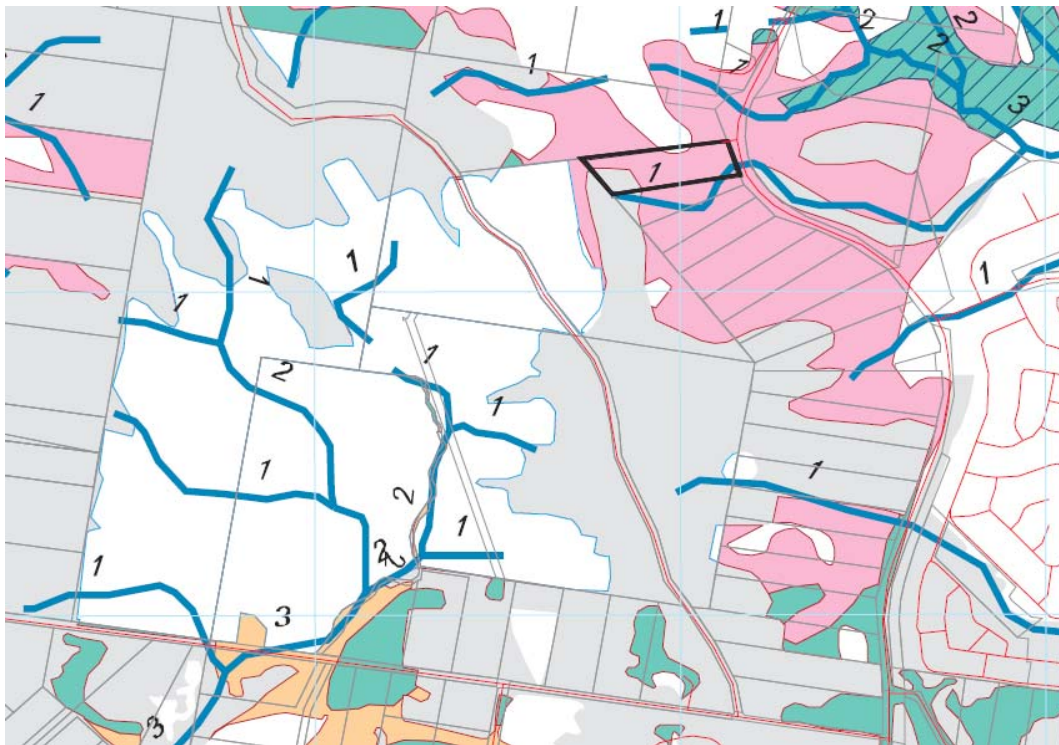


Figure 2 – Current certified mapping of the study area (Version 6.0 – regrowth coverage).

As the remnant vegetation on the proposed quarry expansion area does not have any extant endangered remnant or regrowth regional ecosystem present, exemptions for mapped Key Resource Areas (KRAs) do not trigger restrictive permit applications with respect to the *Vegetation Management Act 1999* for clearing of assessable vegetation.

There remain areas of regrowth dominated by *Acacia disparrima* (Plate 2) on the current certified mapping (Figure 1) that do not conform to the prescriptions of the remnant regional ecosystems towards which they are regenerating. Scale of mapping related issues would appear to have resulted in these areas being mapped as remnant regional ecosystems on the current certified mapping.



Plate 2 – Dense monoculture canopy of *Acacia disparrima* adjacent to existing quarry with remnant vegetation dominated by *Corymbia citriodora* visible on the skyline.

NATURE CONSERVATION ACT 1992 AND SCHEDULES 1994

Whilst a number of taxa listed on the Schedules of the *Nature Conservation (Wildlife) Regulation 1994 SL No. 473 and 474* of the *Nature Conservation Act 1992* are known from the study area (See Table 2), only three were observed in the study area. Several of these are also listed under the complementary *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).

Table 2. Species recorded from the study region (Herbrecs, DERM and DEWHA websites, various times). Status as per NCA, 1992 & amendments 2000.

Schedule 2 (Endangered Flora)

Corchorus cunninghamii

Schedule 3 (Vulnerable Flora)

Acianthus amplexicaulis, *Arthraxon hispidus*, *Macadamia integrifolia* and *Thesium australe*

Schedule 4 (Rare Flora)

Eucalyptus curtisii.

Two species listed under the *Schedules of the Nature Conservation (Wildlife) Regulation 1994 SL No. 473 and 474* of the *Nature Conservation Act 1992* were observed on the site (*Macadamia integrifolia* and *Corchorus cunninghamii*). The population of *Corchorus cunninghamii* is the most significant (Plate 3).



Plate 3 – *Corchorus cunninghamii* in bud and fruit adjacent to regrowth vine forest.

Macadamia integrifolia was only found as a couple of isolated plants amongst a thicket of *Lantana camara* (Plate 4). At present, none of the observed individuals fall beneath or proximal to the quarry expansion footprint. Pre-disturbance surveys will ensure location of any newly germinated individuals of this threatened taxon for subsequent translocation into more secure areas of remnant or regenerating vine forest on the site.



Plate 4 – *Macadamia integrifolia* emerging from a dense shrub layer of *Lantana camara* beneath a monoculture canopy of *Acacia disparrima* north of the proposed quarry footprint.

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The two aforementioned species (*Macadamia integrifolia* and *Corchorus cunninghamii*) are listed under the complementary schedules of the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). Their management is addressed with respect to the future quarry operations in the Rehabilitation Plan in Appendix 2. The impact upon the listed taxa is assessed in the following Table (Table 2).

Table 3. Potential Impacts of the proposed quarry expansion with respect to the EP&BC Act.

EPBC Act Criteria	Potential impacts upon a threatened species – <i>Corchorus cunninghamii</i>	Potential impacts upon a threatened species – <i>Macadamia integrifolia</i>
On-site impacts	No intrusion into, or destruction of, margins of vine forest (habitat of <i>Corchorus cunninghamii</i>) or the potential destruction of individuals of <i>Corchorus cunninghamii</i> .	Increased abundance of <i>Macadamia integrifolia</i> on site due to propagation and use in planting of regenerating vine forest areas.
Off-site impacts	Increasing vulnerability of margins of vine forest (habitat of <i>Corchorus cunninghamii</i>) to further degradation via increased fire intrusion and weed infestations unless land management initiatives implemented to reduce the impact of artificial fire regimes.	Nil due to occurrence in <i>Lantana camara</i> thicket outside the footprint of the proposed quarry expansion area – likely to increase regional conservation of <i>Macadamia integrifolia</i> .
Direct impacts	Nil.	Nil.
Indirect impacts	Fire and weed intrusions into habitat of <i>Corchorus cunninghamii</i> .	Fire and weed intrusions into habitat of <i>Macadamia integrifolia</i> .
Frequency of Action	N/A as outside quarry footprint.	N/A as outside quarry footprint.
Duration of Action	Persistent positive effect.	Persistent positive effect.
Impact over geographical range	Disparate occurrence and rarity of <i>Floydia praealta</i> indicates significant positive impact.	Disparate occurrence and rarity of <i>Macadamia integrifolia</i> indicates significant positive impact.
Sensitivity of Environment	High. Sensitive to weeds and fires.	Moderate. Sensitive to weeds and fires.
Degree of confidence	Confident.	Confident.
DECISION	Protection of area and involvement in recovery plan will have significant positive impacts.	Propagation will have significant positive impacts.

DISCUSSION

The vegetation mosaic of the area has suffered a number of artificial disturbances over many decades. This has resulted in a mix of remnant and regrowth vegetation in the study area. Appendix 1 details the floristic composition of the canopy taxa at selected sample sites across the subject land. The proposed quarry expansion will not impact upon any areas containing any endangered regional ecosystems. The rare and threatened flora recorded from the site do not occur in the proposed quarry expansion area. The rehabilitation plan (Appendix 2) proposes to increase the protection, viability and integrity of the entire suite of rare and threatened flora on the site, including any regenerating *Macadamia integrifolia* individuals that that may germinate in future within the footprint of the proposed expansion of quarrying activities.

The only areas of mapped remnant vegetation (predominantly regrowth vegetation that has attained the canopy structural and floristic characteristics that meet the criteria for remnant vegetation under the *Vegetation Management Act 1999*) that will be negatively impacted by the proposed works are areas of the dry open forest and woodland of regional ecosystem 12.11.5. This regional ecosystem is listed as least concern under the *Vegetation Management Act 1999* (REDD, Version 6.0, November 2009). The provision of offset vegetation (that will also form koala habitat satisfying the requirements of codes and policies related to fauna) will compensate for the loss of the isolated patch and small areas of edges of mapped remnant regional ecosystem that fall beneath the proposed development footprint.

CONCLUSIONS

In conclusion, it is considered that the proposed quarry expansion area does not contain any remnant or regrowth endangered regional ecosystems, nor will the proposed works have a negative impact upon any rare and threatened flora. Any rehabilitation effort outside the development area could focus on providing a woody canopy of trees that will provide food resources for fauna of interest in the area. Particular attention could be given to enhancing the rate of recovery of some regrowth communities where they may provide alternative habitat for fauna. Inappropriate use of regrowth and remnant forests where artificial disturbance regimes are degrading these areas and providing an establishment niche for a number of weeds, is to be minimised in future land management initiatives.

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APPENDICES

Appendix 1 – List of Canopy Taxa at Selected Sample Points within the study area.

Most dominant canopy taxon listed first.

Site 001 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 002 – *Acacia disparrima* monoculture.

Site 003 – *Acacia disparrima* monoculture.

Site 004 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 005 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 006 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 007 – *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 008 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 009 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. microcorys*.

Site 010 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 011 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 012 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *Allocasuarina littoralis*.

Site 013 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 014 – *Acacia disparrima* monoculture.

Site 015 – Vine Forest (spp. list available upon request) with canopy characterised by *Lophostemon confertus*, *Araucaria cunninghamii*, *Jagera pseudorhus*, *Ficus macrophylla*, *Archontophoenix cunninghamiana*, *Flindersia australis*, *F. schottiana*, *F. xanthoxyla*, *Eucalyptus microcorys*, *Guioa semiglauca*, and *Acacia disparrima*.

Site 016 – *Lophostemon confertus*, *Angophora leiocarpa*, *Eucalyptus propinqua*, *E. siderophloia*.

Site 017 – Non-remnant regrowth with *Acacia disparrima*, *Eucalyptus siderophloia*, *Melaleuca quinquenervia*, *Lophostemon suaveolens* and *Eucalyptus microcorys*.

Appendix 2 – Rehabilitation/Revegetation Plan for Quarried Area

The revegetation of the areas to be disturbed during the quarrying operations of the Mount Cotton Quarry Extension (area of operations) will rely on the same natural regenerative processes that have returned woody native vegetation to parts of the cleared slopes and crests of the Mount Cotton region following the abandonment of intensive agriculture and/or grazing in these areas. It has been subject to a long history of artificial disturbances from land clearing, grazing, logging, fire, grazing and weeds and the synergistic impact between these factors. Whilst the dense canopy of *Acacia disparrima* bears testament to the regenerating state of these formerly cleared areas, the important message is that unaided natural processes have been responsible for these areas having a woody native canopy now dominating originally cleared areas of formerly maintained pastures.

These natural regenerative processes will be assisted in areas of disturbance within the Mount Cotton Quarry Extension. This assistance will take the primary form of monitoring and weed management. Monitoring of de-commissioned areas will focus on two factors – density of native woody vegetation and occurrence of weed taxa or infestations that may interfere adversely with the integrity and viability of those native woody taxa. Thus, the revegetation plan is modelled on the observed natural regeneration of this site.

The weed management issue will remain the same during all phases of the project. Regular monitoring surveys of all areas traversed by machinery or humans during the construction, operation and maintenance of the facility will be required and any plants not previously observed should be recorded or collected for subsequent identification. Control measures should be implemented immediately upon discovery of any exotic taxa not previously recorded. This should take the form of control as advised by the appropriate agencies, particularly DERM for any declared plants listed on the *Land Protection (Pest and Stock Route Management) Regulation 2003* of the *Land Protection (Pest and Stock Route Management) Act 2002*. The site/s of any recorded exotic taxa should be noted by GPS and photographic record and subsequent surveys target these sites to ensure no repeated colonisation of the recorded weeds at these sites.

Any vegetation removed should be mulched and placed on areas that have been disturbed during quarrying operations. There should be no access for machinery or humans into adjacent vegetation except along existing or necessary access tracks/roads. All stockpiles

of materials should be located outside the areas of remnant vegetation. All vehicular movements in such areas should be limited to the actual area of works and the perimeter to remnant vegetation marked with temporary fencing. Any disturbance of the ground below the drip line of retained canopy trees should be avoided where prudent and feasible.

All areas of disturbed soil should be brush-matted with branches bearing seeds where practicable. Species such as *Corymbia citriodora*, *Allocasuarina littoralis* or any of the native taxa within the quarry area would be ideal candidates to provide the branches for such works. The remaining areas of disturbed soil should be mulched to a depth of 10-20 cm if necessary. These areas should be monitored for the first six months to assess the proportion of native to exotic taxa with the latter controlled where necessary to enhance the competitive advantage of the native taxa. Where native woody vegetation has not regenerated adequately, then other revegetation strategies (e.g. direct seeding, infill planting, judicious use of fire for weed management and more intensive weed management in such areas) may be considered if the site does not have canopy closure (at least of the shrub layer 2 m tall) of woody native shrubs or trees after 12-18 months – dependant upon seasonal conditions. Fire should be excluded until the regeneration captures the site via canopy closure other than as discussed above.

Therefore, within any disturbed areas, the following revegetation protocols are proposed:

- Provide standard sediment/erosion control devices in areas with loose sediment likely to be translocated downslope into waterways to minimise loss of material from the affected area;
- Following the monitoring program that will assess the natural regeneration across such areas, spray any weed infestations with Biactive Roundup or similar knockdown herbicide only if they are considered to pose a threat to the viability and integrity of the regenerating native taxa. This would apply particularly to any infestations of smothering legumes or other weeds that will smother and stifle the growth of the native taxa. Many weeds such as *Lantana camara* will always be a part of the landscapes in this region and should only be singled out for control when they form a dense infestation that will preclude the growth or regeneration of native taxa. Minor infestations of many exotic taxa are the norm, even in the conservation reserves throughout the region. These should only be targeted for control when they pose a significant threat to native taxa;

- Spray a hydro mulch mixture on bare surfaces containing seeds of *Allocasuarina littoralis* * to enable the dense establishment of this species which provides a weed suppressant canopy and fire retardant interface between retained vegetation and quarried area. Where material is available (i.e. seed laden branches), brush matting would provide a cost-effective means of establishing a woody native vegetation cover as described above;
- Commence seasonal monitoring program to determine need for further application of hydro mulch and/or weed control programs as in-fills in areas where the natural regenerative processes have not proceeded in an adequate time frame. These monitoring events would be conducted at the end of winter, end of spring (following the onset of storm rains) and late summer (prior to the onset of cooler weather);
- Once a canopy has established, the weed survey can be targeted at those areas on the periphery of works, as the thicket of developed *Allocasuarina littoralis* will preclude extensive development of weeds other than colonisations that would be expected in any of the remnant native vegetation of this region.

* *Allocasuarina littoralis* is a known food tree for the rare and threatened Glossy Black Cockatoo that is known from this region.

One component of the revegetation plan, but perhaps the most significant, falls outside the areas to be disturbed during the quarry operations of the Mount Cotton Quarry Extension and the *Corchorus cunninghamii* and *Macadamia integrifolia* populations could be made more viable as follows:

Macadamia integrifolia – At present the only individuals of *Macadamia integrifolia* were observed as coppice in poor regrowth dominated by dense thickets of *Lantana camara* outside the footprint of the proposed quarry expansion works. These individuals could be propagated by cuttings and/or seed (if individuals produce viable seed) and the cuttings/seedlings produced planted into the copses of regenerating vine forest at the head of the steep gullies on site. If practicable, the propagated plants would be planted within small canopy gaps in this area following adequate summer rains and weed maintenance activities (if required) be continued for 2 years until the propagules have established.

Corchorus cunninghamii – Whilst the population of this endangered plant is outside the proposed quarry area, the chance to enhance its survival in the wild as a component of on-going land management of the site should not be overlooked. Involvement of the quarry

managers in the developing recovery plan for this species will ensure financial assistance in its management and interactive advice from statutory authorities as to the most appropriate land management activities for the retained remnant vegetation in which this species is located. These joint land management initiatives are also likely to enhance the regenerative capacity of the adjoining vine forest through more appropriate fire management of the vine forest/open forest interface. The reduction in the frequency of the artificial fire regime will assist in the regeneration of the vine forest and the protection of the *Corchorus cunninghamii* population if undertaken in conjunction with other land management initiatives associated with the recovery plan for this endangered plant.

The rehabilitation plan is modelled on the observed natural regeneration of this site. It has been subject to a long history of artificial disturbances from land clearing, grazing, logging, fire, grazing and weeds and the synergistic impact between these factors. Despite this, the slopes and crests of the site have regenerated a predominantly native plant cover with virtually no active intervention. A similar route for regeneration of the post-quarrying landscape is expected. Upon cessation of quarrying activities in any given area, the following rehabilitation plan is proposed:

- Provide standard sediment/erosion control devices to ensure minimal loss of material from the affected area;
- Spray any weed infestations with Biactive Roundup or similar knockdown herbicide;
- Spray a hydro mulch mixture on bare surfaces containing seeds of *Allocasuarina littoralis* * to enable the dense establishment of this species which provides a weed suppressant canopy and fire retardant interface between retained vegetation and quarried area;
- Commence seasonal monitoring program to determine need for further application of hydro mulch and/or weed control programs. These monitoring events would be conducted at the end of winter, end of spring (following the onset of storm rains) and late summer (prior to the onset of cooler weather);
- Once a canopy has established, the weed survey can be targeted at those areas on the periphery of works, as the thicket of developed *Allocasuarina littoralis* will preclude extensive development of weeds other than colonisations that would be expected in any of the remnant native vegetation of this region.

* *Allocasuarina littoralis* is a known food tree for the rare and threatened Glossy Black Cockatoo that is known from this region.

Appendix 3A

**In regards P&E Court Appeal 1585 of 2007
Between Barro Group Pty Ltd (Appellants) and Redlands Shire Council (Respondent) & Ors.
1st Joint Statement on Flora Matters**

All meetings, conferences and this joint statement have been conducted and prepared in accordance with Practice Direction #1 of 2006. Unless otherwise stated, all references to the development refer to that which forms the original application to **Redlands Shire Council**.
Dr. David Doley (DD); Mr. Simon McNeilage (SM) and Dr. Mike Olsen (MO)) (✓ - Agree: x – Disagree)

	<i>DD</i>	<i>SM</i>	<i>MO</i>	Comments
<i>Nature Conservation Act 1994 and Environment Protection and Biodiversity Conservation Act 1998</i>				
1. <i>Corchorus cunninghamii</i> . This woody herb is located to the north of the proposed quarry footprint and the anticipated reduced dust levels is expected to improve the situation for this species, although no dust issue was apparent in the area of occurrence during the initial site inspections in 2003.	✓	✓	✓	DD, SM & MO The relative dust loads resulting from current and proposed works will be provided by other experts.
2. Understorey species are likely to be affected by dust deposition much more than are canopy species. This is due to their slower rate of replacement of foliage and the low light environment in which they occur. Reductions in the amount of light penetrating to the leaves is more likely to result in a failure to achieve a positive carbon balance, which then leads to death. The long leaf life and generally horizontal leaf display means that leaves are likely to accumulate more dust than would occur in upper canopy species. This accentuates the adverse effect of dust on plant function.	✓	✓	✓	SM and MO agree, but rely on the acknowledged expertise of DD in this area.
3. <i>Macadamia integrifolia</i> . This tree was observed as regrowth individuals in areas that appear to fall beneath the footprint of the proposed quarry. It is recommended that they be propagated and used in rehabilitation of the retained vine forest areas to the north of the proposed footprint.	✓	✓	✓	
<i>Vegetation Management Act 1999</i>				
4. There is not expected to be any loss of the endangered regional ecosystem 12.11.23 as a consequence of the proposed development. Field verification of the floristics of the mapped remnant vegetation will be undertaken to confirm the nature of the vegetation along the western	✓	✓	✓	

Flora and Flora Values – Mount Cotton Quarry

<p>perimeter of the proposed pit.</p> <p>5. REs are characterised by all the species that occur, including understorey species. REs that contain species that are restricted to the understorey are likely to be impacted adversely by the loss of these species. The notes on dust in point 2 above indicate the mechanism by which the understorey species may be affected. It is the whole ecosystem that is important, not just the canopy component that is the lone structural layer of concern with respect to the definition of remnant or non-remnant vegetation with respect to the <i>Vegetation Management Act 1999</i> and its Regulations that define Regional Ecosystems.</p> <p>6. Data on the loss of riparian habitat and mapped remnant vegetation is to be provided along with data on the spatial extent of future riparian habitat and remnant vegetation. A reasonable condition of development would be to provide the proposed offsets of both riparian habitat and remnant vegetation such that following the cessation of operations, the riparian habitats and remnant vegetation extent on site will be enhanced in area and condition.</p>	<p>✓</p> <p>✓</p>	<p>✓</p> <p>✓</p>	<p>✓</p> <p>✓</p>	
<p>Riparian vegetation</p> <p>7. Riparian habitat can be identified by reference to the Redland Planning Scheme “Waterways, Wetlands & Moreton Bay overlay mapping” and Part 5 – Overlays, Division 12 - Waterways, Wetlands & Moreton Bay overlay. The relevant RPS requirements including buffer widths for minor waterways and natural drainage lines are supported for ecological reasons.</p>	<p>✓</p>	<p>✓</p>	<p>✓</p>	

Appendix 3B

In regards P&E Court Appeal 1585 of 2007

Between Barro Group Pty Ltd (Appellants) and Redlands Shire Council (Respondent) & Ors.

2nd Joint Statement on Flora Matters

All meetings, conferences and this joint statement have been conducted and prepared in accordance with Practice Direction #1 of 2006. Unless otherwise stated, all references to the development refer to that which forms the original application to **Redlands Shire Council**. Dr. David Doley (DD); Mr. Simon McNeilage (SM) and Dr. Mike Olsen (MO)) (✓ - Agree; x - Disagree)

	DD	SM	MO	Comments
1. The dust experts report that there will be no increase in dust output from the new facilities and thus, there are no flora issues outstanding that would provide a reason for refusal of the proposed Development Application and the Appeal (if based solely on flora grounds) should be allowed).	✓		✓	This assumes that the dust expert report will provide supporting evidence that there will be no increase in dust levels from those associated with the current operation.

During the course of discussions 2 points were raised that were assessed during a recent field inspection (by MO) – the extent (if any) of endangered remnant regional ecosystem close to the proposed quarry footprint and the analogous nature of the current rehabilitation plantings to the likely pre-clearing regional ecosystems in the areas where works have been undertaken recently.

The recent observations confirm the following:

- The canopy along the western edge of the property is dominated by a mix of *Corymbia citriodora*/*Corymbia intermedia*/*Lophostemon confertus*/*Eucalyptus siderophloia*/*Eucalyptus propinqua*. There was no evidence of *Eucalyptus pilularis*/*Eucalyptus racemosa* – even in the *Acacia disparrima* dominated regrowth. There is certainly an area of endangered remnant regional ecosystem to the south of the subject land, south of the Mt Cotton Driver Training School, but the closest observed to the west of the subject land was along Avalon Road. There was no discernible *Eucalyptus pilularis*/*Eucalyptus racemosa* association proximal to the site along West Mount Cotton Road that would constitute a “regional ecosystem”, although there were some spots where *Eucalyptus pilularis* was evident amongst areas of regional ecosystem 12.11.5. There is no endangered remnant regional ecosystem that will be acutely impacted by the proposed quarrying operations – even more so now the footprint has moved further away from the mapped remnant in the west and north-west of the subject land.
- As to the riparian planting, the mix of species that were established in the gro-tubes included the following: *Eucalyptus tereticornis*, *Melaleuca quinquenervia*, *Carex appressa*, *Lomandra hystrix*, *Lomandra longifolia*, *Eucalyptus microcorys*, *Hovea acutifolia*, *Corymbia citriodora*, *Angophora floribunda*, *Dodonaea triquetra*, *Elaeocarpus reticulatus*, *Eucalyptus propinqua*, *Acacia disparrima*, *Acacia leiocalyx*, *Glochidion ferdinandi*. *Lophostemon suaveolens*, *Alphitonia excelsa*, *Melaleuca viminalis*, *Melaleuca bracteata*, and *Acacia obtusifolia* (a wattle known from the local area, but not from that landscape – this species is expected to drop out as the canopy develops). It was unclear if the *Lophostemon suaveolens* and *Glochidion ferdinandi* were planted or regenerated spontaneously. There is some *Imperata cylindrica* that is sprouting through the wood mulch as well as some *Dianella caerulea* and a few other native herbs. The observations all bode well for these denser plantings if the weed management is continued as it seems to be at present.

Attachment 3

Property Map of Assessable Vegetation

Author: Melissa Cronk
File / Ref number: 2009/002948;
Unit: Vegetation Management Unit
Phone: 3884 5328



2 October 2009

Ms Renee Young
9 McInroy Street
Taringa QLD 4068

Department of
**Environment and Resource
Management**

Dear Ms Young

**Re: Certification of a Property Map of Assessable Vegetation on 1, 17 RP108970,
370 S311071, 162 S31962 & 238 SP218968 - Redland City Council**

This is to advise you that a Property Map of Assessable Vegetation (PMAV) has been certified—consistent with your agreement—by the Department of Environment and Resource Management (DERM) on 6 April 2009. A copy of the certified map is attached for your records.

This PMAV will replace the Regional Ecosystem (RE) map in determining whether an application is required to clear native vegetation on your property. That is, the PMAV determines the assessability of native vegetation on your property. The categories on the PMAV are described as follows:

- Category X shows an area where vegetation is not assessable.
- Categories 1, 2, 3 and 4 show areas where vegetation is assessable.
 - Category 1 may contain 'endangered' remnant vegetation, areas unlawfully cleared, areas declared to be of high nature conservation value and/or areas declared as vulnerable to land degradation.
 - Category 2 contains 'of concern' remnant vegetation.
 - Category 3 contains 'not of concern' remnant vegetation.
 - Category 4 shows an area on an agricultural and grazing lease, which was cleared before 31 December 1989 and does not contain remnant vegetation.

Category X shows the areas in which native vegetation can be cleared without approval under Queensland's vegetation management laws. Categories 1 – 4 show the areas in which a permit is required to clear native vegetation, unless the clearing is for an exempt activity.

Copies of the certified PMAV are attached for each registered owner listed on your original application form. These have been sent to you for distribution, as you are the nominated contact on the application form.

If a registered owner requires additional copies of the certified PMAV, they can be purchased at any Department of Environment and Resource Management Customer Service Centre.

DERM Ipswich
PO Box 864
Ipswich Qld 4305
Facsimile (07) 38845395
Website www.derm.qld.gov.au

If you wish to discuss this matter further, please contact Melissa Cronk on telephone number 3884 5328 quoting the above reference number.

Yours sincerely

A handwritten signature in blue ink, appearing to be 'MC', with a large loop at the end.

Melissa Cronk
Vegetation Management Administration

Additional Information for Property Map of Assessable Vegetation (PMAV)

Vegetation Management Act 1999

1. Replacing a PMAV:

- 1.1. Under the *Vegetation Management Act 1999*, section 20D states when a PMAV map may be replaced by a chief executive. This is shown below:

20D When maps may be replaced

- (1) *The chief executive may replace a property map of assessable vegetation for an area (the **previous area**) with a new property map of assessable vegetation.*
- (2) *The new map may apply to –*
 - (a) *part or all of the previous area; or*
 - (b) *part or all of the previous area and another area.*
- (3) *Subsection (1) applies only –*
 - (a) *if a matter mentioned in section 20B occurs in relation to an area mentioned in subsection (2); or*
 - (b) *to reflect a change to an endangered, of concern or not of concern regional ecosystem in an area mentioned in subsection (2); or*
 - (c) *for a matter other than a matter mentioned in paragraphs (a) and (b) if an owner of the land included in the map agrees to the replacement.*

2. Revoking a PMAV:

- 2.1. Under the *Vegetation Management Act 1999*, section 20E states when a PMAV map may be revoked by a chief executive. This is shown below:

20E When maps may be revoked

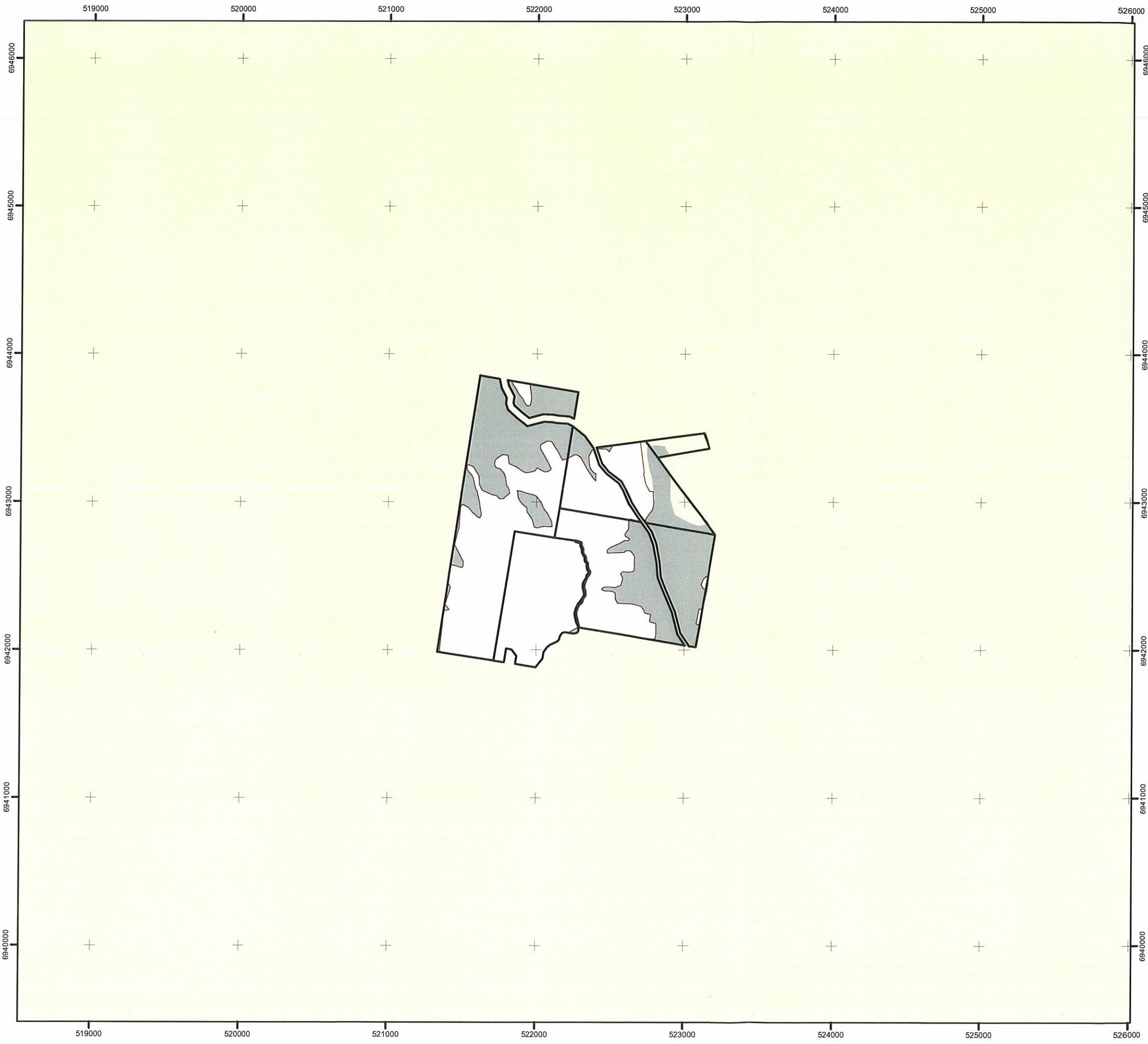
- (1) *The chief executive may revoke a property map of assessable vegetation for an area if –*
 - (a) *for a map made under section 20B(1)(a) – the area is shown on a regional ecosystem map or remnant map as remnant vegetation and the approval for clearing the area has expired; or*
 - (b) *for a map made under section 20B(1)(c) – the area is shown on a regional ecosystem map or remnant map as remnant vegetation and the chief executive has been notified that the area is no longer subject to a native forest practice; or*
 - (c) *for a map made under section 20B(1)(d) – the area is shown on a regional ecosystem map or remnant map as remnant vegetation and the chief executive responsible for administering the Forestry Act 1959 has advised that the State no longer has an interest in commercial timber in the area; or*
 - (d) *for a map made under section 20B(1)(e), (f) or (g) – the area is shown on a regional ecosystem map or remnant map as remnant vegetation.*

(2) *Also, the chief executive may revoke a property map of assessable vegetation made under section 20C(3) if the owner of the land agrees to the revocation.*

2.2. Under the *Vegetation Management Act 1999*, section 20G states the procedures to be followed when revoking a PMAV map. This is shown below:

20G Owners to be advised of revocation of maps

If a property map of assessable vegetation is revoked, the chief executive must give each owner of the land that is included in the map written notice of the revocation and the reasons for the revocation.

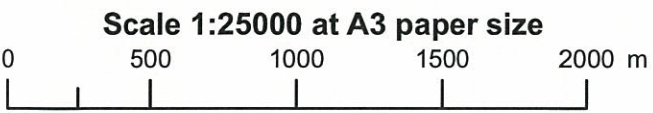


Sheet 1 of 1

Property Map of Assessable Vegetation

PMAV 2009/002984

LOT on PLAN
17RP108970, 370S311071, 162S31962,
238SP218968, 1RP108970



LEGEND

- Subject Lot(s)
- Area to which the PMAV does not apply
- PMAV Categories**
- Category X
- Area that is subject to other PMAVs, or if no PMAV exists, Certified Regional Ecosystem Mapping

Notes:

Property boundary provided by Department of Environment and Resource Management
The property boundaries shown on this plan are approximate only. They are not an accurate representation of the legal boundaries.

Category X area based on Regional Ecosystem Data provided by Department of Environment and Resource Management.
The approximate horizontal accuracy of this data is +/- 25m.

Map Information:
Horizontal Datum: GDA 1994
Projection: Universal Transverse Mercator - Zone 56

This PMAV has been made under Section 20C(3) of the Vegetation Management Act (1999)

Signed for the Chief Executive of the Department of Environment and Resource Management by:

Name: Shannon Cooper

Title: A/Senior Vegetation Management Officer

Signature:

Date: 06/04/2009

Map Prepared by: NWF
Department of Environment and Resource Management
PO Box 864, Ipswich, Qld, 4305
© The State of Queensland (Environment and Resource Management) 2009

Attachment 1.10

Flora and its Values

FLORA AND ITS VALUES

MOUNT COTTON QUARRY EXTENSION

REDLAND CITY COUNCIL



Frontispiece: Open forest (Least Concern regional ecosystem 12.11.5) dominated by *Corymbia citriodora* that comprises the majority of the remnant and regrowth vegetation on the slopes and crests of the site.

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DESCRIPTION OF THE STUDY AREA

It is proposed to extend the current operations as the Mount Cotton Quarry Extension adjacent to Mount Cotton Road. Rural and rural residential lands border the site with remnant vegetation occupying some of the higher crests and slopes. This proposed quarry extension will involve impacts upon a small isolated patch and some limited sections of the edges of the remnant native vegetation on the site and other flora in the environs of the proposed footprint. This impact will be on mapped remnant regional ecosystems (Version 6.0, current certified mapping), but the majority of the observed remnant regional ecosystem to be impacted by the proposed footprint accords with the circumscription of the least concern remnant regional ecosystem 12.11.5 (See Frontispiece). Other documentation will define the precise nature of the proposed works and associated Property Vegetation Management Plan (being prepared by Groundworks Plus) and offset documentation to compensate for the proposed clearing of the mapped remnant least concern regional ecosystems (being prepared by BAAM). Published topographic maps were utilised for location purposes in the field. Existing vegetation and regional ecosystem (RE) mapping and data (DERM website, 2010) was accessed to form the basis for analyses and discussions within this report along with analysis of Herbrecks data on rare and threatened flora purchased from the Queensland Herbarium. This information was enhanced by foot traverses of the study area over a number of years.

Most of the study area was historically cleared or utilised extensively for grazing and logging prior to the regrowth developing over parts of the site. This regrowth has developed to the point where parts of the study area are covered by remnant vegetation as prescribed within the *Vegetation Management Act 1999*. Open forests and woodlands dominate these regrowth and remnant areas on metasediments with only limited areas of vine forest regrowth/remnant vegetation in some of the steeper gullies draining from the crests in the north of the property.

The drainage from these gullies flows ultimately into California Creek, although the current crest that is the site of existing quarrying operations forms the catchment divide between Native Dog and California Creeks. These streams flow into the Logan River. The low-lying portions of the site where there has been some development of alluvium have long been cleared and continue to be utilised for grazing purposes. None of the vegetation on the

alluvium appears to have regenerated to the point where it could be considered as remnant vegetation as defined within the *Vegetation Management Act 1999*.

The remnant vegetation of the site exhibits extensive evidence of past timber harvesting practices, clearing and impacts of artificial fire regimes. The landscape features of the site are clearly visible on the published 1:25,000 topographic map sheet of the study area (Beenleigh 9542-42) and the Google image of the site (Plate 1 below).

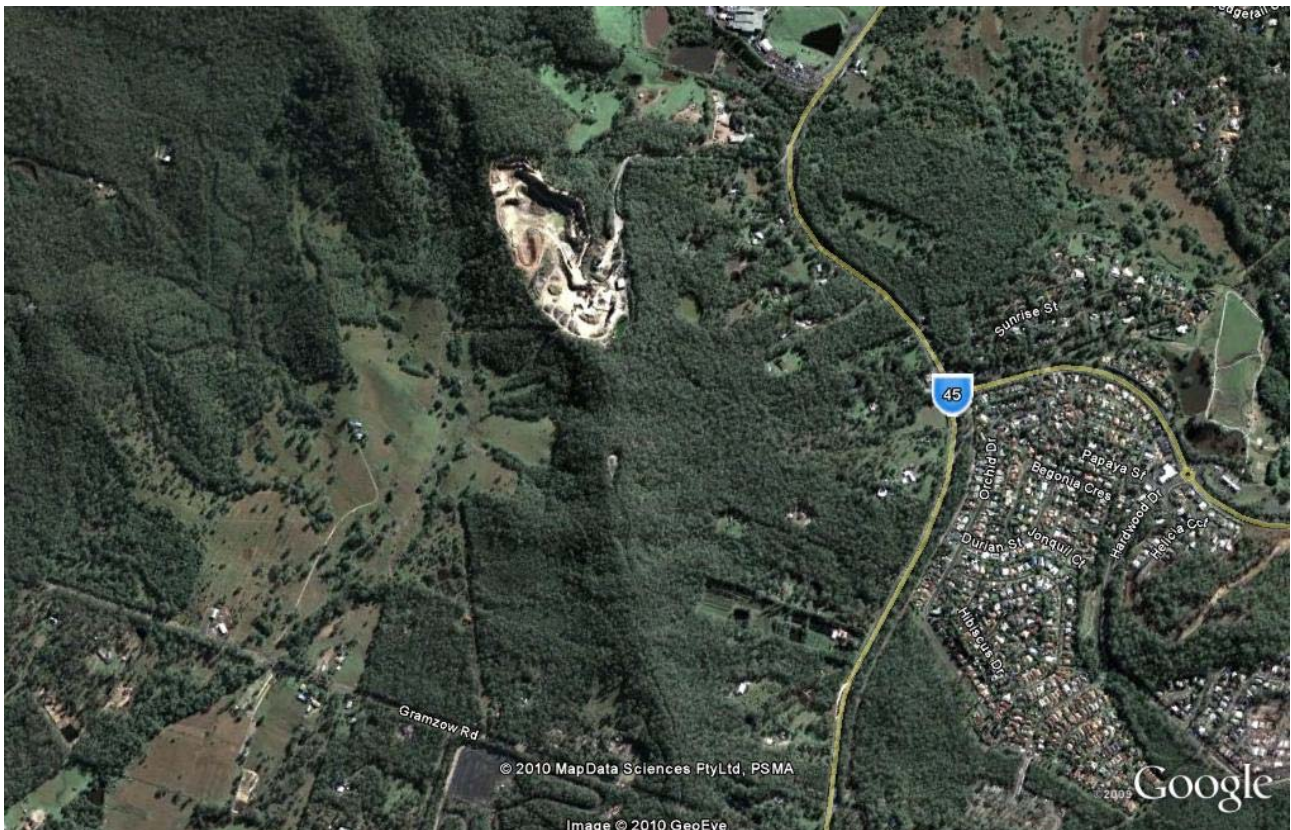


Plate 1 – Google Image of the study area with the existing quarry works clearly visible.

FLORA OF THE STUDY AREA

As stated above, a mosaic of cleared lands, regrowth and remnant native vegetation occurs across the site. The remnant forest has been logged and cleared in the past, with more recent fire related land degradation and weed impacts in evidence during field surveys.

Some elements of the landscaping in the existing rural residential areas adjacent contain a number of serious environmental weeds that are spreading into nearby regrowth and remnant vegetation e.g. *Corymbia torelliana*, *Jacaranda mimosifolia*, *Lantana* spp., *Nephrolepis cordifolia*, *Ochna serrulata*, *Schefflera actinophylla*, *Spathodea campanulata*, *Sphagneticola trilobata* and *Syagrus romanzoffianum*. Several of these taxa are listed as Class 3 environmental weeds on the *Land Protection (Pest and Stock Route Management) Act 2002*. Two Class 2 plants listed under this legislation were observed in the grazed portion of the subject land – Water Hyacinth (*Eichhornia crassipes*) and Fireweed (*Senecio madagascariensis*) – the latter in much reduced population density and abundance in 2009 and 2010. The *Land Protection (Pest and Stock Route Management) Act 2002* states “landowners must take reasonable steps to keep land free of Class 2 pests”. An effective spray program and removal of grazing impacts once quarrying operations have commenced will effectively deal with both of these Class 2 plants. It is considered that grazing should be re-introduced until such time as the expanded quarry works commence in order to best reduce the exotic pasture growth that has occurred with the removal of stock in recent times.

The regrowth and remnant areas have a higher proportional representation of native taxa than the nearby residential areas, but the structural and floristic integrity of these areas testifies to their physical characteristics that minimise the invasion of agricultural weeds in all but the most substantially disturbed areas.

The low nutrient status, shallow soils and low water availability reduce the density and diversity of most weed taxa, although *Lantana camara* and *L. montevidensis* was still extensively represented across the study area with *Ochna serrulata* dominant in some parts of the vine forest regrowth. The relative lack of dense weed infestations on the site may be due to the higher nutrient status of other areas with a greater density and proliferation of weeds due to the influence in such areas of the higher nutrient status of the

substrate and greater effluent and stormwater related nutrient inputs. The greatest density and diversity of exotic flora was associated with the limited alluvial areas where grazing pressure has been reduced recently and exotic pasture species have, as a consequence of the removal of stock, become denser and more abundant.

The remnant vegetation is comprised primarily of dry woodland and open forest of the crests and slopes with some weed dominated regenerating vine forest in the upper parts of the steep gullies in the northern part of the site. The majority of the site is located on metasedimentary rocks (land zone 11). Soil depth, topography and drainage are the major determinants of the natural patterning of the vegetation of the site, although human related disturbance regimes (particularly logging, grazing and artificial fire regimes followed by weed infestations in some areas) have altered the relative displacement, viability and integrity of this mosaic. The most substantive impact in this regard is the incursion of weeds into this community following the impact of these artificial disturbances.

Standard references relevant to the study area or region that have been employed for the taxa listed in this report are as follows: Queensland Herbarium, 2002; Royal Botanic Gardens, 1993; Sharpe, 1986; Simon, 1993; and, Stanley & Ross, 1983. Further nomenclatural changes have been incorporated via regular, personal communication with staff at the Queensland Herbarium. As there is no standard or commonly and universally accepted reference work for plant common names, all taxa mentioned in this report will be referred simply by their currently published scientific names at the time of report preparation.

LEGISLATION AND OTHER RELEVANT MATTERS

STATE LEGISLATION

VEGETATION MANAGEMENT ACT 1999

On the certified map for this region (Version 6.0, November 2009), a number of regional ecosystems are represented in the polygon that includes this site. Pertinent to this discussion is the definition of remnant vegetation given in the *Vegetation Management Act 1999*:

“the vegetation, part of which forms the predominant canopy of the vegetation–

- (a) covering more than 50% of the undisturbed predominant canopy; and
- (b) averaging more than 70% of the vegetation’s undisturbed height; and
- (c) composed of species characteristic of the vegetation’s undisturbed predominant canopy.”

Status and circumscriptions for the following regional ecosystems was obtained by reference to Young and Dilleward (1999) in Sattler and Williams (1999) and DERM data (2010). Concurrence between the certified map and recent field observations is poor across parts of the study area, due primarily to scale and related interpretation constraints of the certified map. The two main regional ecosystems depicted on the certified map are the Least Concern remnant regional ecosystems 12.11.3, 12.11.5 and 12.11.10, a small copse of the Of Concern remnant regional ecosystem 12.3.11 in the southern part of the site and mapped areas of heterogeneous polygons containing the Endangered remnant regional ecosystem 12.11.23.

As seen in the joint expert reports (Appendices 3A and 3B) there is no endangered remnant (or regrowth) regional ecosystem 12.11.23 that will be impacted by the proposed operations. The attributes of the regional ecosystems present on the site are given in Table 1. There is some vine forest developing in the steeper parts of the gully on the northern parts of the site. It is considered that there are no patches of either remnant or regrowth endangered regional ecosystem 12.11.23 proximal to the proposed footprint of the quarry expansion area. Those parts of the site with remnant vegetation coverage

(mapped or otherwise) are dominated by the Least Concern remnant regional ecosystems 12.11.3, 12.11.5 and 12.11.10.

The major disparity between the certified map and the recent field observations is the extent of the mapped remnant and regrowth endangered regional ecosystem 12.11.23 dominated by *Eucalyptus pilularis* with *E. racemosa* a common co-associate in the Venman area west of the subject site. This vegetation type certainly occurs close to the subject land to the west in the Venman Bushland Reserve Conservation Park and near the Mount Cotton Driver Training Centre surrounding Lakeside Drive to the southeast. The dominant remnant and vegetation of the dry open forests and woodlands of the crests and slopes of the site is that of regional ecosystem 12.11.5 with *Corymbia citriodora* abundant in the canopy (See Frontispiece). Regrowth vegetation of this community (and that of regional ecosystems 12.11.3 and 12.11.10) is dominated by *Acacia disparrima* and not taxa characteristic of regrowth regional ecosystem 12.11.23.

Table 1 – Status of Regional Ecosystems mapped within the study area.

<p>12.3.11 – Of Concern under the <i>Vegetation Management Act 1999</i></p> <ul style="list-style-type: none"> Open-forest to woodland of <i>Eucalyptus tereticornis</i>, <i>E. siderophloia</i> and <i>Corymbia intermedia</i>. <i>Corymbia tessellaris</i>, <i>Lophostemon suaveolens</i> and <i>Melaleuca quinquenervia</i> frequently occur and often form a low tree layer. Other species present in scattered patches or low densities include <i>Angophora leiocarpa</i>, <i>E. exserta</i>, <i>E. grandis</i>, <i>C. trachyphloia</i>, <i>C. citriodora</i>, <i>E. latisinensis</i>, <i>E. tindaliae</i>, <i>E. racemosa</i>, <i>Melaleuca sieberi</i> and <i>M. viridiflora</i>. <i>E. seeana</i> may be present south of Landsborough. Occurs on Quaternary alluvial plains and drainage lines along coastal lowlands. Rainfall usually exceeds 1000mm/y.
<p>12.11.3 – Least Concern under the <i>Vegetation Management Act 1999</i></p> <ul style="list-style-type: none"> Open-forest generally with <i>Eucalyptus siderophloia</i> and <i>E. propinqua</i> ± <i>E. microcorys</i>, <i>Lophostemon confertus</i>, <i>Corymbia intermedia</i>, <i>E. biturbinata</i>, <i>E. acmenoides</i>, <i>E. tereticornis</i>, <i>E. moluccana</i>, <i>Angophora leiocarpa</i>, <i>Syncarpia verecunda</i> with vine forest species and <i>E. grandis</i> or <i>E. saligna</i> in gullies. <i>Eucalyptus pilularis</i> and <i>E. tindaliae</i> sometimes present e.g. mid D'Aguilar Range, Conondale Range. Occurs predominantly on hills and ranges of Palaeozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.
<p>12.11.5 – Least Concern under the <i>Vegetation Management Act 1999</i></p> <ul style="list-style-type: none"> Open-forest complex in which spotted gum is a relatively common species. Canopy trees include <i>Corymbia citriodora</i>, <i>Eucalyptus siderophloia</i> or <i>E. crebra</i> (sub coastal ranges), <i>E. major</i> and/or <i>E. longirostrata</i> and <i>E. acmenoides</i> or <i>E. portuensis</i> and/or <i>E. carnea</i> and/or <i>E. eugenioides</i>. Other species that may be present and abundant locally include <i>Corymbia henryi</i>, <i>C. intermedia</i>, <i>C. trachyphloia</i>, <i>Eucalyptus tereticornis</i>, <i>E. propinqua</i>, <i>E. biturbinata</i>, <i>E. moluccana</i>, <i>E. melliodora</i>, <i>E. fibrosa</i> subsp. <i>Fibrosa</i> and <i>Angophora leiocarpa</i>. <i>Lophostemon confertus</i> often present in gullies and as a sub canopy or understorey tree. Mixed understorey of grasses, shrubs and ferns. Occurs on hills and ranges of Palaeozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.
<p>12.11.10 – Least Concern under the <i>Vegetation Management Act 1999</i></p> <ul style="list-style-type: none"> Notophyll and notophyll/microphyll vine forest ± <i>Araucaria cunninghamii</i>. Characteristic species include <i>Argyrodendron trifoliolatum</i>, <i>Argyrodendron</i> sp. (Kin Kin W. D. Francis AQ 81198), <i>Choricarpia subargentea</i>, <i>Dissiliaria baloghioides</i>, <i>Brachychiton discolor</i>, <i>Beilschmiedia obtusifolia</i>, <i>Diospyros pentamera</i>, <i>Grevillea robusta</i>, <i>Gmelina leichhardtii</i> and <i>Ficus macrophylla</i> forma <i>macrophylla</i>. Occurs on Palaeozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.

Table 1 cont'd.

12.11.23 – Endangered under the <i>Vegetation Management Act 1999</i>
<ul style="list-style-type: none"><i>Eucalyptus pilularis</i> open forest. Other canopy species include <i>E. microcorys</i>, <i>Corymbia intermedia</i>, <i>Angophora woodsiana</i>, <i>E. tindaliae</i> and <i>E. carnea</i>. <i>E. racemosa</i> subsp. <i>racemosa</i> and <i>Corymbia trachyphloia</i> are prominent in the Venman area whilst <i>C. gummifera</i> and <i>E. resinifera</i> are prominent in the Nerang area. Occurs on low coastal Paleozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics (Neranleigh-Fernvale beds).

Figures 1 and 2 depict the current certified mapping (remnant and regrowth) for the study area (Version 6.0 downloaded from the DERM website).

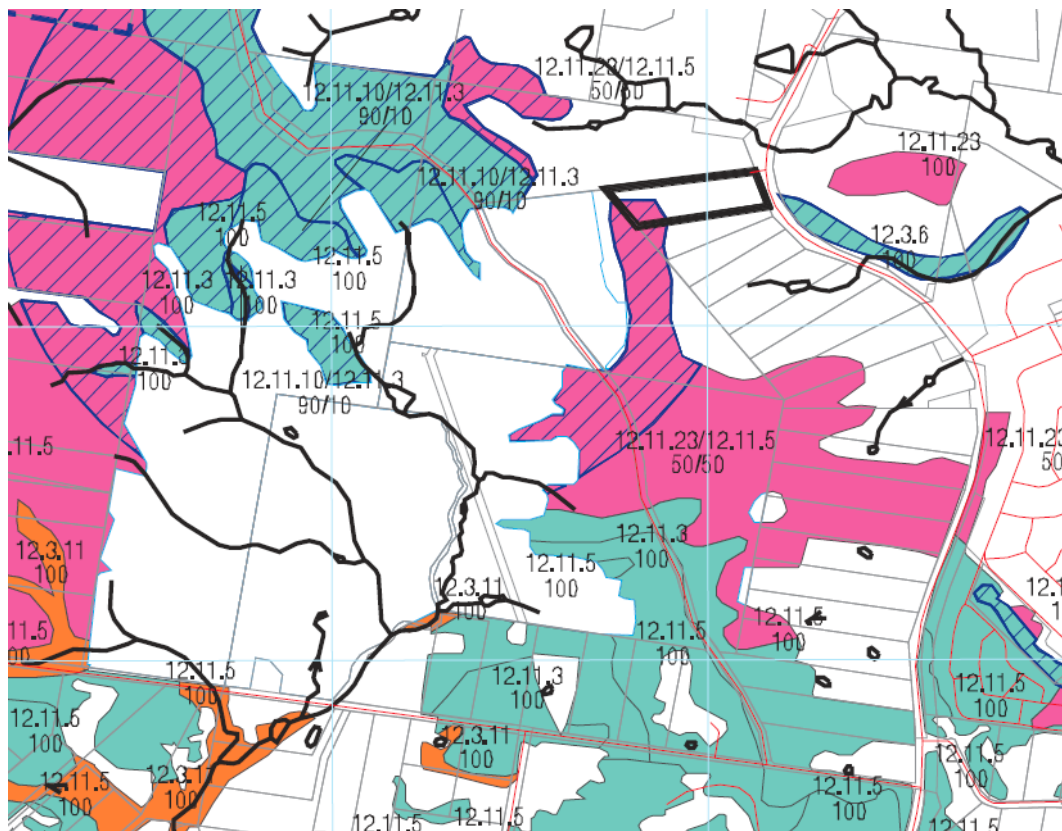


Figure 1 – Current certified mapping of the study area (Version 6.0 – remnant coverage).

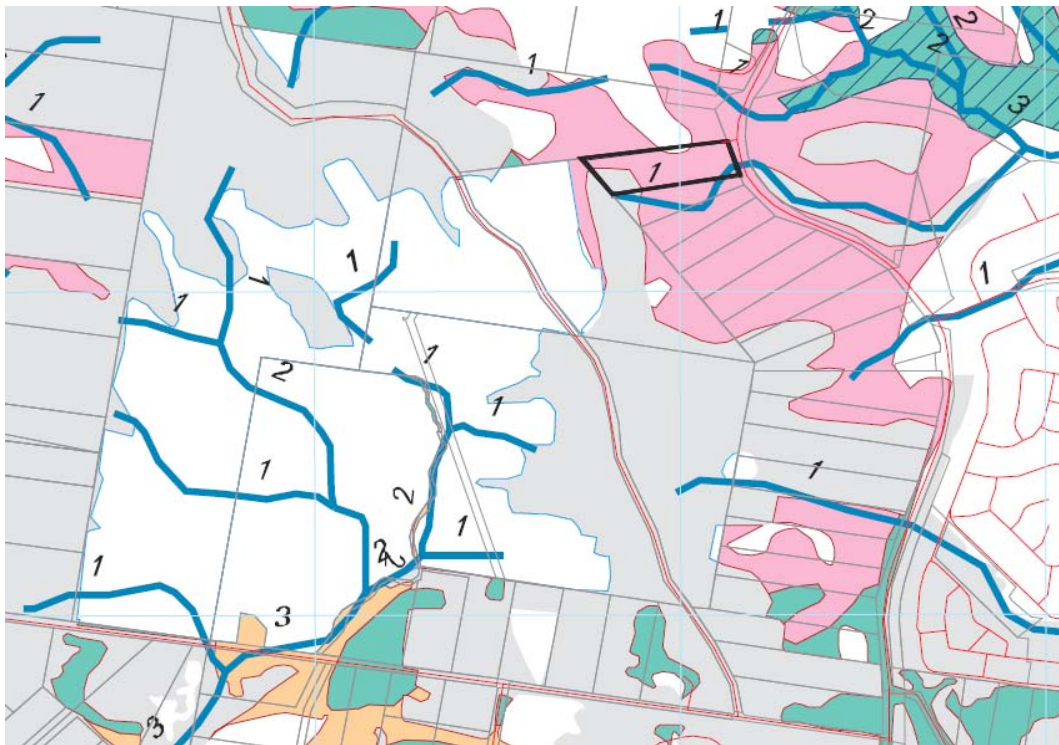


Figure 2 – Current certified mapping of the study area (Version 6.0 – regrowth coverage).

As the remnant vegetation on the proposed quarry expansion area does not have any extant endangered remnant or regrowth regional ecosystem present, exemptions for mapped Key Resource Areas (KRAs) do not trigger restrictive permit applications with respect to the *Vegetation Management Act 1999* for clearing of assessable vegetation.

There remain areas of regrowth dominated by *Acacia disparrima* (Plate 2) on the current certified mapping (Figure 1) that do not conform to the prescriptions of the remnant regional ecosystems towards which they are regenerating. Scale of mapping related issues would appear to have resulted in these areas being mapped as remnant regional ecosystems on the current certified mapping.



Plate 2 – Dense monoculture canopy of *Acacia disparrima* adjacent to existing quarry with remnant vegetation dominated by *Corymbia citriodora* visible on the skyline.

NATURE CONSERVATION ACT 1992 AND SCHEDULES 1994

Whilst a number of taxa listed on the Schedules of the *Nature Conservation (Wildlife) Regulation 1994 SL No. 473 and 474* of the *Nature Conservation Act 1992* are known from the study area (See Table 2), only three were observed in the study area. Several of these are also listed under the complementary *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).

Table 2. Species recorded from the study region (Herbrecs, DERM and DEWHA websites, various times). Status as per NCA, 1992 & amendments 2000.

Schedule 2 (Endangered Flora)

Corchorus cunninghamii

Schedule 3 (Vulnerable Flora)

Acianthus amplexicaulis, *Arthraxon hispidus*, *Macadamia integrifolia* and *Thesium australe*

Schedule 4 (Rare Flora)

Eucalyptus curtisii.

Two species listed under the *Schedules of the Nature Conservation (Wildlife) Regulation 1994 SL No. 473 and 474* of the *Nature Conservation Act 1992* were observed on the site (*Macadamia integrifolia* and *Corchorus cunninghamii*). The population of *Corchorus cunninghamii* is the most significant (Plate 3).



Plate 3 – *Corchorus cunninghamii* in bud and fruit adjacent to regrowth vine forest.

Macadamia integrifolia was only found as a couple of isolated plants amongst a thicket of *Lantana camara* (Plate 4). At present, none of the observed individuals fall beneath or proximal to the quarry expansion footprint. Pre-disturbance surveys will ensure location of any newly germinated individuals of this threatened taxon for subsequent translocation into more secure areas of remnant or regenerating vine forest on the site.



Plate 4 – *Macadamia integrifolia* emerging from a dense shrub layer of *Lantana camara* beneath a monoculture canopy of *Acacia disparrima* north of the proposed quarry footprint.

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The two aforementioned species (*Macadamia integrifolia* and *Corchorus cunninghamii*) are listed under the complementary schedules of the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). Their management is addressed with respect to the future quarry operations in the Rehabilitation Plan in Appendix 2. The impact upon the listed taxa is assessed in the following Table (Table 2).

Table 3. Potential Impacts of the proposed quarry expansion with respect to the EP&BC Act.

EPBC Act Criteria	Potential impacts upon a threatened species – <i>Corchorus cunninghamii</i>	Potential impacts upon a threatened species – <i>Macadamia integrifolia</i>
On-site impacts	No intrusion into, or destruction of, margins of vine forest (habitat of <i>Corchorus cunninghamii</i>) or the potential destruction of individuals of <i>Corchorus cunninghamii</i> .	Increased abundance of <i>Macadamia integrifolia</i> on site due to propagation and use in planting of regenerating vine forest areas.
Off-site impacts	Increasing vulnerability of margins of vine forest (habitat of <i>Corchorus cunninghamii</i>) to further degradation via increased fire intrusion and weed infestations unless land management initiatives implemented to reduce the impact of artificial fire regimes.	Nil due to occurrence in <i>Lantana camara</i> thicket outside the footprint of the proposed quarry expansion area – likely to increase regional conservation of <i>Macadamia integrifolia</i> .
Direct impacts	Nil.	Nil.
Indirect impacts	Fire and weed intrusions into habitat of <i>Corchorus cunninghamii</i> .	Fire and weed intrusions into habitat of <i>Macadamia integrifolia</i> .
Frequency of Action	N/A as outside quarry footprint.	N/A as outside quarry footprint.
Duration of Action	Persistent positive effect.	Persistent positive effect.
Impact over geographical range	Disparate occurrence and rarity of <i>Floydia praealta</i> indicates significant positive impact.	Disparate occurrence and rarity of <i>Macadamia integrifolia</i> indicates significant positive impact.
Sensitivity of Environment	High. Sensitive to weeds and fires.	Moderate. Sensitive to weeds and fires.
Degree of confidence	Confident.	Confident.
DECISION	Protection of area and involvement in recovery plan will have significant positive impacts.	Propagation will have significant positive impacts.

DISCUSSION

The vegetation mosaic of the area has suffered a number of artificial disturbances over many decades. This has resulted in a mix of remnant and regrowth vegetation in the study area. Appendix 1 details the floristic composition of the canopy taxa at selected sample sites across the subject land. The proposed quarry expansion will not impact upon any areas containing any endangered regional ecosystems. The rare and threatened flora recorded from the site do not occur in the proposed quarry expansion area. The rehabilitation plan (Appendix 2) proposes to increase the protection, viability and integrity of the entire suite of rare and threatened flora on the site, including any regenerating *Macadamia integrifolia* individuals that that may germinate in future within the footprint of the proposed expansion of quarrying activities.

The only areas of mapped remnant vegetation (predominantly regrowth vegetation that has attained the canopy structural and floristic characteristics that meet the criteria for remnant vegetation under the *Vegetation Management Act 1999*) that will be negatively impacted by the proposed works are areas of the dry open forest and woodland of regional ecosystem 12.11.5. This regional ecosystem is listed as least concern under the *Vegetation Management Act 1999* (REDD, Version 6.0, November 2009). The provision of offset vegetation (that will also form koala habitat satisfying the requirements of codes and policies related to fauna) will compensate for the loss of the isolated patch and small areas of edges of mapped remnant regional ecosystem that fall beneath the proposed development footprint.

CONCLUSIONS

In conclusion, it is considered that the proposed quarry expansion area does not contain any remnant or regrowth endangered regional ecosystems, nor will the proposed works have a negative impact upon any rare and threatened flora. Any rehabilitation effort outside the development area could focus on providing a woody canopy of trees that will provide food resources for fauna of interest in the area. Particular attention could be given to enhancing the rate of recovery of some regrowth communities where they may provide alternative habitat for fauna. Inappropriate use of regrowth and remnant forests where artificial disturbance regimes are degrading these areas and providing an establishment niche for a number of weeds, is to be minimised in future land management initiatives.

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APPENDICES

Appendix 1 – List of Canopy Taxa at Selected Sample Points within the study area.

Most dominant canopy taxon listed first.

Site 001 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 002 – *Acacia disparrima* monoculture.

Site 003 – *Acacia disparrima* monoculture.

Site 004 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 005 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 006 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 007 – *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 008 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 009 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. microcorys*.

Site 010 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 011 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 012 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *Allocasuarina littoralis*.

Site 013 – *Corymbia citriodora*, *Eucalyptus propinqua*, *E. siderophloia*, *E. acmenoides*.

Site 014 – *Acacia disparrima* monoculture.

Site 015 – Vine Forest (spp. list available upon request) with canopy characterised by *Lophostemon confertus*, *Araucaria cunninghamii*, *Jagera pseudorhus*, *Ficus macrophylla*, *Archontophoenix cunninghamiana*, *Flindersia australis*, *F. schottiana*, *F. xanthoxyla*, *Eucalyptus microcorys*, *Guioa semiglauca*, and *Acacia disparrima*.

Site 016 – *Lophostemon confertus*, *Angophora leiocarpa*, *Eucalyptus propinqua*, *E. siderophloia*.

Site 017 – Non-remnant regrowth with *Acacia disparrima*, *Eucalyptus siderophloia*, *Melaleuca quinquenervia*, *Lophostemon suaveolens* and *Eucalyptus microcorys*.

Appendix 2 – Rehabilitation/Revegetation Plan for Quarried Area

The revegetation of the areas to be disturbed during the quarrying operations of the Mount Cotton Quarry Extension (area of operations) will rely on the same natural regenerative processes that have returned woody native vegetation to parts of the cleared slopes and crests of the Mount Cotton region following the abandonment of intensive agriculture and/or grazing in these areas. It has been subject to a long history of artificial disturbances from land clearing, grazing, logging, fire, grazing and weeds and the synergistic impact between these factors. Whilst the dense canopy of *Acacia disparrima* bears testament to the regenerating state of these formerly cleared areas, the important message is that unaided natural processes have been responsible for these areas having a woody native canopy now dominating originally cleared areas of formerly maintained pastures.

These natural regenerative processes will be assisted in areas of disturbance within the Mount Cotton Quarry Extension. This assistance will take the primary form of monitoring and weed management. Monitoring of de-commissioned areas will focus on two factors – density of native woody vegetation and occurrence of weed taxa or infestations that may interfere adversely with the integrity and viability of those native woody taxa. Thus, the revegetation plan is modelled on the observed natural regeneration of this site.

The weed management issue will remain the same during all phases of the project. Regular monitoring surveys of all areas traversed by machinery or humans during the construction, operation and maintenance of the facility will be required and any plants not previously observed should be recorded or collected for subsequent identification. Control measures should be implemented immediately upon discovery of any exotic taxa not previously recorded. This should take the form of control as advised by the appropriate agencies, particularly DERM for any declared plants listed on the *Land Protection (Pest and Stock Route Management) Regulation 2003* of the *Land Protection (Pest and Stock Route Management) Act 2002*. The site/s of any recorded exotic taxa should be noted by GPS and photographic record and subsequent surveys target these sites to ensure no repeated colonisation of the recorded weeds at these sites.

Any vegetation removed should be mulched and placed on areas that have been disturbed during quarrying operations. There should be no access for machinery or humans into adjacent vegetation except along existing or necessary access tracks/roads. All stockpiles

of materials should be located outside the areas of remnant vegetation. All vehicular movements in such areas should be limited to the actual area of works and the perimeter to remnant vegetation marked with temporary fencing. Any disturbance of the ground below the drip line of retained canopy trees should be avoided where prudent and feasible.

All areas of disturbed soil should be brush-matted with branches bearing seeds where practicable. Species such as *Corymbia citriodora*, *Allocasuarina littoralis* or any of the native taxa within the quarry area would be ideal candidates to provide the branches for such works. The remaining areas of disturbed soil should be mulched to a depth of 10-20 cm if necessary. These areas should be monitored for the first six months to assess the proportion of native to exotic taxa with the latter controlled where necessary to enhance the competitive advantage of the native taxa. Where native woody vegetation has not regenerated adequately, then other revegetation strategies (e.g. direct seeding, infill planting, judicious use of fire for weed management and more intensive weed management in such areas) may be considered if the site does not have canopy closure (at least of the shrub layer 2 m tall) of woody native shrubs or trees after 12-18 months – dependant upon seasonal conditions. Fire should be excluded until the regeneration captures the site via canopy closure other than as discussed above.

Therefore, within any disturbed areas, the following revegetation protocols are proposed:

- Provide standard sediment/erosion control devices in areas with loose sediment likely to be translocated downslope into waterways to minimise loss of material from the affected area;
- Following the monitoring program that will assess the natural regeneration across such areas, spray any weed infestations with Biactive Roundup or similar knockdown herbicide only if they are considered to pose a threat to the viability and integrity of the regenerating native taxa. This would apply particularly to any infestations of smothering legumes or other weeds that will smother and stifle the growth of the native taxa. Many weeds such as *Lantana camara* will always be a part of the landscapes in this region and should only be singled out for control when they form a dense infestation that will preclude the growth or regeneration of native taxa. Minor infestations of many exotic taxa are the norm, even in the conservation reserves throughout the region. These should only be targeted for control when they pose a significant threat to native taxa;

- Spray a hydro mulch mixture on bare surfaces containing seeds of *Allocasuarina littoralis* * to enable the dense establishment of this species which provides a weed suppressant canopy and fire retardant interface between retained vegetation and quarried area. Where material is available (i.e. seed laden branches), brush matting would provide a cost-effective means of establishing a woody native vegetation cover as described above;
- Commence seasonal monitoring program to determine need for further application of hydro mulch and/or weed control programs as in-fills in areas where the natural regenerative processes have not proceeded in an adequate time frame. These monitoring events would be conducted at the end of winter, end of spring (following the onset of storm rains) and late summer (prior to the onset of cooler weather);
- Once a canopy has established, the weed survey can be targeted at those areas on the periphery of works, as the thicket of developed *Allocasuarina littoralis* will preclude extensive development of weeds other than colonisations that would be expected in any of the remnant native vegetation of this region.

* *Allocasuarina littoralis* is a known food tree for the rare and threatened Glossy Black Cockatoo that is known from this region.

One component of the revegetation plan, but perhaps the most significant, falls outside the areas to be disturbed during the quarry operations of the Mount Cotton Quarry Extension and the *Corchorus cunninghamii* and *Macadamia integrifolia* populations could be made more viable as follows:

Macadamia integrifolia – At present the only individuals of *Macadamia integrifolia* were observed as coppice in poor regrowth dominated by dense thickets of *Lantana camara* outside the footprint of the proposed quarry expansion works. These individuals could be propagated by cuttings and/or seed (if individuals produce viable seed) and the cuttings/seedlings produced planted into the copses of regenerating vine forest at the head of the steep gullies on site. If practicable, the propagated plants would be planted within small canopy gaps in this area following adequate summer rains and weed maintenance activities (if required) be continued for 2 years until the propagules have established.

Corchorus cunninghamii – Whilst the population of this endangered plant is outside the proposed quarry area, the chance to enhance its survival in the wild as a component of on-going land management of the site should not be overlooked. Involvement of the quarry

managers in the developing recovery plan for this species will ensure financial assistance in its management and interactive advice from statutory authorities as to the most appropriate land management activities for the retained remnant vegetation in which this species is located. These joint land management initiatives are also likely to enhance the regenerative capacity of the adjoining vine forest through more appropriate fire management of the vine forest/open forest interface. The reduction in the frequency of the artificial fire regime will assist in the regeneration of the vine forest and the protection of the *Corchorus cunninghamii* population if undertaken in conjunction with other land management initiatives associated with the recovery plan for this endangered plant.

The rehabilitation plan is modelled on the observed natural regeneration of this site. It has been subject to a long history of artificial disturbances from land clearing, grazing, logging, fire, grazing and weeds and the synergistic impact between these factors. Despite this, the slopes and crests of the site have regenerated a predominantly native plant cover with virtually no active intervention. A similar route for regeneration of the post-quarrying landscape is expected. Upon cessation of quarrying activities in any given area, the following rehabilitation plan is proposed:

- Provide standard sediment/erosion control devices to ensure minimal loss of material from the affected area;
- Spray any weed infestations with Biactive Roundup or similar knockdown herbicide;
- Spray a hydro mulch mixture on bare surfaces containing seeds of *Allocasuarina littoralis* * to enable the dense establishment of this species which provides a weed suppressant canopy and fire retardant interface between retained vegetation and quarried area;
- Commence seasonal monitoring program to determine need for further application of hydro mulch and/or weed control programs. These monitoring events would be conducted at the end of winter, end of spring (following the onset of storm rains) and late summer (prior to the onset of cooler weather);
- Once a canopy has established, the weed survey can be targeted at those areas on the periphery of works, as the thicket of developed *Allocasuarina littoralis* will preclude extensive development of weeds other than colonisations that would be expected in any of the remnant native vegetation of this region.

* *Allocasuarina littoralis* is a known food tree for the rare and threatened Glossy Black Cockatoo that is known from this region.

Appendix 3A

**In regards P&E Court Appeal 1585 of 2007
Between Barro Group Pty Ltd (Appellants) and Redlands Shire Council (Respondent) & Ors.
1st Joint Statement on Flora Matters**

All meetings, conferences and this joint statement have been conducted and prepared in accordance with Practice Direction #1 of 2006. Unless otherwise stated, all references to the development refer to that which forms the original application to **Redlands Shire Council**.
Dr. David Doley (DD); Mr. Simon McNeilage (SM) and Dr. Mike Olsen (MO)) (✓ - Agree: x – Disagree)

	<i>DD</i>	<i>SM</i>	<i>MO</i>	Comments
<i>Nature Conservation Act 1994 and Environment Protection and Biodiversity Conservation Act 1998</i>				
1. <i>Corchorus cunninghamii</i> . This woody herb is located to the north of the proposed quarry footprint and the anticipated reduced dust levels is expected to improve the situation for this species, although no dust issue was apparent in the area of occurrence during the initial site inspections in 2003.	✓	✓	✓	DD, SM & MO The relative dust loads resulting from current and proposed works will be provided by other experts.
2. Understorey species are likely to be affected by dust deposition much more than are canopy species. This is due to their slower rate of replacement of foliage and the low light environment in which they occur. Reductions in the amount of light penetrating to the leaves is more likely to result in a failure to achieve a positive carbon balance, which then leads to death. The long leaf life and generally horizontal leaf display means that leaves are likely to accumulate more dust than would occur in upper canopy species. This accentuates the adverse effect of dust on plant function.	✓	✓	✓	SM and MO agree, but rely on the acknowledged expertise of DD in this area.
3. <i>Macadamia integrifolia</i> . This tree was observed as regrowth individuals in areas that appear to fall beneath the footprint of the proposed quarry. It is recommended that they be propagated and used in rehabilitation of the retained vine forest areas to the north of the proposed footprint.	✓	✓	✓	
<i>Vegetation Management Act 1999</i>				
4. There is not expected to be any loss of the endangered regional ecosystem 12.11.23 as a consequence of the proposed development. Field verification of the floristics of the mapped remnant vegetation will be undertaken to confirm the nature of the vegetation along the western	✓	✓	✓	

Flora and Flora Values – Mount Cotton Quarry

<p>perimeter of the proposed pit.</p> <p>5. REs are characterised by all the species that occur, including understorey species. REs that contain species that are restricted to the understorey are likely to be impacted adversely by the loss of these species. The notes on dust in point 2 above indicate the mechanism by which the understorey species may be affected. It is the whole ecosystem that is important, not just the canopy component that is the lone structural layer of concern with respect to the definition of remnant or non-remnant vegetation with respect to the <i>Vegetation Management Act 1999</i> and its Regulations that define Regional Ecosystems.</p> <p>6. Data on the loss of riparian habitat and mapped remnant vegetation is to be provided along with data on the spatial extent of future riparian habitat and remnant vegetation. A reasonable condition of development would be to provide the proposed offsets of both riparian habitat and remnant vegetation such that following the cessation of operations, the riparian habitats and remnant vegetation extent on site will be enhanced in area and condition.</p>	<p>✓</p> <p>✓</p>	<p>✓</p> <p>✓</p>	<p>✓</p> <p>✓</p>	
<p>Riparian vegetation</p> <p>7. Riparian habitat can be identified by reference to the Redland Planning Scheme “Waterways, Wetlands & Moreton Bay overlay mapping” and Part 5 – Overlays, Division 12 - Waterways, Wetlands & Moreton Bay overlay. The relevant RPS requirements including buffer widths for minor waterways and natural drainage lines are supported for ecological reasons.</p>	<p>✓</p>	<p>✓</p>	<p>✓</p>	

Appendix 3B

In regards P&E Court Appeal 1585 of 2007

Between Barro Group Pty Ltd (Appellants) and Redlands Shire Council (Respondent) & Ors.

2nd Joint Statement on Flora Matters

All meetings, conferences and this joint statement have been conducted and prepared in accordance with Practice Direction #1 of 2006. Unless otherwise stated, all references to the development refer to that which forms the original application to **Redlands Shire Council**. Dr. David Doley (DD); Mr. Simon McNeilage (SM) and Dr. Mike Olsen (MO)) (✓ - Agree: x – Disagree)

	DD	SM	MO	Comments
1. The dust experts report that there will be no increase in dust output from the new facilities and thus, there are no flora issues outstanding that would provide a reason for refusal of the proposed Development Application and the Appeal (if based solely on flora grounds) should be allowed).	✓		✓	This assumes that the dust expert report will provide supporting evidence that there will be no increase in dust levels from those associated with the current operation.

During the course of discussions 2 points were raised that were assessed during a recent field inspection (by MO) – the extent (if any) of endangered remnant regional ecosystem close to the proposed quarry footprint and the analogous nature of the current rehabilitation plantings to the likely pre-clearing regional ecosystems in the areas where works have been undertaken recently.

The recent observations confirm the following:

- The canopy along the western edge of the property is dominated by a mix of *Corymbia citriodora*/*Corymbia intermedia*/*Lophostemon confertus*/*Eucalyptus siderophloia*/*Eucalyptus propinqua*. There was no evidence of *Eucalyptus pilularis*/*Eucalyptus racemosa* – even in the *Acacia disparrima* dominated regrowth. There is certainly an area of endangered remnant regional ecosystem to the south of the subject land, south of the Mt Cotton Driver Training School, but the closest observed to the west of the subject land was along Avalon Road. There was no discernible *Eucalyptus pilularis*/*Eucalyptus racemosa* association proximal to the site along West Mount Cotton Road that would constitute a “regional ecosystem”, although there were some spots where *Eucalyptus pilularis* was evident amongst areas of regional ecosystem 12.11.5. There is no endangered remnant regional ecosystem that will be acutely impacted by the proposed quarrying operations – even more so now the footprint has moved further away from the mapped remnant in the west and north-west of the subject land.
- As to the riparian planting, the mix of species that were established in the gro-tubes included the following: *Eucalyptus tereticornis*, *Melaleuca quinquenervia*, *Carex appressa*, *Lomandra hystrix*, *Lomandra longifolia*, *Eucalyptus microcorys*, *Hovea acutifolia*, *Corymbia citriodora*, *Angophora floribunda*, *Dodonaea triquetra*, *Elaeocarpus reticulatus*, *Eucalyptus propinqua*, *Acacia disparrima*, *Acacia leiocalyx*, *Glochidion ferdinandi*. *Lophostemon suaveolens*, *Alphitonia excelsa*, *Melaleuca viminalis*, *Melaleuca bracteata*, and *Acacia obtusifolia* (a wattle known from the local area, but not from that landscape – this species is expected to drop out as the canopy develops). It was unclear if the *Lophostemon suaveolens* and *Glochidion ferdinandi* were planted or regenerated spontaneously. There is some *Imperata cylindrica* that is sprouting through the wood mulch as well as some *Dianella caerulea* and a few other native herbs. The observations all bode well for these denser plantings if the weed management is continued as it seems to be at present.

Attachment 1.11

Vegetation Offset Rehabilitation Management Plan



VEGETATION CODE ASSESSMENT AND OFFSET REHABILITATION MANAGEMENT PLAN

Mount Cotton Quarry

Report prepared
for
Barro Group Pty Ltd



**Biodiversity
Assessment**

AND MANAGEMENT PTY LTD

FAUNA AND HABITAT SPECIALISTS

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Client: Barro Group Pty Ltd

Project Title: Vegetation Code Assessment and Offset Rehabilitation Management Plan, Mount Cotton Quarry extension

Project Author/s: Olivia Woosnam, Adrian Caneris

Project Summary: The aim of this report is to provide rehabilitation management recommendations to restore remnant vegetation as part of an offset to obtain approval to clear remnant vegetation RE 12.11.3 and RE 12.11.5 for the extension of Mount Cotton Quarry.

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Purpose of Report

Biodiversity Assessment and Management Pty Ltd has produced this report in its capacity as consultants for and on the request of Barro Group Pty Ltd (the "**Client**") for the sole purpose of providing a Vegetation Offset Rehabilitation Management Plan for the proposed vegetation offset area associated with Mount Cotton quarry extension (the "**Specified Purpose**"). This information and any recommendations in this report are particular to the Specified Purpose and are based on facts, matters and circumstances particular to the subject matter of the report and the Specified Purpose at the time of production. This report is not to be used, nor is it suitable, for any purpose other than the Specified Purpose. Biodiversity Assessment and Management Pty Ltd disclaims all liability for any loss and/or damage whatsoever arising either directly or indirectly as a result of any application, use or reliance upon the report for any purpose other than the Specified Purpose.

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Signed on behalf of
Biodiversity Assessment and Management Pty Ltd

Date: 02 December 2010



Managing Director

VEGETATION CODE ASSESSMENT AND OFFSET REHABILITATION MANAGEMENT PLAN MOUNT COTTON QUARRY EXTENSION

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List of Abbreviations

BAAM	Biodiversity Assessment and Management	
DERM	Queensland Department of Environment and Resource Management	
LP Act	Queensland <i>Land Protection (Pest and Stock Route) Management Act 2002</i>	
NC Act	Queensland <i>Nature Conservation Act 1992</i>	
PMAV	Property Maps of Assessable Vegetation	
VM Act	Queensland <i>Vegetation Management Act 1999</i>	
RE	Regional Ecosystem	

1.0 REGIONAL VEGETATION MANAGEMENT CODE FOR SOUTH EAST QUEENSLAND BIOREGION (VERSION 2)

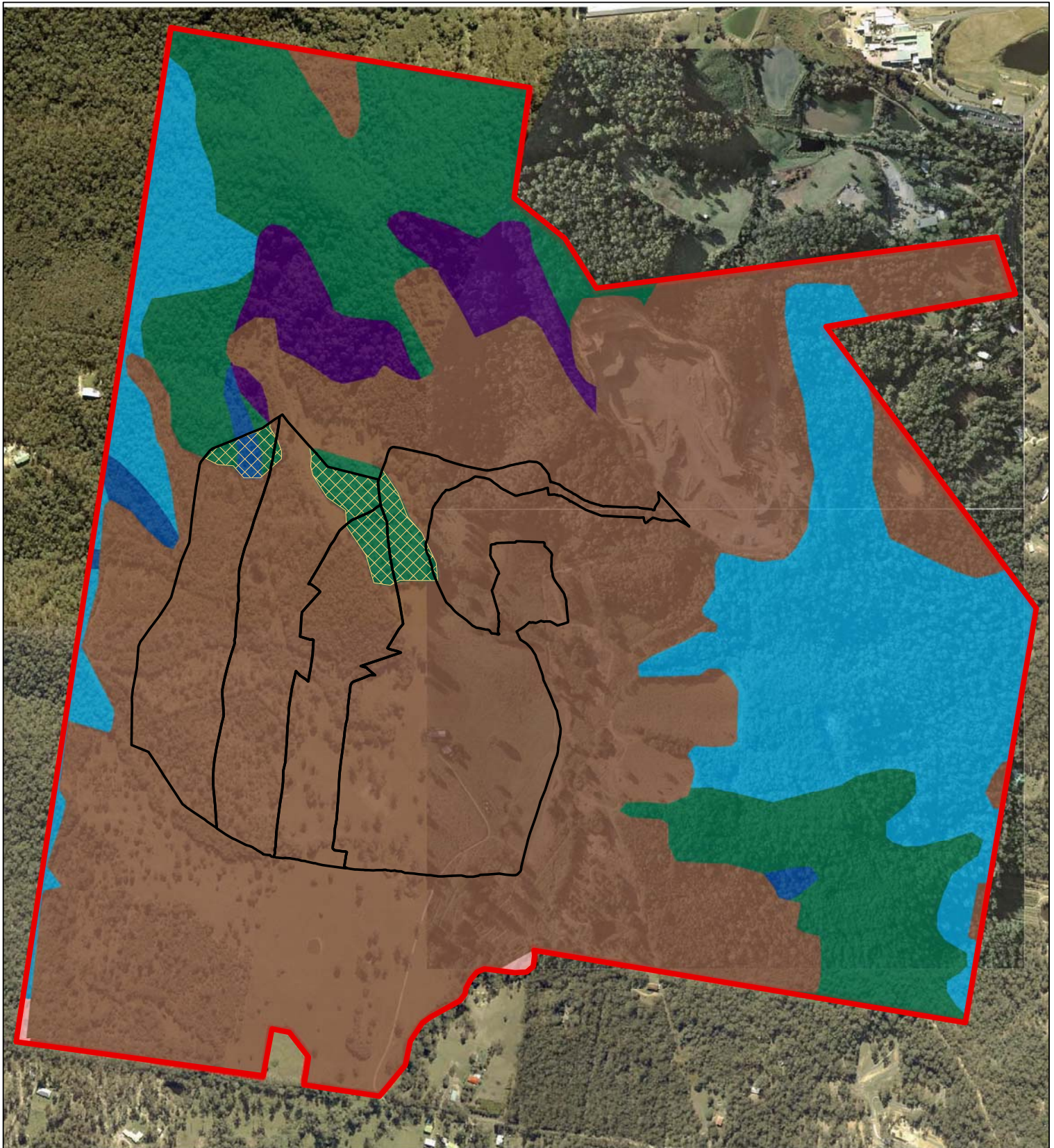
By virtue of Schedule 7 of the *Sustainable Planning Regulation 2009*, the Chief Executive of the Queensland Department of Environment and Resource Management (DERM) is a concurrence agency for this development application and its referral jurisdiction is the purpose of the Queensland *Vegetation Management Act 1999* (VM Act). The purpose of the VM Act is relevantly stated to be achieved by providing codes for the clearing of vegetation. In this regard, the current applicable code for clearing vegetation is the Regional Vegetation Management Code for South East Queensland Bioregion – version 2 dated 6 November 2009.

The following table is an assessment of the proposed development against ‘Part Xa: Requirement• for clearing for an extractive industry in a Key Resource Area’ under the Regional Vegetation Management Code for South East Queensland Bioregion – version 2.

PERFORMANCE CRITERIA	SOLUTION
<p>PR Xa.1: Limits to clearing for an extractive industry To regulate the clearing of vegetation in a way that conserves remnant vegetation that are regional ecosystems, prevents the loss of biodiversity, maintains ecological processes and does not cause land degradation – subject to the limitations required to meet P Xa.2 to PR Xa.10 – clearing is limited to the extent that is necessary for –</p> <ul style="list-style-type: none"> a) dredging material from the bed of any waters; and b) extracting, from a pit or quarry, rock, sand, clay, gravel, loam or other material; and c) screening, washing, grinding, milling, sizing or separating material extracted from a pit or quarry; and d) carrying out work that is the natural and ordinary consequence of carrying out work mentioned in subparagraphs (a), (b) and (c). 	<p>Through quarry design, clearing of remnant vegetation that are remnant regional ecosystems is limited to the extent that is necessary for (b), (c) and (d).</p> <p>There are approximately 97ha of vegetation that are mapped regional ecosystems (REs) on the subject site (Figure 1.1). The proposed development will remove 3.7ha of remnant vegetation, or less than 4% of the total amount of mapped remnant vegetation within the subject site.</p> <p>Removed remnant vegetation is proposed to be offset on the subject site: 12.8ha of land that is currently mapped non-remnant is proposed to be managed, restored and protected from future clearing (Figures 2 and 3) in association with a conservation agreement under the <i>Nature Conservation Act 1992</i> (NC Act). These areas will be managed to achieve remnant status. These proposed offset areas are currently mapped as Category X on the Property Map of Assessable Vegetation (Figure 4).</p>
<p>PR Xa.2: Clearing is staged To regulate the clearing of vegetation in a way that prevents the loss of biodiversity, conserves remnant vegetation that are regional ecosystems, maintains ecological processes and does not cause land degradation – clearing –</p> <ul style="list-style-type: none"> a) is staged in line with operational needs that restricts clearing to the current operational area; and b) is limited to the area from which material will be extracted within the term of the development approval; and c) cannot occur until all required permits are obtained. 	<p>In line with operational needs, clearing will occur in four stages, will be limited to the area from which material will be extracted within the term of the development approval, and will not occur until all required permits are approved.</p>

PERFORMANCE CRITERIA	SOLUTION
<p>PR Xa.3: Wetlands To regulate clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes – <u>maintain the current extent of assessable vegetation</u> associated with any natural <u>significant wetland</u> and/or natural <u>wetland</u> to provide –</p> <ul style="list-style-type: none"> a) water quality by filtering sediments, nutrients and other pollutants; and b) aquatic habitat; and c) terrestrial habitat. 	<p>There are no mapped wetlands within the subject site.</p>
<p>PR Xa.4: Watercourses To regulate the clearing of vegetation in a way that does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes – <u>maintain the current extent of assessable vegetation</u> associated with any <u>watercourses</u> to provide –</p> <ul style="list-style-type: none"> a) bank stability by protecting against bank erosion; and b) water quality by filtering sediments, nutrients and other pollutants; and c) aquatic habitat; and d) terrestrial habitat. 	<p>Vegetation associated with a stream order 1 on the Vegetation Management Watercourse map will be removed (vegetation associated with RE 12.11.3, Figure 5).</p> <p>The proposed offset for the watercourse will:</p> <ul style="list-style-type: none"> - be of the same broad vegetation group; - restore an area to its pre-clearing RE12.11.3 status (Figure 6); and - will be a regional ecosystem associated with a watercourse that has the same stream order as the watercourse proposed for clearing.
<p>PR Xa.5: Connectivity To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes – areas of <u>mapped remnant vegetation</u> are –</p> <ul style="list-style-type: none"> a) of sufficient size and configured in a way to maintain ecosystem functioning; and b) of sufficient size and configured in a way to remain in the landscape in spite of any threatening processes; and c) located on the lot(s) that are the subject of the application to maintain connectivity to <u>mapped remnant vegetation</u> on adjacent properties. 	<p>The proposed development will require removal of less than 4% of the total amount of mapped remnant vegetation within the subject site. All removed remnant vegetation will be offset on site such that the extent of remnant vegetation within the subject site will be increased. The offset proposed is at a ratio greater than 3ha offset for every 1ha cleared.</p> <p>Most of the remnant vegetation to be removed comprises an isolated patch of mapped remnant vegetation containing the Not of Concern RE12.11.5 (Olsen 2010). The areas of mapped remnant vegetation on the balance of the site are considered to be of sufficient size and configured in a way to maintain ecosystem functioning as they are located in areas contiguous to existing remnant vegetation both within the subject site and on adjoining properties. The remaining areas of mapped remnant vegetation on the site are of sufficient size and configured in a way to remain in the landscape in spite of any threatening processes and to maintain connectivity to mapped remnant vegetation on adjacent properties.</p> <p>All three proposed offset sites are:</p> <ul style="list-style-type: none"> - of the same broad vegetation group as that of the remnant vegetation being removed (Figure 6);

PERFORMANCE CRITERIA	SOLUTION
	<ul style="list-style-type: none"> - located in an identified ecological corridor (Figure 7); and - adjacent to existing mapped remnant vegetation on the lots that are the subject of this application (Figure 3). <p>The proposed offset locations will improve connectivity and will prevent any loss of biodiversity. The location and size of these offsets will ensure maintenance and enhancement of ecological processes.</p>
<p>PR Xa.6: Salinity To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes – clearing does not contribute to –</p> <ul style="list-style-type: none"> a) waterlogging; or b) the <u>salinisation of groundwater, surface water or soil.</u> 	<p>The Site Environmental Management Plan includes a Stormwater Quality Management Plan which has been prepared to control drainage, minimise erosion and trap sediment occurring as a result of land disturbance necessary for extractive operations, in accordance with best practice site management procedures and Australia & New Zealand standards and guidelines.</p>
<p>PR Xa.7: Conserving remnant vegetation that are <i>endangered</i> regional ecosystems and of <i>concern</i> regional ecosystems To regulate the clearing of vegetation in a way that conserves remnant vegetation that are <i>endangered</i> regional ecosystems and of <i>concern</i> regional ecosystems – <u>maintain the current extent</u> of <i>endangered</i> regional ecosystems and of <i>concern</i> regional ecosystems.</p>	<p>The two regional ecosystems to be cleared (RE 12.11.3 and 12.11.5) are <i>not of concern</i> under the <i>Vegetation Management Act 1999</i>. No <i>endangered</i> or of <i>concern</i> regional ecosystems will be removed.</p>
<p>PR Xa.8: Essential habitat To regulate the clearing of vegetation in a way that prevents the loss of biodiversity – <u>maintain the current extent</u> of <u>essential habitat</u>.</p>	<p>The remnant vegetation to be cleared is mapped as essential habitat for the Macadamia Nut <i>Macadamia tetraphylla</i> (Figure 8).</p> <p>The proposed offset sites will increase the extent of remnant vegetation on the subject site by a ratio greater than 3ha offset for every 1ha of remnant vegetation cleared.</p>
<p>PR Xa.9: Conservation status thresholds To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and conserves remnant vegetation that are regional ecosystems – <u>maintain the current extent</u> of regional ecosystems listed in Table 2.</p>	<p>None of the regional ecosystems to be cleared are included in Table 2.</p>
<p>PR Xa.10: Acid sulfate soils To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes – clearing activities do not result in disturbance of acid sulfate soils or changes to the hydrology of the location that will either –</p> <ul style="list-style-type: none"> a) aerate horizons containing iron sulfides; or b) mobilise acid and/or metals. 	<p>No acid sulfate soils are recorded for the subject site on the Queensland Department of Mines and Energy Interactive Resources and Tenure Map (accessed September 2010).</p>



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Legend

- Site Boundary
- Proposed Quarry Extension
- Remnant Vegetation to be offset

DERM Regional Ecosystems:


<ul style="list-style-type: none"> 12.11.10/12.11.3 12.11.23/12.11.5 12.11.3 	<ul style="list-style-type: none"> 12.11.5 12.3.11 Non-remnant
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

0 200 400 Meters

Figure 1

Remnant Vegetation to be offset

Vegetation Code Assessment & Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010





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Image courtesy of Google Earth Pro 2010

Legend




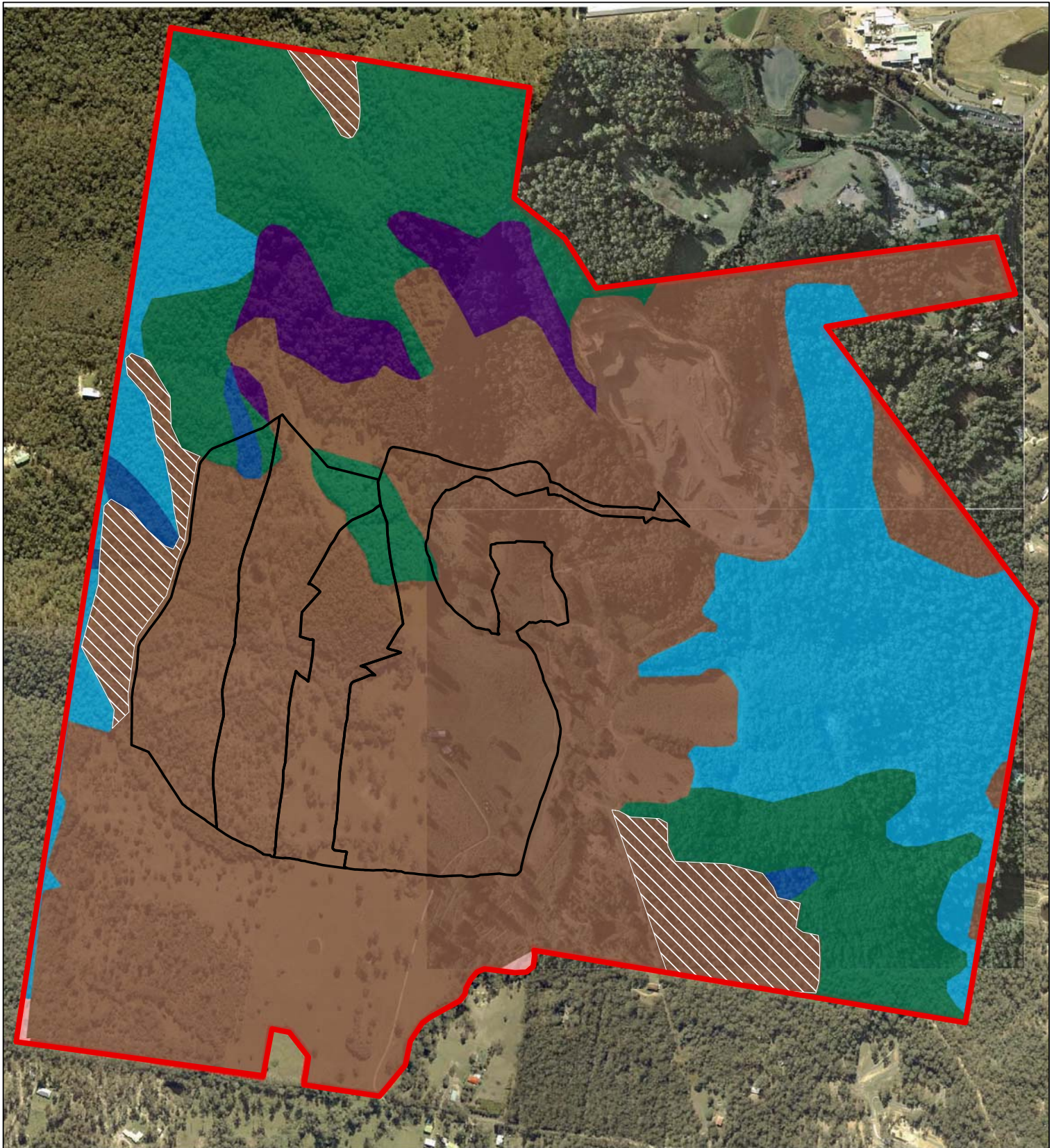
-  Site Boundary
-  Proposed Quarry Extension
-  Proposed Vegetation Offset Areas

Figure 2

Aerial Views of the Proposed Vegetation Offset Areas

Vegetation Code Assessment and Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010





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Legend

Site Boundary

Proposed Quarry Extension

Vegetation Offset:

Vegetation Offset Areas

Regional Ecosystems:

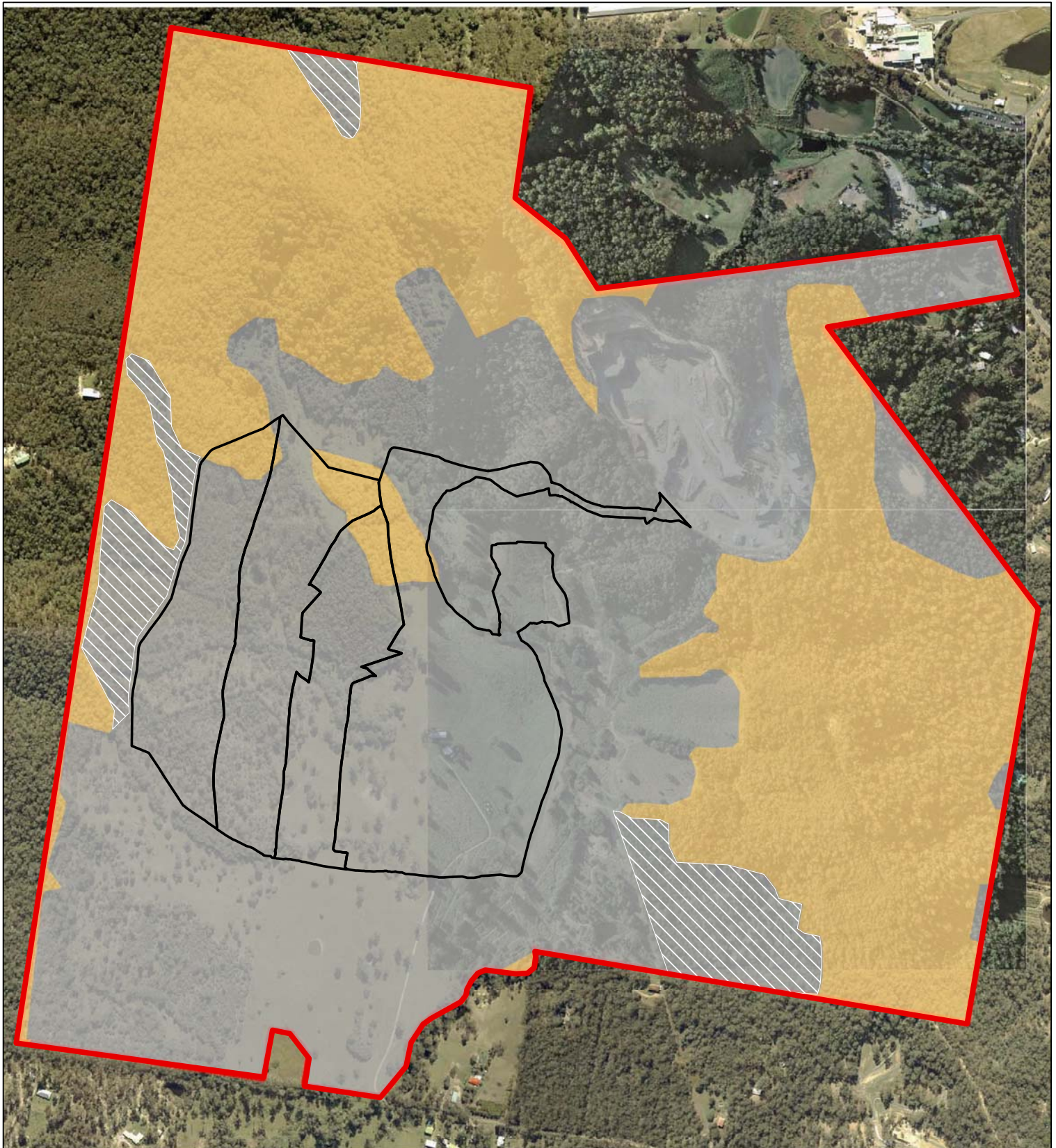
	12.11.10/12.11.3		12.11.5
	12.11.23/12.11.5		12.3.11
	12.11.3		Non-remnant

0 200 400 Meters

Figure 3
DERM Regional Ecosystems and Vegetation Offset

Vegetation Code Assessment & Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
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0 200 400 Meters

Legend

- Site Boundary
- Proposed Quarry Extension

Vegetation Offset :

- Vegetation Offset Areas

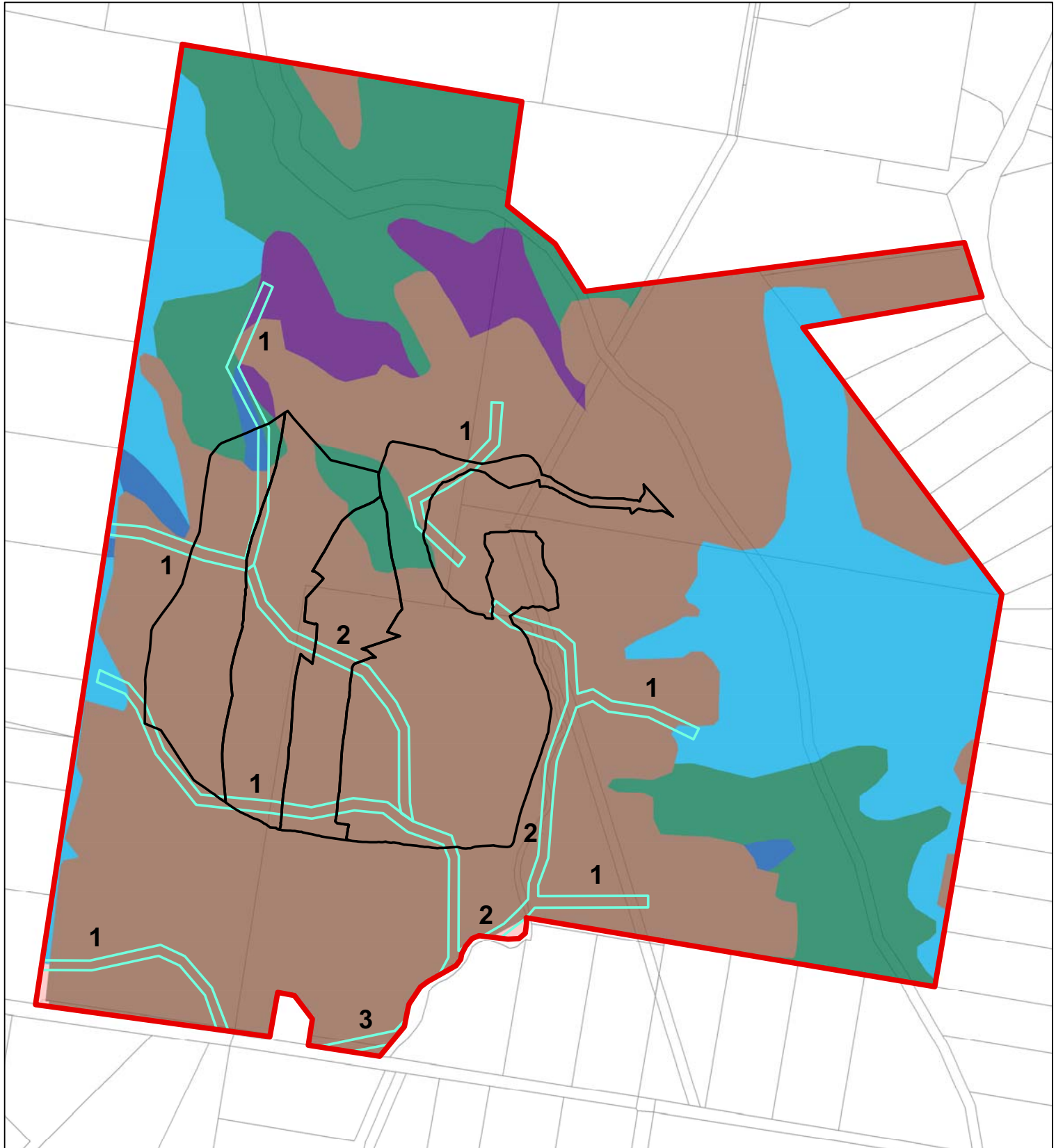
PMAV Category Area

- Category X area
- Area that is the subject to other PMAVs or, if no PMAV exists, a regional ecosystem map, remnant map or regrowth vegetation map

Figure 4
PMAV and
Vegetation Offset

Vegetation Code Assessment & Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
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Legend

- Site Boundary
- Proposed Quarry Extension
- Cadastral Boundaries
- 1 Stream & Order

0 200 400 Meters

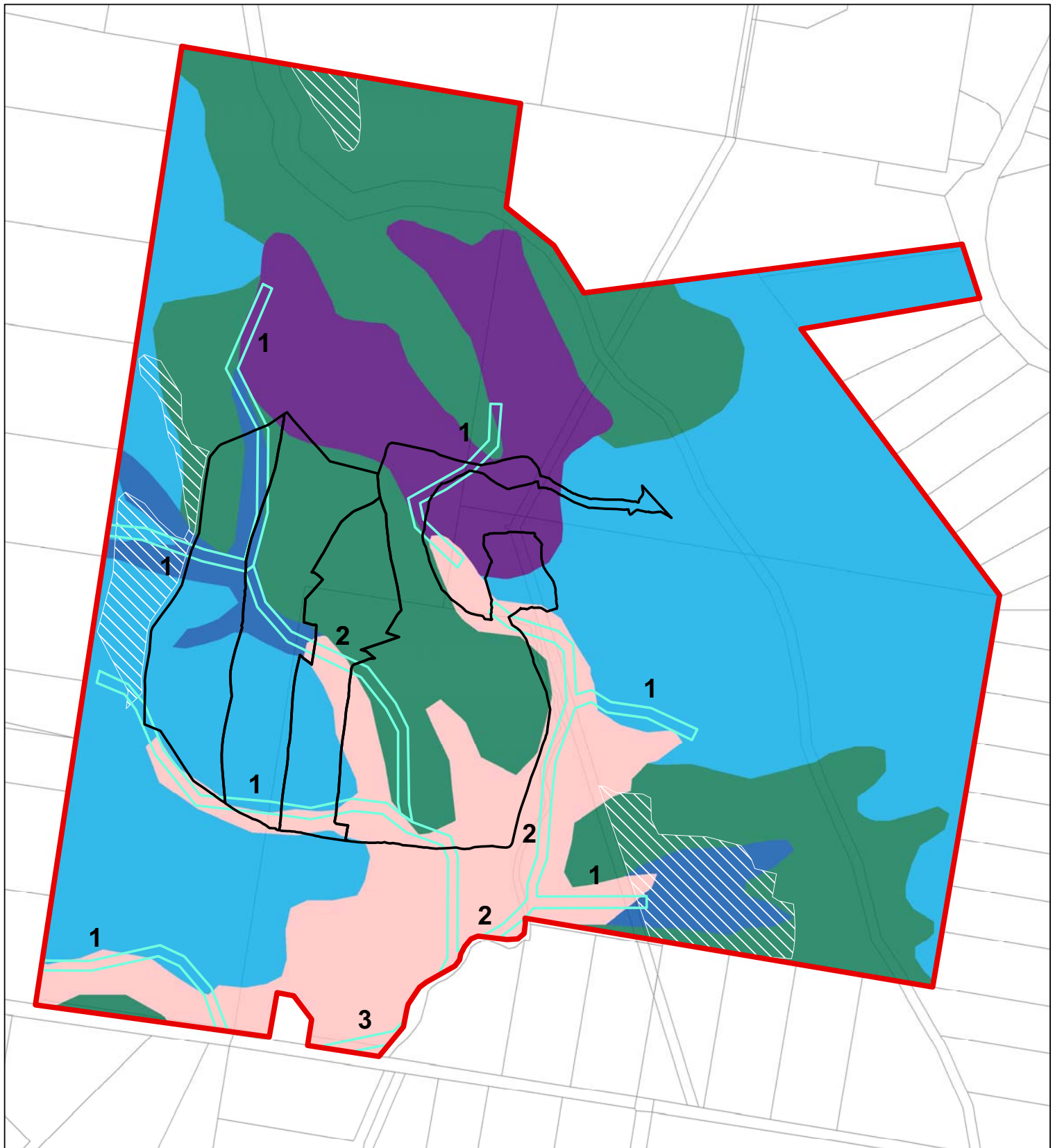
Regional Ecosystems :

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> 12.11.10/12.11.3 12.11.23/12.11.5 12.11.3 | <ul style="list-style-type: none"> 12.11.5 12.3.11 Non remnant |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 5
Watercourses and DERM Regional Ecosystems

Vegetation Code Assessment & Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010





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Legend


- Site Boundary
- Proposed Quarry Extension
- Cadastral Boundaries
- 1 Stream & Order
- Vegetation Offset Areas

Meters
 0 195 390

Pre-clearing Regional Ecosystems :

	12.11.10/12.11.3		12.11.5
	12.11.23/12.11.5		12.3.11
	12.11.3		

Figure 6
Watercourses, Pre-clearing Regional Ecosystems and Vegetation Offset
 Vegetation Code Assessment & Offset
 Rehabilitation Management Plan
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Legend

-  Site Boundary
-  Regional Corridor

Offset Sites:

-  Vegetation Offset Sites
-  Koala Offset Sites

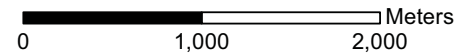
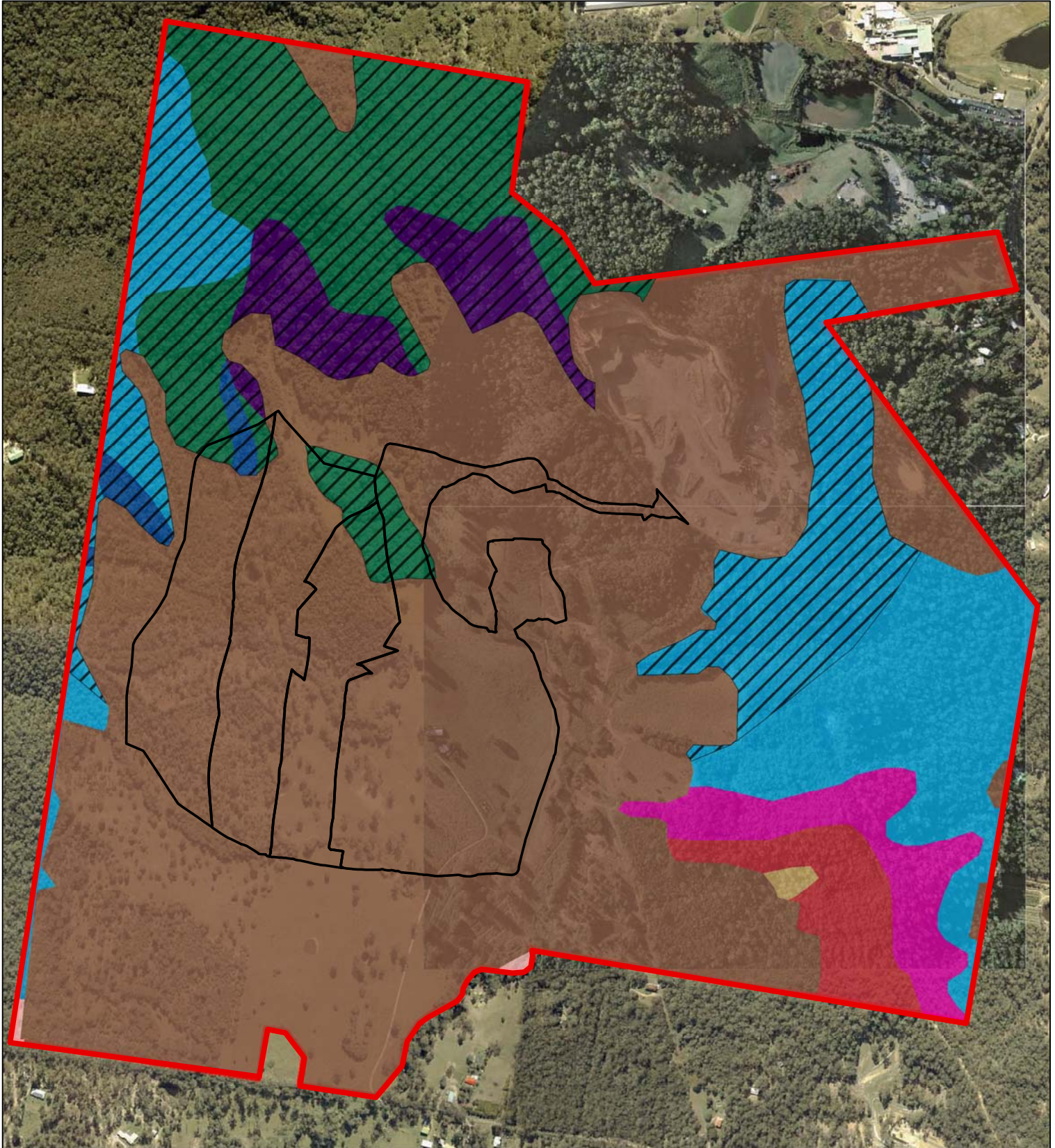


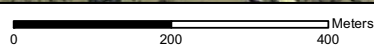
Figure 7
Offset Sites and Regional Corridors (BPA Mapping v.1.3)

Vegetation Code Assessment and Offset Rehabilitation Management Plan
 Mount Cotton Quarry
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 Image courtesy of Google Earth Pro 2010



- Legend**
- Site boundary
 - Proposed Quarry Extension
 - Essential Habitat *Macadamia tetraphylla*

- Regional Ecosystems:**
- 12.11.5e
 - 12.3.11
 - 12.11.3
 - 12.11.3a
 - 12.11.5a
 - 12.11.5a/12.11.5k
 - 12.11.23/12.11.5a/12.11.5k
 - 12.11.10/12.11.3a
 - Non-remnant

Figure 8
DERM
Essential Habitat and
Regional Ecosystems
 Vegetation Code Assessment & Offset
 Rehabilitation Management Plan
 Mount Cotton Quarry
 October 2010

2.0 VEGETATION OFFSET REHABILITATION MANAGEMENT PLAN

2.1 PURPOSE OF THE PLAN

This Vegetation Offset Rehabilitation Management Plan has been prepared by Biodiversity Assessment and Management Pty Ltd (BAAM) for Barro Group Pty Ltd for the purpose providing rehabilitation guidance on vegetation offsets. This plan provides information to mitigate the loss of remnant vegetation Regional Ecosystems (RE) 12.11.5 and 12.11.3 that will require removal as a result of the extension of Mt Cotton Quarry.

2.2 SUBJECT SITE

The subject site is located at 1513 Mt Cotton Road, Mount Cotton, Redland City Council government area, and comprises five (5) lots known as Lot 370 on S311071, Lot 238 on SP218968, Lot 162 on S31962, Lot 17 on RP108970 and Lot 1 on RP108970.

It is understood that the development application also includes the unformed road bisecting and adjoining Lot 17, Lot 370 and Lot 162 and that part of Greenhide (California) Creek located between Lot 238 and Lot 162, although no physical works are proposed in these areas.

2.3 PROPOSED OFFSET FOR REMNANT VEGETATION

As part of the proposed quarry extension, approximately 3.7 ha of remnant vegetation will require removal (**Figure 1**) that is currently mapped as RE 12.11.5 and 12.11.3.

The proposed offset consists of three areas approximately 12.8ha in total (**Figure 2**). All three areas are located within the subject site and are no further than 600m away from the vegetation to be cleared. Two offset areas are located on Lot 370 on S311071 and one offset area is located on Lot 162 on S31962.

The rehabilitation of these three offset areas is the focus of this Vegetation Offset Rehabilitation Management Plan.

2.4 VEGETATION OFFSET REHABILITATION MANAGEMENT PLAN OBJECTIVES

The objectives of this management plan are to provide:

- A map indicating the vegetation to be offset;
- Maps indicating the location of the proposed offset areas; and
- General advice regarding weed eradication and control.

2.5 LOCATION OF OFFSET AREAS AND DESCRIPTION OF EXTANT VEGETATION

All three offset areas are located within the subject site.

These areas are currently not mapped as remnant vegetation under the provisions of the *Queensland Vegetation Management Act 1999* (VM Act).

All offset areas are currently mapped as Category X area under the DERM Property Maps of Assessable Vegetation (PMAV) (**Figure 4**).

The proposed offset areas are approximately 12.8 ha in total and all three areas are located directly adjacent to mature remnant vegetation communities of the same broad vegetation group (**Figure 3**), i.e. Eucalypt/Corymbia open-forest on metasedimentary rocks (landzone 11).

Vegetation within the proposed offset areas is dominated by *Corymbia citriodora*, *Lophostemon confertus*, *Eucalyptus propinqua* and *E. siderophloia*, species characteristic of the ecologically dominant layers of remnant vegetation to be cleared. These offset areas are progressing toward remnant status and mainly require only weed management to ensure remnant status is reached in a timely manner.

However, weeds listed under the provisions of the *Queensland Land Protection (Pest and Stock Route) Management Act 2002* (LP Act) are well represented throughout the subject site (LAMR 2010), and are/may be present within the proposed offset areas. Declared weed species present include:

- Lantana *Lantana camara* and *L. montevidensis* (Class 3);

- Singapore Daisy *Sphagneticola trilobata* (Class 3);
- African Tulip Tree *Spathodea campanulata* (Class 3);
- Water Hyacinth *Eichhornia crassipes* (Class 2); and
- Fireweed *Senecio madagascariensis* (Class 2).

The control of these pest plants is required to ensure progression to remnant status and is the primary focus of this management plan.

2.6 REHABILITATION AND MANAGEMENT OF OFFSET AREAS

2.6.1 Weed Management

Weed eradication/control within the offset areas will ensure that the offsets meets the performance requirements as outlined in **Section 3.1** and that the management intent of the offset areas is achieved. Several weed species are known to occur within the proposed offset area (LAMR 2010). Of the exotic species known, five have been declared under the provisions of the LP Act (**Section 2.1**).

The immediate and complete removal of all weed species within the offset areas can have negative effects on ecosystem function and stability and create management issues that are impractical to maintain. The progressive removal of weed species is recommended.

Ecosystem altering weeds such as smothering legumes and lantana prevent effective regeneration by smothering juveniles and preventing recruitment. These weed should be removed as a matter of priority.

The ecological significance of *Lantana camara* to some native fauna is being increasingly appreciated and care in its management on the site should bear this in mind. It is a weed that only requires management when it retards or deflects natural processes e.g. when it develops a dominant patch > 100m² in extent or > 10 individuals per 100m² – whichever is the lesser (M. Olsen pers. com.).

Infestations of smothering weeds should be controlled when infestation reach greater than 10m².

Woody weeds such as the African Tulip Tree replace endemic canopy species hindering regeneration.

Removal of woody weeds, using direct injection or ring barking, is recommended leaving dead individuals in place. This prevents too much mechanical disturbance and allows stability of soils on slopes to be maintained. Complete removal of woody weeds should be achieved within three years of implementation of this plan.

In order to control weeds in offset areas, where infestation is relatively limited the Quarry Manager will ensure that herbicide usage will be appropriate and specifically designed for use near riparian areas (e.g. Roundup Bioactive[®]) be applied⁽¹⁾.

Alternatively, manual removal of individual plants may be undertaken to ensure complete and immediate success is achieved.

Alternative methods of weed control that may be used within the offset areas to control exotic species are provided in **Appendix 1**.

2.6.2 Revegetation

Given the intact nature of the vegetation canopy within the offset areas, there is no revegetation requirement for these areas.

As stated previously (**Section 2.1**), native vegetation communities at these locations are analogous to the remnant vegetation to be removed. While the height (age) of the canopy does not yet meet RE criteria (i.e. greater than 70% of the original canopy height), species densities approximate those that are naturally found within RE 12.11.3 and 12.11.5.

2.7 MONITORING

Monitoring and evaluation of the weed control program within the offset areas and assessment of the offsets' analogies to RE 12.11.3 and RE 12.11.5 are to be undertaken at regular intervals.

A consistent, integrated monitoring and management approach will ensure that recommended weed removal techniques are effective and allow for modification of any methods that fail to meet performance requirements.

It is essential that the occurrence and spread of weeds within the offset areas is continually

¹ All herbicide use is to be undertaken according to the manufacturer's instructions.

monitored and managed in order to keep abreast of any new infestations and/or other emerging issues.

The Quarry Manager will ensure that an experienced botanist/ecologist assess the abundance and plot the location of significant weed infestations on a twice yearly basis. This information is to be used to assess the success of the weed management program. Photo monitoring points are to be established that clearly depict each management area in north, south, east, west directions. Photographs are to be clearly time-marked with an indication of the viewing direction.

In addition, the offset areas are to be assessed for their analogy to RE 12.11.3 and RE12.11.5 on an annual basis. This is to be in the form of assessment of the canopy cover and height along a 100m transect. Full RE status will be achieved when the offsets have achieved 50% of the canopy cover and 70% of the height of the pre-clearing vegetation type (**Figure 6**) and when the offsets are dominated by species characteristic of RE 12.11.3 and/or 12.11.5. A census of species adjacent to each transect (i.e. 5m either side) is also to be undertaken during the sampling period.

The Quarry Manager will ensure that Barro Group appoint person/persons to undertake the role of data management (including analysing, interpreting and maintaining the database). The data should then be presented in a form that clearly shows the results of each monitoring event. It is a requirement that this data is supplied to DERM during reporting events (**Section 2.9**).

2.8 PERFORMANCE REQUIREMENTS PRIOR TO INCLUSION UNDER THE VM ACT

Prior to formal mapping as an RE, the offset areas must achieve remnant status under the provisions of the VM Act (i.e. must have at least 50% of the canopy cover and 70% of the height of the pre-clearing vegetation type).

In order to measure progress towards remnant status, reference sites must be selected for comparison. In the case of the proposed offset, the remnant vegetation adjacent to the offset sites (**Figure 3**) would serve as suitable references.

In addition, where possible no weeds listed under the provisions of the LP Act should be present within the offset areas. However, minor infestations of some exotic taxa are the

norm even in conservation reserves throughout the region (LAMR 2010). As a minimum requirement, pest plants should not pose a significant threat to native taxa.

2.9 REPORTING

It is a requirement that reporting related to the success and rehabilitation of the offset area be supplied to DERM by the 30th of June every two years. As a minimum, reporting is to include the following information:

- Name and contact details of proponent (i.e. Barro Group Pty Ltd);
- Lot on Plan property description and postal address;
- Data collected from transects, outlining species present, average canopy cover and height of vegetation. All data should be correctly labelled with date, location, GPS points for end points of transect and any other observations;
- An overview of the progress of the management area in achieving the management outcomes and how any risks or threats have impacted on the area;
- An indication of any risks or potential threats that have become apparent to the management area since the development of the management plan, and activities to be undertaken to manage these threats and/or risks; and
- Where the proponent is proposing that the management outcomes have been achieved and the report is being submitted as the final report, the proponent must provide evidence that all management outcomes have been achieved in full (i.e. the site is free of declared weed species and has reached remnant status under the provisions of the VM Act).

3.0 GENERAL ADVICE




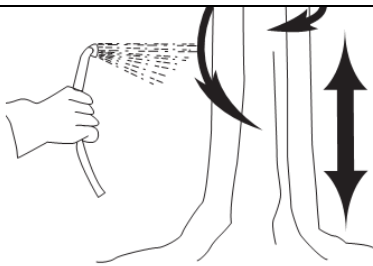
Any major proposed changes to the Vegetation Offset Rehabilitation Management Plan, including changes to the management protocols, are to be approved by DERM. Management of the offset areas will be maintained until vegetation contained within has achieved remnant status of the same broad vegetation group as the remnant vegetation cleared, as defined under the

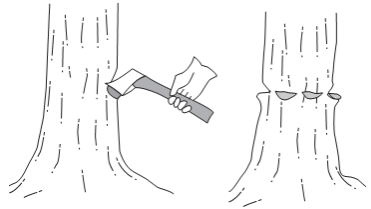

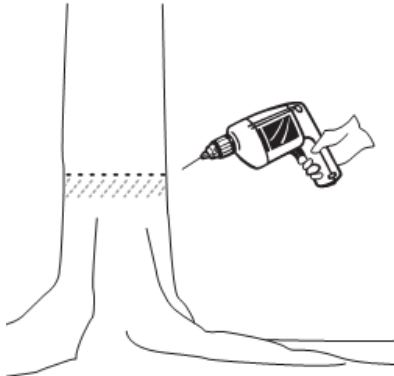
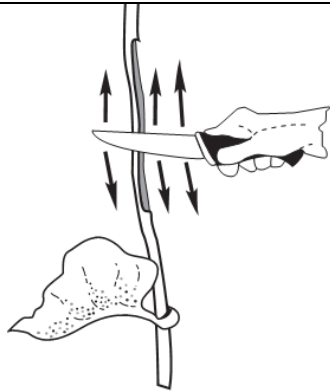
provisions of the VM Act. Regular and frequent monitoring of the weed control program should be undertaken to ensure weed infestations are controlled and that extant native vegetation is well maintained and healthy.


4.0 REFERENCES

LAMR, M (2010). Flora and its values. Report prepared for Barro Group Pty Ltd. September 2010.

APPENDIX 1
WEED CONTROL METHODS

Method	Illustration
<p>Hand Weeding</p> <ul style="list-style-type: none"> • Hand-pulling is a relatively gentle control method for seedlings, herbs and grasses. • Hand-pulling is best carried out when the soil is damp, when the root systems are more easily dislodged and less damage is done to the soil structure. • A number of weeds can be easily hand-weeded from the bush, particularly young plants that have not developed an extensive root system. • This method of control can be very effective when dealing with small populations of environmental weeds. • Attempt to prevent seed dispersal whilst had weeding • Plants with the potential to regrow from discarded material should be carefully bagged and removed. 	
<p>Dig out plants with tougher root systems: This technique is useful for species that grow from a solid central crown below ground level:</p> <ul style="list-style-type: none"> • Insert a long knife or narrow trowel into the soil outside the root system. • Gently loosen the soil, work around the roots and then work the plant out gently. • Plants without seed that will not re-sprout can be left to rot. • Attempt to prevent seed dispersal whilst had digging out weeds • Plants with the potential to regrow from discarded material should be carefully bagged and removed. 	
<p>Spraying Foliar spraying is the use of herbicide diluted with water or diesel at a specific rate, and sprayed over the foliage to the point of runoff (until every leaf is wetted but not dripping). This method is most suited to shrubs, grasses and dense vines less than 6 m. Advantages include quickness and economy. Disadvantages include the potential for spray drift and off-target damage.</p> <p>Boom or Blanket spraying: using a boom spray from a tractor or 4-wheel drive vehicle can be used to treat large areas completely infested with weeds, especially with selective herbicides. Indicating the location of areas to avoid before spraying may decrease the chance of overspray.</p> <p>Spot spraying: Smaller infestations can be sprayed using a backpack / knapsack spray unit or quad mounted spray-pack. This technique can target individual plants and is useful for on-going or follow-up maintenance...</p>	
<p>Stump Spray Basal bark spraying is suitable for thin-barked woody weeds and undesirable trees. Basal bark spraying is also an effective way to treat saplings, regrowth and multi-stemmed shrubs and trees. This method involves mixing an oil soluble herbicide in diesel and spraying the full circumference of the trunk or stem of the plant.</p> <p>It is important to cover the entire circumference of the trunk on every stem arising from the ground to a height of around 30 cm.</p>	

Method	Illustration
<p>Chipping method Useful for killing trees and shrubs to be left <i>in situ</i> to naturally decay:</p> <ul style="list-style-type: none"> shallow cuts are made just under the bark into the living tissue below the lowest branch; herbicide applied with a squeeze bottle immediately (within 30 seconds) into the exposed cut surface; continue cuts around the trunk at the same level, with 5cm gaps between each cut. Generally 1 part Glyphosate to 1.5 parts of water is suitable to achieve a kill with most species 	
<p>Tree Spearing Tree spearing uses a specifically designed tree spear and technique. Useful for killing trees and shrubs to be left <i>in situ</i> to naturally decay</p> <ul style="list-style-type: none"> The spear is thrust into the tree at an angle of 30° to 40° from the vertical, Apply the appropriate herbicide amount into the cut. Repeat the process, forming a row of cut approximately 50 mm apart. 	
<p>Tree injection Useful for killing trees and shrubs >5cm in circumference to be left <i>in situ</i> to naturally decay:</p> <ul style="list-style-type: none"> holes are drilled at a downward angle into the tree's sapwood at 5cm spaces; if a "Side Winder" or similar device is not employed herbicide is then applied immediately (within 30 seconds) into each hole small with a squeeze bottle. drill to make downward-angled holes into the sapwood approximately 5 cm apart. The placement of herbicide into the hole is usually made using a backpack reservoir and syringe that can deliver measured doses of herbicide solution. Best results are achieved with plants, which are actively growing. Generally 1 part Glyphosate to 1.5 parts of water is suitable to achieve a kill with most species. 	
<p>Scraping the stem method This method is used for plants with aerial tubers:</p> <ul style="list-style-type: none"> a sharp knife is employed to lightly scrape a section of stem (approximately 10-30 cm) removing bark and exposing the living tissue; Apply herbicide immediately (within 30 seconds) to the exposed soft underlying green tissue with a small squeeze bottle. With some woody weeds you can peel away the bark surface and paint the exposed wood or spray it with herbicide. Generally 1 part Glyphosate to 1.5 parts of water is suitable to achieve a kill with most species 	

Method	Illustration
<p>Cut stump method</p> <p>This method is ideal for woody plants and vines without aerial tubers:</p> <ul style="list-style-type: none"> • cut the stem close to the ground, if possible below the lowest branch; • apply herbicide immediately (< 10seconds for water-based and 1 minute for diesel soluble herbicides) using a small squeeze bottle or spray pack to the cut surface. • Generally 1 part Glyphosate to 1.5 parts of water is suitable to achieve a kill with most species • Two operators working as a team can use this method effectively • It is a good idea to use a brightly coloured dye in the solution to mark the stumps that have been treated <p>This method has the appeal of removing the weed immediately, and is used mainly for trees and woody weeds. Warning: Many species will sucker if treated by this method.</p>	 <p>The illustration shows a hand holding a spray nozzle, directing a stream of herbicide onto the top surface of a cut tree stump. The stump has several roots extending downwards into the ground.</p>

Attachment 1.12

Terrestrial Fauna Assessment



TERRESTRIAL FAUNA ASSESSMENT

Mount Cotton Quarry

Report prepared
for
Barro Group Pty Ltd



**Biodiversity
Assessment**

AND MANAGEMENT PTY LTD

FAUNA AND HABITAT SPECIALISTS

Document Control Sheet

File Number: 0241-001-2

Project Manager: Adrian Caneris

Client: Barro Group Pty Ltd

Project Title: Terrestrial Fauna Assessment, Mount Cotton Quarry

Project Author/s: Adrian Caneris, Olivia Woosnam

Project Summary: The overall purpose of this report is to provide an assessment of the terrestrial vertebrate fauna and associated habitat values of the Mount Cotton Quarry area.

Revision/ Checking History Track

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Purpose of Report

Biodiversity Assessment and Management Pty Ltd has produced this report in its capacity as {consultants} for and on the request of Barro Group Pty Ltd (the "Client") for the sole purpose of assessing the terrestrial vertebrate fauna values of the Barro Group Mount Cotton Quarry area (the "Specified Purpose"). This information and any recommendations in this report are particular to the Specified Purpose and are based on facts, matters and circumstances particular to the subject matter of the report and the Specified Purpose at the time of production. This report is not to be used, nor is it suitable, for any purpose other than the Specified Purpose. Biodiversity Assessment and Management Pty Ltd disclaims all liability for any loss and/or damage whatsoever arising either directly or indirectly as a result of any application, use or reliance upon the report for any purpose other than the Specified Purpose.

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Signed on behalf of

Date: 02 December 2010

Biodiversity Assessment and Management Pty Ltd



Managing Director

TERRESTRIAL FAUNA ASSESSMENT MOUNT COTTON QUARRY

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Attachment 1	2004 Fauna Assessment Report (BAAM 2004)
Attachment 2	Joint Statements on Fauna and Fauna Habitat Matters (P&E Court Appeal 1585 of 2007)

Abbreviations

BAAM	Biodiversity Assessment and Management
BPA	Biodiversity Planning Assessment
DERM	Department of Environment and Resource Management (formerly EPA)
EPA	Environment Protection Agency (now DERM)
EPBC Act	<i>Environment Protection and Biodiversity Act 1999</i>
NC Act	<i>Nature Conservation Act 1992</i>
P&E Court	Planning and Environment Court
RCC	Redland City Council
SEMP	Site Environmental Management Plan
SEQ	South East Queensland

1.0 INTRODUCTION

1.1 PURPOSE

This report has been prepared for Barro Group Pty Ltd for the purpose of providing an independent assessment of the terrestrial vertebrate fauna and associated habitat values within the proposed extension area of the Mt Cotton Quarry, Mt Cotton, Redland City (the 'subject site'). This report provides the results of initial fieldwork carried out in 2004 together with a summary of more recent site investigations.

The specific aims of the assessment are to provide:

- A survey and report of the terrestrial vertebrate fauna on or that may utilise the subject site, including species lists and significance status under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Queensland's *Nature Conservation Act 1992* (NC Act);
- An evaluation and comment on the presence or absence of any 'at-risk', migratory and/or otherwise significant species of fauna of the subject site;
- An assessment and comment on significant fauna habitats within the subject site, including their contribution to faunal movement corridors; and
- An assessment of the fauna and associated habitats that will or may be affected by the proposed quarry extension, including recommendations on appropriate fauna management actions and mitigation of potential fauna impacts for inclusion within the overall Site Environmental Management Plan (SEMP).

All observations and recommendations in this report are based on site investigations conducted over a five day and four night period from Monday 5 April to Friday 9 April 2004 inclusive (BAAM 2004), as well as ongoing site visits, the expert knowledge of the authors of the local area, a desktop review of existing information undertaken in 2004 and updated in 2009/2010, and agreements reached by ecological experts in the Queensland Planning and Environment (P&E) Court expert meetings for Appeal 1585 of 2007, of which the proposed extension was the focus.

It should be noted that a separate report by

BAAM Pty Ltd (2010) addresses specific assessment of the subject site for Koalas, including an evaluation of the implications of the proposed development under the *South East Queensland Koala Conservation State Planning Regulatory Provisions* (May 2010) and the obligations under the *Offsets for Net Gain of Koala Habitat in South East Queensland Policy* (May 2010).

1.2 SUBJECT SITE

The Mt Cotton Quarry site is situated on Mt Cotton Road in Redland City and has been used for quarrying purposes since the 1960s. The currently active quarry site involves the operation of a range of plant and equipment to produce a variety of extractive resources.

The site of the proposed extension is located approximately 0.5 km south-west of the existing quarry (see **Figure 1.1**) and for the past 30 to 40 years prior to 2004 was used primarily for small crop farming and/or pastoral grazing.

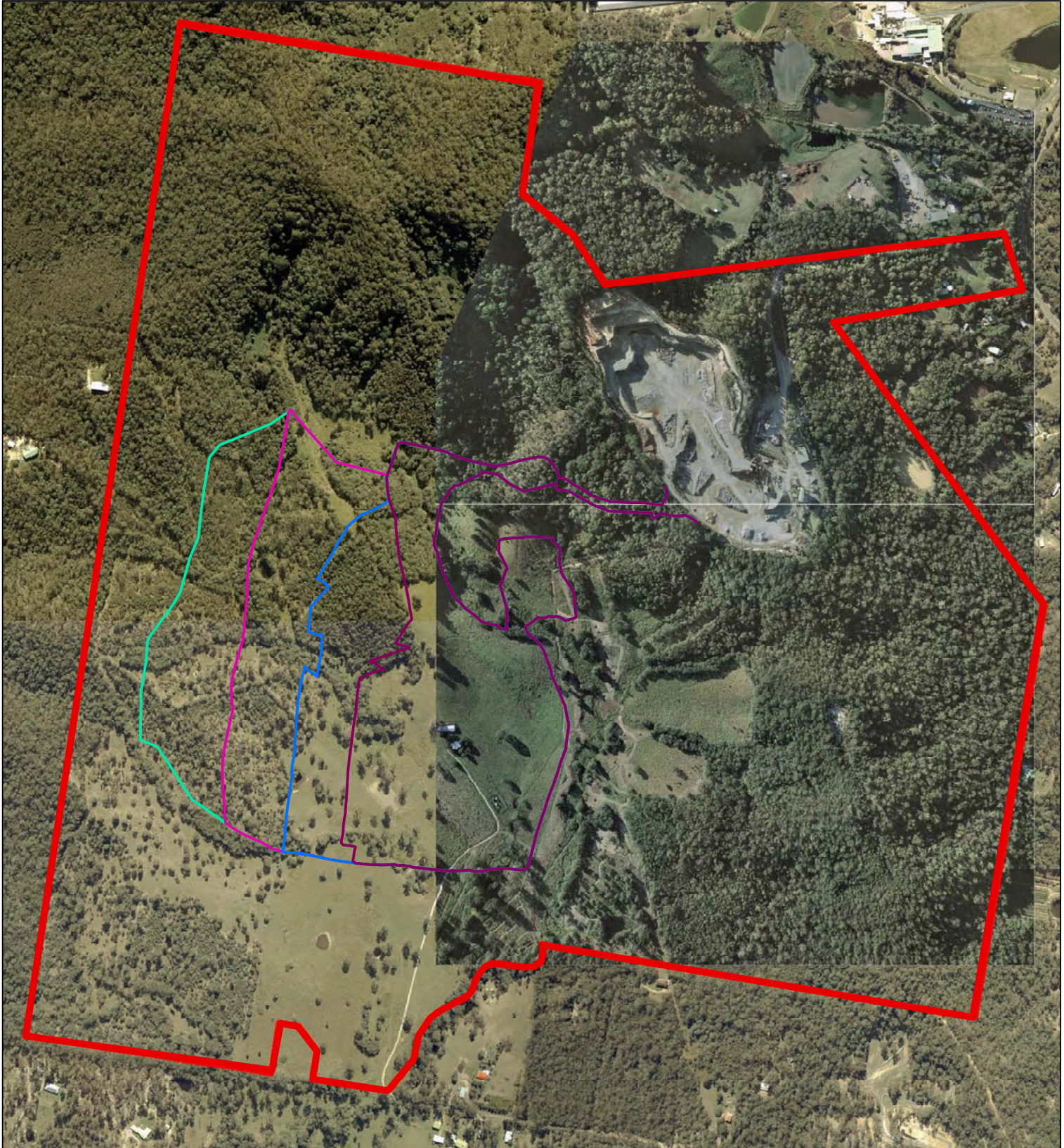
While some old growth vegetation is associated with the gully in the central northern portion of the subject site (LAMR, 2003 & 2010), this vegetation is primarily outside of the proposed extension area, which supports predominantly grassland pasture and acacia and eucalypt regrowth.

The subject site is within the upper catchment of California Creek. Drainage from the site is mostly through creeks along the southern and eastern boundaries of the property.

The adjoining lands are mostly rural residential properties with Venman Bushland National Park to the north-west.

The subject site comprises five (5) lots known as: Lot 370 on S311071, Lot 238 on SP218968, Lot 162 on S31962, Lot 17 on RP108970 and Lot 1 on RP108970.

It is understood the development application may also include the unformed road bisecting and adjoining Lot 17, Lot 370 and Lot 162 and that part of Greenhide (California) Creek located between Lot 238 and Lot 162, although no physical works are proposed in those areas.



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Legend

- Site Boundary
- Proposed Quarry Extension Stages :
- Stage 1
- Stage 2
- Stage 3
- Stage 4

0 200 400 Meters



Figure 1.1
Subject Site and
Proposed Quarry Extension

Terrestrial Fauna Assessment
 Mount Cotton Quarry
 October 2010



1.3 PROPOSED ACTIVITIES

It is understood that the site of the proposed extension contains a high quality hard rock resource within a Key Resource Area, which therefore has State and regional significance. **Figure 1.1** shows the location of the proposed quarry extension and proposed stages of extraction.

Quarried rock would be transported from the extension area to the plant associated with the existing quarry operation via a conveyor system. It is also proposed to construct a new access road between the extension and the existing quarry site approximately 50m north of the proposed conveyor.

It is understood that the amount of truck traffic generated by quarrying activities in the extension area will be similar to that currently associated with the existing operation.

1.4 FORMER COURT APPEAL - SUMMARY

The author (Mr Adrian Caneris from BAAM) was engaged as a fauna and fauna habitat expert in the Planning and Environment Court Appeal 1585 of 2007.

Included as **Attachment 2** of this report are the two Joint Statements on Fauna and Fauna Habitat Matters. Two points of disagreement were raised, relating to habitat offsets and to mitigation of any impediments to connectivity. This report has taken into consideration the matters raised by the experts in the previous appeal.

Since the joint reporting was prepared, the applicable legislative framework for the conservation of fauna and fauna habitat has changed substantially, and the quarry layout has been modified to a small extent. This report considers the revised quarry layout in the

context of the current legislative framework.

2.0 STUDY METHODOLOGY

This report is based on the 2004 Fauna Assessment Report (BAAM 2004) (provided in **Attachment 1**), which was updated in 2009-2010. The following sections detail the methodologies employed for this study.

2.1 DATABASE SEARCHES

Searches of the Commonwealth's EPBC Protected Matters Search Tool, the Queensland Museum's database and the Queensland Department of Environment and Resource Management's (DERM) WildNet database were undertaken for terrestrial vertebrates. Initial searches were carried out in 2004, with the EPBC Protected Matters Search Tool and WildNet database searches updated in 2009-2010.

2.2 AERIAL PHOTOGRAPH INTERPRETATION

In 2004, Redland City Council (RCC) online mapping and drawings, including site topography and extraction areas, were used to identify appropriate fauna survey sites and, with the most recent aerial photography available at the time, used to assist in the development of site fauna management recommendations.

2.3 FIELD SURVEY

2.3.1 Survey Effort

The initial field survey program took place over five days/four nights (5-9 April 2004) in accordance with the EPA (1999) guidelines for fauna surveys. **Table 2.1** summarises the survey effort for this survey.

TABLE 2.1. Summary of 2004 survey methods and effort

Survey Method/Site	Survey Measure	Total Effort
Elliot (type A) traps (22)	88 trap nights x 4 sites	352 trap nights
Elliot (type B) traps (2)	8 trap nights x 4 sites	32 trap nights
Cage traps (1)	4 trap nights x 4 sites	16 trap nights
Pitfall traps (5)	4 trap nights x 3 sites	60 trap nights
Diurnal birds census	1 hr/site/day over 5 days	20 hrs
Diurnal ground searches	1 hr/site/day over 5 days	20 hrs
Nocturnal arboreal and ground spotlighting	0.5 hrs/site x 4 nights	8 hours
Anabat II call detection walking surveys	0.5 hrs/site x 4 nights	8 hours
Nocturnal call playback surveys	0.5 hrs/site x 4 nights	8 hours
Incidental observations	10 hrs/site	40 hours

Subsequently, BAAM conducted targeted frog surveys on the subject site during suitable conditions (2006/07). Between 2004 and 2010, BAAM has carried out numerous site visits as part of site planning, site tours with representatives from relevant regulators and community representatives and for experts' meetings as part of the P&E appeal process. The latest site visit was carried out in July 2010.

2.3.2 2004 Survey Site Selection

During the 2004 survey, survey site selection and active searching locations were based on the type and quality of the habitat present on-site and on topographic variation. Four systematic study sites were selected within the

proposed extension area, as shown on **Figure 2.1**. These were:

- Site 1: Previously cleared wattle regrowth dominated by lantana and exotic understorey species;
- Site 2: Open pasture with wetland and drainage line;
- Site 3: Open forest – woodland regrowth with gully and drainage lines; and
- Site 4: Open forest on top of knoll, supporting primarily native vegetation.

Exact locations are provided in **Table 2.2**.

Table 2.2. Trap and Survey Site Locations of the 2004 survey.

Traps	Midpoint ¹			
Pit Traps	Latitude ^o	Longitude ^o	e ^o	
Pit Trap Site 1	S27 38.306	E153 13.631		
Pit Trap Site 3	S27 38.288	E153 13.457		
Pit Trap Site 4	S27 38.349	E153 13.371		
Elliott & Cage Traps	Start ¹		Finish ¹	
Line 1	S27 38.311	E153 13.631	S27 38.290	E153 13.639
Line 2	S27 38.337	E153 13.535	S27 38.437	E153 13.602
Line 3	S27 38.252	E153 13.364	S27 38.252	E153 13.390
Line 4	S27 38.350	E153 13.375	S27 38.310	E153 13.373

1. Map Datum Aust Geod '84 and locations recorded on Garmin GPS 12.

2.3.3 Survey Techniques

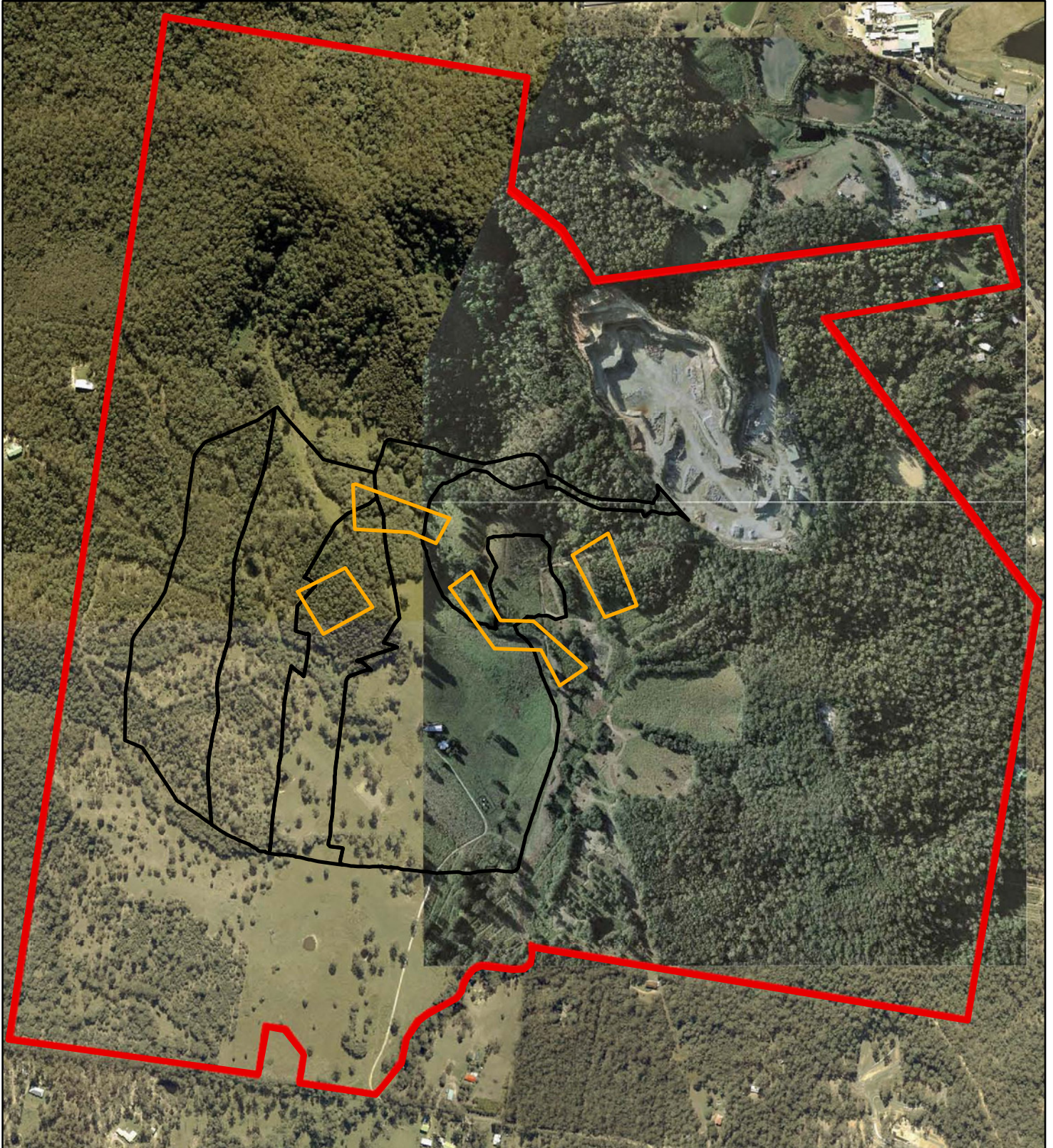
Field techniques followed the EPA (1999) guidelines for fauna surveys. During the 2004 survey, Adrian Caneris (a recognised expert on the vertebrate fauna of south-east Queensland) undertook the main field survey, with assistance from Jedd Appleton.

Field techniques employed during the 2004 survey are detailed in **Appendix 1**.

The targeted frog surveys were conducted using standard techniques for frog surveys in accordance with the EPA guidelines. The surveys were carried out by Mr Adrian Caneris and Dr Glen Ingam during rainfall events in 2006/07.

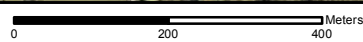
The surveys targeted primarily the disturbance area and Greenhide Creek. In addition, the pondage areas and drainage lines downstream of the disturbance area were also actively searched.

During all site visits (outside of the fauna survey and frog surveys), all incidental observations of any additional species were recorded and are included in this report.



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Legend

- Site Boundary
- Proposed Quarry Extension
- 2004 Fauna Survey Sites

Figure 2.1 2004 Fauna Survey Sites Locations

Terrestrial Fauna Assessment
 Mount Cotton Quarry
 October 2010



3.0 RESULTS

3.1 DATABASE SEARCH RESULTS

Species records obtained from the Queensland Museum, EPA WildNet and the Commonwealth EPBC database searches are listed in **Appendices 2, 3 and 4** respectively. These searches are based on a larger area than the subject site to capture as many records as possible for the local area.

All three databases were searched in 2004 prior to the field survey, and the WildNet and the EPBC databases were searched again in 2009/2010 to check for any changes in species' conservation status and for the listing or unlisting of any conservation significant species as possibly occurring on the subject site.

The major change that has occurred between the 2004 and the 2009/2010 database searches is the unlisting of seventeen species and the listing of the following seven species of special conservation significance as possibly occurring on the subject site:

- Wallum Froglet *Crinia tinnula*;
- Common Sandpiper *Actitis hypoleucos*;
- Eastern Great Egret *Ardea modesta*;
- Wandering Albatross (*Diomedea exulans*);
- Crested Tern *Thalasseus bergii*;
- Northern Quoll *Dasyurus hallucatus*; and
- Water Mouse *Xeromys myoides*.

At the time of this report, database searches returned a total of fifty (50) conservation-significant fauna species listed under State (NC Act) and/or Commonwealth (EPBC Act) legislation as potentially occurring within the local area. However, it should be noted that database records are not necessarily based on verified observations or records and most are unlikely to have come from the actual subject site.

Following the field-based site investigations and considering the habitats present within the subject site and surrounds, only some of those species are considered likely to occur. These species are discussed in **Section 3.3**, while comments regarding species of conservation significance detected from database searches but not expected to occur within the subject site are provided in **Appendix 5**.

3.2 RECORDED TERRESTRIAL VERTEBRATE SPECIES

All fauna species recorded on site during the 2004 survey and subsequent site visits are listed in **Appendix 6**. In total, 130 species have been recorded from the subject site, including 22 mammal species, 88 birds, 14 reptiles and 6 amphibians (**Table 3.1**).

The majority of the site's fauna is currently listed in Queensland's NC Act as 'Least Concern Wildlife' - i.e. native animals that are not currently listed as Presumed Extinct, Endangered, Vulnerable or Near Threatened, although they are still prescribed as protected wildlife.

Table 3.1. Total records of fauna species from 2004 field survey and site visits

Site	Mammals	Birds	Reptiles	Amphibians	Total
Site 1	5	29	3	1	38
Site 2	8	33	1	5	47
Site 3	7	29	2	3	41
Site 4	4	32	6	2	44
Incidental observations	6	29	6	1	42
Study totals (species)	22	88	14	6	130

3.3 SPECIES OF SPECIAL CONSERVATION SIGNIFICANCE

Of the species recorded on the subject site, seven are recognised as species of special conservation significance under Commonwealth or/and State Government legislation, as listed in **Table 3.2** and discussed in **Section 3.3.1**.

The records of migratory species, frogs and reptiles for the site may not provide a full account of the species that may use the site, due to the following factors:

- The main survey was performed during a single seasonal period (April 2004). Consequently, some migratory species that may use the subject site may have been absent during the survey period;
- The weather conditions were suitable for the investigation and assessment of most fauna

species, with the area receiving light rainfall during the first night of survey. However, the low rainfall received on the site and cooler night-time temperatures cannot allow certainty that the maximum level of frog activity was observed; and

- Cooler temperatures cannot allow certainty that the maximum level of reptile activity was observed.

However, given the level and detail of the fauna investigations for this study, combined with the compilation of database search records and subsequent site visits within summer seasons, the ecological experts agreed that it was highly unlikely any additional vertebrate species of special conservation significance would be added to the species listed in **Table 3.2**.

Table 3.2. Species of special conservation significance detected on the subject site

Zoological Name	Common Name	Survey Site*	Inc*	NCA Status*	EPBC Status*
MAMMALS					
<i>Ninox strenua</i>	Powerful Owl		x	V	
<i>Phascolarctos cinereus</i>	Koala		X	V	
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	2		S	
BIRDS					
<i>Ardea ibis</i>	Cattle Egret	2		S	M
<i>Merops ornatus</i>	Rainbow Bee-Eater	1,2		S	M
<i>Monarcha melanopsis</i>	Black-faced Monarch	1,3,4		S	M
<i>Rhipidura rufifrons</i>	Rufous Fantail	2,3		S	M

EPBC Act - Indicates the Australian conservation status of each taxon under the EPBC Act. The values are: Endangered (E), Near Threatened (NT), Vulnerable (V), Migratory (M), and () Not listed.

NC Act - Indicates the Queensland conservation status of each taxon under the NC Act. The values are: Presumed Extinct (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (S) and Common (C).

Other abbreviations: Inc = Incidental records (i.e. not recorded from a systematic survey site).

3.3.1 Conservation-significant fauna species detected on the subject site

Koala *Phascolarctos cinereus*

Status: Vulnerable (SEQ bioregion) NC Act.

Occurrence on site: Koalas were identified as being present within the subject site and surrounding lands. Three individuals were observed during the 2004 survey and scratches and scats were observed in most areas

supporting eucalypt species. One incidental observation of an adult male was also made during the 2010 Koala tree survey. Koalas are considered as residents on the site although the wetter forest areas in steep gullies within the northern portion of the subject site and the areas dominated by acacia regrowth are not considered preferred habitat for Koalas.

Ecology and habitat: Koalas have a distinct association with eucalypt woodland and forest habitat types containing suitable food trees (Hume and Esson 1993; Moore and Foley 2000;

Martin *et al.* 2008). They are not necessarily restricted to bushland or remnant areas and are known to exist and breed within farmland and the urban environment (Dique *et al.* 2004). Similarly, movement is not confined to vegetated corridors, as they also move across cleared rural land and through suburbs (Martin *et al.* 2008).

Koalas use a variety of trees, including many non-eucalypts, for feeding, shelter and breeding purposes (Dique *et al.* 2004; Martin *et al.* 2008). They can, however, have distinct, localised preferences throughout their range, selecting some species in preference to others (Pahl and Hume 1990). They are also known to favour individual trees for which a variety of reasons have been postulated including; high leaf moisture content, high leaf nitrogen content (which is often related to low fibre content making leaves more palatable) and low amounts of chemical compounds produced by eucalypts to resist herbivores (Pahl and Hume 1990; Hume and Esson 1993; Moore and Foley 2000).

Individual animals, although solitary, coexist within overlapping home ranges, which contain a finite number of feed trees that are visited repeatedly and often shared with other individuals (Martin *et al.* 2008).

Distribution and breeding: Koalas occur throughout north-east, central and south-east Queensland, extending south through Victoria into South Australia and Kangaroo Island. In Brisbane, they are renowned throughout the well forested outer suburbs, particularly to the south-east (Low 1995). However, surveys within the 'Koala Coast' region indicate populations have declined by 26% in recent years (EPA 2007).

Breeding occurs in spring/summer when males become territorial, attacking and fighting rivals, and using loud bellows to advertise their presence (Martin *et al.* 2008). Young permanently leave the females pouch after seven months, but continue to ride on the mother's back until 12 months or at the beginning of a new breeding season. After this time adolescent females may remain in the natal habitat, but males generally disperse to new territories between 1-3 years of age (Dique *et al.* 2003a; Martin *et al.* 2008).

Threats: Current threats include habitat destruction and fragmentation, bushfire and disease. Populations around urban areas are at increased risk of mortality due to dog attack and road strike (Maxwell *et al.* 1996).

Potential impacts: Provided revegetation and restoration of retained areas are undertaken, there are no significant impacts on the local Koala population expected from the proposed actions.

A separate Integrated Koala Habitat report (BAAM 2010a) addresses relevant Koala legislation and management requirements.

Short-beaked Echidna *Tachyglossus aculeatus*

Status: Special Least Concern NC Act.

Occurrence on site: Short-beaked Echidna was observed at Site 2 during the 2004 survey.

Ecology and habitat: The Short-beaked Echidna is, with the Platypus and the Long-beaked Echidna *Zaglossus bruijnii* of New Guinea, one of the three extant species of monotremes, a group of mammals believed to have diverged early in the evolution of mammals, possibly about 200 million years ago (Augee *et al.* 2008).

The Short-beaked Echidna is specialised for feeding on ants, termites and beetle larvae. It occurs in almost all terrestrial habitats except for intensively managed farms. The species is active both by day and night and shelters in logs, crevices, burrows and leaf litter (Menkhorst and Knight 2004; Augee 2008).

Distribution and breeding: This species occurs throughout Australia and can be expected in all well forested areas and many rural residential properties across Brisbane.

Mating takes place in July and August with juveniles seen from September (Augee 2008).

Threats: Short-beaked Echidnas are regularly killed by dingoes/dogs and motor vehicles.

Potential impacts on the local population: The quarry extension proposal is not expected to detract from a safe future for the species in the local landscape. The retained and rehabilitated vegetation will provide ongoing habitat and movement options for this species.

Powerful Owl *Ninox strenua*

Status: Vulnerable (NC Act).

Occurrence on site: Although not observed during the 2004 survey, the Powerful Owl was

incidentally observed on site during the 2010 Koala tree survey. It is expected that the species would at least occasionally, if not frequently, visit the site for feeding and there is potential for roosting and/or breeding to occur. The bird has been recorded in the surroundings from the Daisy Hill State Forest, Venman Bushland National Park and bushland areas surrounding the Bayview Estate in Mt Cotton.

Ecology and habitat: Pairs of Powerful Owls occupy large, probably permanent, home ranges of about 1,000 ha (Higgins 1999; Garnett and Crowley 2000), although in Victoria ranges larger than 4,000 ha have been recorded (Soderquist and Gibbons 2007). Their principle prey is medium-sized mammals, particularly possums and gliders, which often represent more than 50% of their diet, but which also includes other birds, flying-foxes, rats and insects (Higgins 1999; Webster et al. 1999).

Powerful Owls are most likely observed at sites with mature dry forest, and many live in hollow-bearing trees (Loyn et al. 2001).

Distribution and breeding: This species is found in south-eastern Australia from Victoria north to Eungella, Queensland, and it is most common on the eastern slopes of the Great Dividing Range (Garnett and Crowley 2000). In Brisbane, they have been recorded from numerous large bushland remnants (Low 1995).

Powerful Owls breed once per year from May to August. Nests are located in large tree hollows, usually at a considerable height above the ground (10-40 m) (Beruldsen 2003). Consequently, the presence of large hollow-bearing trees is important for breeding as well as smaller hollows for the persistence of its prey species. The Powerful Owl has been known to breed successfully in semi-urban areas in Brisbane (Garnett 1993).

Threats: Widespread clearing of Powerful Owl habitat has reduced the amount of available habitat by almost half. However the species is still persistent and stable in remaining habitats (Garnett and Crowley 2000).

Potential impacts on the local population: The actual significance of the subject site to the species has not been studied in detail and is unknown at the time of reporting. However, as the proposed activities do not require the removal of a large number of hollow-bearing trees, and it is intended to establish woodland

habitat in what are currently cleared pasturelands, habitat conditions for the species are likely to improve from the existing situation over the life of the project as rehabilitation areas mature. There are hollow-bearing Eucalypt trees within the subject site, but outside of the proposed extension, which provide suitable breeding resources for the owl and its prey items. These should be retained and enhanced. As well, the densely vegetated gullies in the northern portions provide suitable refuge for diurnal roosting.

Non-threatened Migratory species

Migratory birds recorded from the site during the survey period included Cattle Egret *Ardea ibis*, Rainbow Bee-eater *Merops ornatus*, Black-faced Monarch *Monarcha melanopsis* and Rufous Fantail *Rhipidura rufifrons*. All four species are listed in the international migratory treaties and thus subject to the EPBC Act.

All of the above species are common in south-east Queensland and can be readily found within suitable habitats outside the subject site.

Rainbow Bee-eater is mainly an aerial species and is not expected to be affected by the proposed extension of the quarry. Rufous Fantail and Black-faced Monarch were located in the wet forest and vegetation associated with creeks and gullies. Cattle Egret was observed in association with stock (horses & cattle) present on the subject site at the time of the 2004 survey.

The areas retained outside of the proposed extension contain and will provide ongoing habitat for these species on the subject site. The extension proposal is not expected to detract from a safe future for any of these species.

3.3.2 Other conservation-significant fauna species likely to occur

Although not recorded from the subject site during the field survey or subsequent site visits, it is considered likely that a further twelve (12) conservation-significant species listed under the NC Act and/or the EPBC Act occur on site from time to time. These species are presented in **Table 3.3** and discussed thereafter.

Table 3.3: Species of special conservation significance not detected but expected on the subject site

Zoological Name	Common Name	NCA Status*	EPBC Status*
MAMMALS			
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	C	V
AMPHIBIANS			
<i>Adelotus brevis</i>	Tusked Frog	V	
BIRDS			
<i>Accipiter novaehollandiae</i>	Grey Goshawk	NT	
<i>Acrocephalus australis</i>	Australian Reed-Warbler	S	M
<i>Ardea modesta</i>	Eastern Great Egret	S	M
<i>Cuculus optatus</i>	Oriental Cuckoo	S	M
<i>Haliaeetus leucogaster</i>	White-breasted Sea Eagle	S	M
<i>Hirundapus caudacutus</i>	White-throated Needletail	S	M
<i>Monarcha trivirgatus</i>	Spectacled Monarch	S	M
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	S	M
<i>Turnix melanogaster</i>	Black-breasted Button-Quail	V	V

EPBC Act - Indicates the Australian conservation status of each taxon under the EPBC Act. The values are: Endangered (E), Near Threatened (NT), Vulnerable (V), Migratory (M), and Not listed.

NC Act - Indicates the Queensland conservation status of each taxon under the NC Act. The values are: Presumed Extinct (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (S) and Common (C).

Glossy Black-Cockatoo *Calyptorhynchus lathami*

Status: Vulnerable (NC Act).

Potential occurrence on site: The subject site supports potential feed trees for this bird and it is possible that birds occasion the site.

Ecology and habitat: The Glossy Black-Cockatoo is an extremely specialist feeder, feeding almost exclusively on the seeds of the cones of She-Oaks (Casuarinaceae). Furthermore, although She-Oaks are common across the landscape, the birds select and use only a small portion of this resource (Clout 1989; Crowley and Garnett 2001). The species is known to preferentially select She-Oak species with greater seed fill and kernel ratio, selects trees with greater cone production (usually larger mature trees), and eats exclusively young russet-coloured cones (Cameron and Cunningham 2006).

The birds are usually encountered in small family parties, feeding in groves of She-Oaks throughout the day and coming to ground to drink in the early morning or late afternoon. They occur within a range of forests and woodlands although, due to their dependence on She-Oaks, they prefer habitats dominated by this tree type either in the canopy or middle

stratum (Higgins 1999). In addition, the species is reliant on suitable large hollows in dead or senescent trees in which they can nest.

Distribution and breeding: The species has a patchy distribution throughout Eastern Australia: they occur south from Eungella to Gippsland and inland to south-central Queensland and the Riverina area of NSW. An isolated population is present on Kangaroo Island. They are uncommon and declining, especially in the south-western parts of their range, and are now extinct in mainland South Australia (Garnett and Crowley 2000). Overall, they are the rarest and most endangered of Australia's cockatoos.

They are winter breeders and breed mainly from March to August, although they have been recorded breeding later in Queensland. The female incubates and cares for the young alone within a large hollow tree cavity, but is regularly fed by the male. Only one egg is produced, which hatches in about 30 days. Once hatched the chick fledges in around 60 days, but remains with its parents and is fed for another three months (Garnett et al. 1999).

Threats: Clearance of habitat has reduced the species' range in the south and west of the Great Divide (Garnett and Crowley 2000) and remains a serious

threat to the species throughout its range. In addition, fire can reduce or remove suitable feed trees from large areas for several years. Once this has occurred, She-Oak regeneration can be impeded by grazing.

Fragmentation of habitats may also result in an increase in predation of nestlings and eggs or alternatively result in higher competition for hollows (Downes et al 1997). This threat may be particularly severe where species adapted to altered or open habitats are abundant. These 'edge' species may include species such as Common Brushtail Possums (*Trichosurus vulpecula*), Little Corellas (*Cacatua sanguinea*) and Galahs (*Eolophus roseicapilla*). Without the protection of nest hollows these predators and/or competitors can significantly reduce recruitment (Garnett et al. 1999).

Potential impacts on the local population: The proposed area of disturbance is not considered to hold high value for this species and the proposed activities do not require the removal of hollow-bearing trees suitable for this species' nesting requirements. There are hollow-bearing eucalypt trees within the subject site and surrounds, but outside of the proposed extension, which will continue to provide suitable breeding resources. These are identified as being retained and restoration actions will enhance overall habitat values. It is intended to establish eucalypt woodland habitat in what are currently cleared pasturelands, and habitat conditions for the species are likely to improve from the existing situation over the life of the project as rehabilitation areas mature. The use of suitable food tree species has been incorporated into revegetation plans.

Tusked Frog *Adelotus brevis*

Status: Vulnerable (NC Act).

Potential occurrence on site: Although not recorded on site during the 2004 survey, targeted assessments or subsequent site visits, Tusked Frogs are considered to have the potential to occur on the site or surrounding lands in association with drainage lines and pondage areas.

Ecology and habitat: This species inhabits a variety of habitats including rainforest, wet sclerophyll, dry sclerophyll, woodland and vine forest, and can even be found in low numbers in open grazing country (Eyre et al. 1997). They occur in slow moving streams and dams, particularly around accumulated leaves and small woody debris. On land, they can be found

under logs and in hollows/rock crevices beside streams and ponds (Meyer et al. 2001).

Distribution and breeding: The Tusked Frog occurs on the coast and ranges from the Clarke Range in central Queensland to Moss Vale in New South Wales and as far inland as the Blackdown Tableland and Carnarvon Gorge in Queensland. Historically, the species was common on the western slopes of the Great Dividing Range. However, it has declined in many areas including the New England Tableland, western flowing streams of the Main Range, elevated sites in the Clarke Range and from the Lockyer Valley in SEQ (Ingram and McDonald 1993; Eyre et al. 1997; Gillespie and Hines 1999).

Males construct nests in concealed sites under leaf litter, vegetation or logs in shallow water at the edge of ponds or stream pools with breeding usually occurring between September and April (Anstis 2002).

Threats: Tusked Frogs are very tolerant of habitat modification (Low 1995). Nonetheless, they are threatened by destruction and disturbance of habitat, reduction in water quality, Chytrid fungal disease, predation of eggs and tadpoles by exotic fish species such as mosquito fish *Gambusia holbrooki*, and increased ultraviolet radiation (Gillespie and Hero 1999; NPWS 2003).

Potential impacts on the local population: The distribution of the Tusked Frog within the subject site is expected to be within the more permanent and natural portions of waterways in the north and south-east. These areas are unaffected by the proposal. It is unlikely the species would occur within the proposed extraction area. The watercourse and associated wetland area within the extraction area are considered to contain poor habitat conditions for this species.

The long-term viability of the species within the subject site is dependant upon the retention of suitable foraging and breeding habitat. The preservation of riparian vegetation and maintenance of water quality is crucial to the long-term survival of this species within the subject land.

The reformation of the existing drainage line within the extension area should contain design elements (permanent small pondage areas, apposite vegetation and water quality) that provide additional potential habitat.

The site has been assessed during suitable conditions (under and following summer rainfall periods) and no evidence of the species was detected. It is therefore assumed that the distribution of the species within the subject site is primarily potential to occur rather than actual presence. With the proposed habitat protection in the northern portion of the property, the proposed restoration actions and low likelihood of occurrence, it is considered that the extension proposal will not have a negative impact on the long-term security of the species on the subject site.

Grey-headed Flying-fox *Pteropus poliocephalus*

Status: Vulnerable (EPBC Act).

Potential occurrence on site: Grey-headed Flying-fox was not observed in the subject site but it is expected to occur seasonally and particularly in response to localised flowering events. This species is commonly recorded in fauna surveys in south-eastern Queensland.

Ecology and habitat: Two habitat characteristics are important for Grey-headed Flying-foxes: foraging resources and roosting sites. As the species is a canopy-feeding frugivore and nectarivore, it utilises vegetation including rainforests, open eucalypt forests, woodlands, Melaleuca swamps and Banksia woodlands.

Roosts are commonly within dense vegetation close to water, primarily rainforest patches, stands of Melaleuca, mangroves or riparian vegetation (Nelson 1965), but colonies may use exotic vegetation in urban areas (Birt et al. 1998). The species congregates in large camps of up to 200,000 individuals from early until late summer, with the number of bats within a camp being influenced by the availability of blossom in the surrounding area. Adults normally disperse during the winter and can migrate up to 750 km as individuals or small groups, with the young forming winter camps (Churchill 1998).

Distribution and breeding: Regular or frequently used camps have been located between Rockhampton in Queensland south to around Mallacoota in East Gippsland, Victoria. Less consistent records extend the south range of the species to Warrnambool, Victoria (Duncan et al. 1999). They are generally recorded between the coast and the western slopes of the Great Dividing Range. Recent surveys have located camps of this species as far north as the Mackay region, with several records further

south between Gladstone and Bundaberg, Queensland (Roberts 2006). Despite one regular camp in Melbourne (Menkhorst 1995), the southern range of the species appears to have considerably retracted (Duncan et al. 1999).

Breeding occurs during the spring months when food resources are at their most plentiful.

Threats: Grey-headed Flying-foxes are subject to several threatening processes, the most severe being loss of habitat. It has been suggested that this resulted in a 50% decline in the population by the 1930s (Duncan et al. 1999). The loss of habitat, particularly important habitat such as reliable winter resources along the east coast, has continued to lead to population decline. The species will also forage within commercial fruit farms, sometimes significantly reducing their yield. This has resulted in direct culling or the destruction of camps by harassment. Other threatening processes include accumulation of lethal levels of lead in urban areas (Hariono et al. 1993), electrocution on overhead powerlines, which kills disproportionately high numbers of lactating females (Duncan et al. 1999), and conversion of old-growth forests and woodlands to young, even-aged stands due to too-frequent burning (NPWS 2002).

Potential impacts on the local population: Overall, an activity that affects a single Grey-headed Flying-fox or a small number of individual Grey-headed Flying-foxes would not be expected to have a significant impact on the species and so would not require Commonwealth approval.

As there are no colonies or camps present within the subject site, it can be concluded that the proposed extension would not have any significant impact on the species or threaten the security of the species in the area.

In addition, if the southern portions of the subject site are subjected to regeneration and habitat enhancement, a net increase in potential food resources for this species will result.

Grey Goshawk *Accipiter novaehollandiae*

Status: Near Threatened (NC Act).

Potential occurrence on site: Grey Goshawk *Accipiter novaehollandiae* is a wide-ranging species. Although no evidence of utilisation of the subject site by this species was found during

the 2004 survey or subsequent site visits, it might occasionally occur in the area.

Ecology and Habitat: The Grey Goshawk is a solitary, secretive species that forages by ambushing prey from a concealed perch in the tree canopy or by low, fast flight (Debus 1998). It occurs in temperate, sub-tropical and tropical rainforest, tall open forests, woodlands, wooded gorges, dense timber along watercourses, and farmland, usually in the 760+ mm rainfall zone. Individuals can, however, sometimes be found in other habitats - most likely young birds dispersing from natal territories (Olsen and Olsen 1985; Marchant and Higgins 1993).

Distribution and Breeding: Grey Goshawks occur in all Australian states and the Northern Territory, though never far inland. In Brisbane, they are sometimes observed in well-forested suburbs (Low 1995).

Breeding occurs once per year, usually from August to December. The nest is placed either in an upright fork or on top of a clump of mistletoe, usually in the topmost branches of a tall tree (Beruldsen 2003). Mature forests are important for this species as large habitat trees provide the best nesting sites. Regrowth forest less than 30 years old is seldom used (Marchant and Higgins 1993).

Threats: There has been a slight decrease in populations of Grey Goshawk since European settlement, probably due to habitat loss and persecution (Olsen 1998). The species is still threatened by habitat loss, particularly in south-eastern Australia (Debus 1998).

Potential impacts on the local population: The proposed extension would have little or no detrimental impact on this species or its habitat.

Black-breasted Button-quail *Turnix melanogaster*

Status: Vulnerable (NC Act and EPBC Act).

Occurrence on the subject site: Black-breasted Button-Quail *Turnix melanogaster* might occur on site, although there is only very limited potential to occur due to low habitat values on the subject land. No evidence of their characteristic platelets was observed during the 2004 survey or subsequent visits.

Ecology and Habitat: Black-breasted Button-quail is a cryptic species that occurs in dry rainforest and vine-thickets with abundant leaf-litter. They have also been recorded in Brigalow, Belah and Bottle-tree scrubs, and in

Eucalypt forests with a dense understorey including Lantana (Marchant and Higgins 1993). Studies have shown the species prefers larger vine-thicket remnants (>15 ha) connected to eucalypt woodland (Smyth and Pavey 2001). Radio-tracking studies suggest that the birds do not occupy exclusive territories and have home ranges of between 2.2 and 6.1 hectares (Smith et al. 1998). The species movements are not well understood. They are often recorded in remnant patches intermittently or occasionally, before disappearing for extended periods, suggesting that individuals may move large distances (Marchant and Higgins 1993).

Black-breasted Button-quails forage for seeds and insects in thick leaf-litter, creating distinctive 'platelets' by scratching litter away with the feet and turning in a circular motion. They may be difficult to observe due to the dense vegetation in their preferred habitat and their habit of running quietly along the ground, or freezing rather than flying to avoid danger (Marchant and Higgins 1993).

Distribution and Breeding: Northern records since 1993 have been located west of Gladstone; however it is possible the species range extends north to near Rockhampton. The species extends as far west as the Bunya Mountains and the southern limit is around the NSW/Qld border. There are no recent records from northern NSW and the species may already be extinct there (Marchant and Higgins 1993; Smyth and Pavey 2001).

Most records of nesting birds occur between around November and March, but the species may nest all year round if conditions are suitable. The nest is a shallow depression in the ground lined with leaves. The species is polyandrous and males incubate 3-4 eggs without assistance from the female (Marchant and Higgins 1993; Smith et al. 1998).

Threats: At least 90% of Black-breasted Button-quail habitat has been cleared and the continued loss of habitat remains the greatest threat to this species. Within areas of remaining habitat, pressures such as grazing and other disturbances by cattle and pigs can be locally severe. In addition, the abundant leaf litter and dry vegetation in which the species occurs is prone to fire, often rendering an area unsuitable for the species. The impacts of foxes and cats on this largely terrestrial species are another threat to population survival (Garnett and Crowley 2000; Smyth and Pavey 2001; Mathieson and Smith 2009).

Potential impacts on the local population: If present on the subject land, the species would be restricted to areas outside of the proposed extension and no impacts are expected.

Non-threatened Migratory species

White-breasted Sea Eagle *Haliaeetus leucogaster* is a wide-ranging species that might occur over the area. No evidence of utilisation of the subject site by this species was found during the 2004 survey or subsequent visits and the proposed extension is not expected to result in any detrimental impact on this species or its habitat. The proposed actions should not be viewed as relevant to this species.

White-throated Needletail *Hirundapus caudacutus* is a wide-ranging, aerial species and, although it is expected to occur over the area, the proposed actions should not be viewed as relevant to this species.

Spectacled Monarch *Monarcha trivirgatus* prefers rainforest and wet sclerophyll forests. This species might occur seasonally within suitable habitats within or around the subject lands. No loss of habitat or significant impact is expected from the proposal.

Satin Flycatcher *Myiagra cyanoleuca* is a wide-ranging species and may occur on the subject lands. No loss of core habitat values is expected from the proposal.

Oriental Cuckoo *Cuculus optatus* could be present seasonally within the woodland and forested habitats within the local landscape. Given the low level of habitat loss and the proposed restoration, no direct or significant impacts are expected on this species.

Eastern Great Egret *Ardea modesta* (alternative nomenclature: *Ardea alba*) is found in most shallow, coastal and inland wetland habitats, both estuarine and freshwater, including man-made dams and ponds and moist grasslands (Marchant and Higgins 1993; Pizzey and Knight 2003). In such areas, they hunt for fish, frogs and aquatic insects by wading slowly and waiting for prey. The species occurs throughout Australia where suitable habitat occurs.

The species has high potential and is expected to occur within the drainage lines and/or wetland areas. There will be some loss and disturbance of suitable habitats as part of the extension. However, the restoration, sediment ponds, and diversion drains will provide an increase in potential habitat. Overall, no significant threat is expected for this common species.

Australian Reed-Warbler *Acrocephalus australis* is typified by its affinity with reeds, rushes and sedges, and similar vegetation in and adjacent to most wetland types (Higgins et al. 2006). The species occurs throughout central and eastern Australia and coastal Western Australia (Pizzey and Knight 2003). This species was formerly considered a migratory subspecies of the Clamorous Reed-warbler *Acrocephalus stentoreus* but is now considered an endemic species (Higgins et al. 2006).

South-eastern Australian populations tend to migrate north towards tropical areas from late summer and return in early spring to breed (Higgins et al. 2006). The major threat is loss of habitat due to coastal development in natural habitat areas (Higgins et al. 2006). The proposed extension will remove a small portion of potential habitat. The proposed restoration will replace, over time, all habitat values lost. Overall, the proposed actions will not have an adverse impact on a safe future for this common species.

3.4 TERRESTRIAL FERAL SPECIES

Exotic species noted during the surveys and database searches were the Cane Toad, Northern Mallard, Indian Myna, Rock Dove, Feral Fowl, House Sparrow, Pea Fowl, Spotted Turtle-Dove, European Starling, Cattle, Dog, Horse, Cat, Brown Hare, House Mouse, Black Rat, Feral Pig and European Fox. None of these species are unexpected and all are commonly found in South-east Queensland.

A feral animal monitoring program should be implemented during the life of the project to identify any potential detrimental impacts of feral animals on native fauna species. Groundwork Plus has indicated that contribution to a regional pest animal control program would be considered.

3.5 HABITAT VALUES

In general ecological terms, the subject site maintains valuable habitat types and condition. In particular, the steep gullies containing old growth forest in the northern portions are valuable as this habitat type is rare in Redland City.

The native vegetation of the site is predominately open eucalypt woodland with the northern portions containing wetter forest areas in association with the steep gullies. There is a large area of pastoral land in the central and

southern areas, which is dominated by introduced grasses and contains some native regrowth with large patches of acacia and some eucalypt regeneration. Consequently, these areas support a low number of hollow bearing trees. Drainage is primarily via two watercourses, towards the southern and eastern boundaries of the property.

Previous vegetation removal and prior and ongoing agricultural pursuits, combined with the existing quarry operations, have noticeably affected the area's habitat values. The majority of the proposed extension area has been subject to extensive vegetation removal and subsequent rural pursuits. The remaining vegetation and habitat areas are defined as regrowth with the exception of the vegetation associated with the steep gullies in the central northern portion of the subject site (LAMR, 2003).

Due to previous disturbances and current land uses, the subject site requires ongoing vegetation management to ensure existing habitat values are retained and enhanced. If the site and its vegetation were left unmanaged, the slow but sure encroachment of weed species that is typical following the removal of grazing animals would eventually have significant detrimental impacts on inherent habitat values and the variety of habitat types that currently occur on the subject land. Early signs of weed encroachment were observed during the 18 February 2010 site visit (**Photograph 1**).



Photograph 1: Black Thistle *Cirsium vulgare* encroaching on the site, south of proposed Stage 1.

In its current condition, the subject site retains significant vegetated areas that provide valuable habitat for a high number and diversity of terrestrial vertebrate species. Of particular significance is the known or potential presence

of conservation-significant species, including Koalas (see BAAM 2010a for details on Koala habitat values within the subject site).

3.6 MOVEMENT CORRIDORS

Currently, the subject site maintains substantial linkage with adjoining areas and provides for fauna movement within and through the property, although the east-west linkage is weakened in the south of the site by previous clearing and agricultural use.

Koalas moving on the subject site would comprise resident species and individuals forming part of a larger and wider population that would occasion or traverse the lands which are linked to significant continuous bushland areas including Venman Bushland National Park to the west and north-west.

Fauna movement is, to a large extent, unpredictable and management responses need to incorporate as many options and opportunities as possible. The ongoing protection and maintenance of sufficient habitat and number and size of movement corridors (linkages between core habitat areas) is paramount to successful fauna movement, interaction and dispersal.

The exact size of a corridor required providing safe movement for Koalas and other terrestrial fauna across the subject site is inherently reliant on the habitat values and habitat connectivity of surrounding lands. The appropriate size of any designated movement corridor should be defined with regard for the adjoining lands and their current and future habitat qualities.

Figure 3.1 shows the EPA's Biodiversity Planning Assessment (BPA) mapping for the subject site and surroundings. This figure illustrates that habitat in the north-western portion of the subject site is part of an extensive, continuous bushland area. **Figure 3.2** shows the main regional and local fauna movement corridors for the subject site and surroundings. Habitat in the eastern portion of the subject land is strategically important in that it forms a significant component of a bushland corridor that has been isolated by quarrying and pastoral activities on the subject site, significant agricultural use to the north, clearing associated with adjoining residential development to the east, and the presence of Mt Cotton Road.

An improvement in the east-west habitat linkage across the subject site would benefit local and regional fauna movement opportunities in this

location.

Taking into account the location of the proposed future extraction area (**Figure 1.1**), there is an opportunity to maintain and enhance habitat values on the property outside the extraction area to improve local and regional habitat linkage. In particular, the rehabilitation of pastoral lands across the southern portion of the property would contribute significantly to available habitat and movement opportunities for many species, including Koalas. However, the long term viability and success of local and regional linkages that are maintained or enhanced within the property will ultimately depend on the maintenance of habitat and linkages on surrounding lands.

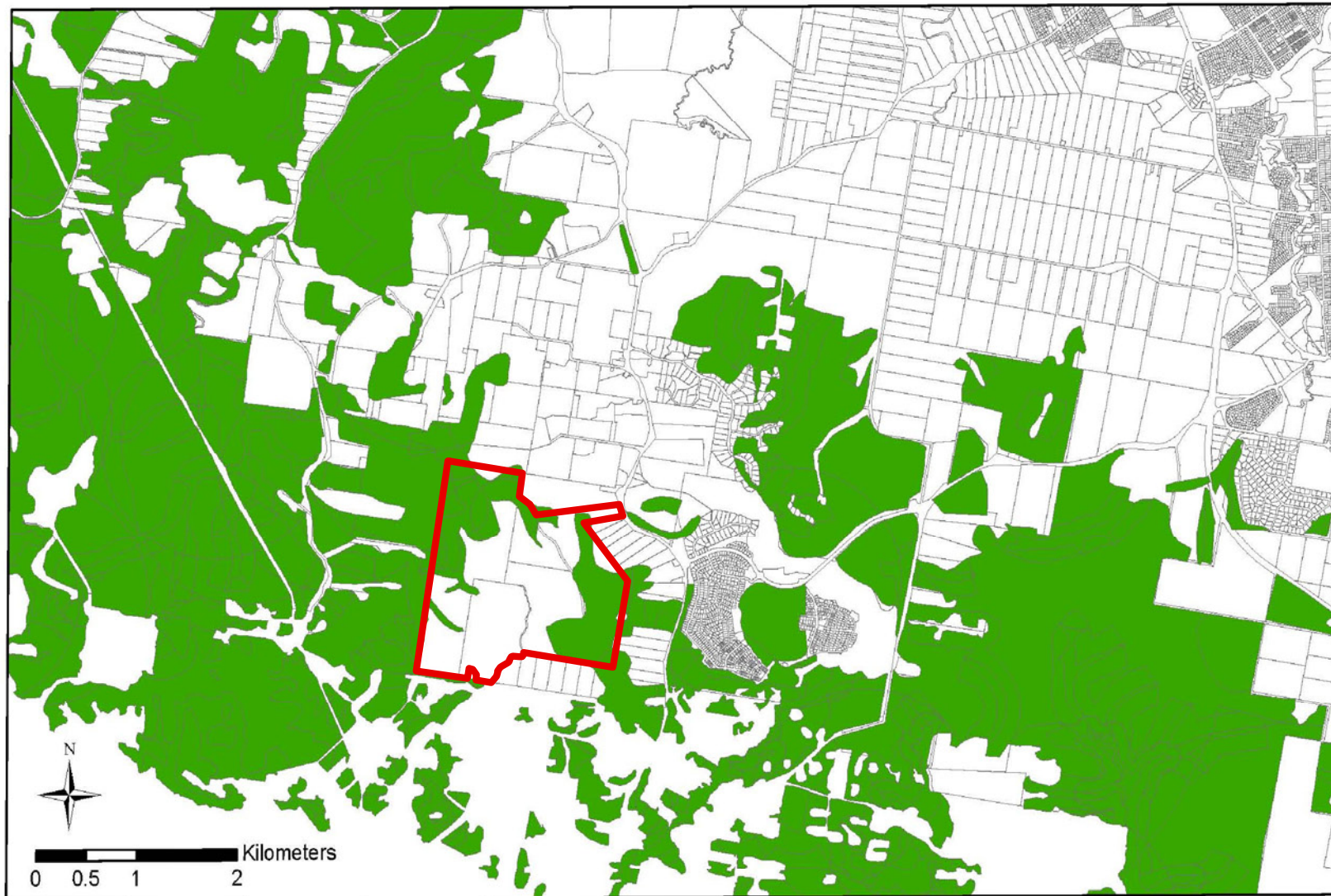
The northern portion of the property supports old growth forest in steep gullies. It is proposed that this area, with linkages to surrounding habitat, be maintained and managed for fauna habitat conservation. The proposed access road between the existing quarry and the proposed extension is located immediately south of this area. The road would require treatment to provide increased safe movement options for the security of crossing fauna. There would be no movement of vehicles along this road during night-time hours; however the topography of the location is such that the construction of an elevated portion (or portions) of the road in the form of a bridging structure, along with the installation of guide fencing, could ensure safe crossing opportunities. Where any steep cuttings are formed, infrastructure such as timber poles should be laid against the cuttings to facilitate fauna movement.

Further south of the proposed access road, it is intended to install a conveyor to transport quarried material from the proposed extension area to the existing plant within the existing quarry area. It is understood that the

conveyor system will be raised above the ground and operated during daylight hours only. Under these circumstances its presence is not expected to represent a barrier to fauna movement.



The facilitation of north-south fauna movement through the property is also important and needs to be considered in project planning. The maintenance and enhancement of habitat outside of the proposed extraction area and the provision of safe movement opportunities for the full range of species within habitats that adjoin the proposed activities is required. In particular, security fencing within fauna habitat and fauna corridor should be such that all species present are able to move freely; however exclusion fencing should be erected in areas where fauna may be injured by the proposed operations or final landform.

Adequate fencing for fauna exclusion rather than facilitation will need to be designed such that it excludes all species, including ground-dwelling species such as the Echidna. This will require the insertion of solid panelling at the base of the fencing and below ground on the habitat side of the fence. It should also have another section of solid panelling at the top of the fence, at least 60cm in width to prevent Koalas and other arboreal species from gaining purchase. Vegetation must be removed to a distance of 3m on the habitat side of the exclusion fence to prevent arboreal species jumping to the top of the fence. A fauna exclusion fencing design currently in use by Brisbane City Council is attached as **Appendix 7**.



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Legend

-  Site Boundary
-  Regional Corridor



**Figure 3.1
Wildlife Corridors
(BPA Mapping v.1.3)**

Terrestrial Fauna Assessment
 Mount Cotton Quarry
 October 2010



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Image courtesy of Google Earth Pro 2006

0 750 1,500 Meters



Figure 3.2 Fauna Movement Corridors



Terrestrial Fauna Assessment
 Mount Cotton Quarry
 October 2010

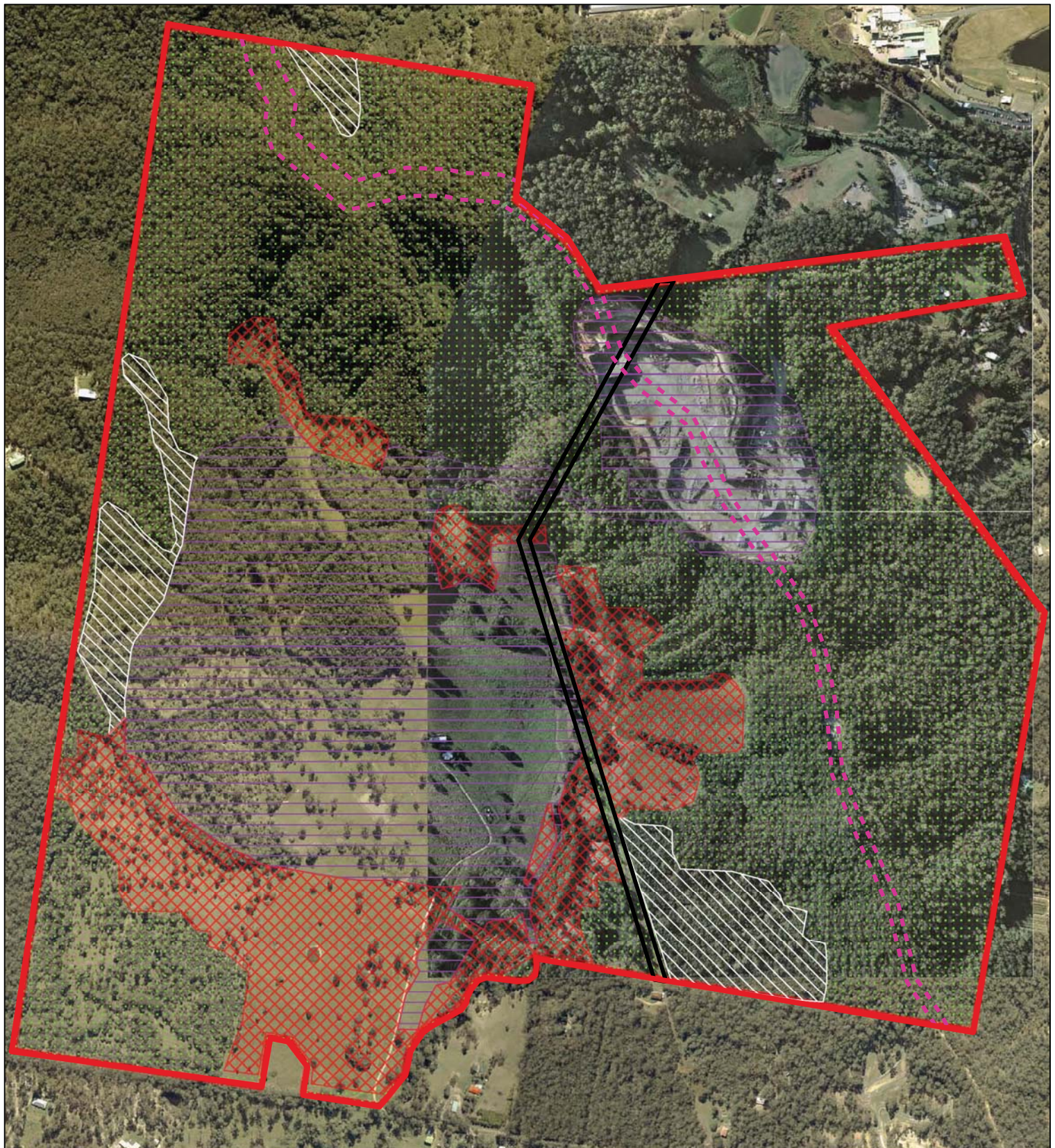
4.0 FAUNA MANAGEMENT UNITS AND FAUNA MANAGEMENT PLAN OF INTENT

Fauna Management Units refer to all areas on the subject site that are not subject to quarrying activities. **Figure 4.1** shows the three units that have been identified:

- Koala Offset Sites – currently largely pasture lands that will be subject to intensive Koala habitat restoration;
- Vegetation Offset Sites – currently areas of non-remnant vegetation that will be managed to achieve remnant status; and
- Buffer Areas – includes all remaining lands on the subject site (includes remnant and non-remnant vegetated areas).

Each Fauna Management Unit will be included in monitoring programs and managed to provide wildlife habitat. Each unit has prescribed management intents to offset habitat losses from proposed quarry activities and to improve fauna movement opportunities through the subject site. Separate reports (BAAM 2010a,b,c) provide more detail on the specific management of these areas.

Table 4.1 sets out a Fauna Management Plan of Intent, which should be incorporated into the SEMP. BAAM does not currently have sufficient detail of the proposed quarry extension to allocate responsibilities or include timelines for recommended actions. These should be incorporated into the final Fauna Management Plan.



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 Image courtesy of Google Earth Pro 2010

Legend

- Site Boundary
- Road Reserve
- Power Easement

Fauna Management Units:

- Buffer Areas
- Koala Offset Sites
- Vegetation Offset Areas
- Rehabilitation Areas

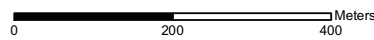


Figure 4.1
Fauna Management Units

Terrestrial Fauna Assessment
 Mount Cotton Quarry
 October 2010



Table 4.1. Fauna Management Plan of Intent

Fauna Value to be Managed	Management Objective	Management Actions
All fauna habitat on site that is a Fauna Management Units (refer to Figure 4.1).	Ensure the long-term viability of the existing habitat and safe movement opportunities, particularly for species of special conservation significance.	<ul style="list-style-type: none"> • Monitoring and management of introduced pest species, particularly cats and foxes. Trap 6-monthly and examine habitat to determine evidence and levels of pest species presence. Undertake baiting programs where necessary in conjunction with any local feral animal control plans. • Monitoring and management of declared and environmental weed species, with any poisoning to be carried out under advice from the Queensland Primary Industries and Fisheries. • Monitoring habitat condition as required - qualitative assessment of habitat quality and threatening processes. Threatening processes to be subsequently addressed through actions to be incorporated into the Fauna Management Plan. • Monitoring of the status of the species of special conservation significance over time in the form of annual targeted surveys (specifically Koala, Powerful Owl, Glossy Black-cockatoo, Grey Goshawk, Black-breasted Button-quail, Tusked Frog, Grey-headed Flying-fox, Short-beaked Echidna and migratory birds). Any additional species of special conservation significance under State or Commonwealth legislation that is recorded during these monitoring periods should be subject to further investigation and assessment, with the resulting management recommendations to be incorporated into the Fauna Management Plan. • Where habitat adjoins quarry works or infrastructure, provide fencing that excludes all fauna from potential danger (e.g. the edges of the quarry pit). • Where person-proof security fencing is required to prevent access to the property, provide fencing that allows fauna passage. • All actions undertaken, including monitoring and corrective actions, to be recorded for reporting purposes.
Habitat established or enhanced through rehabilitation of local providence species, specifically species that are known high-preference Koala food trees in the local area (refer to BAAM 2010a) in association with local mid- and	Ensure the long-term viability of rehabilitated and enhanced habitat, particularly for species of special conservation significance.	<ul style="list-style-type: none"> • Establishment of a Rehabilitation Plan that should be timed to offset habitat loss resulting from the extension activities. Commencement of rehabilitation should be prior to the commencement of extension activities to ensure that the initial stages of rehabilitation are underway and are achieving goals established in the Rehabilitation Plan. • Installation of nest boxes if required for compensation of any habitat trees lost in association with the extension project. Ongoing monitoring is recommended, with data to include identification of species using the nest boxes and the rate of occupancy. • Monitoring and management of introduced pest species, particularly cats and foxes. Trapping and habitat surveys as required to determine evidence and levels of pest species presence. Undertake baiting programs where necessary under advice from Queensland Primary Industries and Fisheries. • Monitoring and management of declared and environmental weed species, with any poisoning to be carried out under advice from Queensland Primary Industries and Fisheries. • Monitoring habitat condition as required - qualitative assessment of habitat quality and threatening

Fauna Value to be Managed	Management Objective	Management Actions
<p>ground-storey species. Refer to Figure 4.1.</p> <p>A comprehensive Rehabilitation Plan will need to be prepared for these areas.</p>		<p>processes. Should be coupled with vegetation survey with qualitative measures of rehabilitation progress. Threatening processes to be subsequently addressed through actions to be incorporated into the final Fauna Management Plan. Any requirements to improve performance and outcomes in the rehabilitated areas to be subsequently addressed through actions to be incorporated into the Rehabilitation Program.</p> <ul style="list-style-type: none"> • Monitoring of the status of the species of special conservation significance over time in the form of regular targeted surveys (specifically Koala, Powerful Owl, Glossy Black-cockatoo, Grey Goshawk, Black-breasted Button-quail, Tusked Frog, Grey-headed Flying-fox, Short-beaked Echidna and migratory birds). Any additional species of special conservation significance under State or Commonwealth legislation that is recorded during these monitoring periods should be subject to further investigation and assessment, with the resulting management recommendations to be incorporated into the final Fauna Management Plan. • Where reinstated habitat adjoins quarry works or infrastructure, provide fencing that excludes all fauna from danger (e.g. the edges of the quarry pit). • Where person-proof security fencing is required to prevent access to the property, provide fencing that allows fauna passage. • All actions undertaken, including monitoring and corrective actions, to be recorded for reporting purposes.
<p>Habitat in Fauna Management Units that is affected by quarry infrastructure (refer to Figure 4.1).</p>	<p>Ensure that all quarry extension development and operations are carried out in such a way as to avoid or minimise negative impacts on fauna habitat.</p>	<ul style="list-style-type: none"> • All personnel and contractors on site are to be aware of the fauna management objectives and their responsibilities with regard to fauna protection. • Any clearing of habitat in association with the extension will be carried out in the presence of a professional fauna “spotter/catcher” to ensure that injuries and deaths to fauna are minimised. • Minimise dust generation through standard dust suppression practices. • Restrict vehicle movement and speed limits within quarry boundaries to the minimum practicable. • Provide ‘Fauna crossing’ signage in areas where fauna are most commonly sighted on access/haul roads. • Provide safe fauna crossing opportunities for the section of haul road between the existing quarry and the extension area. • Conveyor system to be raised above the ground and operated during daylight hours only. • Use cleared vegetative material to enhance habitat values of the rehabilitation areas.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

The majority of the species recorded from the site during the 2004 survey period and subsequent site visits are currently listed as 'Least Concern Wildlife' in Queensland. However, several species known or considered to potentially occur in the area are recognised as 'species of special conservation significance' (or 'at-risk' species) under the NC Act and/or the EPBC Act. The presence of Koala, listed under State legislation as 'Vulnerable' within the south-eastern bioregion, is particularly significant (see BAAM 2010a for more detail). The presence of migratory birds, of the Powerful Owl and Short-beaked Echidna, and the potential presence of Grey-headed Flying Fox, Glossy Black-Cockatoo, Tusked Frog, Grey Goshawk, Black-breasted Button-Quail and a further seven migratory birds, is also significant.

To minimise the potential impacts of the proposal on the long-term viability of fauna habitat on the subject site, it should be ensured that habitat proposed to be retained and/or rehabilitated outside of the extraction zone is sufficient to provide secure resources for the species present as well as providing essential corridors and movement opportunities for those species. It should also be noted that the larger trees provide a range of potential roosting and nesting habitats for insectivorous bats, arboreal mammals and several species of birds, and that these should be retained where they occur outside the area of the proposed quarry extension. Any loss of these "habitat trees" resulting from the proposed quarry extension should be compensated through the provision of nest boxes within appropriate retained habitat areas, although these will be limited in number as the proposed extension area occurs mostly within cleared areas or regrowth vegetation.

It is imperative that the range of existing habitat values on the property are maintained and enhanced to ensure the proposal does not have a detrimental impact on a safe future for those species present. The habitat areas outside of the quarry extension location should be exempt from disturbance. It is understood that these areas would be designated as Fauna Management Units, with a commitment to manage these lands for fauna habitat conservation purposes.

The following conclusions and recommendations are made with regard to the species of

conservation significance known or likely to occur on the subject site.

5.2 KOALA

With appropriate rehabilitation and management thereof, the value of rehabilitation areas as Koala habitat has the potential to considerably outweigh the value of the current grassland.

Continued use of the subject site by Koalas, including the rehabilitated areas, should be monitored as part of the Fauna Management Plan for the extension project. Koala habitat tree offset and facilitation of Koala movement opportunities are further discussed in the Integrated Koala Habitat Report (BAAM 2010a).

The use of a spotter-catcher will be necessary during all clearing activities for the life of the project to protect individual animals.

5.3 MIGRATORY BIRDS

The areas retained outside of the proposed extension area contain and will provide ongoing habitat for these species on the subject site. The extension proposal is not expected to detract from a safe future for any known or likely Migratory species.

5.4 GREY-HEADED FLYING FOX

The proposed quarry extension is not expected to have any significant impact on the species or threaten the security of the species in the area.

Although there are no colonies or camps within the subject site, the Grey-headed Flying-fox is expected to occur seasonally and particularly in response to localised flowering events. If the currently cleared southern portions of the subject site are subjected to regeneration and habitat enhancement, particularly with eucalypt species, a net increase in potential food resources for this species can be achieved.

5.5 POWERFUL OWL

The Powerful Owl is considered to visit the site at least occasionally, if not frequently, for feeding and there is potential for roosting and/or breeding to occur. Further studies would be required to determine the actual significance of the subject site for the species.

As the proposed project does not require the removal of hollow-bearing trees suitable for this species, and it is intended to establish Eucalypt woodland habitat in what are currently cleared pasturelands, habitat conditions for the species are likely to improve from the existing situation over the life of the project as rehabilitation areas mature.

5.6 TUSKED FROG

Although not detected during the survey, Tusked Frog is expected to be present on the site. On the study site, there are portions of waterways and associated vegetation that could provide ideal habitat for the species. As the timing of the field investigation was not ideal for recording the presence of the species; it is recommended that the site be visited in summer rainfall conditions to confirm or discount the presence of the species for future habitat management purposes.

However, the distribution of the Tusked Frog on the subject site is expected to be within the more permanent and natural portions of waterways in the north and east, which are unaffected by the proposal. It is unlikely the species would occur within the proposed extraction area.

Overall, with an understanding of the distribution of the species on the subject site and with the proposed habitat protection in the northern portion of the property, the extension proposal is not expected to have a negative impact on the long-term security of the species on the subject site.

5.7 SHORT-BEAKED ECHIDNA

The retained and rehabilitated vegetation will provide ongoing habitat for this species and the quarry extension proposal is not expected to detract from a safe future for the species. However, the use of a spotter-catcher is also necessary during any on site clearing to protect individual animals.

5.8 GREY GOSHAWK

The retained and rehabilitated vegetation will provide ongoing habitat for this species and the quarry extension proposal is not expected to detract from a safe future for the species.

5.9 BLACK-BREASTED BUTTON-QUAIL

The subject site holds little habitat values for the Black-breasted Button-Quail. If present on the subject site, the species would be restricted to areas outside of the proposed extension and no impacts are expected. The retained and rehabilitated vegetation will provide ongoing habitat for this species and the quarry extension proposal is not expected to detract from a safe future for the species.

5.10 MANAGEMENT OF HABITAT AND FAUNA MOVEMENT

The subject site, situated in close proximity to a National Park and identified as holding significant Koala habitat values under the *South East Queensland Koala Conservation State Planning Regulatory Provisions* (May 2010), supports strategically important habitat for Koalas. The long-term maintenance of Koala habitat and safe movement opportunities for this species is implicit and will benefit other local fauna simultaneously. See BAAM 2010a for further detail.

There are opportunities for improvement of local and regional habitat linkage within the subject site outside of the proposed extension area. Rehabilitation could significantly contribute to available habitat, particularly in the pastoral lands across the southern portion of the subject land. A key ingredient in the long term success and viability of linkages that are maintained and enhanced on the property will be maintenance of habitat and linkages on surrounding lands.

It is recommended that the northern portion of the property, which supports significant old growth forest, be maintained and managed for fauna habitat conservation, with linkages to surrounding habitat.

The access road would require treatment to ensure the security of crossing fauna. No movement of vehicles should occur along this road during night-time hours. Should a bridging structure be considered, guide fencing could be installed to ensure the provision of safe crossing opportunities.

Timber poles are to be laid against the cuttings of any steep cuttings to facilitate fauna movement.

It is understood that the conveyor system will be raised above the ground and operated during daylight hours, which is not expected to represent a barrier to fauna movement.

Areas identified as Fauna Management Units (**Figure 4.1**), which incorporate existing fauna habitats and areas intended to be rehabilitated or enhanced to offset habitat losses from quarry activities, will be managed as wildlife habitat with a focus on improving fauna movement opportunities through the subject site.

The recommended actions of the Fauna Management Plan of Intent (**Table 4.1**) should be incorporated into the Site Environmental Management Plan. In summary, the management objectives of the Fauna Management Plan of Intent are to ensure the long-term viability of existing, rehabilitated and enhanced habitats and fauna movements, and to ensure development and operations of the quarry extension are carried out in such a way that negative impacts on fauna habitat by are avoided or minimised.

With appropriate Fauna Management Plan, Rehabilitation Plan and sufficient resources and expertise to ensure that management intents are achieved, long-term habitat functionality and connectivity can be maintained and in some areas, improved.

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APPENDIX 1
FAUNA SURVEY TECHNIQUES

FAUNA TRAPPING TECHNIQUES

The general survey approach was to visit and assess representative faunal habitats over the study area, recording the fauna species by observations of actual animals, recognition of characteristic vocalisations, and/or identification of animal signs. This involved the following specific techniques:

BOX TRAPS

At each systematic trapping site, over four nights during the survey period, 23 Elliott traps (20 type A and three type B) were placed on the ground 5-8 m apart using a variety of baits (rolled oats, peanut butter, oil and vanilla +/- salami). Trap placement was influenced by vegetation diversity, the size and shape of the vegetation patches and by naturally occurring features such as logs, rock outcrops, tree bases and clumping vegetation. These traps were cleared early morning and reset in late afternoon in accordance with animal ethics requirements.

PITFALL TRAPS

Pitfall lines were established at each trapping site. Four pitfall traps (20 or 10 litre containers, depending on substrate) were buried flush to the ground surface and connected by a 20 m drift fence. These traps were cleared early morning late afternoon in accordance with animal ethics requirements.

DIURNAL SEARCHES

Active diurnal searches were undertaken that involved intensive investigation of ground layer (under logs, rocks and leaf litter), low vegetation (under bark and in tree stumps) and rock crevices for all amphibians, reptiles, bats and animal signs (e.g. scats, bird feeding remnants, remains and tracks). Searches were conducted in conjunction with the morning bird censuses and during the warmer parts of the day when reptile activity was likely to be at its peak.

DIURNAL BIRD CENSUS

Birds were surveyed at each survey site for at least one hour in the morning and afternoon, with incidental observations recorded during other survey activities. Birds were identified from either direct observation or by their calls.

NOCTURNAL SURVEYS

A combination of high-powered spotlights and head torches were used to sample nocturnal mammals (flying, arboreal and terrestrial), birds (owls and nightjars), reptiles and frogs across the study area.

Where deemed necessary during the spotlighting sessions, species-specific detection was assisted by the use of call playback surveys undertaken for nocturnal birds and nocturnal mammals.

An ANABAT II ultrasonic bat call detection unit and associated ZCAIM interface module were also used to capture the calls of insectivorous bat species on each night of the survey within representative habitat types. The use of the ZCAIM unit allows the ANABAT II detector to be left unattended throughout the night, thereby ensuring that peak activity periods for bats are recorded each night.

TARGETED SEARCHES

During the survey period, special effort was made to detect the presence of species of special conservation significance obtained from the database searches.

INCIDENTAL (OPPORTUNISTIC) RECORDS

During the survey period, fauna observations were continuous and species records were obtained outside of the systematic methodology of the survey.

Scat and Pellet Searches

Both predator and non-predator scats were sought during all searches. Only those samples definitely identified were included in the survey results.

Koala-Specific Investigation

Specific search effort was made to locate the presence of Koalas or evidence of their occurrence on the subject lands and the local area.

APPENDIX 2
QUEENSLAND MUSEUM DATABASE SEARCH
RESULTS (2004)

Queensland Museum Database search results

Results of a search for the area of coordinates 27°36'-27°40'S and 153°11'-153°15'E.
Date of the search: 2004

Group	Family	Genus	Species
Birds	ACCIPITRIDAE	<i>Elanus</i>	<i>axillaris</i>
Birds	APODIDAE	<i>Hirundapus</i>	<i>caudacuta</i>
Birds	LORIIDAE	<i>Trichoglossus</i>	<i>chlorolepidotis</i>
Birds	PODARGIDAE	<i>Podargus</i>	<i>strigoides</i>
Birds	RALLIDAE	<i>Amaurornis</i>	<i>wiedii</i>
Frogs	BUFONIDAE	<i>Rhinella</i>	<i>marina</i>
Frogs	MYOBATRACHIDAE	<i>Limnodynastes</i>	<i>peronii</i>
Frogs	MYOBATRACHIDAE	<i>Mixophyes</i>	<i>fasciolatus</i>
Frogs	MYOBATRACHIDAE	<i>Pseudophryne</i>	<i>raveni</i>
Mammals	DASYURIDAE	<i>Sminthopsis</i>	<i>murina</i>
Mammals	MURIDAE	<i>Mus</i>	<i>musculus</i>
Mammals	PERAMELIDAE	<i>Isoodon</i>	<i>macrourus</i>
Mammals	PERAMELIDAE	<i>Perameles</i>	<i>nasuta</i>
Mammals	PETAURIDAE	<i>Petaurus</i>	<i>norfolcensis</i>
Mammals	PHASCOLARCTIDAE	<i>Phascolarctos</i>	<i>cinereus</i>
Reptiles	AGAMIDAE	<i>Chlamydosaurus</i>	<i>kingii</i>
Reptiles	AGAMIDAE	<i>Pogona</i>	<i>barbata</i>
Reptiles	COLUBRIDAE	<i>Boiga</i>	<i>irregularis</i>
Reptiles	ELAPIDAE	<i>Cacophis</i>	<i>squamulosus</i>
Reptiles	ELAPIDAE	<i>Cryptophis</i>	<i>nigrescens</i>
Reptiles	PYGOPODIDAE	<i>Pygopus</i>	<i>lepidopodus</i>
Reptiles	SCINCIDAE	<i>Calyptotis</i>	<i>scutirostrum</i>
Reptiles	SCINCIDAE	<i>Lygisaurus</i>	<i>foliorum</i>
Reptiles	SCINCIDAE	<i>Cyclodomorphus</i>	<i>gerrardii</i>
Reptiles	TYPHLOPIDAE	<i>Ramphotyphlops</i>	<i>proximus</i>
Reptiles	TYPHLOPIDAE	<i>Ramphotyphlops</i>	<i>wiedii</i>

APPENDIX 3
DERM WILDLIFE ONLINE DATABASE SEARCH
RESULTS (January 2010)



Queensland Government

Environmental Protection Agency Queensland Parks and Wildlife Service

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Status: All
Records: All
Date: All
Latitude: 27.6385
Longitude: 153.2243
Distance: 5
Email: jo@biodiversity.tv
Date submitted: Friday 08 Jan 2010 13:31:37
Date extracted: Friday 08 Jan 2010 13:46:02

The number of records retrieved = 1015

Disclaimer

As the EPA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through independent means as to the accuracy and completeness of this information.

No statements, representations or warranties are made about the accuracy or completeness of this information. The State of Queensland disclaims all responsibility for this information and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufo	<i>Rhinella marina</i>	cane toad	Y			23
animals	amphibians	Hylidae	<i>Litoria fallax</i>	eastern sedgefrog		C		19
animals	amphibians	Hylidae	<i>Litoria nasuta</i>	striped rocketfrog		C		6
animals	amphibians	Hylidae	<i>Litoria dentata</i>	bleating treefrog		C		3
animals	amphibians	Hylidae	<i>Litoria peronii</i>	emerald spotted treefrog		C		1
animals	amphibians	Hylidae	<i>Litoria tyleri</i>	southern laughing treefrog		C		5
animals	amphibians	Hylidae	<i>Litoria rubella</i>	ruddy treefrog		C		3
animals	amphibians	Hylidae	<i>Litoria gracilenta</i>	graceful treefrog		C		4
animals	amphibians	Hylidae	<i>Litoria latopalmata</i>	broad palmed rocketfrog		C		3
animals	amphibians	Hylidae	<i>Litoria caerulea</i>	common green treefrog		C		9
animals	amphibians	Limnodynastidae	<i>Adelotus brevis</i>	tusked frog		V		8
animals	amphibians	Limnodynastidae	<i>Limnodynastes peronii</i>	striped marshfrog		C		10
animals	amphibians	Limnodynastidae	<i>Limnodynastes terraereginae</i>	scarlet sided pobblebonk		C		3
animals	amphibians	Limnodynastidae	<i>Platyplectrum ornatum</i>	ornate burrowing frog		C		5
animals	amphibians	Myobatrachidae	<i>Crinia tinnula</i>	wallum froglet		V		1
animals	amphibians	Myobatrachidae	<i>Pseudophryne raveni</i>	copper backed broodfrog		C		11
animals	amphibians	Myobatrachidae	<i>Crinia signifera</i>	clicking froglet		C		5
animals	amphibians	Myobatrachidae	<i>Crinia parinsignifera</i>	beeping froglet		C		5
animals	amphibians	Myobatrachidae	<i>Pseudophryne coriacea</i>	red backed broodfrog		C		5
animals	amphibians	Myobatrachidae	<i>Mixophyes fasciolatus</i>	great barred frog		C		9
animals	birds	Acanthizidae	<i>Acanthiza nana</i>	yellow thornbill		C		5
animals	birds	Acanthizidae	<i>Gerygone mouki</i>	brown gerygone		C		4
animals	birds	Acanthizidae	<i>Acanthiza lineata</i>	striated thornbill		C		3
animals	birds	Acanthizidae	<i>Gerygone levigaster</i>	mangrove gerygone		C		15
animals	birds	Acanthizidae	<i>Gerygone albogularis</i>	white-throated gerygone		C		65
animals	birds	Acanthizidae	<i>Smicrornis brevirostris</i>	weebill		C		14
animals	birds	Acanthizidae	<i>Sericornis magnirostra</i>	large-billed scrubwren		C		3
animals	birds	Acanthizidae	<i>Chthonicola sagittata</i>	speckled warbler		C		5
animals	birds	Acanthizidae	<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill		C		9
animals	birds	Acanthizidae	<i>Sericornis frontalis</i>	white-browed scrubwren		C		35
animals	birds	Acanthizidae	<i>Acanthiza reguloides</i>	buff-rumped thornbill		C		10
animals	birds	Acanthizidae	<i>Acanthiza pusilla</i>	brown thornbill		C		55
animals	birds	Accipitridae	<i>Aquila audax</i>	wedge-tailed eagle		C		18
animals	birds	Accipitridae	<i>Accipiter novaehollandiae</i>	grey goshawk		R		6
animals	birds	Accipitridae	<i>Accipiter cirrocephalus</i>	collared sparrowhawk		C		7
animals	birds	Accipitridae	<i>Hieraaetus morphnoides</i>	little eagle		C		9
animals	birds	Accipitridae	<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle		C		11
animals	birds	Accipitridae	<i>Haliastur sphenurus</i>	whistling kite		C		47
animals	birds	Accipitridae	<i>Aviceda subcristata</i>	Pacific baza		C		14
animals	birds	Accipitridae	<i>Accipiter fasciatus</i>	brown goshawk		C		16
animals	birds	Accipitridae	<i>Lophoictinia isura</i>	square-tailed kite		R		5
animals	birds	Accipitridae	<i>Circus approximans</i>	swamp harrier		C		3
animals	birds	Accipitridae	<i>Pandion cristatus</i>	eastern osprey		C		8
animals	birds	Accipitridae	<i>Elanus axillaris</i>	black-shouldered kite		C		16
animals	birds	Accipitridae	<i>Circus assimilis</i>	spotted harrier		C		1
animals	birds	Accipitridae	<i>Milvus migrans</i>	black kite		C		2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Accipitridae	<i>Haliastur indus</i>	brahminy kite		C		15
animals	birds	Acrocephalidae	<i>Acrocephalus australis</i>	Australian reed-warbler		C		6
animals	birds	Aegothelidae	<i>Aegotheles cristatus</i>	Australian owl-nightjar		C		15
animals	birds	Alcedinidae	<i>Ceyx azureus</i>	azure kingfisher		C		12
animals	birds	Anatidae	<i>Anas castanea</i>	chestnut teal		C		24
animals	birds	Anatidae	<i>Anas gracilis</i>	grey teal		C		29
animals	birds	Anatidae	<i>Cygnus atratus</i>	black swan		C		11
animals	birds	Anatidae	<i>Chenonetta jubata</i>	Australian wood duck		C		73
animals	birds	Anatidae	<i>Dendrocygna eytoni</i>	plumed whistling-duck		C		3
animals	birds	Anatidae	<i>Malacorhynchus membranaceus</i>	pink-eared duck		C		2
animals	birds	Anatidae	<i>Dendrocygna arcuata</i>	wandering whistling-duck		C		21
animals	birds	Anatidae	<i>Anas platyrhynchos</i>	northern mallard	Y			1
animals	birds	Anatidae	<i>Anas superciliosa</i>	Pacific black duck		C		72
animals	birds	Anatidae	<i>Aythya australis</i>	hardhead		C		14
animals	birds	Anatidae	<i>Anas rhynchotis</i>	Australasian shoveler		C		2
animals	birds	Anhingidae	<i>Anhinga novaehollandiae</i>	Australasian darter		C		23
animals	birds	Anseranatidae	<i>Anseranas semipalmata</i>	magpie goose		C		20
animals	birds	Apodidae	<i>Apus pacificus</i>	fork-tailed swift		C		2
animals	birds	Apodidae	<i>Hirundapus caudacutus</i>	white-throated needletail		C		11
animals	birds	Ardeidae	<i>Ardea ibis</i>	cattle egret		C		64
animals	birds	Ardeidae	<i>Ardea intermedia</i>	intermediate egret		C		46
animals	birds	Ardeidae	<i>Ardea pacifica</i>	white-necked heron		C		12
animals	birds	Ardeidae	<i>Ardea modesta</i>	eastern great egret		C		21
animals	birds	Ardeidae	<i>Egretta sp.</i>					2
animals	birds	Ardeidae	<i>Egretta garzetta</i>	little egret		C		18
animals	birds	Ardeidae	<i>Egretta novaehollandiae</i>	white-faced heron		C		48
animals	birds	Ardeidae	<i>Nycticorax caledonicus</i>	Nankeen night-heron		C		6
animals	birds	Ardeidae	<i>Butorides striata</i>	striated heron		C		7
animals	birds	Artamidae	<i>Cracticus tibicen</i>	Australian magpie		C		206
animals	birds	Artamidae	<i>Artamus personatus</i>	masked woodswallow		C		1
animals	birds	Artamidae	<i>Strepera graculina</i>	pieb currawong		C		18
animals	birds	Artamidae	<i>Artamus cyanopterus</i>	dusky woodswallow		C		3
animals	birds	Artamidae	<i>Artamus leucorhynchus</i>	white-breasted woodswallow		C		15
animals	birds	Artamidae	<i>Strepera graculina graculina</i>	pieb currawong (eastern Australia)		C		1
animals	birds	Artamidae	<i>Cracticus nigrogularis</i>	pieb butcherbird		C		155
animals	birds	Artamidae	<i>Cracticus torquatus</i>	grey butcherbird		C		101
animals	birds	Cacatuidae	<i>Cacatua galerita</i>	sulphur-crested cockatoo		C		54
animals	birds	Cacatuidae	<i>Calyptorhynchus banksii</i>	red-tailed black-cockatoo		C		1
animals	birds	Cacatuidae	<i>Calyptorhynchus lathami</i>	glossy black-cockatoo		V		11
animals	birds	Cacatuidae	<i>Calyptorhynchus lathami lathami</i>	glossy black-cockatoo (eastern)		V		1
animals	birds	Cacatuidae	<i>Calyptorhynchus funereus</i>	yellow-tailed black-cockatoo		C		3
animals	birds	Cacatuidae	<i>Cacatua sanguinea</i>	little corella		C		4
animals	birds	Cacatuidae	<i>Eolophus roseicapillus</i>	galah		C		41
animals	birds	Campephagidae	<i>Lalage leucomela</i>	varied triller		C		17
animals	birds	Campephagidae	<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		C		149
animals	birds	Campephagidae	<i>Coracina tenuirostris</i>	cicadabird		C		36

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Campephagidae	<i>Coracina papuensis</i>	white-bellied cuckoo-shrike		C		5
animals	birds	Charadriidae	<i>Vanellus miles</i>	masked lapwing		C		15
animals	birds	Charadriidae	<i>Vanellus miles novaehollandiae</i>	masked lapwing (southern subspecies)		C		70
animals	birds	Charadriidae	<i>Charadrius ruficapillus</i>	red-capped plover		C		2
animals	birds	Charadriidae	<i>Pluvialis fulva</i>	Pacific golden plover		C		1
animals	birds	Charadriidae	<i>Erythronyx cinctus</i>	red-kneed dotterel		C		7
animals	birds	Charadriidae	<i>Euseyonis melanops</i>	black-fronted dotterel		C		21
animals	birds	Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	black-necked stork		R		10
animals	birds	Cisticolidae	<i>Cisticola exilis</i>	golden-headed cisticola		C		33
animals	birds	Climacteridae	<i>Climacteris affinis</i>	white-browed treecreeper		C		2
animals	birds	Climacteridae	<i>Climacteris picumnus</i>	brown treecreeper		C		6
animals	birds	Climacteridae	<i>Cormobates leucophaea metastasis</i>	white-throated treecreeper (southern)		C		57
animals	birds	Climacteridae	<i>Cormobates leucophaea</i>	white-throated treecreeper		C		23
animals	birds	Columbidae	<i>Columba livia</i>	rock dove	Y			3
animals	birds	Columbidae	<i>Columba leucomela</i>	white-headed pigeon		C		4
animals	birds	Columbidae	<i>Ocyphaps lophotes</i>	crested pigeon		C		89
animals	birds	Columbidae	<i>Chalcophaps indica</i>	emerald dove		C		4
animals	birds	Columbidae	<i>Leucosarcia picata</i>	wonga pigeon		C		10
animals	birds	Columbidae	<i>Macropygia amboinensis</i>	brown cuckoo-dove		C		25
animals	birds	Columbidae	<i>Streptopelia chinensis</i>	spotted dove	Y			63
animals	birds	Columbidae	<i>Ptilinopus magnificus</i>	wompoo fruit-dove		C		3
animals	birds	Columbidae	<i>Geopelia humeralis</i>	bar-shouldered dove		C		74
animals	birds	Columbidae	<i>Phaps chalcoptera</i>	common bronzewing		C		14
animals	birds	Columbidae	<i>Geopelia cuneata</i>	diamond dove		C		1
animals	birds	Columbidae	<i>Geopelia striata</i>	peaceful dove		C		59
animals	birds	Coraciidae	<i>Eurystomus orientalis</i>	dollarbird		C		39/1
animals	birds	Corvidae	<i>Corvus orru</i>	Torresian crow		C		143
animals	birds	Cuculidae	<i>Cuculus optatus</i>	oriental cuckoo		C		5
animals	birds	Cuculidae	<i>Chalcites minutillius minutillius</i>	little bronze-cuckoo		C		6
animals	birds	Cuculidae	<i>Scythrops novaehollandiae</i>	channel-billed cuckoo		C		17
animals	birds	Cuculidae	<i>Cacomantis flabelliformis</i>	fan-tailed cuckoo		C		65
animals	birds	Cuculidae	<i>Centropus phasianinus</i>	pheasant coucal		C		32
animals	birds	Cuculidae	<i>Chalcites basalis</i>	Horsfield's bronze-cuckoo		C		4
animals	birds	Cuculidae	<i>Chalcites lucidus</i>	shining bronze-cuckoo		C		32
animals	birds	Cuculidae	<i>Cacomantis pallidus</i>	pallid cuckoo		C		6
animals	birds	Cuculidae	<i>Cacomantis variolosus</i>	brush cuckoo		C		21
animals	birds	Cuculidae	<i>Eudynamys orientalis</i>	eastern koel		C		30
animals	birds	Dicruridae	<i>Dicrurus bracteatus</i>	spangled drongo		C		59
animals	birds	Dicruridae	<i>Dicrurus bracteatus bracteatus</i>	spangled drongo (eastern Australia)		C		2
animals	birds	Diomedeidae	<i>Diomedea exulans</i>	wandering albatross	V		V	1
animals	birds	Estrildidae	<i>Neochmia temporalis</i>	red-browed finch		C		108
animals	birds	Estrildidae	<i>Taeniopygia guttata</i>	zebra finch		C		1
animals	birds	Estrildidae	<i>Taeniopygia bichenovii</i>	double-barred finch		C		200
animals	birds	Estrildidae	<i>Lonchura castaneothorax</i>	chestnut-breasted mannikin		C		20
animals	birds	Eurostopodidae	<i>Eurostopodus mystacalis</i>	white-throated nightjar		C		11
animals	birds	Falconidae	<i>Falco berigora</i>	brown falcon		C		7

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Falconidae	<i>Falco peregrinus</i>	peregrine falcon		C		2
animals	birds	Falconidae	<i>Falco cenchroides</i>	nankeen kestrel		C		6
animals	birds	Falconidae	<i>Falco longipennis</i>	Australian hobby		C		4
animals	birds	Halcyonidae	<i>Dacelo novaeguineae</i>	laughing kookaburra		C		203
animals	birds	Halcyonidae	<i>Todiramphus chloris</i>	collared kingfisher		C		2
animals	birds	Halcyonidae	<i>Todiramphus sanctus</i>	sacred kingfisher		C		284
animals	birds	Halcyonidae	<i>Todiramphus macleayii</i>	forest kingfisher		C		86
animals	birds	Hirundinidae	<i>Hirundo neoxena</i>	welcome swallow		C		73
animals	birds	Hirundinidae	<i>Petrochelidon nigricans</i>	tree martin		C		16
animals	birds	Hirundinidae	<i>Petrochelidon ariel</i>	fairy martin		C		14
animals	birds	Jacanidae	<i>Irediparra gallinacea</i>	comb-crested jacana		C		32
animals	birds	Laridae	<i>Thalasseus bergii</i>	crested tern		C		4
animals	birds	Laridae	<i>Chroicocephalus novaehollandiae</i>	silver gull		C		1
animals	birds	Laridae	<i>Gelocheidon nilotica</i>	gull-billed tern		C		8
animals	birds	Laridae	<i>Hydroprogne caspia</i>	Caspian tern		C		7
animals	birds	Maluridae	<i>Malurus cyaneus</i>	superb fairy-wren		C		40
animals	birds	Maluridae	<i>Malurus melanocephalus</i>	red-backed fairy-wren		C		208
animals	birds	Maluridae	<i>Malurus lamberti</i>	variegated fairy-wren		C		126
animals	birds	Megaluridae	<i>Megalurus timoriensis</i>	tawny grassbird		C		9
animals	birds	Megaluridae	<i>Cincloramphus mathewsi</i>	rufous songlark		C		2
animals	birds	Megapodiidae	<i>Alectura lathamii</i>	Australian brush-turkey		C		13
animals	birds	Meliphagidae	<i>Melithreptus albogularis</i>	white-throated honeyeater		C		322
animals	birds	Meliphagidae	<i>Plectorhyncha lanceolata</i>	striped honeyeater		C		16
animals	birds	Meliphagidae	<i>Acanthorhynchus tenuirostris</i>	eastern spinebill		C		159
animals	birds	Meliphagidae	<i>Lichenostomus fasciocularis</i>	mangrove honeyeater		C		26
animals	birds	Meliphagidae	<i>Manorina melanocephala</i>	noisy miner		C		207
animals	birds	Meliphagidae	<i>Lichenostomus plumulus</i>	grey-fronted honeyeater		C		1
animals	birds	Meliphagidae	<i>Lichenostomus chrysops</i>	yellow-faced honeyeater		C		652
animals	birds	Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird		C		115
animals	birds	Meliphagidae	<i>Melithreptus lunatus</i>	white-naped honeyeater		C		11
animals	birds	Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater		C		119
animals	birds	Meliphagidae	<i>Epthianura albifrons</i>	white-fronted chat		C		1
animals	birds	Meliphagidae	<i>Anthochaera phrygia</i>	regent honeyeater		E	E	2
animals	birds	Meliphagidae	<i>Manorina flavigula</i>	yellow-throated miner		C		1
animals	birds	Meliphagidae	<i>Anthochaera chrysoptera</i>	little wattlebird		C		1
animals	birds	Meliphagidae	<i>Anthochaera carunculata</i>	red wattlebird		C		1
animals	birds	Meliphagidae	<i>Philemon citreogularis</i>	little friarbird		C		29
animals	birds	Meliphagidae	<i>Myzomela sanguinolenta</i>	scarlet honeyeater		C		811
animals	birds	Meliphagidae	<i>Entomyzon cyanotis</i>	blue-faced honeyeater		C		33
animals	birds	Meliphagidae	<i>Meliphaga lewinii</i>	Lewin's honeyeater		C		84
animals	birds	Meliphagidae	<i>Myzomela obscura</i>	dusky honeyeater		C		1
animals	birds	Meropidae	<i>Merops ornatus</i>	rainbow bee-eater		C		45
animals	birds	Monarchidae	<i>Myiagra alecto</i>	shining flycatcher		C		2
animals	birds	Monarchidae	<i>Myiagra rubecula</i>	leaden flycatcher		C		50
animals	birds	Monarchidae	<i>Myiagra cyanoleuca</i>	satin flycatcher		C		2
animals	birds	Monarchidae	<i>Monarcha melanopsis</i>	black-faced monarch		C		22

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animals	birds	Monarchidae	<i>Symposiarchus trivirgatus</i>	spectacled monarch		C		3
animals	birds	Monarchidae	<i>Carterornis leucotis</i>	white-eared monarch		C		2
animals	birds	Monarchidae	<i>Grallina cyanoleuca</i>	magpie-lark		C		129
animals	birds	Monarchidae	<i>Myiagra inquieta</i>	restless flycatcher		C		16
animals	birds	Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian pipit		C		16
animals	birds	Nectariniidae	<i>Dicaeum hirundinaceum</i>	mistletoebird		C		35
animals	birds	Neosittidae	<i>Daphoenositta chrysoptera</i>	varied sittella		C		13
animals	birds	Oriolidae	<i>Oriolus sagittatus</i>	olive-backed oriole		C		91
animals	birds	Oriolidae	<i>Sphecotheres vieillotii</i>	Australasian figbird		C		95
animals	birds	Pachycephalidae	<i>Falcunculus frontatus</i>	crested shrike-tit		C		1
animals	birds	Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush		C		191
animals	birds	Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler		C		313
animals	birds	Pachycephalidae	<i>Pachycephala pectoralis youngi</i>	golden whistler (south-eastern Australia)		C		1
animals	birds	Pachycephalidae	<i>Colluricincla megarhyncha</i>	little shrike-thrush		C		17
animals	birds	Pachycephalidae	<i>Pachycephala pectoralis</i>	golden whistler		C		118
animals	birds	Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote		C		100
animals	birds	Pardalotidae	<i>Pardalotus punctatus</i>	spotted pardalote		C		53
animals	birds	Passeridae	<i>Passer domesticus</i>	house sparrow	Y			4
animals	birds	Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian pelican		C		20
animals	birds	Petroicidae	<i>Petroica rosea</i>	rose robin		C		35
animals	birds	Petroicidae	<i>Eopsaltria australis</i>	eastern yellow robin		C		118
animals	birds	Petroicidae	<i>Microeca fascians</i>	jacky winter		C		7
animals	birds	Phalacrocoracidae	<i>Phalacrocorax carbo</i>	great cormorant		C		4
animals	birds	Phalacrocoracidae	<i>Phalacrocorax varius</i>	piebald cormorant		C		6
animals	birds	Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	little black cormorant		C		38
animals	birds	Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	little pied cormorant		C		42
animals	birds	Phasianidae	<i>Gallus gallus</i>	red junglefowl	Y			1
animals	birds	Phasianidae	<i>Pavo cristatus</i>	Indian peafowl	Y			2
animals	birds	Phasianidae	<i>Coturnix ypsilophora</i>	brown quail		C		10
animals	birds	Pittidae	<i>Pitta versicolor</i>	noisy pitta		C		7
animals	birds	Podargidae	<i>Podargus strigoides</i>	tawny frogmouth		C		32
animals	birds	Podicipedidae	<i>Podiceps cristatus</i>	great crested grebe		C		1
animals	birds	Podicipedidae	<i>Poliiocephalus poliocephalus</i>	hoary-headed grebe		C		1
animals	birds	Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian grebe		C		50
animals	birds	Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler		C		24
animals	birds	Psittacidae	<i>Platycercus elegans</i>	crimson rosella		C		4
animals	birds	Psittacidae	<i>Glossopsitta concinna</i>	musk lorikeet		C		1
animals	birds	Psittacidae	<i>Trichoglossus chlorolepidotus</i>	scaly-breasted lorikeet		C		67
animals	birds	Psittacidae	<i>Trichoglossus haematodus moluccanus</i>	rainbow lorikeet		C		172
animals	birds	Psittacidae	<i>Platycercus adscitus palliceps</i>	pale-headed rosella (southern form)		C		5
animals	birds	Psittacidae	<i>Psephotus haematonotus</i>	red-rumped parrot		C		1
animals	birds	Psittacidae	<i>Platycercus adscitus</i>	pale-headed rosella		C		114
animals	birds	Psittacidae	<i>Platycercus eximius</i>	eastern rosella		C		4
animals	birds	Psittacidae	<i>Alisterus scapularis</i>	Australian king-parrot		C		13
animals	birds	Psittacidae	<i>Glossopsitta pusilla</i>	little lorikeet		C		23

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animals	birds	Psophodidae	<i>Psophodes olivaceus</i>	eastern whipbird		C		49
animals	birds	Psophodidae	<i>Cinclosoma punctatum</i>	spotted quail-thrush		C		4
animals	birds	Ptilonorhynchidae	<i>Sericulus chrysocephalus</i>	regent bowerbird		C		1
animals	birds	Rallidae	<i>Porphyrio porphyrio</i>	purple swamphen		C		77
animals	birds	Rallidae	<i>Gallinula tenebrosa</i>	dusky moorhen		C		72
animals	birds	Rallidae	<i>Porzana pusilla</i>	Baillon's crane		C		2
animals	birds	Rallidae	<i>Gallirallus philippensis</i>	buff-banded rail		C		7
animals	birds	Rallidae	<i>Fulica atra</i>	Eurasian coot		C		23
animals	birds	Recurvirostridae	<i>Himantopus himantopus</i>	black-winged stilt		C		33
animals	birds	Rhipiduridae	<i>Rhipidura albiscapa</i>	grey fantail		C		144
animals	birds	Rhipiduridae	<i>Rhipidura leucophrys leucophrys</i>	willie wagtail (southern)		C		1
animals	birds	Rhipiduridae	<i>Rhipidura leucophrys</i>	willie wagtail		C		119
animals	birds	Rhipiduridae	<i>Rhipidura rufifrons</i>	rufous fantail		C		21
animals	birds	Rostratulidae	<i>Rostratula australis</i>	Australian painted snipe		V	V	1
animals	birds	Scolopacidae	<i>Tringa nebularia</i>	common greenshank		C		2
animals	birds	Scolopacidae	<i>Gallinago hardwickii</i>	Latham's snipe		C		22
animals	birds	Scolopacidae	<i>Numenius phaeopus</i>	whimbrel		C		1
animals	birds	Scolopacidae	<i>Actitis hypoleucos</i>	common sandpiper		C		2
animals	birds	Scolopacidae	<i>Calidris acuminata</i>	sharp-tailed sandpiper		C		10
animals	birds	Scolopacidae	<i>Calidris ferruginea</i>	curlew sandpiper		C		1
animals	birds	Scolopacidae	<i>Tringa stagnatilis</i>	marsh sandpiper		C		10
animals	birds	Strigidae	<i>Ninox boobook</i>	southern boobook		C		13
animals	birds	Strigidae	<i>Ninox strenua</i>	powerful owl		V		18
animals	birds	Sturnidae	<i>Sturnus tristis</i>	common myna	Y			22
animals	birds	Sturnidae	<i>Sturnus vulgaris</i>	common starling	Y			22
animals	birds	Threskiornithidae	<i>Platalea regia</i>	royal spoonbill		C		38
animals	birds	Threskiornithidae	<i>Threskiornis molucca</i>	Australian white ibis		C		54
animals	birds	Threskiornithidae	<i>Threskiornis spinicollis</i>	straw-necked ibis		C		50
animals	birds	Threskiornithidae	<i>Plegadis falcinellus</i>	glossy ibis		C		23
animals	birds	Threskiornithidae	<i>Platalea flavipes</i>	yellow-billed spoonbill		C		13
animals	birds	Timaliidae	<i>Zosterops lateralis</i>	silveryeye		C		940
animals	birds	Timaliidae	<i>Zosterops lateralis cornwalli</i>	silveryeye (eastern)		C		3
animals	birds	Turnicidae	<i>Turnix varius</i>	painted button-quail		C		4
animals	birds	Turnicidae	<i>Turnix maculosus</i>	red-backed button-quail		C		1
animals	bony fish	Eleotridae	<i>Hypseleotris galii</i>	firetail gudgeon				2
animals	bony fish	Eleotridae	<i>Hypseleotris compressa</i>	empire gudgeon				1
animals	bony fish	Poeciliidae	<i>Gambusia holbrooki</i>	mosquitofish	Y			2
animals	bony fish	Poeciliidae	<i>Xiphophorus helleri</i>	swordtail	Y			1
animals	insects	Nymphalidae	<i>Hypocysta sp.</i>					1
animals	insects	Nymphalidae	<i>Melanitis leda bankia</i>	common evening-brown				2
animals	insects	Nymphalidae	<i>Euploea core corinna</i>	common crow				2
animals	insects	Nymphalidae	<i>Hypocysta metirius</i>	brown ringlet				1
animals	insects	Nymphalidae	<i>Junonia villida calybe</i>	meadow argus				1
animals	insects	Nymphalidae	<i>Hypolimnias bolina nerina</i>	varied eggfly				1
animals	insects	Nymphalidae	<i>Heteronympha merope merope</i>	common brown				1
animals	insects	Nymphalidae	<i>Acraea andromacha andromacha</i>	glasswing				1

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animals	insects	Nymphalidae	<i>Danaus plexippus plexippus</i>	monarch				3
animals	insects	Nymphalidae	<i>Geitoneura klugii klugii</i>	marbled xenica				1
animals	insects	Papilionidae	<i>Graphium sarpedon choredon</i>	blue triangle				1
animals	insects	Pieridae	<i>Delias nigrina</i>	black jezebel				1
animals	insects	Pieridae	<i>Eurema hecabe phoebus</i>	large grass-yellow				1
animals	mammals	Acrobatidae	<i>Acrobates pygmaeus</i>	feathertail glider			C	4
animals	mammals	Bovidae	<i>Bos taurus</i>	European cattle	Y			1
animals	mammals	Canidae	<i>Vulpes vulpes</i>	red fox	Y			6
animals	mammals	Canidae	<i>Canis familiaris</i>	dog	Y			5
animals	mammals	Dasyuridae	<i>Antechinus flavipes</i>	yellow-footed antechinus			C	7
animals	mammals	Dasyuridae	<i>Phascogale tapoatafa</i>	brush-tailed phascogale			C	3
animals	mammals	Dasyuridae	<i>Antechinus flavipes flavipes</i>	yellow-footed antechinus (south-east Queensland)			C	2
animals	mammals	Dasyuridae	<i>Sminthopsis murina</i>	common dunnart			C	4
animals	mammals	Dasyuridae	<i>Planigale maculata</i>	common planigale			C	3
animals	mammals	Dasyuridae	<i>Sminthopsis murina murina</i>	common dunnart (SE mainland)			C	1
animals	mammals	Equidae	<i>Equus caballus</i>	horse	Y			1
animals	mammals	Felidae	<i>Felis catus</i>	cat	Y			5
animals	mammals	Leporidae	<i>Lepus capensis</i>	brown hare	Y			6
animals	mammals	Macropodidae	<i>Thylogale sp.</i>					1
animals	mammals	Macropodidae	<i>Macropus parryi</i>	whiptail wallaby			C	4
animals	mammals	Macropodidae	<i>Macropus giganteus</i>	eastern grey kangaroo			C	8
animals	mammals	Macropodidae	<i>Macropus rufogriseus</i>	red-necked wallaby			C	24
animals	mammals	Macropodidae	<i>Wallabia bicolor</i>	swamp wallaby			C	19
animals	mammals	Molossidae	<i>Mormopterus sp.</i>					1
animals	mammals	Molossidae	<i>Mormopterus sp. 2</i>	eastern freetail bat			C	2
animals	mammals	Molossidae	<i>Tadarida australis</i>	white-striped freetail bat			C	8
animals	mammals	Muridae	<i>Mus musculus</i>	house mouse	Y			2
animals	mammals	Muridae	<i>Rattus lutreolus</i>	swamp rat			C	2
animals	mammals	Muridae	<i>Hydromys chrysogaster</i>	water rat			C	2
animals	mammals	Muridae	<i>Rattus rattus</i>	black rat	Y			5
animals	mammals	Ornithorhynchidae	<i>Ornithorhynchus anatinus</i>	platypus			C	5
animals	mammals	Peramelidae	<i>Perameles nasuta</i>	long-nosed bandicoot			C	3
animals	mammals	Peramelidae	<i>Isoodon macrourus</i>	northern brown bandicoot			C	11
animals	mammals	Petauridae	<i>Petaurus breviceps</i>	sugar glider			C	13
animals	mammals	Petauridae	<i>Petaurus norfolcensis</i>	squirrel glider			C	6
animals	mammals	Petauridae	<i>Petaurus australis australis</i>	yellow-bellied glider (southern subspecies)			C	3
animals	mammals	Phalangeridae	<i>Trichosurus caninus</i>	short-eared possum			C	9
animals	mammals	Phalangeridae	<i>Trichosurus vulpecula</i>	common brushtail possum			C	20
animals	mammals	Phascolarctidae	<i>Phascolarctos cinereus</i>	koala			C	52
animals	mammals	Phascolarctidae	<i>Phascolarctos cinereus (southeast Queensland bioregion)</i>	koala (southeast Queensland bioregion)			V	508
animals	mammals	Pseudocheiridae	<i>Petauroides volans</i>	greater glider			C	12
animals	mammals	Pseudocheiridae	<i>Pseudocheirus peregrinus</i>	common ringtail possum			C	7
animals	mammals	Pteropodidae	<i>Pteropus sp.</i>					3

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animals	mammals	Pteropodidae	<i>Pteropus alecto</i>	black flying-fox		C		2
animals	mammals	Pteropodidae	<i>Pteropus scapulatus</i>	little red flying-fox		C		2
animals	mammals	Pteropodidae	<i>Pteropus poliocephalus</i>	grey-headed flying-fox		C	V	5
animals	mammals	Pteropodidae	<i>Syconycteris australis</i>	eastern blossom bat		C		1
animals	mammals	Suidae	<i>Sus scrofa</i>	pig	Y			3
animals	mammals	Tachyglossidae	<i>Tachyglossus aculeatus</i>	short-beaked echidna		C		9
animals	mammals	Vespertilionidae	<i>Myotis macropus</i>	large-footed myotis		C		1
animals	mammals	Vespertilionidae	<i>Scotorepens orion</i>	south-eastern broad-nosed bat		C		2
animals	mammals	Vespertilionidae	<i>Nyctophilus gouldi</i>	Gould's long-eared bat		C		1
animals	mammals	Vespertilionidae	<i>Vespadelus pumilus</i>	eastern forest bat		C		1
animals	mammals	Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's wattled bat		C		3
animals	mammals	Vespertilionidae	<i>Miniopterus australis</i>	little bent-wing bat		C		5
animals	mammals	Vespertilionidae	<i>Chalinolobus nigrogriseus</i>	hoary wattled bat		C		7
animals	mammals	Vespertilionidae	<i>Vespadelus darlingtoni</i>	large forest bat		C		2
animals	mammals	Vespertilionidae	<i>Scoteanax rueppellii</i>	greater broad-nosed bat		C		1
animals	mammals	Vespertilionidae	<i>Vespadelus regulus</i>	southern forest bat		C		1
animals	mammals	Vespertilionidae	<i>Scotorepens greyii</i>	little broad-nosed bat		C		4
animals	mammals	Vespertilionidae	<i>Chalinolobus morio</i>	chocolate wattled bat		C		5
animals	mammals	Vespertilionidae	<i>Nyctophilus bifax</i>	northern long-eared bat		C		2
animals	reptiles	Agamidae	<i>Pogona barbata</i>	bearded dragon		C		12
animals	reptiles	Agamidae	<i>Physignathus lesueurii</i>	eastern water dragon		C		10
animals	reptiles	Agamidae	<i>Diporiphora australis</i>			C		3
animals	reptiles	Boidae	<i>Morelia spilota</i>	carpet python		C		14
animals	reptiles	Chelidae	<i>Chelodina longicollis</i>	eastern snake-necked turtle		C		4
animals	reptiles	Chelidae	<i>Wollumbinia latisternum</i>	saw-shelled turtle		C		1
animals	reptiles	Colubridae	<i>Boiga irregularis</i>	brown tree snake		C		3
animals	reptiles	Colubridae	<i>Tropidonophis mairii</i>	freshwater snake		C		2
animals	reptiles	Colubridae	<i>Dendrelaphis punctulata</i>	common tree snake		C		9
animals	reptiles	Elapidae	<i>Furina diadema</i>	red-naped snake		C		2
animals	reptiles	Elapidae	<i>Hemiaspis signata</i>	black-bellied swamp snake		C		2
animals	reptiles	Elapidae	<i>Cacophis krefftii</i>	dwarf crowned snake		C		2
animals	reptiles	Elapidae	<i>Demansia psammophis</i>	yellow-faced whip snake		C		5
animals	reptiles	Elapidae	<i>Pseudechis porphyriacus</i>	red-bellied black snake		C		6
animals	reptiles	Elapidae	<i>Rhinoplocephalus nigrescens</i>	eastern small-eyed snake		C		6/1
animals	reptiles	Elapidae	<i>Tropidechis carinatus</i>	rough-scaled snake		C		2
animals	reptiles	Elapidae	<i>Cacophis harriettae</i>	white-crowned snake		C		1
animals	reptiles	Gekkonidae	<i>Gehyra dubia</i>			C		1
animals	reptiles	Gekkonidae	<i>Oedura robusta</i>	robust velvet gecko		C		1
animals	reptiles	Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's gecko		C		1
animals	reptiles	Gekkonidae	<i>Diplodactylus vittatus</i>	wood gecko		C		2
animals	reptiles	Pygopodidae	<i>Lialis burtonis</i>	Burton's legless lizard		C		4
animals	reptiles	Scincidae	<i>Carlia vivax</i>			C		4
animals	reptiles	Scincidae	<i>Ctenotus sp.</i>					1
animals	reptiles	Scincidae	<i>Ctenotus arcanus</i>			C		1
animals	reptiles	Scincidae	<i>Eulamprus quoyii</i>	eastern water skink		C		2
animals	reptiles	Scincidae	<i>Bellatorias major</i>	land mullet		C		1

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animals	reptiles	Scincidae	<i>Eulamprus martini</i>			C		2
animals	reptiles	Scincidae	<i>Cryptoblepharus pulcher pulcher</i>	elegant snake-eyed skink		C		14
animals	reptiles	Scincidae	<i>Cyclodomorphus gerrardii</i>	pink-tongued lizard		C		1
animals	reptiles	Scincidae	<i>Cryptoblepharus virgatus</i>	striped snake-eyed skink		C		2
animals	reptiles	Scincidae	<i>Calyptotis scutirostrum</i>			C		14
animals	reptiles	Scincidae	<i>Lampropholis delicata</i>			C		15/1
animals	reptiles	Scincidae	<i>Anomalopus verreauxii</i>			C		3
animals	reptiles	Scincidae	<i>Lampropholis amicula</i>			C		9
animals	reptiles	Scincidae	<i>Eulamprus brachysoma</i>			C		2
animals	reptiles	Scincidae	<i>Ctenotus taeniolatus</i>	copper-tailed skink		C		4
animals	reptiles	Scincidae	<i>Tiliqua scincoides</i>	eastern blue-tongued lizard		C		6
animals	reptiles	Scincidae	<i>Bellatorias frerei</i>	major skink		C		2
animals	reptiles	Scincidae	<i>Ctenotus robustus</i>			C		2
animals	reptiles	Scincidae	<i>Eulamprus tenuis</i>			C		1
animals	reptiles	Typhlopidae	<i>Ramphotyphlops sp.</i>					1
animals	reptiles	Typhlopidae	<i>Ramphotyphlops proximus</i>				C	1/1
animals	reptiles	Varanidae	<i>Varanus varius</i>	lace monitor		C		18
animals	uncertain	Indeterminate	<i>Indeterminate</i>	Unknown or Code Pending		C		1
fungi	club fungi	Basidiomycota	<i>Ganoderma</i>			C		1/1
fungi	club fungi	Basidiomycota	<i>Panaeolus sphinctrinus</i>			C		1/1
fungi	club fungi	Basidiomycota	<i>Macrolepiota dolichaula</i>			C		1/1
fungi	club fungi	Basidiomycota	<i>Thelephora congesta</i>			C		1/1
fungi	club fungi	Basidiomycota	<i>Rubinoboletus</i>			C		1/1
fungi	club fungi	Basidiomycota	<i>Amanita sp. 11</i>			C		1/1
fungi	club fungi	Basidiomycota	<i>Psilocybe cubensis</i>			C		3/3
fungi	sac fungi	Candelariaceae	<i>Candelaria concolor</i>			C		1/1
fungi	sac fungi	Cladoniaceae	<i>Cladonia floerkeana</i>			C		2/2
fungi	sac fungi	Cladoniaceae	<i>Cladonia rigida var. rigida</i>			C		1/1
fungi	sac fungi	Graphidaceae	<i>Dictyographa</i>			C		1/1
fungi	sac fungi	Heterodeaceae	<i>Heterodea muelleri</i>			C		1/1
fungi	sac fungi	Lecanoraceae	<i>Tephromela atra</i>			C		1/1
fungi	sac fungi	Lecanoraceae	<i>Lecanora tropica</i>			C		1/1
fungi	sac fungi	Lecanoraceae	<i>Lecanora caesiorubella</i>			C		1/1
fungi	sac fungi	Opegraphaceae	<i>Opegrapha</i>			C		1/1
fungi	sac fungi	Parmeliaceae	<i>Punctelia pseudocoralloidea</i>			C		1/1
fungi	sac fungi	Parmeliaceae	<i>Parmelina conlabrosa</i>			C		2/2
fungi	sac fungi	Parmeliaceae	<i>Parmotrema crinitum</i>			C		1/1
fungi	sac fungi	Pertusariaceae	<i>Pertusaria thiospoda</i>			C		2/2
fungi	sac fungi	Pertusariaceae	<i>Ochrolechia subpallescens</i>			C		1/1
fungi	sac fungi	Physciaceae	<i>Buellia dissa</i>			C		3/3
fungi	sac fungi	Physciaceae	<i>Buellia curatellae</i>			C		1/1
fungi	sac fungi	Physciaceae	<i>Dirinaria applanata</i>			C		1/1
fungi	sac fungi	Physciaceae	<i>Heterodermia speciosa</i>			C		2/2
fungi	sac fungi	Physciaceae	<i>Buellia disciformis</i>			C		1/1
plants	ferns	Adiantaceae	<i>Pellaea paradoxa</i>	heart fern		C		1/1
plants	ferns	Adiantaceae	<i>Adiantum atroviride</i>			C		1/1

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plants	ferns	Adiantaceae	<i>Adiantum hispidulum</i>			C		5
plants	ferns	Adiantaceae	<i>Cheilanthes distans</i>	bristly cloak fern		C		3/2
plants	ferns	Adiantaceae	<i>Adiantum aethiopicum</i>			C		4/1
plants	ferns	Adiantaceae	<i>Pityrogramma calomelanos var. austroamericana</i>		Y			1/1
plants	ferns	Adiantaceae	<i>Adiantum hispidulum var. hispidulum</i>			C		1/1
plants	ferns	Adiantaceae	<i>Cheilanthes sieberi subsp. sieberi</i>			C		1/1
plants	ferns	Adiantaceae	<i>Cheilanthes sieberi</i>			C		19
plants	ferns	Aspleniaceae	<i>Asplenium attenuatum</i>	walking fern		C		1
plants	ferns	Blechnaceae	<i>Doodia aspera</i>	prickly rasp fern		C		1/1
plants	ferns	Blechnaceae	<i>Doodia caudata</i>			C		5/2
plants	ferns	Blechnaceae	<i>Blechnum indicum</i>	swamp water fern		C		4
plants	ferns	Blechnaceae	<i>Blechnum cartilagineum</i>	gristle fern		C		7/1
plants	ferns	Cyatheaceae	<i>Cyathea cooperi</i>			C		2
plants	ferns	Davalliaceae	<i>Davallia pyxidata</i>			C		2/1
plants	ferns	Dennstaedtiaceae	<i>Hypolepis muelleri</i>	swamp bracken		C		3/1
plants	ferns	Dennstaedtiaceae	<i>Histiopteris incisa</i>	bats-wing fern		C		1/1
plants	ferns	Dennstaedtiaceae	<i>Pteridium esculentum</i>	common bracken		C		27
plants	ferns	Dicksoniaceae	<i>Calochlaena dubia</i>			C		13/2
plants	ferns	Dryopteridaceae	<i>Lastreopsis</i>			C		1/1
plants	ferns	Dryopteridaceae	<i>Arachniodes aristata</i>	prickly shield fern		C		2/1
plants	ferns	Dryopteridaceae	<i>Lastreopsis decomposita</i>	trim shield fern		C		1/1
plants	ferns	Gleicheniaceae	<i>Gleichenia dicarpa</i>	pouched coral fern		C		2/1
plants	ferns	Gleicheniaceae	<i>Sticherus flabellatus var. flabellatus</i>			C		2/2
plants	ferns	Lindsaeaceae	<i>Lindsaea incisa</i>			C		1/1
plants	ferns	Lindsaeaceae	<i>Lindsaea microphylla</i>	lacy wedge fern		C		4/1
plants	ferns	Lindsaeaceae	<i>Lindsaea linearis</i>	screw fern		C		2/1
plants	ferns	Ophioglossaceae	<i>Botrychium australe</i>	parsley fern		C		1/1
plants	ferns	Polypodiaceae	<i>Drynaria rigidula</i>			C		2/1
plants	ferns	Polypodiaceae	<i>Platyserium bifurcatum</i>			C		2/1
plants	ferns	Pteridaceae	<i>Pteris tremula</i>			C		1/1
plants	ferns	Schizaeaceae	<i>Schizaea bifida</i>	forked comb fern		C		12/2
plants	ferns	Schizaeaceae	<i>Lygodium microphyllum</i>	snake fern		C		1
plants	ferns	Thelypteridaceae	<i>Christella dentata</i>	creek fern		C		1
plants	ferns	Thelypteridaceae	<i>Cyclosorus interruptus</i>			C		2/2
plants	higher dicots	Acanthaceae	<i>Rostellularia obtusa</i>			C		1/1
plants	higher dicots	Acanthaceae	<i>Brunoniella australis</i>	blue trumpet		C		8/1
plants	higher dicots	Acanthaceae	<i>Hygrophila angustifolia</i>			C		2/1
plants	higher dicots	Acanthaceae	<i>Pseuderanthemum variabile</i>	pastel flower		C		28/1
plants	higher dicots	Amaranthaceae	<i>Gomphrena celosioides</i>	gomphrena weed	Y			1/1
plants	higher dicots	Amaranthaceae	<i>Alternanthera denticulata</i>	lesser joyweed		C		1/1
plants	higher dicots	Anacardiaceae	<i>Euroschinus falcatus var. falcatus</i>			C		2/1
plants	higher dicots	Aphanopetalaceae	<i>Aphanopetalum resinsum</i>	gumvine		C		1/1
plants	higher dicots	Apiaceae	<i>Centella asiatica</i>			C		1/1
plants	higher dicots	Apiaceae	<i>Cyclospermum leptophyllum</i>		Y			1/1
plants	higher dicots	Apiaceae	<i>Platysace ericoides</i>	heath platysace		C		32/2
plants	higher dicots	Apocynaceae	<i>Carissa ovata</i>	currantbush		C		1/1

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plants	higher dicots	Apocynaceae	<i>Marsdenia longiloba</i>			V	V	1/1
plants	higher dicots	Apocynaceae	<i>Parsonsia straminea</i>	monkey rope		C		24/2
plants	higher dicots	Apocynaceae	<i>Marsdenia coronata</i>	slender milkvine		V	V	3/1
plants	higher dicots	Apocynaceae	<i>Alyxia ruscifolia</i>			C		2/1
plants	higher dicots	Apocynaceae	<i>Tylophora paniculata</i>	thin-leaved tylophora		C		1/1
plants	higher dicots	Apocynaceae	<i>Gomphocarpus physocarpus</i>	balloon cottonbush	Y			10/1
plants	higher dicots	Apocynaceae	<i>Parsonsia eucalyptophylla</i>	gargaloo		C		3/1
plants	higher dicots	Apocynaceae	<i>Asclepias curassavica</i>	red-head cottonbush	Y			4
plants	higher dicots	Araliaceae	<i>Polyscias elegans</i>	celery wood		C		6/1
plants	higher dicots	Araliaceae	<i>Hydrocotyle acutiloba</i>			C		2/1
plants	higher dicots	Araliaceae	<i>Hydrocotyle paludosa</i>			C		1/1
plants	higher dicots	Araliaceae	<i>Astrotricha latifolia</i>			C		3/2
plants	higher dicots	Araliaceae	<i>Hydrocotyle tripartita</i>			C		3
plants	higher dicots	Araliaceae	<i>Trachymene incisa subsp. incisa</i>			C		18/1
plants	higher dicots	Araliaceae	<i>Schefflera actinophylla</i>	umbrella tree		C		5
plants	higher dicots	Asteraceae	<i>Glossocardia bidens</i>	native cobbler's pegs		C		4/1
plants	higher dicots	Asteraceae	<i>Calyptocarpus vialis</i>	creeping cinderella weed	Y			1/1
plants	higher dicots	Asteraceae	<i>Hypochaeris radicata</i>	catsear	Y			3/1
plants	higher dicots	Asteraceae	<i>Ageratum houstonianum</i>	blue billygoat weed	Y			13/1
plants	higher dicots	Asteraceae	<i>Cyanthillium cinereum</i>			C		35/2
plants	higher dicots	Asteraceae	<i>Hypochaeris albiflora</i>		Y			1/1
plants	higher dicots	Asteraceae	<i>Sigesbeckia orientalis</i>	Indian weed		C		4/1
plants	higher dicots	Asteraceae	<i>Conyza canadensis var. pusilla</i>		Y			1
plants	higher dicots	Asteraceae	<i>Centipeda minima subsp. minima</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Pseudognaphalium luteoalbum</i>	Jersey cudweed		C		1/1
plants	higher dicots	Asteraceae	<i>Crassocephalum crepidioides</i>	thickhead	Y			3
plants	higher dicots	Asteraceae	<i>Chrysocephalum apiculatum</i>	yellow buttons		C		17/1
plants	higher dicots	Asteraceae	<i>Centratherum australianum</i>			C		4/1
plants	higher dicots	Asteraceae	<i>Senecio madagascariensis</i>	fireweed	Y			1/1
plants	higher dicots	Asteraceae	<i>Ozothamnus diosmifolius</i>	white dogwood		C		3/1
plants	higher dicots	Asteraceae	<i>Ambrosia artemisiifolia</i>	annual ragweed	Y			1/1
plants	higher dicots	Asteraceae	<i>Cassinia laevis</i>			C		3/1
plants	higher dicots	Asteraceae	<i>Aster subulatus</i>	wild aster	Y			3/1
plants	higher dicots	Asteraceae	<i>Sonchus asper</i>	rough sowthistle	Y			1/1
plants	higher dicots	Asteraceae	<i>Erechtites valerianifolius forma valerianifolius</i>		Y			1/1
plants	higher dicots	Asteraceae	<i>Picris angustifolia subsp. carolorum-henricorum</i>			C		3/1
plants	higher dicots	Asteraceae	<i>Acmella grandiflora var. brachyglossa</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Conyza canadensis var. canadensis</i>		Y			1/1
plants	higher dicots	Asteraceae	<i>Emilia sonchifolia var. javanica</i>		Y			1/1
plants	higher dicots	Asteraceae	<i>Vittadinia cuneata var. hirsuta</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Emilia sonchifolia</i>		Y			4
plants	higher dicots	Asteraceae	<i>Conyza sumatrensis</i>	tall fleabane	Y			2/1
plants	higher dicots	Asteraceae	<i>Conyza bonariensis</i>		Y			2/1
plants	higher dicots	Asteraceae	<i>Calotis cuneifolia</i>	burr daisy		C		1
plants	higher dicots	Asteraceae	<i>Sonchus oleraceus</i>	common sowthistle	Y			2/2
plants	higher dicots	Asteraceae	<i>Euchiton collinus</i>			C		1

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plants	higher dicots	Asteraceae	<i>Epaltes australis</i>	spreading nutheads		C		3
plants	higher dicots	Asteraceae	<i>Eclipta prostrata</i>	white eclipta		C		2/1
plants	higher dicots	Asteraceae	<i>Ageratina riparia</i>	mistflower	Y			3
plants	higher dicots	Asteraceae	<i>Olearia nernstii</i>	Ipswich daisy		C		6/2
plants	higher dicots	Asteraceae	<i>Centipeda minima</i>			C		3
plants	higher dicots	Asteraceae	<i>Cirsium vulgare</i>	spear thistle	Y			3/1
plants	higher dicots	Asteraceae	<i>Wedelia spilanthoides</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Euchiton involucratu</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Baccharis halimifolia</i>	groundsel bush	Y			11
plants	higher dicots	Asteraceae	<i>Lagenophora gracilis</i>			C		7/1
plants	higher dicots	Asteraceae	<i>Gamochaeta americana</i>		Y			1/1
plants	higher dicots	Asteraceae	<i>Ageratina adenophora</i>	crofton weed	Y			4/2
plants	higher dicots	Bignoniaceae	<i>Pandorea pandorana</i>	wonga vine		C		1
plants	higher dicots	Bignoniaceae	<i>Pandorea floribunda</i>			C		1/1
plants	higher dicots	Boraginaceae	<i>Heliotropium amplexicaule</i>	blue heliotrope	Y			1/1
plants	higher dicots	Brassicaceae	<i>Lepidium didymum</i>		Y			1/1
plants	higher dicots	Brassicaceae	<i>Lepidium virginicum</i>	Virginian peppergrass	Y			1/1
plants	higher dicots	Byttneriaceae	<i>Seringia arborescens</i>			C		1/1
plants	higher dicots	Byttneriaceae	<i>Commersonia bartramia</i>	brown kurrajong		C		6/1
plants	higher dicots	Caesalpiniaceae	<i>Senna x floribunda</i>		Y			3
plants	higher dicots	Caesalpiniaceae	<i>Senna pendula var. glabrata</i>	Easter cassia	Y			2/1
plants	higher dicots	Caesalpiniaceae	<i>Chamaecrista nomame var. nomame</i>			C		1/1
plants	higher dicots	Caesalpiniaceae	<i>Senna septemtrionalis</i>		Y			1/1
plants	higher dicots	Campanulaceae	<i>Lobelia gibbosa</i>	native lobelia		C		2
plants	higher dicots	Campanulaceae	<i>Lobelia purpurascens</i>	white root		C		42/1
plants	higher dicots	Campanulaceae	<i>Lobelia gibbosa var. gibbosa</i>			C		1/1
plants	higher dicots	Campanulaceae	<i>Lobelia gibbosa var. browniana</i>			C		1/1
plants	higher dicots	Campanulaceae	<i>Wahlenbergia gracilis</i>	spreading bluebell		C		4/1
plants	higher dicots	Campanulaceae	<i>Lobelia membranacea</i>			C		1
plants	higher dicots	Campanulaceae	<i>Lobelia stenophylla</i>			C		2/2
plants	higher dicots	Capparaceae	<i>Capparis arborea</i>	brush caper berry		C		1/1
plants	higher dicots	Capparaceae	<i>Capparis sarmentosa</i>	scrambling caper		C		1/1
plants	higher dicots	Caprifoliaceae	<i>Sambucus canadensis</i>		Y			1
plants	higher dicots	Carpodetaceae	<i>Abrophyllum ornans</i>			C		1/1
plants	higher dicots	Casuarinaceae	<i>Casuarina glauca</i>	swamp she-oak		C		1/1
plants	higher dicots	Casuarinaceae	<i>Allocasuarina littoralis</i>			C		56/2
plants	higher dicots	Casuarinaceae	<i>Allocasuarina torulosa</i>			C		6/1
plants	higher dicots	Celastraceae	<i>Celastrus subspicata</i>	large-leaved staffvine		C		1/1
plants	higher dicots	Celastraceae	<i>Denhamia celastroides</i>	broad-leaved boxwood		C		4/1
plants	higher dicots	Celastraceae	<i>Denhamia pittosporoides subsp. pittosporoides</i>			C		1/1
plants	higher dicots	Celastraceae	<i>Elaeodendron australe var. australe</i>			C		1/1
plants	higher dicots	Chenopodiaceae	<i>Einadia hastata</i>			C		3/3
plants	higher dicots	Chenopodiaceae	<i>Suaeda australis</i>			C		1/1
plants	higher dicots	Chenopodiaceae	<i>Chenopodium carinatum</i>	green crumbweed		C		1/1
plants	higher dicots	Clusiaceae	<i>Hypericum gramineum</i>			C		12/2
plants	higher dicots	Convolvulaceae	<i>Polymeria calycina</i>	pink bindweed		C		10/2

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plants	higher dicots	Crassulaceae	<i>Bryophyllum pinnatum</i>	resurrection plant	Y			1
plants	higher dicots	Cucurbitaceae	<i>Nothoalsomitra suberosa</i>			R		1
plants	higher dicots	Cucurbitaceae	<i>Trichosanthes subvelutina</i>	silky cucumber		C		1/1
plants	higher dicots	Cunoniaceae	<i>Schizomeria ovata</i>	white cherry		C		2/1
plants	higher dicots	Dilleniaceae	<i>Hibbertia aspera</i>			C		22/1
plants	higher dicots	Dilleniaceae	<i>Hibbertia stricta</i>			C		38/1
plants	higher dicots	Dilleniaceae	<i>Hibbertia scandens</i>			C		1
plants	higher dicots	Dilleniaceae	<i>Hibbertia linearis var. obtusifolia</i>			C		3/1
plants	higher dicots	Droseraceae	<i>Drosera peltata</i>	pale sundew		C		5/1
plants	higher dicots	Droseraceae	<i>Drosera spatulata var. spatulata</i>			C		1/1
plants	higher dicots	Droseraceae	<i>Drosera spatulata</i>			C		1
plants	higher dicots	Ebenaceae	<i>Diospyros kaki</i>	persimmon	Y			2
plants	higher dicots	Elaeocarpaceae	<i>Elaeocarpus obovatus</i>	blueberry ash		C		4
plants	higher dicots	Ericaceae	<i>Monotoca scoparia</i>	prickly broom heath		C		13/1
plants	higher dicots	Ericaceae	<i>Leucopogon juniperinus</i>	prickly heath		C		15/2
plants	higher dicots	Ericaceae	<i>Leucopogon biflorus</i>			C		6/1
plants	higher dicots	Ericaceae	<i>Trochocarpa laurina</i>	tree heath		C		3/1
plants	higher dicots	Ericaceae	<i>Acrotriche aggregata</i>	red cluster heath		C		26/1
plants	higher dicots	Euphorbiaceae	<i>Mallotus philippensis</i>	red kamala		C		2/1
plants	higher dicots	Euphorbiaceae	<i>Chamaesyce hyssopifolia</i>		Y			1/1
plants	higher dicots	Euphorbiaceae	<i>Tragia novae-hollandiae</i>	stinging-vine		C		3/1
plants	higher dicots	Euphorbiaceae	<i>Alchornea ilicifolia</i>	native holly		C		2/1
plants	higher dicots	Euphorbiaceae	<i>Chamaesyce maculata</i>		Y			1/1
plants	higher dicots	Euphorbiaceae	<i>Claoxylon australe</i>	brittlewood		C		2/1
plants	higher dicots	Euphorbiaceae	<i>Acalypha nemorum</i>	hairy acalypha		C		1/1
plants	higher dicots	Euphorbiaceae	<i>Homalanthus stillingiifolius</i>			C		2/1
plants	higher dicots	Fabaceae	<i>Hovea linearis</i>	erect hovea		C		11
plants	higher dicots	Fabaceae	<i>Melilotus albus</i>	sweet clover	Y			1/1
plants	higher dicots	Fabaceae	<i>Glycine tabacina</i>	glycine pea		C		1
plants	higher dicots	Fabaceae	<i>Indigofera australis</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Glycine microphylla</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Galactia tenuiflora</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Desmodium nemorosum</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Daviesia ulicifolia</i>	native gorse		C		10
plants	higher dicots	Fabaceae	<i>Pultenaea paleacea</i>			C		8/2
plants	higher dicots	Fabaceae	<i>Jacksonia scoparia</i>			C		19/2
plants	higher dicots	Fabaceae	<i>Hovea heterophylla</i>			C		2/2
plants	higher dicots	Fabaceae	<i>Daviesia wyattiana</i>	long-leaved bitter pea		C		7/2
plants	higher dicots	Fabaceae	<i>Galactia tenuiflora var. lucida</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Crotalaria pallida var. obovata</i>		Y			1/1
plants	higher dicots	Fabaceae	<i>Desmodium rhytidophyllum</i>			C		16/1
plants	higher dicots	Fabaceae	<i>Gompholobium latifolium</i>	broad wedge pea		C		7/2
plants	higher dicots	Fabaceae	<i>Podolobium ilicifolium</i>			C		4/3
plants	higher dicots	Fabaceae	<i>Hardenbergia violacea</i>			C		10
plants	higher dicots	Fabaceae	<i>Gompholobium pinnatum</i>	poor mans gold		C		4/1
plants	higher dicots	Fabaceae	<i>Desmodium brachypodium</i>	large ticktrefoil		C		1/1

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plants	higher dicots	Fabaceae	<i>Pultenaea petiolaris</i>			C		13/1
plants	higher dicots	Fabaceae	<i>Crotalaria lanceolata subsp. lanceolata</i>		Y			1/1
plants	higher dicots	Fabaceae	<i>Daviesia ulicifolia subsp. stenophylla</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Macrotyloma uniflorum var. uniflorum</i>		Y			1/1
plants	higher dicots	Fabaceae	<i>Glycine clandestina var. clandestina</i>			C		30
plants	higher dicots	Fabaceae	<i>Zornia dyctiocarpa var. dyctiocarpa</i>			C		3/1
plants	higher dicots	Fabaceae	<i>Glycine clandestina var. sericea</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Daviesia villifera</i>	prickly daviesia		C		5/2
plants	higher dicots	Fabaceae	<i>Crotalaria montana</i>			C		5
plants	higher dicots	Fabaceae	<i>Pultenaea villosa</i>	hairy bush pea		C		5/1
plants	higher dicots	Fabaceae	<i>Pultenaea euchila</i>	orange pultenaea		C		5/4
plants	higher dicots	Fabaceae	<i>Crotalaria micans</i>		Y			1
plants	higher dicots	Fabaceae	<i>Crotalaria brevis</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Pultenaea retusa</i>			C		10/1
plants	higher dicots	Fabaceae	<i>Hovea acutifolia</i>			C		5/1
plants	higher dicots	Fabaceae	<i>Desmodium gunnii</i>			C		8/1
plants	higher dicots	Gentianaceae	<i>Schenkia australis</i>			C		1/1
plants	higher dicots	Goodeniaceae	<i>Goodenia glabra</i>			C		1/1
plants	higher dicots	Goodeniaceae	<i>Goodenia rotundifolia</i>			C		52/1
plants	higher dicots	Goodeniaceae	<i>Velleia spathulata</i>	wild pansies		C		5/1
plants	higher dicots	Goodeniaceae	<i>Goodenia paniculata</i>			C		2/2
plants	higher dicots	Goodeniaceae	<i>Goodenia bellidifolia subsp. argentea</i>			C		30/2
plants	higher dicots	Haloragaceae	<i>Myriophyllum gracile</i>			C		5/1
plants	higher dicots	Haloragaceae	<i>Gonocarpus chinensis subsp. verrucosus</i>			C		9/1
plants	higher dicots	Haloragaceae	<i>Haloragis heterophylla</i>	rough raspweed		C		2/1
plants	higher dicots	Lamiaceae	<i>Teucrium argutum</i>			C		2/1
plants	higher dicots	Lamiaceae	<i>Clerodendrum floribundum</i>			C		4
plants	higher dicots	Lamiaceae	<i>Callicarpa pedunculata</i>	velvet leaf		C		2/1
plants	higher dicots	Lamiaceae	<i>Westringia eremicola</i>	slender westringia		C		9/1
plants	higher dicots	Lamiaceae	<i>Gmelina leichhardtii</i>	white beech		C		2/1
plants	higher dicots	Lamiaceae	<i>Plectranthus parviflorus</i>			C		2
plants	higher dicots	Lentibulariaceae	<i>Utricularia aurea</i>	golden bladderwort		C		1/1
plants	higher dicots	Loganiaceae	<i>Mitrasacme alsinoides</i>			C		1/1
plants	higher dicots	Loganiaceae	<i>Mitrasacme paludosa</i>			C		1/1
plants	higher dicots	Loganiaceae	<i>Logania pusilla</i>			C		9/1
plants	higher dicots	Loranthaceae	<i>Amyema bifurcata</i>			C		4/1
plants	higher dicots	Loranthaceae	<i>Amyema congener subsp. congener</i>			C		15/1
plants	higher dicots	Loranthaceae	<i>Dendrophthoe vitellina</i>	long-flowered mistletoe		C		2/1
plants	higher dicots	Malvaceae	<i>Pavonia hastata</i>	pink pavonia	Y			1/1
plants	higher dicots	Malvaceae	<i>Abutilon oxycarpum var. oxycarpum</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Malvastrum coromandelianum subsp. coromandelianum</i>		Y			1/1
plants	higher dicots	Malvaceae	<i>Hibiscus heterophyllus</i>			C		3/1
plants	higher dicots	Malvaceae	<i>Sida rhombifolia</i>		Y			1/1
plants	higher dicots	Melastomataceae	<i>Melastoma malabathricum subsp. malabathricum</i>			C		3
plants	higher dicots	Meliaceae	<i>Synoum glandulosum</i>			C		1
plants	higher dicots	Meliaceae	<i>Synoum glandulosum subsp. glandulosum</i>			C		1/1

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plants	higher dicots	Mimosaceae	<i>Acacia falcata</i>	sickle wattle		C		1/1
plants	higher dicots	Mimosaceae	<i>Acacia fimbriata</i>	Brisbane golden wattle		C		23/4
plants	higher dicots	Mimosaceae	<i>Acacia maidenii</i>	Maiden's wattle		C		6
plants	higher dicots	Mimosaceae	<i>Acacia leiocalyx</i>			C		11
plants	higher dicots	Mimosaceae	<i>Acacia juncifolia</i>			C		4/1
plants	higher dicots	Mimosaceae	<i>Acacia aulacocarpa</i>			C		56
plants	higher dicots	Mimosaceae	<i>Pararchidendron pruinosum</i>			C		1/1
plants	higher dicots	Mimosaceae	<i>Acacia leiocalyx subsp. leiocalyx</i>			C		2/2
plants	higher dicots	Mimosaceae	<i>Acacia melanoxylon</i>	blackwood		C		10/1
plants	higher dicots	Mimosaceae	<i>Acacia ulicifolia</i>			C		3/1
plants	higher dicots	Mimosaceae	<i>Acacia concurrens</i>			C		41/1
plants	higher dicots	Molluginaceae	<i>Glinus oppositifolius</i>			C		1/1
plants	higher dicots	Moraceae	<i>Ficus obliqua</i>			C		1
plants	higher dicots	Moraceae	<i>Ficus coronata</i>	creek sandpaper fig		C		5/1
plants	higher dicots	Moraceae	<i>Trophis scandens subsp. scandens</i>			C		2
plants	higher dicots	Myrsinaceae	<i>Myrsine howittiana</i>			C		2
plants	higher dicots	Myrsinaceae	<i>Aegiceras corniculatum</i>	river mangrove		C		1/1
plants	higher dicots	Myrsinaceae	<i>Embelia australiana</i>	embelia		C		3/1
plants	higher dicots	Myrtaceae	<i>Gossia hillii</i>			C		2/2
plants	higher dicots	Myrtaceae	<i>Acmena smithii</i>	lillypilly satinash		C		7/1
plants	higher dicots	Myrtaceae	<i>Eugenia uniflora</i>	Brazilian cherry tree	Y			1/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus carnea</i>			C		43/2
plants	higher dicots	Myrtaceae	<i>Syzygium oleosum</i>	blue cherry		C		5/2
plants	higher dicots	Myrtaceae	<i>Melaleuca nodosa</i>			C		4/1
plants	higher dicots	Myrtaceae	<i>Corymbia henryi</i>	large-leaved spotted gum		C		4/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus seeana</i>	narrow-leaved red gum		C		31/1
plants	higher dicots	Myrtaceae	<i>Corymbia trachyphloia subsp. trachyphloia</i>			C		2/2
plants	higher dicots	Myrtaceae	<i>Eucalyptus racemosa subsp. racemosa</i>	scribbly gum		C		15/1
plants	higher dicots	Myrtaceae	<i>Leptospermum polygalifolium</i>	tantoon		C		20
plants	higher dicots	Myrtaceae	<i>Leptospermum purpurascens</i>			C		1
plants	higher dicots	Myrtaceae	<i>Melaleuca quinquenervia</i>	swamp paperbark		C		14/1
plants	higher dicots	Myrtaceae	<i>Leptospermum trinervium</i>	woolly tea-tree		C		24/2
plants	higher dicots	Myrtaceae	<i>Eucalyptus tereticornis</i>			C		8/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus siderophloia</i>			C		30/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus planchoniana</i>			C		3/1
plants	higher dicots	Myrtaceae	<i>Rhodomyrtus psidioides</i>	native guava		C		6/3
plants	higher dicots	Myrtaceae	<i>Melaleuca linariifolia</i>	snow-in summer		C		1
plants	higher dicots	Myrtaceae	<i>Lophostemon suaveolens</i>	swamp box		C		36/1
plants	higher dicots	Myrtaceae	<i>Lophostemon confertus</i>	brush box		C		48/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus resinifera</i>	red mahogany		C		45/3
plants	higher dicots	Myrtaceae	<i>Eucalyptus microcorys</i>			C		36/1
plants	higher dicots	Myrtaceae	<i>Corymbia trachyphloia</i>			C		28
plants	higher dicots	Myrtaceae	<i>Backhousia myrtifolia</i>	carrol		C		5/3
plants	higher dicots	Myrtaceae	<i>Eucalyptus tindaliae</i>	Queensland white stringybark		C		44/2
plants	higher dicots	Myrtaceae	<i>Eucalyptus propinqua</i>	small-fruited grey gum		C		16/3
plants	higher dicots	Myrtaceae	<i>Eucalyptus pilularis</i>	blackbutt		C		16/2

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plants	higher dicots	Myrtaceae	<i>Eucalyptus moluccana</i>	gum-topped box		C		2
plants	higher dicots	Myrtaceae	<i>Eucalyptus baileyana</i>	Bailey's stringybark		C		1/1
plants	higher dicots	Myrtaceae	<i>Rhodamnia rubescens</i>			C		3/1
plants	higher dicots	Myrtaceae	<i>Melaleuca bracteata</i>			C		1/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus curtisii</i>	Plunkett mallee		R		2/1
plants	higher dicots	Myrtaceae	<i>Corymbia intermedia</i>	pink bloodwood		C		31
plants	higher dicots	Myrtaceae	<i>Angophora woodsiana</i>	smudgee		C		48/1
plants	higher dicots	Myrtaceae	<i>Angophora leiocarpa</i>	rusty gum		C		25/1
plants	higher dicots	Myrtaceae	<i>Melaleuca salicina</i>			C		38
plants	higher dicots	Myrtaceae	<i>Eucalyptus fibrosa</i>			C		4
plants	higher dicots	Myrtaceae	<i>Syzygium australe</i>	scrub cherry		C		1/1
plants	higher dicots	Ochnaceae	<i>Ochna serrulata</i>	ochna	Y			3/1
plants	higher dicots	Oleaceae	<i>Notelaea ovata</i>	forest olive		C		2/1
plants	higher dicots	Oleaceae	<i>Notelaea longifolia forma glabra</i>			C		2/2
plants	higher dicots	Oleaceae	<i>Notelaea longifolia</i>			C		4/1
plants	higher dicots	Oxalidaceae	<i>Oxalis chnoodes</i>			C		1/1
plants	higher dicots	Oxalidaceae	<i>Oxalis corniculata</i>		Y			13
plants	higher dicots	Passifloraceae	<i>Passiflora edulis</i>		Y			1
plants	higher dicots	Passifloraceae	<i>Passiflora suberosa</i>	corky passion flower	Y			23/1
plants	higher dicots	Passifloraceae	<i>Passiflora aurantia var. aurantia</i>			C		1
plants	higher dicots	Passifloraceae	<i>Passiflora subpeltata</i>	white passion flower	Y			1/1
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus gunnii</i>			C		3/1
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus virgatus</i>			C		8/1
plants	higher dicots	Phyllanthaceae	<i>Poranthera microphylla</i>	small poranthera		C		4/2
plants	higher dicots	Phyllanthaceae	<i>Glochidion sumatranum</i>	umbrella cheese tree		C		4
plants	higher dicots	Phyllanthaceae	<i>Glochidion ferdinandi</i>			C		21
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus tenellus</i>		Y			1/1
plants	higher dicots	Phyllanthaceae	<i>Sauropus hirtellus</i>			C		1/1
plants	higher dicots	Phyllanthaceae	<i>Breynia oblongifolia</i>			C		14/1
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus similis</i>			C		2/1
plants	higher dicots	Picrodendraceae	<i>Petalostigma triloculare</i>	forest quinine		C		1/1
plants	higher dicots	Pittosporaceae	<i>Billardiera scandens</i>			C		1/1
plants	higher dicots	Pittosporaceae	<i>Pittosporum multiflorum</i>			C		1/1
plants	higher dicots	Pittosporaceae	<i>Bursaria spinosa subsp. spinosa</i>			C		1/1
plants	higher dicots	Pittosporaceae	<i>Pittosporum revolutum</i>	yellow pittosporum		C		6/1
plants	higher dicots	Plantaginaceae	<i>Plantago debilis</i>	shade plantain		C		1/1
plants	higher dicots	Plantaginaceae	<i>Plantago lanceolata</i>		Y			1/1
plants	higher dicots	Polygalaceae	<i>Comesperma hispidulum</i>			C		9/2
plants	higher dicots	Polygalaceae	<i>Polygala linariifolia</i>			C		2/1
plants	higher dicots	Polygonaceae	<i>Persicaria elatior</i>			V	V	1/1
plants	higher dicots	Polygonaceae	<i>Muehlenbeckia gracillima</i>			C		1/1
plants	higher dicots	Polygonaceae	<i>Persicaria strigosa</i>			C		1
plants	higher dicots	Polygonaceae	<i>Persicaria attenuata</i>			C		2/2
plants	higher dicots	Polygonaceae	<i>Persicaria decipiens</i>	slender knotweed		C		2/1
plants	higher dicots	Polygonaceae	<i>Persicaria lapathifolia</i>	pale knotweed		C		1/1
plants	higher dicots	Polygonaceae	<i>Persicaria dichotoma</i>			C		1/1

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plants	higher dicots	Proteaceae	<i>Hakea florulenta</i>	three-nerved willow hakea		C		10/2
plants	higher dicots	Proteaceae	<i>Macadamia integrifolia</i>	macadamia nut		V	V	3/3
plants	higher dicots	Proteaceae	<i>Persoonia adenantha - P.stradbrokensis</i>			C		1/1
plants	higher dicots	Proteaceae	<i>Persoonia stradbrokensis x P.virgata</i>			C		1/1
plants	higher dicots	Proteaceae	<i>Banksia integrifolia subsp. compar</i>			C		4
plants	higher dicots	Proteaceae	<i>Macadamia tetraphylla</i>			V	V	1/1
plants	higher dicots	Proteaceae	<i>Grevillea banksii</i>			C		1
plants	higher dicots	Proteaceae	<i>Persoonia sericea</i>	silky geebung		C		5/1
plants	higher dicots	Proteaceae	<i>Lomatia silaifolia</i>	crinkle bush		C		4
plants	higher dicots	Proteaceae	<i>Persoonia cornifolia</i>	broad-leaved geebung		C		31
plants	higher dicots	Putranjivaceae	<i>Drypetes deplanchei</i>	grey boxwood		C		1/1
plants	higher dicots	Rhamnaceae	<i>Alphitonia excelsa</i>	soap tree		C		56/1
plants	higher dicots	Rosaceae	<i>Rubus moluccanus</i>			C		10
plants	higher dicots	Rosaceae	<i>Rubus moluccanus var. trilobus</i>			C		1/1
plants	higher dicots	Rubiaceae	<i>Pomax umbellata</i>			C		14/1
plants	higher dicots	Rubiaceae	<i>Psychotria daphnoides</i>			C		1/1
plants	higher dicots	Rubiaceae	<i>Spermacoce brachystema</i>			C		4/1
plants	higher dicots	Rubiaceae	<i>Psychotria loniceroides</i>	hairy psychotria		C		8/2
plants	higher dicots	Rubiaceae	<i>Cyclophyllum coprosmoides var. coprosmoides</i>			C		1/1
plants	higher dicots	Rubiaceae	<i>Coelospermum paniculatum var. paniculatum</i>			C		1/1
plants	higher dicots	Rubiaceae	<i>Hodgkinsonia ovatiflora</i>	golden ash		C		1/1
plants	higher dicots	Rubiaceae	<i>Richardia brasiliensis</i>	white eye	Y			1
plants	higher dicots	Rubiaceae	<i>Opercularia diphylla</i>			C		5/2
plants	higher dicots	Rubiaceae	<i>Morinda jasminoides</i>	morinda		C		6/1
plants	higher dicots	Rutaceae	<i>Citrus x limon</i>		Y			1
plants	higher dicots	Rutaceae	<i>Acronychia laevis</i>	glossy acronychia		C		6/3
plants	higher dicots	Rutaceae	<i>Acronychia pubescens</i>	hairy acronychia		C		1/1
plants	higher dicots	Rutaceae	<i>Boronia polygalifolia</i>	dwarf boronia		C		3/1
plants	higher dicots	Rutaceae	<i>Melicope elleryana</i>			C		1
plants	higher dicots	Sambucaceae	<i>Sambucus nigra</i>		Y			1/1
plants	higher dicots	Santalaceae	<i>Exocarpos cupressiformis</i>	native cherry		C		8/1
plants	higher dicots	Sapindaceae	<i>Guioa semiglauca</i>	guioa		C		3/1
plants	higher dicots	Sapindaceae	<i>Arytera divaricata</i>	coogera		C		1/1
plants	higher dicots	Sapindaceae	<i>Dodonaea triquetra</i>	large-leaved hop bush		C		6/1
plants	higher dicots	Sapindaceae	<i>Jagera pseudorhus var. pseudorhus</i>			C		5
plants	higher dicots	Sapindaceae	<i>Mischocarpus pyriformis subsp. pyriformis</i>			C		3/1
plants	higher dicots	Sapindaceae	<i>Cupaniopsis parvifolia</i>	small-leaved tuckeroo		C		1/1
plants	higher dicots	Sapindaceae	<i>Alectryon connatus</i>	grey birds-eye		C		1/1
plants	higher dicots	Sapotaceae	<i>Planchonella eerwah</i>			E	E	1/1
plants	higher dicots	Scrophulariaceae	<i>Bacopa monnieri</i>			C		1/1
plants	higher dicots	Scrophulariaceae	<i>Artanema fimbriatum</i>			C		3/1
plants	higher dicots	Scrophulariaceae	<i>Calceolaria tripartita</i>	lady's slipper	Y			1/1
plants	higher dicots	Scrophulariaceae	<i>Gratiola pedunculata</i>			C		1/1
plants	higher dicots	Scrophulariaceae	<i>Veronica plebeia</i>	trailing speedwell		C		3/1
plants	higher dicots	Scrophulariaceae	<i>Scoparia dulcis</i>	Scoparia	Y			3/1
plants	higher dicots	Solanaceae	<i>Physalis angulata</i>		Y			1/1

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plants	higher dicots	Solanaceae	<i>Solanum capsicoides</i>	devil's apple	Y			1/1
plants	higher dicots	Solanaceae	<i>Solanum stelligerum</i>	devil's needles		C		11/2
plants	higher dicots	Solanaceae	<i>Solanum nigrum subsp. nigrum</i>		Y			1/1
plants	higher dicots	Solanaceae	<i>Solanum mauritianum</i>	wild tobacco	Y			2/1
plants	higher dicots	Solanaceae	<i>Solanum nodiflorum</i>		Y			2/2
plants	higher dicots	Sparrmanniaceae	<i>Grewia latifolia</i>	dysentery plant		C		1/1
plants	higher dicots	Sparrmanniaceae	<i>Corchorus cunninghamii</i>			E	E	3/3
plants	higher dicots	Stylidiaceae	<i>Stylidium graminifolium</i>	grassy-leaved trigger-flower		C		5/2
plants	higher dicots	Symplocaceae	<i>Symplocos harroldii</i>	hairy hazelwood		R		1/1
plants	higher dicots	Thymelaeaceae	<i>Pimelea linifolia</i>			C		34/1
plants	higher dicots	Thymelaeaceae	<i>Wikstroemia indica</i>	tie bush		C		2
plants	higher dicots	Thymelaeaceae	<i>Pimelea linifolia subsp. linifolia</i>			C		1/1
plants	higher dicots	Ulmaceae	<i>Trema tomentosa</i>			C		5/1
plants	higher dicots	Verbenaceae	<i>Lantana camara</i>		Y			21/1
plants	higher dicots	Verbenaceae	<i>Verbena hispida</i>	rough verbena	Y			1/1
plants	higher dicots	Verbenaceae	<i>Verbena incompta</i>		Y			1/1
plants	higher dicots	Verbenaceae	<i>Verbena litoralis</i>	verbena	Y			1
plants	higher dicots	Verbenaceae	<i>Lantana montevidensis</i>	creeping lantana	Y			2
plants	higher dicots	Violaceae	<i>Viola hederacea</i>			C		14/1
plants	higher dicots	Violaceae	<i>Hybanthus monopetalus</i>			C		12/2
plants	higher dicots	Violaceae	<i>Hybanthus enneaspermus</i>			C		1
plants	higher dicots	Violaceae	<i>Hybanthus stellarioides</i>			C		10/1
plants	higher dicots	Violaceae	<i>Viola hederacea subsp. hederacea</i>			C		1/1
plants	higher dicots	Viscaceae	<i>Viscum articulatum</i>	flat mistletoe		C		3/1
plants	higher dicots	Viscaceae	<i>Notothixos subaureus</i>	golden mistletoe		C		2/1
plants	higher dicots	Vitaceae	<i>Cissus antarctica</i>			C		1/1
plants	higher dicots	Vitaceae	<i>Cissus hypoglauca</i>			C		7/1
plants	higher dicots	Vitaceae	<i>Clematicissus opaca</i>			C		5/1
plants	higher dicots	Vitaceae	<i>Cayratia clematidea</i>	slender grape		C		2/1
plants	liverworts	Geocalycaceae	<i>Chiloscyphus semiteres</i>			C		1/1
plants	lower dicots	Aristolochiaceae	<i>Aristolochia meridionalis subsp. meridionalis</i>			C		1/1
plants	lower dicots	Eupomatiaceae	<i>Eupomatia laurina</i>	bolwarra		C		1/1
plants	lower dicots	Lauraceae	<i>Beilschmiedia obtusifolia</i>	hard bolly gum		C		1/1
plants	lower dicots	Lauraceae	<i>Cinnamomum camphora</i>	camphor laurel	Y			5
plants	lower dicots	Lauraceae	<i>Cryptocarya glaucescens</i>			C		2/1
plants	lower dicots	Lauraceae	<i>Cryptocarya macdonaldii</i>	McDonald's laurel		C		5/3
plants	lower dicots	Lauraceae	<i>Cryptocarya microneura</i>	murrogon		C		7
plants	lower dicots	Lauraceae	<i>Neolitsea dealbata</i>	white bolly gum		C		3/1
plants	lower dicots	Lauraceae	<i>Cassytha muelleri</i>			C		1/1
plants	lower dicots	Menispermaceae	<i>Pleogyne australis</i>	wiry grape		C		1/1
plants	lower dicots	Menispermaceae	<i>Echinostephia aculeata</i>	prickly snake vine		C		6/1
plants	lower dicots	Menispermaceae	<i>Stephania japonica</i>			C		6
plants	lower dicots	Monimiaceae	<i>Wilkiea huegeliana</i>	veiny wilkiea		C		3/2
plants	lower dicots	Piperaceae	<i>Peperomia blanda var. floribunda</i>			C		2/2
plants	lower dicots	Ranunculaceae	<i>Clematis glycinoides</i>			C		4/1
plants	monocots	Araceae	<i>Gymnostachys anceps</i>	settler's flax		C		9/1

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plants	monocots	Arecaceae	<i>Archontophoenix cunninghamiana</i>	piccabeen palm		C		1
plants	monocots	Asparagaceae	<i>Asparagus densiflorus</i>			C		1
plants	monocots	Colchicaceae	<i>Tripladenia cunninghamii</i>			C		4/2
plants	monocots	Commelinaceae	<i>Commelina diffusa</i>	wandering jew		C		5/2
plants	monocots	Commelinaceae	<i>Murdannia graminea</i>	murdannia		C		9/1
plants	monocots	Commelinaceae	<i>Aneilema acuminatum</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus sesquiflorus</i>		Y			1
plants	monocots	Cyperaceae	<i>Cyperus tetraphyllus</i>			C		2/2
plants	monocots	Cyperaceae	<i>Rhynchospora brownii</i>	beak rush		C		1/1
plants	monocots	Cyperaceae	<i>Schoenus yarrabensis</i>			C		1/1
plants	monocots	Cyperaceae	<i>Scleria mackaviensis</i>			C		2/1
plants	monocots	Cyperaceae	<i>Abildgaardia vaginata</i>			C		1
plants	monocots	Cyperaceae	<i>Lepidosperma laterale</i>			C		49/1
plants	monocots	Cyperaceae	<i>Scleria rugosa</i>			C		2/1
plants	monocots	Cyperaceae	<i>Gahnia clarkei</i>	tall sawsedge		C		5/1
plants	monocots	Cyperaceae	<i>Cyperus laevis</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus haspan</i>			C		3/1
plants	monocots	Cyperaceae	<i>Carex maculata</i>			C		11/1
plants	monocots	Cyperaceae	<i>Scleria levis</i>			C		1/1
plants	monocots	Cyperaceae	<i>Gahnia aspera</i>			C		20/1
plants	monocots	Cyperaceae	<i>Baumea juncea</i>	bare twigrush		C		2/1
plants	monocots	Cyperaceae	<i>Cyperus iria</i>			C		1/1
plants	monocots	Cyperaceae	<i>Chorizandra cymbaria</i>			C		2/1
plants	monocots	Cyperaceae	<i>Cyperus brevifolius</i>	Mullumbimby couch	Y			1/1
plants	monocots	Cyperaceae	<i>Cyperus eragrostis</i>		Y			1/1
plants	monocots	Cyperaceae	<i>Abildgaardia ovata</i>			C		2/1
plants	monocots	Cyperaceae	<i>Isolepis inundata</i>	swamp club rush		C		2/1
plants	monocots	Cyperaceae	<i>Cyperus trinervis</i>			C		4/2
plants	monocots	Cyperaceae	<i>Cyperus exaltatus</i>	tall flatsedge		C		3/1
plants	monocots	Cyperaceae	<i>Cyperus difformis</i>	rice sedge		C		1/1
plants	monocots	Cyperaceae	<i>Cyperus bowmannii</i>			C		2/1
plants	monocots	Cyperaceae	<i>Cyperus polystachyos</i>			C		1
plants	monocots	Cyperaceae	<i>Cyperus aquatilis</i>			C		2/2
plants	monocots	Cyperaceae	<i>Baumea rubiginosa</i>	soft twigrush		C		3/1
plants	monocots	Cyperaceae	<i>Baumea articulata</i>	jointed twigrush		C		9/2
plants	monocots	Cyperaceae	<i>Fuirena ciliaris</i>			C		2/2
plants	monocots	Cyperaceae	<i>Cyperus gracilis</i>			C		1
plants	monocots	Cyperaceae	<i>Cyperus pilosus</i>			C		2/1
plants	monocots	Cyperaceae	<i>Cyperus lucidus</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus enervis</i>			C		3/2
plants	monocots	Cyperaceae	<i>Fimbristylis dichotoma</i>	common fringe-rush		C		10/2
plants	monocots	Cyperaceae	<i>Fimbristylis tristachya</i>			C		1/1
plants	monocots	Cyperaceae	<i>Bolboschoenus caldwellii</i>			C		1/1
plants	monocots	Cyperaceae	<i>Fimbristylis cinnamometorum</i>			C		13/1
plants	monocots	Cyperaceae	<i>Schoenus apogon var. apogon</i>			C		2
plants	monocots	Cyperaceae	<i>Lepidosperma laterale var. laterale</i>			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Dioscoreaceae	<i>Dioscorea transversa</i>	native yam		C		2/1
plants	monocots	Eriocaulaceae	<i>Eriocaulon scariosum</i>			C		1/1
plants	monocots	Flagellariaceae	<i>Flagellaria indica</i>	whip vine		C		5/1
plants	monocots	Haemodoraceae	<i>Haemodorum austroqueenslandicum</i>			C		20/1
plants	monocots	Hemerocallidaceae	<i>Dianella</i>			C		1/1
plants	monocots	Hemerocallidaceae	<i>Geitonoplesium cymosum</i>	scrambling lily		C		10/1
plants	monocots	Hemerocallidaceae	<i>Dianella caerulea</i>			C		1
plants	monocots	Hemerocallidaceae	<i>Dianella longifolia</i>			C		1
plants	monocots	Hemerocallidaceae	<i>Dianella caerulea var. assera</i>			C		5/1
plants	monocots	Hemerocallidaceae	<i>Dianella caerulea var. protensa</i>			C		31
plants	monocots	Hemerocallidaceae	<i>Dianella longifolia var. stenophylla</i>			C		12/1
plants	monocots	Hemerocallidaceae	<i>Dianella revoluta var. revoluta</i>			C		24/1
plants	monocots	Hemerocallidaceae	<i>Dianella caerulea var. producta</i>			C		1
plants	monocots	Hypoxidaceae	<i>Hypoxis pratensis var. pratensis</i>			C		3/1
plants	monocots	Hypoxidaceae	<i>Curculigo ensifolia var. ensifolia</i>			C		1/1
plants	monocots	Hypoxidaceae	<i>Hypoxis hygrometrica var. villosisepala</i>			C		1/1
plants	monocots	Iridaceae	<i>Freesia laxa</i>		Y			2/2
plants	monocots	Iridaceae	<i>Sisyrinchium sp. (Peregian P.R.Sharpe 4970)</i>	scourweed	Y			1/1
plants	monocots	Iridaceae	<i>Dietes iridioides</i>		Y			1/1
plants	monocots	Iridaceae	<i>Patersonia sericea var. sericea</i>			C		2/2
plants	monocots	Iridaceae	<i>Patersonia glabrata</i>			C		3/1
plants	monocots	Johnsoniaceae	<i>Caesia parviflora</i>			C		1/1
plants	monocots	Johnsoniaceae	<i>Tricoryne elatior</i>	yellow autumn lily		C		11
plants	monocots	Johnsoniaceae	<i>Caesia parviflora var. parviflora</i>			C		2
plants	monocots	Johnsoniaceae	<i>Tricoryne anceps subsp. pterocaulon</i>			C		12/1
plants	monocots	Juncaceae	<i>Juncus usitatus</i>			C		3/2
plants	monocots	Juncaceae	<i>Juncus continuus</i>			C		5/1
plants	monocots	Juncaceae	<i>Juncus prismatocarpus</i>	branching rush		C		1/1
plants	monocots	Juncaceae	<i>Juncus polyanthemus</i>			C		3/1
plants	monocots	Juncaginaceae	<i>Triglochin procerum</i>			C		4/1
plants	monocots	Juncaginaceae	<i>Triglochin multifructum</i>			C		1/1
plants	monocots	Juncaginaceae	<i>Maundia triglochoides</i>			V		1/1
plants	monocots	Laxmanniaceae	<i>Lomandra laxa</i>	broad-leaved matrush		C		28/1
plants	monocots	Laxmanniaceae	<i>Lomandra longifolia</i>			C		23
plants	monocots	Laxmanniaceae	<i>Thysanotus tuberosus</i>			C		8/1
plants	monocots	Laxmanniaceae	<i>Lomandra confertifolia</i>			C		1
plants	monocots	Laxmanniaceae	<i>Lomandra filiformis subsp. filiformis</i>			C		4
plants	monocots	Laxmanniaceae	<i>Thysanotus tuberosus subsp. tuberosus</i>			C		2/2
plants	monocots	Laxmanniaceae	<i>Lomandra multiflora subsp. multiflora</i>			C		39/1
plants	monocots	Laxmanniaceae	<i>Lomandra confertifolia subsp. pallida</i>			C		36/1
plants	monocots	Laxmanniaceae	<i>Eustrephus latifolius</i>	wombat berry		C		18/1
plants	monocots	Laxmanniaceae	<i>Cordyline petiolaris</i>	large-leaved palm lily		C		1/1
plants	monocots	Laxmanniaceae	<i>Lomandra filiformis</i>			C		13/2
plants	monocots	Laxmanniaceae	<i>Cordyline rubra</i>	red-fruited palm lily		C		6/1
plants	monocots	Laxmanniaceae	<i>Laxmannia gracilis</i>	slender wire lily		C		13/1
plants	monocots	Orchidaceae	<i>Cymbidium suave</i>			C		2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Orchidaceae	<i>Geodorum densiflorum</i>	pink nodding orchid		C		1
plants	monocots	Orchidaceae	<i>Caladenia catenata</i> var. <i>catenata</i>			C		1/1
plants	monocots	Orchidaceae	<i>Arthrochilus irritabilis</i>	leafy elbow orchid		C		3/2
plants	monocots	Orchidaceae	<i>Dockrillia linguiformis</i>	tongue orchid		C		2
plants	monocots	Orchidaceae	<i>Chiloglottis sylvestris</i>			C		2/1
plants	monocots	Orchidaceae	<i>Genoplesium acuminatum</i>			C		2/1
plants	monocots	Orchidaceae	<i>Spiranthes sinensis</i>	austral ladies tresses		C		2/2
plants	monocots	Orchidaceae	<i>Caladenia catenata</i>			C		2
plants	monocots	Orchidaceae	<i>Cryptostylis erecta</i>	bonnet orchid		C		2/1
plants	monocots	Orchidaceae	<i>Dipodium variegatum</i>			C		9/2
plants	monocots	Orchidaceae	<i>Microtis parviflora</i>	slender onion orchid		C		2/1
plants	monocots	Orchidaceae	<i>Oberonia palmicola</i>			C		1/1
plants	monocots	Philydraceae	<i>Philydrum lanuginosum</i>	frogsmouth		C		4/1
plants	monocots	Poaceae	<i>Urochloa decumbens</i>		Y			1/1
plants	monocots	Poaceae	<i>Eriachne pallescens</i>			C		1
plants	monocots	Poaceae	<i>Paspalidium distans</i>	shotgrass		C		20/1
plants	monocots	Poaceae	<i>Pennisetum setaceum</i>	fountain grass	Y			1/1
plants	monocots	Poaceae	<i>Pennisetum purpureum</i>	elephant grass	Y			1/1
plants	monocots	Poaceae	<i>Ottochloa gracillima</i>	pademelon grass		C		15/1
plants	monocots	Poaceae	<i>Eragrostis bahiensis</i>		Y			1/1
plants	monocots	Poaceae	<i>Digitaria violascens</i>	bastard summergrass	Y			1/1
plants	monocots	Poaceae	<i>Digitaria parviflora</i>			C		25/1
plants	monocots	Poaceae	<i>Digitaria longiflora</i>			C		2/1
plants	monocots	Poaceae	<i>Cymbopogon refractus</i>	barbed-wire grass		C		54/1
plants	monocots	Poaceae	<i>Axonopus fissifolius</i>		Y			2/2
plants	monocots	Poaceae	<i>Sporobolus fertilis</i>	giant Parramatta grass	Y			1/1
plants	monocots	Poaceae	<i>Capillipedium spicigerum</i>	spicytop		C		4/1
plants	monocots	Poaceae	<i>Paspalidium caespitosum</i>	brigalow grass		C		1
plants	monocots	Poaceae	<i>Eragrostis spartinooides</i>			C		5/1
plants	monocots	Poaceae	<i>Paspalum scrobiculatum</i>	ditch millet		C		9/1
plants	monocots	Poaceae	<i>Paspalidium criniforme</i>			C		1
plants	monocots	Poaceae	<i>Chrysopogon sylvaticus</i>			C		5/1
plants	monocots	Poaceae	<i>Arundinella nepalensis</i>	reedgrass		C		3/1
plants	monocots	Poaceae	<i>Alloteropsis semialata</i>	cockatoo grass		C		12/1
plants	monocots	Poaceae	<i>Oplismenus imbecillis</i>			C		6/2
plants	monocots	Poaceae	<i>Panicum effusum</i>			C		7/1
plants	monocots	Poaceae	<i>Chloris virgata</i>	feathertop rhodes grass	Y			1/1
plants	monocots	Poaceae	<i>Aristida vagans</i>			C		20/1
plants	monocots	Poaceae	<i>Panicum simile</i>			C		44/3
plants	monocots	Poaceae	<i>Lolium perenne</i>	perennial ryegrass	Y			2/1
plants	monocots	Poaceae	<i>Chloris gayana</i>	rhodes grass	Y			1/1
plants	monocots	Poaceae	<i>Briza minor</i>	shivery grass	Y			1
plants	monocots	Poaceae	<i>Poa annua</i>	annual poa	Y			1/1
plants	monocots	Poaceae	<i>Setaria pumila</i> subsp. <i>pallidefusca</i>		Y			1/1
plants	monocots	Poaceae	<i>Sacciolepis indica</i>	Indian cupscale grass		C		6/1
plants	monocots	Poaceae	<i>Paspalum distichum</i>	water couch		C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Poaceae	<i>Paspalum dilatatum</i>	paspalum	Y			1/1
plants	monocots	Poaceae	<i>Oplismenus aemulus</i>	creeping shade grass		C		11
plants	monocots	Poaceae	<i>Lolium multiflorum</i>	italian ryegrass	Y			3/2
plants	monocots	Poaceae	<i>Eragrostis sororia</i>			C		1/1
plants	monocots	Poaceae	<i>Eragrostis brownii</i>	Brown's lovegrass		C		31/1
plants	monocots	Poaceae	<i>Entolasia whiteana</i>			C		12/3
plants	monocots	Poaceae	<i>Digitaria eriantha</i>		Y			1/1
plants	monocots	Poaceae	<i>Aristida warburgii</i>			C		33/1
plants	monocots	Poaceae	<i>Paspalum urvillei</i>	vasey grass	Y			1
plants	monocots	Poaceae	<i>Entolasia stricta</i>	wiry panic		C		63/7
plants	monocots	Poaceae	<i>Themeda triandra</i>	kangaroo grass		C		42/2
plants	monocots	Poaceae	<i>Sporobolus laxus</i>			C		3/1
plants	monocots	Poaceae	<i>Sarga leiocladum</i>			C		1/1
plants	monocots	Poaceae	<i>Leersia hexandra</i>	swamp rice grass		C		1/1
plants	monocots	Poaceae	<i>Digitaria fumida</i>			C		1/1
plants	monocots	Poaceae	<i>Megathyrsus maximus var. coloratus</i>		Y			2/1
plants	monocots	Poaceae	<i>Hemarthria uncinata var. uncinata</i>			C		1/1
plants	monocots	Poaceae	<i>Aristida benthamii var. benthamii</i>			C		41/1
plants	monocots	Poaceae	<i>Ischaemum australe var. australe</i>			C		4/1
plants	monocots	Poaceae	<i>Echinopogon nutans var. nutans</i>			C		1/1
plants	monocots	Poaceae	<i>Paspalidium albobillosum</i>			C		2/1
plants	monocots	Poaceae	<i>Notodanthonia longifolia</i>			C		2/1
plants	monocots	Poaceae	<i>Lachnagrostis filiformis</i>			C		1/1
plants	monocots	Poaceae	<i>Aristida queenslandica var. queenslandica</i>			C		31/1
plants	monocots	Poaceae	<i>Poa labillardierei var. labillardierei</i>	tussock grass		C		2/2
plants	monocots	Poaceae	<i>Bothriochloa decipiens var. decipiens</i>			C		1/1
plants	monocots	Poaceae	<i>Dichanthium sericeum subsp. sericeum</i>			C		1/1
plants	monocots	Poaceae	<i>Microlaena stipoides var. stipoides</i>			C		9/2
plants	monocots	Poaceae	<i>Eremochloa bimaculata</i>	poverty grass		C		39/1
plants	monocots	Poaceae	<i>Eragrostis tenuifolia</i>	elastic grass	Y			1/1
plants	monocots	Poaceae	<i>Digitaria breviglumis</i>			C		17
plants	monocots	Poaceae	<i>Dichelachne micrantha</i>	shorthair plumegrass		C		7
plants	monocots	Poaceae	<i>Austrostipa pubescens</i>	tall speargrass		C		8/1
plants	monocots	Poaceae	<i>Andropogon virginicus</i>	whiskey grass	Y			5/1
plants	monocots	Poaceae	<i>Sporobolus africanus</i>	Parramatta grass	Y			2
plants	monocots	Poaceae	<i>Sorghum arundinaceum</i>	Rhodesian Sudan grass	Y			1/1
plants	monocots	Poaceae	<i>Paspalum conjugatum</i>	sourgrass	Y			1/1
plants	monocots	Poaceae	<i>Imperata cylindrica</i>	blady grass		C		44/1
plants	monocots	Poaceae	<i>Eragrostis mexicana</i>	Mexican lovegrass	Y			1/1
plants	monocots	Poaceae	<i>Dichelachne montana</i>			C		2/2
plants	monocots	Poaceae	<i>Digitaria didactyla</i>	Queensland blue couch	Y			1/1
plants	monocots	Poaceae	<i>Entolasia marginata</i>	bordered panic		C		5/3
plants	monocots	Poaceae	<i>Cortaderia selloana</i>	pampas grass	Y			1
plants	monocots	Ripogonaceae	<i>Ripogonum brevifolium</i>	small-leaved supplejack		C		1/1
plants	monocots	Smilacaceae	<i>Smilax australis</i>	barbed-wire vine		C		17/1
plants	monocots	Smilacaceae	<i>Smilax glycyphylla</i>	sweet sarsaparilla		C		2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Xanthorrhoeaceae	<i>Xanthorrhoea johnsonii</i>			C		2
plants	monocots	Xanthorrhoeaceae	<i>Xanthorrhoea macronema</i>			C		8/2
plants	monocots	Xanthorrhoeaceae	<i>Xanthorrhoea latifolia subsp. latifolia</i>			C		25
plants	monocots	Xyridaceae	<i>Xyris complanata</i>	yellow-eye		C		2
plants	monocots	Zingiberaceae	<i>Alpinia caerulea</i>	wild ginger		C		5/1
plants	mosses	Dicranaceae	<i>Campylopus pyriformis</i>			C		1/1
plants	mosses	Hypopterygiaceae	<i>Hypopterygium tamarisci</i>			C		1/1

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Presumed Extinct (PE), Endangered (E), Vulnerable (V), Rare (R), Common (C) or Not Protected ().

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).

This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.

This number is output as 999 if it equals or exceeds this value.

APPENDIX 4
EPBC PROTECTED MATTERS SEARCH TOOL
RESULTS (November 2009)

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Protected Matters Search Tool

You are here: [Environment Home](#) > [EPBC Act](#) > [Search](#)

26 November 2009 14:06

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the [caveat](#) at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at <http://www.environment.gov.au/atlas> may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>

Map of Search Region including any Buffer

This map may contain data which are
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© PSMA Australia Limited

Search Type: Point

Buffer: 5 km

Coordinates: -27.64176,153.2222

Thumbnail Map of Search Region

Report Contents: [Summary](#)

[Details](#)

- [Matters of NES](#)
- [Other matters protected by the EPBC Act](#)
- [Extra Information](#)

[Caveat](#)

[Acknowledgments](#)

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see <http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html>.

World Heritage Properties:	None
National Heritage Places:	None
<u>Wetlands of International Significance:</u> (Ramsar Sites)	1
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
<u>Threatened Species:</u>	28
<u>Migratory Species:</u>	16

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov.au/epbc/permits/index.html>.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
<u>Places on the RNE:</u>	1

Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Other Commonwealth Reserves:	None
Regional Forest Agreements:	1

Details

Matters of National Environmental Significance

Wetlands of International Significance [[Dataset Information](#)]
(Ramsar Sites)

[MORETON BAY](#)

Within 10 km of Ramsar site

Threatened Species [[Dataset Information](#)]

Status Type of Presence

Birds

[Anthochaera phrygia](#)

Regent Honeyeater

Endangered Species or species habitat may occur within area

[Cyclopsitta diophthalma coxeni](#)

Coxen's Fig-Parrot

Endangered Species or species habitat likely to occur within area

[Erythrotriorchis radiatus](#)

Red Goshawk

Vulnerable Species or species habitat likely to occur within area

[Lathamus discolor](#)

Swift Parrot

Endangered Species or species habitat may occur within area

[Rostratula australis](#)

Australian Painted Snipe

Vulnerable Species or species habitat may occur within area

[Turnix melanogaster](#)

Black-breasted Button-quail

Vulnerable Species or species habitat likely to occur within area

Frogs

[Litoria olongburensis](#)

Wallum Sedge Frog

Vulnerable Species or species habitat likely to occur within area

[Mixophyes iteratus](#)

Southern Barred Frog, Giant Barred Frog

Endangered Species or species habitat likely to occur within area

Mammals

[Chalinolobus dwyeri](#)

Large-eared Pied Bat, Large Pied Bat

Vulnerable Species or species habitat may occur within area

<i>Dasyurus hallucatus</i> Northern Quoll	Endangered	Species or species habitat may occur within area
<i>Dasyurus maculatus maculatus (SE mainland population)</i> Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat may occur within area
<i>Potorous tridactylus tridactylus</i> Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<i>Xeromys myoides</i> Water Mouse, False Water Rat	Vulnerable	Species or species habitat known to occur within area
Reptiles		
<i>Coeranoscincus reticulatus</i> Three-toed Snake-tooth Skink	Vulnerable	Species or species habitat may occur within area
Plants		
<i>Allocasuarina defungens</i> Dwarf Heath Casuarina	Endangered	Species or species habitat may occur within area
<i>Baloghia marmorata</i> Marbled Balogia, Jointed Baloghia	Vulnerable	Species or species habitat may occur within area
<i>Bosistoa selwynii</i> Heart-leaved Bosistoa	Vulnerable	Species or species habitat likely to occur within area
<i>Bosistoa transversa</i> Three-leaved Bosistoa	Vulnerable	Species or species habitat likely to occur within area
<i>Corchorus cunninghamii</i> Native Jute	Endangered	Species or species habitat likely to occur within area
<i>Cryptocarya foetida</i> Stinking Cryptocarya, Stinking Laurel	Vulnerable	Species or species habitat likely to occur within area
<i>Cryptostylis hunteriana</i> Leafless Tongue-orchid	Vulnerable	Species or species habitat may occur within area
<i>Gossia gonoclada</i> Angle-stemmed Myrtle	Endangered	Species or species habitat likely to occur within area
<i>Hydrocharis dubia</i> Frogbit	Vulnerable	Species or species habitat likely to occur within area
<i>Macadamia integrifolia</i> Macadamia Nut, Queensland Nut, Smooth-shelled Macadamia, Bush Nut, Nut Oak	Vulnerable	Species or species habitat likely to occur within area
<i>Marsdenia longiloba</i> Clear Milkvine	Vulnerable	Species or species habitat likely to occur within area
<i>Phebalium distans</i> Mt Berryman Phebalium	Critically Endangered	Species or species habitat may occur within area
<i>Taeniophyllum muelleri</i> Minute Orchid, Ribbon-root Orchid	Vulnerable	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence

Migratory Terrestrial Species

Birds[Cyclopsitta diophthalma coxeni](#)

Coxen's Fig-Parrot

Migratory Species or species habitat likely to occur within area

[Haliaeetus leucogaster](#)

White-bellied Sea-Eagle

Migratory Species or species habitat likely to occur within area

[Hirundapus caudacutus](#)

White-throated Needle-tail

Migratory Species or species habitat may occur within area

[Merops ornatus](#)

Rainbow Bee-eater

Migratory Species or species habitat may occur within area

[Monarcha melanopsis](#)

Black-faced Monarch

Migratory Breeding may occur within area

[Monarcha trivirgatus](#)

Spectacled Monarch

Migratory Breeding likely to occur within area

[Myiagra cyanoleuca](#)

Satin Flycatcher

Migratory Breeding likely to occur within area

[Rhipidura rufifrons](#)

Rufous Fantail

Migratory Breeding may occur within area

[Xanthomyza phrygia](#)

Regent Honeyeater

Migratory Species or species habitat may occur within area

Migratory Wetland Species**Birds**[Ardea alba](#)

Great Egret, White Egret

Migratory Species or species habitat may occur within area

[Ardea ibis](#)

Cattle Egret

Migratory Breeding likely to occur within area

[Nettapus coromandelianus albipennis](#)

Australian Cotton Pygmy-goose

Migratory Species or species habitat may occur within area

[Rostratula benghalensis s. lat.](#)

Painted Snipe

Migratory Species or species habitat may occur within area

Migratory Marine Birds[Apus pacificus](#)

Fork-tailed Swift

Migratory Species or species habitat may occur within area

[Ardea alba](#)

Great Egret, White Egret

Migratory Species or species habitat may occur within area

[Ardea ibis](#)

Cattle Egret

Migratory Breeding likely to occur within area

Other Matters Protected by the EPBC ActListed Marine Species [[Dataset Information](#)]

Status Type of Presence

Birds[Anseranas semipalmata](#)

Magpie Goose

Listed - overfly marine Species or species habitat may occur within area

<u><i>Apus pacificus</i></u> Fork-tailed Swift	area Listed - overfly marine area	Species or species habitat may occur within area
<u><i>Ardea alba</i></u> Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
<u><i>Ardea ibis</i></u> Cattle Egret	Listed - overfly marine area	Breeding likely to occur within area
<u><i>Haliaeetus leucogaster</i></u> White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
<u><i>Hirundapus caudacutus</i></u> White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
<u><i>Lathamus discolor</i></u> Swift Parrot	Listed - overfly marine area	Species or species habitat may occur within area
<u><i>Merops ornatus</i></u> Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
<u><i>Monarcha melanopsis</i></u> Black-faced Monarch	Listed - overfly marine area	Breeding may occur within area
<u><i>Monarcha trivirgatus</i></u> Spectacled Monarch	Listed - overfly marine area	Breeding likely to occur within area
<u><i>Myiagra cyanoleuca</i></u> Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
<u><i>Nettapus coromandelianus albipennis</i></u> Australian Cotton Pygmy-goose	Listed - overfly marine area	Species or species habitat may occur within area
<u><i>Rhipidura rufifrons</i></u> Rufous Fantail	Listed - overfly marine area	Breeding may occur within area

[*Rostratula benghalensis s. lat.*](#)

Painted Snipe

Listed - Species or species habitat may occur
overfly within area
marine
area

Places on the RNE [[Dataset Information](#)]

Note that not all Indigenous sites may be listed.

Historic[Carbrook Lutheran Cemetery QLD](#)

Extra Information

State and Territory Reserves [[Dataset Information](#)]

Bayview Conservation Park, QLD

Carbrook Wetlands 1 Conservation Park, QLD

Venman Bushland National Park, QLD

Regional Forest Agreements [[Dataset Information](#)]

Note that all RFA areas including those still under consideration have been included.

South East Queensland RFA, Queensland

Caveat

The information presented in this report has been provided by a range of data sources as [acknowledged](#) at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the *Environment Protection and Biodiversity Conservation Act 1999*. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the [migratory](#) and [marine](#) provisions of the Act have been mapped.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as [extinct or considered as vagrants](#)
- some species and ecological communities that have only recently been listed
- [some terrestrial species](#) that overfly the Commonwealth marine area
- migratory species that are very [widespread, vagrant, or only occur in small numbers](#).

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgments

This database has been compiled from a range of data sources. The Department acknowledges the following custodians who have contributed valuable data and advice:

- [New South Wales National Parks and Wildlife Service](#)
- [Department of Sustainability and Environment, Victoria](#)
- [Department of Primary Industries, Water and Environment, Tasmania](#)
- [Department of Environment and Heritage, South Australia Planning SA](#)
- [Parks and Wildlife Commission of the Northern Territory](#)
- [Environmental Protection Agency, Queensland](#)
- [Birds Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Atherton and Canberra](#)
- [University of New England](#)
- Other groups and individuals

[ANUCliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University](#) was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

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APPENDIX 5
CONSERVATION SIGNIFICANT SPECIES DETECTED
FROM DATABASE SEARCHES BUT NOT EXPECTED
TO OCCUR WITHIN THE SUBJECT SITE

Appendix 5: Conservation significant species detected from database searches but not expected to occur within the subject site

'At-Risk' Species obtained from database searches but not detected on the subject site during survey

Zoological Name	Common Name	Status NCA/EPBC	Comments
AMPHIBIANS			
<i>Crinia tinnula</i>	Wallum Froglet	V / -	Wallum Frogs are 'acid frogs' breeding in low pH freshwater, usually less than pH 6. In Queensland, the frogs are restricted to the coastal lowlands (or "wallum" of Coaldrake 1961) of the southeast. The Wallum Froglet is associated with acidic, soft waters of melaleuca swamps, sedgeland, wet and dry heathland and wallum/woodland areas in sandy coastal lowlands. It may occasionally be found in adjacent forests with a healthy understorey and may be found well away from water. Field investigations have not recorded the species as present during suitable field conditions and that suitable acid water and habitat conditions do not occur within the study site. No impacts expected.
<i>Litoria olongburensis</i>	Olongburra Sedgefrog, Wallum Sedgefrog	V / V	Not expected to occur as no suitable habitat present on the site.
<i>Mixophyes iteratus</i>	Giant Barred Frog	E / E	Not expected to occur on the subject lands. This species has not been recorded in the catchment or local area or in the Redlands.
REPTILES			
<i>Coeranoscincus reticulatus</i>	Three-toed Snake-tooth Skink	NT / V	Not expected to occur on the subject lands. This species has not been recorded in the local area or in the Redlands.
BIRDS			
<i>Actitis hypoleucos</i>	Common Sandpiper	S / M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands. No Impacts expected.
<i>Anthochaera phrygia</i>	Regent Honeyeater	E / E,M	A wide-ranging and rare visitor to SE Queensland, which is not expected to occur on subject, lands. No detrimental impact from proposal expected. It should be noted that this species is listed as migratory in the EPBC Act under the name <i>Xanthomyza Phrygia</i> .
<i>Apus pacificus</i>	Fork-tailed Swift	S / M	A wide-ranging aerial species, which might occasion or occur in the area. Not found during survey and unlikely to occur in the area. No impact expected.
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	S / M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands.
<i>Calidris ferruginea</i>	Curlew Sandpiper	S / M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands.
<i>Cyclopsitta diophthalma coxeni</i>	Double-eyed Fig Parrot (Coxen's Fig Parrot)	E / E,M	No habitat present on the site. No records of this species in the area and considered to be locally extinct. The area also contains very little suitable feeding resources and the quarry extension will not remove any potential habitat. The application should not be viewed as relevant to a secure future for this species. It should be noted that this species is listed as migratory in the EPBC Act under the name <i>Psittaculirostris diophthalma coxeni</i> .
<i>Diomedea exulans</i>	Wandering	V/V,M	An entirely marine/pelagic species associated with marine

Zoological Name	Common Name	Status NCA/EPBC	Comments
	Albatross		habitats. There is no suitable habitat within the subject lands and the species will not occur onsite.
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork (Jabiru)	NT/ -	Very low potential for occurrence within extension area or on subject lands. Mostly associated with large wetlands or marine habitats. Little or no impact expected from proposal.
<i>Erythrotriorchis radiatus</i>	Red Goshawk	E / V	A wide-ranging species, which was not found during survey and is not expected to occur in the area. Little or no impact from proposal.
<i>Hydroprogne caspia</i>	Caspian Tern	S / M	Primarily associated with marine habitats. There is no suitable habitat within the subject lands.
<i>Lathamus discolor</i>	Swift Parrot	E / E	A wide-ranging species, which is not expected to occur on the site. No impact expected from proposal.
<i>Lophoictinia isura</i>	Square-tailed Kite	NT/ -	A wide-ranging species, which was not found during survey and is not expected to occur in the area. Little or no impact from proposal.
<i>Nettapus coromandelianus albigennis</i>	Cotton Pygmy-Goose	R / M	No habitat on the subject lands and not expected to occur on the site.
<i>Numenius phaeopus</i>	Whimbrel	S / M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands.
<i>Pandion cristatus</i>	Eastern Osprey	S / M	A species primarily associated with marine and riparian habitats. There is no suitable habitat within the subject lands and the species is not expected to occur on the subject lands. No impacts expected. It should be noted that this species is listed as migratory in the EPBC Act under the name <i>Pandion haliaetus</i> .
<i>Plegadis falcinellus</i>	Glossy Ibis	S / M	A species primarily associated with large swamps. There is no suitable habitat within the subject lands and the species is not expected to occur on the subject lands. No impacts expected.
<i>Pluvialis fulva</i>	Pacific Golden Plover	S / M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands.
<i>Rostratula australis</i>	Australian Painted Snipe	V / V,M	No habitat on the subject lands. Not expected to occur on the site. It should be noted that this species is listed as migratory in the EPBC Act under the name <i>Rostratula benghalensis s. lat.</i> (Painted Snipe).
<i>Thalasseus bergii</i>	Crested Tern	S / M	This species is primarily associated with marine and estuarine habitats. There is no suitable habitat within the subject lands.
<i>Tringa nebularia</i>	Greenshank	S / M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands.
<i>Tringa stagnatilis</i>	Marsh Sandpiper	S / M	A migratory wader and primarily associated with marine and larger wetland habitats. There is no suitable habitat within the subject lands.
MAMMALS			
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V / V	Only possible occurrence on subject lands. Not detected by Anabat detector. No impact expected from proposal.
<i>Dasyurus hallucatus</i>	Northern Quoll	C / E	Not known or expected to occur in the area. The only habitat of value within the subject site would be outside of the extraction area. The restoration actions proposed would see an increase in habitat values for this species. No direct impact expected.
<i>Dasyurus maculatus maculatus</i> (SE mainland)	Spotted-tailed Quoll (SE mainland)	V / E	Not expected to occur on subject lands. If present, this species would be associated with areas outside of the

Zoological Name	Common Name	Status NCA/EPBC	Comments
			extension.
<i>Ornithorhynchus anatinus</i>	Platypus	S / -	Limited potential habitat on the subject lands. No evidence of their characteristic burrows was observed. The species would be restricted to areas outside of the extension if present on the subject lands. Protection of water quality and flow regimes may be crucial to their ongoing presence in the local area. Targeted surveys would be required to establish their presence or absence from the subject lands.
<i>Potorous tridactylus tridactylus</i>	Long-nosed Potoroo (SE Mainland)	V / V	Not found during survey and is considered unlikely on the subject lands.
<i>Xeromys myoides</i>	Water Mouse, False Water Rat	V / V	This species is entirely associated with marine habitats. There is no suitable habitat within the subject lands. This species will not occur on the subject site. No impacts expected.

EPBC Act - Indicates the Australian conservation status of each taxon under the EPBC Act. The values are: Endangered (E), Near Threatened (NT), Vulnerable (V), and Migratory (M).

NC Act - Indicates the Queensland conservation status of each taxon under the NC Act. The values are: Presumed Extinct (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (S) and Common (C).

APPENDIX 6
LIST OF TERRESTRIAL VERTEBRATE SPECIES
DETECTED ON SITE DURING 2004 SURVEY AND
SUBSEQUENT SITE VISITS

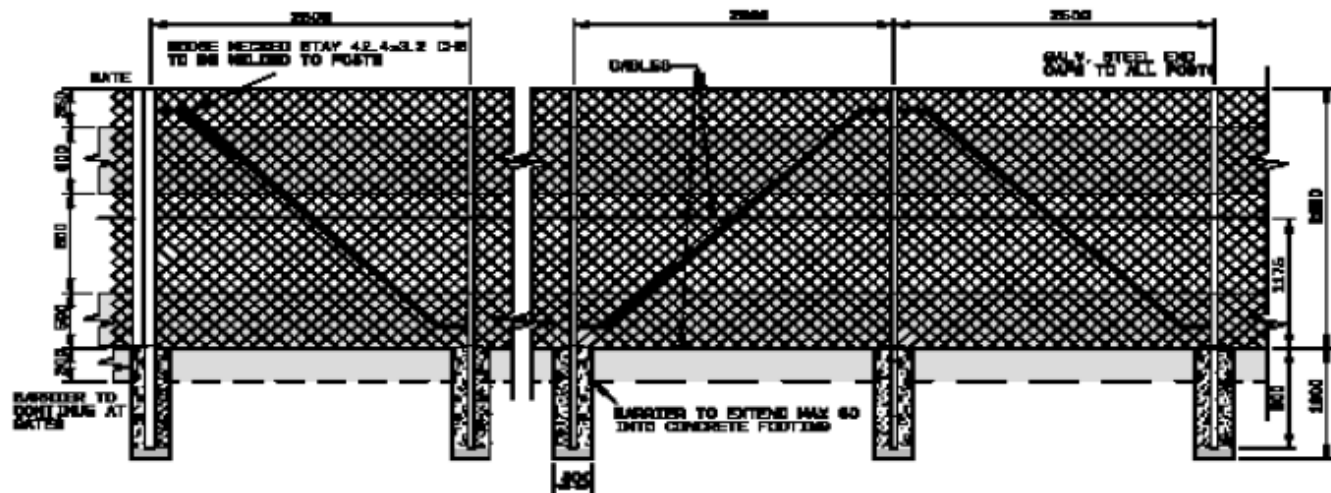
Appendix 6. Fauna species detected during the 2004 BAAM survey and/or subsequent site visits

Zoological Name	Common Name
AMPHIBIANS	
<i>Bufo marinus</i>	Cane Toad
<i>Crinia parinsignifera</i>	Beeping Froglet
<i>Limnodynastes peronii</i>	Striped Marshfrog
<i>Litoria fallax</i>	Eastern Sedgefrog
<i>Pseudophryne coriacea</i>	Red Backed Broodfrog
<i>Pseudophryne raveni</i>	Copper Backed Broodfrog
REPTILES	
<i>Anomalopus verreauxi</i>	Verreaux's Skink
<i>Calyptotis scutirostrum</i>	
<i>Carlia vivax</i>	
<i>Cryptoblepharus virgatus</i>	Wall Skink
<i>Cryptophis nigrescens</i>	Eastern Small-eyed Snake
<i>Ctenotus robustus</i>	Eastern Striped Skink
<i>Ctenotus taeniolatus</i>	Copper-tailed Skink
<i>Dendrelaphis punctulata</i>	Common Tree Snake
<i>Lampropholis amicula</i>	
<i>Lampropholis delicata</i>	Garden Skink
<i>Morelia spilota</i>	Carpet Python
<i>Physignathus lesueurii</i>	Eastern Water Dragon
<i>Pogona barbata</i>	Bearded Dragon
<i>Varanus varius</i>	Lace Monitor
BIRDS	
<i>Acanthiza pusilla</i>	Brown Thornbill
<i>Accipiter fasciatus</i>	Brown Goshawk
<i>Aegotheles cristatus</i>	Australian Owlet Nightjar
<i>Alcedo azureus</i>	Azure Kingfisher
<i>Anas superciliosa</i>	Black Duck
<i>Aquila audax</i>	Wedge-tailed Eagle
<i>Ardea ibis</i>	Cattle Egret
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
<i>Cacatua roseicapilla</i>	Galah
<i>Cacomantis flabelliformis</i>	Fantail Cuckoo
<i>Centropus phasianinus</i>	Pheasant Coucal
<i>Chenonetta jubata</i>	Wood Duck
<i>Cisticola exilis</i>	Golden-headed Cisticola
<i>Colluricincla harmonica</i>	Grey Shrike-Thrush
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike
<i>Coracina papuensis</i>	Little Cuckoo-Shrike
<i>Coracina tenuirostris</i>	Cicadabird
<i>Cormobates leucophaea</i>	White-throated Treecreeper
<i>Corvus orru</i>	Torresian Crow
<i>Cracticus nigrogularis</i>	Pied Butcherbird

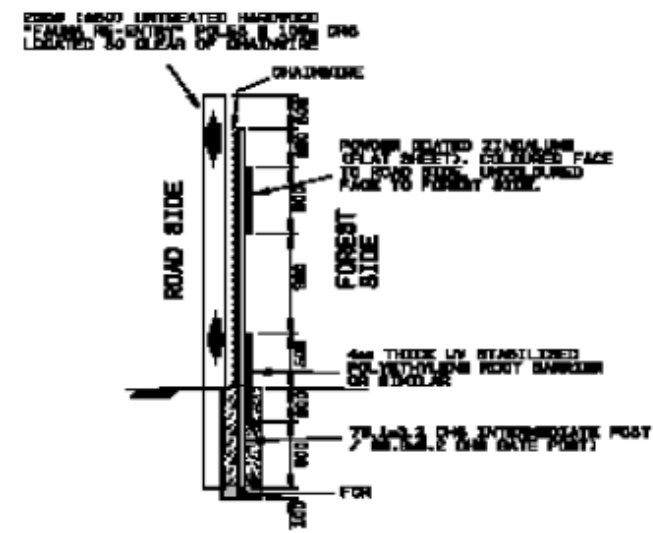
Zoological Name	Common Name
<i>Cracticus torquatus</i>	Grey Butcherbird
<i>Dacelo novaeguineae</i>	Laughing Kookaburra
<i>Daphoenositta chrysoptera</i>	Varied Sittella
<i>Dicaeum hirundinaceum</i>	Mistletoebird
<i>Dicrurus bracteatus</i>	Spangled Drongo
<i>Egretta garzetta</i>	Little Egret
<i>Egretta novaehollandiae</i>	White-faced Heron
<i>Elanus axillaris</i>	Black-shouldered Kite
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater
<i>Eopsaltria australis</i>	Eastern Yellow Robin
<i>Eudynamys scolopacea</i>	Koel
<i>Eurostopodus mystacalis</i>	White-throated Nightjar
<i>Falco cenchroides</i>	Nankeen Kestrel
<i>Gallinula tenebrosa</i>	Dusky Moorhen
<i>Gallirallus philippensis</i>	Banded Land Rail
<i>Geopelia humeralis</i>	Bar-shouldered Dove
<i>Geopelia striata</i>	Peaceful Dove
<i>Gerygone olivacea</i>	White-throated Gerygone
<i>Glossopsitta concinna</i>	Musk Lorikeet
<i>Glossopsitta pusilla</i>	Little Lorikeet
<i>Grallina cyanoleuca</i>	Magpie-Lark or Peewee
<i>Gymnorhina tibicen</i>	Australian Magpie
<i>Haliastur sphenurus</i>	Whistling Kite
<i>Hirundo neoxena</i>	Welcome Swallow
<i>Hirundo nigricans</i>	Tree Martin
<i>Lalage leucomela</i>	Varied Triller
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater
<i>Lichmera indistincta</i>	Brown Honeyeater
<i>Lonchura castaneothorax</i>	Chestnut-breasted Mannikin
<i>Macropygia amboinensis</i>	Brown Cuckoo-Dove
<i>Malurus lamberti</i>	Variegated Fairy-Wren
<i>Malurus melanocephalus</i>	Red-backed Fairy-Wren
<i>Manorina melanocephala</i>	Noisy Miner
<i>Meliphaga lewinii</i>	Lewin's Honeyeater
<i>Melithreptus albogularis</i>	White-throated Honeyeater
<i>Merops ornatus</i>	Rainbow Bee-Eater
<i>Monarcha melanopsis</i>	Black-faced Monarch
<i>Myiagra rubecula</i>	Leaden Flycatcher
<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater
<i>Neochmia temporalis</i>	Red-browed Finch
<i>Ninox novaeseelandiae</i>	Southern Boobook
<i>Ninox strenua</i>	Powerful Owl
<i>Nycticorax caledonicus</i>	Nankeen Night Heron
<i>Ocyphaps lophotes</i>	Crested Pigeon
<i>Oriolus sagittatus</i>	Olive-backed Oriole
<i>Pachycephala pectoralis</i>	Golden Whistler

Zoological Name	Common Name
<i>Pachycephala rufiventris</i>	Rufous Whistler
<i>Pardolotus striatus</i>	Striated Pardalote
<i>Platycercus adscitus</i>	Pale-headed Rosella
<i>Plectorhyncha lanceolata</i>	Striped Honeyeater
<i>Porphyrio porphyrio</i>	Swamphen
<i>Psophodes olivaceus</i>	Eastern Whipbird
<i>Rhipidura fuliginosa</i>	Grey Fantail
<i>Rhipidura leucophrys</i>	Willie Wagtail
<i>Rhipidura rufifrons</i>	Rufous Fantail
<i>Sericornis frontalis</i>	White-browed Scrubwren
<i>Sericornis magnirostris</i>	Large-billed Scrubwren
<i>Sphecotheres viridis</i>	Figbird
<i>Streptopelia chinensis</i>	Spotted Turtle-Dove
<i>Sturnus vulgaris</i>	European Starling
<i>Taeniopygia bichenovii</i>	Double-barred Finch
<i>Threskiornis molucca</i>	White Ibis
<i>Threskiornis spinicollis</i>	Staw-necked Ibis
<i>Todirhamphus macleayii</i>	Forest Kingfisher
<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted Lorikeet
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet
<i>Vanellus miles</i>	Masked Lapwing
<i>Zosterops lateralis</i>	Silvereye
MAMMALS	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat
<i>Chalinolobus nigrogriseus</i>	Hoary Bat
<i>Felis catus</i>	Feral Cat
<i>Hydromys chrysogaster</i>	Water Rat
<i>Isoodon macrourus</i>	Northern Brown Bandicoot
<i>Macropus rufogriseus</i>	Red-necked Wallaby
<i>Mus musculus</i>	House Mouse
<i>Petauroides volans</i>	Greater Glider
<i>Petaurus breviceps</i>	Sugar Glider
<i>Petaurus norfolcensis</i>	Squirrel Glider
<i>Phascolarctos cinereus (Southeastern bioregion)</i>	Koala (Southeastern bioregion)
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum
<i>Pteropus alecto</i>	Black Flying-fox
<i>Pteropus scapulatus</i>	Little Red Flying-fox
<i>Rattus lutreolus</i>	Swamp Rat
<i>Rattus rattus</i>	Black Rat
<i>Scotorepens greyii</i>	Little Broad-nosed Bat
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
<i>Tadarida australis</i>	White-striped Freetail-bat
<i>Trichosurus vulpecula</i>	Common Brushtail Possum
<i>Vulpes vulpes</i>	Fox
<i>Wallabia bicolor</i>	Swamp Wallaby

APPENDIX 7
BCC FAUNA EXCLUSION FENCING DESIGN



ELEVATION



TYPICAL SECTION

NOTES

1. THIS STANDARD IS NOT FOR USE IN A MARINE ENVIRONMENT.
2. GATE, CORNER AND EVERY EIGHTH POSTS TO BE 25.4-3.2 CHS GALVANIZED STEEL TUBE TO AS.1163
3. INTERMEDIATE POSTS TO BE 76.1-3.2 CHS GALVANIZED STEEL TUBE TO AS.1163
4. CORNER POSTS TO BE ADOPTED WHERE THE CHANGE IN ANGLE IN HORIZONTAL ALIGNMENT EXCEEDS 20 DEGREES.
5. GALVANIZED STEEL END CAPS TO BE PROVIDED TO ALL POSTS.
6. ALL WELDS TO BE 6 THICK G.P.W. CONTINUOUS FILLET WELDS TO AS.1654.1 WITH COLD GALVANIZING TREATMENT TO COMPLETED BELOW.
7. 2500 CHAINWIRE TO BE 6.35 THICK 50 MESH TO AS 2429.
8. STAYS TO BE PROVIDED AT END POSTS, GATE POSTS, CORNER POSTS AND EVERY EIGHTH POST.
9. POSTS TO BE VERTICAL.
10. DAMBLS TO BE FORMED FROM TWO 8.18 DIAMETRE WIRMS TWISTED TOGETHER.
11. ALL POSTS, STAYS AND CABLES ARE TO BE GALVANIZED. HOT DIP GALVANIZING: FERROUS OPEN SECTIONS TO AS.4793. FERROUS HOLLOW SECTIONS TO AS.4792
12. ALL CONCRETE TO BE GRADE M20
13. MINIMUM FOOTING STRENGTH TO BE 75MPa
14. CHAIN WIRE TO BE FITTED USING 1.8 WIDE TIES AS FOLLOWS:
 *INTERMEDIATE AND END POSTS AT 3 LOCATIONS
 *HORIZONTAL CABLE AT 275 CENTRES TO TOP CABLE
 *HORIZONTAL CABLE AT 400 CENTRES TO MIDDLE CABLE
 *HORIZONTAL CABLE AT 480 CENTRES TO BOTTOM CABLE.
15. DIMENSIONS IN MILLIMETRES
16. ZINCALINE TO BE 80% POLYCHROME, FLAT SHEET 0.4mm THICK, POWDERCOATED 'CALFIELD GREEN' ON ROAD SIDE
17. ZINCALINE SHEETS & ROOT BARRIER TO BE TIED TO CHAINWIRE WITH 8.18 DIAMETRE WIRE TOP AND BOTTOM AT 500 CHS.

City Design
 Brisbane City Council

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 75 Queen Street
 Brisbane QLD 4000
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 Facsimile: 07 4770 3001
 Email: design@cityofbrisbane.qld.gov.au

Issue	Description	Date	Drawn	Auth.	Drawing Title
A	ORIGINAL ISSUE	12/08			FAUNA EXCLUSION FENCE FAUNA RE-ENTRY DETAILS
B	DETAILS AMENDED	01/04			

Design	Drawn	Check	Authorised
L.A.P. 11/03	L.A.P. 10/04	R.P. 12/04	CHS. BOARD 12/03/03
Reference No.			Scale
Drawing No.		Sheet	Issue
CD-FXF-01			B

ATTACHMENT 1
2004 FAUNA ASSESSMENT REPORT
(BAAM 2004)

TERRESTRIAL FAUNA ASSESSMENT REPORT

BARRO GROUP MT COTTON QUARRY EXTENSION

Report prepared
for
Groundwork Environmental Management Services Pty Ltd

Prepared by:	Dr Glen Ingram, Adrian Caneris
Checked by:	Paulette Jones
Date:	September 2004
File no:	0049-001

Biodiversity Assessment
and Management Pty Ltd
PO Box 3205
BIRKDALE 4159



TERRESTRIAL FAUNA ASSESSMENT REPORT

BARRO GROUP MT COTTON QUARRY EXTENSION

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1.0 INTRODUCTION

This report has been prepared for Groundwork Environmental Management Services Pty Ltd (Groundwork EMS) for the purpose of providing an independent faunal assessment of the area covered by the proposed extension of the Mt Cotton Quarry, Mt Cotton. The proposed extension area is located approximately 0.5 km south-west of the existing Mt Cotton Quarry site operated by the Barro Group Pty Ltd, and would be accessed from the existing quarry via Mt Cotton Road.

The existing quarry site is currently active and a range of plant and equipment are operated to produce a variety of extractive resources and products. It is understood that the site of the proposed quarry extension contains a high quality hard rock quarry resource that is of State and regional significance, and that the Barro Group Pty Ltd proposes to make an application to Redland Shire Council (RSC) for a Material Change of Use to expand the existing operations into this area. The extension area is that defined in Groundwork EMS drawing No. 987.032 (Figure 1.1).

The overall purpose of this report is to provide a comprehensive assessment of the terrestrial vertebrate fauna and associated habitat values of the subject site and surrounding lands ('the study area').

The specific aims of the assessment are to provide:

1. A comprehensive survey and detailed report of the terrestrial vertebrate fauna on or that may utilise the study area, including faunal lists and significance status under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) (which includes the *Japan-Australia Migratory Bird Agreement*, the *China-Australia Migratory Bird Agreement* and the *Bonn Convention*) and Queensland's *Nature Conservation (Wildlife) Regulation 1994* (NCWR);
2. A detailed evaluation and comment on the presence or absence of any 'at-risk', migratory and/or otherwise significant species of fauna of the study area;
3. An assessment of the importance of the study area for Koalas, including an evaluation of the implications for development of the site under the provisions of *SPP 1/97 Conservation of Koalas in the Koala Coast*;
4. A detailed assessment and comment on significant faunal habitats within the study area, including their contribution to faunal movement corridors; and
5. An assessment of the fauna and associated habitats that may or will be affected by the proposed extension of the quarry, including recommendations on appropriate fauna management actions and mitigation of potential fauna impacts for inclusion within the overall Site Environmental Management Plan.

All observations and recommendations are based on site investigations with the main survey conducted over a single period from Monday 5 April to Friday 9 April, 2004, inclusive, the experience of the authors in the local area, and a desktop review of existing information.

2.0 THE QUARRY EXTENSION PROPOSAL

2.1 Site Description

The existing Mt Cotton Quarry site is situated on Mt Cotton Road in Redland Shire, and has been used for quarrying purposes since the 1960's. The site of the proposed extension is located approximately 0.5 km south-west of the existing quarry and has been used primarily for cattle grazing for the past 30 to 40 years. The adjoining lands are mostly rural residential properties with Venman Bushland National Park to the north-west.

While some old growth vegetation is associated with the gully in the central northern portion of the subject lands outside of the proposed extension area (LAMR, 2003), the site of the proposed extension supports predominantly grassland pasture and acacia and eucalypt regrowth.

The site is within the upper catchment of California Creek. Drainage from the site is mostly through creeks along the southern and eastern boundaries of the property.

2.2 Proposed Quarry Activities

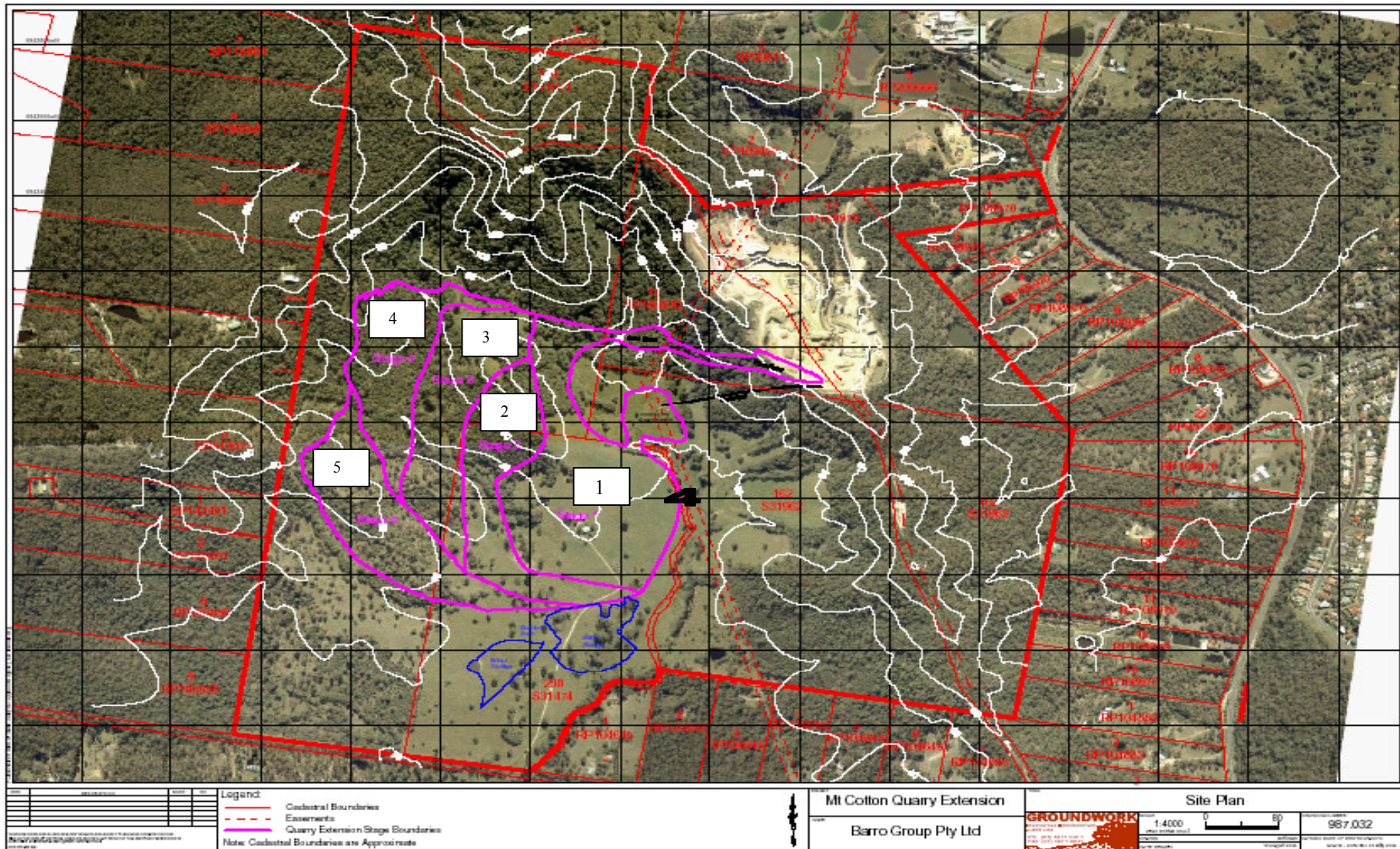
Figure 1.1 shows the proposed quarry extension location and proposed stages of extraction. The following timelines apply to the stages as mapped.

Stage 1:	15 cumulated years
Stage 2:	20 cumulated years
Stage 3:	30 cumulated years
Stage 4:	38 cumulated years
Stage 5:	50 cumulated years

Quarried rock would be transported from the extension area to the plant associated with the existing quarry operation via a conveyor system, shown as a black line on Figure 1.1. It is also proposed to construct a new access road between the extension and the existing quarry site approximately 50m north of the proposed conveyor.

Groundwork EMS advise that the amount of truck traffic generated by quarrying activities in the extension area would not be greater than that currently associated with the existing operation.

FIGURE 1.1



3.0 STUDY METHODOLOGY

The following methodologies have been employed for this study.

3.1 Database Searches

These comprised data searches of the Commonwealth's EPBC Protected Matters Search Tool, the Queensland Museum's database and the Queensland Environment Protection Agency's WildNet Database. All searches were for terrestrial vertebrates.

3.2 Aerial Photograph Interpretation

RSC on-line mapping and drawings provided for the purposes of assessment from Groundwork EMS (drawing nos 987.009 & 987.004), including site topography and proposed extraction areas, were used for the purposes of determining appropriate fauna survey sites and, with more recent photography flown after the survey period (drawing no 987.032 – Figure 1.1) used to assist in the development of site fauna management recommendations.

3.3 Field Survey

3.3.1 Survey Effort

The field survey program took place over five days/four nights (5-9 April, 2004) in accordance with the EPA (1999) guidelines for fauna surveys, and was performed in accordance with the EPA's Queensland Parks and Wildlife Service's Scientific Purposes Permit No. WISP00908103 and Animal Ethics Committee number BRIBIE/50/11/02. Table 3.1 lists the survey effort.

TABLE 3.1. Outline of survey methods and effort

Survey Method/Site	Survey Measure	Total Effort
Elliot (type A) traps (22)	88 trap nights x 4 sites	352 trap nights
Elliot (type B) traps (2)	8 trap nights x 4 sites	32 trap nights
Cage traps (1)	4 trap nights x 4 sites	16 trap nights
Pitfall traps (5)	4 trap nights x 3 sites	60 trap nights
Diurnal birds census	1 hr/site/day over 5 days	20 hrs
Diurnal ground searches	1 hr/site/day over 5 days	20 hrs
Nocturnal arboreal and ground spotlighting	0.5 hrs/site x 4 nights	8 hours
Anabat II call detection walking surveys	0.5 hrs/site x 4 nights	8 hours
Harp trap	1 site	8 hours
Nocturnal call playback surveys	0.5 hrs/site x 4 nights	8 hours
Incidental observations	10 hrs/site	40 hours

Temperatures during the survey period were average for that time of year being slightly cool and possibly reducing the opportunity to fully sample reptile and amphibian populations of the study area, although the habitat types are well-surveyed for the region and predictive results from database searches allow the likely presence of those species to be considered. Rainfall was experienced during the first night of survey, contributing positively to survey conditions.

3.3.2 Site Selection

Study site selection and active searching locations were based on the type and quality of the habitat present on-site and the types of terrain. Four terrestrial study sites were selected within the proposed extension area, as shown on Figure 3.1. These were:

- Site 1: Previously cleared wattle regrowth dominated by lantana and exotic understorey species;
- Site 2: Open pasture with wetland and drainage line;
- Site 3: Open forest -woodland regrowth with gully and drainage lines; and
- Site 4: Open forest on top of knoll with primarily native vegetation understorey.

3.3.3 Techniques

Field techniques followed the EPA (1999) guidelines for fauna surveys. Dr Glen Ingram lead a team of three people – himself, Mr Adrian Caneris who undertook the main field survey, and Mr Jedd Appleton (field assistant). Dr Ingram or Adrian Caneris, both of whom are experts on the vertebrate fauna of Southeast Queensland, carried out all species identifications.

The following is a description of each of the techniques employed.

Diurnal Searching

This involved intensive investigation of ground layer (under logs, rocks and leaf litter), low vegetation (under bark and in tree stumps) and rock crevices for all amphibians, reptiles, mammals and all animal signs, e.g. scats, owl pellets, orts, remains and tracks. Duration approximately 3hr/day, during the middle of the day.

Elliot, cage and possum traps

A total of 22 Elliot type A, two type B and one cage trap were deployed/night/transect over four nights at four sites during the survey. Traps were placed on the ground on an average spacing of 5 -7m apart using a variety of baits (rolled oats and peanut butter +/- bacon, oil or tinned fish with alternative traps baited with salami or chicken). These traps were cleared each morning in accordance with Animal Ethics requirements and reset in late afternoon after 5pm. Trap placement was influenced by vegetation diversity, the size and shape of habitat patches and by naturally occurring features such as logs, rock outcrops, tree bases and clumping vegetation. Exact locations are provided in Table 3.2 and shown on Figure 3.1.

Pitfall Traps

A total of five pitfall traps were also deployed/night/transect over four nights at three of the four sites during the survey, comprising 10 or 20L containers depending on substrate and a 20m drift fence. Pitfall traps were not deployed within study site 2 due to the high water table preventing their deployment in that area. Pitfall traps were cleared early morning and late afternoon in accordance with Animal Ethics requirements. Exact locations are provided in Table 3.2 and shown on Figure 3.1.

TABLE 3.2. Trap and Study Site Locations
 Map Datum Aust Geod '84 and locations recorded on Garmin GPS 12

Traps	Midpoint			
Pit Traps	<i>Latitude°</i>	<i>Longitude°</i>		
Pit Trap Site 1	S27 38.306	E153 13.631		
Pit Trap Site 3	S27 38.288	E153 13.457		
Pit Trap Site 4	S27 38.349	E153 13.371		
Elliott & Cage Traps	Start		Finish	
Line 1	S27 38.311	E153 13.631	S27 38.290	E153 13.639
Line 2	S27 38.337	E153 13.535	S27 38.437	E153 13.602
Line 3	S27 38.252	E153 13.364	S27 38.252	E153 13.390
Line 4	S27 38.350	E153 13.375	S27 38.310	E153 13.373

Diurnal Bird Surveys

Birds were surveyed at each site using a timed transect technique. Each site was surveyed for approximately 30 minutes in the morning and afternoon by pausing at each fifth Elliot trap for six minutes. Early morning counts were conducted between 0630-0930hrs and late afternoon census undertaken between 1500-1730hrs. Birds were identified from either direct observation or their characteristic vocalisations.

Nocturnal Survey

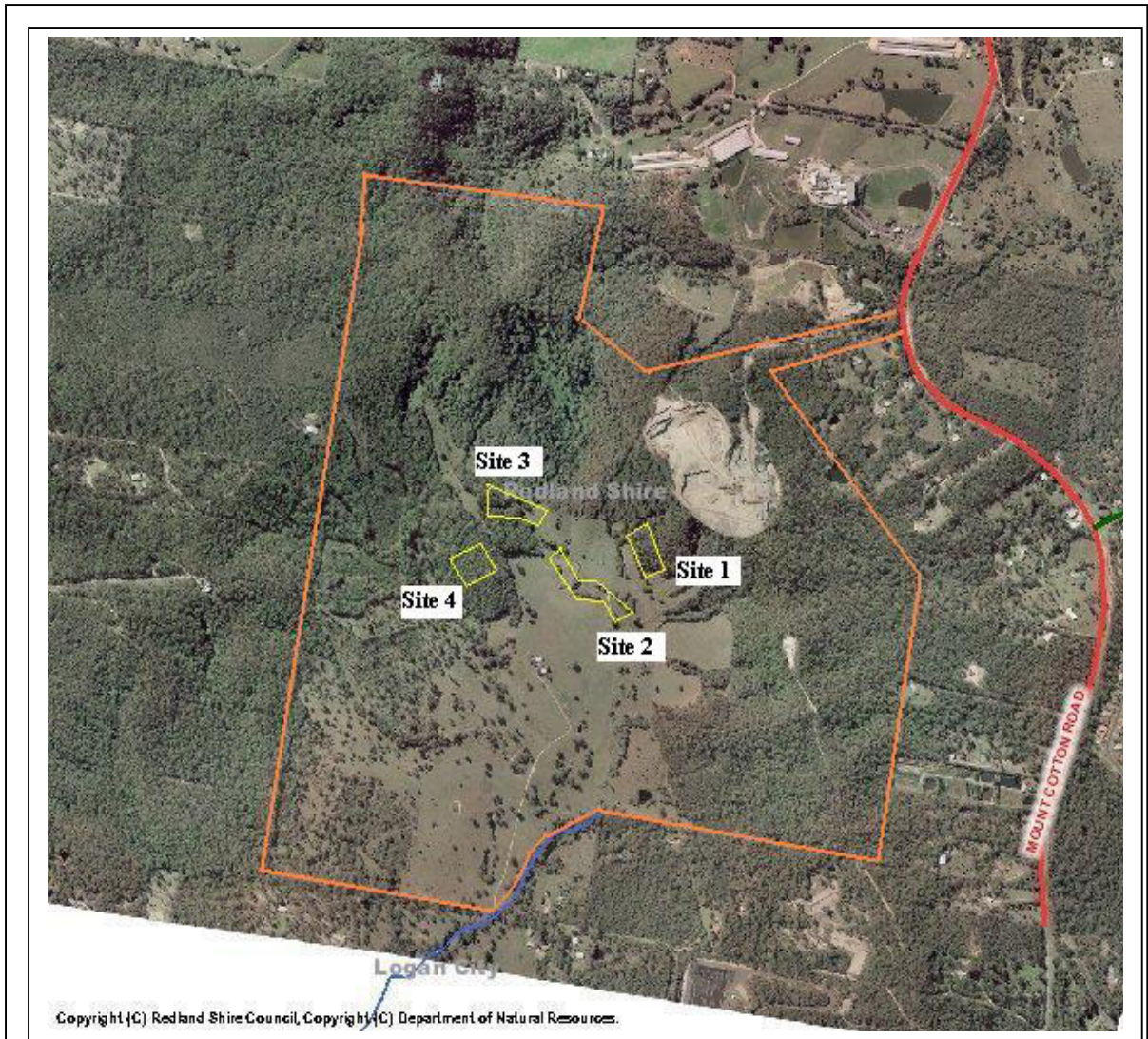
A combination of high-powered spotlights and head torches were used to sample nocturnal mammals (flying, arboreal and terrestrial), birds (owls and nightjars), reptiles and frogs. Sonic bat detectors were also employed to assist in location and identification of microchiropteran bats. As well, a harp trap was deployed at suitable locations on the subject land.

Call Playback

Species-specific work was assisted by the use of call playback. Call playback surveys were undertaken for nocturnal birds and nocturnal mammals at each site using Stewart (1998).

Opportunistic Records

During the survey, fauna observations were continuous and species records were obtained outside of the systematic methodology of the survey.



Legend

- Approximate property boundary
- Fauna Survey Site Locations

Scale: 1:20,000

Source: Redland Shire Council
 2002 Aerial Photography

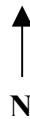


FIGURE 3.1

**FAUNA SURVEY SITE
 LOCATIONS**

Terrestrial Fauna Assessment Report
 Barro Group Mt Cotton Quarry Extension
 for Groundwork Environmental
 Management Services Pty Ltd

Scat and Pellet Searches

Both predator and non-predator scats were sought during all searches. Only those samples definitely identified were included in the survey results.

Koala-Specific Investigation

Specific search effort was made to locate the presence of Koalas or evidence of their occurrence on the subject lands and the local area.

4.0 RESULTS

4.1 Survey Results - Recorded Terrestrial Vertebrate Species

All vertebrate species recorded during the survey are listed in Appendix A, including the species recorded from the Queensland Museum and WildNet database searches. Nomenclature follows Ingram, McDonald and Natrass (2002) for frogs, Pizzey and Knight (2003) for birds, Menkhorst and Knight (2001) for mammals and Wilson and Swan (2003) for reptiles. In total, 130 species were recorded from the subject site, which includes 22 species of mammals, 88 species of birds, 14 reptiles and 6 amphibians (see Table 4.1).

TABLE 4.1. Species totals from field surveys

Site	Mammals	Birds	Reptiles	Amphibians	Total
Site1	5	29	3	1	38
Site2	8	33	1	5	47
Site3	7	29	2	3	41
Site4	4	32	6	2	44
Incidental observations	6	29	6	1	42
Study totals (species)	22	88	14	6	130

The majority of the site's fauna is currently listed in Queensland's NCWR as 'Common Wildlife'. 'Common Wildlife' refers to native animals that are not currently listed as Presumed Extinct, Endangered, Vulnerable or Rare, although are still prescribed as protected wildlife.

Of the species observed on the subject lands, six are recognised as species of special conservation significance under Commonwealth and State Government legislation (see Table 4.2 and Section 4.3).

TABLE 4.2. ‘At-Risk’ Species detected on the study area during survey.

Special Status abbreviations are as follows:

Queensland’s Nature Conservation (Wildlife) Regulation 1994 (NCA Status): E = Endangered, V = Vulnerable, R = Rare, S = Special Cultural Significance, C = Common wildlife.

Federal Environment Protection and Biodiversity Conservation Act 1999 (EPBC Status): E = endangered, V = vulnerable, M = Migratory Species.

Other abbreviations: Site = study site 1-4 or D for Dam, Inc = Incidental records.

Zoological Name	Common Name	Site	Inc	NCA Status	EPBC Status
BIRDS					
<i>Ardea ibis</i>	Cattle Egret	2		C	M
<i>Merops ornatus</i>	Rainbow Bee-Eater	1,2		C	M
<i>Monarcha melanopsis</i>	Black-faced Monarch	1,3,4		C	M
<i>Rhipidura rufifrons</i>	Rufous Fantail	2,3		C	M
MAMMALS					
<i>Phascolarctos cinereus</i> (Southeastern bioregion)	Koala		X	VS	
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	3		CS	

4.2 Database Search Results

Three databases were accessed for fauna data. Species records obtained from the Queensland Museum, EPA WildNet and the Commonwealth database searches are listed in Appendices 2, 3 4, respectively. These searches are based on a larger area than the subject lands to capture as many records as possible for the local area.

Species of special conservation significance obtained from the database searches but not detected during the study are detailed in Table 5. This listing includes possible ‘at-risk’ species that could occur in the area based on historical records. However, it should be noted that none of the records from the database searches come from the actual study area and, from consideration of the habitats in the study area and the known ranges of the animals (see ‘Comments’ in Table 4.3), only some of those species listed in Table 4.3 are considered likely to occur.

TABLE 4.3. ‘At-Risk’ Species obtained from database searches but not detected on the study area during survey

Special Status abbreviations are as follows for the Federal *Environment Protection and Biodiversity Conservation Act 1999*: e = endangered, v = vulnerable, M = Migratory species; and for Queensland’s *Nature Conservation (Wildlife) Regulation 1994*, E = Endangered, V = Vulnerable, R = Rare, S = Special Cultural Significance, C = Common wildlife.

Zoological Name	Common Name	Status	Comments
AMPHIBIANS			
<i>Adelotus brevis</i>	Tusked Frog	V	This species may occur on the subject lands and surrounds. Not known from the area but there is a high potential for the species to exist in suitable waterways. Protection of creeks and drainage lines is required for species protection.

Zoological Name	Common Name	Status	Comments
<i>Litoria olongburensis</i>	Wallum Sedgefrog	V,v	Not expected to occur as no suitable habitat present on the site.
<i>Mixophyes iteratus</i>	Giant Barred Frog	E,e	Not expected to occur on the subject lands. This species has not been recorded in the catchment or local area or within the Redland Shire.
REPTILES			
<i>Coeranoscincus reticulatus</i>	Three-toed Snake-tooth Skink	R,v	Not expected to occur on the subject lands. This species has not been recorded in the local area or within the Redland Shire.
BIRDS			
<i>Accipiter novaehollandiae</i>	Grey Goshawk	R	A wide-ranging species, which might occasion or occur in the area. Not found during survey and would have little impact from proposal.
<i>Apus pacificus</i>	Fork-tailed Swift	C,M	A wide-ranging aerial species, which might occasion or occur in the area. Not found during survey and unlikely to occur in the area. No impact expected.
<i>Arenaria interpres</i>	Ruddy Turnstone	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Calidris canutus</i>	Red Knot	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Calidris ferruginea</i>	Curlew Sandpiper	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Calidris ruficollis</i>	Red-necked Stint	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Calidris tenuirostris</i>	Great Knot	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Charadrius leschenaultii</i>	Large Sand Dotterel	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Charadrius mongolus</i>	Mongolian Dotterel	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Charadrius ruficapillus</i>	Red-capped Dotterel	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Climacteris erythroptis</i>	Red-browed Treecreeper	R	Low potential for occurrence within extension area. Mostly associated with large wet forested areas and rainforest, all of which is retained under the proposal. Little or no impact, expected from proposal.
<i>Cyclopsitta diophthalma coxeni</i>	Double-eyed Fig Parrot (Coxen's)	E,e,M	No habitat present on the site. No records of this species in the area and considered to be locally extinct. The area also contains very

Zoological Name	Common Name	Status	Comments
			little suitable feeding resources and the quarry extension will not remove any potential habitat. The application should not be viewed as relevant to a secure future for this species.
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork (Jabiru)	R	Very low potential for occurrence within extension area or on subject lands. Mostly associated with large wetlands or marine habitats. Little or no impact, expected from proposal.
<i>Erythrotriorchis radiatus</i>	Red Goshawk	E,v	A wide-ranging species, which was not found during survey and is not expected to occur in the area. Little or no impact from proposal.
<i>Gallinago hardwickii</i>	Japanese Snipe	C,M	No suitable habitat areas and not expected to occur on the subject lands.
<i>Grantiella picta</i>	Painted Honeyeater	R	Rare visitor to SE Queensland. Not expected to occur on the subject lands.
<i>Haliaeetus leucogaster</i>	White-breasted Sea-Eagle	C,M	A wide-ranging species, which might occur in the area. Not found during survey and would have no detrimental impact from proposal.
<i>Heteroscelus brevipes</i>	Grey-tailed Tattler	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands.
<i>Hirundapus caudacutus</i>	White-throated Needletail	C,M	A wide-ranging aerial species, which is expected to occur over the area. Their aerial nature will result in no impact from the quarry extension.
<i>Lathamus discolor</i>	Swift Parrot	E,e	A wide-ranging species, which is not expected to occur on the site. No impact expected from proposal.
<i>Limicola falcinellus</i>	Broad-billed Sandpiper	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Limosa lapponica</i>	Bar-tailed Godwit	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Lophoictinia isura</i>	Square-tailed Kite	R	A wide-ranging species, which was not found during survey and is not expected to occur in the area. Little or no impact from proposal.
<i>Monarcha trivirgatus</i>	Spectacled Monarch	C,M	This species prefers rainforest and wet sclerophyll forests. Possible occurrence within those habitats on the subject lands. No significant impact expected from proposal
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	C,M	Possible occurrence on subject lands. However a wide-ranging species, which might occasion the area and little or no impact, expected from proposal.
<i>Nettapus coromandelianus albipennis</i>	Cotton Pygmy-Goose	R,M	No habitat on the subject lands and not expected to occur on the site.
<i>Ninox strenua</i>	Powerful Owl	V	Likely occurrence on subject lands.

Zoological Name	Common Name	Status	Comments
			However a wide-ranging species, which would occasion the area for feeding and possibly breeding purposes. Known to breed in the nearby Venman National Park. Retention of remnant forested areas and revegetation of corridors will result in little or no impact from proposal.
<i>Numenius madagascariensis</i>	Eastern Curlew	R,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Numenius phaeopus</i>	Whimbrel	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
<i>Pandion haliaetus</i>	Osprey	C,M	A species primarily associated with marine and riparian habitats. There is no suitable habitat within the subject lands and the species is not expected to occur on the subject lands. No impacts expected.
<i>Plegadis falcinellus</i>	Glossy Ibis	C,M	A species primarily associated with large swamps. There is no suitable habitat within the subject lands and the species is not expected to occur on the subject lands. No impacts expected.
<i>Pluvialis fulva</i>	Lesser Golden Plover	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands.
<i>Rhipidura rufifrons</i>	Rufous Fantail	C,M	Expected to occur seasonally on subject lands. Retention of remnant forested areas and revegetation of corridors will result in little or no impact from proposal.
<i>Rostratula australis</i>	Australian Painted Snipe	V,v,M	No habitat on the subject lands. Not expected to occur on the site.
<i>Sterna albifrons</i>	Little Tern	E,M	A species primarily associated with marine habitats. There is no suitable habitat within the subject lands and the species is not expected to occur on the subject lands.
<i>Sterna caspia</i>	Caspian Tern	C,M	Primarily associated with marine habitats. There is no suitable habitat within the subject lands.
<i>Sterna hirundo</i>	Common Tern	C,M	A species primarily associated with marine habitats. There is no suitable habitat within the subject lands and the species is not expected to occur on the subject lands.
<i>Tringa nebularia</i>	Greenshank	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands.
<i>Tringa stagnatilis</i>	Marsh Sandpiper	C,M	A migratory wader and primarily associated with marine and larger wetland habitats. There is no suitable habitat within the subject lands.
<i>Turnix melanogaster</i>	Black-breasted Button-Quail	V,v	Limited potential habitat on the subject land. No evidence of their characteristic platelets was observed. The species would be restricted to areas outside of the extension if present on the subject lands.

Zoological Name	Common Name	Status	Comments
<i>Xanthomyza Phrygia</i>	Regent Honeyeater	E,e,M	A wide-ranging and rare visitor to SE Queensland, which is not expected to occur on subject, lands. No detrimental impact from proposal expected.
<i>Xenus cinereus</i>	Terek Sandpiper	C,M	A migratory wader and primarily associated with marine habitats. There is no suitable habitat within the subject lands
MAMMALS			
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	R,v	Only possible occurrence on subject lands. Not detected by Anabat detector. No impact expected from proposal.
<i>Dasyurus maculatus maculatus</i>	Spotted-tailed Quoll	V,v	Not expected to occur on subject lands. If present, this species would be associated with areas outside of the extension.
<i>Ornithorhynchus anatinus</i>	Platypus	CS	Limited potential habitat on the subject lands. No evidence of their characteristic burrows was observed. The species would be restricted to areas outside of the extension if present on the subject lands. Protection of water quality and flow regimes may be crucial to their ongoing presence in the local area. Targeted surveys would be required to establish their presence or absence from the subject lands.
<i>Potorous tridactylus tridactylus</i>	Long-nosed Potoroo (SE Mainland)	V,v	Not found during survey and is considered unlikely on the subject lands.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	C,v	Expected to frequent the subject site. Commonly recorded in SE Queensland and known from local area. No camps recorded, however. Suitable feeding habitat occurs on the subject lands and some potential feeding resources would be lost under the proposal, though revegetation will provide additional and an increase in such resources over time.

Those species present or likely to be present on the site are discussed further in Section 4.3.

4.3 Species of Special Conservation Significance

As noted in the preceding, the majority of the species recorded are currently listed as ‘Common Wildlife’ in Queensland. However, several species known or considered to potentially occur in the area are recognised as ‘species of special conservation significance’ (or ‘at-risk’ species) under NCWR and/or the EPBC.

The species of special conservation significance recorded from the study area and listed in Table 4.2 are individually discussed in the following sections. The presence of Koala, listed under State legislation as ‘Vulnerable’ within the south-eastern bioregion, is particularly significant. As well, the potential presence of migratory birds, the Grey-headed Flying fox *Pteropus poliocephalus*, Powerful owl *Ninox strenua* and the Tusked frog *Adelotis brevis* are also discussed. It is recognised that

the records of migratory species, frogs and reptiles for the site may not provide a full account of the species that may use the site, due to the following factors:

- The current survey was performed during a single seasonal period (April 2004). Consequently, some migratory species that may use the study site would not be present;
- The weather conditions were suitable for the investigation and assessment of numerous species, with the area receiving mild rainfall during the first night of survey. However, the low rainfall received on the site and cooler night-time temperatures cannot allow certainty that the maximum level of frog activity was observed; and
- Cooler temperatures cannot allow certainty that the maximum level of reptile activity was observed.

However, given the level and detail of the fauna investigations for this study, combined with the compilation of database search records, it is highly unlikely any additional vertebrate species of special conservation significance would be added to the species listed in Tables 4.2 and 4.3.

4.3.1 Koala

Koalas *Phascolarctos cinereus* were identified as being present on the subject land and surrounding lands. Three animals were actually observed on the subject land and scratches and scats were observed in most areas supporting eucalypt species. In South-east Queensland, the Koala is currently listed as 'Regionally Vulnerable' in the *Nature Conservation (Wildlife) Regulation 1994* of the *Queensland Nature Conservation Act 1992*.

The listing as a 'regionally vulnerable' species requires State and local governments, property developers and the general public to take actions to prevent or reduce any further decline in Koala numbers. A Conservation Plan for Koalas under the *Nature Conservation Act 1992* is currently being prepared by the Queensland EPA, with a draft due for release in mid 2004.

Koalas are also listed as a 'Special cultural' species under Queensland's *Nature Conservation (Wildlife) Regulation 1994*. This listing recommends, "...governments have regard to the special cultural significance of the wildlife and the management requirements needed to conserve existing populations of the wildlife".

The *State Planning Policy 1/97 – Conservation of Koalas in the Koala Coast* is particularly relevant to the subject lands. The subject lands are located within the area designated as Koala Conservation Area and is therefore considered of high value under the policy (see; Section 4.7 State and Local Government Koala Policies and Legislation).

The Koala is not currently listed in the schedules of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, although it is listed as ‘Lower Risk (near threatened)’ in the Action Plan for Australian marsupials and monotremes (Maxwell *et al.*, 1996).

The field investigations did indicate the subject lands contain areas of high value to Koalas and that the animals live and breed on the subject lands. A review of the Queensland parks and Wildlife Service’s data for the area also suggests that the species is widespread and common in the local area. The wetter forest areas in steep gullies within the northern portion of the subject lands are not preferred habitat for Koalas.

The proposed extraction area as shown in Groundwork Drawing No. 987. 032 (Figure 1.1) incorporates mostly cleared pastoral lands and wattle regrowth, with an area of eucalypt regrowth on the western portions currently providing Koala feeding and breeding resources.

It is recommended that the area and number of existing Koala food trees be measured precisely within the proposed extraction area, and that at least an equivalent area and number of Koala food trees be established through a Rehabilitation Plan in the currently cleared southern portion of the subject lands. There is a proposed 50-year timeframe for resource extraction shown in Figure 1.1; however the Koala food trees within the rehabilitation areas would be of sufficient age to adequately compensate for lost feeding resources for the entire extraction area within 15 years. With appropriate management of rehabilitation areas over the 50 year life of the proposed quarry extension, including cattle exclusion and weed control, the value of the rehabilitation areas as Koala habitat will considerably outweigh the value of the current grassland, eucalypt and wattle regrowth areas that are subject to agricultural (grazing) land management practices within the proposed quarry extension area.

Continued used of the subject lands by Koalas, including the rehabilitated areas, should be monitored as part of the Fauna Management Plan for the extension project.

The use of a spotter catcher would be necessary during all clearing activities for the life of the project to protect individual animals.

Koala habitat replacement and enhancement, and facilitation of Koala movement opportunities are further discussed in Section 4.6.

4.3.2 Powerful Owl

The Powerful Owl *Ninox strenua* is listed as ‘Vulnerable’ in the NCWR. The Powerful Owl occurs in dry and wet eucalypt forest and is reliant on the maintenance of suitable nesting hollows, usually found within large old growth eucalypts. The Powerful Owl is known from nearby bushland areas. The bird has been recorded from the Daisy Hill State Forest, Venman Bushland National Park and bushland areas surrounding the Bayview Estate in Mt Cotton.

There are hollow bearing eucalypt trees within the study area, but outside of the proposed extension, which provide suitable breeding resources for the owl and its prey items. These should be retained and enhanced. As well, the densely vegetated gullies in the northern portions provide suitable refuge for diurnal roosting requirements.

The species was not detected on the subject site during the survey. However it is considered that the species would at least occasionally, if not frequently, visit the site for feeding and there is potential for roosting and/or breeding to occur.

Studies and anecdotal observations have shown the species can persist in logging mosaics and within urban remnant patches. A study by Kavanagh *et al.* (1995) found that there was no difference in the frequency of owl detection between heavily logged and lightly logged and un-logged forest. Kavanagh *et al.* (1995) state that densities of Powerful Owls in remaining forests are affected by a reduction in the availability of nest hollows and den sites for their prey.

The actual significance of the subject lands to the species is unknown and would need to be studied over a longer period of time than was available here. However, as the proposed project does not require the removal of hollow-bearing trees, and it is intended to establish eucalypt woodland habitat in what are currently cleared pasturelands, habitat conditions for the species are likely to improve from the existing situation over the life of the project as rehabilitation areas mature.

4.3.3 Tusked Frog

The Tusked Frog *Adelotus brevis* has potential to be present on the site. The species is restricted to eastern Queensland and New South Wales and is currently listed as 'Vulnerable' under Queensland's NCWR.

The Tusked Frog is mostly associated with permanent waterways and water in rainforest and wet sclerophyll forest and is encountered under cover such as logs and vegetation beside small water bodies or streams. On the study site, there are portions of waterways and associated vegetation that could provide ideal habitat for the species. The timing of the field investigation was not ideal for recording the presence of the species. The most suitable survey time would be during the warmer (summer) months following a rainfall event.

The distribution of the Tusked Frog on the subject lands is expected to be within the more permanent and natural portions of waterways in the north and east. These areas are unaffected by the proposal.

It is unlikely the species would occur within the proposed extraction area. The watercourse and associated wetland area within the extraction area are considered to contain poor habitat conditions for this species.

The long-term viability of the species within the subject lands is dependant upon the retention of suitable foraging and breeding habitat. The preservation of the

creekline's riparian vegetation and maintenance of water quality is crucial to the long-term survival of this species within the subject land.

The reformation of the existing drainage line within the extension area should contain design elements (permanent small pondage areas, apposite vegetation and water quality) to provide additional potential habitat.

An informed understanding of the distribution of the species on the subject lands through targeted investigations under summer rainfall conditions would contribute to the successful management of the species on the site. It is probable however, that with the proposed habitat protection in the northern portion of the property, the extension proposal is unlikely to have a negative impact on the long-term security of the species on the subject lands.

4.3.4 Grey-headed Flying-fox

The Grey-headed Flying-fox was not observed in the study area but it is expected to occur seasonally and particularly in response to localised flowering events. This species is commonly recorded in most fauna surveys in south-eastern Queensland but is listed as 'Vulnerable' under the EPBC.

The following is from Environment Australia (2001):

An action that will have, or is likely to have a significant impact on Grey-headed Flying-foxes is one that 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.*

Overall, an activity that affects a single Grey-headed Flying-fox or a small number of individual Grey-headed Flying-foxes would not be expected to have a significant

impact on the species and so would not require Commonwealth approval.

As there are no colonies or camps present within the subject site, it can be concluded that the proposed area subjected to extension would not have any significant impact on the species or threaten the security of the species in the area.

In addition, if the southern portions of the subject lands are subjected to regeneration and habitat enhancement a net increase in potential food resources for this species will result.

4.3.5 Short-beaked Echidna

The Short-beaked Echidna *Tachyglossus aculeatus* is listed as a 'Special cultural' species under NCWR. This listing recommends that, "...governments have regard to the special cultural significance of the wildlife and the management requirements needed to conserve existing populations of the wildlife".

The retained and rehabilitated vegetation will provide ongoing habitat for this species. However, the use of a spotter catcher is also necessary during any on site clearing to protect individual animals.

The quarry extension proposal is not expected to detract from a safe future for the species.

4.3.6 Migratory Birds

Migratory birds recorded from the site during the survey period were the Rainbow Bee-eater, Rufous Fantail, White-throated Needletail, Black-faced Monarch, Spectacled Monarch and Cattle Egret. These species are all listed in the international migratory treaties and thus subject to the EPBC. However, all are listed as 'Common Wildlife' under the NCWR.

All of the above species are common in suitable habitats outside the study area. Rainbow Bee-eater and White-throated Needletail are mainly aerial species and are not expected to be affected by the proposed extension of the quarry. Rufous Fantail, and Black-faced Monarch were located in the wet forest and vegetation associated with creeks and gullies and the Spectacled Monarch is expected to occur seasonally. The Cattle Egret is present in association with stock present on the subject lands.

The areas retained outside of the proposed extension contain and will provide ongoing habitat for these species on the subject lands. The extension proposal is not expected to detract from a safe future for any of these species.

4.4 Terrestrial Feral Species

Exotic species noted during the surveys and database searches were the Cane Toad, Indian Myna, Rock Dove, Feral Fowl, Spice Finch, House Sparrow, Pea Fowl,

Spotted Turtle-Dove, European Starling, Cattle, Dog, Horse, Cat, Brown Hare, House Mouse, Rabbit, Black Rat, Feral Pig and European Fox. None of these species are unexpected and all are commonly found in South-eastern Queensland.

A feral animal monitoring program should be implemented during the life of the project to determine any potential detrimental impacts of feral animals on native fauna species. Groundwork EMS has indicated that contribution to a regional pest animal control program would be considered.

4.5 Habitat Values

The subject lands in general ecological terms maintain a valuable habitat type and condition. In particular, the steep gullies containing old growth forest areas in the northern portions are valuable because this habitat type is rare in the Redland Shire.

The native vegetation of the site is predominately open eucalypt woodland with the northern portions containing wetter forest areas in association with the steep gullies. There is a large area of pastoral land in the central and southern areas. The pastoral areas are dominated by introduced grasses and contain some native regrowth, with large patches of acacia and some eucalypt regeneration. Consequently, these areas support a low number of hollow bearing trees. Drainage is primarily via two watercourses, with drainage towards the southern and eastern boundaries of the property.

Previous vegetation removal and prior and ongoing agricultural pursuits, combined with the existing quarry operations has noticeably affected the area's habitat values. The majority of the area has been subject to select and wholesale vegetation removal and subsequent rural pursuits. The remaining vegetation and habitat areas are defined as regrowth with the exception of the vegetation associated with the steep gullies in the central northern portion of the subject lands (LAMR, 2003).

Due to previous disturbances and current land uses, the subject lands require ongoing vegetation management to ensure existing habitat values are retained and enhanced. If the site and its vegetation were left unmanaged, the slow but sure encroachment of weed species that is typical following the removal of grazing animals would eventually have significant detrimental impacts on inherent habitat values and the variety of habitat types that are currently occur on the subject land.

In its current condition, the subject land retains significant vegetated areas that provide valuable habitat for a high number and diversity of terrestrial vertebrate species. Of particular significance is the known or potential presence of 'at-risk' species currently listed in the schedules of the *Nature Conservation (Wildlife) Regulation 1994* of the *Queensland Nature Conservation Act 1992* as discussed in Section 4.3.

To minimise the potential impacts of the proposal on the long-term viability of fauna habitat on the subject lands, it should be ensured that habitat that is proposed to be retained and/or rehabilitated outside of the extraction zone is sufficient to provide

secure resources for the species present as well as providing essential corridors and movement opportunities for those species. It should also be noted that the larger trees provide a range of potential roosting and nesting habitats for insectivorous bats, arboreal mammals and several species of birds, and that these should be retained throughout the property where they occur. Any loss of these “habitat trees” resulting from the proposed quarry extension should be compensated through the provision of nest boxes within appropriate retained habitat areas, although these will be limited in number as the proposed extension area occurs mostly within cleared areas or regrowth vegetation.

It is imperative that the range of existing habitat values on the property are maintained and enhanced to ensure the proposal does not have a detrimental impact on a safe future for those species present. The habitat areas outside of the quarry extension location should be exempt from disturbance. It is understood that these areas would be designated as ‘Buffer Land’, with a commitment to management of these lands for fauna habitat conservation purposes.

4.6 Movement Corridors

Fauna movement is, to a large extent, unpredictable and management responses need to incorporate as many options and opportunities as possible. Currently, the subject site maintains substantial linkage with adjoining areas and provides for fauna movement within and through the property, although the east-west linkage is weakened in the south of the property by previous clearing and agricultural use.

The ongoing protection and maintenance of sufficient habitat and number and size of movement corridors (linkages between core habitat areas) is paramount to successful fauna movement, interaction and dispersal. Animal movements on the subject lands would comprise resident species and individuals, which form part of a larger and wider population which would occasion or traverse the lands which are linked to significant continuous bushland areas, including Venman Bushland National Park to the west and north-west.

Given the presence of species of conservation significance on the site, and those additional scheduled species known from the area, it is expected that the state and local governments will require clear identification and justification of long-term fauna movement prospects and opportunities within and through the subject site.

The lands, situated in close proximity to a National Park and falling within the *State Planning Policy (SPP) 1/97 ‘Koala Conservation Area’*, support strategically important habitat and the long-term maintenance of habitat and safe movement opportunities for Koalas in particular is implicit.

The SPP 1/97, Planning Guidelines Conservation of Koalas in the Koala Coast provides clear planning intents and statements for minimising impedance or threats to the movement of Koalas. The key points are:

- “ensure links are as wide as possible, and no less than 100m, to minimise edge effects.
- where a link includes cleared or partially cleared areas, consider a revegetation program to rehabilitate these areas and include the planting of recognised Koala food trees.
- minimise the extent to which Koala habitat and connections between habitat areas are disrupted by roads or other service corridors.”

The exact size of a corridor required to provide safe movement for Koalas across the subject lands is inherently reliant on the habitat values and habitat connectivity of surrounding lands. The appropriate size of any designated movement corridor should be defined with regard for the adjoining lands and their current and future habitat qualities.

Figure 4.2 is based on a 2002 aerial photograph of the site and surrounding lands. The photograph shows that habitat in the western portion of the subject land is part of an extensive, continuous bushland area. Habitat in the eastern portion of the subject land is strategically important in that it forms a significant component of a bushland corridor that has been isolated by quarrying and pastoral activity on the subject lands, significant agricultural use to the north, clearing associated with adjoining residential development to the east, and the presence of Mt Cotton Road. An improvement in the east-west habitat linkage across the subject site would be of benefit to local and regional fauna movement opportunities in this location.

Taking into account the location of the proposed future extraction area (Figure 1.1), there is an opportunity to maintain and enhance habitat values within the property boundaries outside of this area to improve local and regional habitat linkage. In particular, the rehabilitation of pastoral lands across the southern portion of the property would contribute significantly to available habitat and movement opportunities for many species, including Koalas. However, the long term viability and success all local and regional linkages that are maintained or enhanced within the property will ultimately depend on the maintenance of habitat and linkages on surrounding lands.

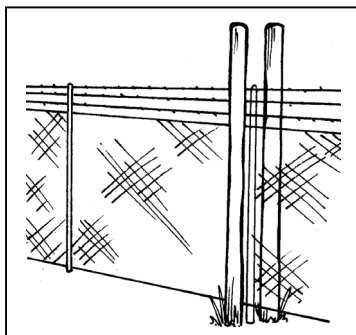
The northern portion of the property supports significant old growth forest in steep gullies, and it is recommended that this area, with linkages to surrounding habitat, be maintained and managed for fauna habitat conservation. The proposed access road between the existing quarry and the proposed extension is located immediately south of this area. The road would require treatment to ensure the security of crossing fauna. There would be no movement of vehicles along this road during night-time hours, however the topography of the location is such that the construction of an elevated portion (or portions) of the road in the form of a bridging structure, along with guide fencing could be installed to ensure the provision of safe crossing opportunities. Where any steep cuttings are formed, infrastructure such as timber poles should be laid against the cuttings to facilitate fauna movement.

Immediately south of the proposed access road it is intended to install a conveyor to transport quarried material from the proposed extension area to the existing plant within the existing quarry area. Details of the conveyor system have not been provided; however it is understood that it would be raised above the ground and operated during daylight hours. Under these circumstances its presence is not expected to represent a barrier to fauna movement.

The facilitation of north-south fauna movement through the property is also important and needs to be considered in project planning. The maintenance and enhancement of habitat outside of the proposed extraction area and the provision of safe movement opportunities for the full range of species within habitat that adjoins the proposed activities is required. In particular, security fencing within fauna habitat and fauna corridor should be such that all species present are able to move freely; however exclusion fencing should be erected in areas where fauna may be injured by the proposed operations or final landform. Drawing 1 shows an example of the type of security fencing that can be installed to facilitate Koala movement provided that it meets the necessary human safety specifications.

Fencing designed for fauna exclusion rather than facilitation will need to be designed such that it excludes all species, including ground-dwelling species, such as the Echidna. This will require the insertion of solid panelling at the base of the fencing and below ground on the habitat side of the fence. It should also have another section of solid panelling at the top of the fence, at least 60cm in width, to prevent Koalas and other arboreal species from gaining purchase. Vegetation must be removed to a distance of 3m from the habitat side of the exclusion fence to prevent arboreal species jumping to the top of the fence.

A fauna exclusion fencing design currently in use by Brisbane City Council is attached as Appendix 5.



Drawing 1: Example of Koala-friendly security fencing (Source: Chenoweth EPLA, 2003)



Legend

— Approximate property boundary

Scale: 1:60,000

Source: Redland Shire Council
2002 Aerial Photography



FIGURE 4.2

**STUDY SITE REGIONAL
CONTEXT – REDLAND SHIRE**

Terrestrial Fauna Assessment Report
Barro Group Mt Cotton Quarry Extension
for Groundwork Environmental
Management Services Pty Ltd

5.0 RELEVANT KOALA POLICIES AND LEGISLATION

5.1 National Koala Conservation Strategy

The *National Koala Conservation Strategy* (ANZECC, 1998) was prepared to deal with the many important management issues facing one of Australia's most high profile species. While still relatively abundant and widespread on a national basis, the Koala is "*clearly declining in parts of its range and because of its cultural significance there is much public and scientific concern about its conservation.*" The *Strategy* aims to provide a national framework for the conservation of the Koala in all States and Territories in which it naturally occurs.

While the responsibility for management of wildlife, including Koalas rests primarily with the State and Territory Governments, the *Strategy* recognises that local government plays a key role in land use planning and zoning.

The authors of the *Strategy* agreed that the conservation of Koalas depends on the conservation of their habitat and the maintenance of ecosystem health and biological diversity, and stress the need for better understanding of the conservation biology of Koalas and the need for monitoring Koala populations and habitats to contribute to management planning.

The need to incorporate Koala conservation into land use planning at all levels was also recognised, with particular emphasis on local government through its environmental protection and zoning powers. The objective to conserve Koalas in their existing habitat is to be achieved, amongst other measures, through:

"Integration of Koala conservation planning into local government planning processes. Local Government has a major role in the conservation of natural areas through its control over the use and development of private land, as specified in planning schemes and strategic planning documents...."

5.2 State Planning Policy 1/97

State Planning Policy 1/97 – Conservation of Koalas in the Koala Coast is particularly relevant to this proposal. Local governments, the Planning and Environment Court, and the Queensland Government are required to have regard to the Policy when carrying out their planning functions.

The issues set out in the Policy regarding development in and adjacent to designated areas within the Koala Coast must be addressed when preparing, reviewing and amending planning schemes, and when making decisions on development applications. The Policy stresses that it is the role of the planning system to reconcile development requirements with the need to protect, conserve and, where appropriate, improve the Koala habitat values of the Koala Coast.

The Queensland Government has announced the preparation of a comprehensive Koala Conservation Plan for Queensland. The new plan will include a review of existing management tools to achieve wider protection. As part of the Plan, *State Planning Policy 1/97* will also be reviewed.

This *Policy* establishes three broad designations:

- i. the Koala Conservation Area;
- ii. Other Major Habitat; and
- iii. the Koala Coast Balance Area.

These designations are delineated on the Policy Map in Appendix 1 of the *SPP 1/97* document.

The subject lands are entirely located within the area designated as 'Koala Conservation Area'. The 'Koala Conservation Area' designation comprises a large, integrated and relatively undisturbed area of Koala habitat. While Koalas are found throughout this area, individual animals generally use large, established home ranges.

This designation contains a significant planning objective to conserve Koalas and their habitat in ways that do not affect existing uses and development rights or remove development commitments.

5.3 RSC Koala Conservation Policy and Greenspace Planning

The *RSC Corporate Plan 2002-2006* states that the strategic directions of the Council are to be guided by the principle of environmental sustainability. Objective 1.1 of RSC's Natural Environment Strategic Priority is "*to protect, maintain and rehabilitate environmental values and biodiversity*" where planning and design, delivery and regulation of activities that are likely to affect Koalas and native animals within the Shire form the basis of a coordinated program to achieve the objective. The long-term objective of the program is to protect, maintain and enhance the health of the Shire's Koalas and native animals.

Corporate Policy 362, as part of the *Koala Conservation and Management Policy and Strategy* endorsed by RSC in August 2002, supports Council's Corporate Plan 2002-2206 Objective 1.2 "*to ensure the sustainability of the Shire's Koala population*".

In order to achieve this objective, Council will support, develop and implement integrated strategies which:

1. *Protect, enhance and manage habitat required to maintain a stable, healthy population of Koalas;*
2. *Enhance existing, and improve future development infrastructure provision to achieve outcomes compatible with Koala conservation and management;*

3. *Promote and market the Koala, and educate the community and stakeholders, to facilitate responsibility and support for Koala conservation and management;*
4. *Achieve appropriate domestic and pest animal management which is compatible with Koala conservation and management; and*
5. *Encourage research into, and monitoring of health, welfare and sustainability of Koala populations within Redland Shire and the Koala Coast.*

The subject land is incorporated within RSC's 'Greenspace' area. The Greenspace areas are composed of publicly and privately owned lands, incorporating:

- Major areas of high environmental and conservation value due to their bushland, habitat, corridor or water quality protection values; and
- Areas of high landscape and scenic value important to the character of the Shire.

For land, such as the subject lands, within or adjoining Greenspace Habitat, there are implications for land use as set out in the *Redland Shire Council Strategic Plan*. Although not its primary purpose, the *Plan* states that the Greenspace plan is a mechanism through which the Council will meet its obligation to recognise and support the objectives of *State Planning Policy 1/97 – Conservation of Koalas in the Koala Coast*. The Greenspace mapping includes the 'Koala Conservation Area' and areas of 'Other Major Habitat'.

The overall aim of the Strategic Plan is to achieve orderly and ecologically sustainable development in the Shire. One of the nine goals identified to support the overall aim for the Strategic Plan is:

To manage the Shire's natural environment, including bushland areas and Moreton Bay, so that its ecological functions and biological diversity are protected and enhanced.

This goal is achieved through the implementation of Council's Environmental Protection Strategy. The Strategy is, in part, achieved by protecting areas identified in Section 5.0 of the Strategic Plan ('Greenspace'), and on the associated Greenspace Map, from incompatible forms of development that would adversely affect the environmental attributes of these locations.

It must be recognised that the subject lands are within the Greenspace area and are surrounded by the highest value (or priority) habitat areas as designated by Redland Shire Council. It is important that, in conjunction with the proposed quarry extension, the proposal for a Material Change of Use for the subject lands incorporates a habitat maintenance and enhancement program to offset the habitat loss due to the quarry extension that results in no net loss of habitat for any species, while also achieving a strengthening of the existing east-west fauna movement opportunities, and particularly Koala movement, through the property to achieve a positive long term gain for Redland Shire.

6.0 FAUNA MANAGEMENT AREAS AND FAUNA MANAGEMENT PLAN OF INTENT

Figure 6.1 shows the intended and recommended land uses in the subject lands surrounding the proposed quarry extension footprint. All areas outside of the extension area and the existing quarry site are shown as “Buffer Land”. These areas incorporate existing fauna habitat as well as areas that should be subject habitat rehabilitation or habitat enhancement to offset habitat losses from quarry activities, and improve fauna movement opportunities (particularly for Koalas) through the subject lands. Areas that are still intended for cattle grazing are also included in the “Buffer Land” category.

With the exception of the areas proposed for continued grazing activities, the proponent intends to manage all “Buffer Land” as wildlife habitat.

Table 6.1 sets out a Fauna Management Plan of Intent, which should be incorporated into the Site Environmental Management Plan. BAAM Pty Ltd does not currently have sufficient detail of the proposed quarry extension to allocate responsibilities or include timelines for recommended actions. These should be incorporated into the final Fauna Management Plan.

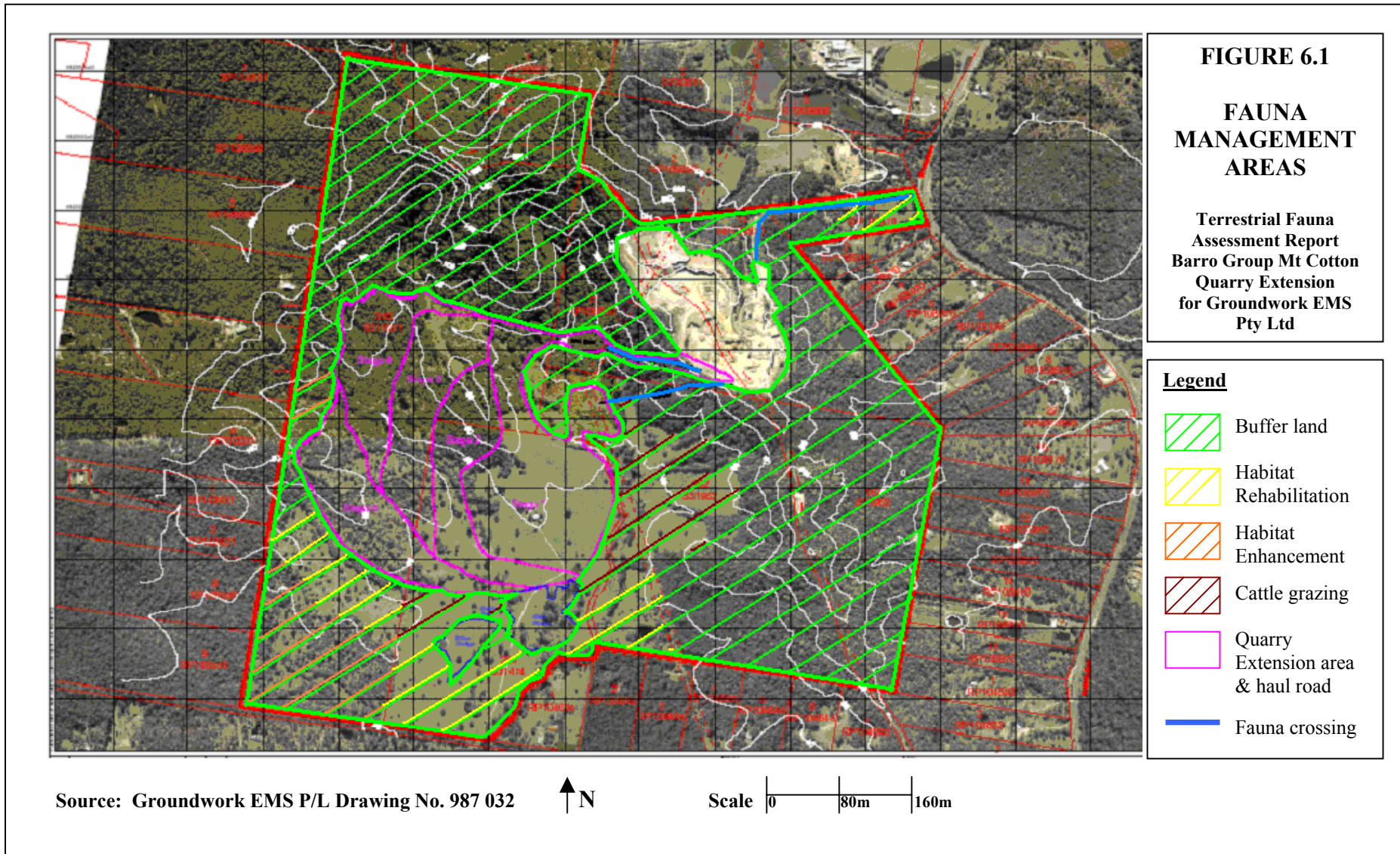


Table 6.1. Fauna Management Plan of Intent

Fauna Value to be Managed	Management Objective	Management Actions
<p>All fauna habitat on site that is termed “Buffer Land” (refer Figure 6.1).</p>	<p>Ensure the long-term viability of the existing habitat and safe movement opportunities, particularly for species of special conservation significance.</p>	<ul style="list-style-type: none"> • Exclusion of stock through the installation of fauna-friendly fencing where necessary. • Monitoring and management of introduced pest species, particularly cats and foxes. Trap 6-monthly and examine habitat to determine evidence of and levels of pest species presence. Undertake baiting programs where necessary in conjunction with any local feral animal control plans. • Monitoring and management of declared and environmental weed species, with any poisoning to be carried out under advice from the Queensland DPI. • Monitoring habitat condition 6-monthly - qualitative assessment of habitat quality and threatening processes. Threatening processes to be subsequently addressed through actions to be incorporated into the Fauna EMP. • Monitoring of the status of the species of special conservation significance over time in the form of annual targeted surveys (specifically Koala, Powerful Owl, Tusked Frog, Grey-headed Flying-fox, Short-beaked Echidna and migratory birds). Any additional species of special conservation significance under State or Commonwealth legislation that is recorded during these monitoring periods should be subject to further investigation and assessment, with the resulting management recommendations to be incorporated into the Fauna Management Plan. • Where habitat adjoins quarry works or infrastructure, provide fencing that excludes all fauna from potential danger (eg. the edges of the quarry pit). • Where person-proof security fencing is required to prevent access to the property, provide fencing that allows fauna passage (as shown in Drawing 1). • All actions undertaken, including monitoring and corrective actions, to be recorded for reporting purposes.
<p>Habitat established or enhanced through rehabilitation of local providence species, specifically species that are known high-preference Koala food trees in the local area (eg. <i>Eucalyptus tereticornis</i>, <i>E. propinqua</i>, <i>E. major</i>,</p>	<p>Ensure the long-term viability of rehabilitated and enhanced habitat, particularly for species of special conservation significance.</p>	<ul style="list-style-type: none"> • Establishment of a Rehabilitation Plan that should be timed to offset habitat loss resulting from the extension activities. Commencement of rehabilitation should be prior to the commencement of extension activities to ensure that the initial stages of rehabilitation are underway and are achieving goals established in the Rehabilitation Plan. • Installation of nest boxes if required for compensation of any habitat trees lost in association with the extension project. 6-monthly monitoring recommended, with data to include identification of species using the nest boxes and the rate of occupancy. • Exclusion of stock through the installation of fauna-friendly fencing where necessary. • Monitoring and management of introduced pest species, particularly cats and foxes. Trap 6-monthly and examine habitat to determine evidence and levels of pest species presence. Undertake baiting programs where necessary under advice from the Queensland DPI.

Fauna Value to be Managed	Management Objective	Management Actions
<p><i>E. signata</i>, <i>E. microcorys</i>, <i>E. intermedia</i>, <i>E. resinifera</i>) in association with local mid- and ground-storey species). Refer Figure 6.1.</p> <p>A comprehensive Rehabilitation Plan will need to be prepared for these areas.</p>		<ul style="list-style-type: none"> • Monitoring and management of declared and environmental weed species, with any poisoning to be carried out under advice from the Queensland DPI. • Monitoring habitat condition 6-monthly - qualitative assessment of habitat quality and threatening processes. Should be coupled with vegetation survey with qualitative measures of rehabilitation progress. Threatening processes to be subsequently addressed through actions to be incorporated into the Fauna EMP. Any requirements to improve performance and outcomes in the rehabilitated areas to be subsequently addressed through actions to be incorporated into the Rehabilitation Program. • Monitoring of the status of the species of special conservation significance over time in the form of annual targeted surveys. (specifically Koala, Powerful Owl, Tusked Frog, Grey-headed Flying-fox, Short-beaked Echidna and migratory birds). Any additional species of special conservation significance under State or Commonwealth legislation that is recorded during these monitoring periods should be subject to further investigation and assessment, with the resulting management recommendations to be incorporated into the Fauna Management Plan. • Where reinstated habitat adjoins quarry works or infrastructure, provide fencing that excludes all fauna from danger (eg. the edges of the quarry pit). • Where person-proof security fencing is required to prevent access to the property, provide fencing that allows fauna passage. • All actions undertaken, including monitoring and corrective actions, to be recorded for reporting purposes.
<p>Habitat outside of “Buffer Land” areas that is affected by quarry infrastructure (refer Figure 6.1).</p>	<p>Ensure that all quarry extension development and operations are carried out in such a way as to avoid or minimise negative impacts on fauna habitat.</p>	<ul style="list-style-type: none"> • All personnel and contractors on site are to be aware of the fauna management objectives and their responsibilities with regard to fauna protection. • Any clearing of habitat in association with the extension will be carried out in the presence of a professional fauna “spotter/catcher” to ensure that injuries and deaths to fauna are minimised. • Minimise dust generation through standard dust suppression practices. • Restrict vehicle movement and speed limits within quarry boundaries to the minimum practicable. • Provide ‘Fauna crossing’ signage in areas where fauna are most commonly sighted on access/haul roads. • Provide safe fauna crossing opportunities for the section of haul road between the existing quarry and the extension area, and for the length of the proposed conveyor line. • Use cleared vegetative material to enhance habitat values of the rehabilitation areas.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The majority of the species recorded from the site during the survey period are currently listed as 'Common Wildlife' in Queensland. However, several species known or considered to potentially occur in the area are recognised as 'species of special conservation significance' (or 'at-risk' species) under NCWR and/or the EPBC. However, the presence of Koala, listed under State legislation as 'Vulnerable' within the south-eastern bioregion, is particularly significant. As well, the potential presence of migratory birds and the Grey-headed Flying Fox *Pteropus poliocephalus* (listed under Commonwealth legislation), and the Powerful Owl *Ninox strenua*, Tusked Frog *Adelotis brevis* and Short-beaked Echidna *Tachyglossus aculeatus* (listed under Queensland legislation) is significant.

The following conclusions and recommendations are made with regard to these species:

- ***Koalas***

It is recommended that the area and number of existing Koala food trees be measured precisely within the proposed extraction area, and that at least an equivalent area and number of Koala food trees be established through a Rehabilitation Plan in the currently cleared southern portion of the subject lands (refer Figure 6.1). There is a proposed 50-year timeframe for resource extraction shown in Figure 1.1, however the Koala food trees within the rehabilitation areas would be of sufficient age to adequately compensate for lost habitat for the entire extraction area within 15 years. With appropriate management of rehabilitation areas over the 50 year life of the proposed quarry extension, including cattle exclusion and weed control, the value of the rehabilitation areas as Koala habitat will considerably outweigh the value of the current grassland, eucalypt and wattle regrowth areas that are subject to agricultural (grazing) land management practices within the proposed quarry extension area.

Continued used of the subject lands by Koalas, including the rehabilitated areas, should be monitored as part of the Fauna Management Plan for the project.

The use of a spotter catcher would be necessary during all clearing activities for the life of the project to protect individual animals.

- ***Migratory Birds***

The areas retained outside of the proposed extension contain and will provide ongoing habitat for these species on the subject lands. The extension proposal is not expected to detract from a safe future for any of these species.

- ***Grey-headed Flying Fox***

The Grey-headed Flying-fox was not observed in the study area but it is expected to occur seasonally and particularly in response to localised flowering events.

Overall, an activity that affects a single Grey-headed Flying-fox or a small number of individual Grey-headed Flying-foxes would not be expected to have a significant impact on the species and so would not require Commonwealth approval. As there are no colonies or camps present within the subject site, it can be concluded that the proposed area subjected to extension would not have any significant impact on the species or threaten the security of the species in the area.

If the currently cleared southern portions of the subject lands are subjected to regeneration and habitat enhancement, particularly with eucalypt species, a net increase in potential food resources for this species can be achieved.

- **Powerful Owl**

The Powerful Owl was not detected on the subject site during the survey. However it is considered that the species would at least occasionally, if not frequently, visit the site for feeding and there is potential for roosting and/or breeding to occur.

The actual significance of the subject lands to the species is unknown and would need to be studied over a longer period of time than was available here. However, as the proposed project does not require the removal of hollow-bearing trees, and it is intended to establish eucalypt woodland habitat in what are currently cleared pasturelands, habitat conditions for the species are likely to improve from the existing situation over the life of the project as rehabilitation areas mature.

- **Tusked Frog**

The Tusked Frog *Adelotus brevis* is expected to be present on the site. The species is mostly associated with permanent waterways and water in rainforest and wet sclerophyll forest and is encountered under cover such as logs and vegetation beside small water bodies or streams. On the study site, there are portions of waterways and associated vegetation that could provide ideal habitat for the species. The timing of the field investigation was not ideal for recording the presence of the species. The most suitable survey time would be during the warmer (summer) months following a rainfall event. It is recommended that the site be visited during such conditions to confirm or discount the presence of the species for future habitat management purposes.

The distribution of the Tusked Frog on the subject lands is expected to be within the more permanent and natural portions of waterways in the north and east. These areas are unaffected by the proposal. It is unlikely the species would occur within the proposed extraction area.

With an understanding of the distribution of the species on the subject lands, and with the proposed habitat protection in the northern portion of the property, the extension proposal is not expected to have a negative impact on the long-term security of the species on the subject lands.

- ***Short-beaked Echidna***

The retained and rehabilitated vegetation will provide ongoing habitat for this species. However, the use of a spotter catcher is also necessary during any on site clearing to protect individual animals.

The quarry extension proposal is not expected to detract from a safe future for the species.

Given the presence of species of conservation significance on the site, and those additional scheduled species known from the area, it is expected that the State and Local governments will require clear identification and justification of long-term fauna movement prospects and opportunities within and through the subject site.

The lands, situated in close proximity to a National Park and falling within the *State Planning Policy 1/97* 'Koala Conservation Area', support strategically important habitat, and the long-term maintenance of habitat and safe movement opportunities for Koalas in particular is implicit.

The Queensland Government has announced the preparation of a comprehensive Koala Conservation Plan for Queensland, due to be released for public comment in September 2004. The new plan will include a review of existing management tools to achieve wider protection. As part of the Plan, *State Planning Policy 1/97* will also be reviewed. The proposed quarry extension will be subject to review in light of the new Koala Conservation Plan and any relevant changes to *SPP 1/97*.

Taking into account the location of the proposed future extraction area (Figure 1.1), there is an opportunity to maintain and enhance habitat values within the property boundaries outside of this area to improve local and regional habitat linkage. In particular, the rehabilitation of pastoral lands across the southern portion of the property would contribute significantly to available habitat and movement opportunities for many species, including Koalas. However, the long term viability and success all local and regional linkages that are maintained or enhanced within the property will ultimately depend on the maintenance of habitat and linkages on surrounding lands.

The northern portion of the property supports significant old growth forest in steep gullies, and it is recommended that this area, with linkages to surrounding habitat, be maintained and managed for fauna habitat conservation. The proposed access road between the existing quarry and the proposed extension is located immediately south of this area. The road would require treatment to ensure the security of crossing fauna. There would be no movement of vehicles along this road during night-time hours; however the topography of the location is such that the construction of an elevated portion (or portions) of the road in the form of a bridging structure, along with guide fencing could be installed to ensure the provision of safe crossing opportunities. Where any steep cuttings are formed, infrastructure such as timber poles should be laid against the cuttings to facilitate fauna movement.

Immediately south of the proposed access road it is intended to install a conveyor to transport quarried material from the proposed extension area to the existing plant within the existing quarry area. Details of the conveyor system have not been provided, however it is understood that it would be raised above the ground and operated during daylight hours. Under these circumstances its presence is not expected to represent a barrier to fauna movement.

All areas outside of the proposed quarry extension area and the existing quarry site would be incorporated within areas shown as “Buffer Land” (Figure 6.1). These areas incorporate existing fauna habitat as well as areas that should be subject to habitat rehabilitation or habitat enhancement to offset habitat losses from quarry activities, and improve fauna movement opportunities (particularly for Koalas) through the subject lands. Areas that are still intended for cattle grazing are also included in the “Buffer Land” category.

With the exception of the areas proposed for continued grazing activities, the proponent intends to manage all “Buffer Land” as wildlife habitat.

A recommended Fauna Management Plan of Intent is provided in Table 6.1. The recommended actions should be incorporated into the Site Environmental Management Plan.

In summary, the management objectives of the Fauna Management Plan of Intent are to:

1. Ensure the long-term viability of the existing habitat and fauna movement opportunities within the “Buffer Land” (Figure 6.1), particularly for species of conservation significance.
2. Ensure the long-term viability of the rehabilitated and enhanced habitat within the “Buffer Land”, particularly for species of special conservation significance. A comprehensive Rehabilitation Plan will need to be prepared for these areas.
3. Ensure that all quarry extension development and operations are carried in such a way as to avoid or minimise negative impacts on fauna habitat.

With the implementation of an appropriate Fauna Management Plan and Rehabilitation Plan within the overall Site Management Plan, and the long-term (50+ years) management of the proposed “Buffer Land” for fauna habitat protection and enhancement rather than for rural uses such as grazing, the implications of the proposed development for long-term habitat viability and connectivity within the boundaries of the subject land can be maintained and in some areas, improved.

The management of the fauna habitat within the boundaries of the subject land has implications for local and regional fauna habitat availability and connectivity and should be allocated sufficient resources and expertise to ensure that the management intents are achieved.

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Appendix 1. Fauna Species Lists

Special Status abbreviations are as follows:

Queensland's Nature Conservation (Wildlife) Regulation 1994 (NCA Status): E = Endangered, V = Vulnerable, R = Rare, S = Special Cultural Significance, C = Common wildlife.

Federal Environment Protection and Biodiversity Conservation Act 1999 (EPBC Status): E = endangered, V = vulnerable, M = Migratory Species.

Other abbreviations: I = Introduced; Site = study site 1-4 or D for Dam, Inc = Incidental records, DB = results of searches from Queensland Museum or the EPA WildNet databases.

Nomenclature follows Ingram, McDonald and Natrass (2002), Pizzey and Knight (2003), Menkhorst and Knight (2001) and Wilson and Swan (2003).

Zoological Name	Common Name	Site	Inc	DB	NCA Status	EPBC Status
AMPHIBIANS						
<i>Adelotus brevis</i>	Tusked Frog			X	V	
<i>Bufo marinus</i>	Cane Toad	1,2,3,4			I	
<i>Crinia parinsignifera</i>	Beeping Froglet	2			C	
<i>Crinia signifera</i>	Clicking Froglet			X	C	
<i>Limnodynastes ornatus</i>	Ornate Burrowing Frog			X	C	
<i>Limnodynastes peronii</i>	Striped Marshfrog	2			C	
<i>Limnodynastes terraereginae</i>	Scarlet Sided Pobblebonk			X	C	
<i>Litoria caerulea</i>	Common Green Treefrog			X	C	
<i>Litoria dentata</i>	Bleating Treefrog			X	C	
<i>Litoria fallax</i>	Eastern Sedgefrog	2,3,4			C	
<i>Litoria gracilentata</i>	Graceful Treefrog			X	C	
<i>Litoria latopalmata</i>	Broad Palmed Rocketfrog			X	C	
<i>Litoria nasuta</i>	Striped Rocketfrog			X	C	
<i>Litoria rubella</i>	Ruddy Treefrog			X	C	
<i>Litoria tyleri</i>	Southern Laughing Treefrog			X	C	
<i>Mixophyes fasciolatus</i>	Great Barred Frog			X	C	
<i>Pseudophryne coriacea</i>	Red Backed Broodfrog		X		C	
<i>Pseudophryne raveni</i>	Copper Backed Broodfrog	2,3			C	
REPTILES						
<i>Anomalopus verreauxi</i>	Verreaux's Skink		X		C	
<i>Boiga irregularis</i>	Brown Tree Snake			X	C	
<i>Cacophis harrietae</i>	White Crowned Snake			X	C	
<i>Cacophis krefftii</i>	Dwarf Crowned Snake			X	C	
<i>Cacophis squamulosus</i>	Goldern Crowned Snake			X	C	
<i>Calypotis scutirostrum</i>		3,4			C	
<i>Carlia foliorum</i>	Leaf-litter Skink			X	C	
<i>Carlia vivax</i>			X		C	
<i>Chelodina longicollis</i>	Eastern Snake-necked Turtle/Long-necked Tortoise			X	C	
<i>Chlamydosaurus kingii</i>	Friiled Lizard			X	C	
<i>Cryptoblepharus virgatus</i>	Wall Skink	1,4			C	

Zoological Name	Common Name	Site	Inc	DB	NCA Status	EPBC Status
<i>Cryptophis nigrescens</i>	Eastern Small-eyed Snake		X		C	
<i>Ctenotus robustus</i>	Eastern Striped Skink		X		C	
<i>Ctenotus taeniolatus</i>	Copper-tailed Skink		X		C	
<i>Cyclodomorphus gerrardii</i>	Pink-Tongued Lizard			X	C	
<i>Demansia psammophis</i>	Yellow-faced Whip Snake			X	C	
<i>Dendrelaphis punctulata</i>	Common Tree Snake		X		C	
<i>Diplodactylus vittatus</i>	Wood Gecko			X	C	
<i>Diporiphora australis</i>				X	C	
<i>Egernia frerei</i>	Major Skink			X	C	
<i>Eulamprus brachysoma</i>				X	C	
<i>Eulamprus martini</i>				X	C	
<i>Furina diadema</i>	Red-naped Snake			X	C	
<i>Gehyra dubia</i>				X	C	
<i>Hemiaspis signata</i>	Black-bellied Swamp Snake			X	C	
<i>Lampropholis amicula</i>		4			C	
<i>Lampropholis delicata</i>	Garden Skink	1,3			C	
<i>Lialis burtonis</i>	Burton's Snake-Lizard			X	C	
<i>Morelia spilota</i>	Carpet Python	1,4			C	
<i>Oedura robusta</i>	Robust Velvet Gecko			X	C	
<i>Physignathus lesueurii</i>	Eastern Water Dragon	2			C	
<i>Pogona barbata</i>	Bearded Dragon	4			C	
<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake			X	C	
<i>Pygopus lepidopodus</i>	Common Scaly-foot			X	C	
<i>Ramphotyphlops proximus</i>				X	C	
<i>Ramphotyphlops wiedii</i>				X	C	
<i>Tiliqua scincoides</i>	Eastern Blue-tongued Lizard			X	C	
<i>Tropidechis carinatus</i>	Rough-scaled Snake			X	C	
<i>Tropidonophis mairii</i>	Freshwater Snake			X	C	
<i>Varanus varius</i>	Lace Monitor	4			C	
BIRDS						
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped or Yellow-tailed Thornbill			X	C	
<i>Acanthiza lineata</i>	Striated Thornbill			X	C	
<i>Acanthiza nana</i>	Little Thornbill			X	C	
<i>Acanthiza pusilla</i>	Brown Thornbill	1,2			C	
<i>Acanthiza reguloides</i>	Buff-tailed Thornbill			X	C	
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill			X	C	
<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk			X	C	
<i>Accipiter fasciatus</i>	Brown Goshawk	1			C	
<i>Accipiter novaehollandiae</i>	Grey Goshawk			X	R	
<i>Acridotheres tristis</i>	Indian Myna			X	I	
<i>Acrocephalus stentoreus</i>	Australian Reedwarbler			X	C	M
<i>Aegotheles cristatus</i>	Australian Owlet Nightjar	4			C	
<i>Ailuroedus crassirostris</i>	Green Catbird			X	C	
<i>Alcedo azureus</i>	Azure Kingfisher		X		C	
<i>Alectura lathami</i>	Brush Turkey			X	C	
<i>Alisteris scapularis</i>	King Parrot			X	C	

Zoological Name	Common Name	Site	Inc	DB	NCA Status	EPBC Status
<i>Amaurornis olivacea</i>	Bush-hen			X	C	
<i>Anas castanea</i>	Chestnut Teal			X	C	
<i>Anas gracilis</i>	Grey Teal			X	C	
<i>Anas rhynchos</i>	Blue-winged Shoveller			X	C	
<i>Anas superciliosa</i>	Black Duck		X		C	
<i>Anhinga melanogaster</i>	Darter			X	C	
<i>Anseranas semipalmata</i>	Magpie Goose			X	C	
<i>Anthochaera carunculata</i>	Red Wattlebird			X	C	
<i>Anthochaera chrysoptera</i>	Little Wattlebird			X	C	
<i>Anthus novaeseelandiae</i>	Australian Pipit			X	C	
<i>Apus pacificus</i>	Fork-tailed Swift			X	C	M
<i>Aquila audax</i>	Wedge-tailed Eagle	2,4			C	
<i>Ardea alba</i>	Great or White Egret			X	C	
<i>Ardea ibis</i>	Cattle Egret	2			C	M
<i>Ardea intermedia</i>	Intermediate Egret			X	C	
<i>Ardea pacifica</i>	White-necked Heron			X	C	
<i>Arenaria interpres</i>	Ruddy Turnstone			X	C	M
<i>Artamus cyanopterus</i>	Dusky Woodswallow			X	C	
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow		X		C	
<i>Artamus personatus</i>	Masked Woodswallow			X	C	
<i>Aviceda subcristata</i>	Pacific Baza or Crested Hawk			X	C	
<i>Aythya australis</i>	White-eyed Duck			X	C	
<i>Botaurus poiciloptilus</i>	Brown Bittern			X	C	
<i>Burhinus grallarius</i>	Bush Stone-Curlew			X	C	
<i>Butorides striatus</i>	Mangrove Heron			X	C	
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo		X		C	
<i>Cacatua roseicapilla</i>	Galah		X		C	
<i>Cacatua sanguinea</i>	Little Corella			X	C	
<i>Cacomantis flabelliformis</i>	Fantail Cuckoo	3,4			C	
<i>Cacomantis variolosus</i>	Brush Cuckoo			X	C	
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper			X	C	M
<i>Calidris canutus</i>	Red Knot			X	C	M
<i>Calidris ferruginea</i>	Curlew Sandpiper			X	C	M
<i>Calidris ruficollis</i>	Red-necked Stint			X	C	M
<i>Calidris tenuirostris</i>	Great Knot			X	C	M
<i>Calyptorhynchus banksii</i>	Red-tailed Black Cockatoo			X	C	
<i>Calyptorhynchus funereus</i>	Yellow-tailed Black Cockatoo			X	C	
<i>Calyptorhynchus lathami</i>	Glossy Black Cockatoo			X	V	
<i>Centropus phasianinus</i>	Pheasant Coucal	2			C	
<i>Chalcophaps indica</i>	Emerald Dove or Green-winged Pigeon			X	C	
<i>Charadrius leschenaultii</i>	Large Sand Dotterel			X	C	M
<i>Charadrius mongolus</i>	Mongolian Dotterel			X	C	M
<i>Charadrius ruficapillus</i>	Red-capped Dotterel			X	C	M
<i>Chenonetta jubata</i>	Wood Duck		X		C	
<i>Chlidonias hybridus</i>	Marsh Tern			X	C	
<i>Chrysococcyx basalis</i>	Horsfield Bronze-Cuckoo			X	C	

Zoological Name	Common Name	Site	Inc	DB	NCA Status	EPBC Status
<i>Chrysococcyx lucidus</i>	Shining Bronze-Cuckoo			X	C	
<i>Chrysococcyx minutillus</i>	Little Bronze-Cuckoo			X	C	
<i>Chrysococcyx russatus</i>	Rufous-breasted Bronze-Cuckoo			X	C	
<i>Chthonicola sagittata</i>	Speckled Warbler			X	C	
<i>Cincloramphus mathewsi</i>	Rufous Songlark			X	C	
<i>Cinclosoma punctatum</i>	Spotted Quail-Thrush			X	C	
<i>Circus approximans</i>	Swamp Harrier			X	C	
<i>Cisticola exilis</i>	Golden-headed Cisticola	2			C	
<i>Climacteris erythrops</i>	Red-browed Treecreeper			X	R	
<i>Climacteris picumnus</i>	Brown Treecreeper			X	C	
<i>Colluricincla harmonica</i>	Grey Shrike-Thrush	2,4			C	
<i>Colluricincla megarhyncha</i>	Little Shrike-Thrush or Rufous Shrike-Thrush			X	C	
<i>Columba leucomela</i>	White-headed Pigeon			X	C	
<i>Columba livia</i>	Rock Dove			X	I	
<i>Coracina novaeollandiae</i>	Black-faced Cuckoo-Shrike	1,2,4			C	
<i>Coracina papuensis</i>	Little Cuckoo-Shrike		X		C	
<i>Coracina tenuirostris</i>	Cicadabird	3,4			C	
<i>Cormobates leucophaea</i>	White-throated Treecreeper	3,4			C	
<i>Corvus orru</i>	Torresian Crow	1,2,3,4			C	
<i>Coturnix chinensis</i>	King Quail			X	C	
<i>Coturnix pectoralis</i>	Stubble Quail			X	C	
<i>Coturnix ypsilophora</i>	Brown Quail			X	C	
<i>Cracticus nigrogularis</i>	Pied Butcherbird	2,4			C	
<i>Cracticus torquatus</i>	Grey Butcherbird	1,4			C	
<i>Cuculus pallidus</i>	Pallid Cuckoo			X	C	
<i>Cuculus saturatus</i>	Oriental Cuckoo			X	C	M
<i>Cygnus atratus</i>	Black Swan			X	C	
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	1,3,4			C	
<i>Daphoenositta chrysoptera</i>	Varied Sittella		X		C	
<i>Dendrocygna arcuata</i>	Wandering Whistling-Duck			X	C	
<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck			X	C	
<i>Dicaeum hirundinaceum</i>	Mistletoebird	1,3,4			C	
<i>Dicrurus bracteatus</i>	Spangled Drongo	1,3			C	
<i>Egretta garzetta</i>	Little Egret		X		C	
<i>Egretta novaehollandiae</i>	White-faced Heron		X		C	
<i>Elanus axillaris</i>	Black-shouldered Kite		X		C	
<i>Elsayornis melanops</i>	Black-fronted Dotterel			X	C	
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater		X		C	
<i>Eopsaltria australis</i>	Eastern Yellow Robin	1,3			C	
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork (Jabiru)			X	R	
<i>Erythronyx cinctus</i>	Red-kneed Dotterel			X	C	M
<i>Eudynamys scolopacea</i>	Koel	3			C	
<i>Eurostopodus mystacalis</i>	White-throated Nightjar	4			C	
<i>Eurystomus orientalis</i>	Dollarbird			X	C	
<i>Falco berigora</i>	Brown Falcon			X	C	

Zoological Name	Common Name	Site	Inc	DB	NCA Status	EPBC Status
<i>Falco cenchroides</i>	Nankeen Kestrel		X		C	
<i>Falco longipennis</i>	Little Falcon			X	C	
<i>Falco peregrinus</i>	Peregrine Falcon			X	C	
<i>Falco subniger</i>	Black Falcon			X	C	
<i>Falcunculus frontalis</i>	Shriketit			X	C	
<i>Rhipidura rufiventris</i>	Northern Fantail			X	C	
<i>Fulica atra</i>	European Coot			X	C	
<i>Gallinago hardwickii</i>	Japanese Snipe			X	C	M
<i>Gallinula tenebrosa</i>	Dusky Moorhen		X		C	
<i>Gallirallus philippensis</i>	Banded Land Rail		X		C	
<i>Gallus gallus</i>	Feral Fowl			X	I	
<i>Geopelia cuneata</i>	Diamond Dove			X	C	
<i>Geopelia humeralis</i>	Bar-shouldered Dove	1,3,4			C	
<i>Geopelia striata</i>	Peaceful Dove	2			C	
<i>Gerygone laevigaster</i>	Mangrove Warbler			X	C	
<i>Gerygone mouki</i>	Brown Warbler			X	C	
<i>Gerygone olivacea</i>	White-throated Gerygone	2,4			C	
<i>Glossopsitta concinna</i>	Musk Lorikeet		X		C	
<i>Glossopsitta pusilla</i>	Little Lorikeet		X		C	
<i>Grallina cyanoleuca</i>	Magpie-Lark or Peewee	2			C	
<i>Grantiella picta</i>	Painted Honeyeater			X	R	
<i>Gymnorhina tibicen</i>	Australian Magpie	3,4			C	
<i>Haematopus longirostris</i>	Pied Oystercatcher			X	C	
<i>Haliaeetus leucogaster</i>	White-breasted Sea-Eagle			X	C	M
<i>Haliastur indus</i>	Brahminy Kite			X	C	
<i>Haliastur sphenurus</i>	Whistling Kite		X		C	
<i>Heteroscelus brevipes</i>	Grey-tailed Tattler			X	C	M
<i>Hieraaetus morphnoides</i>	Little Eagle			X	C	
<i>Himantopus himantopus</i>	Pied Stilt			X	C	M
<i>Hirundapus caudacutus</i>	White-throated Needletail			X	C	M
<i>Hirundo ariel</i> (See Note)	Fairy Martin			X	C	
<i>Hirundo neoxena</i>	Welcome Swallow	2			C	
<i>Hirundo nigricans</i>	Tree Martin		X		C	
<i>Irediparra gallinacea</i>	Comb-crested Jacana			X	C	
<i>Ixobrychus minutus</i>	Little Bittern			X	C	
<i>Lalage leucomela</i>	Varied Triller	3			C	
<i>Larus novaehollandiae</i>	Silver Gull			X	C	
<i>Leucosarcia melanoleuca</i>	Wonga Pigeon			X	C	
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	1,3			C	
<i>Lichmera indistincta</i>	Brown Honeyeater	1,4			C	
<i>Limicola falcinellus</i>	Broad-billed Sandpiper			X	C	M
<i>Limosa lapponica</i>	Bar-tailed Godwit			X	C	M
<i>Lonchura castaneothorax</i>	Chestnut-breasted Mannikin		X		C	
<i>Lonchura punctulata</i>	Spice Finch			X	I	
<i>Lophoictinia isura</i>	Square-tailed Kite			X	R	
<i>Lopholaimus antarcticus</i>	Topknot Pigeon			X	C	
<i>Macropygia amboinensis</i>	Brown Cuckoo-Dove	1,2,3,4			C	

Zoological Name	Common Name	Site	Inc	DB	NCA Status	EPBC Status
<i>Malurus cyaneus</i>	Superb Blue Wren			X	C	
<i>Malurus lamberti</i>	Variiegated Fairy-Wren	1,2,3			C	
<i>Malurus melanocephalus</i>	Red-backed Fairy-Wren	1,2,3,4			C	
<i>Manorina melanocephala</i>	Noisy Miner	1,2			C	
<i>Megalurus gramineus</i>	Little Grassbird			X	C	M
<i>Megalurus timoriensis</i>	Tawny Grassbird			X	C	M
<i>Meliphaga fasciocularis</i>	Mangrove Honeyeater			X	C	
<i>Meliphaga lewinii</i>	Lewin's Honeyeater	1,2,3,4			C	
<i>Melithreptus albobularis</i>	White-throated Honeyeater	1,3,4			C	
<i>Melithreptus lunatus</i>	White-naped Honeyeater			X	C	
<i>Melophaga fusca</i>	Fuscous Honeyeater			X	C	
<i>Melophaga melanops</i>	Yello-tufted Honeyeater			X	C	
<i>Merops ornatus</i>	Rainbow Bee-Eater	1,2			C	M
<i>Microeca fascinans</i>	Jacky Winter			X	C	
<i>Milvus migrans</i>	Fork-tailed Kite			X	C	
<i>Monarcha leucotis</i>	White-eared Monarch			X	C	
<i>Monarcha melanopsis</i>	Black-faced Monarch	1,3,4			C	M
<i>Monarcha trivirgatus</i>	Spectacled Monarch			X	C	M
<i>Myiagra cyanoleuca</i>	Satin Flycatcher			X	C	M
<i>Myiagra inquieta</i>	Restless Flycatcher			X	C	
<i>Myiagra rubecula</i>	Leaden Flycatcher	1,3			C	
<i>Myzomela obscura</i>	Dusky Honeyeater			X	C	
<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater	1,3,4			C	
<i>Neochmia temporalis</i>	Red-browed Finch	2			C	
<i>Ninox novaeseelandiae</i>	Southern Boobook	2,4			C	
<i>Ninox strenua</i>	Powerful Owl			X	V	
<i>Numenius madagascariensis</i>	Eastern Curlew			X	R	M
<i>Numenius phaeopus</i>	Whimbrel			X	C	M
<i>Nycticorax caledonicus</i>	Nankeen Night Heron		X		C	
<i>Nymphicus hollandicus</i>	Cockatiel			X	C	
<i>Ocyphaps lophotes</i>	Crested Pigeon		X		C	
<i>Oriolus sagittatus</i>	Olive-backed Oriole		X		C	
<i>Orthonyx temminckii</i>	Spine-tailed Logrunner			X	C	
<i>Pachycephala pectoralis</i>	Golden Whistler	3,4			C	
<i>Pachycephala rufiventris</i>	Rufous Whistler	1,3,4			C	
<i>Pandion haliaetus</i>	Osprey			X	C	M
<i>Pardalotus punctatus</i>	Spotted Pardalote			X	C	
<i>Pardalotus striatus</i>	Striated Pardalote	1,2,3,4			C	
<i>Passer domesticus</i>	House Sparrow			X	I	
<i>Pavo cristatus</i>	Pea Fowl			X	I	
<i>Pelecanus conspicillatus</i>	Australian Pelican			X	C	
<i>Petroica goodenovii</i>	Red-capped Robin			X	C	
<i>Petroica rosea</i>	Rose Robin			X	C	
<i>Phalacrocorax carbo</i>	Black Cormorant			X	C	
<i>Phalacrocorax melaleucos</i>	Little Pied Cormorant			X	C	
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant			X	C	
<i>Phalacrocorax varius</i>	Pied Cormorant			X	C	

Zoological Name	Common Name	Site	Inc	DB	NCA Status	EPBC Status
<i>Phaps chalcoptera</i>	Common Bronzewing			X	C	
<i>Philemon citreogularis</i>	Little Friarbird			X	C	
<i>Philemon corniculatus</i>	Noisy Friarbird			X	C	
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater			X	C	
<i>Piezorhynchus alecto</i>	Shining Flycatcher			X	C	
<i>Pitta versicolor</i>	Noisy Pitta			X	C	
<i>Platalea flavipes</i>	Yellow-billed Spoonbill			X	C	
<i>Platalea regia</i>	Royal Spoonbill			X	C	
<i>Platycercus adscitus</i>	Pale-headed Rosella	1,2			C	
<i>Platycercus elegans</i>	Crimson Rosella			X	C	
<i>Platycercus eximius</i>	Eastern Rosella			X	C	
<i>Plectorhyncha lanceolata</i>	Striped Honeyeater		X		C	
<i>Plegadis falcinellus</i>	Glossy Ibis			X	C	M
<i>Pluvialis dominica</i>	American Golden Plover			X		
<i>Pluvialis fulva</i>	Lesser Golden Plover			X	C	M
<i>Podargus strigoides</i>	Tawny Frogmouth			X	C	
<i>Podiceps cristatus</i>	Crested Grebe			X	C	
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe			X	C	
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler			X	C	
<i>Porphyrio porphyrio</i>	Swamphen	2			C	
<i>Porzana pusilla</i>	Marsh Crake			X	C	
<i>Psephotus haematonotus</i>	Red-rumped Parrot			X	C	
<i>Psophodes olivaceus</i>	Eastern Whipbird	1,3			C	
<i>Ptilinopus magnificus</i>	Wompoo Pigeon			X	C	
<i>Ptilonorhynchus violaceus</i>	Satin Bowerbird			X	C	
<i>Ptiloris paradiseus</i>	Paradise Riflebird			X	C	
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet			X	C	M
<i>Rhipidura fuliginosa</i>	Grey Fantail	1,4			C	
<i>Rhipidura leucophrys</i>	Willie Wagtail	2,3			C	
<i>Rhipidura rufifrons</i>	Rufous Fantail	2,3			C	M
<i>Rostratula benghalensis</i>	Painted Snipe			X	V	M
<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo			X	C	
<i>Sericornis frontalis</i>	White-browed Scrubwren	2,3			C	
<i>Sericornis magnirostris</i>	Large-billed Scrubwren		X		C	
<i>Sericulus chrysocephalus</i>	Regent Bowerbird			X	C	
<i>Smicrornis brevirostris</i>	Weebill			X	C	
<i>Sphecotheres viridis</i>	Figbird		X		C	
<i>Sterna albifrons</i>	Little Tern			X	E	M
<i>Sterna bergii</i>	Crested Tern			X	C	
<i>Sterna caspia</i>	Caspian Tern			X	C	M
<i>Sterna hirundo</i>	Common Tern			X	C	M
<i>Sterna nilotica</i>	Gull-billed Tern			X	C	
<i>Strepera graculina</i>	Pied Currawong			X	C	
<i>Streptopelia chinensis</i>	Spotted Turtle-Dove		X		I	
<i>Sturnus vulgaris</i>	European Starling		X		I	
<i>Tachybaptus novaehollandiae</i>	Australian Grebe			X	C	

Zoological Name	Common Name	Site	Inc	DB	NCA Status	EPBC Status
<i>Taeniopygia bichenovii</i>	Double-barred Finch	2			C	
<i>Taeniopygia guttata</i>	Zebra Finch			X	C	
<i>Threskiornis molucca</i>	White Ibis	2			C	
<i>Threskiornis spinicollis</i>	Staw-necked Ibis		X		C	
<i>Todirhamphus chloris</i>	Mangrove Kingfisher			X	C	
<i>Todirhamphus macleayii</i>	Forest Kingfisher	4			C	
<i>Todirhamphus sanctus</i>	Sacred Kingfisher			X	C	
<i>Tregellasia capito</i>	Pale Yellow Robin			X	C	
<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted Lorikeet	1,2,4			C	
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	2,4			C	
<i>Tringa nebularia</i>	Greenshank			X	C	M
<i>Tringa stagnatilis</i>	Marsh Sandpiper			X	C	M
<i>Turnix maculosa</i>	Red-backed Button-Quail			X	C	
<i>Turnix varia</i>	Painted Button-Quail			X	C	
<i>Vanellus miles</i>	Masked Lapwing	2			C	
<i>Xanthomyza phrygia</i>	Regent Honeyeater			X	E	EM
<i>Xenus cinereus</i>	Terek Sandpiper			X	C	M
<i>Zosterops lateralis</i>	Silvereye	1,2,3,4			C	
MAMMALS						
<i>Acrobates pygmaeus</i>	Feathertail Glider			X	C	
<i>Antechinus flavipes</i>	Yellow-footed Antechinus			X	C	
<i>Bos taurus</i>	Ox			X	I	
<i>Canis familiaris</i>	Dog			X	I	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat			X	C	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat		X		C	
<i>Chalinolobus nigrogriseus</i>	Hoary Bat		X		C	
<i>Equus caballus</i>	Brumby			X	I	
<i>Felis catus</i>	Feral Cat		X		I	
<i>Hydromys chrysogaster</i>	Water Rat	2			C	
<i>Isodon macrourus</i>	Northern Brown Bandicoot	3			C	
<i>Lepus capensis</i>	Brown Hare			X	I	
<i>Macropus giganteus</i>	Eastern Grey Kangaroo			X	C	
<i>Macropus parryi</i>	Whiptail Wallaby			X	C	
<i>Macropus rufogriseus</i>	Red-necked Wallaby	2,3			C	
<i>Miniopterus australis</i>	Little Bent-winged Bat			X	C	
<i>Mormopterus loriae</i>	Little Northern Mastiff-bat			X	C	
<i>Mus musculus</i>	House Mouse	1			I	
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat			X	C	
<i>Ornithorhynchus anatinus</i>	Platypus			X	CS	
<i>Oryctolagus cuniculus</i>	Rabbit			X	I	
<i>Perameles nasuta</i>	Long-nosed Bandicoot			X	C	
<i>Petauroides volans</i>	Greater Glider		X		C	
<i>Petaurus australis</i>	Yellow-bellied Glider			X	C	
<i>Petaurus breviceps</i>	Sugar Glider	4			C	
<i>Petaurus norfolcensis</i>	Squirrel Glider	3,4			C	
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale			X	C	

Zoological Name	Common Name	Site	Inc	DB	NCA Status	EPBC Status
<i>Phascolarctos cinereus</i> (Southeastern bioregion)	Koala (Southeastern bioregion)		X		VS	
<i>Planigale maculata</i>	Common Planigale			X	C	
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	3			C	
<i>Pteropus alecto</i>	Black Flying-fox	2			C	
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox			X	C	V
<i>Pteropus scapulatus</i>	Little Red Flying-fox	2			C	
<i>Rattus lutreolus</i>	Swamp Rat	2			C	
<i>Rattus rattus</i>	Black Rat	2			I	
<i>Scotorepens greyii</i>	Little Broad-nosed Bat		X		C	
<i>Sminthopsis murina</i>	Common Dunnart			X	C	
<i>Sus scrofa</i>	Feral Pig			X	I	
<i>Syconycteris australis</i>	Queensland Blossum Bat			X	C	
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	3			CS	
<i>Tadarida australis</i>	White-striped Freetail-bat	1,2,3			C	
<i>Trichosurus caninus</i>	Mountain Brushtail Possum			X	C	
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	1,4			C	
<i>Vespadelus pumilus</i>	Eastern Forest Bat			X	C	
<i>Vulpes vulpes</i>	Fox	1			I	
<i>Wallabia bicolor</i>	Swamp Wallaby	1,2,3,4			C	

Appendix 2. Queensland Museum Database search results

Results of a search for the area of coordinates 27°36'-27°40'S and 153°11'-153°15'E.

Group	Family	Genus	Species
Birds	ACCIPITRIDAE	<i>Elanus</i>	<i>axillaris</i>
Birds	APODIDAE	<i>Hirundapus</i>	<i>caudacuta</i>
Birds	LORIIDAE	<i>Trichoglossus</i>	<i>chlorolepidotis</i>
Birds	PODARGIDAE	<i>Podargus</i>	<i>strigoides</i>
Birds	RALLIDAE	<i>Amaurornis</i>	<i>olivacea</i>
Frogs	BUFONIDAE	<i>Bufo</i>	<i>marinus</i>
Frogs	MYOBATRACHIDAE	<i>Limnodynastes</i>	<i>peronii</i>
Frogs	MYOBATRACHIDAE	<i>Mixophyes</i>	<i>fasciolatus</i>
Frogs	MYOBATRACHIDAE	<i>Pseudophryne</i>	<i>raveni</i>
Mammals	DASYURIDAE	<i>Sminthopsis</i>	<i>murina</i>
Mammals	MURIDAE	<i>Mus</i>	<i>musculus</i>
Mammals	PERAMELIDAE	<i>Isoodon</i>	<i>macrourus</i>
Mammals	PERAMELIDAE	<i>Perameles</i>	<i>nasuta</i>
Mammals	PETAURIDAE	<i>Petaurus</i>	<i>norfolcensis</i>
Mammals	PHASCOLARCTIDAE	<i>Phascolarctos</i>	<i>cinereus</i>
Reptiles	AGAMIDAE	<i>Chlamydosaurus</i>	<i>kingii</i>
Reptiles	AGAMIDAE	<i>Pogona</i>	<i>barbata</i>
Reptiles	COLUBRIDAE	<i>Boiga</i>	<i>irregularis</i>
Reptiles	ELAPIDAE	<i>Cacophis</i>	<i>squamulosus</i>
Reptiles	ELAPIDAE	<i>Cryptophis</i>	<i>nigrescens</i>
Reptiles	PYGOPODIDAE	<i>Pygopus</i>	<i>lepidopodus</i>
Reptiles	SCINCIDAE	<i>Calyptotis</i>	<i>scutirostrum</i>
Reptiles	SCINCIDAE	<i>Carlia</i>	<i>foliorum</i>
Reptiles	SCINCIDAE	<i>Cyclodomorphus</i>	<i>gerrardii</i>
Reptiles	TYPHLOPIDAE	<i>Ramphotyphlops</i>	<i>proximus</i>
Reptiles	TYPHLOPIDAE	<i>Ramphotyphlops</i>	<i>wiedii</i>

Appendix 3. Wildnet Database search results

WildNet Data for the Mt Cotton area:

Latitude between: -27.6802114764835 and -27.5897700220303

Longitude between: 153.174388601681 and 153.275569808274

Class	Family	Scientific Name	Common Name
amphibians	Bufonidae	<i>Bufo marinus</i>	cane toad
amphibians	Hylidae	<i>Litoria caerulea</i>	common green treefrog
amphibians	Hylidae	<i>Litoria dentata</i>	bleating treefrog
amphibians	Hylidae	<i>Litoria fallax</i>	eastern sedgefrog
amphibians	Hylidae	<i>Litoria gracilentia</i>	graceful treefrog
amphibians	Hylidae	<i>Litoria latopalmata</i>	broad palmed rocketfrog
amphibians	Hylidae	<i>Litoria nasuta</i>	striped rocketfrog
amphibians	Hylidae	<i>Litoria rubella</i>	ruddy treefrog
amphibians	Hylidae	<i>Litoria tyleri</i>	southern laughing treefrog
amphibians	Myobatrachidae	<i>Adelotus brevis</i>	tusked frog
amphibians	Myobatrachidae	<i>Crinia parinsignifera</i>	beeping froglet
amphibians	Myobatrachidae	<i>Crinia signifera</i>	clicking froglet
amphibians	Myobatrachidae	<i>Limnodynastes ornatus</i>	ornate burrowing frog
amphibians	Myobatrachidae	<i>Limnodynastes peronii</i>	striped marshfrog
amphibians	Myobatrachidae	<i>Limnodynastes terraereginae</i>	scarlet sided pobblebonk
amphibians	Myobatrachidae	<i>Mixophyes fasciolatus</i>	great barred frog
amphibians	Myobatrachidae	<i>Pseudophryne coriacea</i>	red backed broodfrog
amphibians	Myobatrachidae	<i>Pseudophryne raveni</i>	copper backed broodfrog
birds	Accipitridae	<i>Accipiter cirrhocephalus</i>	collared sparrowhawk
birds	Accipitridae	<i>Accipiter fasciatus</i>	brown goshawk
birds	Accipitridae	<i>Accipiter novaehollandiae</i>	grey goshawk
birds	Accipitridae	<i>Aquila audax</i>	wedge-tailed eagle
birds	Accipitridae	<i>Aviceda subcristata</i>	Pacific baza
birds	Accipitridae	<i>Circus approximans</i>	swamp harrier
birds	Accipitridae	<i>Elanus axillaris</i>	black-shouldered kite
birds	Accipitridae	<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle
birds	Accipitridae	<i>Haliastur indus</i>	brahminy kite
birds	Accipitridae	<i>Haliastur sphenurus</i>	whistling kite
birds	Accipitridae	<i>Hieraaetus morphnoides</i>	little eagle
birds	Accipitridae	<i>Lophoictinia isura</i>	square-tailed kite
birds	Accipitridae	<i>Milvus migrans</i>	black kite
birds	Accipitridae	<i>Pandion haliaetus</i>	osprey
birds	Aegothelidae	<i>Aegotheles cristatus</i>	Australian owllet-nightjar
birds	Alcedinidae	<i>Alcedo azurea</i>	azure kingfisher
birds	Anatidae	<i>Anas castanea</i>	chestnut teal
birds	Anatidae	<i>Anas gracilis</i>	grey teal
birds	Anatidae	<i>Anas rhynchotis</i>	Australasian shoveler
birds	Anatidae	<i>Anas superciliosa</i>	Pacific black duck
birds	Anatidae	<i>Aythya australis</i>	hardhead
birds	Anatidae	<i>Chenonetta jubata</i>	Australian wood duck
birds	Anatidae	<i>Cygnus atratus</i>	black swan
birds	Anatidae	<i>Dendrocygna arcuata</i>	wandering whistling-duck
birds	Anatidae	<i>Dendrocygna eytoni</i>	plumed whistling-duck

birds	Anhingidae	<i>Anhinga melanogaster</i>	darter
birds	Anseranatidae	<i>Anseranas semipalmata</i>	magpie goose
birds	Apodidae	<i>Apus pacificus</i>	fork-tailed swift
birds	Apodidae	<i>Hirundapus caudacutus</i>	white-throated needletail
birds	Ardeidae	<i>Ardea alba</i>	great egret
birds	Ardeidae	<i>Ardea ibis</i>	cattle egret
birds	Ardeidae	<i>Ardea intermedia</i>	intermediate egret
birds	Ardeidae	<i>Ardea pacifica</i>	white-necked heron
birds	Ardeidae	<i>Botaurus poiciloptilus</i>	Australasian bittern
birds	Ardeidae	<i>Butorides striatus</i>	striated heron
birds	Ardeidae	<i>Egretta garzetta</i>	little egret
birds	Ardeidae	<i>Egretta novaehollandiae</i>	white-faced heron
birds	Ardeidae	<i>Egretta sp.</i>	
birds	Ardeidae	<i>Ixobrychus minutus</i>	little bittern
birds	Ardeidae	<i>Nycticorax caledonicus</i>	nankeen night heron
birds	Artamidae	<i>Artamus cyanopterus</i>	dusky woodswallow
birds	Artamidae	<i>Artamus leucorhynchus</i>	white-breasted woodswallow
birds	Artamidae	<i>Artamus personatus</i>	masked woodswallow
birds	Artamidae	<i>Cracticus nigrogularis</i>	piebald butcherbird
birds	Artamidae	<i>Cracticus torquatus</i>	grey butcherbird
birds	Artamidae	<i>Gymnorhina tibicen</i>	Australian magpie
birds	Artamidae	<i>Strepera graculina</i>	piebald currawong
birds	Burhinidae	<i>Burhinus grallarius</i>	bush stone-curlew
birds	Cacatuidae	<i>Cacatua galerita</i>	sulphur-crested cockatoo
birds	Cacatuidae	<i>Cacatua roseicapilla</i>	galah
birds	Cacatuidae	<i>Cacatua sanguinea</i>	little corella
birds	Cacatuidae	<i>Calyptorhynchus banksii</i>	red-tailed black-cockatoo
birds	Cacatuidae	<i>Calyptorhynchus funereus</i>	yellow-tailed black-cockatoo
birds	Cacatuidae	<i>Calyptorhynchus lathami</i>	glossy black-cockatoo
birds	Cacatuidae	<i>Nymphicus hollandicus</i>	cockatiel
birds	Campephagidae	<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike
birds	Campephagidae	<i>Coracina papuensis</i>	white-bellied cuckoo-shrike
birds	Campephagidae	<i>Coracina tenuirostris</i>	cidabird
birds	Campephagidae	<i>Lalage leucomela</i>	varied triller
birds	Caprimulgidae	<i>Eurostopodus mystacalis</i>	white-throated nightjar
birds	Centropodidae	<i>Centropus phasianinus</i>	pheasant coucal
birds	Charadriidae	<i>Charadrius leschenaultii</i>	greater sand plover
birds	Charadriidae	<i>Charadrius mongolus</i>	lesser sand plover
birds	Charadriidae	<i>Charadrius ruficapillus</i>	red-capped plover
birds	Charadriidae	<i>Elsyornis melanops</i>	black-fronted dotterel
birds	Charadriidae	<i>Erythrogonyx cinctus</i>	red-kneed dotterel
birds	Charadriidae	<i>Pluvialis dominica</i>	American golden plover
birds	Charadriidae	<i>Pluvialis fulva</i>	Pacific golden plover
Birds	Charadriidae	<i>Vanellus miles miles</i>	masked lapwing (northern subspecies)
Birds	Charadriidae	<i>Vanellus miles novaehollandiae</i>	masked lapwing (southern subspecies)
birds	Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	black-necked stork
birds	Cinclosomatidae	<i>Cinclosoma punctatum</i>	spotted quail-thrush
birds	Cinclosomatidae	<i>Psophodes olivaceus</i>	eastern whipbird
birds	Climacteridae	<i>Climacteris erythroptera</i>	red-browed treecreeper
birds	Climacteridae	<i>Climacteris picumnus</i>	brown treecreeper
Birds	Climacteridae	<i>Cormobates leucophaeus metastasis</i>	white-throated treecreeper (southern)

birds	Columbidae	<i>Chalcophaps indica</i>	emerald dove
birds	Columbidae	<i>Columba leucomela</i>	white-headed pigeon
birds	Columbidae	<i>Columba livia</i>	rock dove
birds	Columbidae	<i>Geopelia cuneata</i>	diamond dove
birds	Columbidae	<i>Geopelia humeralis</i>	bar-shouldered dove
birds	Columbidae	<i>Geopelia striata</i>	peaceful dove
birds	Columbidae	<i>Leucosarcia melanoleuca</i>	wonga pigeon
birds	Columbidae	<i>Lopholaimus antarcticus</i>	topknot pigeon
birds	Columbidae	<i>Macropygia amboinensis</i>	brown cuckoo-dove
birds	Columbidae	<i>Ocyphaps lophotes</i>	crested pigeon
birds	Columbidae	<i>Phaps chalcoptera</i>	common bronzewing
birds	Columbidae	<i>Ptilinopus magnificus</i>	wompoo fruit-dove
birds	Columbidae	<i>Streptopelia chinensis</i>	spotted turtle-dove
birds	Coraciidae	<i>Eurystomus orientalis</i>	dollarbird
birds	Corvidae	<i>Corvus orru</i>	Torresian crow
birds	Cuculidae	<i>Cacomantis flabelliformis</i>	fan-tailed cuckoo
birds	Cuculidae	<i>Cacomantis variolosus</i>	brush cuckoo
birds	Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's bronze-cuckoo
birds	Cuculidae	<i>Chrysococcyx lucidus</i>	shining bronze-cuckoo
birds	Cuculidae	<i>Chrysococcyx minutillus</i>	little bronze-cuckoo
birds	Cuculidae	<i>Chrysococcyx russatus</i>	Gould's bronze-cuckoo
birds	Cuculidae	<i>Cuculus pallidus</i>	pallid cuckoo
birds	Cuculidae	<i>Cuculus saturatus</i>	oriental cuckoo
birds	Cuculidae	<i>Eudynamis scolopacea</i>	common koel
birds	Cuculidae	<i>Scythrops novaehollandiae</i>	channel-billed cuckoo
birds	Dicaeidae	<i>Dicaeum hirundinaceum</i>	mistletoebird
birds	Dicruridae	<i>Dicrurus bracteatus</i>	spangled drongo
birds	Dicruridae	<i>Grallina cyanoleuca</i>	magpie-lark
birds	Dicruridae	<i>Monarcha leucotis</i>	white-eared monarch
birds	Dicruridae	<i>Monarcha melanopsis</i>	black-faced monarch
birds	Dicruridae	<i>Monarcha trivirgatus</i>	spectacled monarch
birds	Dicruridae	<i>Myiagra alecto</i>	shining flycatcher
birds	Dicruridae	<i>Myiagra cyanoleuca</i>	satin flycatcher
birds	Dicruridae	<i>Myiagra inquieta</i>	restless flycatcher
birds	Dicruridae	<i>Myiagra rubecula</i>	leaden flycatcher
birds	Dicruridae	<i>Rhipidura fuliginosa</i>	grey fantail
birds	Dicruridae	<i>Rhipidura leucophrys</i>	willie wagtail
birds	Dicruridae	<i>Rhipidura rufifrons</i>	rufous fantail
birds	Falconidae	<i>Falco berigora</i>	brown falcon
birds	Falconidae	<i>Falco cenchroides</i>	nankeen kestrel
birds	Falconidae	<i>Falco longipennis</i>	Australian hobby
birds	Falconidae	<i>Falco peregrinus</i>	peregrine falcon
birds	Falconidae	<i>Falco subniger</i>	black falcon
birds	Haematopodidae	<i>Haematopus longirostris</i>	pie'd oystercatcher
birds	Halcyonidae	<i>Dacelo novaeguineae</i>	laughing kookaburra
birds	Halcyonidae	<i>Todiramphus chloris</i>	collared kingfisher
birds	Halcyonidae	<i>Todiramphus macleayii</i>	forest kingfisher
birds	Halcyonidae	<i>Todiramphus sanctus</i>	sacred kingfisher
birds	Hirundinidae	<i>Hirundo ariel</i>	fairy martin
birds	Hirundinidae	<i>Hirundo neoxena</i>	welcome swallow
birds	Hirundinidae	<i>Hirundo nigricans</i>	tree martin
birds	Jacanidae	<i>Irediparra gallinacea</i>	comb-crested jacana
birds	Laridae	<i>Chlidonias hybridus</i>	whiskered tern
birds	Laridae	<i>Larus novaehollandiae</i>	silver gull

birds	Laridae	<i>Sterna albifrons</i>	little tern
birds	Laridae	<i>Sterna bergii</i>	crested tern
birds	Laridae	<i>Sterna caspia</i>	Caspian tern
birds	Laridae	<i>Sterna hirundo</i>	common tern
birds	Laridae	<i>Sterna nilotica</i>	gull-billed tern
birds	Maluridae	<i>Malurus cyaneus</i>	superb fairy-wren
birds	Maluridae	<i>Malurus lamberti</i>	variegated fairy-wren
birds	Maluridae	<i>Malurus melanocephalus</i>	red-backed fairy-wren
birds	Megapodiidae	<i>Alectura lathami</i>	Australian brush-turkey
birds	Meliphagidae	<i>Acanthorhynchus tenuirostris</i>	eastern spinebill
birds	Meliphagidae	<i>Anthochaera carunculata</i>	red wattlebird
birds	Meliphagidae	<i>Anthochaera chrysoptera</i>	little wattlebird
birds	Meliphagidae	<i>Entomyzon cyanotis</i>	blue-faced honeyeater
birds	Meliphagidae	<i>Grantiella picta</i>	painted honeyeater
birds	Meliphagidae	<i>Lichenostomus chrysops</i>	yellow-faced honeyeater
birds	Meliphagidae	<i>Lichenostomus fasciocularis</i>	mangrove honeyeater
birds	Meliphagidae	<i>Lichenostomus fuscus</i>	fuscous honeyeater
birds	Meliphagidae	<i>Lichenostomus melanops</i>	yellow-tufted honeyeater
birds	Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater
birds	Meliphagidae	<i>Manorina melanocephala</i>	noisy miner
birds	Meliphagidae	<i>Meliphaga lewinii</i>	Lewin's honeyeater
birds	Meliphagidae	<i>Melithreptus albogularis</i>	white-throated honeyeater
birds	Meliphagidae	<i>Melithreptus lunatus</i>	white-naped honeyeater
birds	Meliphagidae	<i>Myzomela obscura</i>	dusky honeyeater
birds	Meliphagidae	<i>Myzomela sanguinolenta</i>	scarlet honeyeater
birds	Meliphagidae	<i>Philemon citreogularis</i>	little friarbird
birds	Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird
birds	Meliphagidae	<i>Phylidonyris nigra</i>	white-cheeked honeyeater
birds	Meliphagidae	<i>Plectorhyncha lanceolata</i>	striped honeyeater
birds	Meliphagidae	<i>Xanthomyza phrygia</i>	regent honeyeater
birds	Meropidae	<i>Merops ornatus</i>	rainbow bee-eater
birds	Motacillidae	<i>Anthus novaeseelandiae</i>	Richard's pipit
birds	Neosittidae	<i>Daphoenositta chrysoptera</i>	varied sittella
birds	Oriolidae	<i>Oriolus sagittatus</i>	olive-backed oriole
birds	Oriolidae	<i>Sphecotheres viridis</i>	figbird
birds	Orthonychidae	<i>Orthonyx temminckii</i>	logrunner
birds	Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush
birds	Pachycephalidae	<i>Colluricincla megarhyncha</i>	little shrike-thrush
birds	Pachycephalidae	<i>Falcunculus frontatus</i>	crested shrike-tit
birds	Pachycephalidae	<i>Pachycephala pectoralis</i>	golden whistler
birds	Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler
birds	Paradisaeidae	<i>Ptiloris paradiseus</i>	paradise riflebird
birds	Pardalotidae	<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill
birds	Pardalotidae	<i>Acanthiza lineata</i>	striated thornbill
birds	Pardalotidae	<i>Acanthiza nana</i>	yellow thornbill
birds	Pardalotidae	<i>Acanthiza pusilla</i>	brown thornbill
birds	Pardalotidae	<i>Acanthiza reguloides</i>	buff-rumped thornbill
birds	Pardalotidae	<i>Chthonicola sagittata</i>	speckled warbler
birds	Pardalotidae	<i>Gerygone levigaster</i>	mangrove gerygone
birds	Pardalotidae	<i>Gerygone mouki</i>	brown gerygone
birds	Pardalotidae	<i>Gerygone olivacea</i>	white-throated gerygone
birds	Pardalotidae	<i>Pardalotus punctatus</i>	spotted pardalote
birds	Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote
birds	Pardalotidae	<i>Sericornis frontalis</i>	white-browed scrubwren

birds	Pardalotidae	<i>Sericornis magnirostris</i>	large-billed scrubwren
birds	Pardalotidae	<i>Smicrornis brevirostris</i>	weebill
birds	Passeridae	<i>Lonchura castaneothorax</i>	chestnut-breasted mannikin
birds	Passeridae	<i>Lonchura punctulata</i>	nutmeg mannikin
birds	Passeridae	<i>Neochmia temporalis</i>	red-browed finch
birds	Passeridae	<i>Passer domesticus</i>	house sparrow
birds	Passeridae	<i>Taeniopygia bichenovii</i>	double-barred finch
birds	Passeridae	<i>Taeniopygia guttata</i>	zebra finch
birds	Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian pelican
birds	Petroicidae	<i>Eopsaltria australis</i>	eastern yellow robin
birds	Petroicidae	<i>Microeca fascians</i>	jacky winter
birds	Petroicidae	<i>Petroica goodenovii</i>	red-capped robin
birds	Petroicidae	<i>Petroica rosea</i>	rose robin
birds	Petroicidae	<i>Tregellasia capito</i>	pale-yellow robin
birds	Phalacrocoracidae	<i>Phalacrocorax carbo</i>	great cormorant
birds	Phalacrocoracidae	<i>Phalacrocorax melanoleucos</i>	little pied cormorant
birds	Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	little black cormorant
birds	Phalacrocoracidae	<i>Phalacrocorax varius</i>	pied cormorant
birds	Phasianidae	<i>Coturnix chinensis</i>	king quail
birds	Phasianidae	<i>Coturnix pectoralis</i>	stubble quail
birds	Phasianidae	<i>Coturnix ypsilophora</i>	brown quail
birds	Phasianidae	<i>Gallus gallus</i>	red junglefowl
birds	Phasianidae	<i>Pavo cristatus</i>	Indian peafowl
birds	Pittidae	<i>Pitta versicolor</i>	noisy pitta
birds	Podargidae	<i>Podargus strigoides</i>	tawny frogmouth
birds	Podicipedidae	<i>Podiceps cristatus</i>	great crested grebe
birds	Podicipedidae	<i>Poliiocephalus poliocephalus</i>	hoary-headed grebe
birds	Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian grebe
birds	Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler
birds	Psittacidae	<i>Alisterus scapularis</i>	Australian king-parrot
birds	Psittacidae	<i>Glossopsitta pusilla</i>	little lorikeet
birds	Psittacidae	<i>Platycercus adscitus</i>	pale-headed rosella
birds	Psittacidae	<i>Platycercus elegans</i>	crimson rosella
birds	Psittacidae	<i>Platycercus eximius</i>	eastern rosella
birds	Psittacidae	<i>Psephotus haematotus</i>	red-rumped parrot
birds	Psittacidae	<i>Trichoglossus chlorolepidotus</i>	scaly-breasted lorikeet
Birds	Psittacidae	<i>Trichoglossus haematodus</i>	rainbow lorikeet
birds	Ptilonorhynchidae	<i>Ailuroedus crassirostris</i>	green catbird
birds	Ptilonorhynchidae	<i>Ptilonorhynchus violaceus</i>	satin bowerbird
birds	Ptilonorhynchidae	<i>Sericulus chrysocephalus</i>	regent bowerbird
birds	Rallidae	<i>Fulica atra</i>	Eurasian coot
birds	Rallidae	<i>Gallinula tenebrosa</i>	dusky moorhen
birds	Rallidae	<i>Gallirallus philippensis</i>	buff-banded rail
birds	Rallidae	<i>Porphyrio porphyrio</i>	purple swamphen
birds	Rallidae	<i>Porzana pusilla</i>	Baillon's crake
birds	Recurvirostridae	<i>Himantopus himantopus</i>	black-winged stilt
birds	Recurvirostridae	<i>Recurvirostra novaehollandiae</i>	red-necked avocet
birds	Rostratulidae	<i>Rostratula benghalensis</i>	painted snipe
birds	Scolopacidae	<i>Arenaria interpres</i>	ruddy turnstone
birds	Scolopacidae	<i>Calidris acuminata</i>	sharp-tailed sandpiper
birds	Scolopacidae	<i>Calidris canutus</i>	red knot
birds	Scolopacidae	<i>Calidris ferruginea</i>	curlew sandpiper
birds	Scolopacidae	<i>Calidris ruficollis</i>	red-necked stint

birds	Scolopacidae	<i>Calidris tenuirostris</i>	great knot
birds	Scolopacidae	<i>Gallinago hardwickii</i>	Latham's snipe
birds	Scolopacidae	<i>Heteroscelus brevipes</i>	grey-tailed tattler
birds	Scolopacidae	<i>Limicola falcinellus</i>	broad-billed sandpiper
birds	Scolopacidae	<i>Limosa lapponica</i>	bar-tailed godwit
birds	Scolopacidae	<i>Numenius madagascariensis</i>	eastern curlew
birds	Scolopacidae	<i>Numenius phaeopus</i>	whimbrel
birds	Scolopacidae	<i>Tringa nebularia</i>	common greenshank
birds	Scolopacidae	<i>Tringa stagnatilis</i>	marsh sandpiper
birds	Scolopacidae	<i>Xenus cinereus</i>	terek sandpiper
birds	Strigidae	<i>Ninox novaeseelandiae</i>	southern boobook
birds	Strigidae	<i>Ninox strenua</i>	powerful owl
birds	Sturnidae	<i>Acridotheres tristis</i>	common myna
birds	Sturnidae	<i>Sturnus vulgaris</i>	common starling
birds	Sylviidae	<i>Acrocephalus stentoreus</i>	clamorous reed-warbler
birds	Sylviidae	<i>Cincloramphus mathewsi</i>	rufous songlark
birds	Sylviidae	<i>Cisticola exilis</i>	golden-headed cisticola
birds	Sylviidae	<i>Megalurus gramineus</i>	little grassbird
birds	Sylviidae	<i>Megalurus timoriensis</i>	tawny grassbird
birds	Threskiornithidae	<i>Platalea flavipes</i>	yellow-billed spoonbill
birds	Threskiornithidae	<i>Platalea regia</i>	royal spoonbill
birds	Threskiornithidae	<i>Plegadis falcinellus</i>	glossy ibis
birds	Threskiornithidae	<i>Threskiornis molucca</i>	Australian white ibis
birds	Threskiornithidae	<i>Threskiornis spinicollis</i>	straw-necked ibis
birds	Turnicidae	<i>Turnix maculosa</i>	red-backed button-quail
birds	Turnicidae	<i>Turnix varia</i>	painted button-quail
birds	Zosteropidae	<i>Zosterops lateralis</i>	silveryeye
bony fish	Poeciliidae	<i>Gambusia holbrooki</i>	mosquitofish
Insects	Nymphalidae	<i>Acraea andromacha andromacha</i>	Glasswing
insects	Nymphalidae	<i>Danaus plexippus plexippus</i>	monarch
insects	Nymphalidae	<i>Euploea core corinna</i>	common crow
insects	Nymphalidae	<i>Geitoneura klugii klugii</i>	marbled xenica
insects	Nymphalidae	<i>Heteronympha merope merope</i>	common brown
insects	Nymphalidae	<i>Hypocysta sp.</i>	
insects	Nymphalidae	<i>Hypolimnas bolina nerina</i>	varied eggfly
insects	Nymphalidae	<i>Junonia villida calybe</i>	meadow argus
insects	Papilionidae	<i>Graphium sarpedon choredon</i>	blue triangle
insects	Pieridae	<i>Delias nigrina</i>	black jezebel
insects	Pieridae	<i>Eurema hecabe phoebus</i>	large grass-yellow
mammals	Acrobatidae	<i>Acrobates pygmaeus</i>	feathertail glider
mammals	Bovidae	<i>Bos taurus</i>	European cattle
mammals	Canidae	<i>Canis familiaris</i>	dog
mammals	Canidae	<i>Vulpes vulpes</i>	red fox
mammals	Dasyuridae	<i>Antechinus flavipes</i>	yellow-footed antechinus
mammals	Dasyuridae	<i>Phascogale tapoatafa</i>	brush-tailed phascogale
mammals	Dasyuridae	<i>Planigale maculata</i>	common planigale
mammals	Dasyuridae	<i>Sminthopsis murina</i>	common dunnart
mammals	Equidae	<i>Equus caballus</i>	horse
mammals	Felidae	<i>Felis catus</i>	cat
mammals	Leporidae	<i>Lepus capensis</i>	brown hare
mammals	Leporidae	<i>Oryctolagus cuniculus</i>	rabbit
mammals	Macropodidae	<i>Macropus giganteus</i>	eastern grey kangaroo
mammals	Macropodidae	<i>Macropus parryi</i>	whiptail wallaby

mammals	Macropodidae	<i>Macropus rufogriseus</i>	red-necked wallaby
mammals	Macropodidae	<i>Thylogale sp.</i>	
mammals	Macropodidae	<i>Wallabia bicolor</i>	swamp wallaby
mammals	Molossidae	<i>Mormopterus loriae ridei</i>	little north-eastern freetail bat
mammals	Molossidae	<i>Nyctinomus australis</i>	white-striped freetail bat
mammals	Muridae	<i>Hydromys chrysogaster</i>	water rat
mammals	Muridae	<i>Mus musculus</i>	house mouse
mammals	Muridae	<i>Rattus lutreolus</i>	swamp rat
mammals	Muridae	<i>Rattus rattus</i>	black rat
mammals	Ornithorhynchidae	<i>Ornithorhynchus anatinus</i>	platypus
mammals	Peramelidae	<i>Isoodon macrourus</i>	northern brown bandicoot
mammals	Peramelidae	<i>Perameles nasuta</i>	long-nosed bandicoot
Mammals	Petauridae	<i>Petaurus australis australis</i>	yellow-bellied glider (southern subspecies)
mammals	Petauridae	<i>Petaurus breviceps</i>	sugar glider
mammals	Petauridae	<i>Petaurus norfolcensis</i>	squirrel glider
mammals	Phalangeridae	<i>Trichosurus caninus</i>	short-eared possum
mammals	Phalangeridae	<i>Trichosurus vulpecula</i>	common brushtail possum
Mammals	Phascolarctidae	<i>Phascolarctos cinereus (SEQ bioregion)</i>	koala (SEQ bioregion)
mammals	Pseudocheiridae	<i>Petauroides volans</i>	greater glider
mammals	Pseudocheiridae	<i>Pseudocheirus peregrinus</i>	common ringtail possum
mammals	Pteropodidae	<i>Pteropus poliocephalus</i>	grey-headed flying-fox
mammals	Pteropodidae	<i>Pteropus sp.</i>	
mammals	Pteropodidae	<i>Syconycteris australis</i>	eastern blossom bat
mammals	Suidae	<i>Sus scrofa</i>	pig
mammals	Tachyglossidae	<i>Tachyglossus aculeatus</i>	short-beaked echidna
mammals	Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's wattled bat
mammals	Vespertilionidae	<i>Chalinolobus morio</i>	chocolate wattled bat
mammals	Vespertilionidae	<i>Chalinolobus nigrogriseus</i>	hoary wattled bat
mammals	Vespertilionidae	<i>Miniopterus australis</i>	little bent-wing bat
mammals	Vespertilionidae	<i>Nyctophilus gouldi</i>	Gould's long-eared bat
mammals	Vespertilionidae	<i>Scotorepens greyii</i>	little broad-nosed bat
mammals	Vespertilionidae	<i>Vespadelus pumilus</i>	eastern forest bat
reptiles	Agamidae	<i>Diporiphora australis</i>	
reptiles	Agamidae	<i>Physignathus lesueurii</i>	eastern water dragon
reptiles	Agamidae	<i>Pogona barbata</i>	bearded dragon
reptiles	Boidae	<i>Morelia spilota</i>	carpet python
reptiles	Chelidae	<i>Chelodina longicollis</i>	eastern snake-necked turtle
reptiles	Colubridae	<i>Boiga irregularis</i>	brown tree snake
reptiles	Colubridae	<i>Dendrelaphis punctulata</i>	common tree snake
reptiles	Colubridae	<i>Tropidonophis mairii</i>	freshwater snake
reptiles	Elapidae	<i>Cacophis harriettae</i>	white-crowned snake
reptiles	Elapidae	<i>Cacophis krefftii</i>	dwarf crowned snake
reptiles	Elapidae	<i>Demansia psammophis</i>	yellow-faced whip snake
reptiles	Elapidae	<i>Furina diadema</i>	red-naped snake
reptiles	Elapidae	<i>Hemiaspis signata</i>	black-bellied swamp snake
reptiles	Elapidae	<i>Pseudechis porphyriacus</i>	red-bellied black snake
reptiles	Elapidae	<i>Rhinoplocephalus nigrescens</i>	eastern small-eyed snake
reptiles	Elapidae	<i>Tropidechis carinatus</i>	rough-scaled snake
reptiles	Gekkonidae	<i>Diplodactylus vittatus</i>	wood gecko
reptiles	Gekkonidae	<i>Gehyra dubia</i>	
reptiles	Gekkonidae	<i>Oedura robusta</i>	robust velvet gecko
reptiles	Pygopodidae	<i>Lialis burtonis</i>	Burton's legless lizard

reptiles	Scincidae	<i>Anomalopus verreauxii</i>	
reptiles	Scincidae	<i>Calyptotis scutirostrum</i>	
reptiles	Scincidae	<i>Carlia vivax</i>	
reptiles	Scincidae	<i>Cryptoblepharus virgatus</i>	
reptiles	Scincidae	<i>Ctenotus robustus</i>	
reptiles	Scincidae	<i>Ctenotus sp.</i>	
reptiles	Scincidae	<i>Ctenotus taeniolatus</i>	copper-tailed skink
reptiles	Scincidae	<i>Cyclodomorphus gerrardii</i>	pink-tongued lizard
reptiles	Scincidae	<i>Egernia frerei</i>	major skink
reptiles	Scincidae	<i>Eulamprus brachysoma</i>	
reptiles	Scincidae	<i>Eulamprus martini</i>	
reptiles	Scincidae	<i>Lampropholis amicula</i>	
reptiles	Scincidae	<i>Lampropholis delicata</i>	
reptiles	Scincidae	<i>Tiliqua scincoides</i>	eastern blue-tongued lizard
reptiles	Typhlopidae	<i>Ramphotyphlops proximus</i>	
reptiles	Varanidae	<i>Varanus varius</i>	lace monitor

Appendix 4. Commonwealth Protected Matters Search Tool results

Report created on : Monday, March 29, 2004

Report on : World Heritage Properties, National Heritage Places, Wetlands of International Significance (Ramsar Sites), Commonwealth Marine Areas, Threatened Ecological Communities, Threatened Species, Migratory Species and Listed Marine Species

Search type : Area

Coordinates used : -27.62178,153.23518 - 27.62178,153.20912 - 27.64866,153.23518 – 27.64856,153.24376 - 27.62168,153.24262

World Heritage Properties

None found

National Heritage Places

None found

Wetlands of International Significance (Ramsar Sites)

Within Catchment Area of Moreton Bay

Commonwealth Marine Areas

None found

Threatened Ecological Communities

None found

Threatened Species

20 species

Migratory Species

11 species

Listed Marine Species

11 species

Threatened Species

Class	Scientific Name	Common Name	Type of Presence	Status
Amphibia	<i>Litoria olongburensis</i>	Wallum SedgeFrog	Species or species habitat likely to occur within area	Vulnerable
Amphibia	<i>Mixophyes iteratus</i>	Giant Barred Frog	Species or species habitat likely to occur within area	Endangered
Aves	<i>Cyclopsitta diophthalma coxeni</i>	Coxen's Fig-Parrot	Species or species habitat likely to occur within area	Endangered
Aves	<i>Erythrotriorchis radiatus</i>	Red Goshawk	Species or species habitat likely to occur within area	Vulnerable
Aves	<i>Lathamus discolor</i>	Swift Parrot	Species or species habitat may occur within area -	Endangered
Aves	<i>Rostratula australis</i>	Australian Painted Snipe	Species or species habitat may occur within area -	Vulnerable
Aves	<i>Turnix melanogaster</i>	Black-breasted Button-quail	Species or species habitat likely to occur within area	Vulnerable
Aves	<i>Xanthomyza phrygia</i>	Regent Honeyeater	Species or species habitat may occur within area -	Endangered
Mammalia	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat, Large Pied Bat	Species or species habitat may occur within area -	Vulnerable
Mammalia	<i>Dasyurus maculatus maculatus (s. lat.)</i>	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (south-east mainland and Tasmanian subspecies)	Species or species habitat likely to occur within area	Vulnerable

Mammalia	<i>Potorous tridactylus tridactylus</i>	Long-nosed Potoroo (SE mainland)	Species or species habitat may occur within area -	Vulnerable
Mammalia	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Species or species habitat likely to occur within area	Vulnerable
Reptilia	<i>Coeranoscincus reticulatus</i>	Three-toed Snake-tooth Skink	Species or species habitat likely to occur within area -	Vulnerable

Migratory Terrestrial Species

Class	Scientific Name	Common Name	Type of Presence
Aves	<i>Cyclopsitta diophthalma coxeni</i>	Coxen's Fig-Parrot	Species or species habitat likely to occur within area
Aves	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Species or species habitat likely to occur within area
Aves	<i>Hirundapus caudacutus</i>	White-throated Needletail	Species or species habitat may occur within area
Aves	<i>Monarcha melanopsis</i>	Black-faced Monarch	Breeding may occur within area
Aves	<i>Monarcha trivirgatus</i>	Spectacled Monarch	Breeding likely to occur within area
Aves	<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Breeding likely to occur within area
Aves	<i>Rhipidura rufifrons</i>	Rufous Fantail	Breeding may occur within area
Aves	<i>Xanthomyza phrygia</i>	Regent Honeyeater	Species or species habitat may occur within area

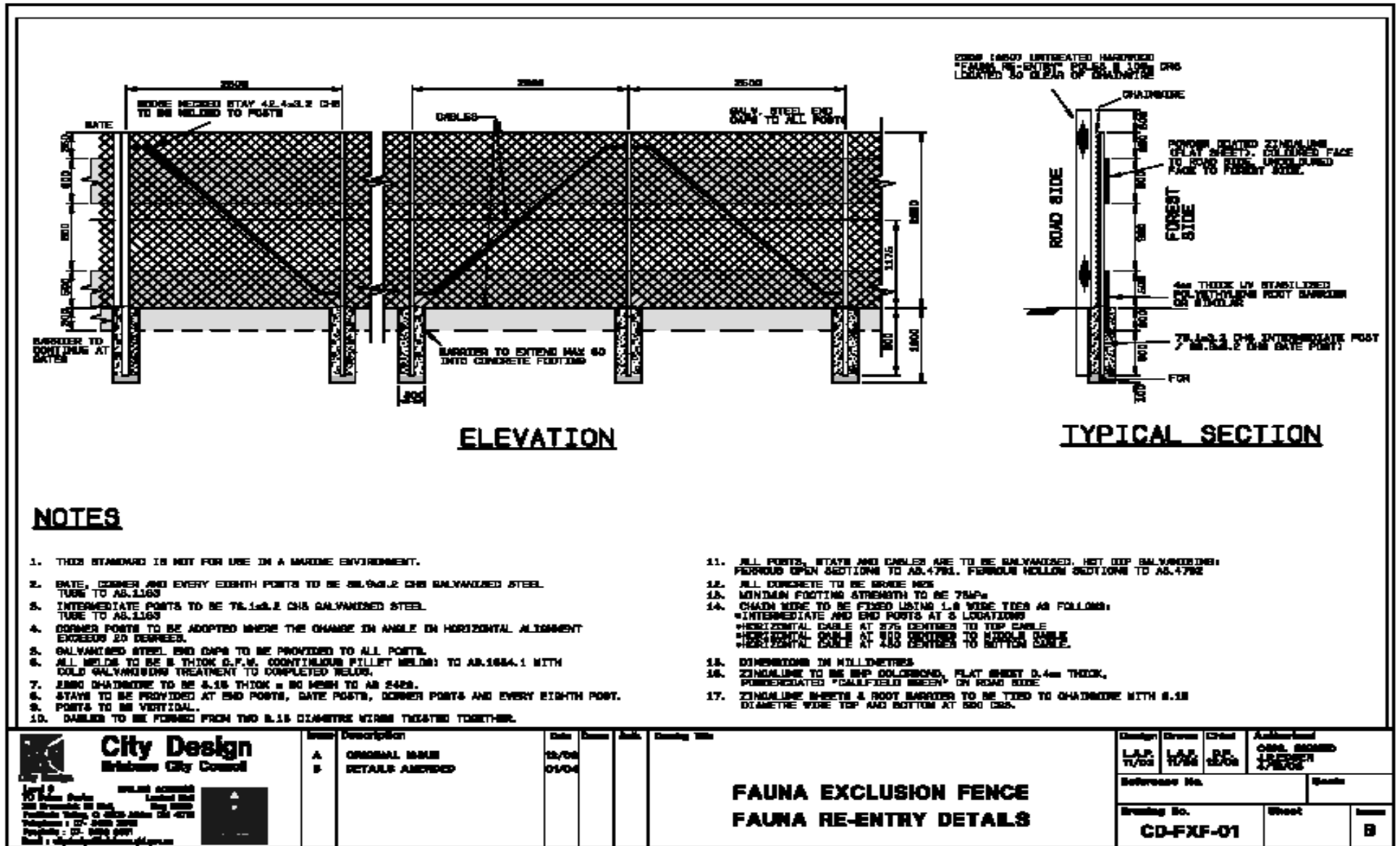
Migratory Wetland Species

Class	Scientific Name	Common Name	Type of Presence
Aves	<i>Gallinago hardwickii</i>	Latham's Snipe, Japanese Snipe	Species or species habitat may occur within area
Aves	<i>Nettapus coromandelianus albipennis</i>	Australian Cotton Pygmy-goose	Species or species habitat may occur within area
Aves	<i>Rostratula benghalensis s. lat.</i>	Painted Snipe	Species or species habitat may occur within area

Listed Marine Species

Class	Scientific Name	Common Name	Type of Presence	Status
Aves	<i>Anseranas semipalmata</i>	Magpie Goose	Species or species habitat may occur within area	Overfly marine area
Aves	<i>Gallinago hardwickii</i>	Latham's Snipe, Japanese Snipe	Species or species habitat may occur within area	Overfly marine area
Aves	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Species or species habitat likely to occur within area	Listed
Aves	<i>Hirundapus caudacutus</i>	White-throated Needletail	Species or species habitat may occur within area	Overfly marine area
Aves	<i>Lathamus discolor</i>	Swift Parrot	Species or species habitat may occur within area	Overfly marine area
Aves	<i>Monarcha melanopsis</i>	Black-faced Monarch	Breeding may occur within area	Overfly marine area

Aves	<i>Monarcha trivirgatus</i>	Spectacled Monarch	Breeding likely to occur within area	Overfly marine area
Aves	<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Breeding likely to occur within area	Overfly marine area
Aves	<i>Nettapus coromandelianus albipennis</i>	Australian Cotton Pygmy-goose	Species or species habitat may occur within area	Overfly marine area
Aves	<i>Rhipidura rufifrons</i>	Rufous Fantail	Breeding may occur within area	Overfly marine area
Aves	<i>Rostratula benghalensis s. lat.</i>	Painted Snipe	Species or species habitat may occur within area	Overfly marine area



**ATTACHMENT 2
JOINT STATEMENTS ON FAUNA AND
FAUNA HABITAT MATTERS
(P&E COURT APPEAL 1585 OF 2007)**

In regards P&E Court Appeal 1585 of 2007

Between Barro Group Pty Ltd (Appellants) and Redlands Shire Council (Respondent) & WPSQ Bayside Branch (Co-Respondent).

1st Joint Statement on Fauna and Fauna Habitat Matters

27 October 2008

All meetings, conferences and this joint statement have been conducted and prepared in accordance with Practice Direction #1 of 2006.

Unless otherwise stated, all references to the development refer to that which forms the original application to the **Redlands Shire Council**.

Experts involved - Mr. Adrian Caneris (AC); Mr. Simon McNeilage (SM); Ms. Lynn Roberts (LR) and Dr William Ellis (WE)

Key to opinions below: ✓ Agree, X Disagree, NA Not applicable to this expert

The experts note that the meetings were productive and useful. It has been agreed that further discussions and agreement is desirable to assist the Court, and it is intended that this take place once information requirements noted below have been addressed.

Statement	AC	SM	WE	LR	Comments
1. There are no fauna species listed under the <i>Environment Protection and Biodiversity Conservation Act 1998</i> which are considered to be threatened by the proposed actions.	✓	✓	NA	NA	(SM) I have no reason not to rely on the professionalism and competency of the ecological advisors to the Proponent and the accuracy of their reported investigations. I therefore accept the statement in the absence of any current contradictory information.
2. There are species listed under the Nature Conservation Act 1994 known to occur on the subject site	✓	✓	✓	✓	(SM) I have no reason not to rely on the professionalism and competency of the ecological advisors to the Proponent and the accuracy of their reported investigations. I therefore accept the statement in the absence of any current contradictory information.
3. Data on the loss of riparian habitat and mapped remnant vegetation is to be provided along with data on the spatial extent of future riparian habitat and remnant vegetation. A reasonable condition of development would be to provide the proposed offsets of both riparian habitat and remnant vegetation such that they are progressively established during operations and fully implemented and viable following the cessation of operations, the riparian habitats and remnant vegetation extant on site will be enhanced in area and condition. It is desirable to have the amount of vegetation lost detailed for each stage of the development and correspondingly the revegetation defined by type and area. Details of expected habitat values and timing of such should be provided for comparison.	✓	✓	✓	✓	

A. Caneris

SM

WE

LR

Between Barro Group Pty Ltd (Appellants) and Redlands Shire Council (Respondent) & WPSQ Bayside Branch (Co-Respondent).

1st Joint Statement on Fauna and Fauna Habitat Matters

Statement	AC	SM	WE	LR	Comments
4. Potential riparian habitat can be identified by reference to the Redland Planning Scheme "Waterways, Wetlands & Moreton Bay overlay mapping" and Part 5 – Overlays, Division 12 - Waterways, Wetlands & Moreton Bay overlay. The relevant RPS requirements including buffer widths for minor waterways and natural drainage lines as described in Part 11 – Planning Scheme Policy 14 Waterways, Wetlands & Moreton Bay are supported for ecological reasons.	✓	✓	✓	✓	
5. Consideration of riparian habitat should include the extant values of the site and the rehabilitation of new drainage channels to achieve natural habitat values where practical.	✓	✓	✓	✓	
6. Riparian habitat is viewed as providing important habitat for koala.	✓	✓	✓	✓	(AC & SM) The value of riparian habitat for koala will depend on the degree to which it provides for movement, refuge and food. This will be strongly influenced by the presence of vegetation and vegetation type.
7. The site's values and contribution to regional and local fauna movement (including Koala) should be both described and illustrated on a figure.	✓	✓	✓	✓	
8. While water quality is being addressed by other experts any water quality criteria agreed should protect downstream ecological values including in-stream fauna and aquatic and riparian vegetation.	✓	✓	✓	✓	
9. Details on the proposed type and extent of fencing are required to assess potential impacts on fauna (including Koala) movement or habitat loss.	✓	✓	✓	✓	
10. The experts wish to continue discussions with the aim to document further agreement once information set out in points 3, 5, 7 8 and 9 is available and Lynn Roberts has undertaken a site visit.	✓	✓	✓	✓	

a. covers

SM
WE

LR

In regards P&E Court Appeal 1585 of 2007

Between Barro Group Pty Ltd (Appellants) and Redlands Shire Council (Respondent) & WPSQ Bayside Branch (Co-Respondent).

1st Joint Statement on Fauna and Fauna Habitat Matters

Signed:

Mr. Adrian Caneris (AC)

Mr. Simon McNeilage (SM)

Ms. Lynn Roberts (LR)

Dr William Ellis (WE)

In regards P&E Court Appeal 1585 of 2007

**Between Barro Group Pty Ltd (Appellants) and Redlands City Council
(Respondent) & WPSQ Bayside Branch (Co-Respondent).**

2nd Joint Statement on Fauna and Fauna Habitat Matters

All meetings, conferences and this joint statement have been conducted and prepared in accordance with Practice Direction #1 of 2006.

Unless otherwise stated, all references to the development refer to that which forms the amended application as shown in the plans distributed by Adrian Caneris to the experts listed below by e-mail on 27 November 2008. Those distributed plans were labelled Schematic of Proposed Plant Layout Figure 2.7A, Orth photo with Schematic of Proposed Plant Layout Overlay Dwg. No. 987.133, Quarry development Plan – Stage 3 Rev. 2, and Quarry Development Plan – Stage 4 Rev. 3.

Experts involved - Mr. Adrian Caneris (AC) Fauna; Mr. Simon McNeilage (SM) Fauna & Koala; and Ms. Lynn Roberts (LR) Koala, Dr William Ellis (WE) Koala

POINTS OF AGREEMENT

1. Present conservation status of the Koala in South East Queensland

- 1.1. Koalas are listed as Vulnerable in South East Queensland under the *Nature Conservation Act 1994*.
- 1.2. Koalas have been recognised as 'endangered' within the Koala Coast Region in Redlands Koala Policy 2008.
- 1.3. We understand that the Court will have regard to both the SEQ Regional Plan Interim Guideline: Koalas and Development (the Koala Guidelines), as well as the Nature Conservation (Koala) Plan 2006 and Management Program 2006-2016 (the Koala Plan). These matters will be further considered through discussions between LR, SM and WE, in their individual reports, and informed through consultation with relevant EPA officers.
- 1.4. The quarry site is centrally located in the Koala Conservation Area designated under both the Interim Guideline and the Koala Plan.
- 1.5. Koala Coast Surveys 2005-2006 reported population declines of 26%, and we agree that this decline appears to be continuing based on advice from the EPA.
- 1.6. The next ten to fifteen years will be crucial to the survival of koalas in the Koala Coast. Habitat loss is considered to be the main cause of declining populations.



2ND FAUNA EXPERTS AGREEMENT
IN REGARD TO P&E COURT APPEAL 1585 OF 2007



1.7. The proposed quarry development is likely to result in a decline in the numbers of koalas on site in the first 15 years of operation. While the mitigation efforts that are proposed are likely to have long term benefits, the initial onsite decline in koala numbers shown in the graph in "Development Proposal Report, Section 9.4 (Koala Habitat Assessment): Estimated Koala Numbers Over Time" is recognised.

2. Connectivity

2.1. The site's relationship to likely regional and local fauna movement patterns (including Koala) is illustrated on the figure in Attachment 1 titled "Fauna Movement Corridors" (prepared by BAAM).

2.2. The proposed quarry development is likely to impede koala movement.

3. Rehabilitation and Revegetation

3.1. The quarry proposal will permanently remove some 50 hectares of existing and potentially valuable koala habitat.

3.2. Vegetation removal for each Stage of the proposed development will result in habitat loss, which must be offset by compensatory plantings to generate replacement habitat that will exceed in extant value that habitat removed. It is recognised that those compensatory plantings have already commenced, in part, and that natural regeneration has also commenced.

3.3. The compensatory plantings must be managed to ensure their successful growth.

3.4. If the development is to proceed, every effort should be made to establish koala habitat as quickly as possible

3.5. For Stage 1 of the proposed development it is recognised that while ultimately habitat and riparian revegetation (including specific koala habitat requirements under the koala planning documents referred to in point 1.3 above and the Redland Planning Scheme) must be verified to be equivalent to and adequately compensate for the loss of habitat that will result from that Stage of development this may not be fully achieved in the short term. We therefore recommend that verification of successful and required revegetation for Stage 1 is undertaken both after five years of operations and at the completion of Stage 1. Development of any type should not proceed for Stage 2 until it can be verified that replacement habitat is equivalent to and adequately compensates for the loss of habitat that will result from all of the Stage 1 development. That verification must be undertaken by a suitably qualified and experienced person. In addition, there should be strong incentives for the applicant to ensure that the rehabilitation is well underway at the end of the first five years of operation in Stage 1.



- 3.6. For Stages 2, 3 and 4 habitat and riparian revegetation (including specific koala habitat requirements under the koala planning documents referred to in point 1.3 above and the Redland Planning Scheme) must be verified to be equivalent to and adequately compensate for the loss of habitat that will result from that Stage of development (and must not include revegetation from previous stages) before any clearing or ground disturbance can take place for the next Stage. That verification must be undertaken by a suitably qualified and experienced person.
- 3.7. The compensatory plantings must be protected from predation by wallabies.
- 3.8. The revegetation and natural regeneration should proceed as quickly as possible but be informed by research outcomes from research plots (as described in the Habitat Management Plan) as they become available.

4. Other Koala Issues

- 4.1. It is agreed that the internal access road from the existing quarry to the proposed quarry should avoid if possible, the three large Eucalypts in the vicinity. However, there should be a precautionary offset to allow for possible impacts on all of these trees. That offset should fully compensate for the three trees.
- 4.2. Monitoring of koalas should be undertaken to better understand the relationship between rehabilitation works and movement requirements. It is noted that this may be undertaken by site-specific studies or through a contribution to a broader regional study if suitable studies can be identified.
- 4.3. Although no definitive studies have been identified, it is possible that dust deposits on koala food trees may affect selection and / or palatability of such leaves to koalas. Additionally there may be other effects such as increased tooth wear from abrasion by dust particles on leaf. Koalas are present on site near the pit, and koalas are known to inhabit areas of high dust deposition.
- 4.4. The long term and short term effects of the noise from the operations, such as blasting, on koala are unknown.
- 4.5. Traffic impacts on koalas external to the site have been minimised by restricting truck movements to daylight hours. There are likely to be 30 deliveries per annum between 7pm and 5am. Koalas are known to be road victims during the day as well as at night.
- 4.6. Exclusion fencing has been proposed to keep fauna from potential danger (e.g. the edges of the quarry pit) and security fencing is



proposed in other locations. The effects of all fencing on fauna, especially kolas, must be considered.


POINTS OF DISAGREEMENT

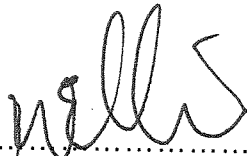
- 1.1. The habitat offsets required for each stage of the development will be considered in individual reports.
- 1.2. If the proposal is to proceed, it is critical to mitigate any impediments to connectivity. SM and WE say this will be best addressed by detailed design to ensure infrastructure (including roads, water treatment areas, embankments and structures) do not unnecessarily impede movement, the establishment of compensatory habitat within the site, speed control of vehicles, ongoing education of all people accessing the site, installation of the conveyor belt above the ground, properly designed fencing, prohibition of dogs from the site, and the maintenance of linkages to areas beyond the site. AC says these matters are addressed in the draft habitat management plan and recommended conditions. LR and SM note that the water treatment ponds and filtration system must be designed to allow for fauna movement, but would still impede fauna movement to some extent depending on final arrangements.

Dated 18 December 2008


.....
Mr. Adrian Caneriš (AC)


.....
Mr. Simon McNeilage (SM)

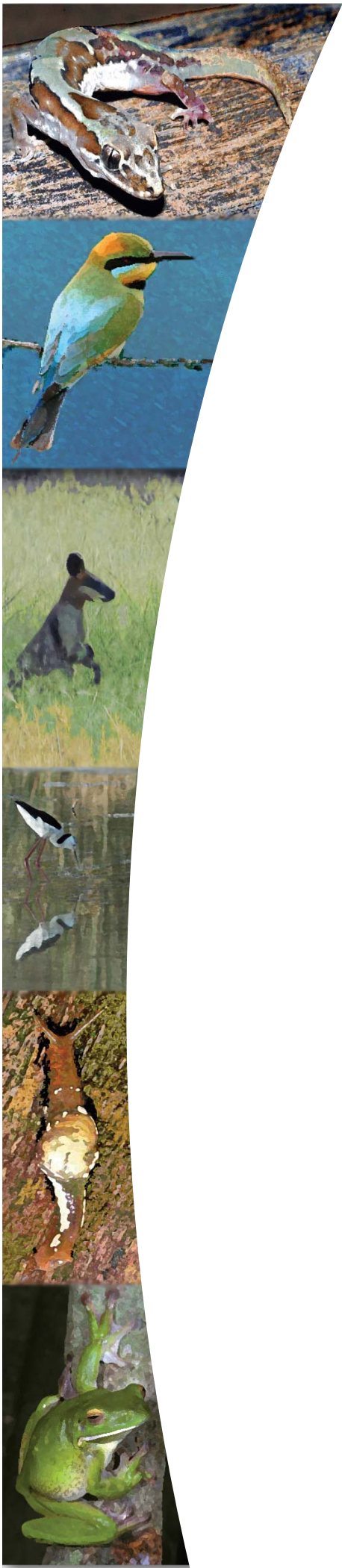

.....
Ms. Lynn Roberts (LR)


.....
Dr William Ellis (WE)



Attachment 1.13

Integrated Koala and Koala Habitat Report



INTEGRATED KOALA AND KOALA HABITAT REPORT

Mount Cotton Quarry

Report prepared
for
Barro Group Pty Ltd



**Biodiversity
Assessment**

AND MANAGEMENT PTY LTD

FAUNA AND HABITAT SPECIALISTS

Document Control Sheet

File Number: 0241-001-1

Project Manager: Adrian Caneris

Client: Barro Group Pty Ltd

Project Title: Integrated Koala and Koala Habitat Report, Mount Cotton Quarry

Project Author/s: Adrian Caneris, Olivia Woosnam

Project Summary: This report provides a compilation of studies and reports relative to Koala and Koala habitat values carried out by BAAM Pty Ltd and other experts between 2006 and 2010 for Mount Cotton Quarry.

Revision/ Checking History Track

Version	Date of Issue	Checked by	Issued by
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Purpose of Report

Biodiversity Assessment and Management Pty Ltd has produced this report in its capacity as consultants for and on the request of Barro Group Pty Ltd (the "**Client**") for the sole purpose of providing an Integrated Koala and Koala Habitat Report for Mount Cotton Quarry (the "**Specified Purpose**"). This information and any recommendations in this report are particular to the Specified Purpose and are based on facts, matters and circumstances particular to the subject matter of the report and the Specified Purpose at the time of production. This report is not to be used, nor is it suitable, for any purpose other than the Specified Purpose. Biodiversity Assessment and Management Pty Ltd disclaims all liability for any loss and/or damage whatsoever arising either directly or indirectly as a result of any application, use or reliance upon the report for any purpose other than the Specified Purpose.

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Signed on behalf of
Biodiversity Assessment and Management Pty Ltd

Date: 18 November 2010



Managing Director

INTEGRATED KOALA AND KOALA HABITAT REPORT

MOUNT COTTON QUARRY

Foreword

The subject site, known as Mt Cotton Quarry, is located at 1513 Mount Cotton Road, Mount Cotton, in Redland City Council government area and comprises five (5) lots known as: Lot 370 on S311071, Lot 238 on SP218968, Lot 162 on S31962, Lot 17 on RP108970 and Lot 1 on RP108970.

This report has been prepared for Barro Group Pty Ltd, the owner of the subject lands, in the context of a proposed quarry extension on the subject site. This extension is approximately 50ha and is located directly south-west of the existing quarry. Barro Group is applying for a Material Change of Use under the *Sustainable Planning Act 2009* (SP Act) and therefore has addressed the relevant Koala conservation policies under the SP Act, namely:

- the *State Planning Policy 2/10 Koala Conservation in South East Queensland 2010*;
- the *South East Queensland Koala Conservation State Planning Regulatory Provisions 2010*; and
- the *Offsets for Net Gain of Koala Habitat in South East Queensland Policy 2010*.

The following report demonstrates how the proposed actions will meet the requirements of the above-mentioned policies and provides details of the proposed actions.

Between 2006 and 2010, Biodiversity Assessment and Management Pty Ltd (BAAM) have conducted a number of Koala and Koala habitat studies on the subject site for Barro Group Pty Ltd. These studies have included detailed site assessment to identify extant Koala habitat values and inform reporting.

The Integrated Koala and Koala Habitat Report comprises six sections:

- **Section 1:** Koala Tree Survey Report (BAAM 2010);
- **Section 2:** Koala Offset Strategy (BAAM 2010);
- **Section 3:** Koala Offset Site Management Plan (BAAM 2010);
- **Section 4:** Statement from Dr William Ellis (Ellis 2010);
- **Section 5:** Koala Habitat Assessment (BAAM 2006); and
- **Section 6:** Joint Statements on Fauna and Fauna Habitat Matters, P&E Court Appeal 1585 of 2007.

2007 COURT APPEAL – SUMMARY

The author (Mr Adrian Caneris from BAAM) was engaged as a fauna and fauna habitat expert in the Planning and Environment Court Appeal 1585 of 2007.

Included as Section 6 of this report are the two Joint Statements on Fauna and Fauna Habitat Matters. Two points of disagreement were raised, relating to habitat offsets and to mitigation of any impediments to connectivity. This report has taken into consideration the matters raised by the experts in the appeal.

Since the joint reporting was prepared, the legislative framework for Koala and Koala habitat conservation in South East Queensland has changed significantly, and the quarry layout has been modified to a minor extent.

This report considers the proposed quarry extension and addresses matters of relevance in the context of the current legislative framework for Koala and Koala habitat conservation.

SECTION 1
KOALA TREE SURVEY REPORT
(BAAM 2010)



KOALA TREE SURVEY REPORT

Mount Cotton Quarry

Report prepared
for
Barro Group Pty Ltd



**Biodiversity
Assessment**

AND MANAGEMENT PTY LTD

FAUNA AND HABITAT SPECIALISTS

Document Control Sheet

File Number: 0241-001-11

Project Manager: Adrian Caneris

Client: Barro Group Pty Ltd

Project Title: Koala Tree Survey Report, Mount Cotton Quarry

Project Author/s: Adrian Caneris, Olivia Woosnam

Project Summary: This report details the methodology used to estimate the number of non-juvenile Koala habitat trees within the proposed quarry extension area, and provides the results of that survey. This tree estimate is intended to be used as a basis for determining the Koala tree offset obligation under the *Offsets for Net Gain of Koala Habitat in South East Queensland Policy*.

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Purpose of Report

Biodiversity Assessment and Management Pty Ltd has produced this report in its capacity as consultants for and on the request of Barro Group Pty Ltd (the "**Client**") for the sole purpose of providing an estimate of the number of non-juvenile Koala habitat trees within the proposed Mount Cotton Quarry extension (the "**Specified Purpose**"). This information and any recommendations in this report are particular to the Specified Purpose and are based on facts, matters and circumstances particular to the subject matter of the report and the Specified Purpose at the time of production. This report is not to be used, nor is it suitable, for any purpose other than the Specified Purpose. Biodiversity Assessment and Management Pty Ltd disclaims all liability for any loss and/or damage whatsoever arising either directly or indirectly as a result of any application, use or reliance upon the report for any purpose other than the Specified Purpose.

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Biodiversity Assessment and Management Pty Ltd

Date: 18 November 2010



Managing Director

KOALA TREE SURVEY REPORT

MOUNT COTTON QUARRY

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List of Abbreviations

BAAM	Biodiversity Assessment and Management Pty Ltd
DERM	Queensland Department of Environment and Resource Management
KSPRP	<i>South East Queensland Koala Conservation State Planning Regulatory Provisions 2010</i>
Offset Policy	<i>Offsets for Net Gain of Koala Habitat in South East Queensland Policy 2010</i>
RE	Regional Ecosystems

1.0 INTRODUCTION

This report has been prepared to provide Barro Group Pty Ltd with an independent estimate of the number of non-juvenile Koala habitat trees present within the boundaries of the proposed Mount Cotton quarry extension.

This tree estimate is intended to be used as a basis for determining the Koala tree offset obligation under the *Offsets for Net Gain of Koala Habitat in South East Queensland Policy 2010* (Offset Policy) for the proposed quarry extension. Throughout this report, 'non-juvenile Koala tree' should be understood as any tree of the *Corymbia*, *Melaleuca*, *Lophostemon* or *Eucalyptus* genera, or of a preferred species such as *Angophora*, with a height of more than 4 metres or a trunk circumference of more than 31.5cm at 1.3m above the ground (or both), as specified in Schedule 4 of the *South East Queensland Koala Conservation State Planning Regulatory Provisions 2010* (KSPRP).

This report should be read in conjunction with the Koala Habitat Assessment (BAAM 2006) which provides an assessment of the Koala habitat values on the subject land.

Figure 1.1 shows the Koala Habitat Values as identified in Schedule 1 of the KSPRP.

2.0 METHODOLOGY

The methodology was developed by BAAM in July 2010 (see **Appendix 1**) and provided to Redland City Council (RCC) for comment to obtain their acceptance of the approach prior to fieldwork commencing.

2.1. GENERAL APPROACH

The methodology developed to estimate the total number of non-juvenile Koala trees in the area to be cleared is a combination of census (total count) and stratified random quadrat sampling*. **Sections 2.1.1** and **2.2.2** provide a summary of the methodology; the full details of the methodology are provided in **Appendix 1**.

* Stratified random sampling is sampling carried out at random from each stratum of a stratified population. If elements within each stratum are similar, greater accuracy in estimates may be obtained.

2.1.1. Stratification

Seven polygons were identified (see **Figure 2.1**) to reflect existing vegetation communities and expected Koala tree densities within the proposed quarry extension area. These expectations were based on BAAM's intimate knowledge of the site through numerous visits since 2003, as well as close analysis of aerial photography and DERM-certified remnant vegetation mapping (**Figure 2.2**).

2.1.2. Survey Design and Effort

Two survey methods were used:

- Census (total tree count); and
- Stratified random quadrat sampling.

Census

A total count of non-juvenile Koala trees was undertaken within Polygons 2, 4 and 7 (**Figure 2.1**). These areas were traversed by foot and all relevant trees counted manually. Where tree density made visual counting difficult, the surveyors used survey spray-paint to mark each tree surveyed so that sampling error was eliminated.

See **Appendix 1** for further details of the methodology.

Stratified Random Quadrat Sampling

Within Polygons 1, 3, 5 and 6 (**Figure 2.1**), non-juvenile Koala trees were counted within randomly selected 50m x 20m quadrats. One coordinate was randomly generated for each quadrat, which was to represent one end of the quadrat. The direction of quadrats was intentionally left to the judgement of the surveyors so that representative Koala tree densities and other relevant features such as representative landforms were captured and reflected in the survey.

Two rules were created to ensure consistency in sampling and determine minimum sampling effort in each polygon:

Rule 1: At least one quadrat per 1.5ha; and

Rule 2: No fewer than 2 quadrats per polygon.

Non-juvenile Koala tree density was then calculated for each polygon by calculating the

mean density of the quadrats surveyed in that polygon, and then extrapolating that figure to the total surface area of that particular polygon.

Sampling error was determined prior to commencing the quadrat tree counts (**Section 3.2.2**).

Appendix 1 provides further details of the methodology.

3.0 RESULTS

The fieldwork was undertaken by Olivia Woosnam and Adam Abbott over four days between 12 and 16 July 2010.

Appendix 2 provides pictures images and general observations recorded for each area surveyed.

3.1. RESULTS OF CENSUS (POLYGONS 2, 4 AND 7)

3.1.1. Number of trees counted

The total number of non-juvenile Koala trees counted within Polygons 2, 4 and 7 totals 1,546 trees.

Table 3.1 shows the details of the census for each polygon.

Table 3.1: Results of the census

Polygon	Number of Koala trees* counted
Polygon 2	3
Polygon 4	27
Polygon 7	1,516
TOTAL	1,546

* Non-juvenile Koala habitat trees as defined in the KSPRP.

3.1.2. Sampling error

Marginal to no sampling error is expected to have occurred during the census.

The count was easy within cleared areas and pasture lands. Toward the western portions of polygon 7 where vegetation was reasonably dense at times, spray paint was used to exclude the risk of double-counting.

Access within polygon 4 was difficult due to dense vegetation. The surveyors had some problems walking along the boundary of that polygon and as a result some minor sampling

error may have occurred within polygon 4. When surveyors were in doubt as to whether a relevant tree was inside or outside of the polygon boundary, the tree in question was included. However if sampling error did occur within polygon 4, it is expected to be very low and, given the limited density of relevant trees in that area, the impact of any error on the total census would be minor.

3.2. RESULTS OF QUADRAT SAMPLING (POLYGONS 1, 3, 5 AND 6)

Figure 2.1 shows the location of all quadrats surveyed.

3.2.1. Extrapolation

The extrapolation exercise returned a total number of 13,255 non-juvenile Koala habitat trees within Polygons 1, 3, 5 and 6.

This figure was obtained by firstly calculating the mean number of non-juvenile Koala trees per hectare within each polygon (based on the results of the quadrat counts within that polygon), and then multiplying this mean by the surface area of that polygon. **Table 3.2** provides the results of the quadrat surveys and subsequent extrapolation.

3.2.2. Sampling error

Sampling error was determined prior to commencing quadrat counts by running a "test plot".

Within the western portion of polygon 7, a 100m x 100m plot (1 ha) was marked with flagging tape and the boundary entered into the hand-held GPS (see 'Test plot' on **Figures 1.1** and **2.1**). This area was chosen specifically for its relatively dense vegetation and varying density of non-juvenile Koala trees. The test plot was intentionally located in High and Medium Value Bushland Habitat (see **Figure 1.1**).

A total count of non-juvenile Koala trees was carried out within that 1 ha plot. Subsequently, two 50m x 20m (0.1 ha) quadrats were run within that 1 ha plot. The location of each quadrat was determined by random generation of coordinates; the direction of each quadrat followed the principles described in **section 2.1.2**.

Table 3.2: Results of the quadrat surveys and extrapolation

Polygon	Approximate total surface area (ha)	Mean density of Koala trees* per ha	Extrapolated number of Koala trees*
Polygon 1	1.15	1,155	1,329
Polygon 3	2.80	960	2,688
Polygon 5	10.23	460	4,706
Polygon 6	4.98	910	4,532
TOTAL	19.16		13,255

* Non-juvenile Koala habitat trees as defined in the KSPRP.

The results of the census and of the extrapolation exercise were then compared to determine the sampling error:

Census = 342 trees/ha

Test Quadrat 1 = 49 trees counted

Test Quadrat 2 = 23 trees counted

Extrapolation: $(49 + 23) / 2 \times 10 = 360$ trees/ha

Sampling error: $(360 - 342) / 342 = 5.26\%$

In this study, the sampling error for the estimated number of non-juvenile Koala trees based on quadrat sampling was calculated as 5.26%.

3.2.3. Estimation

Given a 5.26% sampling error, the total number of non-juvenile Koala trees in polygons 1, 3, 5 and 6 is estimated at 13,255 trees ($\pm 5.26\%$, or between 12,557 and 13,953 trees).

3.3. TOTAL ESTIMATED NUMBER OF NON-JUVENILE KOALA TREES WITHIN THE PROPOSED EXTENSION

Based on the results of the census and the quadrat sampling, the total number of non-juvenile Koala trees within the extraction area at the time of survey was estimated at 14,801 trees².

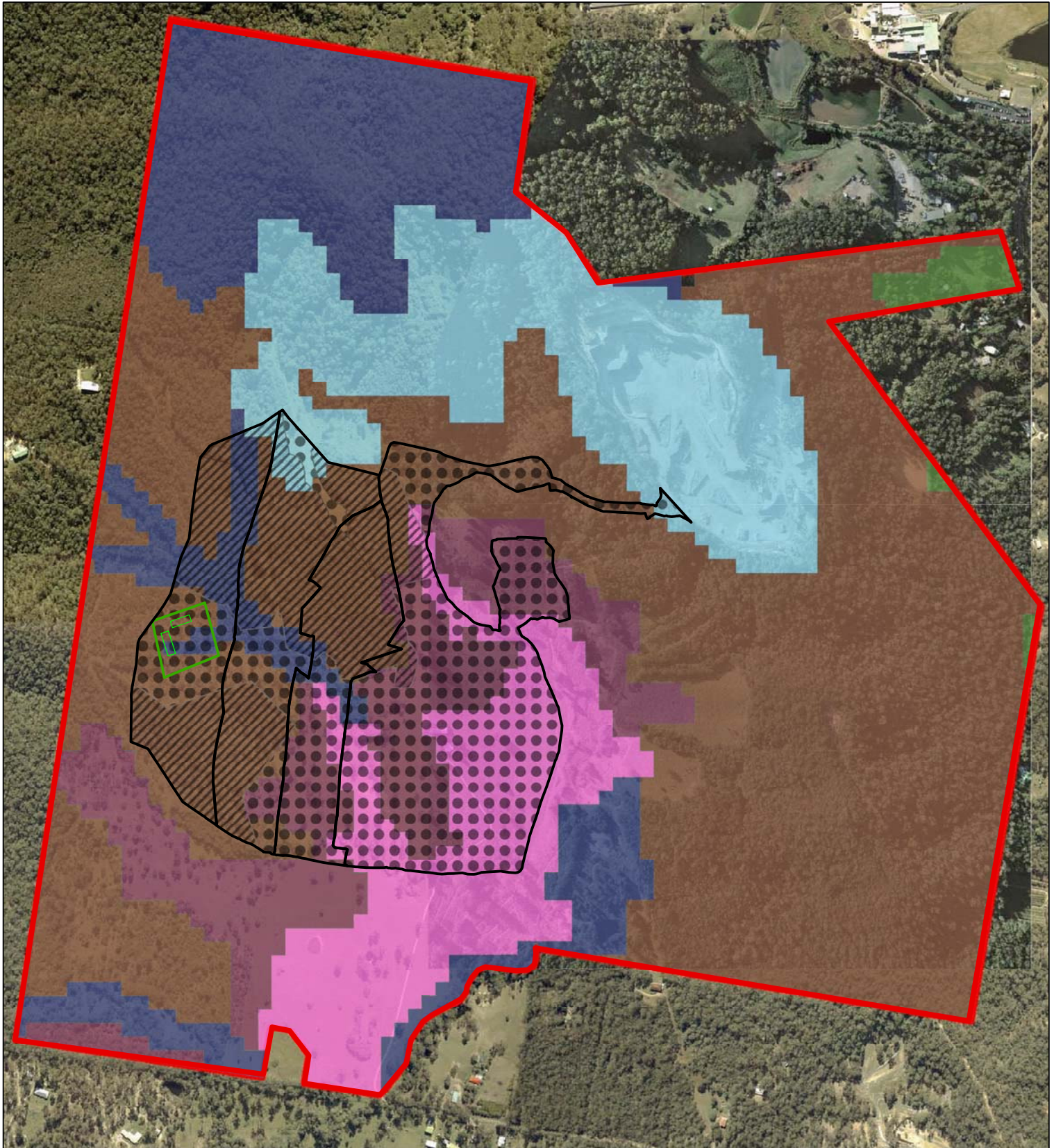
3.3.1. Overall Survey Precision

The overall survey precision for this study was determined to be 95.29%:

² $\pm 5.26\%$.






$$1 - (0.0526 \times 13,255) / 14,801 = 0.9529$$

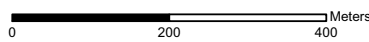
Empirical studies achieving a precision $\geq 95\%$ are generally considered to accurately reflect reality (Tyre *et al.* 2003; Wintle *et al.* 2004; Hobbs & Hilborn 2006).



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 Image courtesy of Google Earth Pro 2010

Legend

-  Site Boundary
-  Test plot and test quadrats
-  Proposed Quarry Extension
- Sampling method:**
-  Quadrat sampling
-  Census



Koala Habitat Values:







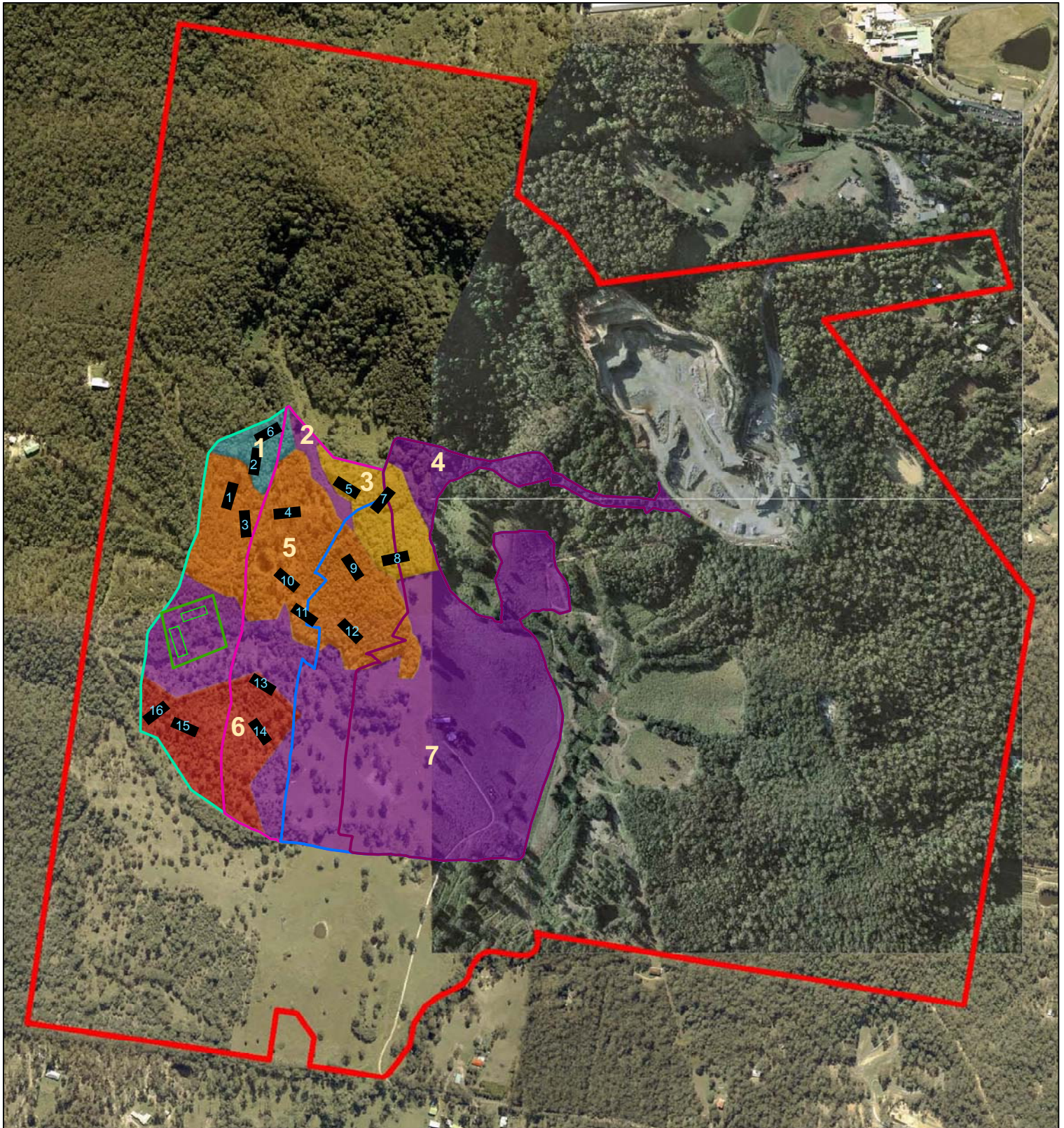
-  Bushland - High Value
-  Bushland - Medium Value
-  Rehabilitation - High Value
-  Rehabilitation - Medium Value
-  Rehabilitation - Low Value
-  Non Habitat or Generally Not Suitable

Figure 1.1

Koala Habitat Values (KSPRP) and Sampling Methods

Koala Tree Survey
 Mt Cotton Quarry Extension
 October 2010





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Image courtesy of Google Earth Pro 2010

Legend

- Site boundary
- Test plot and test quadrats
- Location of quadrats and quadrat number

- Proposed quarry extension:**
- Stage 1
 - Stage 2
 - Stage 3
 - Stage 4

- Survey type and effort:**
- Census (Polygons 2, 4 and 7)
 - Polygon 5: 7 quadrats
 - Polygon 6: 4 quadrats
 - Polygon 1: 2 quadrats
 - Polygon 3: 3 quadrats

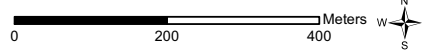
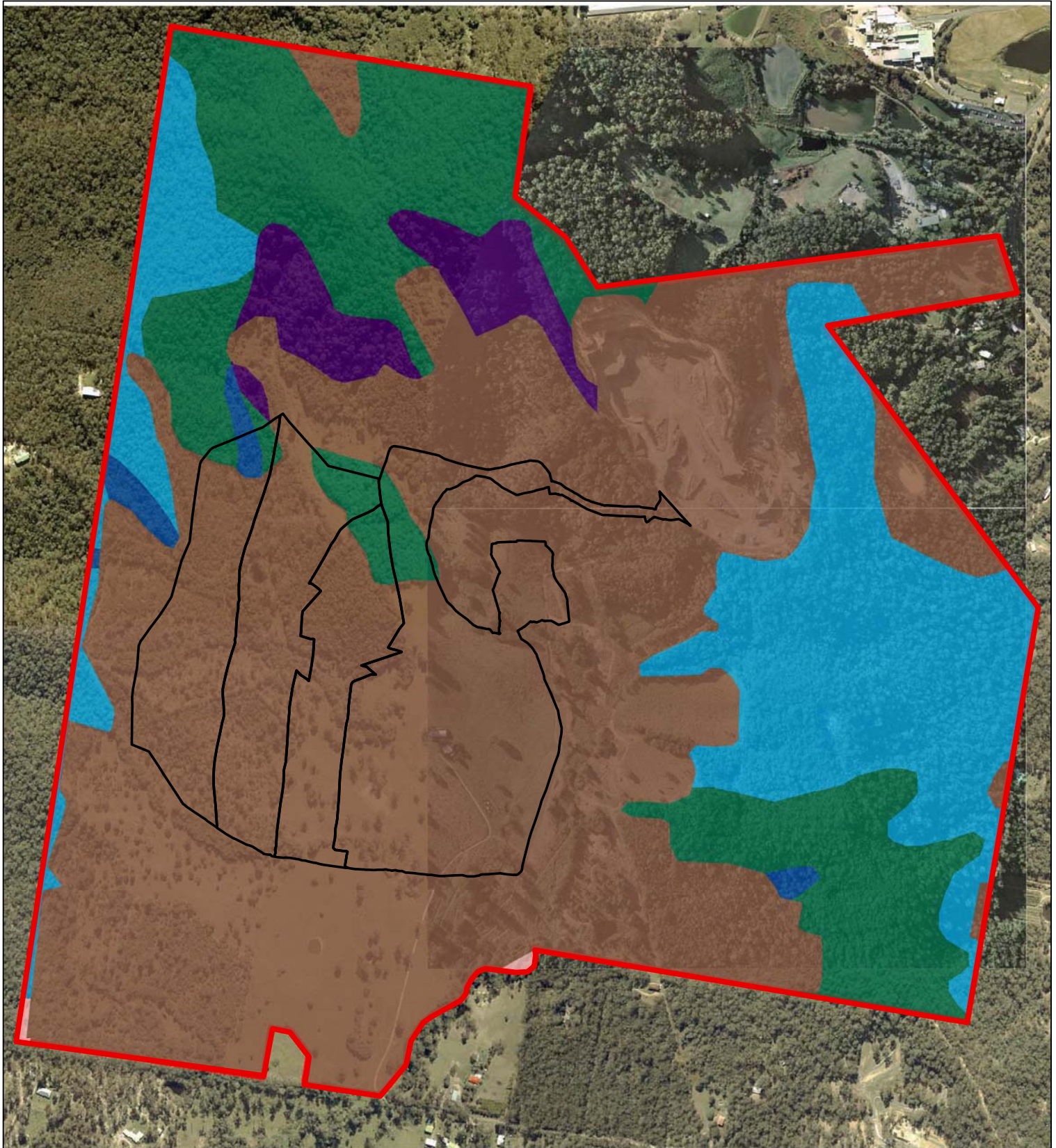


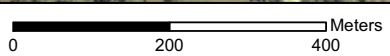
Figure 2.1
Koala Tree Survey

Koala Tree Survey
 Mount Cotton Quarry Extension
 October 2010







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 Image courtesy of Google Earth Pro 2010



Legend

-  Site Boundary
-  Proposed Quarry Extension

Regional Ecosystems:







- | | | | |
|-------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------------|-------------|
|  | 12.11.10/12.11.3 |  | 12.11.5 |
|  | 12.11.23/12.11.5 |  | 12.3.11 |
|  | 12.11.3 |  | Non remnant |

Figure 2.2
DERM
Regional Ecosystems

Koala Tree Survey
 Mount Cotton Quarry Extension
 October 2010



4.0 REFERENCES

Hobbs NT and Hilborn R (2006). Alternatives to statistical hypothesis in ecology: a guide to self teaching. *Ecological Applications* 16(1):15-19.

Tyre AJ, Tenhumberg B, Field SA, Niejalke D, Parris KM and Possingham HP (2003). Improving precision and reducing bias in biological surveys by estimating false negative error rates in presence-absence data. *Ecological Applications* 13(6):1790-1801.

Wintle BA, McCarthy MA, Parris KM and Burgman MA (2004). Precision and bias of methods for estimating point survey detection probabilities. *Ecological Applications* 14(3):703-712.

APPENDIX 1
DETAILED TREE SURVEY METHODOLOGY

MT COTTON QUARRY

KOALA TREE SURVEY METHODOLOGY

The following document has been prepared by Biodiversity Assessment and Management Pty Ltd (BAAM) for the purposes of discussion with the Redland City Council in regard to a proposed methodology for estimating the number of Koala trees present within a proposed quarry extension area at the BARRO Group Mt Cotton Quarry, Redland City. This tree estimate is intended to be used as a basis for determining the Koala tree offset obligation under the *Offset for Net Gain of Koala Habitat in South East Queensland Policy* (Offset policy).

1. BACKGROUND

Barro Group intends to submit an application for a quarry extension. The subject land and proposed quarry extension are shown on **Figure 1**. The total surface area for the quarry extension area (including all 4 Stages) is approximately 49 hectares.

Table 1 below shows the areas of currently mapped Koala Habitat Values in each of the 4 stages (as per the *SEQ Koala Conservation State Planning Regulatory Provisions May 2010* (SPRP) 'Assessable Development Area Koala Habitat Values' map). These areas were determined via GIS by overlaying the shapefiles of the proposed quarry extension stages and the shapefiles of the regulatory mapping.

Table 1: Koala Habitat Values within the individual stages (in hectares):

	Bushland HV	Bushland MV	Rehab MV	Rehab LV	Non-Habitat	TOTAL
Stage 1	3.04	0.19	8.71	9.81	0.15	21.90
Stage 2	4.17	0.49	2.48	0.60	0	7.74
Stage 3	7.72	1.30	0.44	0	0.92	10.38
Stage 4	6.39	2.55	0	0	0.17	9.11
TOTAL	21.32	4.53	11.63	10.41	1.24	49.13

2. PROPOSED METHODOLOGY

2.1 General approach

Seven polygons were identified as a function of vegetation communities and expected Koala tree densities within the proposed quarry extension area. These expectations are based on BAAM's intimate knowledge of the site through numerous visits since 2003, as well as close analysis of aerial photography and DERM-certified remnant vegetation mapping (**Figure 2**).

It is proposed to use two survey methods:

- Census (total tree count); and
- Stratified random quadrat sampling.

Where a census is not practical (see below), it is proposed to count all Koala trees¹ within 50m x 20m quadrats. It is then proposed to calculate mean Koala tree density per unit of surface area (1,000m²) within a given polygon, and extrapolate the figure to the total surface area of that polygon.

2.2 Survey design and effort

For each vegetation community encountered during the survey, observations will be recorded including tree species represented and their ratio in that specific community, typical height / diameter at 1.3m above ground,

¹ Throughout this document, "Koala tree" is to be understood as 'non-juvenile Koala habitat tree' as per the definition contained in the SPRP.

as well as general floristic observations etc. Photos will also be taken at start point for each vegetation community encountered.

Census

BAAM intends to conduct a census in polygons numbered 2 and 7 (see **Figure 1**). Both these polygons are primarily pasture land with few scattered Koala trees, as illustrated in **Picture 1** and **Picture 2**.

A census will also be attempted in polygon 4. Although vegetation throughout this polygon can be relatively dense at times, our intimate knowledge of the site suggests that Koala tree density should be relatively low so that a total count is likely to be achievable.

Because Koala trees in these areas are expected to be well circumscribed and easy to count, a total count is expected to accurately reflect reality (Lindenmayer & Burgman 2005). A 100% precision with 0% sampling error should be achievable.

If, once on site, some patches are found to be less easy to count than anticipated, each tree will be marked as soon as it has been surveyed in order to eliminate any potential sampling error.

If it is found that there might be a risk of sampling error within specific areas, then these areas will be plotted by GPS, set aside for later sampling under a different sampling design (to be determined on a case by case basis) and removed from the census area.

Stratified Random Quadrat Sampling

Within polygons 1, 3, 5 and 6 (see **Figure 1**) BAAM intends to count all Koala trees within 50m x 20m quadrats (0.1 ha). The number and location of quadrats within those polygons are shown on **Figure 1**. As illustrated in **Pictures 3, 4, 5** and **6**, these polygons are expected to support relatively high Koala tree abundance, with the majority of Koala trees being young ($\leq 31.5\text{cm cbh}^2$) but many being $\geq 4\text{m}$ high. With a ground layer that generally enables ease of access, the fieldwork team is not expected to encounter any significant issue in establishing the quadrats as shown on **Figure 1**.

Why quadrats?

A complete count in those polygons is not statistically desirable: Koala trees and other woody vegetation can be dense and sampling error would be likely to occur (for instance, inadvertently leaving out some Koala trees); but neither the sampling error nor the confidence limit would be known, so the precision of the count could not be determined.

With quadrat sampling, population size and confidence limits can be estimated (Lindenmayer & Burgman 2005). BAAM will sum up the number of trees counted in all quadrats of a given polygon, and extrapolate that figure to the total surface area of that polygon.

Survey precision

In order to determine our survey precision and test the methodology, BAAM will first carry out a preliminary survey.

Surveys of this type are widely accepted to be highly accurate when they achieve at least 95% precision (in other terms, a sampling error of 5% or less). If the trial is successful in determining a 95% or higher precision level, we will then proceed with the full survey. If the trial survey determines a lower precision level, the methodology will be discussed and reviewed.

Within the western portion of polygon 7 (within the more vegetated portions where Koala tree density is expected to be analogous to that expected in some parts of polygons 1, 3, 5 and 6), a total count will occur within a quadrat of 1 ha. Subsequently, within that same 1 ha quadrat a 50m x 20m quadrat will be randomly selected and Koala trees counted therein. The number of trees within the 0.1 ha polygon will be multiplied by 10 to give an abundance estimate for a 1 ha area within that type of Koala tree density. The difference between the true value determined through the census and the estimate determined through the quadrat methodology

² cbh = circumference at breast height, or circumference at 1.3m above ground.

will provide us with an estimate of survey precision. This survey precision will be the main statistical assumption in the quadrat sampling survey.

Size of quadrats

Although to date no peer-reviewed paper is available on tree count methodologies specific to Koala trees, Neldner *et al.* (2005) prescribes 0.1ha quadrats in the methods for estimating tree abundance based on tree crowns. Moreover, the 0.1 ha quadrat size approach seems to have been empirically tested and proven, and a literature review found that a number of forest inventories and other tree-based surveys of all scales around the world, including Australia, have used the 0.1 ha approach (Adams & Stephenson 1989; Kitahara *et al.* 2008; Levin *et al.* 2007; McElhinny 2005; McElhinny *et al.* 2006; Stephenson *et al.* 2007; Whittaker 1963, 1969; Whittaker & Woodwell 1969; Whittaker & Niering 1975).

Stratification

As Lindenmayer & Burgman (2005) suggest, quadrat sampling is best undertaken and more precise if the strategy takes into account relevant variations and samples are stratified accordingly. In this case, vegetation density (based on DERM vegetation mapping and aerial photography analysis) coupled with expected Koala tree density (based on our intimated knowledge of the study site), were the basis for stratification and determination of the 7 polygons as shown on **Figure 1**. Indeed, this stratification is expected to result in increased precision because it takes into account the different Koala tree densities that may occur within the study site.

Sampling effort

In order to ensure consistency in sampling and determine minimum sampling effort in each stratum, we created two rules:

Rule 1: There is to be a minimum of one 50m x20m quadrat per 1.5ha; and

Rule 2: There are to be no fewer than 2 quadrats per polygon (for statistical robustness; extrapolating a figure out of a single sample is just too weak).

Based on these rules, the proposed sampling effort is the following:

Polygon 1 = 1.15Ha = 2 quadrats = 8.7% of the polygon surveyed

Polygon 3 = 2.80 Ha = 3 quadrats (rule 2: $2.8/1.5 = 1.87$) = 10.7% of the polygon surveyed

Polygon 5 = 10.22 Ha = 7 quadrats (rule 1: $10.22/1.5 = 6.8$) = 6.85% of the polygon surveyed

Polygon 6 = 4.98 Ha = 4 quadrats (rule 1: $4.98/1.5 = 3.38$) = 8% of the polygon surveyed

These rules allow the method to be objective and repeatable, and minimise the amount of variability that may occur within such a sampling exercise (Margules & Stein 1989). Moreover, these rules allow for the allocation of quadrats to be proportional to the size of the strata, except for the smaller strata (polygons 1 and 3) which require oversampling to ensure sampling bias is minimised (Neldner *et al.* 1995, 2005).

Random selection within strata

All quadrats were selected randomly. As shown on **Figure 1**, a grid was placed over the subject site. Each horizontal and vertical line was numbered and a random function was then run under Excel using the function “=RANDBETWEEN(min,max)”. The random generation was run until in each polygon the sampling effort plus at least one “reserve site” was achieved. Reserve sites will be used as alternative location in case access prevents surveying a selected quadrat.

Each randomly selected coordinate will represent one corner of the quadrat. Determining the direction of the quadrat is intentionally left at the discretion of the surveyors in order for them to judge the most appropriate location as a function of representativeness or terrain. On site, the four corners of each quadrat will be recorded on GPS.

**Picture 1: Polygon 7
(Southern portion of Stage 1)**



**Picture 2: Polygon 7
(In the distance, Southern portion of Stage 2)**



**Picture 3: Polygon 5
(Northern portion of Stage 2)**



**Picture 4: Polygon 5
(Northern portion of Stage 4)**

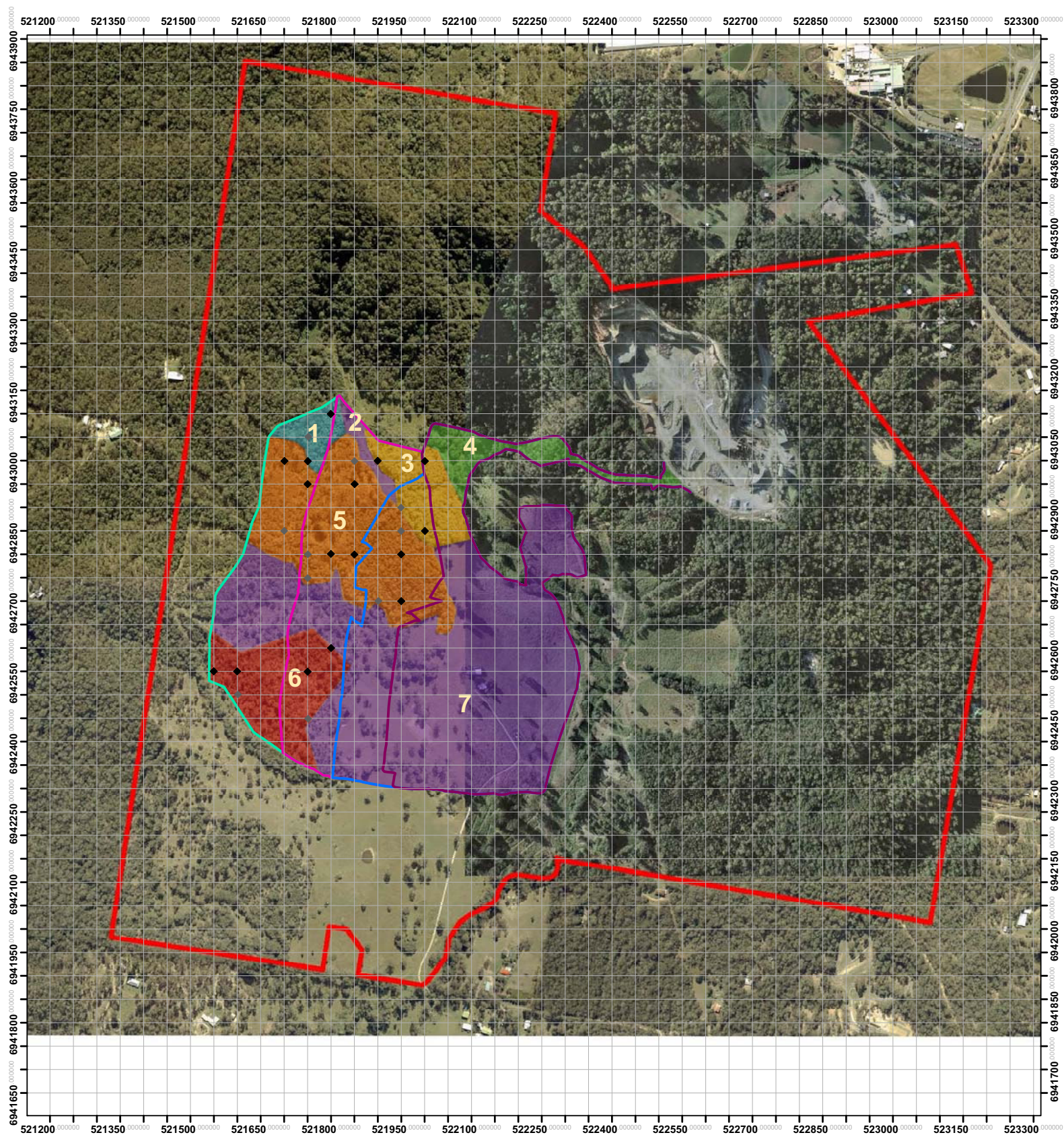


**Picture 5: Polygon 3
(Northern tips of Stages 2 and 3)**



**Picture 6: Polygon 3
(Northern tips of Stages 2 and 3)**





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Image courtesy of Google Earth Pro 2010

Legend

- Subject land boundary
- ◆ Selected quadrat locations
- ◆ "Reserve" quadrat locations

Proposed quarry extension:

- Stage 1
- Stage 2
- Stage 3
- Stage 4

Survey type and effort:

- Census
- 5 quadrats
- 4 quadrats
- 2 quadrats
- 3 quadrats
- Census (tentative)

N
 W — E
 S

0 100 200 Meters

Figure 1
 Proposed Tree Survey Requirements



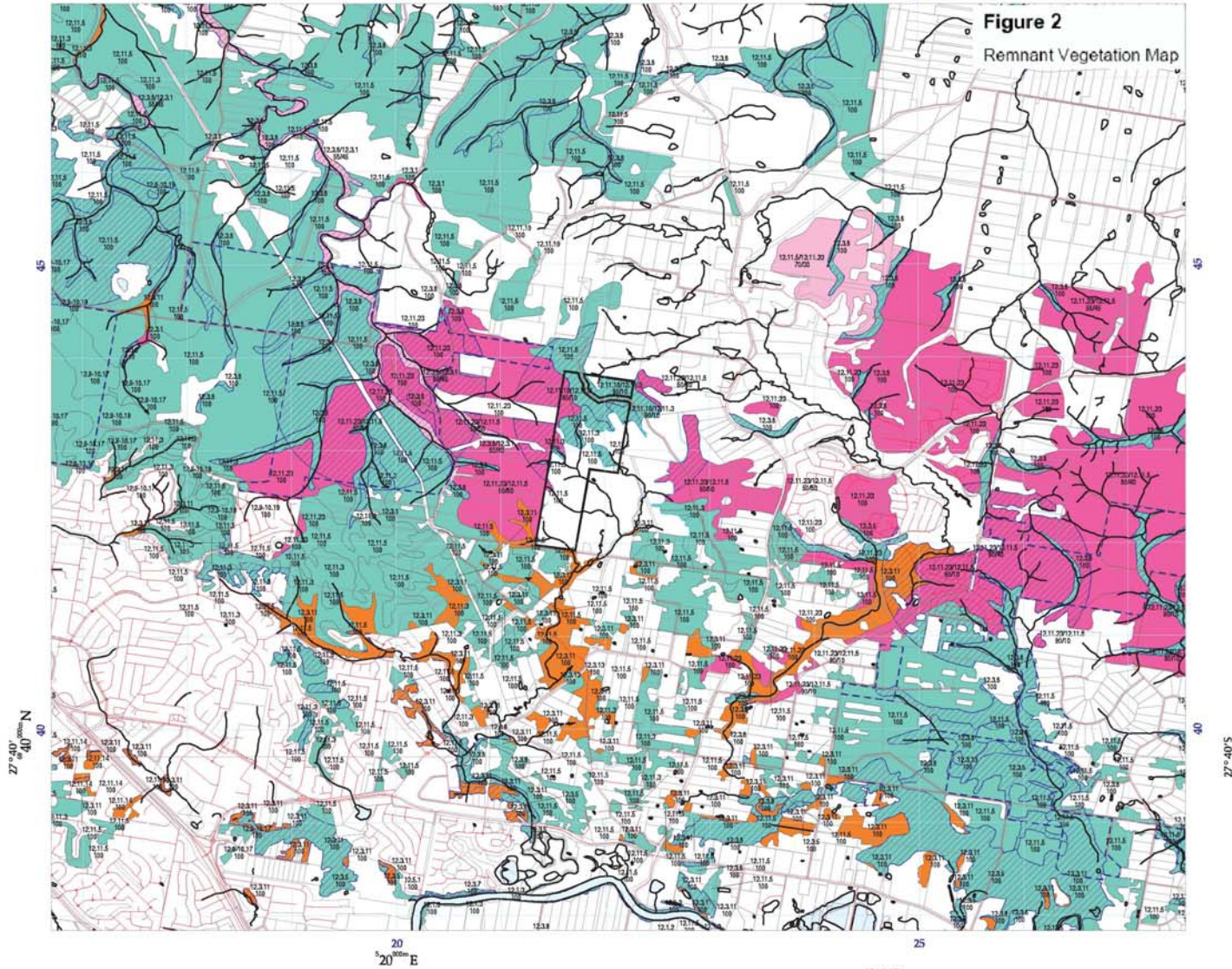
Mount Cotton Quarry

153° 15' E

20

25

Figure 2
Remnant Vegetation Map



Vegetation Management Act Regional Ecosystem and Remnant Map-Version 6

Remnant vegetation containing endangered regional ecosystems

Based on 2006 Landsat TM imagery

A remnant map covers areas not covered by a regional ecosystem map.

- Dominant
- Sub-dominant

Requested By: OLIVIA@BIODIVERSITY.TV
Date: 09 Apr 10 Time: 12.20.05

Defined map areas are labelled with the regional ecosystem (RE) code along with the percentage breakdown if more than one RE occurs within the area. Detailed definitions of regional ecosystems are available from www.derm.qld.gov.au/REDD. Defined map areas smaller than 5ha may not be labelled.

- Remnant vegetation containing of concern regional ecosystems
- Dominant
- Sub-dominant
- Remnant vegetation that is a least concern regional ecosystem
- Remnant vegetation under Section 20AH of the VMA
- Non-remnant
- Plantation Forest
- Dam or Reservoir
- Remnant Vegetation
- PMAV Category X area
- Great Barrier Reef Wetlands
- Vegetation Management Act Essential Habitat

Centered on point position:
Latitude: -27.6385 Longitude: 153.2243 (decimal degrees)
Bioregion: Southeast Queensland

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/-100 metres. The extent of remnant regional ecosystems as of 2006, depicted on this map is based on rectified 2006 Landsat TM imagery (supplied by the Statewide Landcover and Trees Study (SLATS), Department of Environment and Resource Management (DERM)).

- Non-remnant
- Plantation Forest
- Dam or Reservoir
- Remnant Vegetation
- PMAV Category X area
- Great Barrier Reef Wetlands
- Vegetation Management Act Essential Habitat



Queensland Government

LOCALITY DIAGRAM



- For further information on VMA Essential Habitat, please see the attached VMA Essential Habitat map.
- Subject Lot
- Watercourse (Stream order shown as black number against stream where available)
- Bioregion boundary
- Roads © MapInfo Australia Pty Ltd 2009
- National Park, Conservation Area State Forest and other reserves
- Cadastral line
- The maximum spatial error of parcels extracted for this map from the Digital Cadastral Data Base(DCDB) range from: 14m to 251m at a 95% confidence level. Property boundaries shown are provided as a locational aid only.
- Towns
- Coordinate entered

Some watercourse lines are derived from GeoScience Australia 1:250 000 mapping.

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All datasets are updated as they become available to provide the most current information as of the date shown on this map.

Additional information is required for the purposes of land clearing or assessment of a regional ecosystem map or PMAV applications. For further information go to the web site: www.derm.qld.gov.au/vegetation or contact the Department of Environment and Resource Management.

Digital regional ecosystem data is available in shapefile format, for Lot on Plans from www.derm.qld.gov.au/REDATA or from DERM for larger areas.

1000 0 1000 m




Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

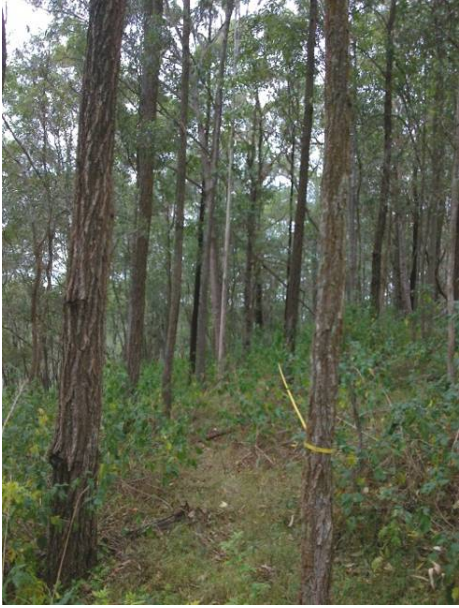
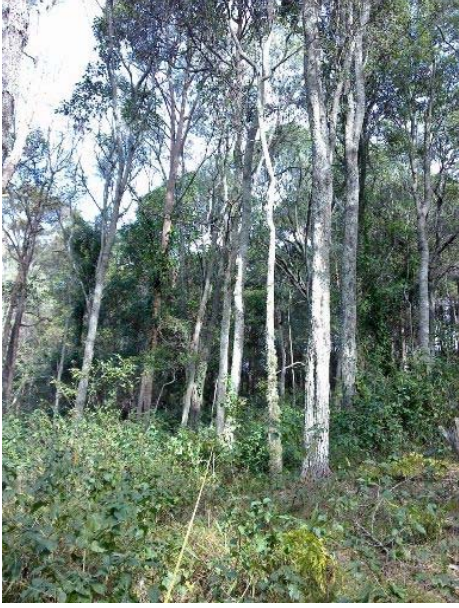

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APPENDIX 2
FIELD OBSERVATIONS


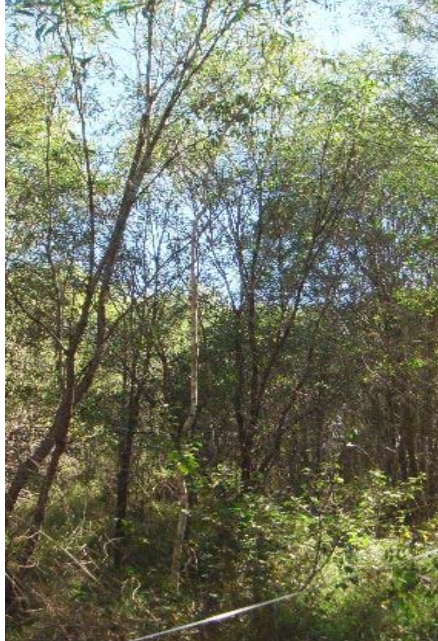
Polygon	Location or Quadrat number	General observations	Picture
1	Quadrat 2	Dominated by non-juvenile <i>Lophostemon confertus</i> regrowth; some <i>Melaleuca saligna</i> and very few, scattered <i>Eucalyptus propinqua</i> . Presence of Lantana.	
	Quadrat 6	Dominated by non-juvenile <i>Lophostemon confertus</i> regrowth; a few scattered <i>Eucalyptus propinqua</i> and a few large <i>E. siderophloia</i> . Presence of Lantana.	
2	Entire polygon	Thin strip of land almost entirely cleared; very few, mature <i>Corymbias</i> along the track.	



Polygon	Location or Quadrat number	General observations	Picture
3	Quadrat 5	<p>Dominated by young <i>E. siderophloia</i> and some mature, large <i>E. siderophloia</i>. Also some <i>L. confertus</i> but to a lesser extent.</p> <p>Presence of Lantana, dense at times.</p>	
	Quadrat 7	<p>Dominated by tall, mature <i>Acacia</i> spp. Some mature and regrowth <i>L. confertus</i> and <i>L. suaveolens</i>; also presence of some <i>E. siderophloia</i> and <i>Angophora woodsiana</i> to a lesser extent.</p> <p>Presence of relatively dense Lantana.</p>	
	Quadrat 8	<p>Dominated by <i>L. confertus</i> (mature and regrowth) and <i>Corymbia intermedia</i>. Presence of some <i>E. propinqua</i>.</p>	





Polygon	Location or Quadrat number	General observations	Picture
4	Entire polygon	<p>Dominated by rainforest vegetation and Lantana. Few Koala trees across the polygon: very few, scattered large <i>E. tereticornis</i> along the slope and some <i>L. suaveolens</i> (mature and regrowth) towards the western portion of the polygon.</p> <p>Extremely dense Lantana throughout the polygon.</p>	
5	Quadrat 1	<p>Largely dominated by Acacia regrowth. Only very few other tree species including a few <i>L. confertus</i> and <i>E. propinqua</i>.</p>	

Polygon	Location or Quadrat number	General observations	Picture
5	Quadrat 3	Dominated by <i>Acacia</i> spp (quadrat bordering pure <i>Acacia</i> spp regrowth). Other tree species include mostly <i>L. confertus</i> regrowth and a few mature <i>M. saligna</i> .	
	Quadrat 4	Dominated by <i>Acacia</i> spp. Other tree species include only very few, scattered <i>E. siderophloia</i> and <i>E. propinqua</i> .	
	Quadrat 9	Dominated by <i>L. confertus</i> (regrowth and mature), mature <i>E. propinqua</i> subdominant. Some <i>E. siderophloia</i> and a few <i>E. acmenoides</i> . Presence of <i>Lantana</i>	

Polygon	Location or Quadrat number	General observations	Picture
5	Quadrat 10 and Quadrat 11	Largely dominated by Acacia spp regrowth with <i>Allocasuarina</i> regrowth as subdominant vegetation. Other tree species include very few, scattered <i>L. confertus</i> , <i>E. propinqua</i> and <i>E. siderophloia</i> . Presence of Lantana at times.	
	Quadrat 12	Dominated by mature <i>Allocasuarina</i> and Acacia spp regrowth. Other tree species include mainly <i>L. confertus</i> and <i>E. propinqua</i> .	

Polygon	Location or Quadrat number	General observations	Picture
6	Quadrat 13	Largely dominated by Acacia spp regrowth. The very few other tree species include a few mature <i>E. tereticornis</i> .	
	Quadrat 14	Largely dominated by Acacia spp regrowth. The very few other tree species include <i>E. tereticornis</i> regrowth and <i>E. acmenoides</i> . Presence of Lantana.	

Polygon	Location or Quadrat number	General observations	Picture
6	Quadrat 15	<p>Dominated by <i>Acacia</i> spp regrowth and <i>E. citriodora</i> regrowth.</p> <p>Presence of <i>Lantana</i> limited.</p>	
	Quadrat 16	<p>Dominated by <i>E. citriodora</i> regrowth and <i>Acacia</i> spp regrowth. A few mature <i>E. citriodora</i>.</p>	

Polygon	Location or Quadrat number	General observations	Picture
7	Open grasslands	Picture typical of the open areas of polygon 7: dominated by grassland with some scattered, large <i>E. tereticornis</i> .	
	North-eastern portion of polygon 7	Picture typical of the northern portion of polygon 7: open grassland with no Koala trees.	
	Western portion of polygon 7	<p>The more vegetated areas of polygon 7 are typically dominated by <i>L. confertus</i> regrowth, with some <i>M. quinquenervia</i> in the creek line.</p> <p>Lantana typically dense along the creek banks.</p> <p>The far north-western portion of polygon 7 includes an area dominated by <i>Acacia</i> spp regrowth.</p>	 

SECTION 2
KOALA TREE OFFSET STRATEGY
(BAAM 2010)



KOALA TREE OFFSET STRATEGY

Mount Cotton Quarry

Report prepared
for
Barro Group Pty Ltd



**Biodiversity
Assessment**

AND MANAGEMENT PTY LTD

FAUNA AND HABITAT SPECIALISTS

Document Control Sheet

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Client: Barro Group Pty Ltd

Project Title: Koala Tree Offset Strategy, Mount Cotton Quarry

Project Authors: Adrian Caneris, Olivia Woosnam

Project Summary: This report presents the proposed strategy for offsetting non-juvenile Koala habitat trees to be cleared as a result of the proposed quarry extension, in accordance with the *Offsets for Net Gain of Koala Habitat in South East Queensland Policy 2010*.

Revision/Checking History Track

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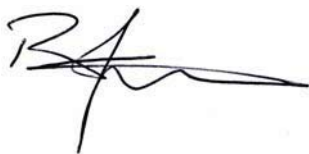
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Signed on behalf of
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Date: 02 December 2010



Managing Director

KOALA TREE OFFSET STRATEGY MOUNT COTTON QUARRY

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List of Abbreviations

BAAM	Biodiversity Assessment and Management Pty Ltd
BPA	Biodiversity Planning Assessment
DERM	Department of Environment and Resource Management
KSPRP	<i>South East Queensland Koala Conservation State Planning Regulatory Provisions 2010</i>
Koala Offset Policy	<i>Offsets for Net Gain of Koala Habitat in South East Queensland Policy 2010</i>
RE	Regional Ecosystems

1.0 INTRODUCTION

This report has been prepared to provide Barro Group Pty Ltd with a strategy for the offset of non-juvenile Koala habitat trees⁽¹⁾ cleared as a result of the proposed Mount Cotton quarry extension, in accordance with the *Offsets for Net Gain of Koala Habitat in South East Queensland Policy 2010* (Koala Offset Policy).

The subject site is located in a Priority Koala Assessable Development Area as identified in Schedule 1, Part 1 of the *South East Queensland Koala Conservation State Planning Regulatory Provisions 2010* (KSPRP). Under the KSPRP, the applicable division for this proposed quarry extension is 'Division 5 – Development for extractive industry within the Assessable Development Area'.

Figure 1.1 shows the proposed quarry extension and the Koala Habitat Values as identified in Schedule 1, Part 2 of the KSPRP.

2.0 GENERAL APPROACH

Quarry design and the staging schedule have been developed to avoid clearing of non-juvenile Koala habitat trees and where unavoidable, such clearing has been minimised.

Although tree clearing will occur progressively, the entire offset obligation will be delivered within 12 months from the time of approval in accordance with the Koala Offset Policy, or as required by development approval conditions. As a result, no net loss of Koala habitat is expected within the subject site and in time, a net gain in Koala habitat should be achieved both in terms of increased food resources and enhanced habitat connectivity.

The offset obligation is based on the results of the Koala tree survey (BAAM 2010a) which identified the number of non-juvenile Koala habitat trees present at the time of survey within the proposed extension.

3.0 KOALA HABITAT VALUES

3.1. PROPOSED MAP OF KOALA HABITAT VALUES

After discussion with Redland City Council (in

¹ Any tree of the *Corymbia*, *Melaleuca*, *Lophostemon* or *Eucalyptus* genera, or of a preferred species such as *Angophora*, with a height of more than 4 metres or a trunk circumference of more than 31.5cm at 1.3m above the ground, as specified in Schedule 4 of the KSPRP.

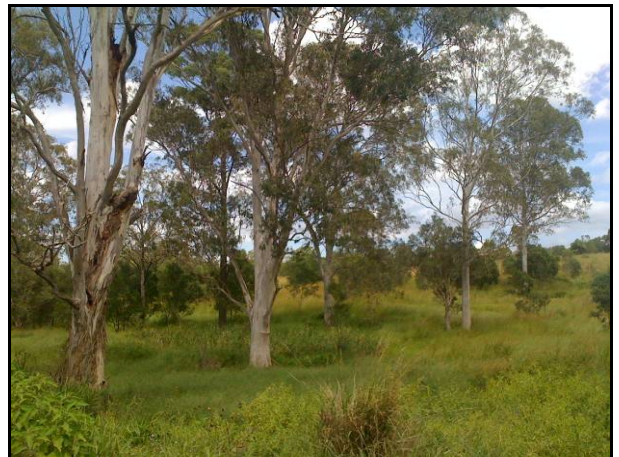
July 2010) and after groundtruthing as part of the Koala tree survey (BAAM 2010a), a revised map of Koala habitat values (see **Figure 3.1**) has been prepared to provide a more accurate map of the existing Koala habitat values within the subject site. This mapping has been produced based on observations in the field, on analysis of aerial photography and on the Department of Environment and Resource Management (DERM) Regional Ecosystem (RE) mapping.

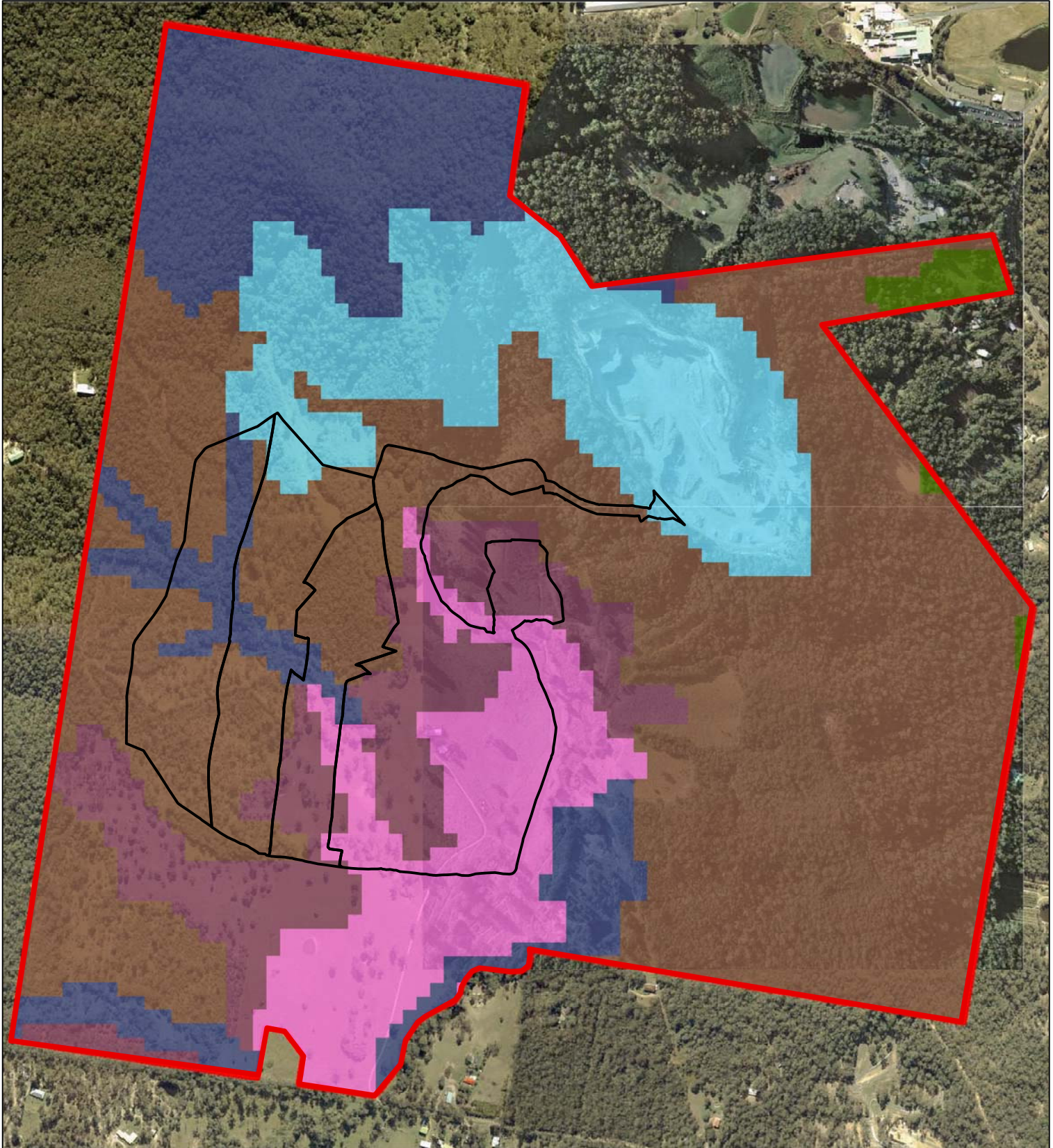
It should be noted that none of the proposed 'medium value rehabilitation' areas shown in **Figure 3.1** are located within mapped Regional Ecosystems.

As part of this application, the applicant Barro Group Pty Ltd requests Redland City Council, as assessment manager, to make a determination that the land the subject of the development application is of a different Koala habitat type (namely as shown on **Figure 3.1**) that the Koala habitat type shown for the land on the Map of Assessable Development Area Koala Habitat Values (**Figure 1.1**).

Photograph 1 shows Koala habitat currently identified as 'low value rehabilitation', which is proposed to be changed to 'medium value rehabilitation'. Indeed, these areas typically consist of scattered, mature Queensland Blue Gum *Eucalyptus tereticornis* (preferred Koala food tree) on alluvial soils. Koalas are known to be present in this area and rehabilitation would provide a significant increase in extant Koala habitat values in the local landscape.

Photograph 1: Scattered, mature *E. tereticornis* providing good opportunities for Koala habitat rehabilitation





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 Image courtesy of Google Earth Pro 2010

Legend

- Site Boundary
- Proposed Quarry Extension
- Koala Habitat Values:**
- Bushland - High Value
- Bushland - Medium Value
- Rehabilitation - High Value
- Rehabilitation - Medium Value
- Rehabilitation - Low Value
- Non Habitat or Generally Not Suitable

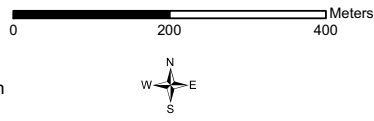
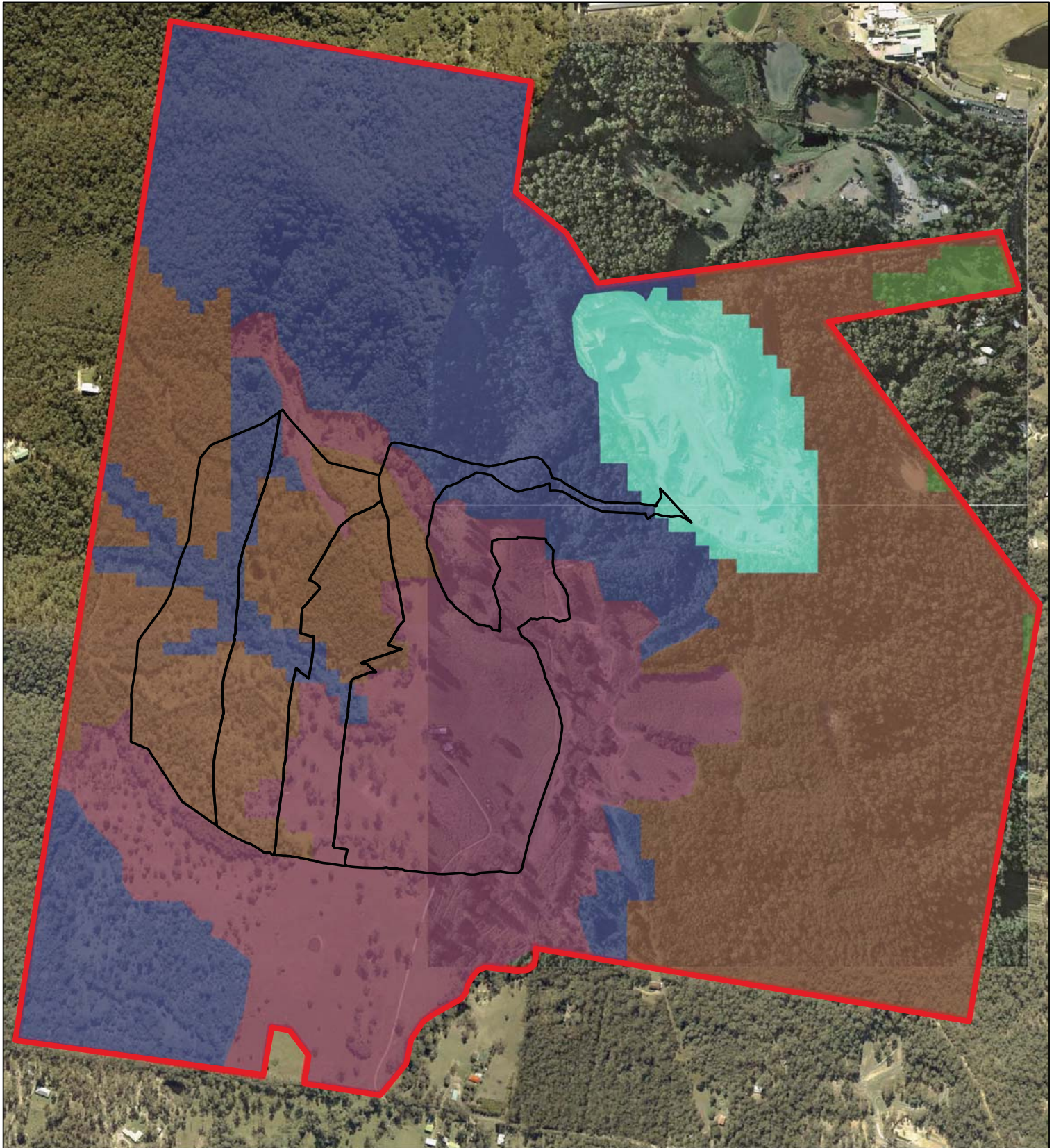


Figure 1.1
KSPRP Map of Koala Habitat Values and Proposed Quarry Extension

Koala Tree Offset Strategy
 Mount Cotton Quarry
 October 2010





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Legend

- Site Boundary
- Proposed Quarry Extension

0 200 400 Meters



Koala Habitat Values:

- Bushland - High Value
- Bushland - Medium Value
- Rehabilitation - High Value
- Rehabilitation - Medium Value
- Non Habitat or Generally Not Suitable

Figure 3.1
Proposed Map of Koala Habitat Values

Koala Tree Offset Strategy
 Mount Cotton Quarry
 October 2010



4.0 OFFSET OBLIGATION

4.1. KOALA HABITAT VALUES TO BE OFFSET

Under Table 5 of the KSPRP (Division 5), unavoidable clearing of non-juvenile Koala habitat trees in areas of bushland habitat and high and medium value rehabilitation habitat is to be minimised and offset in accordance with the Koala Offset Policy.

The ground-truthed map of Koala habitat values (**Figure 3.1**) identifies almost all areas within the proposed quarry extension area as bushland habitat (medium and high values) or medium value rehabilitation.

As a result, the applicant proposes to offset all non-juvenile Koala habitat trees to be cleared progressively from within the proposed extension area.

4.2. TOTAL OFFSET OBLIGATION

The Koala tree survey (BAAM 2010a) identified a total of 14,801 non-juvenile Koala habitat trees to be cleared progressively within the proposed quarry extension area. Of these, 10,784 trees will be offset to a ratio of 5:1 (five new Koala trees for every one non-juvenile cleared), in accordance with the Koala Offset Policy.

The remaining 4,017 non-juvenile Koala trees proposed to be cleared are located in remnant vegetation which will be offset on-site in accordance with the *Policy for Vegetation Management Offsets 2010* (see BAAM 2010b). Since the remaining 4,017 trees will already be the subject of an offset under another Queensland Government policy, it is proposed to offset those trees at a ratio of 3:1⁽²⁾.

The proposed offset package is therefore 65,971 new Koala trees:
 $(10,784 \times 5) + [(1,329+2,688) \times 3] = 65,971$.

5.0 OFFSET DELIVERY

5.1. DELIVERY OPTION: DIRECT DELIVERY

The Quarry Manager commits to ensuring the offset obligation is delivered on the subject site prior to impacts being realised and within the appropriate timeframe, in accordance with section 6.4 of the Koala Offset Policy or as required by Redland City Council approval conditions.

5.2. KOALA OFFSET SITES

It is proposed to locate all offset sites within the subject site, as identified on **Figure 5.1** and **Figure 5.2**.

It is expected that the offset obligation can be achieved within the areas identified as 'Koala offset sites'.

If for any reason it is deemed that these offset sites cannot accommodate the entire offset obligation under this policy, then any shortfall will be met by Barro Group by way of direct delivery on other land, through an offset broker or by way of payment of a financial contribution for offset delivery in accordance with the Offset Policy.

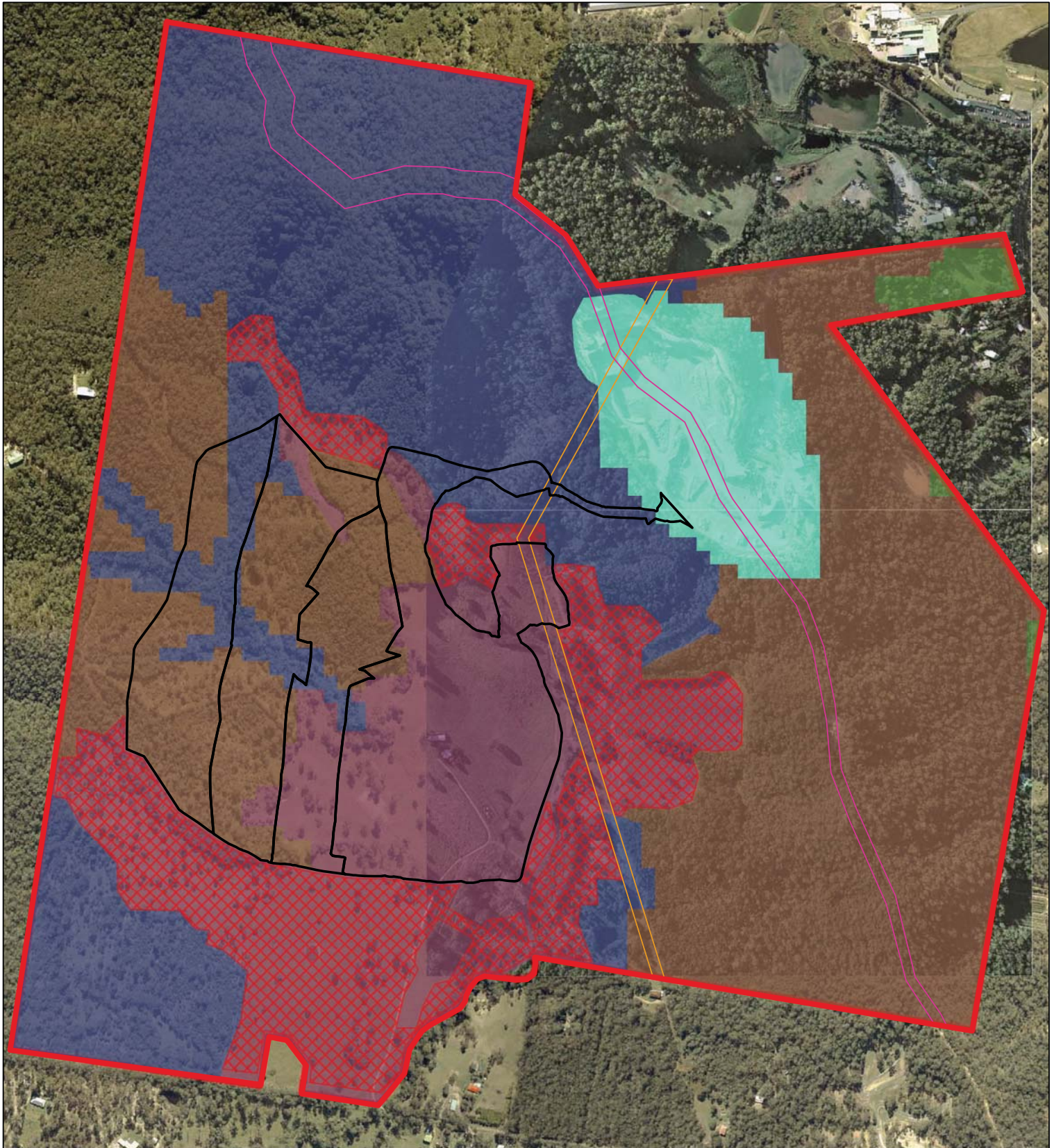
5.2.1. Location of Koala offset sites

Approximately 35 ha of land have been identified on the subject site as suitable Koala offset sites.

These areas are currently largely cleared and situated in areas mapped as 'medium value rehabilitation' on the ground-truthed map of Koala habitat values (see **Figure 5.1**).

The Koala offset sites are not situated within remnant vegetation that are Regional Ecosystems (see **Figure 5.2**).

² Section 4.3 of the *South East Queensland Koala Conservation State Planning Regulatory Provisions 2010*: "If an offset is required by another Queensland Government specific-issue offset policy for impacts to values other than koala habitat, as well as under this policy, then an offset package may be used to meet the requirements of both this policy and the other specific-issue offset policy – as long as it meets the requirements of both policies."




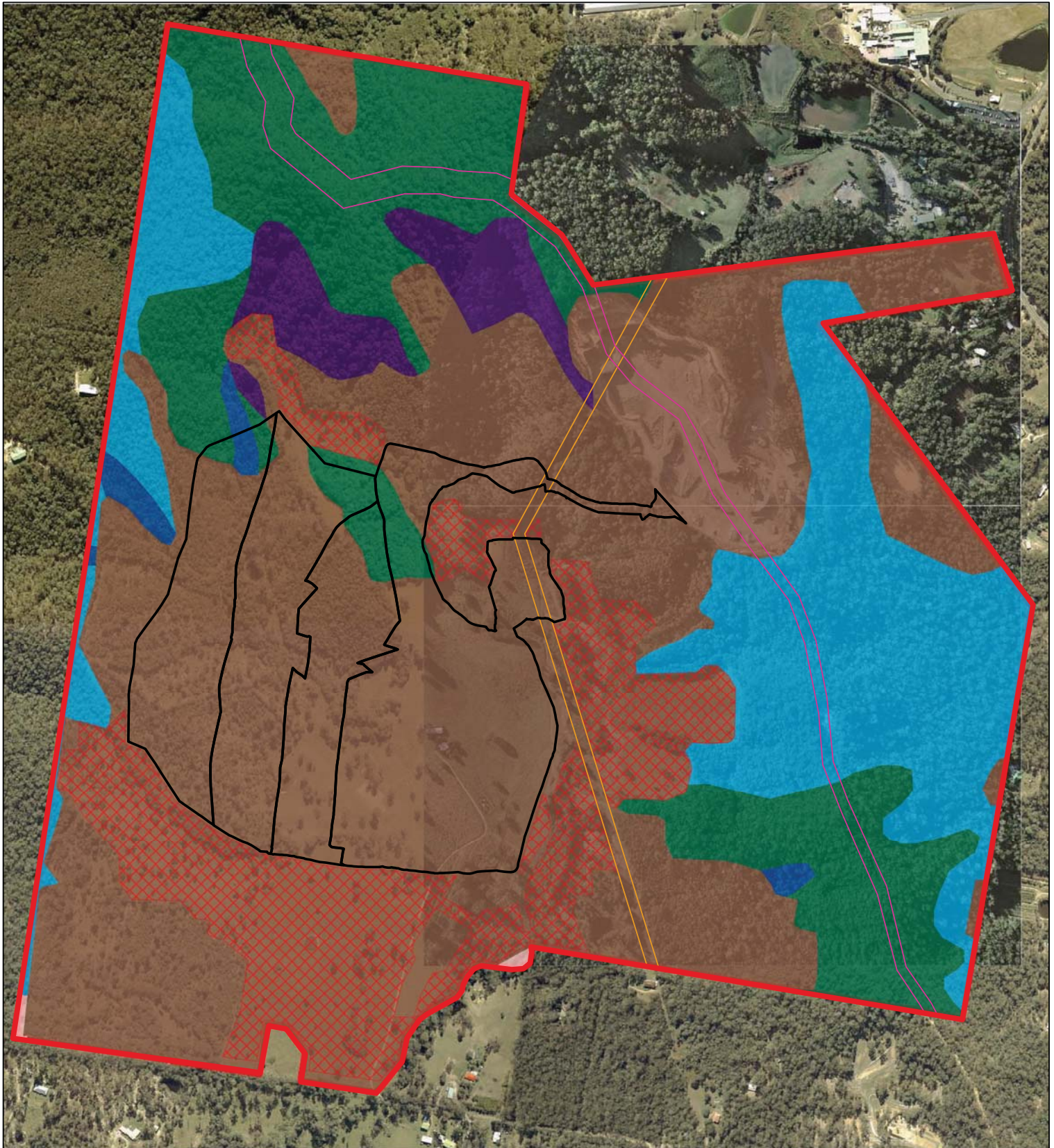
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- Legend**
- Site Boundary
 - Proposed Quarry Extension
 - Power Easement
 - Road Reserve
 - Koala Offset Sites

- 0 200 400 Meters
- Koala Habitat Values:**
- Bushland - High Value
 - Bushland - Medium Value
 - Rehabilitation - High Value
 - Rehabilitation - Medium Value
 - Non Habitat or Generally Not Suitable

Figure 5.1
Koala Offset Sites and Proposed Map of Koala Habitat Values
 Koala Tree Offset Strategy
 Mount Cotton Quarry
 October 2010





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 Image courtesy of Google Earth Pro 2010

Legend

- Site Boundary
- Proposed Quarry Extension
- Power Easement
- Road Reserve
- Koala Offset Sites

0 200 400 Meters

Regional Ecosystems:

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> 12.11.10/12.11.3 12.11.23/12.11.5 12.11.3 | <ul style="list-style-type: none"> 12.11.5 12.3.11 Non remnant |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 5.2
Koala Offset Sites and DERM Regional Ecosystems

Koala Tree Offset Strategy
 Mount Cotton Quarry
 October 2010



5.2.2. Improved connectivity

There is currently a distinct lack of east-west connectivity in the local landscape, as shown on the DERM Biodiversity Planning Assessment (BPA) mapping (see **Figure 5.3**).

Planting Koala trees in the areas identified as Koala offset sites will benefit Koala populations (as well as other fauna) through the reinstatement of suitable habitat within the subject site, and enhancement of safe movement opportunities in the local landscape.

Combined with the vegetation offset sites (see BAAM 2010b), the proposed offset works will provide a functional linkage between Koala habitats surrounding the subject site, particularly for east-west movement.

5.2.3. Planting density

Trees will be planted at an average of 2 metre centres, with some areas at higher and others at lower density depending on tree species, soil type, exposure, slope etc. Further detail on species mix and planting density is provided in the Koala Offset Site Management Plan (BAAM 2010c).

With an average of 2 metre centre plantings, the total carrying capacity of Koala offset sites is 87,500 trees. Given that these areas currently support only sparse trees, they are expected to accommodate the proposed offset package of 65,971 Koala trees to meet the offset obligation under the Koala Offset Policy.

Further detail regarding the management and maintenance of Koala offset sites is provided in the Koala Offset Site Management Plan (BAAM 2010c).

6.0 PROTECTION OF KOALA OFFSET SITES

All Koala offset sites will be protected from future development impacts by securing the sites for conservation purposes.

This will be achieved through a conservation agreement under the *Nature Conservation Act 1992*.





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Image courtesy of Google Earth Pro 2010

Legend

-  Site Boundary
-  Regional Corridor

Offset Sites:

-  Koala Offset Sites
-  Vegetation Offset Sites

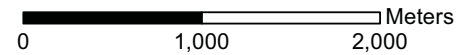


Figure 5.3
Offset Areas and
Regional Corridors
(BPA Mapping v.1.3)



Koala Tree Offset Strategy
 Mount Cotton Quarry
 October 2010

7.0 REFERENCES

BAAM (2010a). Koala Tree Survey Report, Mt Cotton Quarry extension. Report prepared for Barro Group Pty Ltd. September 2010.

BAAM (2010b). Vegetation Code Assessment and Offset Rehabilitation Management Plan. Report prepared for Barro Group Pty Ltd. September 2010.

BAAM (2010c). Koala Offset Site Management Plan, Mt Cotton Quarry extension. Report prepared for Barro Group Pty Ltd. September 2010.

Department of Environment and Resource Management (2010). *Offsets for Net Gain of Koala Habitat in South East Queensland Policy.* Queensland Government. May 2010.

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SECTION 3
KOALA OFFSET SITE MANAGEMENT PLAN
(BAAM 2010)



KOALA OFFSET SITE MANAGEMENT PLAN

Mount Cotton Quarry

Report prepared
for
Barro Group Pty Ltd



**Biodiversity
Assessment**

AND MANAGEMENT PTY LTD

FAUNA AND HABITAT SPECIALISTS

Document Control Sheet

File Number: 0241-0013

Project Manager: Adrian Caneris

Client: Barro Group Pty Ltd

Project Title: Koala Offset Site Management Plan, Mount Cotton Quarry

Project Author/s: Adrian Caneris, Olivia Woosnam

Project Summary: To provide management strategies to achieve the desired outcomes for the Koala offset sites for the proposed Mount Cotton Quarry extension.

Revision/ Checking History Track

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Acknowledgement

Barro Group Pty Ltd acknowledges the Koala Offset Site Management Plan:

- (a) is signed in its capacity as both Applicant to the development application that approves this Koala Offset Site Management Plan and as owner of the offset sites;
- (b) is to be approved by the Assessment Manager, Minister or State Agency; and
- (c) may be made available to the public and the department administering the *Offsets for Net Gain of Koala Habitat in South East Queensland Policy* (the Queensland Department of Environment and Resource Management), if and when requested.

Signed by:

Name and Position

Signature

Date

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Purpose of Report

Biodiversity Assessment and Management Pty Ltd has produced this report in its capacity as consultants for and on the request of Barro Group Pty Ltd (the "**Client**") for the sole purpose of providing a Koala Offset Site Management Plan for the proposed Mount Cotton Quarry extension (the "**Specified Purpose**"). This information and any recommendations in this report are particular to the Specified Purpose and are based on facts, matters and circumstances particular to the subject matter of the report and the Specified Purpose at the time of production. This report is not to be used, nor is it suitable, for any purpose other than the Specified Purpose. Biodiversity Assessment and Management Pty Ltd disclaims all liability for any loss and/or damage whatsoever arising either directly or indirectly as a result of any application, use or reliance upon the report for any purpose other than the Specified Purpose.

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Signed on behalf of
Biodiversity Assessment and Management Pty Ltd

Date: 18 November 2010



Managing Director

KOALA OFFSET SITE MANAGEMENT PLAN MOUNT COTTON QUARRY

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List of Abbreviations

BAAM	Biodiversity Assessment and Management Pty Ltd
DERM	Queensland Department of Environment and Resource Management
KMP	Koala Offset Site Management Plan
Koala Offset Policy	<i>Offsets for Net Gain of Koala Habitat in South East Queensland Policy 2010</i>
LP Act	<i>Queensland Lands Protection (Pest and Stock Route Management) Act 2002</i>
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
SPP	<i>State Planning Policy 2/10: Koala Conservation in South East Queensland</i>

1.0 INTRODUCTION

1.1 Purpose of the Plan

This report has been prepared by Biodiversity Assessment and Management (BAAM) Pty Ltd to provide Barro Group Pty Ltd with a Koala Offset Site Management Plan (the Plan) for the proposed Mount Cotton quarry extension. The plan is prepared in accordance with the *Offsets for Net Gain of Koala Habitat in South East Queensland Policy* (Koala Offset Policy).

This Plan is designed to provide strategies and actions that will ensure the Koala offset sites are adequately managed and the desired outcomes are achieved.

This Management Plan addresses both the short-term and long-term management of the Koala offset sites and includes measures to maximise success during all phases of Koala habitat restoration.

1.2 Background Information

The subject site is located at 1513 Mount Cotton Road, Mount Cotton, Redland City Council government area, and comprises five (5) lots known as: Lot 370 on S311071, Lot 238 on SP218968, Lot 162 on S31962, Lot 17 on RP108970 and Lot 1 on RP108970.

Barro Group Pty Ltd is the owner of the subject site.

The Koala offset sites will be located within the subject site:

Address: Mount Cotton Quarry
1513 Mount Cotton Road
Mount Cotton QLD 4165
Telephone: (07) 3206 6211
Facsimile: (07) 3206 6480

Contact details for the Barro Group Pty Ltd are:

Address: 191 Drummond Street
Carlton, Victoria 3053
Australia
Telephone: (03) 9663 1333
Facsimile: (03) 9663 2555

2.0 OVERVIEW OF KOALA OFFSET SITES

Figure 2.1 shows the proposed quarry extension and the location of the proposed Koala offset sites.

All of the required Koala offset sites will be located within the subject site, although they will be outside of the footprint of the proposed quarry extension and any associated infrastructure (e.g. pondage areas) and outside of any road reserve or power easement that traverse the subject site.

Approximately 35 ha of the subject site have been identified as Koala offset sites where Koala habitat will be restored (**Figure 2.1**). It is expected that these areas will accommodate the entire offset obligation of 65,971 trees (BAAM 2010a), in accordance with the Koala Offset Policy.

Koala offset sites have been planned so as to maximise Koala movement opportunities and Koala habitat values in the local landscape and to contribute to the aims of the *State Planning Policy 2/10: Koala Conservation in South East Queensland* (SPP) ⁽¹⁾.

3.0 KOALA OFFSET SITE MANAGEMENT PLAN

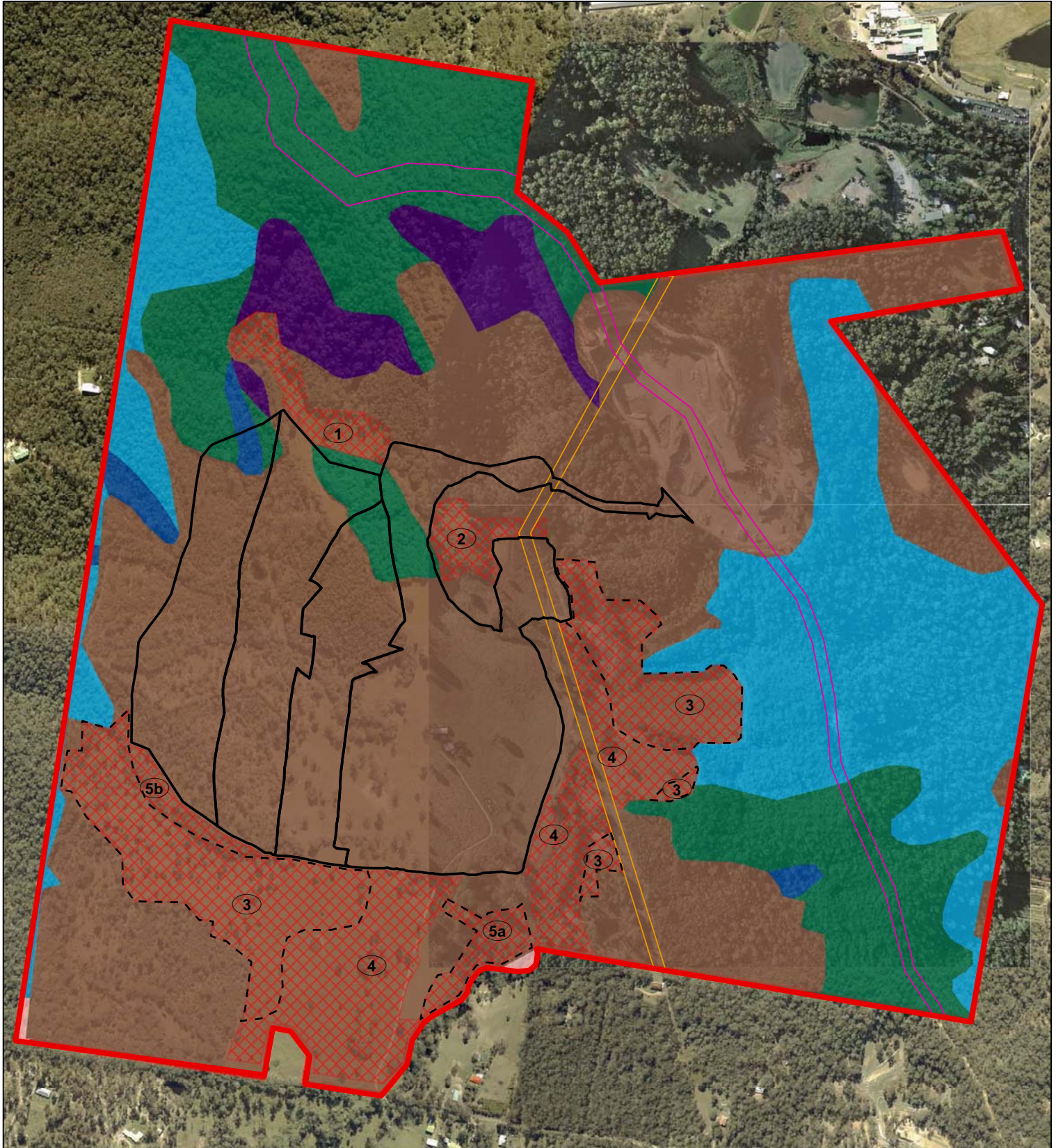
3.1 Aims and Objectives

The primary aim of the Koala Offset Site Management Plan (KMP) is to reinstate mature Koala bushland habitat ⁽²⁾ within the offset sites.

¹ The aims of the SPP are to “ensure that koala habitat conservation is taken into account in planning processes [...], contributing to a net increase in koala habitat in south-east Queensland, and assist in the long term retention of viable koala populations in south-east Queensland”.

² Habitat restored in the Koala offset sites will be considered ‘mature Koala bushland habitat’ once:

- at least 75% of trees planted are either 4 metres high or 31.5cm trunk circumference at 1.3m above ground (as per the definition of a non-juvenile Koala habitat tree under the *South East Queensland Koala Conservation State Planning Regulatory Provisions 2010*); and
- Presence of Koalas is confirmed in the Koala Offset sites.



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Legend

- Site Boundary
- Proposed Quarry Extension
- Power Easement
- Road Reserve
- 1 Koala Offset Sites and Species Mix Category

0 205 410 Meters

Regional Ecosystems:

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12.11.10/12.11.3 | 12.11.5 |
| 12.11.23/12.11.5 | 12.3.11 |
| 12.11.3 | Non remnant |

Figure 2.1

Koala Offset Sites, Species Mix Categories and Regional Ecosystems

Koala Offset Site Management Plan
 Mount Cotton Quarry
 October 2010



The objectives of the KMP are to provide:

- readily understandable guidelines for the restoration of Koala habitat in the offset sites;
- an integrated approach to responsible management and maintenance of restored Koala habitat; and
- a schedule of monitoring and reporting to be undertaken to facilitate adaptive management and meet reporting obligations.

3.2 Desired Outcomes

The key priority of the Koala Offset Site Management Plan is to address the long-term management of Koala offset sites and specifically:

- to protect restored Koala habitat from any future development;
- to ensure that restored Koala habitat is sustainable over the long term;
- to reduce Koala habitat fragmentation within the subject site and to increase opportunities for safe Koala movement in the local landscape; and
- to ensure a maximised survival rate for new Koala habitat trees planted in the Koala offset sites.

3.3 Performance Objectives

This Management Plan addresses all phases of the Koala offset sites, until they reach mature Koala bushland habitat status.

The primary aim (Section 3.1) of the plan will be achieved through the following performance objectives:

- To inform all relevant personnel of the Koala Offset Site Management Plan;
- To protect and secure the Koala offset sites;
- To collect baseline data for the Koala offset sites;
- To plant a sufficient number of new Koala trees in the Koala offset sites to meet the offset obligation in accordance with the Koala Offset Policy;
- To manage and maintain the Koala offset sites; and

- To implement monitoring and reporting protocols to inform on the progress of restored Koala habitat and evaluate the success of Koala habitat restoration works.

The performance objectives and specific management actions/responsibilities, performance indicators, corrective actions/responsibilities and timing/frequency for monitoring and reporting are provided in **Appendix 1**.

4.0 MANAGEMENT STRATEGIES

The Koala offset sites identified on **Figure 2.1** consist of areas that are currently largely cleared or that support low tree density. There are a few scattered, mature *Eucalyptus tereticornis* (Queensland Blue Gum) in some locations and although Koalas are known to utilise these trees, there is currently poor habitat connectivity (BAAM 2010a).

Rehabilitation of Koala bushland habitat will benefit Koala populations by restoring suitable habitat within the subject site and providing safe movement opportunities within the local landscape.

The Koala offset sites identified in **Figure 2.1** are expected to accommodate the entire offset obligation in accordance with the Koala Offset Policy.

4.1 Planting schedule

Six (6) categories of suitable species mix have been identified (**Table 3.1**) to reflect the range of species cleared, soil types, pre-clearing Regional Ecosystems (**Figure 4.1**), the range of species present within each area, and to maximise survival rate and overall Koala habitat values.

4.2 Management of exotic vegetation

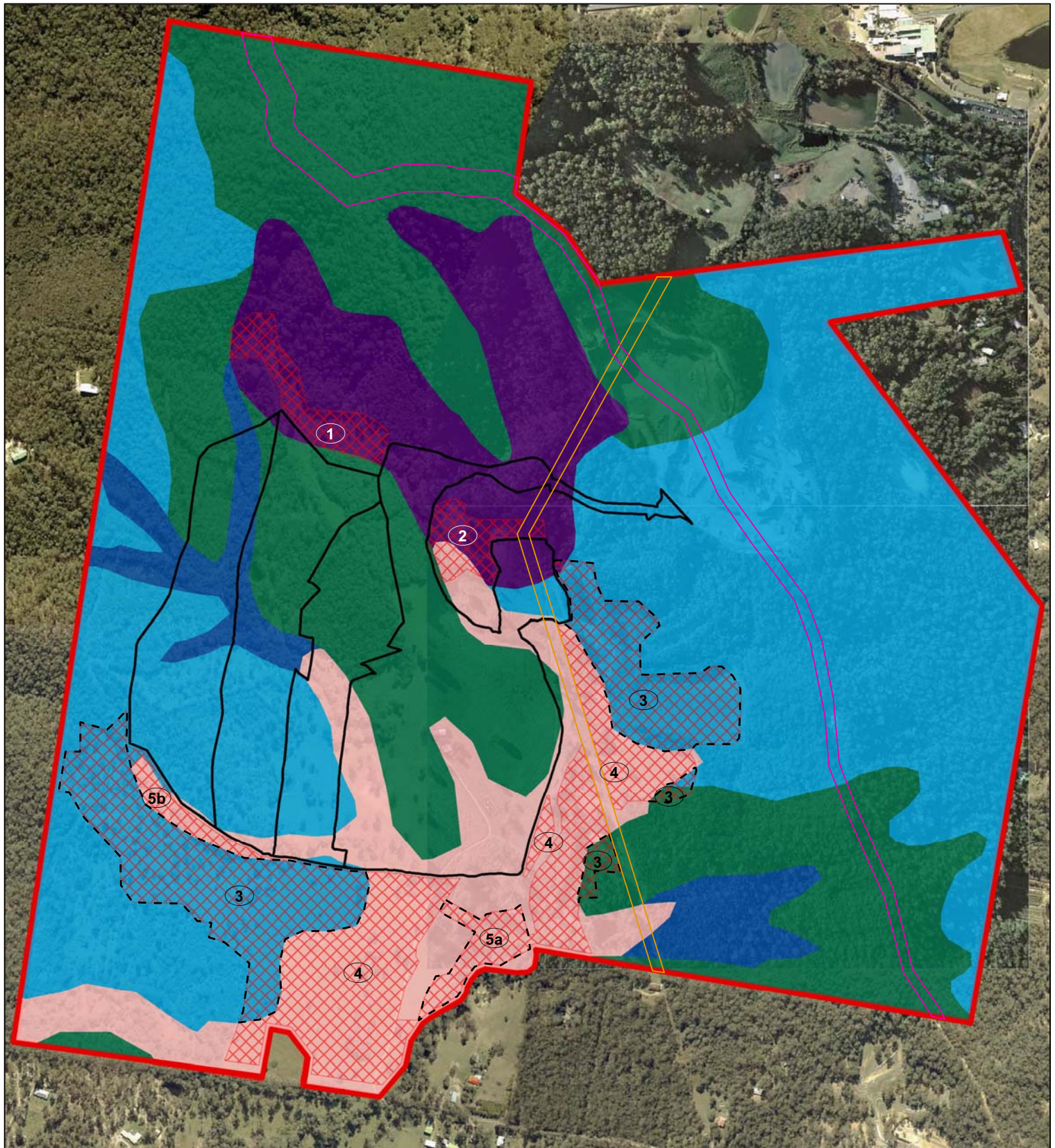
During Koala tree survey (BAAM 2010d) Lantana was observed throughout the subject site, in some areas at very high densities.

Where necessary, weed control will be carried within the Koala offset sites before any restoration works commence and will continue until plants reach mature status.

Weed control will be conducted across the site for the duration of the quarry development in accordance with the Queensland *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act).

Table 3.1: Planting schedule

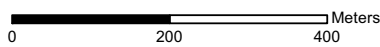
Category (refer to Figure 2.1) and species mix	Proportion (% of each category)	Maximum planting density	Notes
CATEGORY 1			
<i>Lophostemon confertus</i>	20-30 2m	centre	
<i>E. propinqua</i>	10-20 2m	centre	
<i>E. siderophloia</i>	10-20 2m	centre	
<i>L. suaveolens</i>	10-20 2m	centre	
<i>Eucalyptus microcorys</i>	10-20 2m	centre	
<i>Angophora woodsiana</i>	5-10 2m	centre	
<i>Melaleuca saligna</i>	5-10	1m centre	In or near gully lines only
CATEGORY 2			
<i>L. confertus</i>	20-30 2m	centre	
<i>L. suaveolens</i>	20-30 2m	centre	
<i>E. tereticornis</i>	10-20 3m	centre	
<i>Corymbia intermedia</i>	10-20 3m	centre	
<i>E. propinqua</i>	5-10 2m	centre	
<i>E. siderophloia</i>	5-10 2m	centre	
<i>A. woodsiana</i>	5-10 2m	centre	
CATEGORY 3			
<i>E. tereticornis</i>	10-20 2m	centre	
<i>C. intermedia</i>	10-20	3m centre	In dryer areas on hillside
<i>E. propinqua</i>	10-20 2m	centre	
<i>E. tindaliae</i>	10-20	2m centre	In dryer areas on hillside
<i>C. henryi</i>	10-20 2m	centre	
<i>E. racemosa</i>	5-10 3m	centre	
<i>C. trachyphloia</i>	5-10 2m	centre	
<i>E. microcorys</i>	5-10 3m	centre	
<i>C. citriodora</i>	5-10 2m	centre	
<i>E. carnea</i>	5-10	2m centre	In dryer areas on hillside
<i>E. siderophloia</i>	5-10 2m	centre	
<i>A. woodsiana</i>	5-10 2m	centre	
<i>E. crebra</i>	5-10 2m	centre	In dryer areas on hillside
CATEGORY 4			
<i>E. tereticornis</i>	30-40 3m	centre	
<i>C. intermedia</i>	10-20 3m	centre	
<i>E. siderophloia</i>	10-20 2m	centre	
<i>E. seeana</i>	5-10	2m centre	In scattered patches or at low density
<i>C. citriodora</i>	5-10	2m centre	In scattered patches or at low density
<i>E. racemosa</i>	5-10	3m centre	In scattered patches or at low density
<i>E. tindaliae</i>	5-10	2m centre	In scattered patches or at low density
<i>C. trachyphloia</i>	5-10	2m centre	In scattered patches or at low density
<i>C. tessellaris</i>	5-10	2m centre	Low tree layer
<i>M. sieberi</i>	5-10	1m centre	In low-lying areas
CATEGORY 5a			
<i>M. quinquenervia</i>	50-60 1m	centre	
<i>L. suaveolens</i>	30-40 2m	centre	
<i>E. tereticornis</i>	10-20 3m	centre	
CATEGORY 5b			
<i>M. quinquenervia</i>	60-70 1m	centre	
<i>L. suaveolens</i>	30-40 2m	centre	



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 Image courtesy of Google Earth Pro 2010

Legend

- Site Boundary
- Proposed Quarry Extension
- Power Easement
- Road Reserve
- 1 Koala Offset Sites and Species Mix Category



Pre-clearing Regional Ecosystems :

- 12.11.10/12.11.3
- 12.11.5
- 12.11.23/12.11.5
- 12.3.11
- 12.11.3

Figure 4.1

Koala Offset Sites, Species Mix Categories and Pre-clearing Regional Ecosystems

Koala Offset Site Management Plan
 Mount Cotton Quarry
 October 2010



4.3 Securing and protecting Koala offset sites

Koala offset sites will be protected from future development impacts by securing the offset sites for conservation purposes through a conservation agreement under the *Nature Conservation Act 1992* (NC Act).

In order to protect the offset sites from impacts from quarry operations, vehicle and/or machinery access to/through the offset sites will be strictly controlled and no unauthorised access will be permitted.

For offset sites located adjacent to the quarry extension, the offset sites will be clearly delineated where necessary to prevent unauthorised access.

Compulsory site inductions will ensure that all staff are aware of the location of all Koala offset sites, which will be “no-go” areas.

Site visitors/uninducted persons will be accompanied by staff if visiting the Koala offset areas.

4.4 Monitoring and reporting

A monitoring and reporting program will be implemented to evaluate the progress of Koala habitat restoration works in the offset sites and provide feedback for adaptive management.

Baseline data will be collected prior to the commencement of any restoration works for future performance monitoring. Regular surveys will then be undertaken to collect data that will allow for comprehensive evaluation of the success of Koala habitat restoration works and for regular reporting to Redland City Council.

During these monitoring events, any maintenance works required (weed control, replacement plantings, etc) will be reported to the Quarry Manager.

The monitoring events, together with their timing/frequency, performance indicators and the person responsible for undertaking each event are outlined within **Appendix 1**.

5.0 GENERAL ENVIRONMENTAL DUTIES

The following sections provide guidelines for the responsibilities of designated personnel

who are engaged to ensure compliance with this Koala Offset Site Management Plan.

5.1 Barro Group

The roles and general responsibilities of Barro Group are to:

- Comply with the Koala Offset Policy, NC Act, LP Act and *Vegetation Management Act 1999*;
- Nominate a Site Manager who will represent the Principal in reviewing the performance of staff, issue instructions and variations, and be responsible for KMP implementation;
- Promptly notify Redland City Council of any changes to this Management Plan and its implementation, reporting or monitoring, and any breach of any conditions and propose corrective actions; and
- As necessary, engage the services of an experienced and/or appropriately qualified person for the habitat restoration works (thereafter referred to as Landcarer, responsible for planting and/or maintenance and/or monitoring).

It will be the responsibility of Barro Group to ensure that the contents of this Management Plan are adequately communicated to all site personnel, and that they are advised of the consequences if the recommended actions are not observed.

5.2 Quarry Manager

The roles and responsibilities of the Quarry Manager (and/or its representatives) are to:

- Conform to specified (as per approval conditions) Environmental Management Practices;
- Satisfactorily demonstrate to Barro Group and relevant authorities that appropriate measures have been implemented on site to adequately manage the Koala offset sites, as noted in this Management Plan;
- Keep records of complaints / dysfunctions / breaches reported and responses relating to the Koala offset sites, advise Barro Group and the Landcarer, investigate and (where appropriate) implement control measures / corrective actions as soon as possible;

- Be present at inspections and as triggered by any environmental events or incidents;
 - Notify the Landcarer regarding performance and monitoring, non-compliance and actions taken, and seek advice and attendance at on-site inspections when required;
 - Notify the Landcarer within 24 hours regarding environmental incidents with potential to cause environmental harm or nuisance to the Koala offset sites and provide written details to the Landcarer within 7 days of occurrence;
 - Report to Barro Group on the implementation and performance of this Management Plan on completion of all on-site works and following maintenance and monitoring events; and
 - Follow directions of Barro Group with respect to performance of this Management Plan.
- Management Plan/Site Instructions and its implementation;
 - Immediately contact the Quarry Manager regarding any environmental incidents that have the potential to cause environmental harm or nuisance to the Koala offset;
 - Issue a Work Plan for correction action to the Quarry Manager within seven (7) days of inspections and completion of the Inspection Procedures and Checklist(s); and
 - Review and advise Barro Group of any necessary changes to this Management Plan.

All unauthorised access to the offset sites must be reported to the Quarry Manager immediately, or as soon as practical, after the incident has occurred.

It will be the responsibility of the Quarry Manager to investigate why unauthorised access has occurred and to take any necessary corrective action to repair any damage caused by such and prevent further unauthorised access and (e.g. repair broken/damaged protective fencing, replace any planting irreparably damaged, ensure all staff is aware of this Management Plan and of the location of the offset sites, etc).

5.3 Landcarer

The roles and responsibilities of the Landcarer may include:

- Liaise with the Quarry Manager and Barro Group to facilitate compliance with legislation, Council policies and conditions during the project;
- Conduct tree planting, maintenance and / or monitoring events as required / requested by the Quarry Manager and/ or Barro Group, and any other events if required / requested as triggered by environmental events or incidents;
- Advise the Quarry Manager on the compliance and effectiveness of this

6.0 REFERENCES

BAAM (2010a). Koala Tree Offset Strategy – Mount Cotton Quarry Extension. Report prepared for Barro Group. September 2010.

BAAM (2010b). Habitat Management Plan – Mount Cotton Quarry Extension. Report prepared for Barro Group. September 2010.

BAAM (2010d). Vegetation Code Assessment and Offset Rehabilitation Management Plan – Mount Cotton Quarry Extension. Report prepared for Barro Group. September 2010.

BAAM (2010d). Koala Tree Survey Report – Mount Cotton Quarry Extension. Report prepared for Barro Group. September 2010.

APPENDIX 1
KOALA OFFSET SITE MANAGEMENT PLAN

Overall Project Management		Aim: To reinstate mature Koala bushland habitat within the Koala offset sites.		
(PO) Performance Objective	(AR) Actions / Responsibilities	(PI) Performance Indicators	(CR) Corrective Actions / Responsibilities	(TF) Timing / Frequency
<p>PO-1 To inform all relevant personnel of the Koala Offset Site Management Plan</p>	<p>1AR-1 A pre-start meeting is to be arranged by Barro Group to clearly define roles and the approach to the management of Koala offset sites.</p> <p>1AR-2 Compulsory site inductions are to be undertaken to ensure all staff and visitors to the quarry are aware of this Management Plan.</p> <p>1AR-3 Quarry Manager to organise and conduct the pre-start meeting; and</p> <p>1AR-4 Quarry Manager to ensure site inductions are undertaken.</p> <p>1AR-5 The Landcarer may assist in organising and/or conducting the pre-start meeting.</p> <p>1AR-6 This Koala Offset Site Management Plan is to be kept on site at all stages until the objectives and outcomes of the Koala Offset Site Management Plan are achieved.</p>	<p>1.PI-1 A pre-start meeting has been undertaken and all relevant personnel (including contractors) are aware of the Koala Offset Site Management Plan and of the location of all offset sites;</p> <p>1PI-2 All relevant personnel (including contractors) are informed of their obligations with regard to Koala offset sites; and</p> <p>1PI-3 All staff and visitors to the quarry have undergone a site induction informing them of this Management Plan.</p>	<p>1CR-1 The Quarry Manager will investigate reasons why the performance objective has not been met and ensure that all relevant staff (including contractors) not present at the pre-start meeting are debriefed and advised of their responsibilities.</p>	<p>1TF-1 Pre-start meeting: at the time this Management Plan is implemented.</p> <p>1TF-2 Inductions: ongoing.</p>

Overall Project Management		Aim: To reinstate mature Koala bushland habitat within the Koala offset sites.		
(PO) Performance Objective	(AR) Actions / Responsibilities	(PI) Performance Indicators	(CR) Corrective Actions / Responsibilities	(TF) Timing / Frequency
<p>PO-2 To protect and secure the Koala offset sites</p>	<p>2AR-1 All Koala offset sites are to be protected from future development impacts and quarry operations by securing the sites for conservation purposes.</p> <p>2AR-2 Access to Koala Offset Sites is strictly controlled and no unauthorised access is permitted.</p> <p>2AR-3 Site inductions for all staff and visitors to the quarry identify Koala offset sites as “no-go” areas.</p> <p>2AR-4 Barro Group to secure all Koala offset sites through a conservation agreement under the <i>Nature Conservation Act 1992</i>.</p> <p>2AR-5 Quarry Manager to establish protective or temporary fencing around the Koala offset sites where deemed necessary; and</p> <p>2-AR-6 Quarry Manager to ensure site inductions are undertaken.</p> <p>2AR-7 Landcarer may assist delineating Koala offset sites to be fenced for protection where necessary.</p>	<p>2PI-1 All Koala offset sites are secured for conservation purposes;</p> <p>2PI-2 All Koala offset sites are clearly delineated on site where necessary; and</p> <p>2PI-3 There is no unauthorised access to / through the Koala offset sites.</p>	<p>2CR-1 The Quarry Manager will investigate reasons why the performance objective has not been met and ensure that the Koala offset sites are protected, secured, and delineated where necessary.</p> <p>2CR-2 The Quarry Manager will ensure the monitoring of Koala offset sites includes identification of unauthorised access.</p> <p>2CR-3 The Quarry Manager will report to the relevant Authorities why the performance objective has not been met, what corrective actions were taken and how this may or may not impact the Koala offset obligation.</p>	<p>2TF-1 Securing the Koala offset sites: within 12 months from the time of development approval.</p> <p>2TF-2 Protecting the Koala offset sites: ongoing.</p>

Overall Project Management		Aim: To reinstate mature Koala bushland habitat within the Koala offset sites.		
(PO) Performance Objective	(AR) Actions / Responsibilities	(PI) Performance Indicators	(CR) Corrective Actions / Responsibilities	(TF) Timing / Frequency
<p>PO-3 To collect baseline data for the Koala offset sites</p>	<p>3AR-1 Collect baseline data and conduct detailed field surveys for all Koala offset sites for future performance monitoring regarding the success of site maintenance.</p> <p>3AR-2 Quarry Manager to ensure a qualified Landcarer is appointed to carry out field survey for collection of baseline data;</p> <p>3AR-3 Landcarer to carry out the detailed field survey to collect the baseline data and report to Quarry Manager.</p>	<p>3PI-1 The most recent available aerial imagery of the subject site are obtained and kept on record; and</p> <p>3PI-2 All floristic information is recorded and photographs are taken for all offset sites and included in monitoring reports; and</p> <p>3PI-3 The floristic information collected includes:</p> <ul style="list-style-type: none"> - Tree diameter (at 1.3m above ground) along set quadrats within the Koala offset sites; - General health and condition of trees (incl. any signs of disease/fire/grazing etc.); - Measure of weed cover (percentage cover within each quadrat, incl. identification of the weeds); - Mid-storey and understorey composition and structure; - Any signs of Koala visitation. 	<p>3CR-1 The Quarry Manager will investigate reasons why all relevant baseline data was not collected and recorded prior to commencement of restoration works, and will ensure any missing data is immediately collected.</p>	<p>3TF-1 Collection of data: at commencement of offset delivery.</p> <p>3TF -2 Timing: at the time the Koala offset sites are secured, and prior to commencement of restoration works.</p>

Overall Project Management		Aim: To reinstate mature Koala bushland habitat within the Koala offset sites.		
(PO) Performance Objective	(AR) Actions / Responsibilities	(PI) Performance Indicators	(CR) Corrective Actions / Responsibilities	(TF) Timing / Frequency
<p>PO-4 To plant a sufficient number of new Koala trees in the Koala offset sites to meet the offset obligation in accordance with the Koala Offset Policy</p>	<p>4AR-1 Plant a minimum of 65,971 new Koala trees within the Koala offset sites;</p> <p>4AR-2 Barro Group/Quarry Manager to commission and implement a detailed Koala Tree Revegetation Plan;</p> <p>4AR-3 Allocate sufficient funds to purchase and plant (or subcontract planting of) the offset trees;</p> <p>4AR-4 Ensure appropriate species mix and ratios are planted;</p> <p>4AR-5 Ensure qualified staff is appointed for revegetation works;</p> <p>4AR-6 Revegetation Staff plant all trees as instructed;</p> <p>4AR-7 Revegetation staff, if necessary, to install protective fencing around each planting/ or planting area to prevent grazing from local macropods or other fauna.</p>	<p>4PI-1 Where necessary, invasive weeds have been brought under control prior to commencement of planting works;</p> <p>4PI-2 A minimum of 65,971 new Koala trees have been planted within the identified Koala offset sites;</p> <p>4PI-3 Species mix and ratios follow the planting schedule provided in Appendix 1.</p>	<p>4CR-1 The Quarry Manager will investigate the reasons why the performance objective has not been met and will take immediate action to ensure the performance objective is met.</p>	<p>4TF-1 Timing: after collection of baseline data and where necessary, after invasive weeds have been brought under control.</p>

Overall Project Management		Aim: To reinstate mature Koala bushland habitat within the Koala offset sites.		
(PO) Performance Objective	(AR) Actions / Responsibilities	(PI) Performance Indicators	(CR) Corrective Actions / Responsibilities	(TF) Timing / Frequency
<p>PO-5 To manage and maintain the Koala offset sites</p>	<p>5AR-1 Develop and implement a management and maintenance program to manage and maintain Koala offset sites in order to maximise the successful establishment of trees planted;</p> <p>5AR-2 The Koala offset sites are managed in accordance with the Habitat Management Plan (BAAM 2010b);</p> <p>5AR-3 Quarry Manager to appoint qualified staff for ongoing management and maintenance of the Koala offset sites;</p> <p>5AR-4 Qualified Staff to conduct regular surveys to check for presence of weeds; control weeds where necessary; replace/adjust protective fencing if necessary; replace mulch where/when necessary, etc.;</p> <p>5AR-5 Qualified Staff to, where necessary, remove any unsuccessfully established planting and replace by new planting;</p> <p>5AR-6 Qualified Staff to maintain plantings until mature status is obtained; and</p> <p>5AR-7 Qualified Staff to report to Quarry Manager.</p>	<p>5PI-1 Weeds and pests are kept under control and do not represent a threat to the successful establishment of planted trees;</p> <p>5PI-2 Planted trees are healthy and growing;</p> <p>5PI-3 The trees are under no significant stress;</p> <p>5PI-4 Natural recruitment of understorey species is occurring;</p> <p>5PI-5 There is an appropriate ratio of species mix;</p> <p>5PI-6 The plantings are closely managed and maintained until at least 75% of all trees reach maturity (i.e. 4m high or 31.5cm diameter at 1.3m above ground);</p> <p>5PI-7 The Koala offset sites are self-sustaining; and</p> <p>5PI-8 There is Koala visitation in the Koala offset sites within 4 years onwards from the time the offset was delivered.</p>	<p>5CR-1 As soon as a weed infestation is reported, the Quarry Manager takes prompt action to control weeds where necessary.</p> <p>5CR-2 All maintenance works required are to be reported to the Quarry Manager.</p>	<p>5TF-1 Management & maintenance: ongoing.</p> <p>5TF-2 Regular surveys:</p> <ul style="list-style-type: none"> - Monthly surveys during the first 12 months, the first survey being conducted 1 month after the first trees were planted; - Seasonal surveys (every 3 months) for the following 3 years; - Yearly surveys thereafter and until restored habitats have become mature Koala bushland habitats.

Overall Project Management		Aim: To reinstate mature Koala bushland habitat within the Koala offset sites.		
(PO) Performance Objective	(AR) Actions / Responsibilities	(PI) Performance Indicators	(CR) Corrective Actions / Responsibilities	(TF) Timing / Frequency
PO-6 To implement monitoring and reporting protocols to inform on the progress of restored Koala habitat	6AR-1 Develop and implement a monitoring and reporting program capable of detecting changes in Koala habitat quality and extent over time. 6AR-2 Quarry Manager to appoint qualified staff for monitoring events.	6PI-1 The monitoring and reporting program provides relevant indicators to inform on the progress of restored Koala habitat in the Koala offset sites:		
	6AR-3 Qualified staff to obtain and keep records of all latest available satellite imagery (Google Earth, NearMap or other sources) for the subject site. 6AR-4 Qualified staff to establish photo points at key locations and clearly indicate the location and direction of each photo.	6PI-2 At least one satellite imagery of the subject site every two years, is obtained and kept on record; and 6PI-3 Photos are taken at least once every two years at each photo point;	6CR-1 The Quarry Manager will ensure that all latest available satellite imagery of the subject site is obtained and kept on record. 6CR-2 The Quarry Manager will ensure that photos are taken in a timely manner and kept on record.	6TF-1 Maximum of two-year intervals to identify changes in the extent of Koala habitat over the long term.
	6AR-5 Conduct surveys to collect floristic data to measure the progress of Koala offset sites. 6AR-6 Report the findings of each survey to the Quarry Manager.	6PI-4 The floristic information recorded includes: - Tree diameter (at 1.3m above ground) along set quadrats within the Koala offset sites; - General health and condition of trees (incl. any signs of disease/fire/grazing etc.); - Measure of weed cover (percentage cover within each quadrat, incl. identification of the weeds); - Mid-storey and understorey composition and structure; - Any signs of Koala visitation.	6CR-3 The Quarry Manager will ensure regular surveys are undertaken on time and will be responsible for ensuring the detailed register is kept and updated. 6CR-4 The Quarry Manager ensures that any tree that is unsuccessfully established is replaced as soon as possible.	6TF-2 Monthly surveys during the first 12 months, the first survey being conducted 1 month after the first trees were planted; 6TF-3 Seasonal surveys (every 3 months) for the following 3 years; 6TF-4 Yearly surveys thereafter and until restored habitats have become mature Koala bushland habitats.

Overall Project Management		Aim: To reinstate mature Koala bushland habitat within the Koala offset sites.		
(PO) Performance Objective	(AR) Actions / Responsibilities	(PI) Performance Indicators	(CR) Corrective Actions / Responsibilities	(TF) Timing / Frequency
		- A detailed register of the progress of Koala habitat restoration is kept and updated after each survey; and		
	6AR-7 Report monitoring outcomes to Redland City Council.	6PI-5 Progress reports are provided to Redland City Council in a timely manner.	6CR-5 The Quarry Manager is responsible for ensuring progress reports are provided to Redland City Council.	6TF-5 First progress report within 12 months from the date the Koala offset sites were secured; 6TF-6 Following progress reports on a 12-monthly basis, until restored habitats have become mature Koala bushland habitats.

SECTION 4
STATEMENT FROM DR WILLIAM ELLIS
(2010)

To be inserted here once statement is finalised

SECTION 5
KOALA HABITAT ASSESSMENT
(BAAM 2006)

KOALA HABITAT ASSESSMENT

BARRO GROUP MOUNT COTTON QUARRY

Report prepared
for
Groundwork EMS Pty Ltd

Prepared by:	Adrian Caneris, Paulette Jones
Checked by:	Dr Glen Ingram
Date:	April 2006
File no:	0049-002

Biodiversity Assessment
and Management Pty Ltd
38 Middle Street
CLEVELAND 4163



KOALA HABITAT ASSESSMENT BARRO GROUP MOUNT COTTON QUARRY

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Appendix 1: Habitat Area Descriptions

Appendix 2: Estimates of Koala Habitat Quantity and Quality Over Time

1.0 INTRODUCTION

This report has been compiled to provide Groundwork EMS Pty Ltd with an independent assessment of Koala habitat on the lands associated with the proposed extension of the Barro Group Mt Cotton Quarry. This follows a comprehensive assessment of the terrestrial vertebrate fauna and associated habitat values of the study area undertaken by BAAM in April 2004, from which there was a recommendation for further assessment of the value of the property for Koalas and the potential impacts of the proposed development on the local and regional Koala populations.

The specific aims of this assessment are to:

1. Determine the extent and quality of the existing Koala habitat;
2. Estimate the number of Koalas currently utilising the property, both within and outside of the proposed quarry extension area;
3. Estimate the likely Koala carrying capacity of the subject land;
4. Measure the extent and quality of habitat that would be lost to quarrying activity;
5. Estimate the number of Koalas affected by loss of habitat due to quarrying activity;
6. Assess the extent and likely quality of the proposed rehabilitation habitat;
7. Estimate the likely Koala carrying capacity of the proposed rehabilitation habitat;
8. Assess the likely impacts on Koala populations over the life of the extended quarry activity, including calculations of habitat lost and habitat gained over time; and
9. Develop a Koala monitoring program to be adopted for the life of the proposed quarry extension.

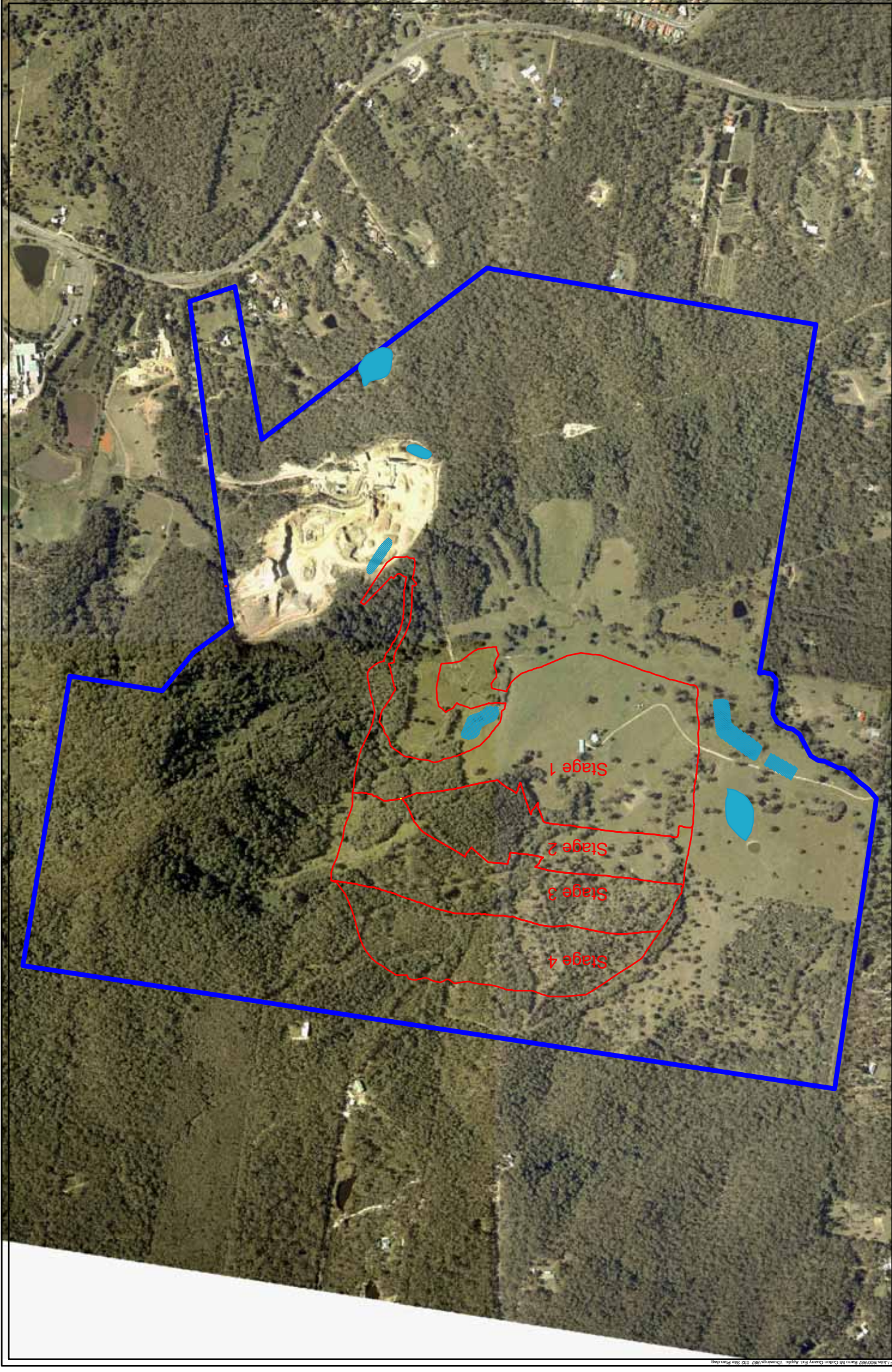
The findings of this report are based on field investigations conducted by Adrian Caneris and Paul Grimshaw on August 25, 2005 (vegetation and habitat assessment), and Adrian Caneris and Jedd Appleton on 6 & 8 September 2005 (Koala assessment).

2.0 SITE AND PROPOSAL DESCRIPTION

2.1 EXISTING SITE CHARACTERISTICS

The existing Mt Cotton Quarry site is situated on Mt Cotton Road in Redland Shire and has been used for quarrying purposes since the 1960s. Current operations involve a range of plant and equipment operated to produce a variety of extractive resources and products.

The property is approximately 241 ha in area, with the site of the proposed extension located 0.5 km south-west of the existing quarry (Figure 1). In addition to the existing extractive industry use, the property has a long history of cattle grazing. The more fertile alluvial soils have been cleared for pasture, while the drier, less fertile slopes remain timbered with varying levels of disturbance from timber-getting and weed invasion.



REV	DATE	BY	DESCRIPTION

Legend:
— Property boundary
— Proposed quarry staging areas
■ Proposed water treatment structures

PROJECT: Mt Cotton Quarry Extension
CLIENT: Barro Group Pty Ltd

FIGURE 1: PROPOSED QUARRY STAGING
GROUNDWORK
 SCALE: 1:8000
 DRAWN: [Name]
 CHECKED: [Name]
 DATE DRAWN: 18 September 2020
 DRAWING NUMBER: 0049-002 F1
 DRAWING DATE OF PRACTICABILITY: [Date]
 CD/HA - Zone 6/1/2/ May 2014

BAAM (2004a) examines the significance of the fauna habitat present, identifying the continuing facilitation of Koala feeding, breeding and movement as key considerations for the future of the property. This assessment should be considered as supplemental to that original fauna report.

2.2 PROPOSED QUARRY ACTIVITIES

Figure 1 shows the proposed quarry extension location and proposed stages of extraction. The following timelines apply to the stages as mapped.

Stage	Projected Cumulative Years	Projected Range (cumulative years)
Stage 1	20	18-22
Stage 2	30	27-35
Stage 3	45	40-50
Stage 4	60	50-65

It is understood that the site of the proposed extension is identified as a Key Resource Area within the Draft State Planning Policy for the Protection of Extractive Industries.

Quarried rock would be transported from the extension area to the plant associated with the existing quarry operation via a conveyor system. A new access road would be constructed between the extension and the existing quarry site approximately 50m north of the proposed conveyor.

An assessment of the impact of traffic movement on Koalas will need to be carried out when the results of a Traffic Study, currently being undertaken, are available.

3.0 ASSESSMENT METHODOLOGY & RESULTS

3.1 FIELD ASSESSMENT

Existing vegetation mapping and aerial photography were used to broadly define habitat areas prior to field assessment. The property was subsequently traversed and each habitat area was mapped accurately on the aerial photography, and assessed based on (1) the quality and quantity of Koala food trees present; (2) evidence of Koala presence, including individuals sighted, Koala scats and Koala scratches; and (3) the strategic location of habitat areas for the facilitation of Koala movement within and through the property.

In all, 25 discrete habitat areas were defined, and each attributed with a Map Unit Number as shown on Figure 2.

Each of the mapped habitat areas are described fully in Appendix 1.



Legend:

Koala Habitat Map Units



Mt Cotton Quarry Extension

Barro Group Pty Ltd

FIGURE 2: KOALA HABITAT MAP UNITS

	SCALE	1:8000	DRAWING NUMBER	0049-002 F2
	DATE DRAWN	18 September 2005	PROJECT TITLE	MT COTTON QUARRY EXTENSION

3.2 HABITAT QUALITY INDEX

Table 1 provides an index of Koala habitat values of the property as determined through field investigation. The habitats are indexed in order of significance from lowest (a score of 0) to highest (a score of 12).

Table 1. Habitat Quality Index

Koala Habitat Index	Description
0	Cleared land – no habitat present.
1	Remnant and/or non-remnant vegetation supporting few Koala food trees and not providing connection between Koala habitat areas.
3	Scattered food trees within pasture.
4	Remnant and/or non-remnant vegetation supporting few Koala food trees and providing connection between Koala habitat areas.
5	Non-remnant/disturbed vegetation supporting Koala food trees, but disturbed to an extent where Koala access is limited e.g. by the presence of prolific lantana or rank grasses, or isolation through clearing.
6	Non-remnant/disturbed vegetation on drier slopes supporting Koala food trees and with good connections to larger habitat areas.
8	Non-remnant/disturbed open forest and woodland on coastal areas, alluvial soils or creeklines, supporting Koala food trees and with good connections to larger habitat areas.
9	Remnant open forest and woodland on drier slopes incorporating Koala food species and with good connections to other habitat areas.
12	Remnant woodland of coastal areas, alluvial plains and creeklines incorporating a high proportion of <i>E. tereticornis</i> and with good connections to other habitat areas.

Each of the 25 discrete habitat map units has been assigned a quality index from the table above. The result for the property is shown in Figure 3.

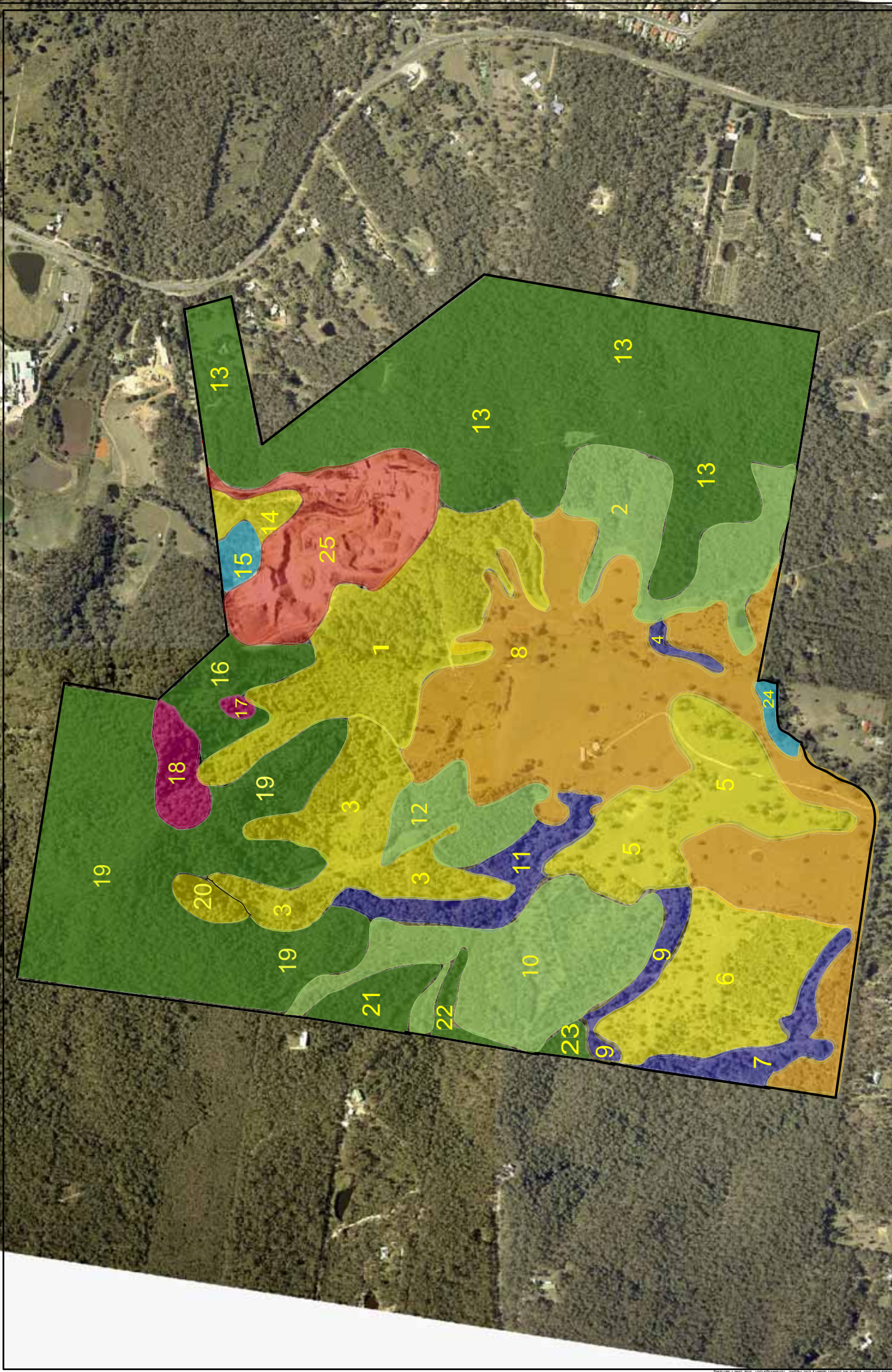


FIGURE 3: ESTIMATED KOALA HABITAT VALUES - 2005

SCALE: 1:8000
When Printed On A3

DRAWING NUMBER: 0049-002 F3

DATE: 19 September 2005

DATE: 26th May 2004



Mt Cotton Quarry Extension
Barro Group Pty Ltd

Disturbed corridors on alluvial soils
Remnants on drier slopes

- Legend:**
- Few food trees but providing habitat connection
 - Non-remnant - Koala access limited by disturbance
 - Non-remnant - providing food trees & habitat connection
 - Cleared land
 - Few food trees & poor connection
 - Scattered food trees in pasture

3.3 ESTIMATE OF CURRENT KOALA POPULATION

In order to estimate the current Koala population, each habitat quality index has been assigned a Koala density, shown in Table 2.

The densities are based on:

1. Assessment of habitat quality and Koala presence/signs during field assessment.
2. The results of regional research reported by Dique *et al.* 2004, determining Koala densities in southeast Queensland habitats.
3. Knowledge of the author of typical Koala densities within Redland Shire habitats.

Table 2: Koala Density Estimates for Each Habitat Index

Koala Habitat Index	Description	Equivalent habitat Dique <i>et al.</i> 2004	Estimated Koala density per ha
0	Cleared land – no habitat value	n/a	0.0
1	Remnant and/or non-remnant vegetation supporting few Koala food trees and not providing connection between Koala habitat areas	n/a	0.01
2	Scattered food trees within pasture	n/a	0.04
3	Remnant and/or non-remnant vegetation supporting few Koala food trees and providing connection between Koala habitat areas	n/a	0.05
5	Non-remnant/disturbed vegetation supporting Koala food trees, but disturbed to an extent where Koala access is limited e.g. by the presence of prolific lantana or rank grasses, or isolation through clearing	n/a	0.07
6	Non-remnant/disturbed vegetation on drier slopes supporting Koala food trees and with good connections to larger habitat areas	Low-density bushland <0.2/h-1	0.1
8	Non-remnant/disturbed open forest and woodland on coastal areas, alluvial soils or creeklines, supporting Koala food trees and with good connections to larger habitat areas	High-density bushland $\geq 0.2/h-1$	0.2
9	Remnant open forest and woodland on drier slopes incorporating Koala food species and with good connections to other habitat areas	Low-density remnant bushland <0.4/h-1	0.2
12	Remnant woodland of coastal areas, alluvial soils and creeklines incorporating a high proportion of <i>E. tereticornis</i> and with good connections to other habitat areas	High-density remnant bushland $\geq 0.4/h-1$	0.4

Based on the extent of each of the habitat indices within the property, and the estimated Koala density/ha for each index, the estimated Koala population of the property in its current condition is **29** individuals.

3.4 ESTIMATION OF KOALA HABITAT QUALITY AND POPULATION CHANGES OVER TIME

3.4.1 Habitat Quality and Koala Densities of Rehabilitation Areas

To calculate estimated changes in habitat value and Koala densities over time, in addition to the natural and semi natural bushland present on the property the proposed rehabilitation areas also need to be assigned a habitat value index, with a corresponding Koala density.

The estimated habitat values and Koala densities of the rehabilitation areas are shown in Table 3.

Table 3: Estimated habitat indices and Koala densities for rehabilitated habitat

Koala Habitat Index	Description	Equivalent habitat <i>Dique et al</i> 2004	Estimated Koala density per ha
4	Areas of planting of preferred Koala woodland habitat on alluvial soils -23 years old and with good connections to other habitat areas	n/a	0.1
7	Areas of rehabilitation/regeneration of preferred Koala woodland habitat on alluvial soils. 20-30 years old and with good connections to other habitat areas	Low-density bushland <0.2/h-1	0.15
10	Areas of rehabilitation/regeneration of preferred Koala woodland habitat on alluvial soils. 30-45 years old and with good connections to larger habitat areas	Low-density remnant bushland <0.4/h-1	0.3
11	Areas of rehabilitation/regeneration of preferred Koala woodland habitat on alluvial soils. >45 years old and with good connections to other habitat areas	High-density remnant bushland ≥0.4/h-1	0.4

3.4.2 Study Assumptions

In order to estimate the habitat quality of the property over the approximately 60 year quarry extension project, a number of important assumptions are made:

1. That currently cleared pasture land is rehabilitated/regenerated to reflect the original vegetation which would represent high quality Koala habitat. This would commence approximately three years prior to the commencement of expansion.
2. That all non-remnant eucalypt vegetation communities will be managed such that habitat values equivalent to those of remnant vegetation will be achieved over the life of the project.
3. That the habitat areas currently subject to disturbance from weed infestation and domestic stock will be managed to enhance values for Koalas and other fauna.
4. That all remnant vegetation outside of the extraction area is managed such that current habitat values are retained over the life of the project.

5. That the local Koala population remains stable during the life of the project, and that local and regional Koala movement corridors outside of the property boundaries are maintained.
6. That the habitat quality and Koala densities estimated are accurate. These will need to be confirmed through standardised Koala survey methods prior to and during the quarry extension project (see Section 5.0).

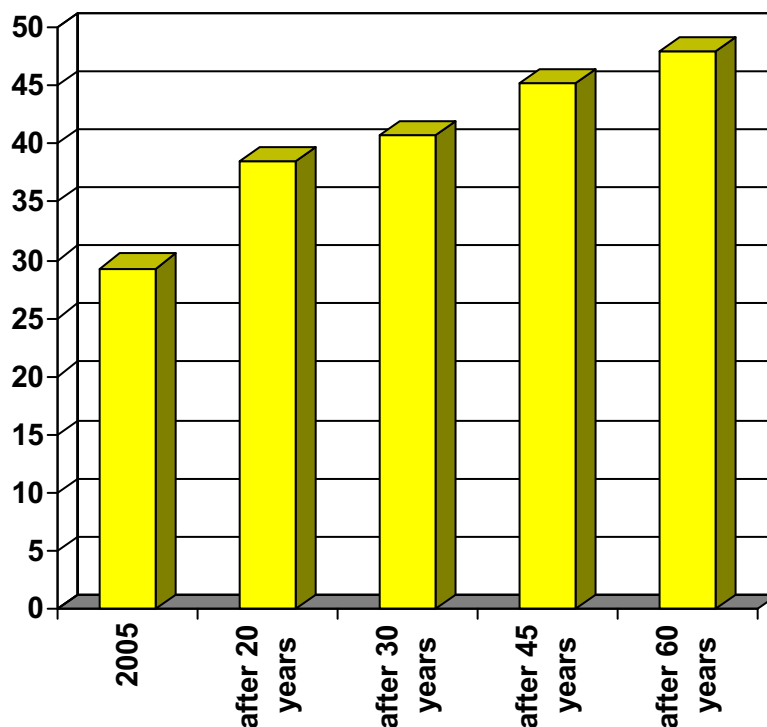
3.4.3 Calculations

A spread sheet is included as Appendix 2 that provides the following details:

- The total area of each defined habitat area during the life of the project (present, 0-20 years, 20-30 years, 30-45 years and >45 years);
- The habitat indices, estimated Koala densities and estimated numbers of Koalas present within each habitat area over the life of the project;
- The estimated number of Koalas supported by the study area over the life of the project.

Figure 4 shows the results of the calculations, taking into account habitat lost for the expansion of the quarry pit, and habitat gained through rehabilitation and regeneration of the remainder of the property. The calculations are conservative as they do not take into account progressive rehabilitation of the quarry expansion area.

Figure 4. Estimated Koala Numbers Over Time



Figures 5, 6, 7 & 8 depict the predicted changes in habitat quality and quantity over the life of the project.



Legend: (numbers in brackets = habitat ranking)

- Cleared land (0)
- Few food trees & poor connection (1)
- 23 year old rehabilitation (4)
- Few food trees but providing habitat connection (3)
- Non-remnant - providing food trees & habitat connection (6)
- Remnant corridors on alluvial soils (12)
- Remnants on drier slopes (9)
- Disturbed corridors on alluvial soils (8)
- Proposed water treatment structures

Figure 5: PREDICTED KOALA HABITAT VALUES AFTER 20 YRS

SCALE: 1:80000
When Printed On A3

DRAWING NUMBER: 0049-002 F5

DATE DRAWN: 3/20/2023

DATE OF LAST UPDATE: 26/04/2024

PROJECT: Mt Cotton Quarry Extension

CLIENT: Barro Group Pty Ltd

COMPANY: Biodiversity Assessment AND MANAGEMENT PTY LTD



Legend: (numbers in brackets = habitat ranking)

- Cleared land (0)
- Few food trees & poor connection (1)
- 30 year old rehabilitation
- Few food trees but providing habitat connection (3)
- Non-remnant - providing food trees & habitat connection (6)
- Remnants on drier slopes (9)
- Remnant corridors on alluvial soils (12)
- Proposed water treatment structures

Scale: 1:8000
Map: Printed On A3
 Date: 20/04/2024
 Scale: 3.240.000

North Arrow: N

Project Information:
 Mt Cotton Quarry Extension
 Barro Group Pty Ltd
FIGURE 6: PREDICTED KOALA HABITAT VALUES 20-30 YEARS
 Biodiversity Assessment
 DRAWING NUMBER: 0049-002 F6
 DATE: 20/04/2024



Legend: (numbers in brackets = habitat ranking)

- Cleared land (0)
- Few food trees (1)
- 45 year old rehabilitation (10)
- Predominantly non-eucalypt providing habitat connection (3)
- Remnants on drier slopes (9)
- Remnant vegetation on alluvial soils (12)
- Proposed water treatment structures

Scale: 1:8000
Drawn: Peter Pridmore
 3 MAY 2024

North Arrow

Client: Mt Cotton Quarry Extension
Company: Barro Group Pty Ltd

Title: FIGURE 7: PREDICTED KOALA HABITAT VALUES 30- 45 YEARS

DRAWING NUMBER: 0049-002 F6
DATE DRAWN: 3 MAY 2024



Legend: (numbers in brackets = habitat ranking)

- Cleared land (0)
- Few food trees (1)
- Remnants on drier slopes (9)
- Predominantly non-eucalypt providing habitat connection (3)
- 40-60 year old rehabilitation (11)
- Remnant vegetation on alluvial soils and creeklines (12)
- Proposed water treatment structures

FIGURE 8: PREDICTED KOALA HABITAT VALUES 45 - 60 YEARS

Mt Cotton Quarry Extension
Barro Group Pty Ltd

Biodiversity Assessment

SCALE: 1:8000
DRAWN: [unreadable]
DATE DRAWN: 3 April 2020

DRAWING NUMBER: 0049-002 F8
CLIENT: STATE OF QUEENSLAND
DRAWN BY: [unreadable]
DATE: 20th Nov 2014

4.0 DISCUSSION

With appropriate management, the Koala habitat of the study area is predicted to improve over the sixty-year life of the proposed quarry extension, despite the removal of some habitat areas for quarrying purposes. Contributing factors include the predominantly cleared areas proposed for quarry extension, and the quantity of pastoral land on fertile soils that is available for rehabilitation to compensate for the habitat loss and enhance the value of the property for Koalas and other fauna. In addition, over the life of the quarry, the areas of vegetation that are currently classified as regrowth will mature and, under protection and management, will become increasingly valuable Koala habitat.

The success of the proposed compensatory habitat through rehabilitation and enhancement of the Koala habitat values of the property will hinge on the quality of the rehabilitation plan, rehabilitation works, and the ongoing management of regeneration, groundcover characteristics, weeds, fire and exotic fauna. Consideration of the potential impacts of quarry-associated actions on Koalas and their movement should be formally incorporated into decision-making processes and works programs.

While it is important to understand the current value of the property for Koalas, the precise determination of the number of Koalas utilising the property at present is not entirely necessary to gain an understanding of the potential benefits that may be derived from this large area being under management, and government and public scrutiny, for the benefit of the local Koala population.

However, it will be necessary to gain a full understanding of Koala population characteristics and dynamics for the property in order to conduct appropriate monitoring of the impacts, both positive and negative, of the quarry extension project.

Section 5.0 sets out a suggested Koala Monitoring Program for the life of the quarry. This must be incorporated into a Fauna Management Plan that includes information feedback to the land managers with responsibilities for implementing ameliorative actions, if necessary, in response to the monitoring data.

5.0 SUGGESTED KOALA MONITORING PROGRAM

Koala population monitoring is important to determine the success or otherwise of the rehabilitation program and other management practices. Monitoring should commence prior to the commencement of the quarry expansion project.

It is recommended that the monitoring program be developed in conjunction with the Queensland Parks and Wildlife Service to ensure that local and regional survey results undertaken by the Service are comparable with results from the subject land, and that Koala population trends can be taken into account in the interpretation of monitoring results.

6.0 BIBLIOGRAPHY

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APPENDIX 1

HABITAT AREA DESCRIPTIONS

APPENDIX 1

HABITAT AREA DESCRIPTIONS MT COTTON QUARRY LANDS

The spatial distribution of the following Habitat Areas are shown on Figure 2 of the main report.

Habitat Area	Description
1	This area supports regrowth vegetation which has been highly disturbed. The most important value in this area is its value as a linkage between areas 13 and 19 and the highly valuable remnant vegetation habitat within those areas. There are occasional food trees present, but the vegetation is dominated by <i>Acacia</i> regrowth and lantana.
2	This area has high Koala habitat value as it contains mixed eucalypts. The area holds similar values for Koalas as the vegetation mapped as remnant immediately to the east (area 13). The habitat within this area is contiguous with the adjoining area 13 and has similar values found in remnant vegetation in regional ecosystem 12.11.5.
3	This area is dominated by regrowth vegetation which has been highly disturbed. The area provides a buffer to remnant vegetation and contains a mixture of scrub and Eucalypt regrowth. There was no evidence of Koala visitation and the food trees present are mostly relatively isolated secondary species (eg. less-preferred food species).
4	This is a relatively small area containing a mixture of habitats. There are <i>Eucalyptus tereticornis</i> present and these are highly valuable Koala food trees. The area provides good habitat for Koala movement along the watercourse. Although of high value, habitat quality is reduced by its isolation from other similar habitats. Scratches and scats present indicate that the area is visited periodically, rather than having Koalas permanently present.
5	This area on alluvial soils has high value as a feeding resource. The trees present in this area, although containing some regrowth, are mostly mature trees. In particular the Grey Gums <i>E. major</i> and <i>E. tereticornis</i> are of high value. Currently the area is subject to grazing by domestic stock that has assisted in keeping the ground vegetation low and traversable by Koalas. If the stock were to be removed and other land management actions are not commencing (e.g. slashing) the trees would become relatively inaccessible to Koalas. Koalas were observed within this area during the field assessment.
6	This area is regrowth vegetation which has been highly disturbed and is subject to grazing by domestic stock (cattle and horses). This area contains a mixture of eucalypt and wattle-dominated vegetation. Where present, the Koala food trees have relatively good value as a feeding resource. This was evidenced by signs of Koala presence.
7	This relatively small area has some highly valuable vegetation present. The area contains a small watercourse along which three species of primary food trees <i>E. tereticornis</i> , <i>E major</i> and <i>E .microcorys</i> . A koala was observed in vegetation along the creekline during the field assessment. This area also provides for Koala movement along the watercourse to habitats west of the property. Evidence of Koala visitation indicated that the area is regularly used.
8	This area contains mostly pasture with little or no Koala habitat. There was some evidence of visitation to isolated trees, most likely reflecting occasional Koalas traversing through to surrounding habitat areas. There is some natural regeneration occurring although the levels of this are low due to cattle grazing.

Appendix 1 (cont.)

Habitat Area	Description
9	This relatively small linear area supports valuable vegetation for Koala feeding and movement. The area incorporates a small drainage line along which primary food trees are present. There is evidence of relatively high levels of visitation. Some portions are dominated by wattle and Brush box regrowth.
10	This area is dominated by regrowth vegetation which has been highly disturbed and is subject to grazing. A mixture of eucalypt and wattle dominated-vegetation is present. Where they occur, the koala food trees have relatively good value as a feeding resource and this is evidenced by signs of visitation. As well, the area provides linkage to key habitats in the immediate area. Natural regrowth is present and with suitable restoration this area could provide additional key habitat over time.
11	This small linear area of vegetation supports some highly valuable Koala habitat. The area contains a small watercourse and gully lines along which there are primary food trees present. There are some portions dominated by wattle regrowth, but these are generally small and contain Koala food trees within. Evidence of Koala visitation is relatively high suggests that the area is being consistently used. This area provides habitat suitable for Koala movement although some portions in the northern area contain steep gullies which would limit movement options.
12	This area is mapped as remnant vegetation (RE 12.11.5). This area contains valuable feeding resources which are being used regularly. Although mapped as remnant, many of the trees on the outer edges are young and would not meet the criteria as remnant. The area has been highly disturbed and is subject to grazing. The understorey is dominated by lantana and this is limiting the value of the area for Koala movement. There are some old growth trees present, many of which show signs of high visitation levels. A female with back-riding young was observed in the area, demonstrating that this habitat provides a breeding resource.
13	This large area is dominated by remnant vegetation (RE 12.11.5). This area contains valuable feeding, breeding and movement resource and is considered as critical habitat for the species. There has been some prior disturbance to the area with evidence of prior selective logging activities and a network of tracks. Overall the habitat is relatively intact with good levels of natural regeneration occurring and only low levels of environmental weeds. There are old growth hollow bearing trees present. Koala visitation is apparent throughout the area with increased evidence in close proximity to watercourses and drainage lines where their preferred food trees contain higher levels of moisture. Koalas were observed within the area during the field assessment.
14	This small area contains eucalypt habitat which contains trees of high value for Koalas. Some of this area is mapped as remnant vegetation (RE 12.11.5) and the area contains the habitat qualities expected with that RE. This area contains a valuable resource and evidence indicates regular use by Koalas. The area's immediate proximity to the roadway and active quarrying area has reduced some values. There has been considerable disturbance in the past with numerous weed species present. Overall the habitat is in relatively good condition and natural regeneration is occurring. Koalas were observed within the area during the BAAM (2004) fauna survey. This area provides an important vegetated link on the northern boundary of the property.
15	This area, although mapped as remnant vegetation (RE 12.11.5), is highly disturbed and the presence of weed species is high. The undergrowth and topography are expected to limit the presence of Koalas. Although where they occur, the trees in this area provide a potentially valuable feeding resource, the evidence of visitation is light. The understorey is very thick in portions, dominated by lantana and similar species, seriously limiting the area's value

Appendix 1 (cont.)

Habitat Area	Description
	for Koala movement. Ongoing habitat management in the removal of weeds, management of the understorey and encouragement of regeneration would significantly improve the value of this area for Koala movement in an important location.
16	This area is dominated by remnant vegetation (RE 12.11.5) and holds values similar to Area 13. This area contains valuable feeding, breeding and movement resource and is considered as critical habitat for the species. There is little evidence of prior selective logging activities and there are numerous old growth hollow bearing trees present. Koala visitation is apparent throughout the area.
17	This polygon is entirely dominated by remnant vegetation (RE 12.11.11). Whilst the area does have some Koala food trees present, the high density of vegetation and steepness of the gully makes the resource all but inaccessible. Overall Koalas are not expected to have a high use of this area or habitat type and this is supported by the lack of evidence of their presence.
18	As for Area 17, this polygon is entirely dominated by remnant vegetation (RE 12.11.11). Whilst the area does have some Koala food trees present, the high density of vegetation and steepness of the gully makes the resource all but inaccessible. Overall Koalas are not expected to have a high use of this area or habitat type and this is supported by the lack of evidence of their presence.
19	This polygon has the same qualities as Site 13, although there is lower evidence of prior or ongoing disturbances. This area contains an extremely valuable habitat for Koala feeding, breeding and movement requirements and is considered as critical habitat for the species. Its proximity to significant habitat areas north and west of the property increases the habitat value of the area. Evidence of Koala visitation is high.
20	This polygon has the same qualities as Site 18 although there is greater evidence of prior disturbances and weed infestations. This area contains an extremely steep gully which limits Koala movement options. There are only a few suitable food trees present.
21	This area is dominated by remnant vegetation (RE 12.3.6) and contains valuable Koala feeding, breeding and movement resources. There is evidence of prior selective logging activities and there are only a few trees which could be considered as old growth. Koala visitation is evident across the area.
22	This area is dominated by remnant vegetation (RE 12.3.6) and has the similar values as site 21, although evidence of Koala presence is lower.
23	This area is dominated by remnant vegetation (RE 12.3.6) and has the similar values as site 22.
24	This is a relatively small area of remnant riparian vegetation associated with a main waterway. There are food trees present and these are providing a highly valuable source of fodder. The area provides good habitat for Koala movement along the watercourse. Although of high value, evidence of visitation is low. This is expected to be a result of the area's isolation from other similar habitats and the presence of tall pastoral grasses surrounding the area and limiting Koala movement.
25/26	This is the existing operational area of the Mt Cotton Quarry. This area has little or no vegetation within and holds almost no habitat value to Koalas, although it is planned to rehabilitate approximately one third of the current operational area with vegetation suitable for Koalas.

APPENDIX 2

**ESTIMATES OF KOALA HABITAT
QUANTITY AND QUALITY OVER TIME**

APPENDIX 2

ESTIMATES OF KOALA HABITAT QUANTITY AND QUALITY OVER TIME
MT COTTON QUARRY PROPERTY

Map Unit No	Current Vegetation Description	2005				-3-20 years				20-30 years				30-45 years				45-60 years			
		Total Area (ha)	Habitat Ranking	Estimated Koala Density/ha	Estimated Koalas present/ha	Total Area (ha)	Habitat Ranking	Estimated Koala Density/ha	Estimated Koalas present/ha after 20 years	Total Area (ha)	Habitat Ranking	Estimated Koala Density/ha	Estimated Koalas present/ha after 30 years	Total Area (ha)	Habitat Ranking	Estimated Koala Density/ha	Estimated Koalas present/ha after 45 years	Total Area (ha)	Habitat Ranking	Estimated Koala Density/ha	Estimated Koalas present/ha after 60 years
1	Acacia Regrowth	17.24	3	0.05	0.9	16.23	9	0.2	3.2	16.23	9	0.2	3.2	16.23	9	0.2	3.2	16.23	9	0.2	3.2
2	Eucalypt Regrowth	10.75	6	0.1	1.1	10.75	9	0.2	2.2	10.75	9	0.2	2.2	10.75	9	0.2	2.2	10.75	9	0.2	2.2
3	Scrub/Euc. Regrowth	10.85	3	0.05	0.5	9.34	6	0.1	0.9	9.22	6	0.1	0.9	4.92	6	0.1	0.5	4.91	6	0.1	0.5
4	Non-remnant mixed sp.	0.60	8	0.2	0.1	0.60	12	0.4	0.2	0.60	12	0.4	0.2	0.60	12	0.4	0.2	0.60	12	0.4	0.2
5a	Non-remnant Euc.	12.16	3	0.05	0.6	2.87	6	0.1	0.3	0.0	0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0.0
5b	Included in above					4.5	4	0.1	0.4	4.50	7	0.15	1.4	4.20	10	0.3	1.3	4.20	11	0.4	1.7
6	Non-remnant mixed sp.	11.94	3	0.05	0.6	11.94	4	0.1	1.2	11.94	7	0.15	1.8	11.94	10	0.3	3.6	11.94	11	0.4	4.8
7	Watercourse Euc.	3.39	8	0.2	0.7	3.39	12	0.4	1.4	3.39	12	0.4	1.4	3.39	12	0.4	1.4	3.39	12	0.4	1.4
8	Pasture & Euc. Regen.	44.61	2	0.04	1.8	30.05	4	0.1	3	29.63	7	0.15	4.4	29.63	10	0.3	8.9	29.63	11	0.4	11.8
9	Watercourse mixed sp.	2.25	8	0.2	0.4	2.25	12	0.4	0.9	2.17	12	0.4	0.9	1.79	12	0.4	0.7	1.75	12	0.4	0.7
10	Acacia/Euc. Regrowth	15.99	6	0.1	1.6	15.99	9	0.2	3.2	15.83	9	0.2	3.2	12.3	9	0.2	2.5	4.25	9	0.2	0.9
11	Watercourse mixed sp.	4.78	8	0.2	1.0	4.08	12	0.4	1.6	2.99	12	0.4	1.2	0.94	12	0.4	0.4	0.03	12	0.4	0.0
12	RE 12.11.5	5.06	9	0.2	1.0	3.87	3	0.05	0.2	0.87	3	0.05	0.0	0.02	3	0.05	0.0	0.02	3	0.05	0.0
13	RE 12.11.5	49.84	9	0.2	10	49.84	9	0.2	10	49.84	9	0.2	10	49.84	9	0.2	10	49.84	9	0.2	10
14	RE 12.11.5 & Regrowth	1.60	3	0.05	0.1	1.60	9	0.2	0.3	1.60	9	0.2	0.3	1.60	9	0.2	0.3	1.60	9	0.2	0.3
15	RE 12.11.5	1.13	5	0.07	0.1	1.13	9	0.2	0.2	1.13	9	0.2	0.2	1.13	9	0.2	0.2	1.13	9	0.2	0.2
16	RE 12.11.5	4.40	9	0.2	0.9	4.40	9	0.2	0.9	4.40	9	0.2	0.9	4.40	9	0.2	0.9	4.40	9	0.2	0.9
17	RE 12.11.1	0.30	1	0.01	0.0	0.30	1	0.01	0.0	0.30	1	0.01	0.0	0.30	1	0.01	0.0	0.30	1	0.01	0.0
18	RE 12.11.1	2.71	1	0.01	0.0	2.71	1	0.01	0.0	2.71	1	0.01	0.1	2.71	1	0.01	0.1	2.71	1	0.01	0.1
19	RE 12.11.5	35.15	9	0.2	7	35.15	9	0.2	7	35.15	9	0.2	7	35.15	9	0.2	7	34.79	9	0.2	7
20	Scrub/Euc. Regrowth	1.19	3	0.05	0.1	1.19	3	0.05	0.1	1.19	3	0.05	0.1	1.19	3	0.05	0.1	1.19	3	0.05	0.1
21	RE 12.3.6	2.68	9	0.2	0.5	2.68	9	0.2	0.5	2.68	9	0.2	0.5	2.68	9	0.2	0.5	2.14	9	0.2	0.5
22	RE 12.3.6	0.99	9	0.2	0.2	0.99	9	0.2	0.2	0.99	9	0.2	0.2	0.99	9	0.2	0.2	0.71	9	0.2	0.2
23	RE 12.3.6	0.74	9	0.2	0.1	0.74	9	0.2	0.1	0.74	9	0.2	0.1	0.74	9	0.2	0.1	0.74	9	0.2	0.1
24	Riparian Vegetation	0.66	5	0.07	0.0	0.66	8	0.2	0.1	0.66	12	0.4	0.3	0.66	12	0.4	0.3	0.66	12	0.4	0.3
25	Existing Quarry	2.08	0	0	0.0	13.50	0	0.00	0.0	13.50	0	0.00	0.0	13.50	0	0.0	0.0	13.50	0	0.0	0.0
26	Existing Quarry rehab	1.9ha	4	0.1	0.4	1.9ha	4	0.1	0.4	1.9	7	0.15	3.0	1.9	10	0.3	0.6	1.9	12	0.4	0.8
TOTALS					29.7				38.5			40.8					45.2				47.9

SECTION 6
JOINT STATEMENTS ON FAUNA AND
FAUNA HABITAT MATTERS
(P&E COURT APPEAL 1585 OF 2007)

In regards P&E Court Appeal 1585 of 2007

Between Barro Group Pty Ltd (Appellants) and Redlands Shire Council (Respondent) & WPSQ Bayside Branch (Co-Respondent).

1st Joint Statement on Fauna and Fauna Habitat Matters

27 October 2008

All meetings, conferences and this joint statement have been conducted and prepared in accordance with Practice Direction #1 of 2006.

Unless otherwise stated, all references to the development refer to that which forms the original application to the **Redlands Shire Council**.

Experts involved - Mr. Adrian Caneris (AC); Mr. Simon McNeilage (SM); Ms. Lynn Roberts (LR) and Dr William Ellis (WE)

Key to opinions below: ✓ Agree, X Disagree, NA Not applicable to this expert

The experts note that the meetings were productive and useful. It has been agreed that further discussions and agreement is desirable to assist the Court, and it is intended that this take place once information requirements noted below have been addressed.

Statement	AC	SM	WE	LR	Comments
1. There are no fauna species listed under the <i>Environment Protection and Biodiversity Conservation Act 1998</i> which are considered to be threatened by the proposed actions.	✓	✓	NA	NA	(SM) I have no reason not to rely on the professionalism and competency of the ecological advisors to the Proponent and the accuracy of their reported investigations. I therefore accept the statement in the absence of any current contradictory information.
2. There are species listed under the Nature Conservation Act 1994 known to occur on the subject site	✓	✓	✓	✓	(SM) I have no reason not to rely on the professionalism and competency of the ecological advisors to the Proponent and the accuracy of their reported investigations. I therefore accept the statement in the absence of any current contradictory information.
3. Data on the loss of riparian habitat and mapped remnant vegetation is to be provided along with data on the spatial extent of future riparian habitat and remnant vegetation. A reasonable condition of development would be to provide the proposed offsets of both riparian habitat and remnant vegetation such that they are progressively established during operations and fully implemented and viable following the cessation of operations, the riparian habitats and remnant vegetation extant on site will be enhanced in area and condition. It is desirable to have the amount of vegetation lost detailed for each stage of the development and correspondingly the revegetation defined by type and area. Details of expected habitat values and timing of such should be provided for comparison.	✓	✓	✓	✓	

A. Caneris

SM

WE

LR

Between Barro Group Pty Ltd (Appellants) and Redlands Shire Council (Respondent) & WPSQ Bayside Branch (Co-Respondent).

1st Joint Statement on Fauna and Fauna Habitat Matters

Statement	AC	SM	WE	LR	Comments
4. Potential riparian habitat can be identified by reference to the Redland Planning Scheme "Waterways, Wetlands & Moreton Bay overlay mapping" and Part 5 – Overlays, Division 12 - Waterways, Wetlands & Moreton Bay overlay. The relevant RPS requirements including buffer widths for minor waterways and natural drainage lines as described in Part 11 – Planning Scheme Policy 14 Waterways, Wetlands & Moreton Bay are supported for ecological reasons.	✓	✓	✓	✓	
5. Consideration of riparian habitat should include the extant values of the site and the rehabilitation of new drainage channels to achieve natural habitat values where practical.	✓	✓	✓	✓	
6. Riparian habitat is viewed as providing important habitat for koala.	✓	✓	✓	✓	(AC & SM) The value of riparian habitat for koala will depend on the degree to which it provides for movement, refuge and food. This will be strongly influenced by the presence of vegetation and vegetation type.
7. The site's values and contribution to regional and local fauna movement (including Koala) should be both described and illustrated on a figure.	✓	✓	✓	✓	
8. While water quality is being addressed by other experts any water quality criteria agreed should protect downstream ecological values including in-stream fauna and aquatic and riparian vegetation.	✓	✓	✓	✓	
9. Details on the proposed type and extent of fencing are required to assess potential impacts on fauna (including Koala) movement or habitat loss.	✓	✓	✓	✓	
10. The experts wish to continue discussions with the aim to document further agreement once information set out in points 3, 5, 7 8 and 9 is available and Lynn Roberts has undertaken a site visit.	✓	✓	✓	✓	

a. covers

SM
WE

LR

In regards P&E Court Appeal 1585 of 2007

Between Barro Group Pty Ltd (Appellants) and Redlands Shire Council (Respondent) & WPSQ Bayside Branch (Co-Respondent).

1st Joint Statement on Fauna and Fauna Habitat Matters

Signed:

Mr. Adrian Caneris (AC)

Mr. Simon McNeilage (SM)

Ms. Lynn Roberts (LR)

Dr William Ellis (WE)

In regards P&E Court Appeal 1585 of 2007

**Between Barro Group Pty Ltd (Appellants) and Redlands City Council
(Respondent) & WPSQ Bayside Branch (Co-Respondent).**

2nd Joint Statement on Fauna and Fauna Habitat Matters

All meetings, conferences and this joint statement have been conducted and prepared in accordance with Practice Direction #1 of 2006.

Unless otherwise stated, all references to the development refer to that which forms the amended application as shown in the plans distributed by Adrian Caneris to the experts listed below by e-mail on 27 November 2008. Those distributed plans were labelled Schematic of Proposed Plant Layout Figure 2.7A, Orth photo with Schematic of Proposed Plant Layout Overlay Dwg. No. 987.133, Quarry development Plan – Stage 3 Rev. 2, and Quarry Development Plan – Stage 4 Rev. 3.

Experts involved - Mr. Adrian Caneris (AC) Fauna; Mr. Simon McNeilage (SM) Fauna & Koala; and Ms. Lynn Roberts (LR) Koala, Dr William Ellis (WE) Koala

POINTS OF AGREEMENT

1. Present conservation status of the Koala in South East Queensland

- 1.1. Koalas are listed as Vulnerable in South East Queensland under the *Nature Conservation Act 1994*.
- 1.2. Koalas have been recognised as 'endangered' within the Koala Coast Region in Redlands Koala Policy 2008.
- 1.3. We understand that the Court will have regard to both the SEQ Regional Plan Interim Guideline: Koalas and Development (the Koala Guidelines), as well as the Nature Conservation (Koala) Plan 2006 and Management Program 2006-2016 (the Koala Plan). These matters will be further considered through discussions between LR, SM and WE, in their individual reports, and informed through consultation with relevant EPA officers.
- 1.4. The quarry site is centrally located in the Koala Conservation Area designated under both the Interim Guideline and the Koala Plan.
- 1.5. Koala Coast Surveys 2005-2006 reported population declines of 26%, and we agree that this decline appears to be continuing based on advice from the EPA.
- 1.6. The next ten to fifteen years will be crucial to the survival of koalas in the Koala Coast. Habitat loss is considered to be the main cause of declining populations.



2ND FAUNA EXPERTS AGREEMENT
IN REGARD TO P&E COURT APPEAL 1585 OF 2007



1.7. The proposed quarry development is likely to result in a decline in the numbers of koalas on site in the first 15 years of operation. While the mitigation efforts that are proposed are likely to have long term benefits, the initial onsite decline in koala numbers shown in the graph in "Development Proposal Report, Section 9.4 (Koala Habitat Assessment): Estimated Koala Numbers Over Time" is recognised.

2. Connectivity

2.1. The site's relationship to likely regional and local fauna movement patterns (including Koala) is illustrated on the figure in Attachment 1 titled "Fauna Movement Corridors" (prepared by BAAM).

2.2. The proposed quarry development is likely to impede koala movement.

3. Rehabilitation and Revegetation

3.1. The quarry proposal will permanently remove some 50 hectares of existing and potentially valuable koala habitat.

3.2. Vegetation removal for each Stage of the proposed development will result in habitat loss, which must be offset by compensatory plantings to generate replacement habitat that will exceed in extant value that habitat removed. It is recognised that those compensatory plantings have already commenced, in part, and that natural regeneration has also commenced.

3.3. The compensatory plantings must be managed to ensure their successful growth.

3.4. If the development is to proceed, every effort should be made to establish koala habitat as quickly as possible

3.5. For Stage 1 of the proposed development it is recognised that while ultimately habitat and riparian revegetation (including specific koala habitat requirements under the koala planning documents referred to in point 1.3 above and the Redland Planning Scheme) must be verified to be equivalent to and adequately compensate for the loss of habitat that will result from that Stage of development this may not be fully achieved in the short term. We therefore recommend that verification of successful and required revegetation for Stage 1 is undertaken both after five years of operations and at the completion of Stage 1. Development of any type should not proceed for Stage 2 until it can be verified that replacement habitat is equivalent to and adequately compensates for the loss of habitat that will result from all of the Stage 1 development. That verification must be undertaken by a suitably qualified and experienced person. In addition, there should be strong incentives for the applicant to ensure that the rehabilitation is well underway at the end of the first five years of operation in Stage 1.



- 3.6. For Stages 2, 3 and 4 habitat and riparian revegetation (including specific koala habitat requirements under the koala planning documents referred to in point 1.3 above and the Redland Planning Scheme) must be verified to be equivalent to and adequately compensate for the loss of habitat that will result from that Stage of development (and must not include revegetation from previous stages) before any clearing or ground disturbance can take place for the next Stage. That verification must be undertaken by a suitably qualified and experienced person.
- 3.7. The compensatory plantings must be protected from predation by wallabies.
- 3.8. The revegetation and natural regeneration should proceed as quickly as possible but be informed by research outcomes from research plots (as described in the Habitat Management Plan) as they become available.

4. Other Koala Issues

- 4.1. It is agreed that the internal access road from the existing quarry to the proposed quarry should avoid if possible, the three large Eucalypts in the vicinity. However, there should be a precautionary offset to allow for possible impacts on all of these trees. That offset should fully compensate for the three trees.
- 4.2. Monitoring of koalas should be undertaken to better understand the relationship between rehabilitation works and movement requirements. It is noted that this may be undertaken by site-specific studies or through a contribution to a broader regional study if suitable studies can be identified.
- 4.3. Although no definitive studies have been identified, it is possible that dust deposits on koala food trees may affect selection and / or palatability of such leaves to koalas. Additionally there may be other effects such as increased tooth wear from abrasion by dust particles on leaf. Koalas are present on site near the pit, and koalas are known to inhabit areas of high dust deposition.
- 4.4. The long term and short term effects of the noise from the operations, such as blasting, on koala are unknown.
- 4.5. Traffic impacts on koalas external to the site have been minimised by restricting truck movements to daylight hours. There are likely to be 30 deliveries per annum between 7pm and 5am. Koalas are known to be road victims during the day as well as at night.
- 4.6. Exclusion fencing has been proposed to keep fauna from potential danger (e.g. the edges of the quarry pit) and security fencing is



proposed in other locations. The effects of all fencing on fauna, especially kolas, must be considered.


POINTS OF DISAGREEMENT

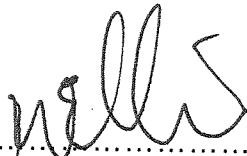
- 1.1. The habitat offsets required for each stage of the development will be considered in individual reports.
- 1.2. If the proposal is to proceed, it is critical to mitigate any impediments to connectivity. SM and WE say this will be best addressed by detailed design to ensure infrastructure (including roads, water treatment areas, embankments and structures) do not unnecessarily impede movement, the establishment of compensatory habitat within the site, speed control of vehicles, ongoing education of all people accessing the site, installation of the conveyor belt above the ground, properly designed fencing, prohibition of dogs from the site, and the maintenance of linkages to areas beyond the site. AC says these matters are addressed in the draft habitat management plan and recommended conditions. LR and SM note that the water treatment ponds and filtration system must be designed to allow for fauna movement, but would still impede fauna movement to some extent depending on final arrangements.

Dated 18 December 2008


.....
Mr. Adrian Caneriš (AC)


.....
Mr. Simon McNeilage (SM)


.....
Ms. Lynn Roberts (LR)


.....
Dr William Ellis (WE)



Attachment 1.14

Economic Need Assessment

ECONOMIC NEED ASSESSMENT
~
**PROPOSED QUARRY EXTENSION,
MT COTTON**

Prepared For:
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DISCLAIMER

This Report has been prepared solely for the purposes recorded at Section 1 of the Report and solely for the benefit of the party to whom the report is addressed. No third party is entitled to rely upon this Report for any purpose without the written consent of Leyshon Consulting Pty Ltd having first been sought and obtained.

This Report involves the making of future projections. Those projections are grounded upon the facts and matters contained in this Report. Some or all of those facts and matters comprise assumptions and/or representations upon which Leyshon Consulting Pty Ltd has relied but about which it has no knowledge of its own. By reason of this, Leyshon Consulting Pty Ltd cannot warrant or represent the correctness or accuracy of such assumptions and/or representations. It follows that, while the projections contained in this Report are made with care and judgment, Leyshon Consulting Pty Ltd cannot confirm, warrant or guarantee that actual results achieved will be consistent with the results projected by this Report.



1 INTRODUCTION

1.1 Background

This Report has been prepared by Leyshon Consulting Pty Ltd for Barro Group Pty Ltd. The Report addresses the issue of whether there is an economic need for the proposed development.

In preparing this Report we have inspected the subject quarry, reviewed reports submitted as part of a previous development application to Redland City Council (Council) and undertaken research with respect to the demand for material produced by quarries in South East Queensland in general and Redland City in particular.

2

EXISTING OPERATIONS

The Barro Group operate a quarry at Mount Cotton which has been in existence since the 1960s. At present the Barro quarry extracts quartzite-based materials which it supplies to the construction and civil engineering industries in Redland City and surrounding areas.

We also understand that the reserves in Stage 5 of the quarry are nearing exhaustion. Barro has identified a reserve of quartzite material and meta-greywacke on adjoining land. Access to these reserves would extend the life of its quarry for approximately another 40 years depending on the rate of extraction.

The current quarrying operation has produced some 500,000 tonnes of quarry product per annum. The material produced by the quarry includes:

- ▶ crushed rock road base and sub-base pavement materials
- ▶ concrete aggregates
- ▶ other products used in civil engineering including bedding materials, erosion control rock, processed landscape materials and drainage media.

The quarry has employed up to 15 full-time staff and up to 50 additional staff on a part-time or contract basis.

The primary markets for the product produced by the existing Barro quarry are Redland, Logan City, the northern part of the Gold Coast, Ipswich and the Brisbane metropolitan area.

There are two significant quarries in Redland City. One being the Barro quarry and the nearby major quarry operated by the Karreman Group. We understand in 2007 Council approved an expansion of production at the Karreman quarry by some 2,000,000 tonnes per annum. This approval will enable the quarry ultimately to produce some 4,000,000 tonnes of product per annum.

We note that in consenting to the expansion of the Karreman quarry Council accepted there was a need for additional output of quarry materials at the existing facility.

We understand there are two smaller quarries in Redland which are operated by Council and "Red Barry". These quarries only operate on an intermittent basis, however.

3 DEMAND ANALYSIS

3.1 Introduction

The demand for quarrying materials in broad terms is directly related to population growth and urban development. It is generally accepted that the demand for quarry-related products has been growing on a per capita basis in South-East Queensland (and other areas) over the past decade. This is due to the increasing sophistication of infrastructure and improvements in the quality of urban development. Both of these factors have increased demand for quarry materials for use in civil engineering projects, land subdivision and residential and commercial construction.

Estimates produced by the Institute of Quarrying Australia in 2007 suggest the per capita demand for quarry materials varies substantially across the nation. For instance, Queensland is estimated to have the highest rate of usage of some 10 tonnes per capita. Tasmania meanwhile is estimated to have much lower demand of around six tonnes per capita.

The primary reason Queensland has a per capita usage rate substantially above that of other states is due to the significant development of infrastructure in South-East Queensland in particular and Queensland in general during the past one to two decades. This, combined with high population growth, has increased the demand for quarry material in Queensland to levels well above those evident in the rest of Australia.

3.2 Population Growth

As previously noted, Barro’s quarry at Mount Cotton principally supplies Redland City and adjoining areas which form part of South-East Queensland. In 2006 the estimated residential population of this area was some 2,705,705 persons. The population of the principal markets serviced by Barro (Brisbane, Gold Coast, Ipswich, Logan and Redland) in 2006 was some 1,952,279 persons.

Recent projections prepared by the Queensland Department of Infrastructure and Planning (Planning Information and Forecasting Unit [PIFU]) indicate relatively strong population growth in South-East Queensland is forecast to continue up to 2031.

As indicated in TABLE 3.1, the estimated resident population of South-East Queensland is projected to increase from 2.7 million to 4.2 million between 2006-31. During this period the average annual rate of growth is estimated at +1.8% per annum, slightly above the estimated rate for Queensland as whole of +1.7%.

TABLE 3.1
ESTIMATED RESIDENT POPULATION (ERP) and PROJECTED RESIDENT POPULATION (MEDIUM SERIES) – QUEENSLAND STATISTICAL DIVISIONS, 2006-31 (No. Persons)

Statistical Division	ERP	Medium Series – Projected Resident Population				
	2006	2011	2016	2021	2026	2031
Brisbane	1, 857,813	2,047,123	2,254,253	2,447,462	2, 625,471	2,793,164
Gold Coast	466,433	542,145	615,571	681,447	737,986	788,231
Sunshine Coast	295,084	339,663	381,458	421,343	460,862	501,179
West Moreton	86,375	97,981	112,494	127,886	144,198	161,263
South East Queensland ¹	2, 705,705	3,026,913	3,363,775	3,678,138	3, 968,518	4,243,837

Note1: Brisbane, Gold Coast, Sunshine Coast and West Moreton Statistical Divisions.

Source: PIFU, Department of Infrastructure and Planning 2008.

The population growth forecast for South-East Queensland is equivalent to an annual increase of 61,525 persons during the 25 year period to 2031. During this period, PIFU forecast that the population of Redland City will increase from 131,210 in 2006 to 188,878 in 2031—growth of +57,668 persons at an average of +1.5% per annum.

3.3 Demand for Quarry Products

3.3.1 Per Capita Demand

Utilising the PIFU forecasts of population growth detailed above, an estimate has been prepared of the potential future demand for quarry products in Brisbane, Gold Coast, Ipswich, Logan and Redland.

As indicated in TABLE 3.2, the population of this area is projected by PIFU to increase from approximately two million people in 2006 to 3.1 million in 2031—growth of approximately +1.1 million persons.

TABLE 3.2
ESTIMATED DEMAND for QUARRY PRODUCTS – SELECTED AREAS of SOUTH-EAST QUEENSLAND, 2006-31 (Tonnes Million Per Annum)

Factor ...	2006	2011	2016	2021	2026	2031	2006-31
Area Population (No.)							
Brisbane City	991,260	1,070,300	1,141,558	1,185,620	1,208,295	1,220,543	–
Gold Coast	466,433	542,145	615,571	681,447	737,986	788,231	–
Ipswich	142,200	169,653	215,784	275,328	350,333	434,788	–
Logan	260,081	285,566	316,866	351,382	386,962	425,918	–
Redland	131,210	144,656	157,899	170,976	181,688	188,878	–
Total	1,991,184	2,212,320	2,447,678	2,664,753	2,865,264	3,058,358	–
Increase in Population (No.)							
Brisbane City	–	79,040	71,258	44,062	22,675	12,248	229,283
Gold Coast	–	75,712	73,426	65,876	56,539	50,245	321,798
Ipswich	–	27,453	46,131	59,544	75,005	84,455	292,588

TABLE 3.2
ESTIMATED DEMAND for QUARRY PRODUCTS – SELECTED AREAS of SOUTH-EAST QUEENSLAND,
2006-31 (Tonnes Million Per Annum)

Factor ...	2006	2011	2016	2021	2026	2031	2006-31
Logan	–	25,485	31,300	34,516	35,580	38,956	165,837
Redland	–	13,446	13,243	13,077	10,712	7,190	57,668
Total	–	221,136	235,358	217,075	200,511	193,094	1,067,174
Demand for Quarry Products (Tonnes Million Per Annum)							
Brisbane City	9.9	10.7	11.4	11.9	12.1	12.2	–
Gold Coast	4.7	5.4	6.2	6.8	7.4	7.9	–
Ipswich	1.4	1.7	2.2	2.8	3.5	4.3	–
Logan	2.6	2.9	3.2	3.5	3.9	4.3	–
Redland	1.3	1.4	1.6	1.7	1.8	1.9	–
Total	19.9	22.1	24.5	26.6	28.7	30.6	–
Increase (Tonnes Million Per Annum)							
Brisbane City	–	0.8	0.7	0.4	0.2	0.1	2.3
Gold Coast	–	0.8	0.7	0.7	0.6	0.5	3.2
Ipswich	–	0.3	0.5	0.6	0.8	0.8	2.9
Logan	–	0.3	0.3	0.3	0.4	0.4	1.7
Redland	–	0.1	0.1	0.1	0.1	0.1	0.6
Total	–	2.2	2.4	2.2	2.0	1.9	10.7

Sources: PIFU and Leyshon Consulting Estimates, December 2008.

In summary, we project the demand for quarry products will increase from approximately 19.9 million tonnes per annum in 2006 to 30.6 million tonnes per annum in 2031. In Redland City alone demand is projected to rise from 1.3 million tonnes per annum to 1.9 million tonnes per annum during the forecast time-frame.

Thus in total the region which is supplied by Barro is forecast to experience an increase of 10.7 million tonnes per annum or approximately 2.2 million tonnes per intercensal period (five years) during the forecast time-frame.

In broad terms, South-East Queensland will require at least 630 million tonnes of quarry product over the next 25 years based on an average demand of about 25.3 tonnes per annum during this period.

On the basis of the above projections, it is clear there will be a sustained and significant increase in demand for quarry product to service population growth, investment in infrastructure and property development in selected parts of South-East Queensland for the foreseeable future.

We understand that the estimates contained in TABLE 3.2 are broadly consistent with data set out in the Development Proposal report prepared for the Barro Mount Cotton Quarry Extension by Groundwork EMS Pty Ltd in April, 2006. That report provided data sourced from the then Queensland Department of Mines and Energy which published annual production statistics up to 2004.

In 2004 the Department estimated the production of aggregates in Brisbane, Gold Coast, Ipswich, Logan and Redland Local Government Areas (LGAs) to be as follows:

▶	broken rock	...	1,795,000 tonnes per annum
▶	crushed coarse aggregates	...	7,374,000
▶	crushed fine aggregates	...	3,124,000
▶	prepared road base and sub base	...	6,681,000
▶	Total	...	18,974,000.

3.3.2 Infrastructure Programs

A further perspective on the potential demand for quarry products can be obtained from spending forecasts contained in the *South-East Queensland Infrastructure Plan and Program* published by the

Department of Infrastructure and Planning in 2008 (hereafter the Infrastructure Plan). The Infrastructure Plan covers the period 2008-26.

The Infrastructure Plan identified spending of \$107 billion (\$2008) during the period 2008-26. Significant expenditure in regions proximate to Redland identified in the Plan included the following projects:

▶ Airport Link	...	\$3.4 billion
▶ Gateway Motorway upgrade Nudgee to Bruce Highway	...	\$2.6 billion
▶ Gateway Motorway upgrade Mount Gravatt – Capalaba Road to Pacific Motorway	...	\$1.1 billion
▶ Gateway Motorway upgrade Mount Gravatt – Capalaba Road to Nudgee Road including Gateway bridge duplication	...	\$1.9 billion
▶ Port of Brisbane Motorway	...	\$1.3 billion
▶ Cleveland Redland Bay Road upgrade	...	\$62.0 million
▶ Redland Sub-arterial Road upgrade Mount Gravatt – Capalaba Road to Tingalpa Creek	...	\$196.0 million
▶ South Eastern bus way – extension to Springwood	...	\$365.0 million
▶ Redland bus priority program	...	\$130.0 million
▶ Cleveland Rail corridor upgrades	...	\$180.0 million
▶ Port infrastructure	...	\$800.0 million
▶ Port land development	...	\$1.0 billion
▶ Pacific Motorway additional lanes and interchange upgrades	...	\$3.2 billion.

In addition, some \$7.8 billion was forecast to be spent on regional water infrastructure including completion of the Eastern and Southern Pipeline projects and the desalination facility on the Gold Coast. All of these projects consume quarry materials, in particular aggregates, as a basic input to the construction process.

Since the 2008 Infrastructure Plan was released, some of the projects noted above have been substantially progressed. Nevertheless, the majority of expenditure on the identified projects will occur between 2010-26.

Despite a slow-down in dwelling investment in Queensland in 2008-09 of -6.9%, there is no indication that the Global Financial Crisis (GFC) which became evident in late 2008 and early 2009 has significantly affected Government plans for future infrastructure spending in South East Queensland.

Continuing population growth in South East Queensland, based on continuing positive net interstate migration and an increasing level of net overseas migration, is almost certain to reverse the decline in dwelling investment in the period 2008-09 to 2010-11.

4

SUPPLY CONSIDERATIONS

4.1 Local Supply

A key characteristic of the quarrying sector is that the output of quarrying is expensive to transport because of its weight. In economic terms quarry product is one exhibiting relatively low value and high transportation costs relative to its value.

Accordingly, it is important that quarries be located close to markets. This is so costs for the construction industry are contained and environmental costs associated with transporting product from quarries to market areas are minimised.

As previously indicated, there are only two existing major hard rock quarries in Redland City, namely:

- ▶ Karreman at Mount Cotton West
- ▶ Barro at Mount Cotton.

In adjacent LGAs hard rock quarries are operated in the Gold Coast area by Boral (Ormeau and Stapylton), Fulton Hogan (Stapylton and Cedar Creek), Holcim (Beenleigh), Nucrush (Coomera), Hymix (Nerang) and Hanson (Wolffdene).

In the Brisbane region hard rock quarries exist at Ferny Grove (Hanson) and Mount Coot-tha (Brisbane City Council). The latter has limited output, however.

According to a listing of Queensland's Major Extractive Industry Operators prepared by the Department of Mining and Energy in 2007, there are no major producers of hard rock in Logan Shire.

In relation to the sources of supply in the City of Brisbane, all are located in areas to the west/north-west of the CBD such as Ferny Grove.

If the Barro proposal to extend its Mount Cotton facility is not approved the quarry's output will reduce and within three to four years the existing approved resource will be depleted. If this occurs then there will be only one well located major supplier of hard rock and aggregates in Redland City and the eastern part of Brisbane will exist—namely Karreman.

In our opinion (notwithstanding the influence of smaller operators), such an outcome effectively would confer monopoly powers on the Karreman quarry in terms of it being a major supplier in Redland City, parts of Logan and parts of the Brisbane area of hard rock and aggregates.

We consider such an outcome would not be advantageous as far as market competition and the containment of construction costs are concerned.

4.2 Regional Supply

We have also reviewed a report prepared by consultants GHD for the Industry Group Cement, Concrete and Aggregates Australia (CCAA) (*Availability of Extractive Resources in South East Queensland* dated July 2005).

We understand the GHD report was commissioned to estimate the extent of extractive resources available in South East Queensland following the introduction of new environmental policy and legislation. GHD identify that these legislative changes included the following:

- ▶ restrictions on vegetation clearing imposed by the Vegetation Management Act 1999;
- ▶ restrictions on development within designated koala management areas imposed by the Draft Nature Conservative (Koala) Conservation Plan 2005 and Management Plan 2005-15, and the State Planning Policy: Conservation of Koalas in South East Queensland; and
- ▶ Regional Vegetation Management Code for Ongoing Clearing Purposes: South East Queensland.

The GHD report classified land containing relevant extractive resources into four categories:

- ▶ **not developable** – no further development of extractive resources within areas as a consequence of the requirements of specific environmental legislation
- ▶ **development with restrictions** – extractive resource area able to be developed subject to environmental requirements outlined in the legislation
- ▶ **development requires a clearing permit** – all extractive resource areas that have mapped remnant vegetation on site

- ▶ **no development constraints** – extractive resource areas that have no environmental constraints in terms of the above legislation.

GHD estimated, taking into account infrastructure programs in South East Queensland, that by 2026 the total demand for aggregate is likely to be in the range of 650 to 700 million tonnes. If a high rate of population growth is maintained in South East Queensland, the demand for aggregates was estimated to be 710 million tonnes by 2026.

The estimated total extractive resource in South East Queensland is identified in Table 1, Section 2.3 of the GHD report as follows:

- ▶ total resource ... 1,680 million tonnes
- ▶ approved ... 832 million tonnes
- ▶ not approved ... 847 million tonnes.

GHD found that of the total identified stock of resource (both approved and not yet approved for extraction) only some 569 million tonnes of the identified resource stock was not subject to constraints.

Of the approved extractive resource available in South East Queensland (832 million tonnes) the following categories could be applied:

- ▶ not developable ... 435 million tonnes
- ▶ developable with restrictions ... 23 million tonnes
- ▶ permit required ... 33 million tonnes
- ▶ no constraints ... 341 million tonnes.

Thus by comparing the likely future maximum demand (710 million tonnes) with the approved resource available in South East Queensland

with no constraints (341 million tonnes), a notional shortfall over the period 2006-26 of 369 million tonnes is evident.

Even if the volume of “unconstrained” resource (both approved and unapproved – 569 million tonnes) is considered against the potential maximum demand (710 million tonnes), a shortfall of 141 million tonnes is projected.

The analysis drew GHD to conclude that in terms of the total resource (approved and not approved) in South East Queensland according to the demand forecasts discussed above, the available resource would be depleted by 2022. In terms of the approved amount of resource available without environmental constraints, this would be depleted by 2018.

No doubt there could be argument about the classification system utilised by GHD in their analysis of individual resources within South East Queensland. That said, the GHD report does in our opinion suggest a significant shortfall of available extractive resource is looming in South East Queensland of the type produced by Barro at its existing quarrying operation at Mount Cotton and in relation to its proposed extension of quarrying activities at Mount Cotton.

The introduction by the State Government, since the GHD analysis, of further restrictions on firstly development which adversely affects koala habitat and, secondly, on the clearing of regrowth native vegetation is likely to further constrain the development of quarry resources in South East Queensland.

The potential shortfall underlines the very significant economic need for the proposed development to meet identified regional demand for aggregates.

5

CONCLUSION

On the basis of the research reviewed in preparing this Report we conclude that:

- ▶ there is likely to be a sustained demand for quarry products in both Redland City and South-East Queensland in general over the period to at least 2031;
- ▶ the potential increase in the demand for aggregates in the period up to 2031 is estimated to be in the order of 10.7 million tonnes per annum;
- ▶ existing infrastructure spending (and the prospect of additional spending) will fuel sustained demand for quarry products in the construction sector in Redland and surrounding LGAs into the foreseeable future; and
- ▶ substantial economic advantages would flow from maintaining a competitive market in terms of major quarry producers in Redland City and surrounding LGAs
- ▶ there is clear evidence of emerging constraints which could result in the supply of aggregates in South East Queensland being depleted by 2018. These include constraints related to environmental and biodiversity issues as well as constraints related to the fragmentation of ownership of land and the like.

Given the above, we conclude there is a very significant economic need for the proposed development and that it should be approved.





NOISE IMPACT ASSESSMENT
MOUNT COTTON QUARRY EXTENSION
BARRO GROUP PTY LTD

Prepared for:
The Barro Group

Prepared by:
MWA Environmental

December 2010

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FIGURES**ATTACHMENTS**

1.0 INTRODUCTION

1.1 Purpose of Report

MWA Environmental has been engaged by The Barro Group to prepare a Noise Impact Assessment for the proposed extension of the existing Mt Cotton Quarry.

The report addresses the potential noise impact from the proposed quarrying activities on surrounding land uses with reference to the noise objectives specified in the Queensland EPA *Guideline – Noise – Planning for Noise Control*. Blast noise and vibration is assessed separately by others.

MWA Environmental (formerly trading as Max Winders & Associates Pty Ltd) prepared a noise impact assessment report for the previous development application by Barro for the proposed quarry extension. This report is included as **Attachment 1**.

The author (Mr Paul King of MWA Environmental) was engaged as a noise expert in Planning and Environment Court Appeal No BD3438 of 2007 related to a previous development application for essentially the same development. The noise modelling and assessment methodology applied for the current assessment is consistent with that agreed by the noise experts involved in Planning and Environment Court Appeal No BD3438 of 2007 (Mr Frits Kamst of ASK Consulting Engineers, Mr John Savery of Savery & Associates and Mr Russell Brown of Acoustics RB Pty Ltd).

The joint witness report which was concluded by the noise experts is included as **Attachment 2**.

1.2 Subject Site

The subject site is located at Mount Cotton and over Lot 162 on S31962, Lot 238 on SP218968, Lot 370 on S311071 and Lots 1 and 17 on RP108970. It is understood the development application also includes the unformed road bisecting and adjoining Lot 17, Lot 370 and Lot 162 and that part of Greenhide (California) Creek located between Lot 238 and Lot 162, although no physical works are proposed in these areas.

The site is located approximately 36 kilometres southeast of the Brisbane CBD.

The location of the subject site is shown on **Figure 1**.

An aerial photograph of the subject site and surrounding area, including nominated surrounding residences, is included as **Figure 2**.

1.3 Proposed Development

It is proposed to extend current quarrying activities onto Lot 238 on S31474 and Lot 370 on S311071 to access meta-greywacke source rock. The primary crushing and secondary crushing are proposed to be undertaken at a shielded location on Lot 162 on S31962. Crushed material will then be

transported via conveyor to new processing plant to be located on Lot 17 on RP108970. Processed materials will be stockpiled on Lot 17 on RP108970.

Site vehicular access is proposed to remain generally in the location of the existing entrance to Mount Cotton Road.

The proposed extension is to extend the life of the quarry and exploit the available resource. Annual production rates fluctuate as they are determined by market demand.

This assessment has been based upon the proposed maximum annual production rate of 1 million tonnes per annum.

It is proposed to locate the primary crushing and conveyor loading area within an excavated area to maximise topographic shielding. Furthermore, the tip head and crushing plant are to be partially enclosed as a noise control measure. Crushed material will be transported to the main processing plant by conveyor, minimising noise emissions from internal haulage of crushed rock.

The existing concrete batching plant, with partially enclosed batching point, will be retained on Lot 17 on RP108970.

As currently occurs, the quarry is proposed to operate between the hours 6:30am to 6:00pm Monday to Friday and 6:30am to 4:00pm Saturday. The concrete batching plant is proposed to operate the same hours. Maintenance of plant and equipment may occur during the periods 6:00am to 8:00pm Monday to Friday and 6:30am to 5:00pm Saturday.

The progressive development stages of the quarry are shown on the Groundwork Plus drawings included in **Attachment 3**.

1.4 Surrounding Land Uses

Surrounding land uses are shown on the aerial photograph included as **Figure 2**.

Surrounding land uses comprise:

To the north	Rural residential, poultry processing and growing
To the west	Rural residential, Forest
To the south	Rural residential, MG Car Club, Driver Training Centre
To the east	Rural residential, Mount Cotton Road

Selected existing residential dwellings in the locality are marked on **Figure 2** as Residences 1 to 32. Other surrounding residences are also shown on the aerial photograph.

2.0 NOISE IMPACT ASSESSMENT

2.1 Ambient Noise Levels

To characterise the ambient noise levels at the locality, previous noise datalogging was conducted with a noise datalogger located adjacent to Gramzow Road West on the southern site boundary (Noise Datalogger Location A) for the period 24 August to 2 September 2006. The monitoring location was well separated and topographically shielded from the existing activities on the subject site and is thus considered representative of the ambient noise environment at the residences to the south and west of the subject site.

The residences to the east of the subject site, adjacent to Mount Cotton Road, experience higher ambient noise levels due to Mount Cotton Road traffic and proximity to denser residential development. The ambient noise environment at the residences to the east of the subject site is more appropriately represented by previous long-term noise monitoring undertaken to the east of the subject site. A noise datalogger was located approximately 70 metres to the east of Mount Cotton Road on Lot 1 on RP123227 (Noise Datalogger Location B) for the period 7 to 9 September 2004. This monitoring location is considered to be representative of the ambient noise environment at the residences to the east of the subject site.

With due regard to recent inspections of the general locality of the site and surrounds it is considered that the ambient noise environment has not significantly changed since noise datalogging was conducted and that the recorded noise measurements are suitable for application of noise criteria.

The noise datalogger locations are shown on **Figure 2**.

Table 1 below provides the minimum, maximum and average statistical noise levels recorded at Noise Datalogger Location A.

**Table 1: Recorded Range of Ambient Noise Levels – dB(A)
Datalogger Location A
24 August to 2 September 2006 – 15-Minute Samples**

PARAMETER	PERIOD	RECORDED NOISE LEVELS - dBA		
		MINIMUM	MAXIMUM	AVERAGE
L ₁	Daytime (7am-6pm)	46.4	79.3	55.0
	Evening (6pm-10pm)	38.0	61.8	48.0
	Nighttime (10pm-7am)	33.9	65.4	46.3
L ₁₀	Daytime (7am-6pm)	42.3	74.6	48.6
	Evening (6pm-10pm)	35.7	57.9	43.0
	Nighttime (10pm-7am)	29.5	63.1	40.2
L ₉₀	Daytime (7am-6pm)	33.6	51.2	39.5
	Evening (6pm-10pm)	32.1	51.5	39.0
	Nighttime (10pm-7am)	25.9	51.8	34.9
L _{eq}	Daytime (7am-6pm)	39.6	69.6	46.2
	Evening (6pm-10pm)	34.7	54.1	41.8
	Nighttime (10pm-7am)	28.4	58.7	38.8

The key statistical noise level parameters recorded at Noise Datalogger Location A included:

Average Recorded L_{90} 6am to 7am	=	41.0 dB(A)
Average Recorded L_{90} 7am to 6pm	=	39.5 dB(A)
Average Recorded L_{90} 6pm to 10pm	=	39.0 dB(A)
Average Recorded L_{90} 6pm to 8pm	=	40.2 dB(A)
Average Recorded L_{10} 6am to 7am	=	49.7 dB(A)
Average Recorded L_{10} 7am to 6pm	=	48.6 dB(A)
Average Recorded L_{10} 6pm to 8pm	=	45.4 dB(A)

The complete results from Noise Datalogger Location A are presented as a trace of noise level versus time for the statistical noise level descriptors L_1 , L_{10} , L_{90} and L_{eq} in **Attachment 4**.

Table 2 below provides the minimum, maximum and average statistical noise levels recorded at Noise Datalogger Location B.

**Table 2: Recorded Range of Ambient Noise Levels – dB(A)
Datalogger Location B
7 to 9 September 2004 – 15-Minute Samples**

PARAMETER	PERIOD	RECORDED NOISE LEVELS - dBA		
		MINIMUM	MAXIMUM	AVERAGE
L_1	Daytime (7am-6pm)	57.0	72.5	60.0
	Evening (6pm-10pm)	52.0	58.5	55.6
	Nighttime (10pm-7am)	46.0	65.0	55.3
L_{10}	Daytime (7am-6pm)	53.5	58.5	55.5
	Evening (6pm-10pm)	49.5	55.0	51.9
	Nighttime (10pm-7am)	36.0	59.5	48.6
L_{90}	Daytime (7am-6pm)	40.0	53.0	45.5
	Evening (6pm-10pm)	34.5	45.5	39.2
	Nighttime (10pm-7am)	30.0	51.5	37.7
L_{eq}	Daytime (7am-6pm)	50.5	58.5	52.4
	Evening (6pm-10pm)	44.5	51.5	47.9
	Nighttime (10pm-7am)	34.5	56.5	45.6

The key statistical noise level parameters recorded at Noise Datalogger Location B included:

Average Recorded L_{90} 6am to 7am	=	48.8 dB(A)
Average Recorded L_{90} 7am to 6pm	=	45.5 dB(A)
Average Recorded L_{90} 6pm to 10pm	=	39.2 dB(A)
Average Recorded L_{90} 6pm to 8pm	=	40.9 dB(A)
Average Recorded L_{10} 6am to 7am	=	57.6 dB(A)
Average Recorded L_{10} 7am to 6pm	=	55.5 dB(A)
Average Recorded L_{10} 6pm to 8pm	=	53.1 dB(A)

The complete results from Noise Datalogger Location B are presented as a trace of noise level versus time for the statistical noise level descriptors L_1 , L_{10} , L_{90} and L_{eq} in **Attachment 5**.

In addition to the above long-term noise datalogging, short-term noise measurements were conducted at a range of residential locations in the locality on 28 September 2006. The short-term noise monitoring locations are shown on **Figure 2**. The results of the short-term noise monitoring are provided in **Table 3** below.

Table 3: Recorded Short-Term Noise Levels – dB(A)

#	LOCATION	TIME	RECORDED STATISTICAL NOISE LEVEL - dB(A)					COMMENTS
			L_1	L_{10}	L_{50}	L_{90}	L_{eq}	
1	Quarry access road (70m to Mt Cotton Rd)	1355 – 1405	76.0	59.1	55.1	52.5	62.5	Traffic on Mt Cotton Rd, some traffic on quarry road, no quarry noise audible
2	Orchid Drive (60m to Mt Cotton Rd)	1420 – 1430	63.3	59.9	56.6	52.6	57.4	Traffic on Mt Cotton Rd, no quarry noise audible
3	Gramzow Road (southern site boundary)	1440 – 1450	53.6	51.2	47.0	44.9	48.6	Distant traffic noise, wind noise, no quarry noise audible
4	West Mt Cotton Rd (15m to road)	1500 - 1510	65.1	53.1	46.8	43.5	52.3	Some West Mt Cotton Rd traffic noise, no quarry noise

2.2 Noise Criteria

The Queensland EPA *Guideline – Noise – Planning for Noise Control* provides methods for the determination of the appropriate noise criteria to be applied to the assessment of proposed industrial developments affecting sensitive land uses.

The first step in setting the appropriate noise criteria for a new development is to calculate the Specific Noise Level, or component level $L_{Aeq,1hour}$, as per the following equation:

$$L_{Aeq,1hour} = \min L_{A90,1hour} + 3 \text{ dB(A)}$$

where $\min L_{A90,1hour}$ is the Rating Background Level, being the median of the Assessment Background Levels for each monitoring period.

and the Assessment Background Level is defined as the 10th percentile 1 hour average background noise level for a monitoring period.

As part of the previous development application and the ensuing Court proceedings, the author was involved in meetings between the noise experts for the appeal. As part of the experts' assessment, noise monitoring data was

obtained for locations to the west, south and east of the quarry lands to determine ambient noise levels from long term noise logging, representative of the existing residences. The noise monitoring data has been used to determine the Rating Background Level for 4 locations being:

- **West** of the quarry – residences on West Mt Cotton Road
- **South** of the quarry – residences on Gramzow Road
- **Southeast** of the quarry – residences on Mt Cotton Road – south of existing quarry
- **East/northeast** of the quarry – residences on Mt Cotton Road – east of existing quarry.

The following Table outlines the noise limits determined for each of the above localities using the methodology of the Ecoaccess – Planning for Noise Control Guideline. The noise limits have been adopted for the proposed quarrying hours of 6.30am to 6.00pm.

Location	Time Period	Daily RBL	PFNCG Adjustments			Noise Limit as Component Leq	Area Description
			Table 1	Table 2 adj	Table 2 Res	PNL	
	Mon to Sat	Median (measured)					
1. West - West Mt Cotton Rd	Day	29	40	5	34	37	Rural residential
2. South - Gramzow Road	Day	33	40	5	38	41	Rural residential
3. Southeast Mt Cotton Rd	Day	40	45	-2	43	46	Residential area on a busy road
4 East - Mt Cotton Road	Day	42	45	-3	42	45	Residential area on a busy road

As such, it is considered that the following noise limits are appropriate for the assessment of potential noise amenity impacts from the proposed quarrying at the surrounding sensitive land uses:

ADOPTED NOISE CRITERIA

Sensitive Land Uses to West:	37 dB(A)
Sensitive Land Uses to South:	41 dB(A)
Sensitive Land Uses to Southeast:	46 dB(A)
Sensitive Land Uses to East/northeast:	45 dB(A)

2.3 Noise Level Predictions

2.3.1 Methodology

To enable assessment of noise from the proposed extended quarrying operations, a detailed noise model has been established using the SoundPLAN 7.0 software applying the ISO9613 standard. This model is an accepted regulatory model that allows input of terrain specific data and source noise data as sound power level spectra.

The noise modelling undertaken considered meteorological conditions as per the methodology of the ISO9613 standard, with a temperature of 21 degrees Celsius and 70% humidity, a temperature inversion and the following wind conditions as per the worst-case assumptions of ISO9613:

Downwind propagation conditions for the method specified in this part of ISO 9613 are as specified in 5.4.3.3 of ISO 1996-2:1987, namely

- wind direction within an angle of $\pm 45^\circ$ of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region, with the wind blowing from source to receiver, and
- wind speed between approximately 1 m/s and 5 m/s, measured at a height of 3 m to 11 m above the ground.

As such, given the above assumptions, there is little potential for atypical meteorological conditions to cause resultant noise levels at residences to exceed those predicted in the modelling.

The SoundPLAN 7.0 model has been setup to represent noise emissions from each of the nominated quarrying Stages 1 to 4 as per the Groundwork Plus drawings included as **Attachment 3**. Additionally, an Initial Establishment phase model has been prepared which includes the existing quarry plant noise sources and mobile machinery at the quarry expansion site undertaking preparatory earthworks prior to quarrying commencement in the new pit. As an example, the Stage 1 model layout and the source locations are shown on the drawings included in **Attachment 6**.

The sources used in the SoundPLAN 7.0 model were as per the following **Table 4**. Source noise data for the noise sources was derived from measurements conducted by MWA Environmental at the existing quarry and at similar operations. The source noise data is provided in **Attachment 6**.

Table 4: Noise Sources Used in SoundPLAN 7.0 Modelling

LOCATION	NOISE SOURCES	INITIAL ESTABLISHMENT MODEL	STAGE 1B MODEL	STAGE 2 MODEL	STAGE 3 MODEL	STAGE 4 MODEL
		Source Used in Model Scenario (Yes)				
Existing Processing Plant	Primary Crusher	Yes				
	Secondary Crusher	Yes				
	Tertiary Crusher	Yes				
	Screen 1	Yes				
	Screen 2	Yes				
Future Processing Plant	Primary Crusher Enclosed		Yes	Yes	Yes	Yes
	Secondary Crusher Enclosed		Yes	Yes	Yes	Yes
	Tertiary Crusher Enclosed		Yes	Yes	Yes	Yes
	Quaternary Crusher Enclosed		Yes	Yes	Yes	Yes
	Conveyor Motors		Yes	Yes	Yes	Yes
	Screen 1 Enclosed		Yes	Yes	Yes	Yes
	Screen 2 Enclosed		Yes	Yes	Yes	Yes
	Screen 3 Enclosed		Yes	Yes	Yes	Yes
	Screen 4 Enclosed		Yes	Yes	Yes	Yes
	Screen 5 Enclosed		Yes	Yes	Yes	Yes
Screen 6 Enclosed		Yes	Yes	Yes	Yes	
Mobile Equipment	Rock Drills		Yes	Yes	Yes	Yes
	Haul Trucks	Yes	Yes	Yes	Yes	Yes
	Road Trucks	Yes	Yes	Yes	Yes	Yes
	Loading Trucks	Yes	Yes	Yes	Yes	Yes
	Excavator	Yes				
	Dozer	Yes				
Batching Plant	Agitator Truck at Slump Stand	Yes	Yes	Yes	Yes	Yes
	Agitator Truck at Washout Pit	Yes	Yes	Yes	Yes	Yes
	Bag Filter Fans	Yes	Yes	Yes	Yes	Yes
	Partially enclosed Loading of Agitator Truck at Batching Point	Yes	Yes	Yes	Yes	Yes

The modelling considered the resultant noise levels at the surrounding residences with all noise sources above operating simultaneously for each of the modelled stages. The receptor heights applied to the modelling were 1.8 and 4.5 metres above ground level for ground level and upper level receivers respectively.

For each Stage, the modelling has considered two scenarios of differing rock drill locations. The rock drill sources have been located on the western and southern benches for each stage. Results of modelling for each scenario are provided in the below section.

Although the above noise sources are considered to represent typical noise emissions from the operation of the proposed quarry and concrete batching plant it is unlikely that all modelled sources would be operating simultaneously in practice. Other plant items and vehicles may be required to be used at the quarry at times but should not increase overall noise emissions above the level of the above modelled noise sources.

The model was established over an area of 5km by 5km metres surrounding the site. Topographical contours for the surrounding area were taken from the Department of Lands Topographic Image Maps *Capalaba 9542-41* and *Beenleigh 9542-42*. Current topography for the subject site and for proposed future quarry development was taken from Groundwork Plus drawings.

2.3.2 Results of Modelling

Modelling of the proposed future quarrying activities, including the processing plant, demonstrates that in order to satisfy the regulatory noise limits at the surrounding sensitive land uses it shall be necessary to incorporate a range of noise control measures. The recommended noise control measures are:

- All new processing plant should achieve modern industry best practice;
- Provide enclosure or partial enclosure to primary, secondary, tertiary and quaternary crushers to achieve approximately 5dB noise reduction;
- Provide enclosure or partial enclosure to Screen 1, Screen 2, Screen 3, Screen 4, Screen 5 and Screen 6 to achieve approximately 8dB noise reduction;
- Provide 2 dB(A) noise attenuation for loading trucks by provision of modern loaders with residential grade exhaust silencer as compared to standard silencer;
- Partially enclosed loading agitator truck at batching point as presently exists;
- When rock drilling is required in exposed locations use quietened rock drill or alternative drilling technology achieving maximum 111 dB(A) Sound Power Level. Potential quietening measures may include residential grade acoustic silencer, engine hush kit and/or enclosure of the drill mast or use alternative methods such as down the hole drilling;
- Planning measures to conduct rock drilling within rebated benches (i.e. wall(s) between drill and residential areas) to minimise noise transmission towards the west and south;
- In addition to the rebated benches for rock drilling, provision of acoustic screens will be required to the southern and eastern edges of the proposed extraction area;
- Before any rock drilling commences for Stage 1, the following acoustic screens, also shown graphically on **Figure 3**, are required:

- o Minimum 6 metre high acoustic screen along the southern edge of the extraction area; and,
- o Minimum 4 metre high acoustic screen along the southern part of the eastern edge of the extraction area.

The results of the future SoundPLAN 7.0 modelling considering the above noise control measures are provided as contours of predicted resultant noise levels on a cadastral base showing the locations of the surrounding residences (Residences 1 to 32 - refer **Figure 2**). The results are included as **Attachment 7**.

The modelling results for the Stage 1a initial establishment phase are included in **Attachment 8**. The initial establishment works are considered to be building works and would be assessed under Section 440R of the Environmental Protection Act 1994. This section places no numerical noise limits on construction activities provided they are conducted between the time period 6.30am to 6.30pm Monday to Saturday. The construction works for Stage 1a will be scheduled to occur within this timeframe.

The predicted resultant noise levels from the various quarrying stages at the nominated surrounding residences are summarised in **Tables 5** and **6** below.

**Table 5: Summary of Model Results for Nominated Sensitive Receptors
Ground Level – dB(A)**

SURROUNDING RECEPTOR	GROUND LEVEL PREDICTED RESULTANT NOISE LEVEL - Leq - dB(A) NORMAL OPERATION - WITH ROCK DRILL								CRITERION NOISE LEVEL - Leq - dB(A)
	STAGE 1B Rock Drill to West	STAGE 1B Rock Drill to South	STAGE 2 Rock Drill to West	STAGE 2 Rock Drill to South	STAGE 3 Rock Drill to West	STAGE 3 Rock Drill to South	STAGE 4 Rock Drill to West	STAGE 4 Rock Drill to South	
1	34	34	35	34	34	35	34	36	37
2	33	34	34	34	34	34	34	36	37
3	31	33	33	32	29	32	31	34	37
4	30	32	31	31	30	30	32	30	41
5	32	33	34	32	31	30	33	31	41
6	38	38	39	38	37	37	38	37	41
7	35	34	35	34	33	33	35	34	41
8	35	35	36	34	35	35	35	34	41
9	40	41	41	40	40	41	40	40	41
10	40	41	40	39	39	39	38	39	41
11	36	37	36	36	35	36	36	36	41
12	35	36	36	35	35	36	35	35	41
13	31	30	32	30	30	30	31	30	41
14	31	31	31	30	30	30	30	29	41
15	41	41	41	41	41	41	41	41	45
16	41	41	41	41	41	41	41	41	45
17	42	42	41	41	42	41	41	41	45
18	41	41	41	41	41	41	41	41	45
19	41	41	41	41	41	41	41	41	45
20	41	41	41	41	40	40	40	40	45
21	34	34	34	34	35	34	34	34	46
22	36	36	36	36	36	36	36	36	46
23	32	32	32	32	32	32	32	32	46
24	31	31	31	31	31	31	31	31	46
25	36	36	35	35	35	35	35	35	45
26	41	41	41	41	41	41	41	41	45
27	36	36	36	36	36	36	36	36	45
28	37	37	37	37	37	37	37	37	45
29	35	35	35	35	35	35	35	35	46
30	34	34	34	34	34	34	33	33	46
31	34	34	34	34	34	33	34	34	46
32	41	41	41	41	41	41	41	41	45

**Table 6: Summary of Model Results for Nominated Sensitive Receptors
Upper Level – dB(A)**

SURROUNDING RECEPTOR	UPPER LEVEL PREDICTED RESULTANT NOISE LEVEL - Leq - dB(A) NORMAL OPERATION - WITH ROCK DRILL								CRITERION NOISE LEVEL - Leq - dB(A)
	STAGE 1B Rock Drill to West	STAGE 1B Rock Drill to South	STAGE 2 Rock Drill to West	STAGE 2 Rock Drill to South	STAGE 3 Rock Drill to West	STAGE 3 Rock Drill to South	STAGE 4 Rock Drill to West	STAGE 4 Rock Drill to South	
1	35	35	36	35	35	37	35	37	37
2	34	35	35	35	35	35	35	37	37
3	32	34	34	34	30	33	33	36	37
4	31	33	32	31	30	31	33	30	41
5	32	34	34	33	32	30	34	32	41
6	39	39	40	38	38	38	39	38	41
7	36	36	37	35	35	35	36	35	41
8	36	35	36	35	36	35	36	35	41
9	41	41	41	41	41	41	40	40	41
10	41	41	40	40	39	40	39	39	41
11	37	37	37	36	36	37	36	36	41
12	36	37	37	36	36	36	36	36	41
13	32	31	32	31	31	30	31	31	41
14	31	32	31	31	31	30	31	30	41
15	42	42	42	42	42	42	42	42	45
16	41	41	42	42	42	42	41	41	45
17	42	42	42	42	42	42	42	42	45
18	42	42	42	42	42	42	42	42	45
19	42	42	42	42	41	41	41	41	45
20	41	41	41	41	41	41	41	41	45
21	35	35	35	35	35	35	35	35	46
22	36	36	36	36	37	36	36	36	46
23	33	33	32	32	33	32	32	32	46
24	32	31	31	31	32	31	32	32	46
25	39	39	39	39	39	39	39	39	45
26	41	41	41	41	41	41	41	41	45
27	36	36	36	36	36	36	36	36	45
28	37	37	37	37	37	37	37	37	45
29	35	35	35	35	35	35	35	35	46
30	37	37	37	37	37	37	37	37	46
31	34	34	34	34	34	34	34	34	46
32	41	41	41	41	41	41	41	41	45

The results of the modelling indicate that for all proposed quarrying stages, with the provision of the noise control measures detailed above, the adopted noise criteria can be satisfied at both ground and upper levels of all surrounding residences.

Given the extensive range of noise sources modelled as operating simultaneously and the adverse meteorological conditions considered in the modelling, actual resultant noise levels from the proposed quarrying activities will generally be significantly below the levels detailed in **Tables 5 and 6** above.

In summary, detailed noise modelling has demonstrated that with the implementation of appropriate noise controls and management measures, the proposed staged quarrying activities can be undertaken without causing adverse noise amenity impacts at surrounding sensitive land uses.

2.4 Discussion of Results of Noise Modelling

The ambient noise monitoring and predictive computer noise modelling undertaken indicates that the proposed extended quarry can operate within the appropriate noise amenity standards.

In order to satisfy the regulatory noise limits under future quarrying conditions it will be necessary to implement a range of noise controls and management measures.

The recommended noise control measures are:

- All new processing plant should achieve modern industry best practice;
- Provide enclosure or partial enclosure to primary, secondary, tertiary and quaternary crushers to achieve approximately 5dB noise reduction;
- Provide enclosure or partial enclosure to Screen 1, Screen 2, Screen 3, Screen 4, Screen 5 and Screen 6 to achieve approximately 8dB noise reduction;
- Provide 2 dB(A) noise attenuation for loading trucks by provision of modern loaders with residential grade exhaust silencer as compared to standard silencer;
- Partially enclosed loading agitator truck at batching point as presently exists;
- When rock drilling is required in exposed locations use quietened rock drill or alternative drilling technology achieving maximum 111 dB(A) Sound Power Level. Potential quietening measures may include residential grade acoustic silencer, engine hush kit and/or enclosure of the drill mast or use alternative methods such as down the hole drilling;
- Planning measures to conduct rock drilling within rebated benches (i.e. wall(s) between drill and residential areas) to minimise noise transmission towards the west and south;
- In addition to the rebated benches for rock drilling, provision of acoustic screens will be required to the southern and eastern edges of the proposed extraction area;
- Before any rock drilling commences for Stage 1, the following acoustic screens, also shown graphically on **Figure 3**, are required:
 - Minimum 6 metre high acoustic screen along the southern edge of the extraction area; and,
 - Minimum 4 metre high acoustic screen along the southern part of the eastern edge of the extraction area.

The above noise controls measures will need to be designed and installed appropriately to ensure that the necessary noise reductions are achieved. Experience dictates that the recommended noise controls are feasible.

Acoustic design of the noise controls will form an integral part of the detailed design process for future quarrying development on the site.

2.5 After Hours Maintenance Noise

Maintenance of plant and equipment is proposed to occur within the period 6:00am to 8:00pm Monday to Friday and 6:30am to 5:00pm Saturday.

Scheduled maintenance at the quarry is generally conducted within normal operating hours (i.e. 6:30am to 6:00pm Monday to Friday and 6:30am to 4:00pm Saturday), with no potential to cause adverse noise impacts above the impact of general quarry operation (i.e. processing plant, site vehicles).

Occasional after hours maintenance will be required at the quarry during breakdown situations. This after hours repair work may occur during the morning (6:00am to 6:30am) and evening (6pm to 8pm) periods with limited maintenance staff.

As per the noise monitoring results detailed in **Section 2.2**, the appropriate noise criteria for after hours maintenance noise occurring during the period (6:00am to 8:00pm) are **37 dB(A)** at sensitive land uses to the west, **41 dB(A)** at sensitive land uses to the south, **45 dB(A)** at sensitive land uses to the northeast and **46 dB(A)** at sensitive land uses to the east and southeast.

The maintenance work outside of normal operating hours will typically involve only 2 to 3 staff members. As such, the after hours work conducted will not be intense or constant, but typically may involve the following tasks as required:

- *Repair of Equipment Failures, i.e.:*
 - electric motor repair (disassembly, replacement of parts, reassembly)
 - gearbox repair (disassembly, replacement of parts, reassembly)
 - conveyor repair (disassemble sections, replace / repair belts etc)
 - repair of heavy machinery and vehicles (disassembly, replacement of parts, reassembly)

The equipment that will be required on occasions for the above maintenance activities includes:

- Hand tools (i.e. spanner, wrenches, pliers, screw drivers);
- Grinding (generally within workshop);
- Electric welding (may require use of generator);
- Mobile crane when lifting required;
- Electric air compressor;
- Hammer;
- Vehicles (utilities and/or trucks).

Wherever practicable, maintenance and repair work shall be conducted within the workshop building at the quarry due to access to tools and suitable workspace. However, sometimes the maintenance work on processing plant

will have to occur at the processing plant. In these cases care should be taken by maintenance personnel not to generate any unnecessarily loud noise emissions from uncontrolled dropping of large metal equipment and similar.

Calculations considering the above maintenance activities and equipment operation after hours demonstrate that the resultant noise levels will be well within the criteria limits at all surrounding residences. This is primarily due to the substantial separation distance to the nearest residences, with intervening topographic shielding reducing the impact of maintenance noise at the surrounding residential dwellings.

As such, and considering that the proposed after hours maintenance will be relatively low intensity (typically only 2 or 3 staff members), it is considered that after hours maintenance can occur at the quarry without causing adverse amenity impacts at the surrounding residences.

2.6 Road Truck Noise

Mount Cotton Road currently carries in the order of 13,000 vehicles per day. Traffic volumes on the road are expected to grow. The future traffic generation at the quarry is of the order of 250 to 310 truck movements per day. Traffic noise modelling theory dictates that a doubling of traffic volume on a section of roadway results in approximately 3 dB(A) increase in noise emissions. Thus, as quarry traffic volumes will not be a significant proportion of existing ambient traffic, even with future variations in production rate at the quarry, the impact will be an insignificant increase in the overall traffic volume and hence noise on Mount Cotton Road and other haul routes.

General noise assessment recognises that a change in noise level of 3 dB(A) is barely perceptible to the average person with a change of 5 dB(A) generally being noticeable. This is documented in Hassall, J.R. & Zaveri, K., *Acoustic Noise Measurements*, Bruel & Kjaer, Denmark, January 1979, as follows:

"... The following short table shows the subjective effects of changes in noise levels.

<i>Change on Noise Level</i>	<i>Subjective Response</i>
3	<i>just perceptible</i>
5	<i>clearly perceptible</i>
10	<i>twice as loud ..."</i>

As such, the actual impact of potential future increases in traffic movements due to market fluctuations will have no significant impact on traffic noise levels experienced at residences along Mt Cotton Road and other haul routes. Thus, the proposed development will not result in adverse traffic noise impacts at the surrounding residential land uses.

3.0 CONCLUSIONS

MWA Environmental has been engaged by The Barro Group to prepare a Noise Impact Assessment for the proposed extension of the existing Mt Cotton Quarry. The assessment has addressed the potential impact of noise emissions from the proposed quarrying activities on surrounding land uses with reference to the noise objectives specified in the Queensland EPA *Guideline – Noise – Planning for Noise Control*.

The assessment and modelling methodology has been maintained as consistent with that agreed by the noise experts involved in Planning and Environment Court Appeal No BD3438 of 2007 which related to a previous development application for essentially the same development at the site.

Computer noise modelling of the proposed quarry development demonstrates that compliance with the appropriate noise criteria may be achieved with the provision of certain noise controls and noise management measures.

The noise control measures recommended for the quarry to achieve compliance with the regulatory noise limits are:

- All new processing plant should achieve modern industry best practice;
- Provide enclosure or partial enclosure to primary, secondary, tertiary and quaternary crushers to achieve approximately 5dB noise reduction;
- Provide enclosure or partial enclosure to Screen 1, Screen 2, Screen 3, Screen 4, Screen 5 and Screen 6 to achieve approximately 8dB noise reduction;
- Provide 2 dB(A) noise attenuation for loading trucks by provision of modern loaders with residential grade exhaust silencer as compared to standard silencer;
- Partially enclosed loading agitator truck at batching point as presently exists;
- When rock drilling is required in exposed locations use quietened rock drill or alternative drilling technology achieving maximum 111 dB(A) Sound Power Level. Potential quietening measures may include residential grade acoustic silencer, engine hush kit and/or enclosure of the drill mast or use alternative methods such as down the hole drilling;
- Planning measures to conduct rock drilling within rebated benches (i.e. wall(s) between drill and residential areas) to minimise noise transmission towards the west and south;
- In addition to the rebated benches for rock drilling, provision of acoustic screens will be required to the southern and eastern edges of the proposed extraction area;
- Before any rock drilling commences for Stage 1, the following acoustic screens, also shown graphically on **Figure 3**, are required:
 - Minimum 6 metre high acoustic screen along the southern edge of the extraction area; and,
 - Minimum 4 metre high acoustic screen along the southern part of the eastern edge of the extraction area.

As such, with appropriate noise controls and management measures to mitigate noise emissions from the proposed quarrying activities, adverse noise amenity impacts shall not result at the surrounding residences.

Calculations also demonstrate that the noise of maintenance activities within the period 6:00am to 8:00pm Monday to Friday and 6:30am to 5:00pm Saturday will be within the appropriate limits at the surrounding residences.

Thus, the noise impact assessment has concluded that, with appropriate noise management and noise controls, the proposed quarrying activities shall not cause adverse amenity impacts at the surrounding sensitive land uses.

**MWA Environmental
December 2010**

Figures



MOUNT CO
4165

PROJECT
MT COTTON
NOISE IMPACT
ASSESSMENT
Proposed Quarry
Extension

CLIENT
BARRO GROUP PTY LTD

TITLE
GENERAL
SITE LOCATION

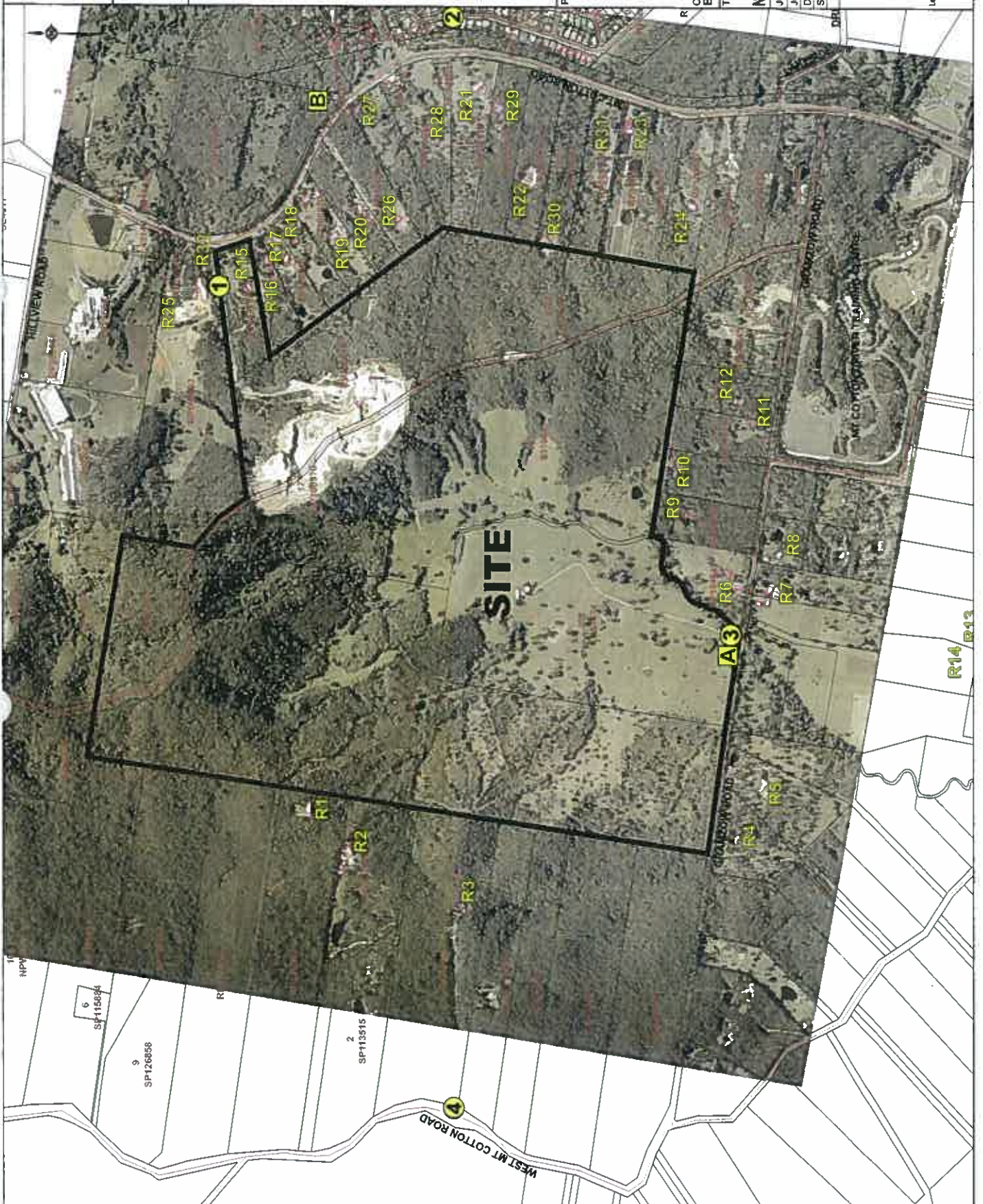
JOB	MT COTTON	FIGURE 1
JOB NO.	09-129	DRAWING NUMBER
DATE	27/09/10	SCALE
SCALE	1:15,000 (A4)	09-129-1N1A



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LEGEND
 Surrounding Residences (Ref: Groundworks Plus)
A Noise Dataloggers (A&B)
1 Noise Monitoring Locations (4)

Drawing References:
 Geotechnical EMS Aerial Photograph
 NIMM Property CD Coastal Overlay
 0 100 200 300 400m
 Scale 1:15,000 @ A4



PROJECT
MT COTTON
NOISE IMPACT
ASSESSMENT
Proposed Quarry Extension

CLIENT
 BARRO GROUP PTY LTD

TITLE
SURROUNDING RESIDENCES &
NOISE MEASUREMENT LOCATIONS
FIGURE 2

JOB NO. MT COTTON 09-129
DATE 27/09/10
SCALE 1:15,000 (A4)
DRAWING NUMBER 09-129-2NIA

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Attachment 1

Previous MWA Environmental Report

*“Noise Impact Assessment – Proposed Quarry Extension –
Barro Quarry – Mount Cotton” (6 October 2006)*

Max Winders & Associates

Consulting Engineers & Environmental Scientists

NOISE IMPACT ASSESSMENT
PROPOSED QUARRY EXTENSION
BARRO QUARRY
MOUNT COTTON

Prepared for:

The Barro Group
c/- Groundwork EMS

Prepared by:

Max Winders & Associates Pty Ltd

6 October 2006

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FIGURES

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1.0 INTRODUCTION

1.1 Purpose of Report

This report has been prepared to respond to matters of interest to the Environmental Protection Agency in relation to noise issues associated with the proposed extension of an existing quarry at Mount Cotton.

It is proposed to extend quarrying activity to Lot 162 on S31962, Lot 238 on S31474 and Lot 370 on S311071 and maintain existing processing facilities on the Lots 1 and 17 on RP108970.

The relevant section of the Environmental Protection Agency (EPA) information request is as follows:

Matters of Interest to the Environmental Protection Agency

"NOISE AND VIBRATION

26. *Provide results of any baseline monitoring of noise and vibration in the proposed vicinity of the proposal. Baseline monitoring should include a selection of sensitive areas affected by the proposal*

Sufficient data should be gathered to provide a baseline for later studies. The daily variation of background noise levels at nearby residences should be monitored and reported by the proponent.

27. *Comment should be provided in any current activities near the proposal area which may cause a background level of ground vibration.*

28. *Submit information (noise contours, modelling results) on the proposed generation of noise. The potential environmental harm of noise and vibration at all potentially sensitive places, in particular, any place of work or residence should be quantified in terms of objectives, standards and indicators to be achieved."*

This report addresses the potential noise amenity impacts of the proposed extended quarrying activities. Blast noise and vibration is assessed separately by others.

1.2 Subject Site

It is proposed to extend quarrying activity to Lot 162 on S31962, Lot 238 on S31474 and Lot 370 on S311071 and maintain existing processing facilities on the Lots 1 and 17 on RP108970.

The site is located approximately 36 kilometres southeast of the Brisbane CBD.

The location of the subject site is shown on Figure 1.

An aerial photograph of the subject site and surrounding area, including nominated surrounding residences, is included as Figure 2.

1.3 Proposed Development

It is proposed to extend current quarrying activities onto Lot 238 on S31474 and Lot 370 on S311071 to access meta-greywacke source rock. The primary crushing and secondary crushing are proposed to be undertaken at a shielded location on Lot 162 on S31962. Crushed material will then be transported via conveyor to new processing plant to be located in a similar location to existing plant on Lot 17 on RP108970. Processed materials will be stockpiled on Lot 17 on RP108970.

Site access is proposed to remain as the existing entrance to Mount Cotton Road.

The proposed extension is to extend the life of the quarry and exploit the available resource. Annual production rates are determined by market demand and the proposed development will not in itself result in an increase in production. Thus, the extension of the quarrying area will not result in an increased production rate at the quarry nor an increase in traffic movements generated.

It is proposed to locate the primary crushing and conveyor loading area within an excavated area to maximise topographic shielding. Furthermore, the tip head and crushing plant are to be partially enclosed as a noise control measure. Crushed material will be transported to the main processing plant by conveyor, minimising noise emissions from internal haulage of crushed rock.

The existing concrete batching plant, with enclosed batching point, will be retained on Lot 17 on RP108970.

The staged quarrying plans identify a proposed 4 metre high amenity bund along the southern and eastern edges of the pit to shield noise emissions towards surrounding residences. Additional amenity bunds may be incorporated into the quarry as necessary to shield noise emissions towards sensitive land uses.

As currently occurs, the quarry is proposed to operate between the hours 6:30am to 6:00pm Monday to Friday and 6:30am to 4:00pm Saturday and Public Holidays. The concrete batching plant is proposed to operate the same hours. Maintenance of plant and equipment may occur during the periods 6:00am to 8:00pm Monday to Friday and 6:30am to 5:00pm Saturday and Public Holidays.

The progressive development stages of the quarry are shown on the Groundwork EMS drawings included in *Attachment 1*.

1.4 Surrounding Land Uses

Surrounding land uses are shown on the aerial photograph included as Figure 2.

Surrounding land uses comprise:

To the north	Rural residential, poultry processing and growing
To the west	Rural residential, Forest
To the south	Rural residential, MG Car Club, Driver Training Centre
To the east	Rural residential, Mount Cotton

Selected existing residential dwellings in the locality are marked on Figure 2 as Residences 1 to 20. Other surrounding residences are also shown on the aerial photograph.

2.0 NOISE IMPACT ASSESSMENT

2.1 Ambient Noise Levels

To characterise the current ambient noise levels at the locality, a noise datalogger was located adjacent to Gramzow Road West on the southern site boundary (Noise Datalogger Location A) for the period 24 August to 2 September 2006. The monitoring location was well separated and topographically shielded from the existing activities on the subject site and is thus considered representative of the ambient noise environment at the residences to the south and west of the subject site.

The residences to the east of the subject site, adjacent to Mount Cotton Road, experience higher ambient noise levels due to Mount Cotton Road traffic and proximity to denser residential development. The ambient noise environment at the residences to the east of the subject site is more appropriately represented by recent long-term noise monitoring undertaken to the east of the subject site. A noise datalogger was located approximately 70 metres to the east of Mount Cotton Road on Lot 1 on RP123227 (Noise Datalogger Location B) for the period 7 to 9 September 2004. This monitoring location is considered to be representative of the ambient noise environment at the residences to the east of the subject site.

The noise datalogger locations are shown on Figure 2.

Table 1 below provides the minimum, maximum and average statistical noise levels recorded at Noise Datalogger Location A.

Table 1: Recorded Range of Ambient Noise Levels – dB(A)
Datalogger Location A
24 August to 2 September 2006 – 15-Minute Samples

PARAMETER	PERIOD	RECORDED NOISE LEVELS - dBA		
		MINIMUM	MAXIMUM	AVERAGE
L ₁	Daytime (7am-6pm)	46.4	79.3	55.0
	Evening (6pm-10pm)	38.0	61.8	48.0
	Nighttime (10pm-7am)	33.9	65.4	46.3
L ₁₀	Daytime (7am-6pm)	42.3	74.6	48.6
	Evening (6pm-10pm)	35.7	57.9	43.0
	Nighttime (10pm-7am)	29.5	63.1	40.2
L ₅₀	Daytime (7am-6pm)	33.6	51.2	39.5
	Evening (6pm-10pm)	32.1	51.5	39.0
	Nighttime (10pm-7am)	25.9	51.8	34.9
L _{eq}	Daytime (7am-6pm)	39.6	69.6	46.2
	Evening (6pm-10pm)	34.7	54.1	41.8
	Nighttime (10pm-7am)	28.4	58.7	38.8

The key statistical noise level parameters recorded at Noise Datalogger Location A included:

Average Recorded L_{50} 6am to 7am=	41.0 dB(A)
Average Recorded L_{50} 7am to 6pm=	39.5 dB(A)
Average Recorded L_{50} 6pm to 10pm=	39.0 dB(A)
Average Recorded L_{50} 6pm to 8pm=	40.2 dB(A)
Average Recorded L_{10} 6am to 7am=	49.7 dB(A)
Average Recorded L_{10} 7am to 6pm=	48.6 dB(A)
Average Recorded L_{10} 6pm to 8pm=	45.4 dB(A)

The complete results from Noise Datalogger Location A are presented as a trace of noise level versus time for the statistical noise level descriptors L_1 , L_{10} , L_{50} and L_{eq} in *Attachment 2*.

Table 2 below provides the minimum, maximum and average statistical noise levels recorded at Noise Datalogger Location A.

**Table 2: Recorded Range of Ambient Noise Levels – dB(A)
Datalogger Location B
7 to 9 September 2004 – 15-Minute Samples**

PARAMETER	PERIOD	RECORDED NOISE LEVELS - dBA		
		MINIMUM	MAXIMUM	AVERAGE
L_1	Daytime (7am-6pm)	57.0	72.5	60.0
	Evening (6pm-10pm)	52.0	58.5	55.6
	Nighttime (10pm-7am)	46.0	65.0	55.3
L_{10}	Daytime (7am-6pm)	53.5	58.5	55.5
	Evening (6pm-10pm)	49.5	55.0	51.9
	Nighttime (10pm-7am)	36.0	59.5	48.6
L_{50}	Daytime (7am-6pm)	40.0	53.0	45.5
	Evening (6pm-10pm)	34.5	45.5	39.2
	Nighttime (10pm-7am)	30.0	51.5	37.7
L_{eq}	Daytime (7am-6pm)	50.5	58.5	52.4
	Evening (6pm-10pm)	44.5	51.5	47.9
	Nighttime (10pm-7am)	34.5	56.5	45.6

The key statistical noise level parameters recorded at Noise Datalogger Location B included:

Average Recorded L_{50} 6am to 7am=	48.8 dB(A)
Average Recorded L_{50} 7am to 6pm=	45.5 dB(A)
Average Recorded L_{50} 6pm to 10pm=	39.2 dB(A)
Average Recorded L_{50} 6pm to 8pm=	40.9 dB(A)
Average Recorded L_{10} 6am to 7am=	57.6 dB(A)
Average Recorded L_{10} 7am to 6pm=	55.5 dB(A)
Average Recorded L_{10} 6pm to 8pm=	53.1 dB(A)

The complete results from Noise Datalogger Location B are presented as a trace of noise level versus time for the statistical noise level descriptors L_1 , L_{10} , L_{50} and L_{eq} in *Attachment 3*.

In addition to the above long-term noise datalogging, short-term noise measurements were conducted at a range of residential locations in the locality on 28 September 2006. The short-term noise monitoring locations are shown on Figure 2. The results of the short-term noise monitoring are provided in Table 3 below.

Table 3: Recorded Short-Term Noise Levels – dB(A)

#	LOCATION	TIME	RECORDED STATISTICAL NOISE LEVEL - dB(A)					COMMENTS
			L_1	L_{10}	L_{50}	L_{90}	L_{eq}	
1	Quarry access road (70m to Mt Cotton Rd)	1355 – 1405	76.0	59.1	55.1	52.5	62.5	Traffic on Mt Cotton Rd, some traffic on quarry road, no quarry noise audible
2	Orchid Drive (60m to Mt Cotton Rd)	1420 – 1430	63.3	59.9	56.6	52.6	57.4	Traffic on Mt Cotton Rd, no quarry noise audible
3	Gramzow Road (southern site boundary)	1440 – 1450	53.6	51.2	47.0	44.9	48.6	Distant traffic noise, wind noise, no quarry noise audible
4	West Mt Cotton Rd (15m to road)	1500 – 1510	65.1	53.1	46.8	43.5	52.3	Some West Mt Cotton Rd traffic noise, no quarry noise

2.2 Noise Criteria

The Queensland EPA *Guideline – Noise – Planning for Noise Control* provides methods for the determination of the appropriate noise criteria to be applied to the assessment of proposed industrial developments affecting sensitive land uses.

The first step in setting the appropriate noise criteria for a new development is to calculate the Specific Noise Level, or component level $L_{Aeq,1hour}$, as per the following equation:

$$L_{Aeq,1hour} = \min L_{A90,1hour} + 3 \text{ dB(A)}$$

where $\min L_{A90,1hour}$ is the Rating Background Level, being the median of the Assessment Background Levels for each monitoring period.

and the Assessment Background Level is defined as the 10th percentile 1 hour average background noise level for a monitoring period.

The following Rating Background Noise Levels for the daytime period were determined from the results of the noise datalogger measurements:

Noise Datalogger Location A: 38 dB(A)

Noise Datalogger Location B: 43 dB(A)

As such, it is considered that the following Specific Noise Level criteria are appropriate for the assessment of potential noise amenity impacts from the proposed quarrying at the surrounding sensitive land uses:

ADOPTED NOISE CRITERIA

Sensitive Land Uses to West / South: 41 dB(A)

Sensitive Land Uses to East: 46 dB(A)

As the average recorded L_{90} and L_{10} noise levels at Noise Datalogger Locations A and B were higher during the period 6am to 7am than for the period 7am to 6pm, it is considered that the above noise limits may be applied to the assessment of proposed quarrying operations from 6:30am to 6:00pm Monday to Friday and 6:30am to 4:00pm Saturday and Public Holidays.

Furthermore, the average recorded L_{90} and L_{10} noise levels during the periods 6:00am to 6:30am and 6:00pm to 8:00pm are comparable to the noise levels experienced during the daytime period (7:00am to 6:00pm). As such, it is considered that the above noise limits may be applied to the assessment maintenance activities that may occur between 6:00am to 8:00pm Monday to Friday and 6:30am to 4:00pm Saturday and Public Holidays.

2.3 Noise Level Predictions

2.3.1 Methodology

To enable assessment of noise from the proposed extended quarrying operations on Lot 162 on S31962, Lot 238 on S31474 and Lot 370 on S311071 a detailed noise model has been established using the SoundPLAN 6.2 software applying the ISO9613 standard. This model is an accepted regulatory model that allows input of terrain specific data and source noise data as sound power level spectra.

The noise modelling undertaken considered meteorological conditions as per the methodology of the ISO9613 standard, with a temperature of 10 degrees Celsius and 70% humidity, a temperature inversion and the following wind conditions as per the worst-case assumptions of ISO9613:

Downwind propagation conditions for the method specified in this part of ISO 9613 are as specified in 5.4.3.3 of ISO 1996-2:1997, namely

- wind direction within an angle of $\pm 45^\circ$ of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region, with the wind blowing from source to receiver, and
- wind speed between approximately 1 m/s and 5 m/s, measured at a height of 3 m to 11 m above the ground.

As such, given the above assumptions, there is little potential for atypical meteorological conditions to cause resultant noise levels at residences to exceed those predicted in the modelling.

The Soundplan 6.2 model has been setup to represent noise emissions from each of the nominated quarrying Stages 1 to 4 as per the Groundwork EMS drawings included as *Attachment 1*. The Stage 1 model layout and the source locations are shown on the drawings included in *Attachment 4*.

The sources used in the SoundPLAN 6.2 model were as per the following Table 4. Source noise data for the noise sources was derived from measurements conducted by Max Winders and Associates at similar operations. The source noise data is provided in *Attachment 4*.

Table 4: Noise Sources Used in SoundPLAN 6.2 Modelling

LOCATION	MODELLED NOISE SOURCES
Lot 162 on S31962	Haul Truck at Tip Head
	Primary Crusher (partially enclosed)
	Secondary Crusher (partially enclosed)
	Primary Screen (partially enclosed)
Lot 17 on RP108970	Tertiary Crusher
	Quaternary Crusher
	Tertiary Screen
	Screen House
	Conveyor Motor
	Loader at Processing Area
	Loader at Stockpile Area
	Road Truck at Stockpile Area
Lot 238 on S31474 and Lot 370 on S311071	Haul Truck at Pit
	Loader at Pit
	Rock Drill
Concrete Batching Plant	Agitator Truck at Batching Point (enclosed)
	Agitator Truck at Stump Stand
	Agitator Truck at Washout Pit
	Loader
	Road Truck
	Bag Filter Fan (3 of)

The modelling considered the resultant noise levels at the surrounding residences with all noise sources above operating simultaneously. The receptor height applied to the modelling was 1.5 metres above ground level.

Although the above noise sources are considered to represent typical noise emissions from the operation of the proposed quarry and concrete batching plant it is unlikely that all modelled sources would be operating simultaneously in practice. Other plant items and vehicles may be required to be used at the quarry at times but should not increase overall noise emissions above the level of the above modelled noise sources.

The model was established over an area of 5km by 5km metres surrounding the site. Topographical contours for the surrounding area were taken from the Department of Lands Topographic Image Maps *Capalaba 9542-41* and *Beenleigh 9542-42*. Current topography for the subject site and for proposed future quarry development was taken from Groundwork EMS drawings.

2.3.2 Results of Modelling

Modelling of the proposed future quarrying activities, including the processing plant, demonstrates that in order to satisfy the regulatory noise limits at the surrounding sensitive land uses it shall be necessary to incorporate a range of noise control measures. The recommended noise control measures are:

- All new processing plant should achieve modern industry best practice;
- Provide enclosure or partial enclosure to primary and secondary crushers to achieve approximately 10dB noise reduction;
- When rock drilling is required in exposed locations use quietened rock drill or alternative drilling technology achieving maximum 111 dB(A) Sound Power Level. Potential quietening measures may include residential grade acoustic silencer, engine hush kit and/or enclosure of the drill mast;
- Planning measures to conduct rock drilling within rebated benches (i.e. wall(s) between drill and residential areas) to minimise noise transmission towards the west and south;
- If rebated benches for rock drilling are not possible during late stage quarrying, provide minimum 4 metre high amenity bund / acoustic barrier between rock drill and residences to the west for Stage 4 quarrying;
- Construct minimum 4 metre high amenity bunds along the southern and eastern edges of the proposed pit, as shown on Groundwork EMS quarry staging plans.

The results of the future SoundPLAN 6.2 modelling considering the above noise control measures are provided as contours of predicted resultant noise levels on a cadastral base showing the locations of the surrounding residences (Residences 1 to 20 - refer Figure 2). The results are presented as follows:

Stage 1:	Figure 3
Stage 2:	Figure 4
Stage 3:	Figure 5
Stage 4:	Figure 6

The predicted resultant noise levels from the various quarrying stages at the nominated surrounding residences are summarised in Table 5 below.

Table 5: Summary of Model Results for Nominated Sensitive Receptors - dB(A)

RECEPTOR	PREDICTED RESULTANT NOISE LEVEL - dB(A)				CRITERION NOISE LEVEL - dB(A)
	STAGE 1	STAGE 2	STAGE 3	STAGE 4	
1	33	34	34	38	41
2	32	34	34	38	41
3	32	31	33	33	41
4	29	31	30	32	41
5	30	33	32	32	41
6	37	38	36	37	41
7	35	34	34	34	41
8	33	34	33	33	41
9	38	39	38	38	41
10	38	37	38	37	41
11	34	35	35	34	41
12	33	34	34	33	41
15	42	42	42	41	46
16	42	41	42	41	46
17	41	41	42	42	46
18	41	41	42	41	46
19	40	40	41	40	46
20	40	40	40	40	46

The results of the modelling indicate that for all proposed quarrying stages, with the provision of the noise control measures detailed above, the adopted noise criteria can be satisfied at all surrounding residences.

Given the extensive range of noise sources modelled as operating simultaneously and the adverse meteorological conditions considered in the modelling, actual resultant noise levels from the proposed quarrying activities will generally be significantly below the levels detailed in Table 5 above.

In summary, detailed noise modelling has demonstrated that with the implementation of appropriate noise controls and management measures, the proposed staged quarrying activities can be undertaken without causing adverse noise amenity impacts at surrounding sensitive land uses.

2.4 Discussion of Results of Noise Modelling

The ambient noise monitoring and predictive computer noise modelling undertaken indicates that the proposed extended quarry can operate within the appropriate noise amenity standards.

In order to satisfy the regulatory noise limits under future quarrying conditions it will be necessary to implement a range of noise controls and management measures.

The recommended noise control measures are:

- All new processing plant should achieve modern industry best practice;
- Provide enclosure or partial enclosure to primary and secondary crushers to achieve approximately 10dB noise reduction;
- When rock drilling is required in exposed locations use quietened rock drill or alternative drilling technology achieving maximum 111 dB(A) Sound Power Level. Potential quietening measures may include residential grade acoustic silencer, engine hush kit and/or enclosure of the drill mast;
- Planning measures to conduct rock drilling within rebated benches (i.e. wall(s) between drill and residential areas) to minimise noise transmission towards the west and south;
- If rebated benches for rock drilling are not possible during late stage quarrying, provide minimum 4 metre high amenity bund / acoustic barrier between rock drill and residences to the west for Stage 4 quarrying;
- Construct minimum 4 metre high amenity bunds along the southern and eastern edges of the proposed pit, as shown on Groundwork EMS quarry staging plans.

The primary and secondary crushers are proposed to be partially enclosed. It is recommended that the enclosure be designed to achieve a minimum of 10dB of noise reduction towards residential receptors.

Due to the exposed location at which the rock drill must operate during later quarrying stages, it is recommended that noise controls be installed on the drill. Such noise controls may include the installation of a residential grade acoustic silencer and/or an engine hush kit and may require the enclosure of the drill hammer to achieve a maximum sound power level (SWL) of 111 dB(A). Wherever practicable, quarry planning should provide for rock drilling to be conducted at a shielded location such as within a rebated bench or behind an amenity bund to minimise noise transmission towards residences to the northeast.

The above noise controls measures will need to be designed and installed appropriately to ensure that the necessary noise reductions are achieved. Experience dictates that the recommended noise controls are feasible. Acoustic design of the noise controls will form an integral part of the detailed design process for future quarrying development on the site.

2.5 After Hours Maintenance Noise

Maintenance of plant and equipment is proposed to occur within the period 6:00am to 8:00pm Monday to Friday and 6:30am to 5:00pm Saturday and Public Holidays.

Scheduled maintenance at the quarry is generally conducted within normal operating hours (i.e. 6:30am to 6:00pm Monday to Friday and 6:30am to 4:00pm Saturday and Public Holidays), with no potential to cause adverse noise impacts above the impact of general quarry operation (i.e. processing plant, site vehicles).

Occasional after hours maintenance will be required at the quarry during breakdown situations. This after hours repair work may occur during the morning (6:00am to 6:30am) and evening (6pm to 8pm) periods with limited maintenance staff.

As per the noise monitoring results detailed in Section 2.2, the appropriate noise criteria for after hours maintenance noise occurring during the period (6:00am to 8:00pm) are 41 dB(A) at sensitive land uses to the west/south and 46 dB(A) at sensitive land uses to the east.

The maintenance work outside of normal operating hours will typically involve only 2 to 3 staff members. As such, the after hours work conducted will not be intense or constant, but typically may involve the following tasks as required:

- *Repair of Equipment Failures, i.e:*
 - electric motor repair (disassembly, replacement of parts, reassembly)
 - gearbox repair (disassembly, replacement of parts, reassembly)
 - conveyor repair (disassemble sections, replace / repair belts etc)
 - repair of heavy machinery and vehicles (disassembly, replacement of parts, reassembly)

The equipment that will be required on occasions for the above maintenance activities includes:

- Hand tools (i.e. spanner, wrenches, pliers, screw drivers);
- Grinding (generally within workshop);
- Electric welding (may require use of generator);
- Mobile crane when lifting required;
- Electric air compressor;
- Hammer;
- Vehicles (utilities and/or trucks).

Wherever practicable, maintenance and repair work shall be conducted within the workshop building at the quarry due to access to tools and suitable workspace. However, sometimes the maintenance work on processing plant will have to occur at the processing plant. In these cases care should be taken by maintenance personnel not to generate any unnecessarily loud noise emissions from uncontrolled dropping of large metal equipment and similar.

Calculations considering the above maintenance activities and equipment operation after hours demonstrate that the resultant noise levels will be well within the criteria limits at all surrounding residences. This is primarily due to the substantial separation distance to the nearest residences, with intervening topographic shielding reducing the impact of maintenance noise at the surrounding residential dwellings.

As such, and considering that the proposed after hours maintenance will be relatively low intensity (typically only 2 or 3 staff members), it is considered that after hours maintenance can occur at the quarry without causing adverse amenity impacts at the surrounding residences.

2.6 Road Truck Noise

The proposed extension of quarrying activities will not necessarily increase production rate (tonnes per annum) at the quarry. Production rates are determined by market demand and the proposed development will not in itself result in an increase in production or associated increase traffic movements.

There will be periods in the future when traffic movements associated with the quarry and concrete batching plant increase above current levels due to market demand. It has been determined that the maximum potential increase in production at the subject quarry in the future would generate approximately 60 % more traffic movements than currently occurs.

Mount Cotton Road currently carries in the order of 13 000 vehicles per day. Traffic volumes on the road are expected to grow. For the purpose of modelling future traffic conditions associated with the quarry an optimistic product demand projection for 10 years was made. The increased future traffic generation at the quarry is of the order of 250 movements per day. Traffic noise modelling theory dictates that a doubling of traffic volume on a section of roadway results in approximately 3 dB(A) increase in noise emissions. Thus, potential future variations in production rate at the quarry relate to an insignificant increase in the overall traffic volume on Mount Cotton Road and other haul routes.

General noise assessment recognises that a change in noise level of 3 dB(A) is barely perceptible to the average person with a change of 5 dB(A) generally being noticeable. This is documented in Hassall, J.R. & Zaveri, K., *Acoustic Noise Measurements*, Bruel & Kjaer, Denmark, January 1979, as follows:

"... The following short table shows the subjective effects of changes in noise levels.

<i>Change on Noise Level</i>	<i>Subjective Response</i>
3	<i>just perceptible</i>
5	<i>clearly perceptible</i>
10	<i>twice as loud ..."</i>

As such, the actual impact potential future increases in traffic movements due to market fluctuations will have no significant impact on traffic noise levels experienced at residences along Mt Cotton Road and other haul routes. Thus, the proposed development will not result in adverse traffic noise impacts at the surrounding residential land uses.

3.0 CONCLUSIONS

This report has been prepared to respond to Matters of Interest to the Environmental Protection Agency in relation to noise issues associated with the proposed extension of an existing quarry at Mount Cotton.

It is proposed to extend quarrying activity to Lot 162 on S31962, Lot 238 on S31474 and Lot 370 on S311071 and maintain existing processing facilities on the Lots 1 and 17 on RP108970.

It is proposed to extend current quarrying activities onto Lot 238 on S31474 and Lot 370 on S311071 to access meta-greywacke source rock. The primary crushing and secondary crushing are proposed to be undertaken at a shielded location on Lot 162 on S31962. Crushed material will then be transported via conveyor to new processing plant to be located in a similar location to existing plant on Lot 17 on RP108970. Processed materials will be stockpiled on Lot 17 on RP108970. The extension of the quarrying area will not result in an increased production rate at the quarry nor an increase in traffic movements generated by the quarry.

Computer noise modelling of the proposed quarry development demonstrates that compliance with the appropriate noise criteria may be achieved with the provision of certain noise controls and noise management measures.

The noise control measures recommended for the quarry to achieve compliance with the regulatory noise limits are:

- All new processing plant should achieve modern industry best practice;
- Provide enclosure or partial enclosure to primary and secondary crushers to achieve approximately 10dB noise reduction;
- When rock drilling is required in exposed locations use quietened rock drill or alternative drilling technology achieving maximum 111 dB(A) Sound Power Level. Potential quietening measures may include residential grade acoustic silencer, engine hush kit and/or enclosure of the drill mast;
- Planning measures to conduct rock drilling within rebated benches (i.e. wall(s) between drill and residential areas) to minimise noise transmission towards the west and south;
- If rebated benches for rock drilling are not possible during late stage quarrying, provide minimum 4 metre high amenity bund / acoustic barrier between rock drill and residences to the west for Stage 4 quarrying;
- Construct minimum 4 metre high amenity bunds along the southern and eastern edges of the proposed pit, as shown on Groundwork EMS quarry staging plans.

As such, with appropriate noise controls and management measures to mitigate noise emissions from the proposed quarrying activities, adverse noise amenity impacts shall not result at the surrounding residences.

Calculations also demonstrate that the noise of maintenance activities within the period 6:00am to 8:00pm Monday to Friday and 6:30am to 5:00pm Saturday and Public Holidays will be within the appropriate limits at the surrounding residences.

The proposed extension of quarrying activities will not necessarily increase production rate (tonnes per annum) at the quarry. However, there will be periods in the future when traffic movements associated with the quarry and concrete batching plant increase above current levels due to market demand. Given the ambient traffic volume carried on Mount Cotton Road and the maximum potential future increases in traffic movements at the quarry, it has been determined that the proposed development will not result in adverse traffic noise impacts at the surrounding residential land uses.

Thus, the noise impact assessment has concluded that, with appropriate noise management and noise controls, the proposed quarrying activities shall not cause adverse amenity impacts at the surrounding sensitive land uses.

Max Winders and Associates
6 October 2006

Figures

MOUNT CO
4165

PROJECT
MT COTTON
FIGURE 1
SITE LOCATION

CLIENT
GROUNDWORKS E&S

DATE
2017-06-01

SCALE
1:1000

PROJECT NO.
2017-06-01

ISSUED FOR
CONSTRUCTION

ISSUED BY
GROUNDWORKS E&S

ISSUED DATE
2017-06-01

ISSUED FOR
CONSTRUCTION

SITE ⊕

LEGEND

- A** Above Data Register (A&D)
- B** Above Mounting
- 1** Location (A)
- 2** Mounting location
- PC20** (Per E. Geographical Data)

Scale 1:10,000 G.A.
0 100 200 300 400m

Drawn by: [Name]
Checked by: [Name]
Approved by: [Name]

MT COTTON
FIGURE 2
Above Mounting Location
& Surrounding Reservoirs

MT COTTON 06.117
CLIENT: [Name]
PROJECT: [Name]

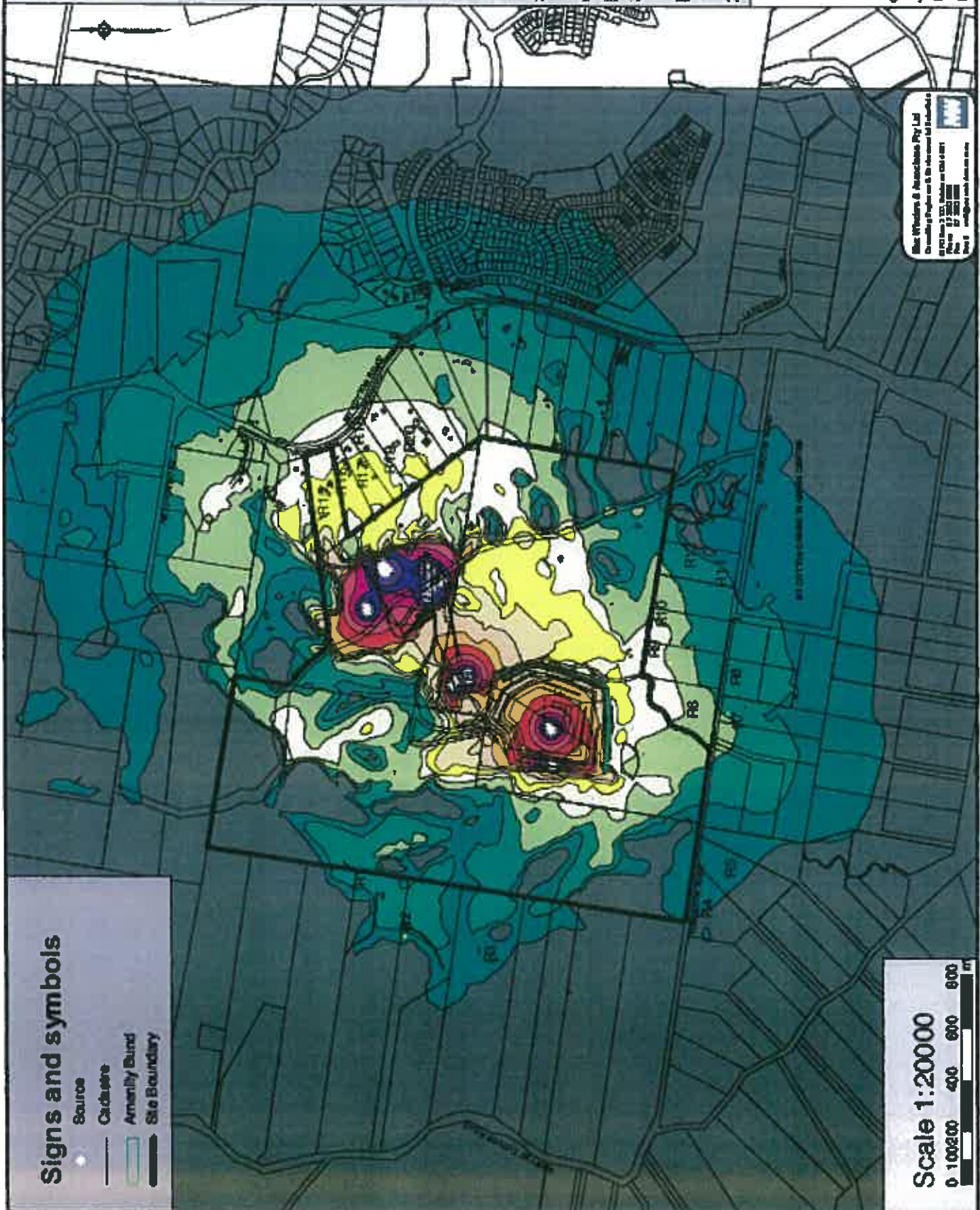
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Approved by: [Name]

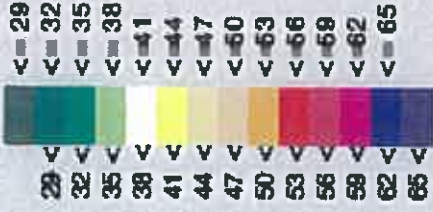


Signs and symbols

- Source
- Catchment
- ▭ Amenity Bund
- ▬ Site Boundary



Noise level
LrD
in dB(A)



Mt Cotton 06-138

Stage 1

Quietered Rock Drill
Enclosed Primary &
Secondary Crusher

Enclosed Batching Point

29.09.06

FIGURE 3

**STAGE 1 MODEL
NOISE CONTOURS**

CLIENT GROUNDWORKS EMS

JOB No. MT COTTON 06-138

DWG No. 06-138-03

DATE 08/10/06

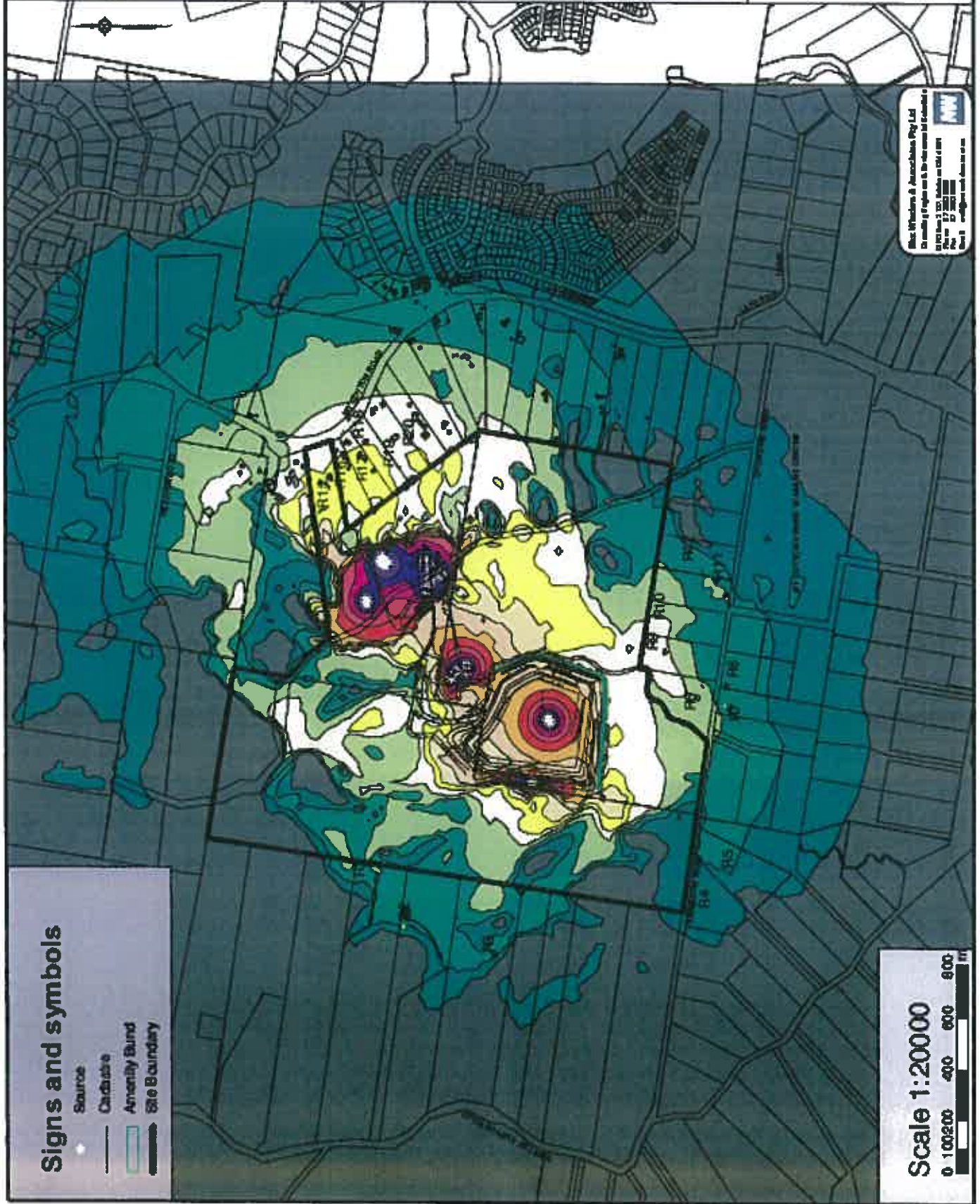
Blue Windows & Associates Pty Ltd
Consulting Engineers & Environmental Planners
Level 12, 200 Pitt Street, Sydney, NSW 2000
Ph: 61 2 9231 1111
Fax: 61 2 9231 1111
www.bwain.com.au

Scale 1:20000



Signs and symbols

- Source
- Contour
- Anomaly Bund
- Site Boundary



Blue Whiskers & Associates Pty Ltd
 25 Southport Road, Southport QLD 4215
 Phone: 07 5531 1111
 Fax: 07 5531 1111
 Email: info@bluewhiskers.com.au

Scale 1:20000
 0 100000 200000 300000 400000 500000 600000 700000 800000 900000 1000000

Noise level
LrD
in dB(A)

<= 29
<= 32
<= 35
<= 38
<= 41
<= 44
<= 47
<= 50
<= 53
<= 56
<= 59
<= 62
<= 65

Mt Cotton 06-138

Stage 2

Quietered Rock Drill
Enclosed Primary &
Secondary Crusher

Enclosed Batching Point

29.09.06

FIGURE 4 STAGE 2 MODEL NOISE CONTOURS

CLIENT GROUNDWORKS EMS

JOB No. MT COTTON 06-138

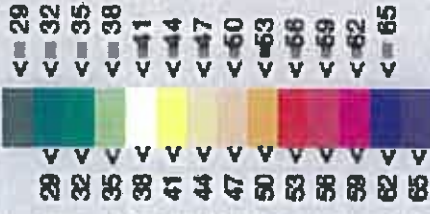
DWG No. 06-138-04

DATE 06/10/06

Signs and symbols

- Source
- Calclastre
- Amenity Bund
- Site Boundary

Noise level
L₁₀
in dB(A)



Mt Cotton 06-138

Stage 3

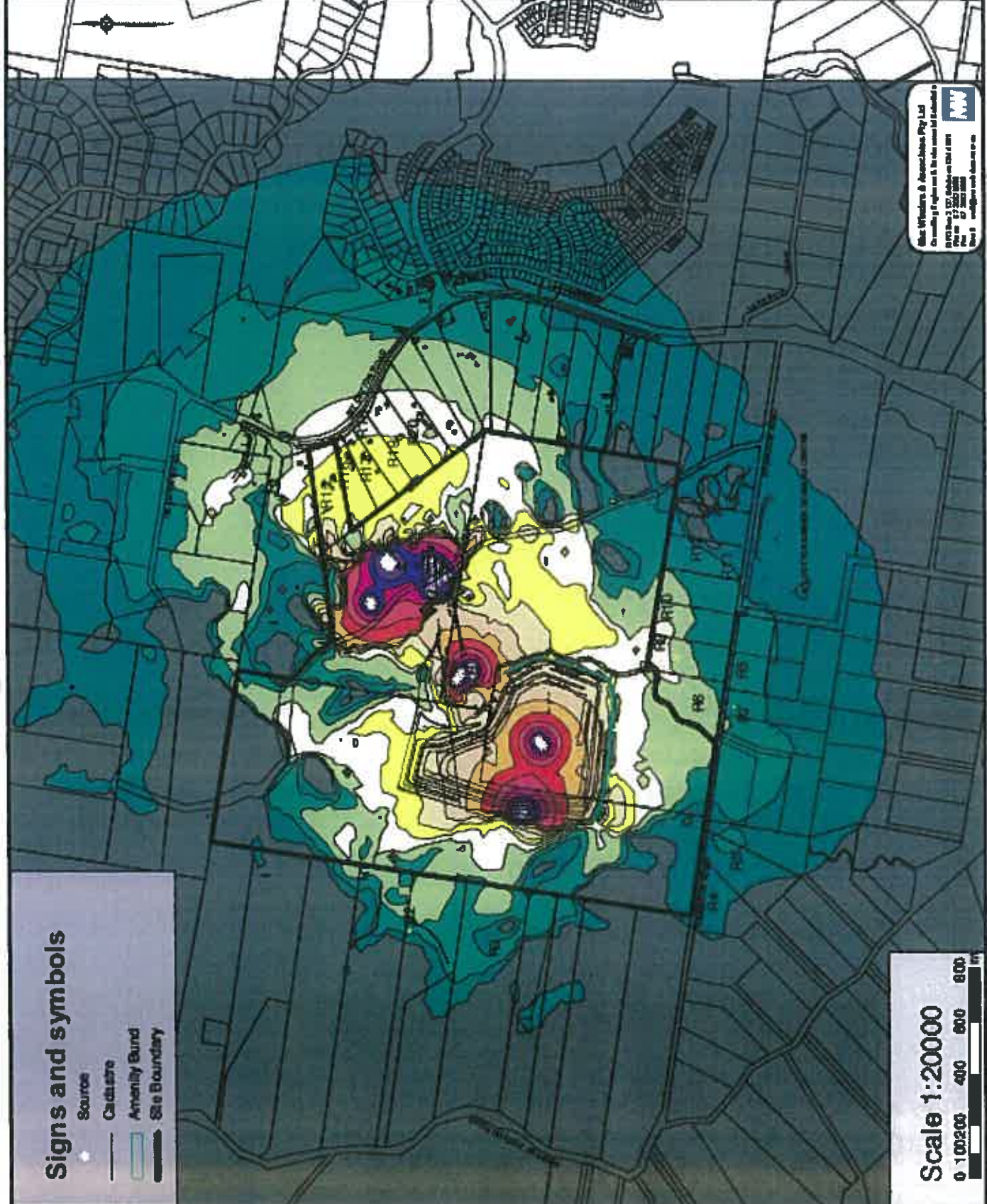
Quietered Rock Drill
Enclosed Primary &
Secondary Crusher

Enclosed Batching Point

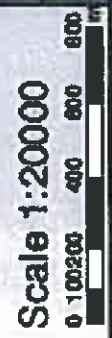
29.09.06

FIGURE 5 STAGE 3 MODEL NOISE CONTOURS

CLIENT GROUNDWORKS ENG
JOB No. MT COTTON 06-138
DWG No. 06-138-05
DATE 09/10/06

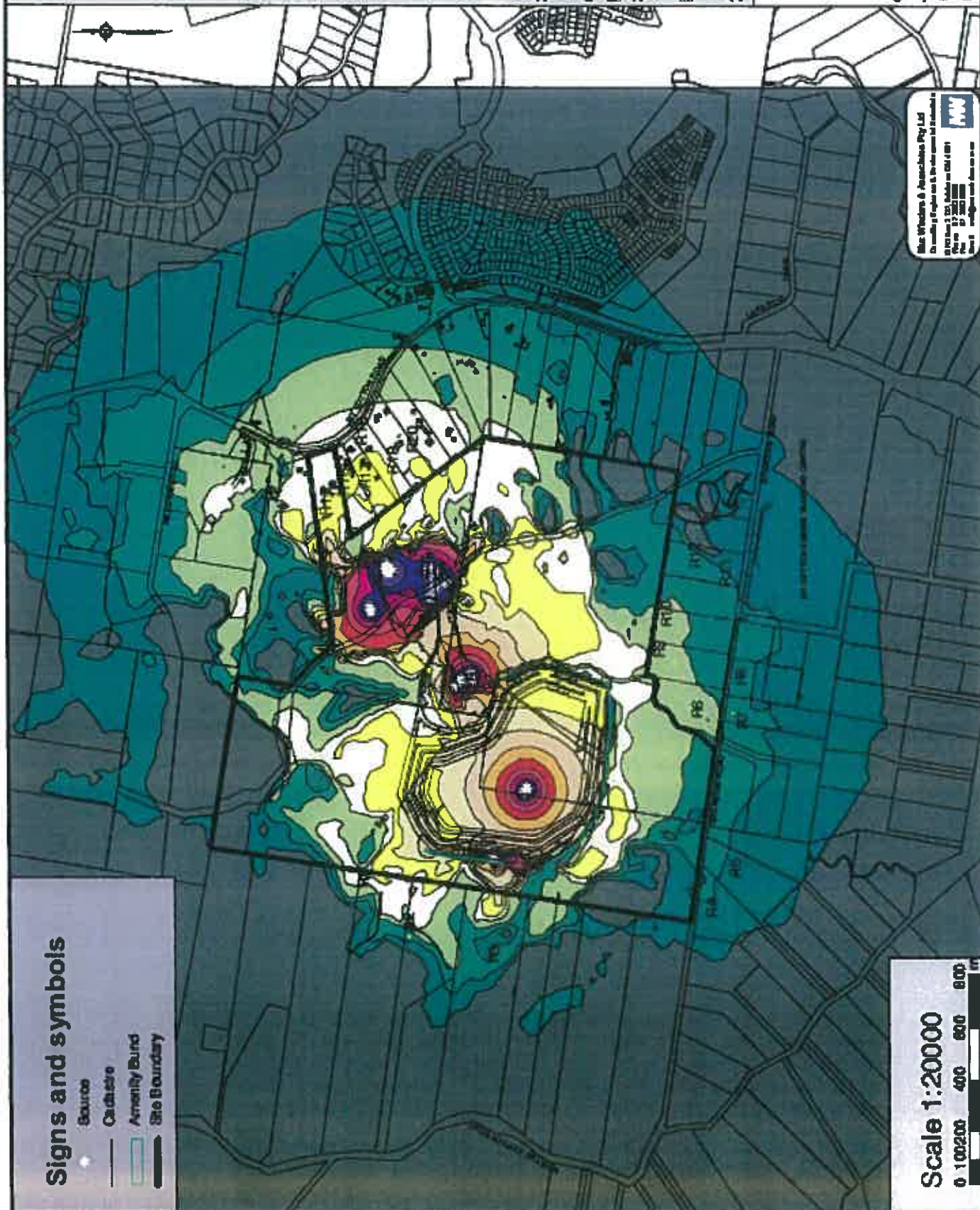


Blue Woodlands & Associates Pty Ltd
On behalf of Groundworks Eng. The information contained in this drawing is for the use of the client only. It is not to be used for any other purpose without the written consent of Blue Woodlands & Associates Pty Ltd.
Date: 09/10/06
Drawn by: [Signature]
Checked by: [Signature]

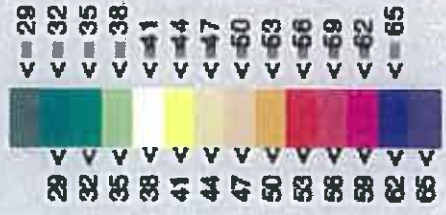


Signs and symbols

- Source
- Outline
- Amenity Bund
- Site Boundary



Noise level
LrD
in dB(A)



Mt Cotton 06-138

Stage 4

Quietered Rock Drill
Enclosed Primary &
Secondary Crusher

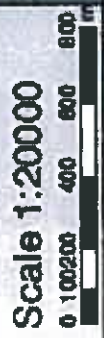
Enclosed Batching Point

29.09.06

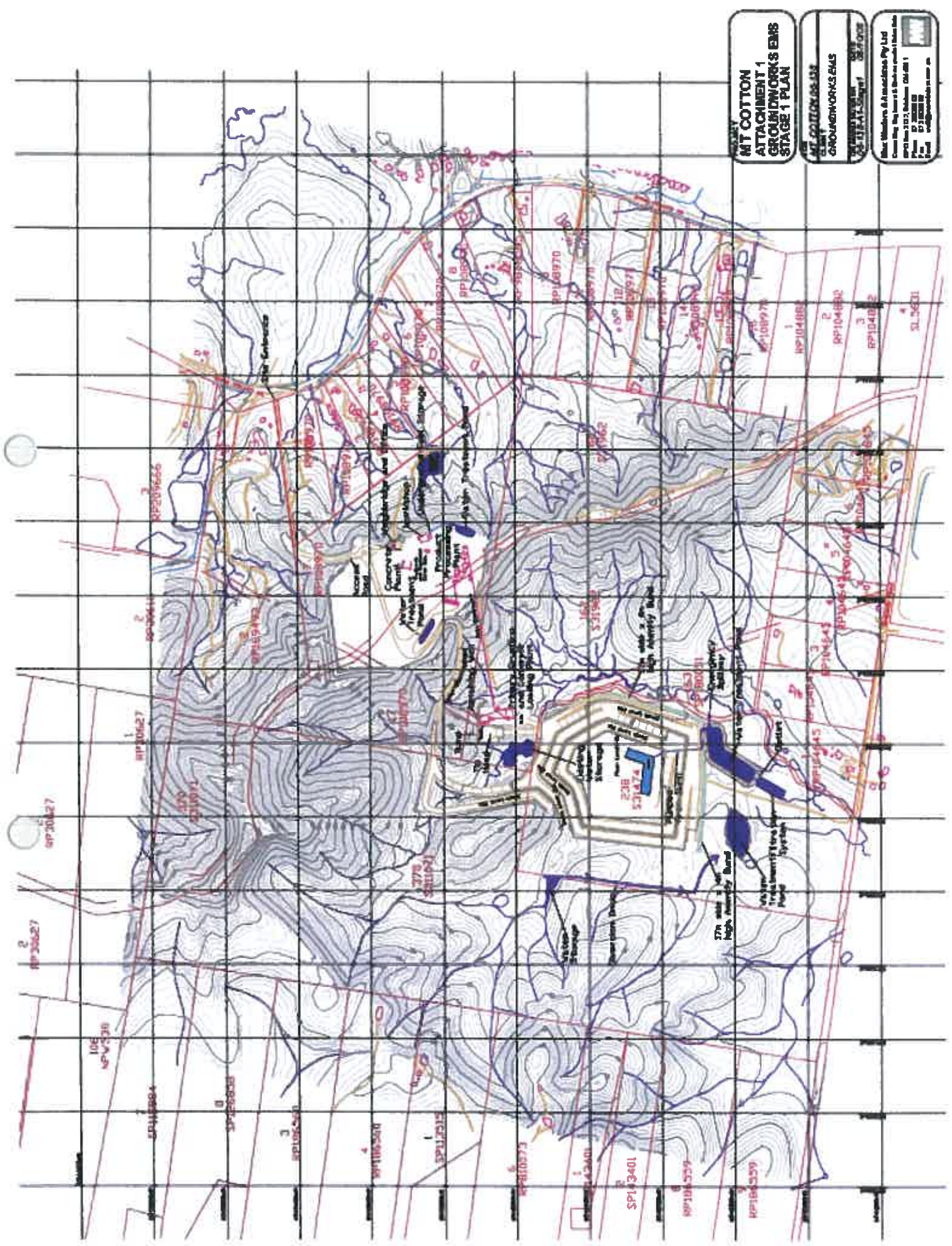
FIGURE 6 STAGE 4 MODEL NOISE CONTOURS

CLIENT GROUNDWORKS EIMS
JOB No. MT COTTON 06-138
DWG No. 06-138-06
DATE 09/10/06

Mr. William A. Hutchinson Pty Ltd
Environmental Engineers & Planners
120, Adelaide Rd, Mt Cotton QLD 4285
Ph: 07 5522 1111
Fax: 07 5522 1112
www.wah.com.au



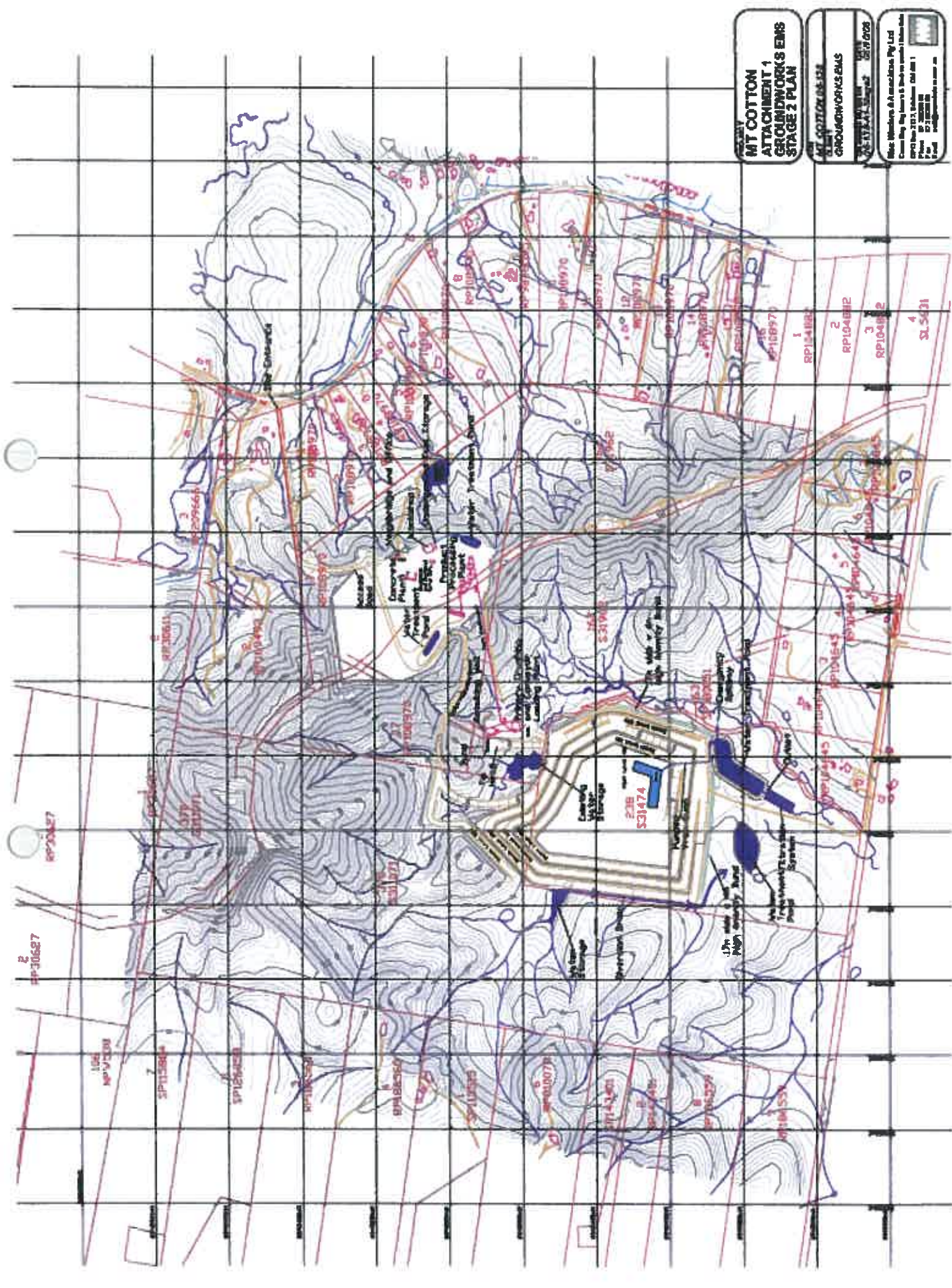
Attachment 1
Groundwork EMS
Quarry Staging Plans



**MT COTTON
ATTACHMENT 1
GROUNDWORKS EMS
STAGE 1 PLAN**

REV
DATE
BY
APP'D
DESCRIPTION

Blue Mountains & Attandarra Pty Ltd
Crown Mt, Mt Cotton & Blue Mountains (BMA) Ltd
PO Box 2127, Blackheath NSW 2105
Phone 02 2322 2222
Fax 02 2322 2222
www.bma.com.au

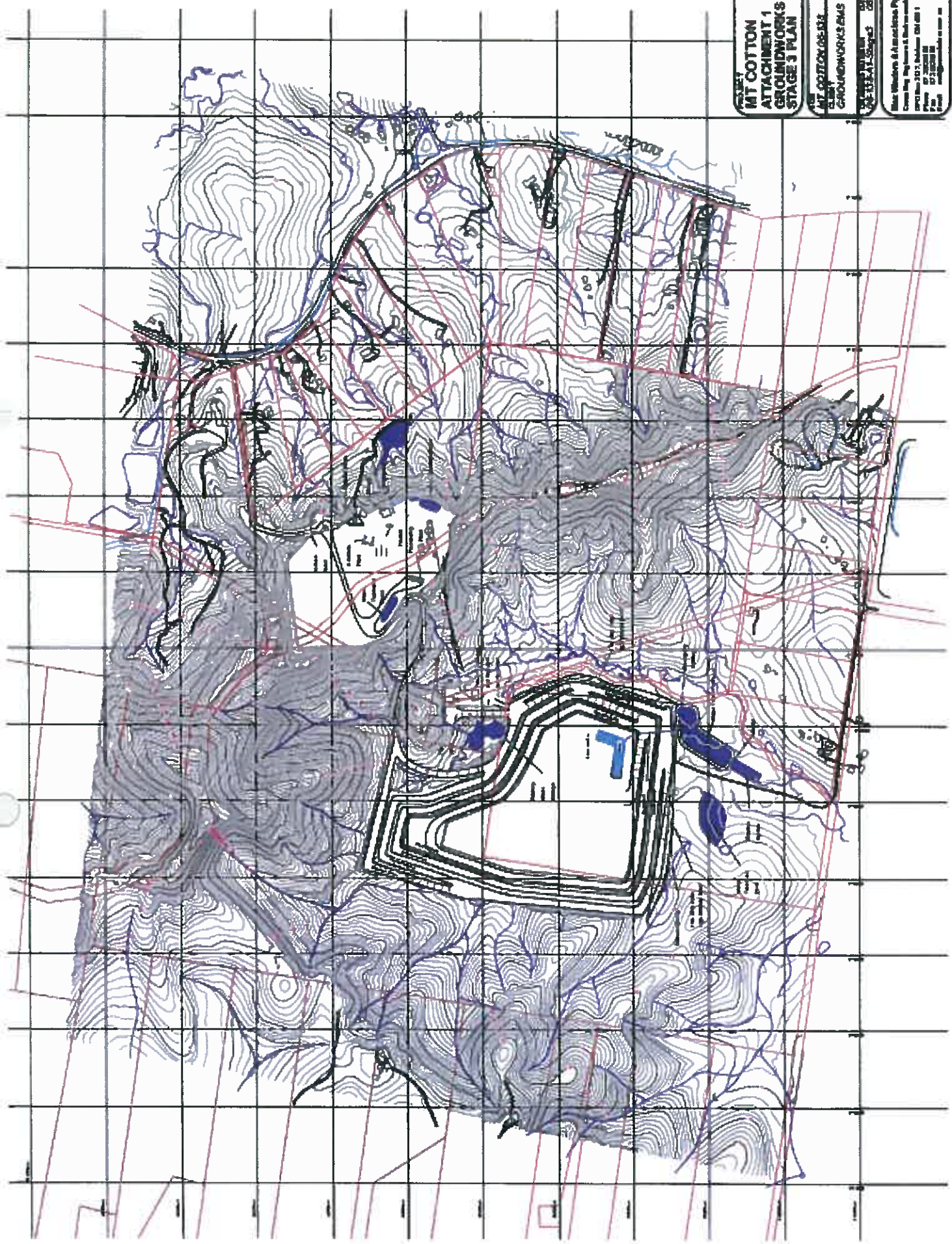


**MT COTTON
ATTACHMENT 1
GROUNDWORKS EMS
STAGE 2 PLAN**

MT COTTON
GROUNDWORKS EMS
2017-18-19
2018-19-20

Site: Murrumbidgee & Murrumbidgee P/L Ltd
Client: Murrumbidgee & Murrumbidgee P/L Ltd
Project: Murrumbidgee & Murrumbidgee P/L Ltd
Date: 10/10/2018
Scale: 1:10000

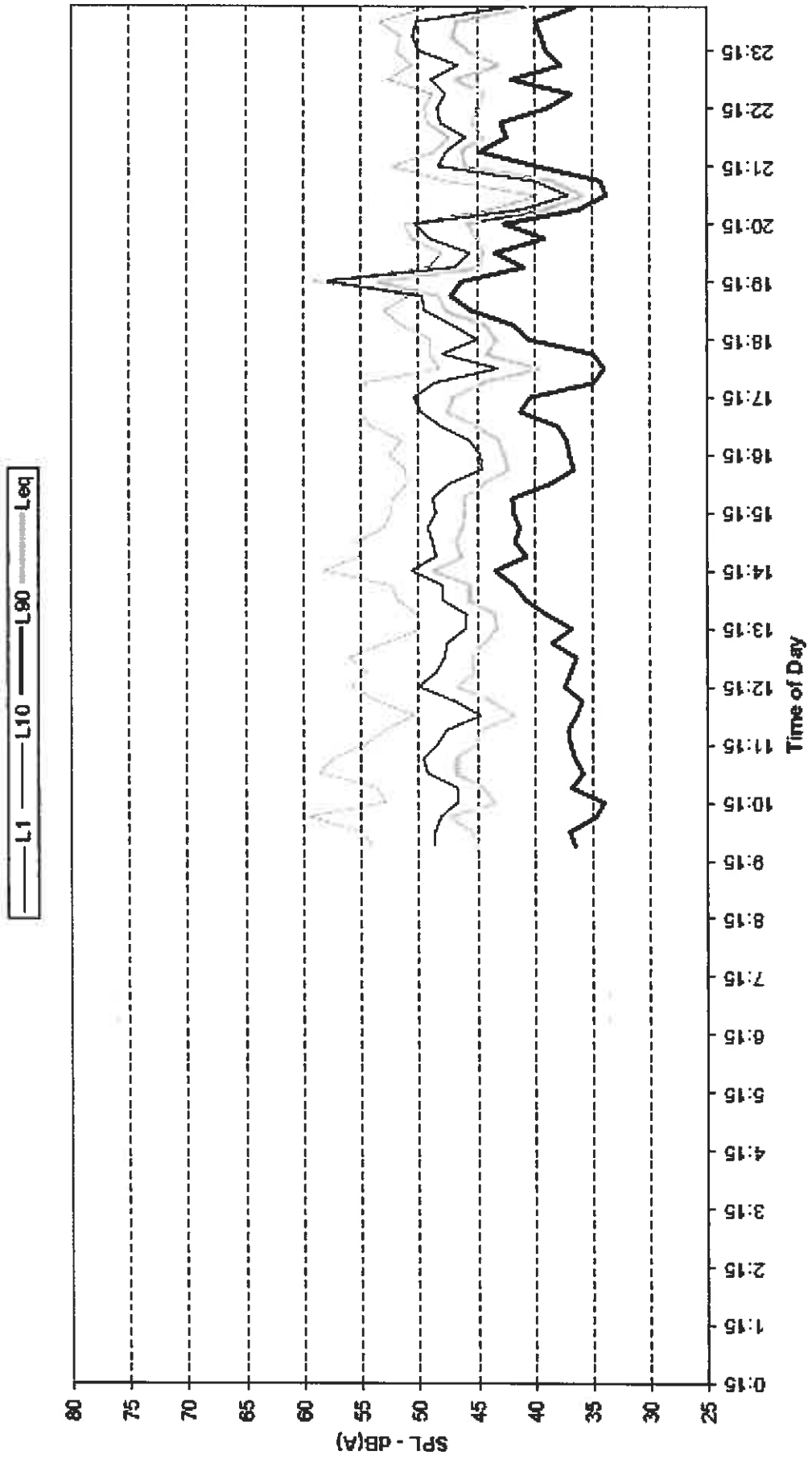
PROJECT	
MT COTTTON ATTACHMENT 1 GROUNDWORKS EMS STAGE 3 PLAN	
DATE	MT COTTTON 08.05.12
CLIENT	MT COTTTON GROUNDWORKS EMS
SCALE	AS SHOWN
DESIGNER	DRW GIBSON
Mike Widdows & Associates Pty Ltd 10/100 The Esplanade, Scarborough, Western Australia 6150 PO Box 3037, Scarborough WA 6150 Phone 08 9438 2000 Fax 08 9438 2001 www.mwa.com.au	
MWA	



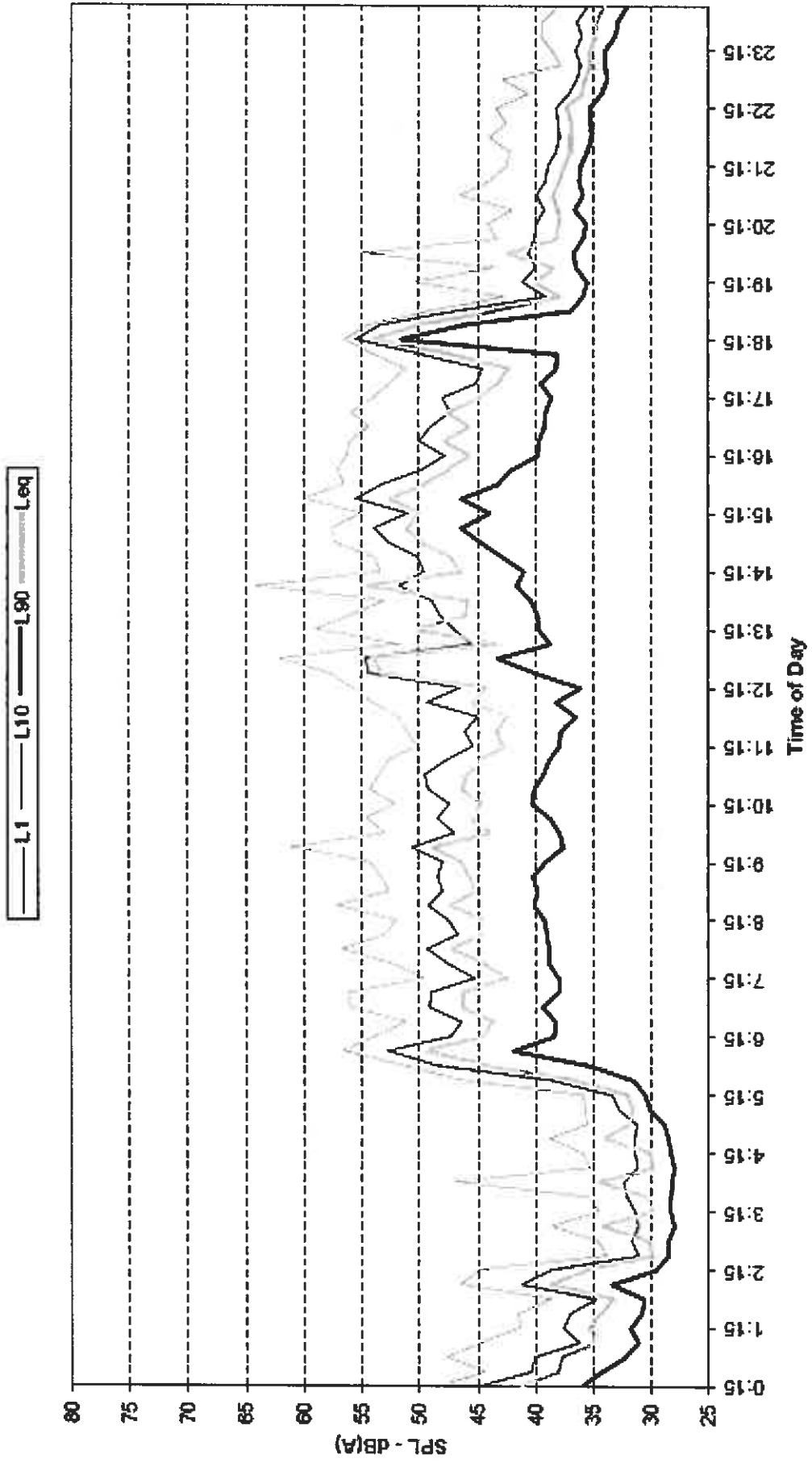
Attachment 2

Noise Datalogger Location A Results

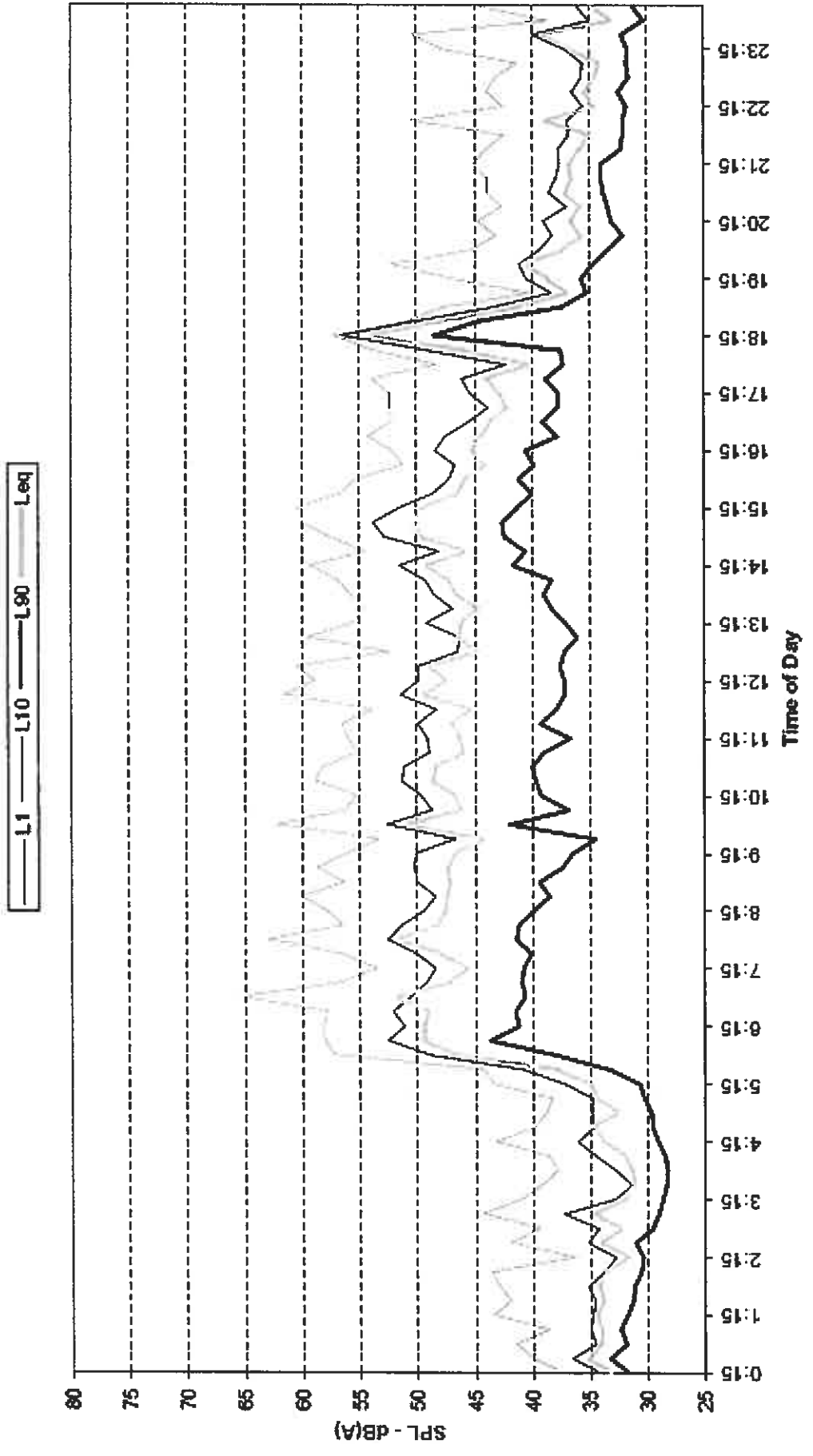
Recorded Statistical Noise Levels - Noise Datalogger Location A - 24 August 2006



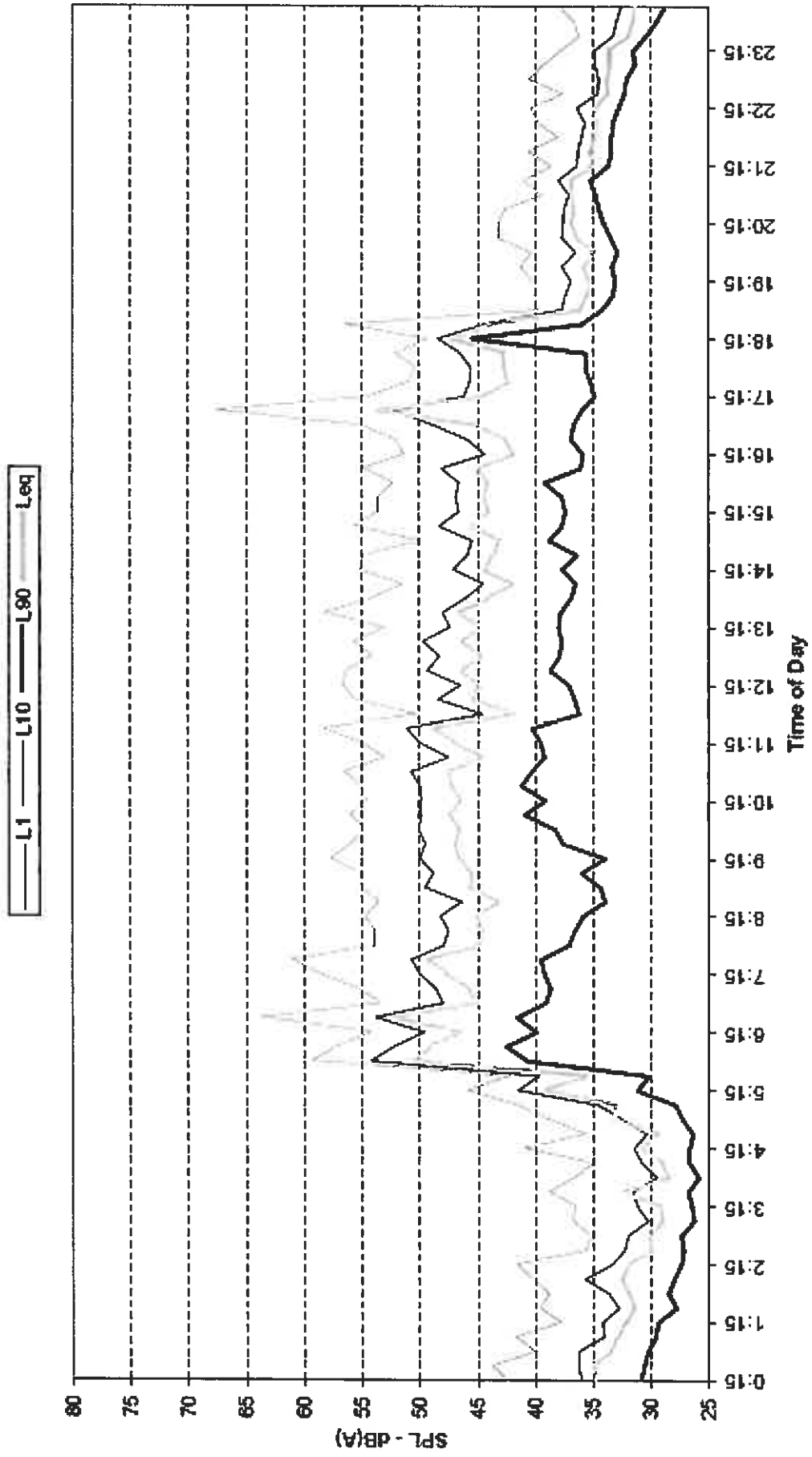
Recorded Statistical Noise Levels - Noise Datalogger Location A - 25 August 2006



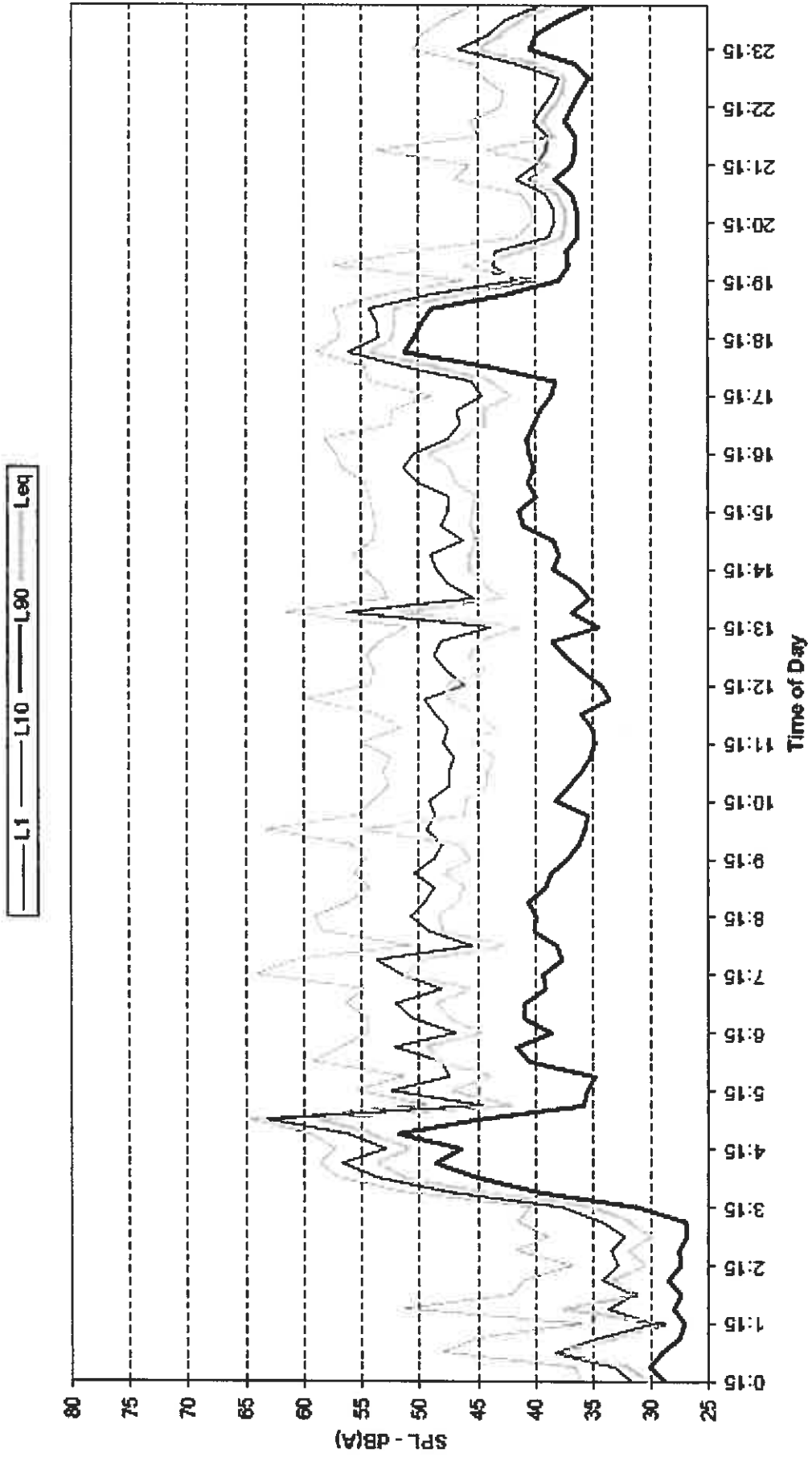
Recorded Statistical Noise Levels - Noise Datalogger Location A - 26 August 2006



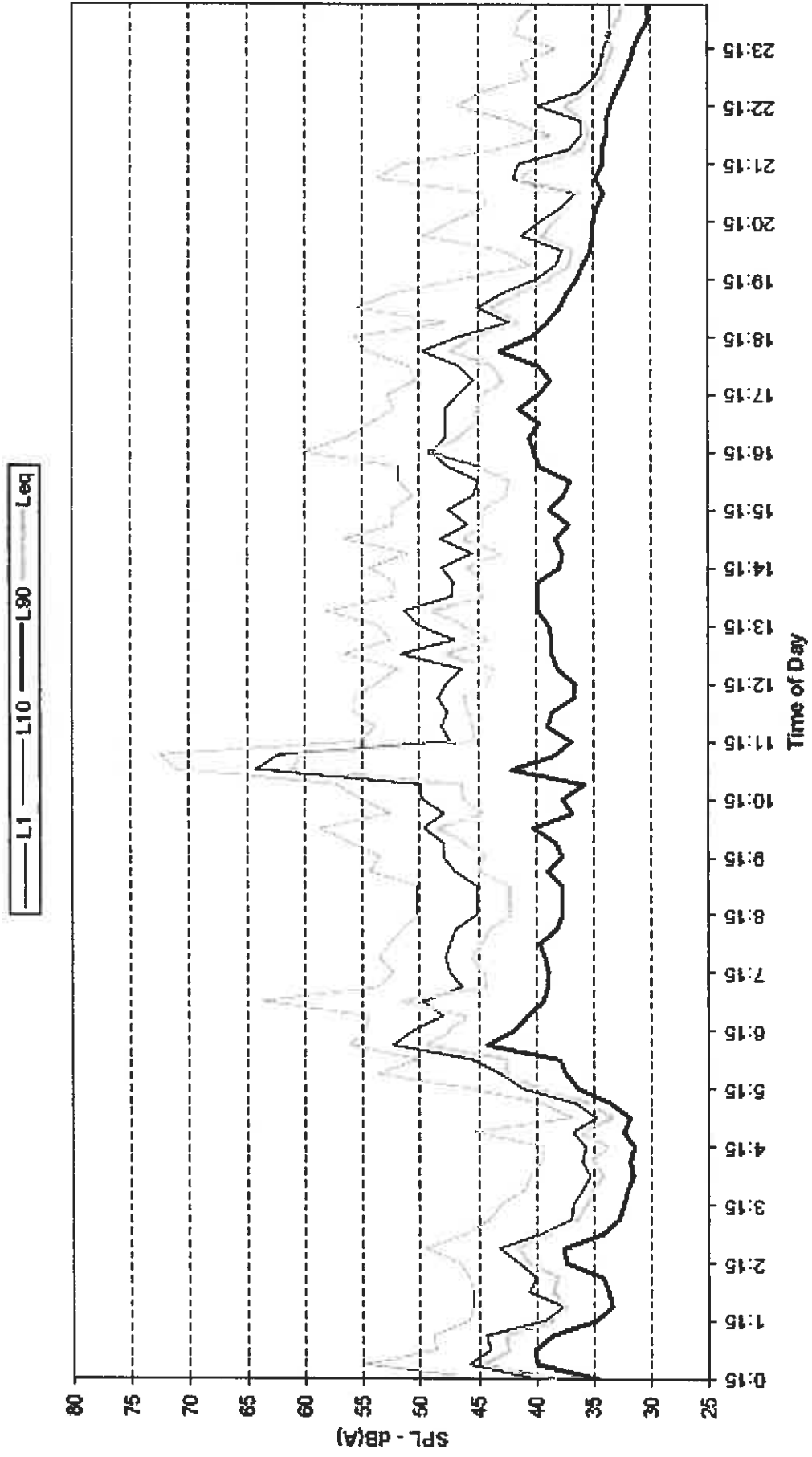
Recorded Statistical Noise Levels - Noise Datalogger Location A - 27 August 2006



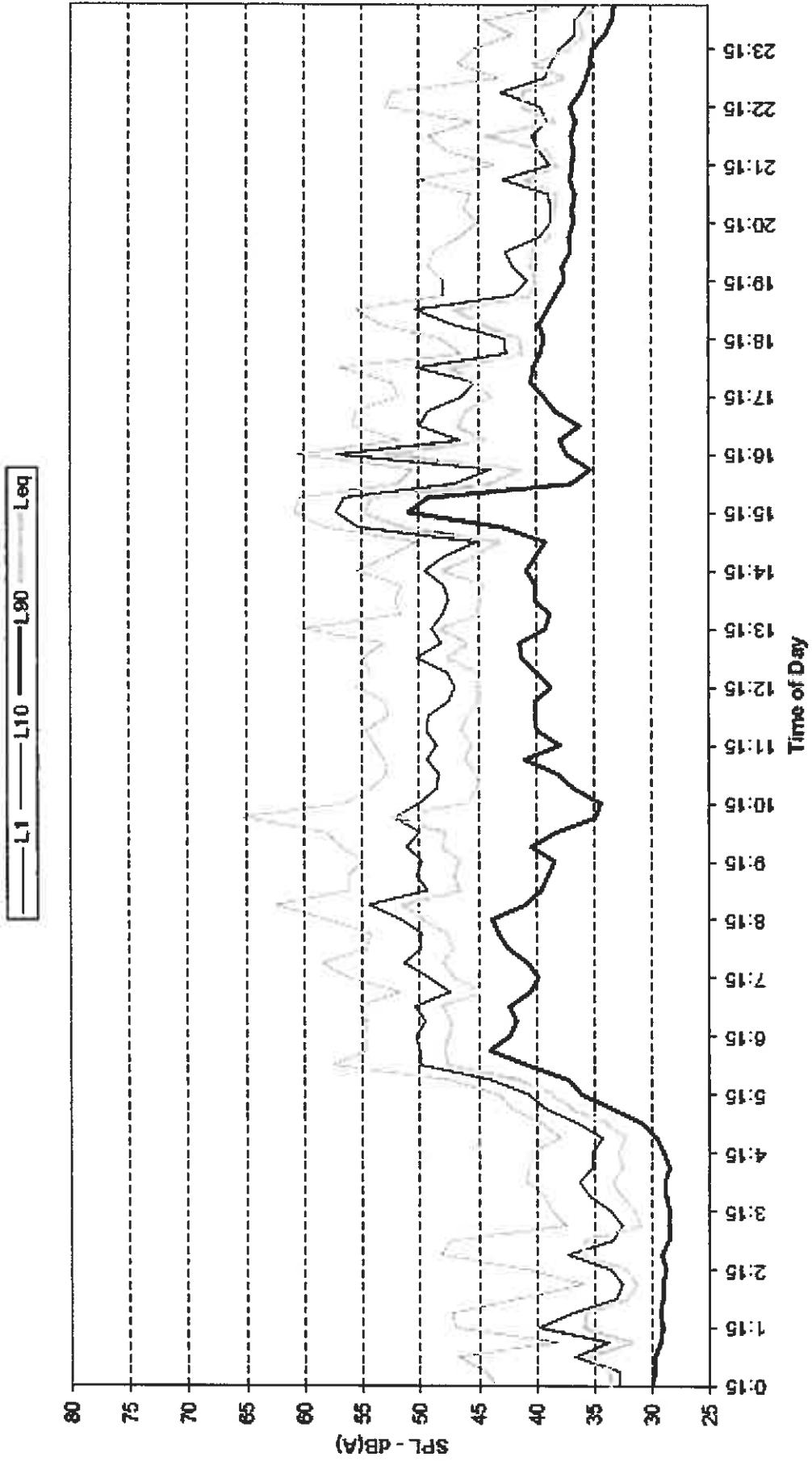
Recorded Statistical Noise Levels - Noise Datalogger Location A - 28 August 2006



Recorded Statistical Noise Levels - Noise Datalogger Location A - 29 August 2006

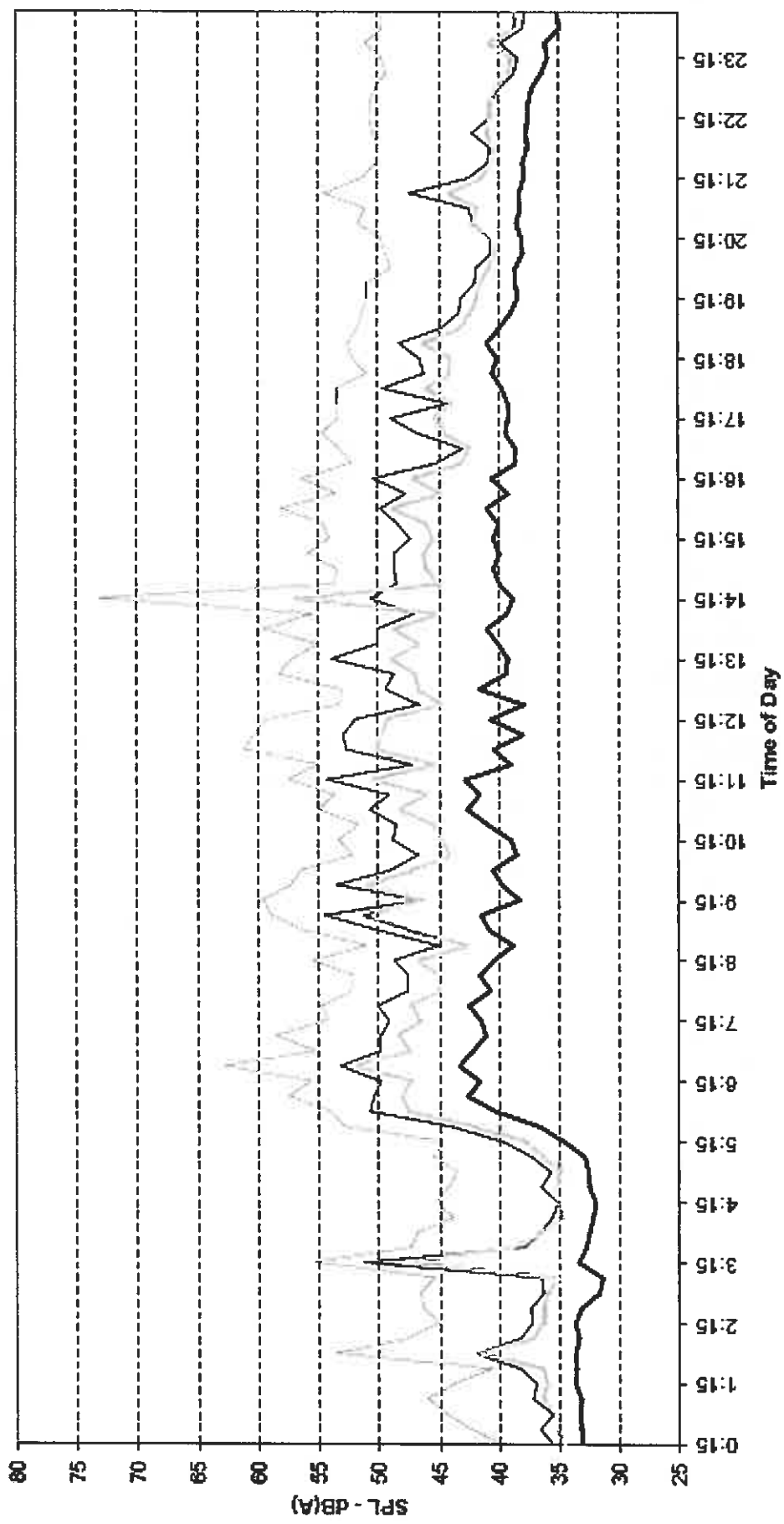


Recorded Statistical Noise Levels - Noise Datalogger Location A - 30 August 2006

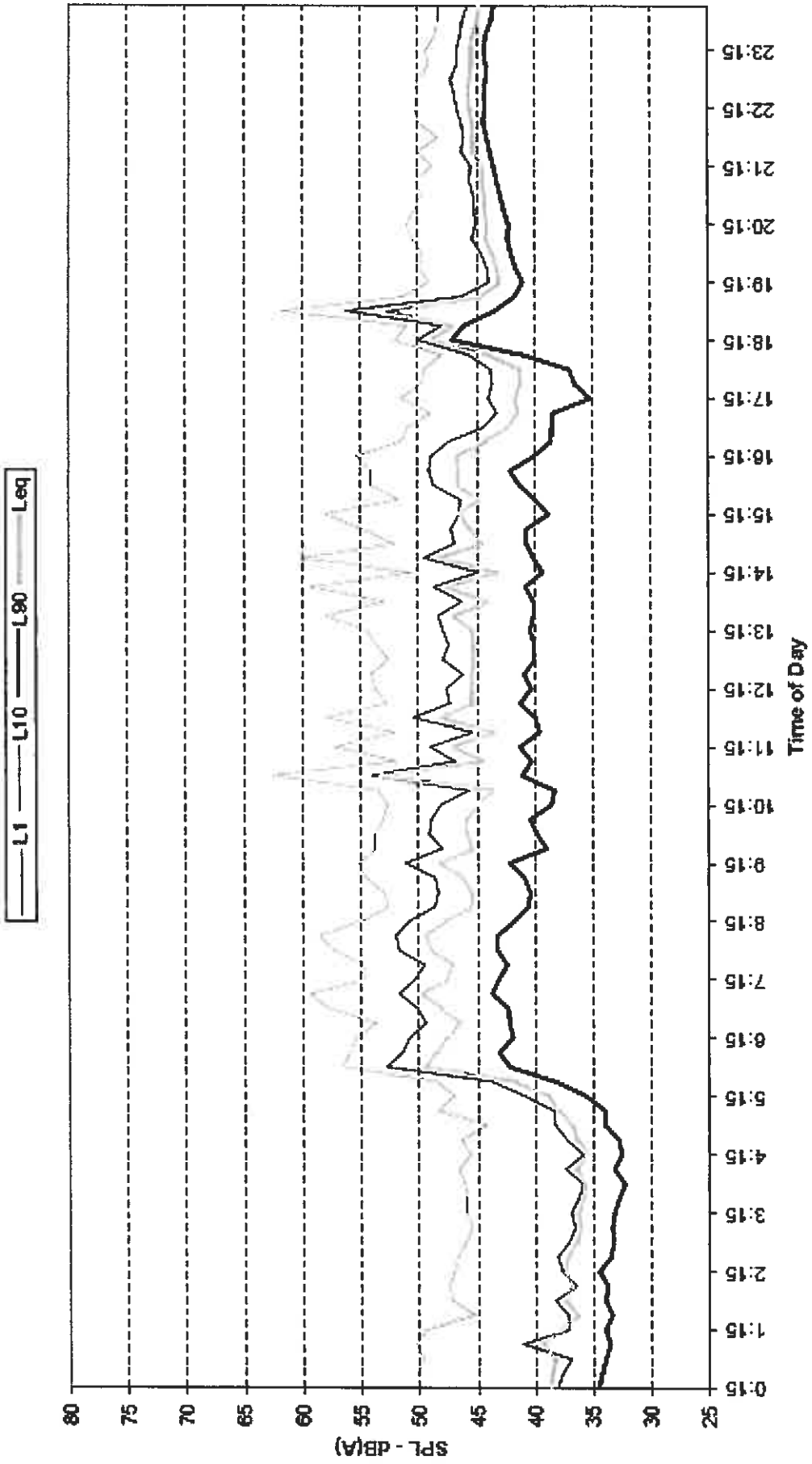


Recorded Statistical Noise Levels - Noise Datalogger Location A - 31 August 2006

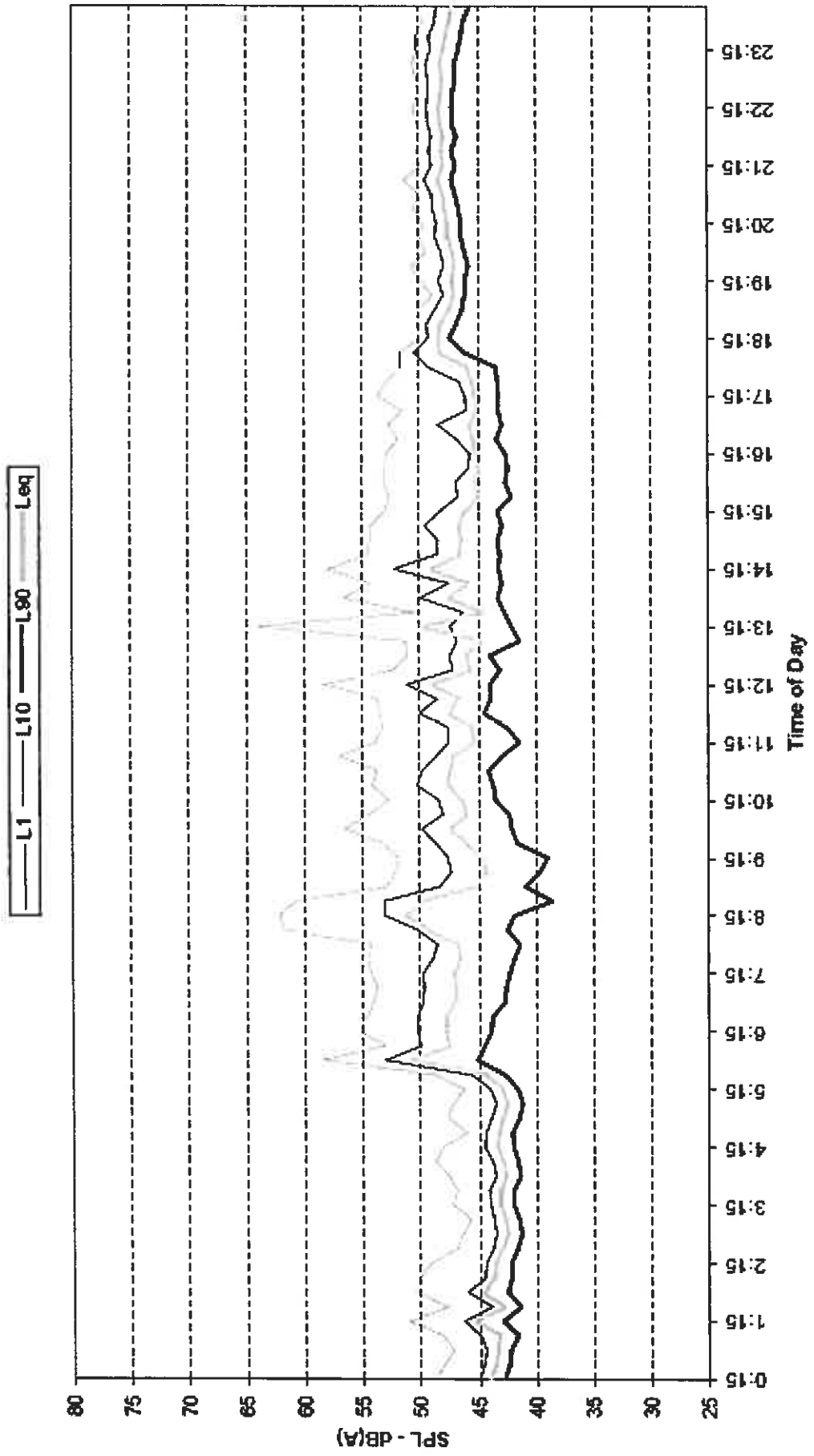
L1 L10 L90 Leq



Recorded Statistical Noise Levels - Noise Datalogger Location A - 1 September 2006



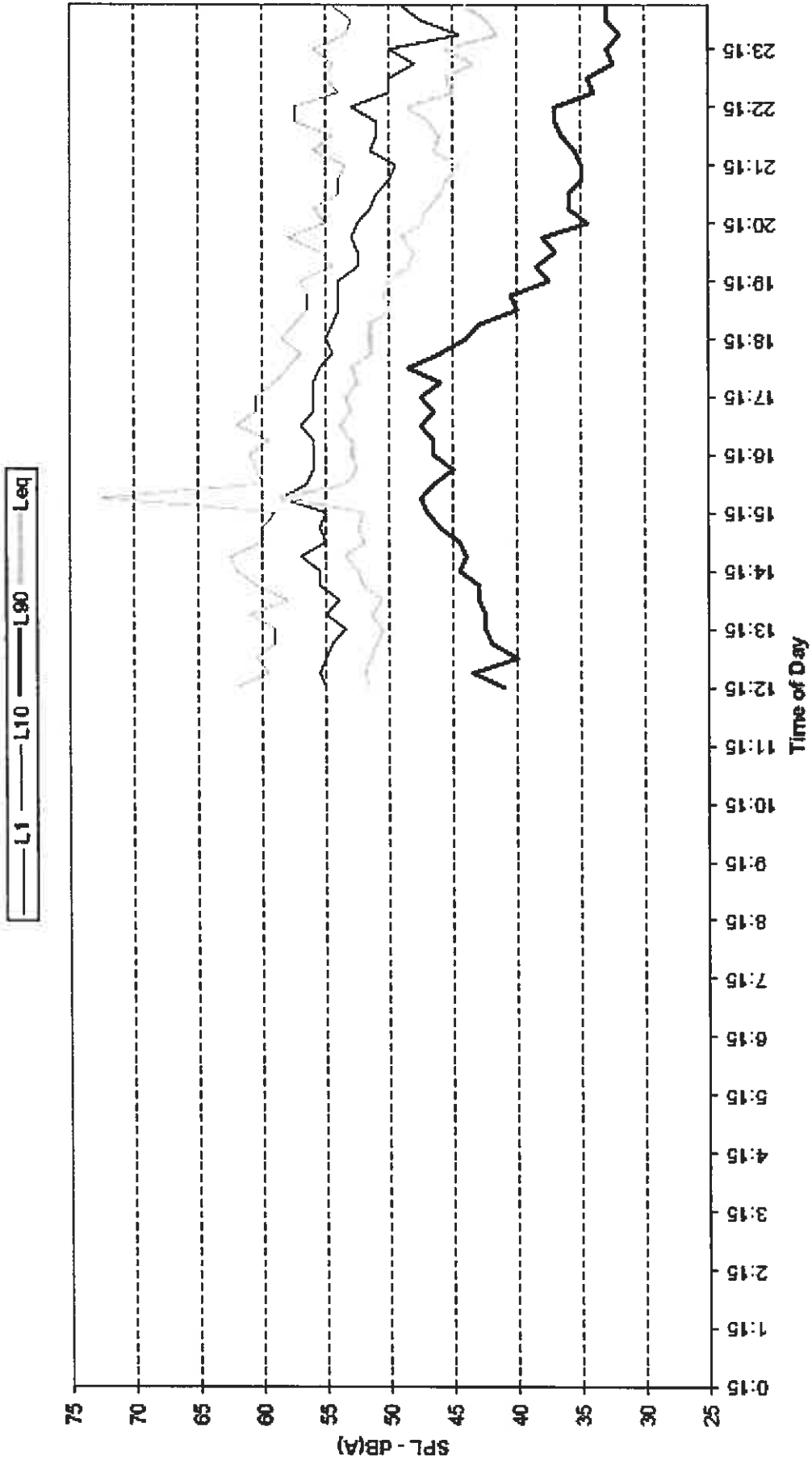
Recorded Statistical Noise Levels - Noise Datalogger Location A - 2 September 2006



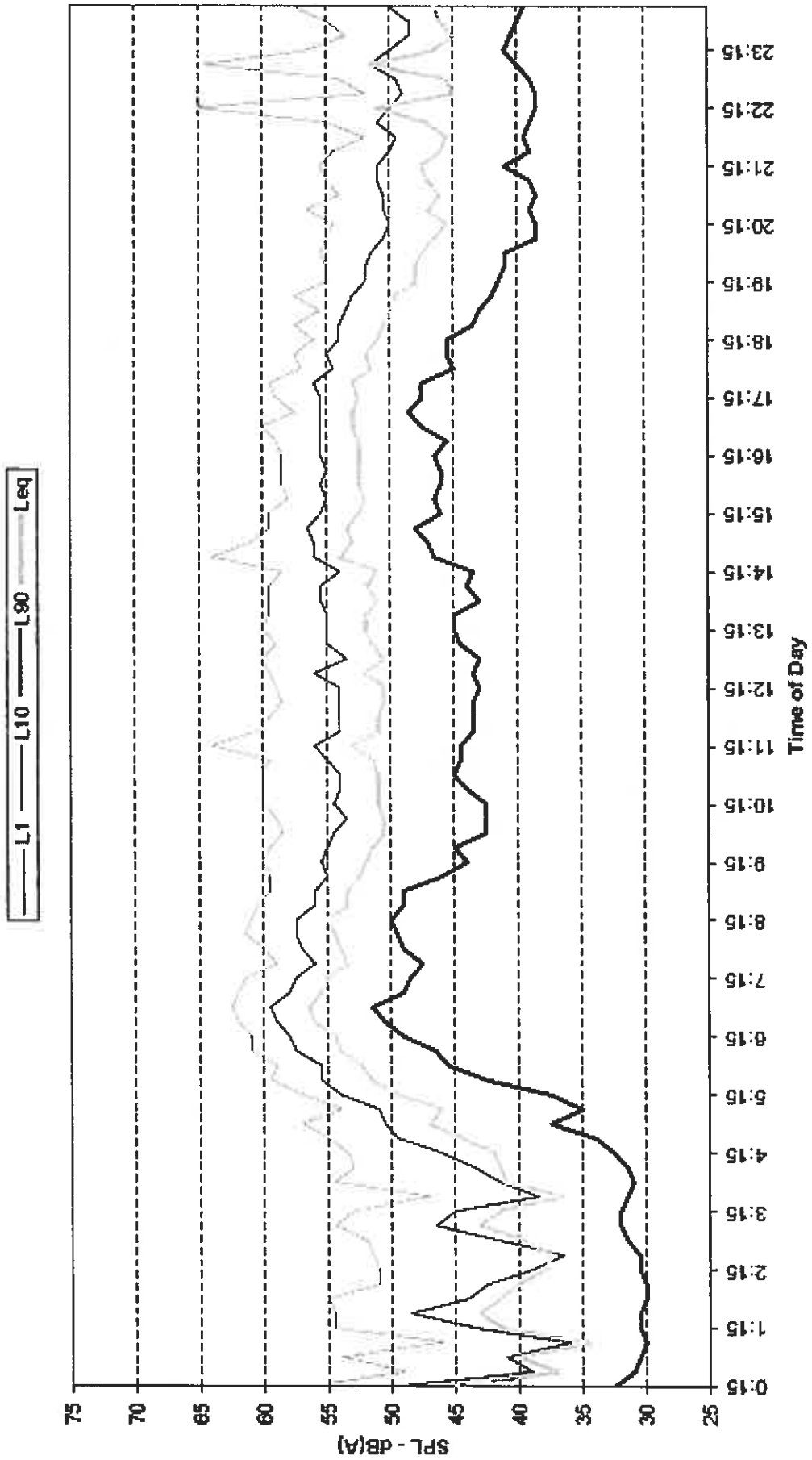
Attachment 3

Noise Datalogger Location B Results

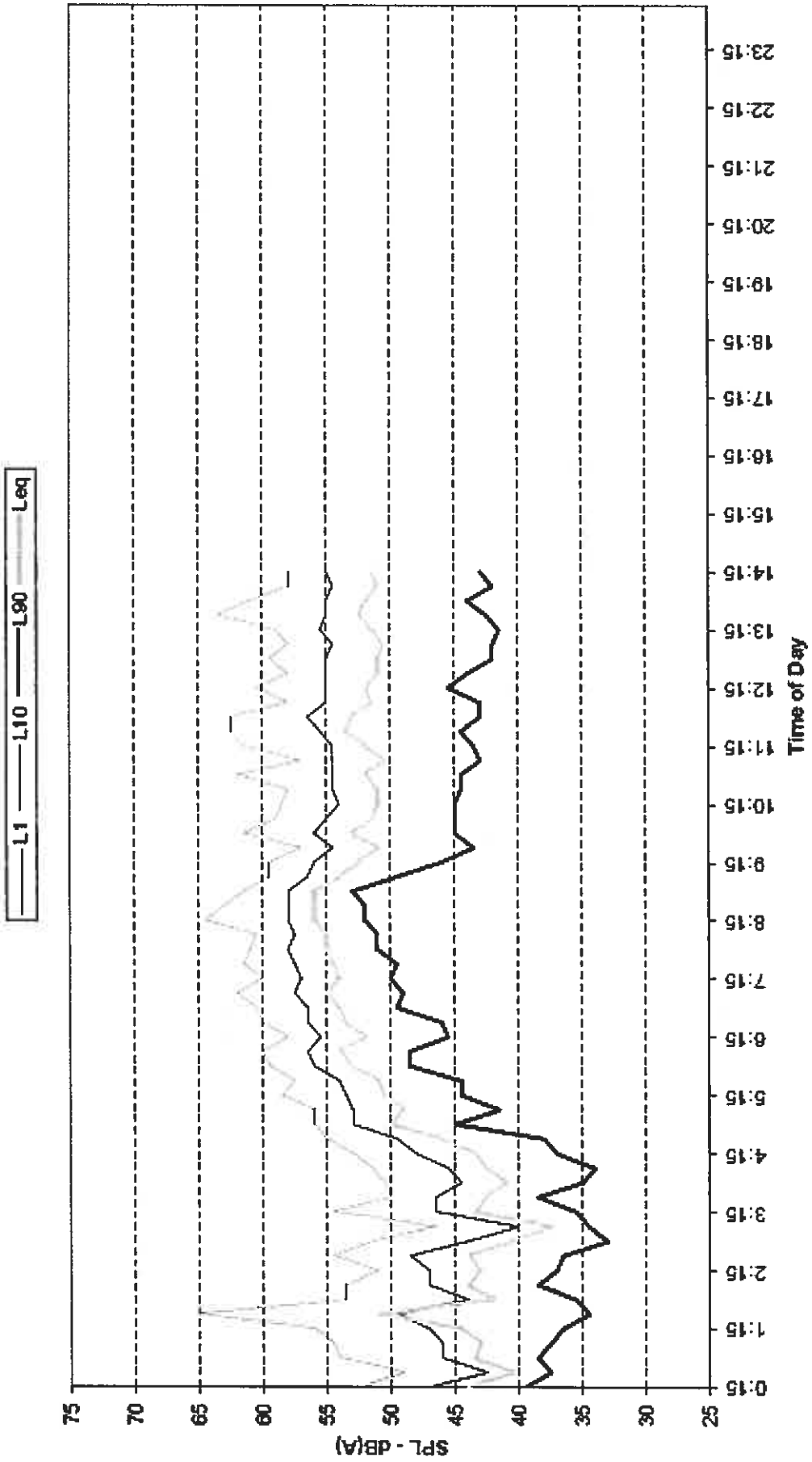
Recorded Statistical Noise Levels - Noise Datalogger Location B - 7 September, 2004



Recorded Statistical Noise Levels - Noise Datalogger Location B - 8 September, 2004



Recorded Statistical Noise Levels - Noise Datalogger Location B - 9 September, 2004

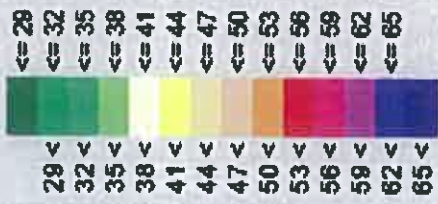


Attachment 4

***Source Noise Data
&
Model Layout***

Signs and symbols

- Source
- Contour
- Amenity Band



Mt Cotton 06-138

Stage 1
Model Layout
29.09.06

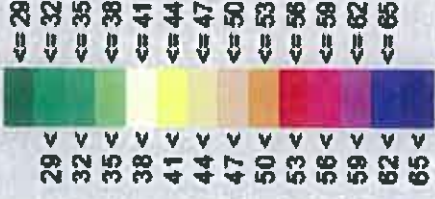


Scale 1:20000



Signs and symbols

- Source 
- Contour 
- Amenity Band 



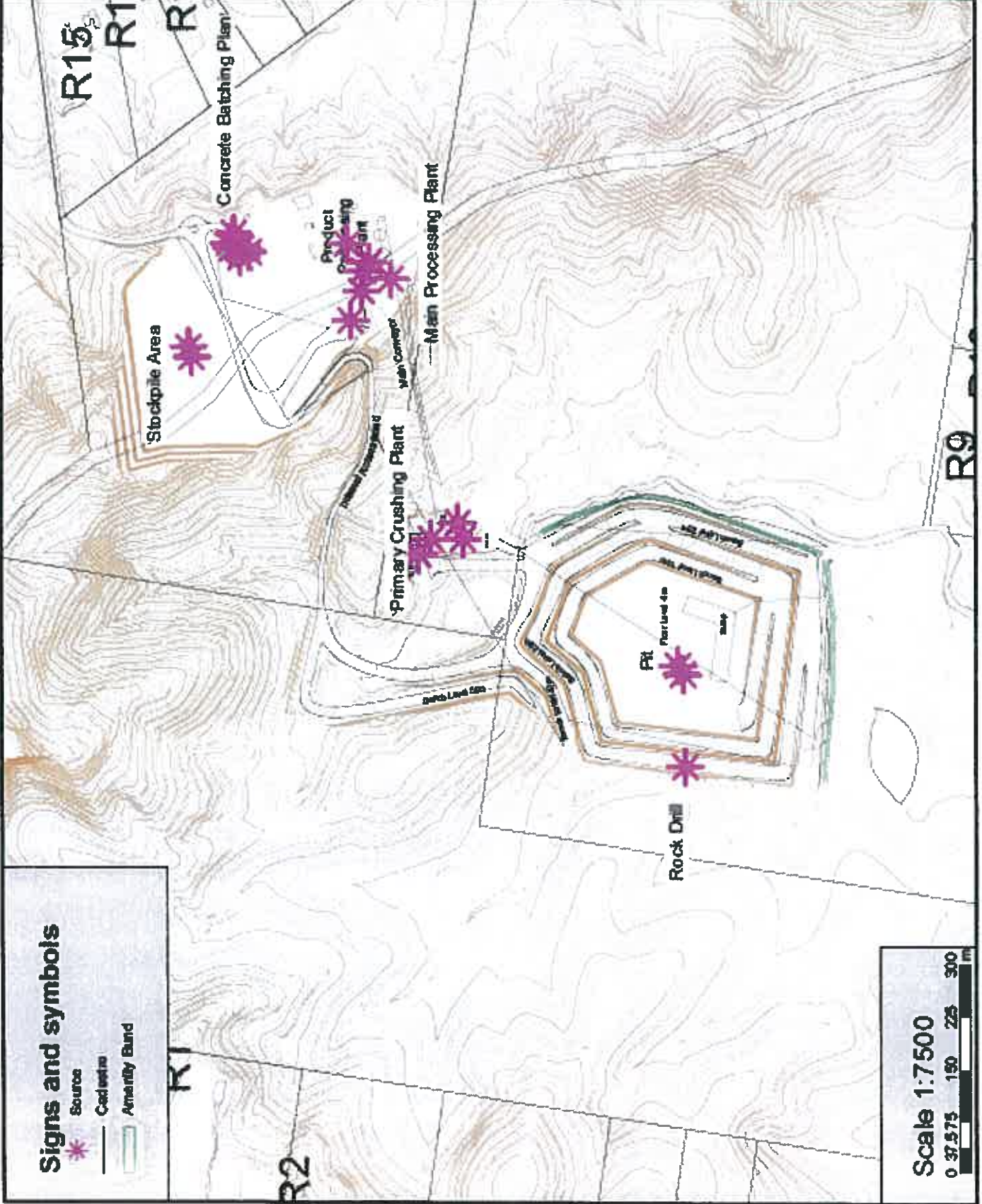
Mt Cotton 06-138

Stage 1

Source Layout

28.09.06

MW



Scale 1:7500



SoundPLAN Emission Library

Element name	Unit	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz	Sum
Rock Drill	dB(A)Muti	72.0	88.1	100.5	102.4	111.7	114.1	117.6	115.5	109.2		121.6
Primary Crusher	dB(A)Muti	70.9	88.1	93.8	96.5	101.3	103.3	101.3	97.9	91.4		106.0
Secondary Crusher	dB(A)Muti	70.9	88.1	93.8	96.5	101.3	103.3	101.3	97.9	91.4		106.0
Tertiary Crusher	dB(A)Muti	66.1	86.6	79.4	82.2	84.8	88.7	101.2	80.9	83.6		104.6
Scrap	dB(A)Muti	44.3	62.6	74.0	82.1	84.4	88.9	88.4	86.7	91.0		103.7
Loader at Processing / Stockpile Area	dB(A)Muti	74.3	83.2	90.1	93.5	97.0	100.2	97.6	92.2	84.8		104.3
Haul Truck	dB(A)Muti	78.1	81.6	87.8	91.7	97.3	100.8	97.1	91.9	84.6		104.3
Road Truck	dB(A)Muti	41.7	64.6	76.6	88.7	86.4	89.6	89.5	85.3	88.4		104.1
Conveyor Motor	dB(A)Muti	62.7	72.6	80.6	89.0	84.1	97.6	82.6	85.5	75.4		100.3
Agitator Truck @ Stump Stand	dB(A)Muti		65.8	83.9	87.4	97.8	102.0	105.2	101.0	93.9		106.5
Agitator Truck @ Washout Pit	dB(A)Muti		61.8	66.9	81.4	89.8	95.0	96.2	99.0	93.9		102.7
Loading of Agitator Truck @ Batching Pit	dB(A)Muti		61.8	86.9	92.4	104.8	109.0	110.2	110.0	107.9		115.8
Bag Filter Fan	dB(A)Muti		52.8	62.9	69.4	79.8	80.0	77.2	69.0	60.9		84.3
Rock Drill - Catenated (10dB)	dB(A)Muti	82.0	78.1	90.5	92.4	101.7	104.1	107.6	105.5	99.2		111.8
Enclosed Loading Agitator Truck @ Batch	dB(A)Muti	51.8	76.9	82.4	84.8	84.8	89.0	100.2	100.0	97.9		105.8
Enclosed Primary Crusher	dB(A)Muti	65.9	83.1	87.8	91.5	86.3	86.3	86.3	82.9	86.4		103.0
Enclosed Secondary Crusher	dB(A)Muti	65.9	83.1	88.8	91.5	86.3	86.3	86.3	82.9	86.4		103.0
Enclosed Screen	dB(A)Muti	39.3	57.6	69.0	77.1	89.4	93.9	93.4	91.7	86.0		96.7

Max Winders and Associates Consulting Engineers and Environmental Scientists

Attachment 2

Noise Experts Joint Witness Report

Planning and Environment Court Appeal No BD3438 of 2007

**In the Planning and Environment Court
Held at: Brisbane**

Appeal No BD3438 of 2007

Between:	BARRO GROUP PTY LTD	Appellant
And:	REDLAND SHIRE COUNCIL	Respondent
And:	DAVID PETER KEOGH AND JAYNE ELIZABETH KEOGH	First Co-Respondent
And:	DON BAXTER, BIRKDALE PROGRESS ASSOCIATION	Second Co-Respondent
And:	CHIEF EXECUTIVE, DEPARTMENT OF NATURAL RESOURCES AND WATER	Third Co-Respondent
And:	CHIEF EXECUTIVE, DEPARTMENT OF MAIN ROADS	Fourth Co-Respondent
And:	NATHAN DONALDSON	Fifth Co-Respondent
And:	NATASHA DANIELL	Sixth Co-Respondent
And:	CHIEF EXECUTIVE OF THE DEPARTMENT OF THE ENVIRONMENTAL PROTECTION AGENCY	Seventh Co-Respondent
And:	RAFAEL ROD NATHAN AND LINDA SUSANNE NATHAN, JANET KIRSTEN DENMAN AND PETER WILLIAM BRATOLICH, TREVOR GERALD PENSON, ANTHONY PETER MALONEY, GEOFFREY ROBERT HOUSTOUN, WILDLIFE PRESERVATION SOCIETY OF QUEENSLAND, BAYSIDE BRANCH (QLD) INC, BRAD SCOTT, IAN WILLIAM BRIDGE, KENNETH HAINSTOCK AND EVA LYNNE PORTER.	Eighth Co-Respondent
And:	LESLEY ALEXANDRA NOAH	Ninth Co-Respondent
And:	ANDREW RICHARD RIMINGTON	Tenth Co-Respondent
And:	WILDLIFE PRESERVATION SOCIETY OF QUEENSLAND, LOGAN BRANCH INCORPORATED	Eleventh Co-respondent
And:	LOGAN CITY COUNCIL	Twelfth Co-respondent

**Appeal Against Decision to Approve a Development Application
for a Development Permit for a Material Change of Use for an Extractive Industry (Extension of
Quarry Operations)**

Joint Statement of Noise Experts

**Prepared for the Planning and Environmental Court
by
Paul King, Frits Kamst, John Savery and Russell Brown**

September 30, 2008

September 2008

1. The subject appeal relates to a decision by the Respondent, Redland Shire Council, to refuse a Development Application by the Appellant, Barro Group Pty Ltd for a Development Permit for a Material Change of Use for an Extractive Industry (Extension of Quarry Operations) including ERA 20(c) (Extracting rock or other material), ERA 22(c) (Screening etc materials), ERA 11(a) (Crude oil or petroleum product storing) and ERA 28 (Motor vehicle workshop) at 1513-1515 Mount Cotton Road and 195 Gramzow Road, Mount Cotton more particularly described as Lots 1 to 17 RP108970, Lot 162 on S31962, Lot 238 on S31474 & Lot 370 on S311071.
2. On 29 November 2007, Barro Group Pty Ltd filed a Notice of Appeal against the refusal of the application.
3. On 10 July 2008, an Order was made by Judge Wilson SC setting a timetable for the progress of the appeal.
4. At Clause 9 of the Order of 10 July 2008, His Honour directed that on or before 29 August 2008, the expert witnesses in the same field, notified in accordance with paragraph 14 of the Order, other than town planners, shall hold meetings of experts in accordance with Practice Direction No 1 of 2006 and prepare a joint report identifying, in relation to the disputed issues relevant to their particular field of expertise:-
 - (a) information or data to be used to address the disputed issues;
 - (b) the appropriate methodology to be applied to address the disputed issues;
 - (c) relevant standards (including, but not limited to provisions of any relevant local planning instrument, and/or of any State or Federal legislation) to be referred to address the disputed issues;
 - (d) how, when and by whom any relevant testing, field surveys or investigations agreed to be necessary to properly address the disputed issues will be carried out; and
 - (e) a brief summary of the differences, if any, between the experts in respect of the matters referred to in subparagraphs (a), (b) and (c) above.
5. The Appellant, the Respondent, the Eighth Co-Respondent and the Twelfth Co-Respondent have each briefed noise experts to assess the specific noise issue raised in the appeal. Mr Paul King of MWA Environmental represents the Appellant, Mr Frits Kamst of ASK Consulting Engineers Pty Ltd represents the Respondent, Mr John Savery of Savery & Associates (S&A) represents the Eighth Co-Respondent and Mr Russell Brown of Acoustics RB Pty Ltd (ARB) represents the Twelfth Co-Respondent. None of the other parties to this appeal has briefed a noise expert.
6. This Joint Statement of Noise Experts has been prepared by Messrs King, Kamst, Savery and Brown to assist the court in deciding this matter. The purpose of this joint statement is to convey the results of meetings between the experts held on Tuesday 19 August 2008, Friday 29 August 2008 and Thursday September 11 2008 as well subsequent e-mail correspondence and telephone discussions between the experts.
7. The objective of the meetings of the noise experts held on 19 and 29 August and September 11 2008 was to reach agreement as far as possible on the following issues with respect to matters of environmental noise emission:-
 - (i) Noise level data required to be collected and any noise level testing required to be undertaken
 - (ii) Methodology to be adopted to assess and control environmental noise emission
 - (iii) The nature and extent of any field surveys and investigations required to be conducted
 - (iv) Relevant standards to be adopted when determining the acceptability or otherwise of noise emitted to the community

8. The opinions of the experts that are presented in the following paragraphs are joint opinions unless otherwise noted.
9. On Issue (i), ie noise level data required to be collected and noise level testing required to be undertaken, the following was agreed:-
- The background and ambient noise level logging conducted by Mr Savery at four residential locations (ie Lot 4 RP186560, Lot 4 RP108970, Lot 16 RP108970 and Lot 3 RP104645) be endorsed. Subject to approval by Redland City Council (formerly Redland Shire Council) and Logan City Council and selected local residents, background and ambient noise level logging is to be conducted at three locations. The locations and the parties responsible for conducting the noise level logging are (a) at or near the SE corner of the subject site (MWA), (b) at or near the residence overlooking the subject site to the west and located on Lot 4 RP 186460 (ASK), and (c) at or near the residence on Gramzow Road at Lot 18 SP154294 (ARB). If possible, the noise level logging is to be completed by 11 September 2008 and is to include one Sunday. Each of MWA, ASK, S&A and ARB is to analyse the monitored noise levels to determine the background noise levels during the day (ie 07:00-18:00) and early morning (ie 06:00-07:00) time periods.
 - On-site determinations of the actual sound power levels of all major items of items of plant and equipment, ie fixed and mobile, currently operating on the site are to be conducted by MWA with assistance from ARB, ASK and S&A. The sound power level determinations are to be conducted during the period from September 5 to 10 October 2008. The sound power levels so determined are to be used as the input into the noise model that is to be prepared for the current operations of the quarry.
10. On Issue (ii), ie methodology to be adopted to assess and control environmental noise emission, the following was agreed:-
- A SoundPLAN noise model is to be prepared to quantify the level of noise emission from the current operations of the quarry. The noise model is to be compiled and noise level predictions are to be completed by 27 October 2008 to allow sufficient time for (a) detailed joint review of the noise model and the output of the model to be conducted and (b) the meeting of experts to be held for the purpose of identifying areas of agreement and disagreement.
 - On-site and off-site noise level measurements are to be conducted by MWA with assistance from ARB, ASK and S&A to quantify the current level of noise emission from the quarry. The results of these noise levels measurements are to be used to verify the accuracy of the noise model.
 - The noise model that has been prepared to predict the level of noise emission from the proposed future operations of the quarry is to be updated to include (a) the actual source sound power levels for the items of plant and equipment that are to be retained, (b) adjustments as appropriate to the assumed source sound power levels for new plant and equipment that is be introduced onto the site and (c) in the light of the results of the on-site and off-site noise level measurements, any modifications to the noise model deemed necessary to improve the accuracy of the noise level predictions.

- Predictions of noise emission are to be conducted by MWA and are to use (a) the ISO9613 algorithms as applied by SoundPLAN as well as (b) the CONCAWE methodology with calm wind conditions and no temperature inversion.
 - The preparation/updating of the noise model for the proposed future operations of the quarry and the compilation of the noise level predictions for the future operations are to be completed by 27 October 2008 to allow sufficient time for (a) a detailed joint review of the noise model and the output of the model to be conducted and (b) the meeting of experts to be held for the purpose of identifying areas of agreement and disagreement.
11. On Issue (iii), ie nature and extent of any field surveys and investigations, the following was agreed:-
- A joint site inspection is to be conducted on September 3, 2008.
 - The purpose of this site inspection is to inspect the current operations of the quarry and the proposed locations of the future new crushing and screening plant as well as verify the locations of the current nearby residential premises.
12. On Issue (iv), ie relevant standards to be adopted, the following agreement was reached:-
- Messrs King, Kamst and Brown agreed that DEH Guideline E3 is to be used to set the permitted maximum level of noise emission from the activities of the quarry, but not from the activities of the concrete batching plant.
 - Mr Kamst is of the view that DEH Guideline E3 is to be viewed as an upper limit only, and where possible, lower noise levels should be achieved through the adoption of best practice technology in relation to quarry development and equipment.
 - Mr Savery disagreed with the use of Guideline E3 for the purpose of assessing the noise impact of the proposed quarry upon the existing residential properties in the separation area surrounding the proposed new quarry. It is the opinion of Mr Savery that the Planning for Noise Control Guideline (PFNCG) is the current EPA approved guideline that is applicable to quarries as well as other industrial development in Queensland. Mr Savery's view is that the methodology of this guideline is appropriate for assessment of this application and it should be the basis for determining appropriate and suitable development conditions that take account of the State Planning Policy 2/07 and the environmental values of the Environmental Protection (Noise) Policy 1997. Mr Savery considered that Guideline E3 has been withdrawn by EPA and is no longer applicable as an approved planning guideline. Mr Savery stated that, in addition to PFNCG, the comparison of various acoustic parameters to the background noise level may also be helpful in determining the noise impact, provided that the background noise level is assessed in accordance with PFNCG methods.
 - All four noise experts agreed that the noise from all activities of the concrete batching plant, other than the noise generated by movements of trucks on the access road, is to be assessed against the noise level limits specified at Table 1 of Schedule F in EPA Permit No IPDE00986808 dated 8 May 2008. The noise generated by the movement of trucks on the access road is to be assessed using the comparison-of-like-parameters methodology having due regard to the significance of the specific characteristics of the noise of the truck movements when making the determination of acceptability or otherwise of the emitted noise levels.
 - Messrs Brown, Kamst and King agreed that best-practice noise control techniques are to be adopted during the design and operation of the quarry to both (i) achieve compliance with the noise level limits targets of Guideline E3 and (ii) to the extent feasible, routinely reduce emitted noise to levels below the E3 targets.

- Mr Savery agreed with Messrs Brown, Kamst and King that best practice noise control techniques are to be adopted during the design and operation of the quarry, but to achieve compliance with the noise targets derived from the PFNCG.
- Messrs Brown, Kamst and King agreed that, for each stage of expansion of the quarry, the level of noise emitted to each nearby residential dwelling is to be quantified and compared against the level of noise current emitted by the existing operations. Changes in noise levels are to be quantified to allow judgements to be made about the significance of the changes (a) at individual residences and (b) on a whole-of-community basis.
- It is the opinion of Mr Savery that the appropriate methodology for incorporating existing industry noise emissions in the setting of limits for new emissions is the PFNCG baseline measurement and assessment methodology. Mr Savery considered that this is achieved by quantitative assessments based on both the $L_{A90,T}$ and $L_{Aeq,T}$ parameters

13. Statement to the Court

In preparing this joint written statement, it is acknowledged that we have each been instructed in respect of an expert's duty to assist the Court in accordance with paragraph 15 of Practice Direction 1 of 2006 and that we have understood and discharged that duty. Furthermore, we confirm that no instructions have been given or accepted to adopt, or reject, any particular opinion when preparing this joint written statement.



Paul King

Date: 30 September 2008



per **Frits Kamst**

Date: 30 September 2008



John Savery

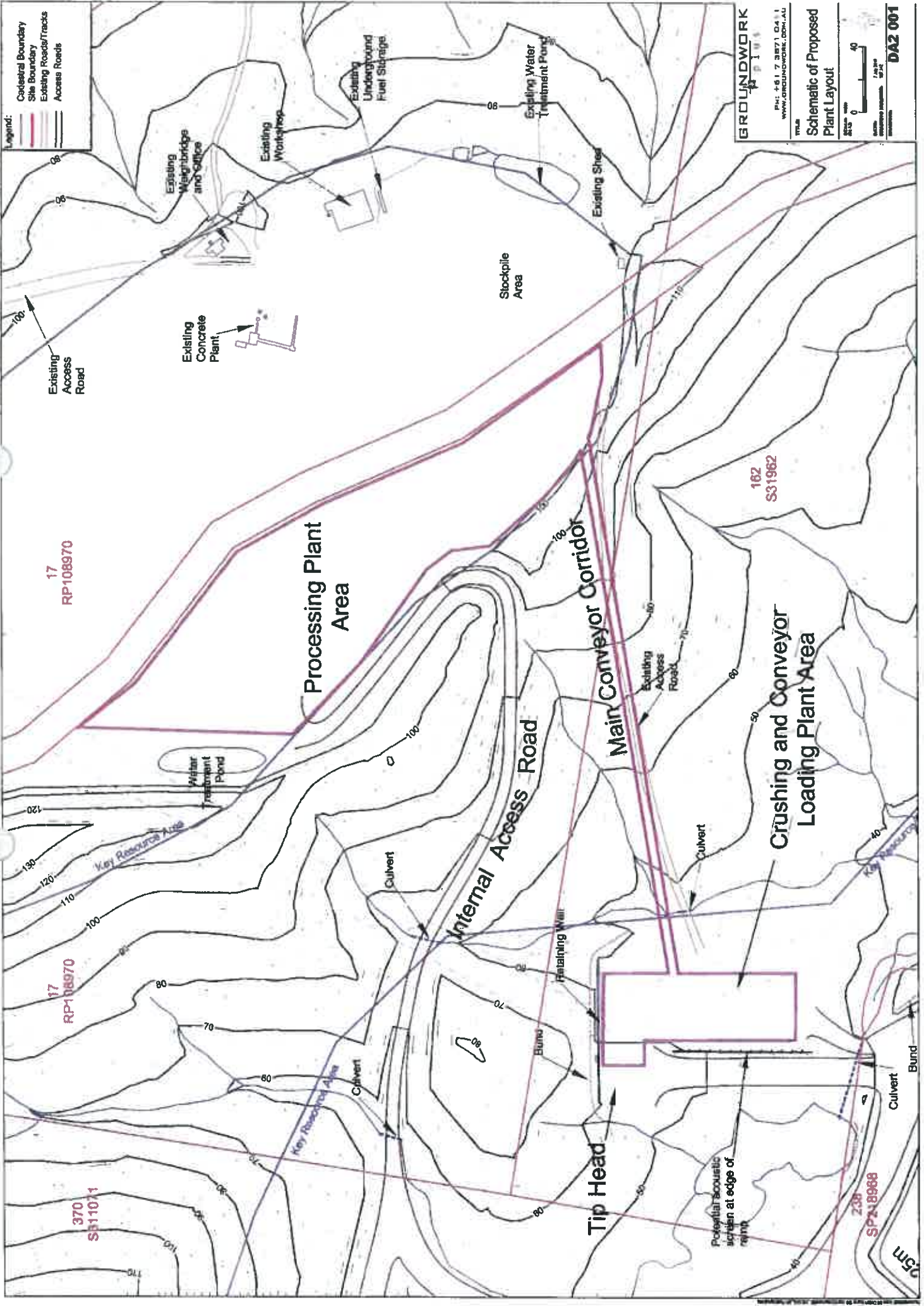
Date: 30 September 2008



Russell Brown

Date: 30 September 2008

Attachment 3
Groundwork Plus
Quarry Staging Plans



- Legend:**
- Central Boundary
 - Site Boundary
 - Existing Roads/Tracks
 - Access Roads

GROUNDWORK
 PTY. LTD.
 PH: +61 7 3871 0411
 WWW.GROUNDWORK.COM.AU

TRA
 Schematic of Proposed
 Plant Layout

Scale: 1:1000
 0 20 40
 METRES

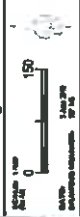
DA2 001

- Legend:
- Cadastral Boundary
 - Site Boundary
 - Existing Roads/Tracks
 - Access Roads
 - Amenity Bund
 - Water Treatment/Storage

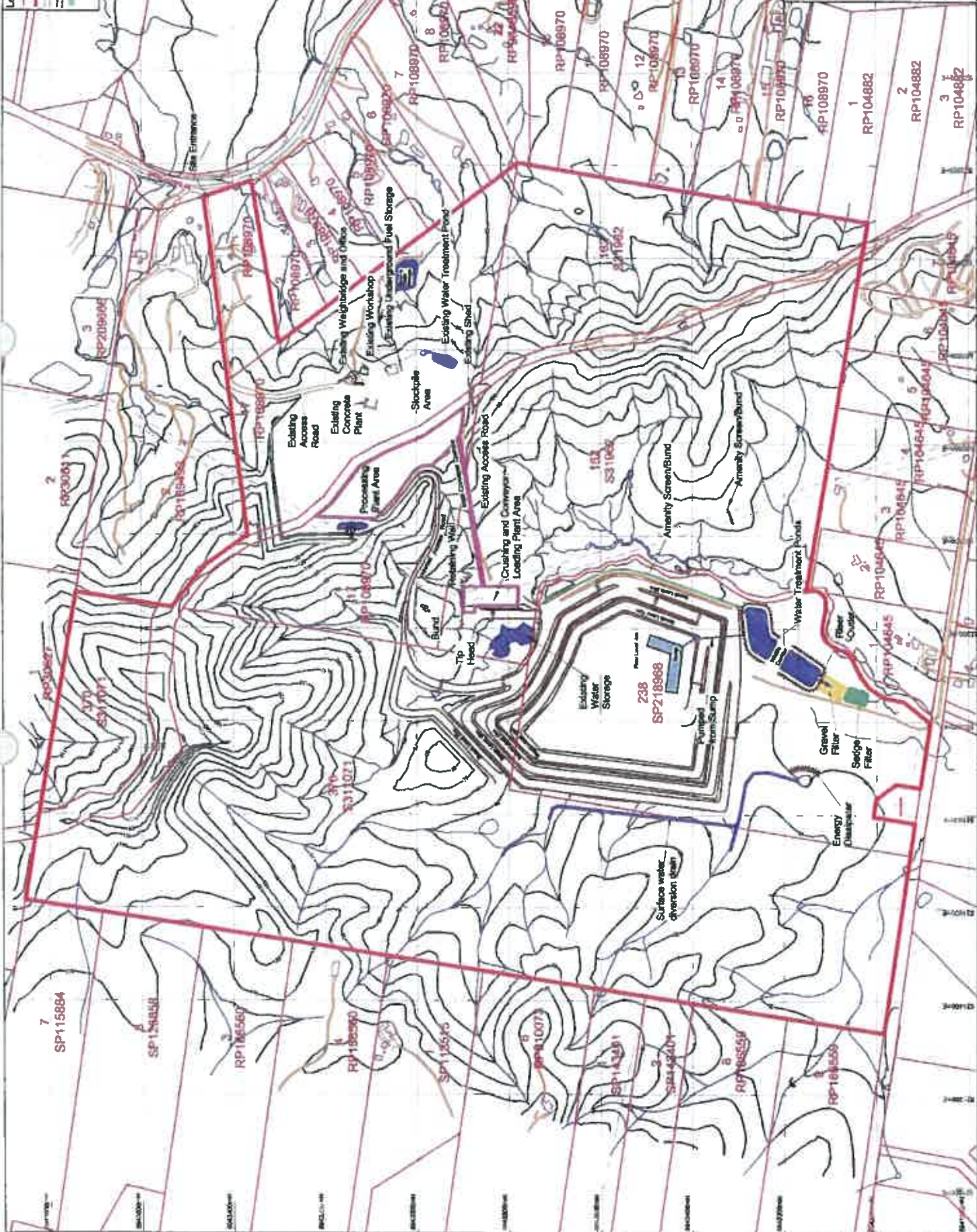
GROUNDWORK
P L U M B I N G

PH: +61 7 3871 0411
www.groundwork.com.au

Quarry Development
Plan - Stage 2



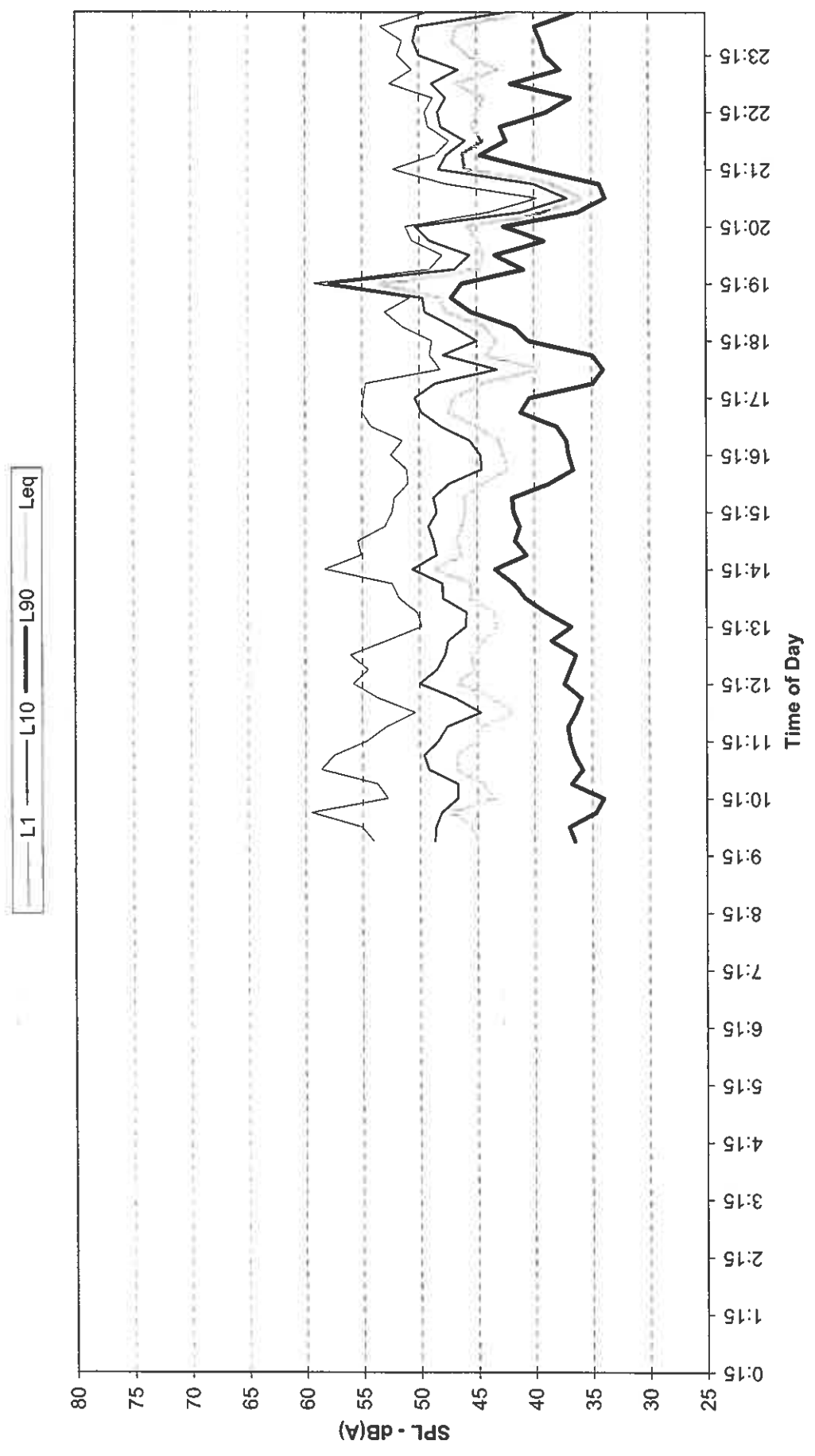
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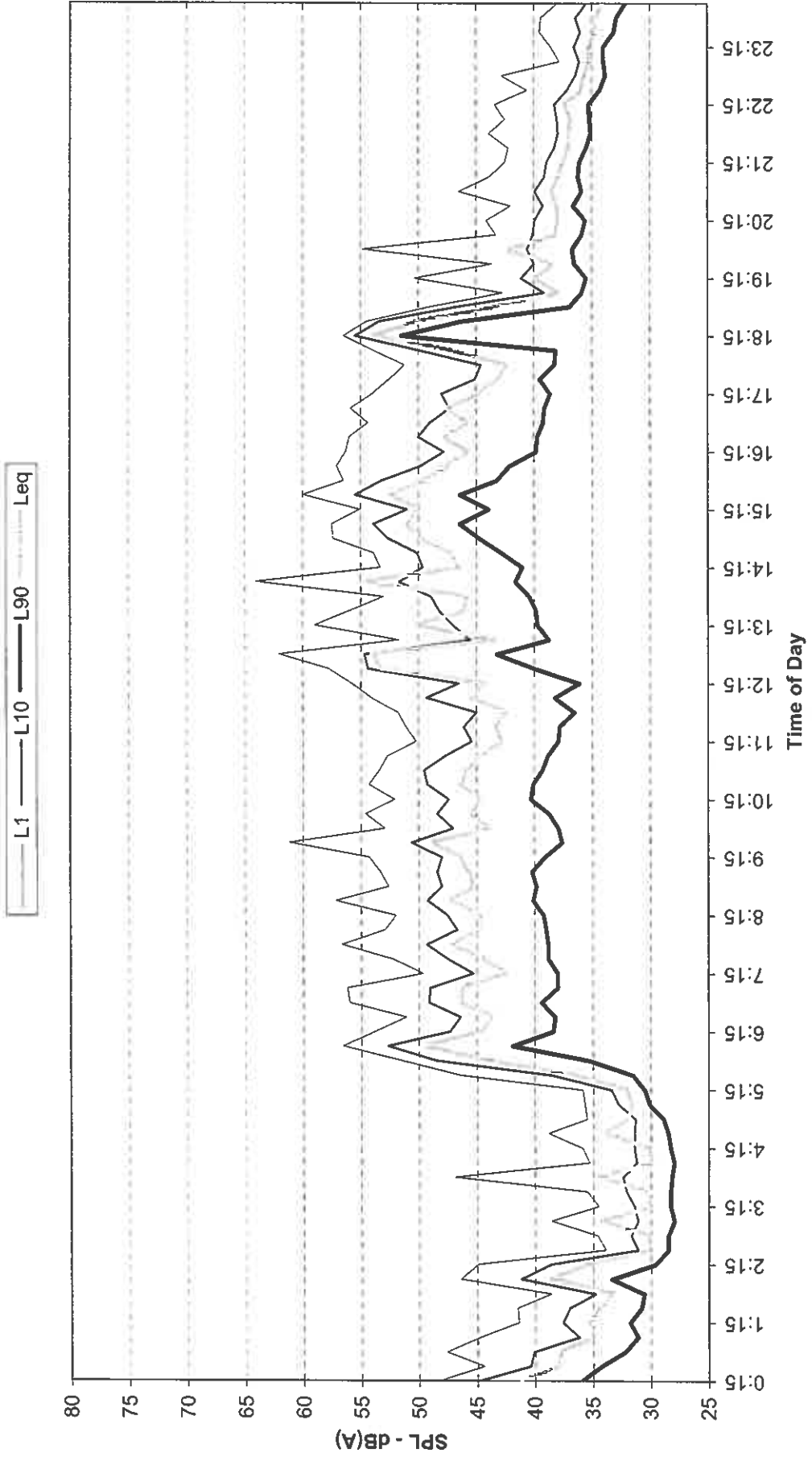
Attachment 4

Noise Datalogger Location A Results

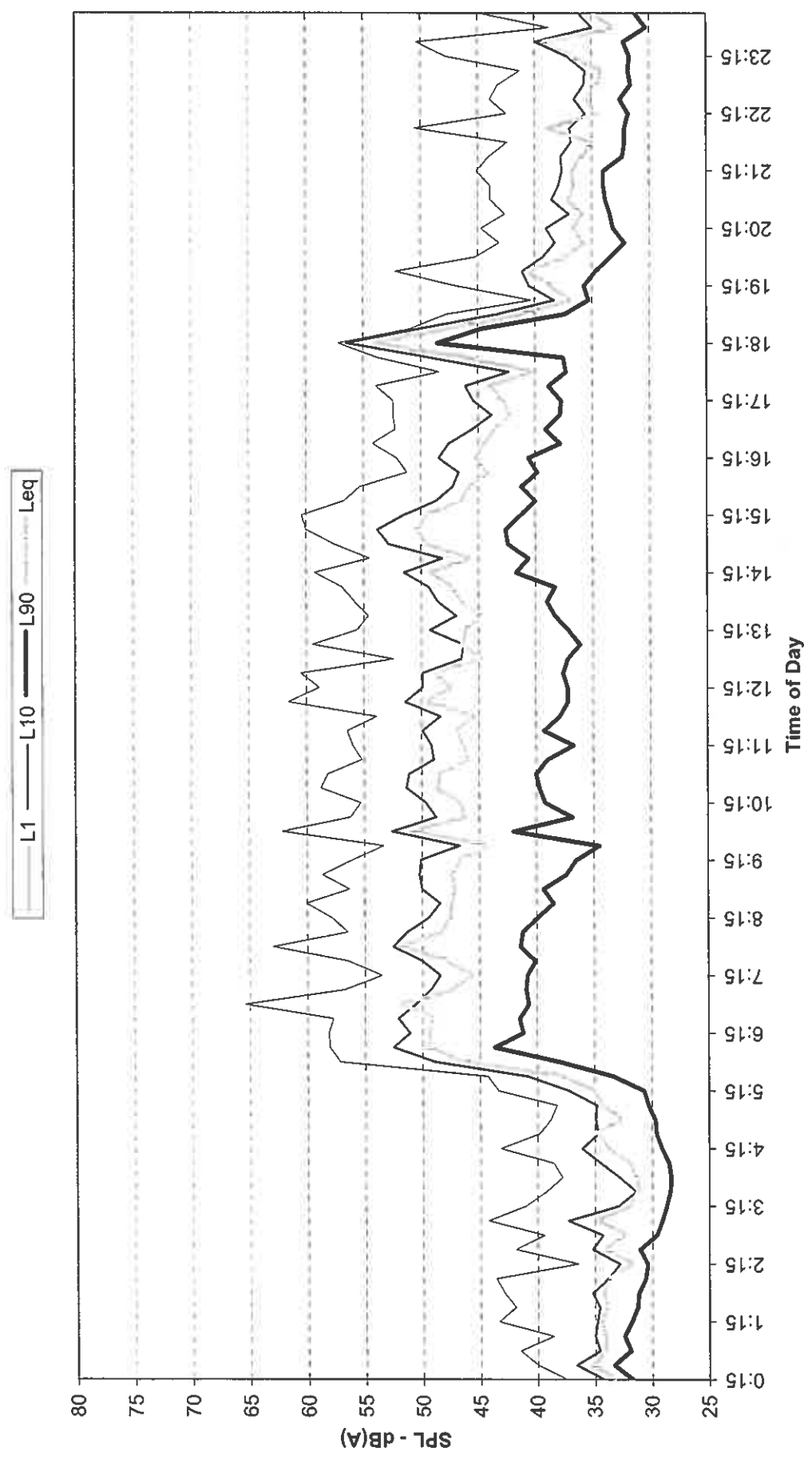
Recorded Statistical Noise Levels - Noise Datalogger Location A - 24 August 2006



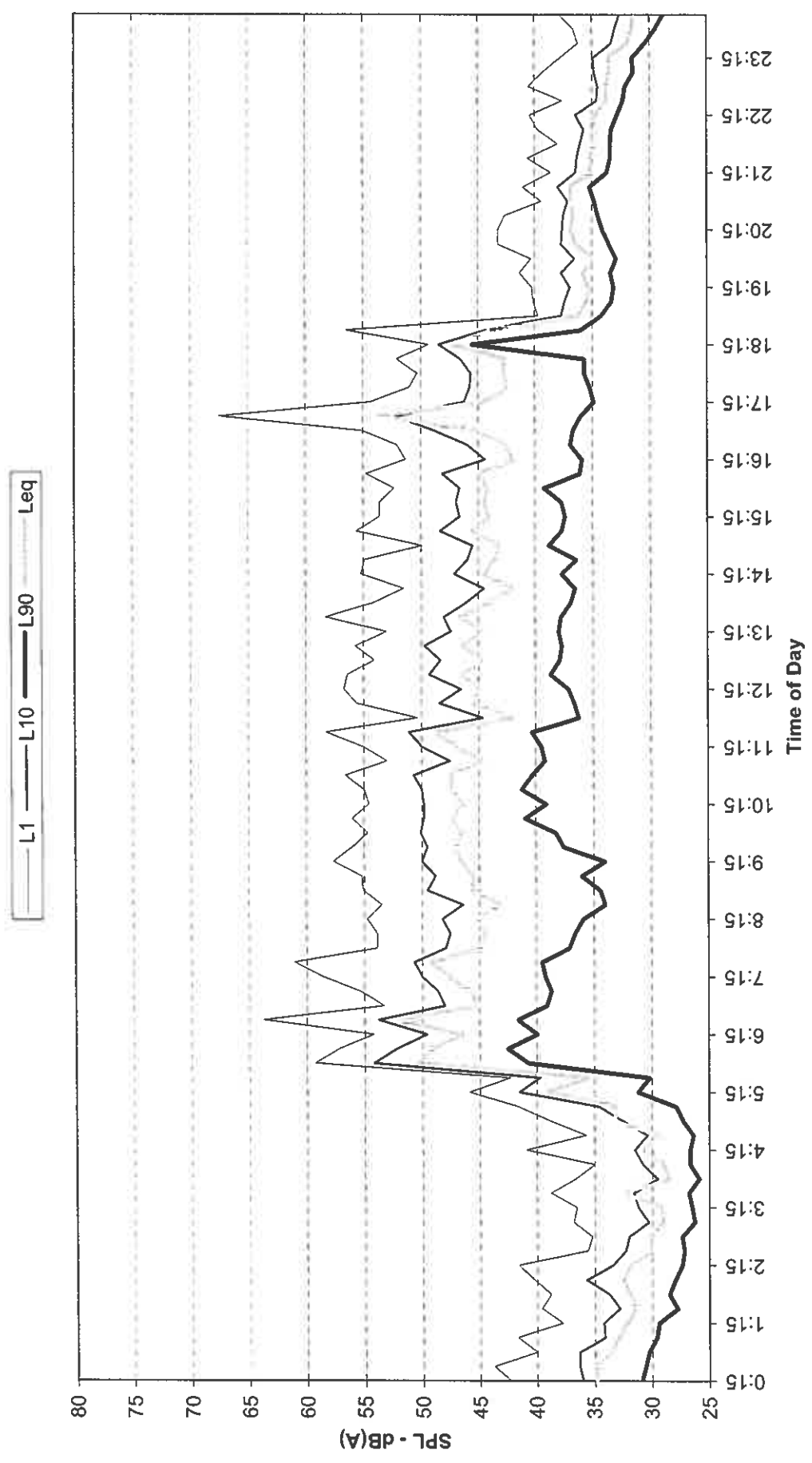
Recorded Statistical Noise Levels - Noise Datalogger Location A - 25 August 2006



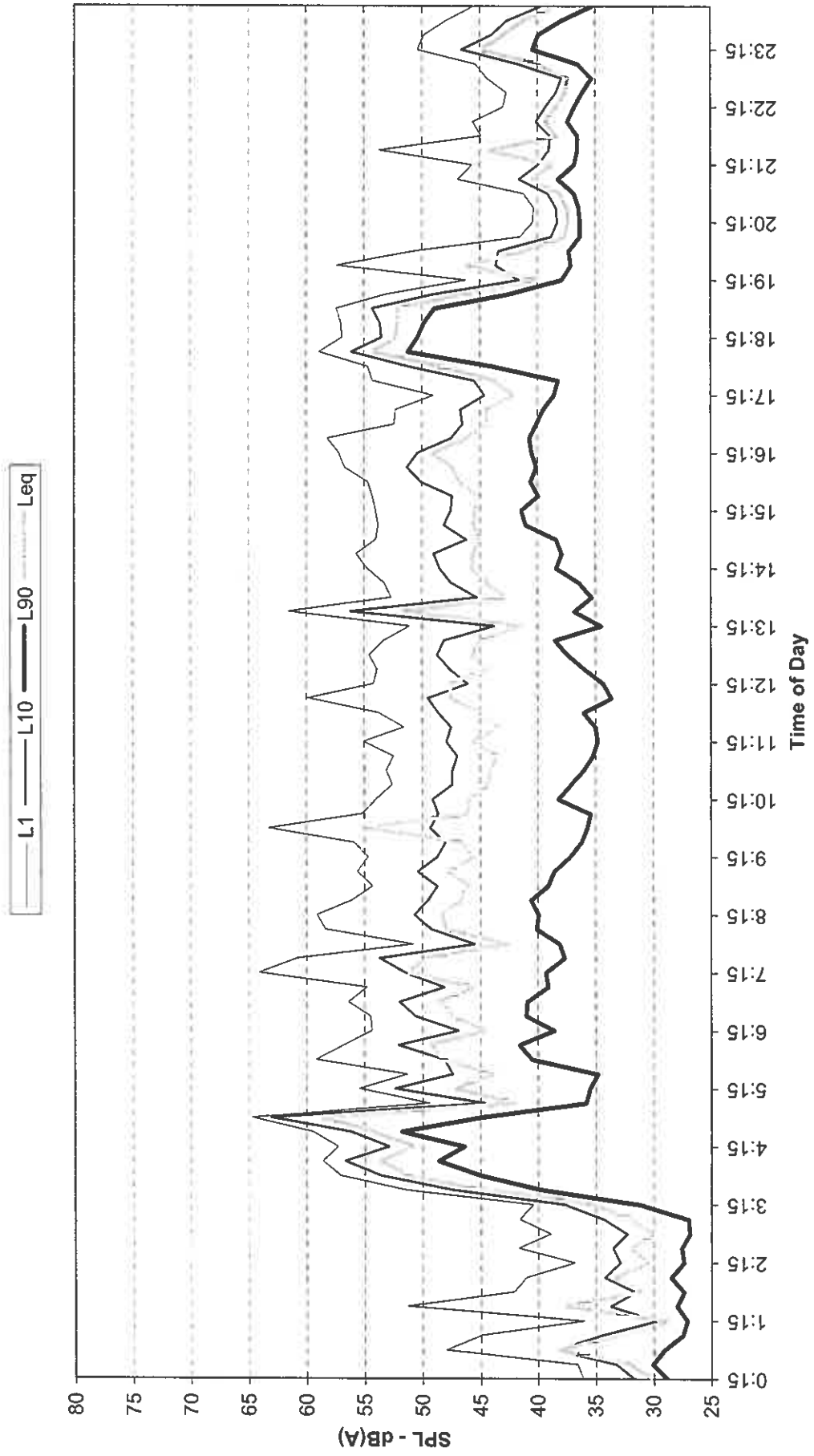
Recorded Statistical Noise Levels - Noise Datalogger Location A - 26 August 2006



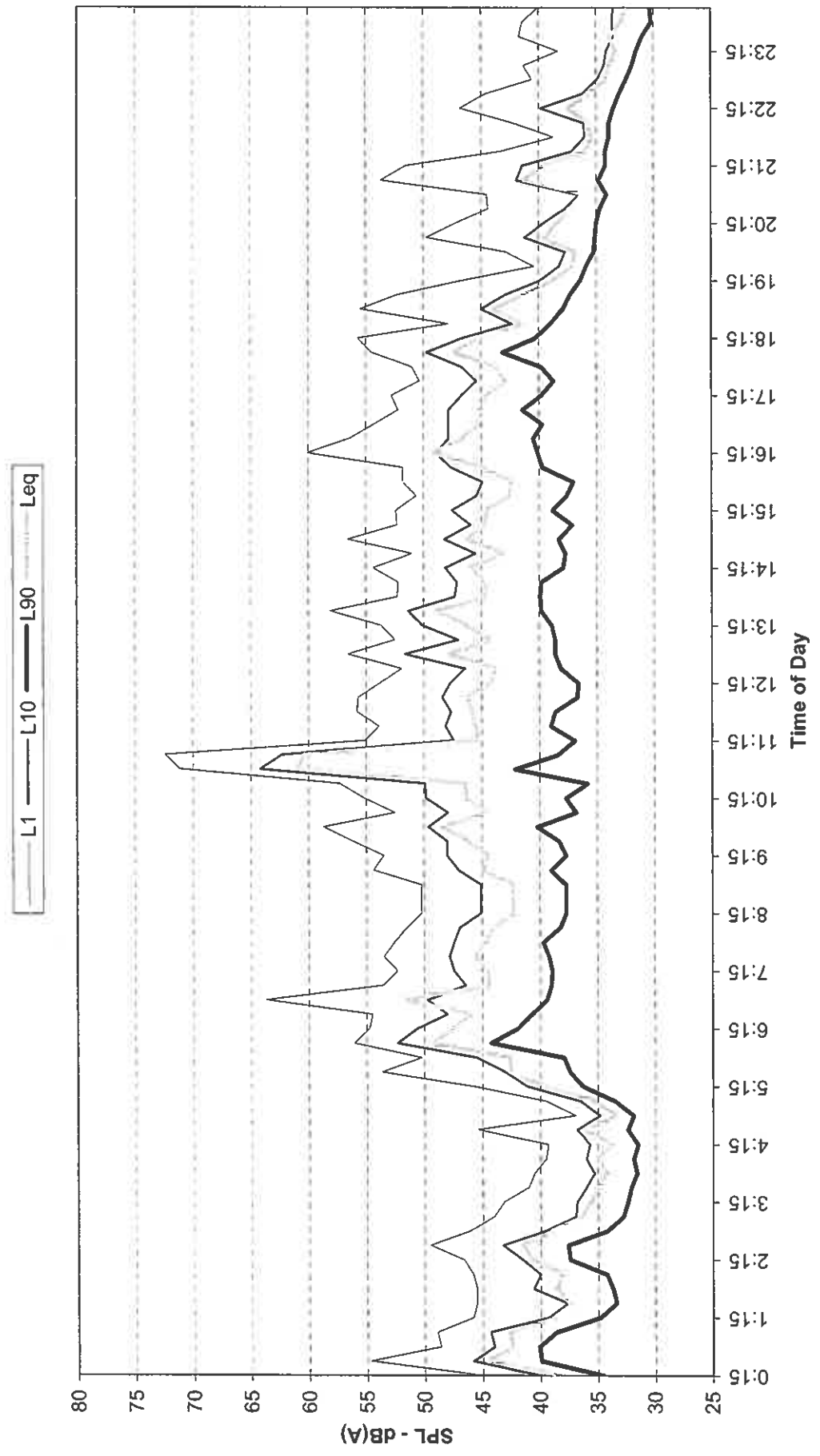
Recorded Statistical Noise Levels - Noise Datalogger Location A - 27 August 2006



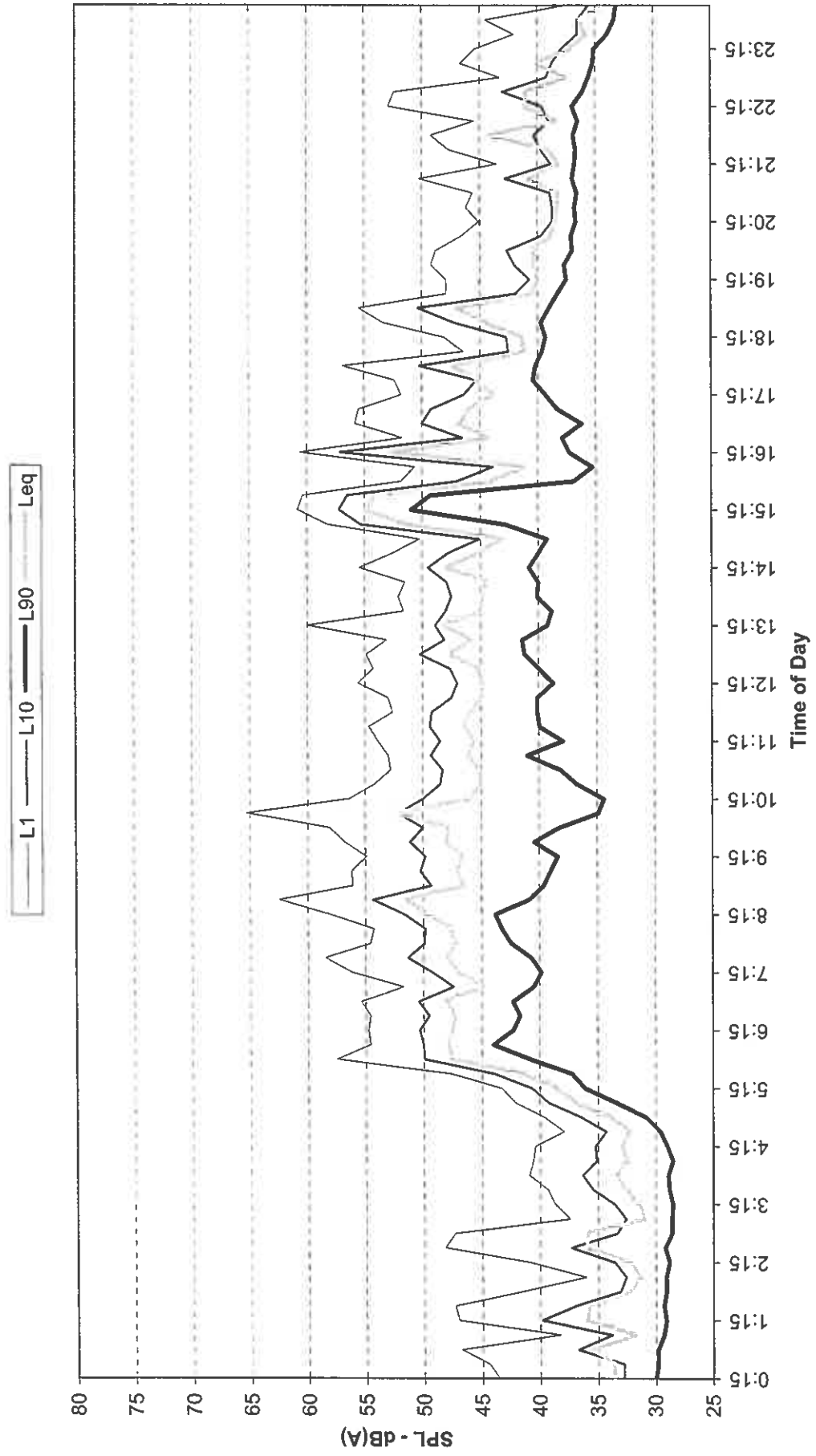
Recorded Statistical Noise Levels - Noise Datalogger Location A - 28 August 2006



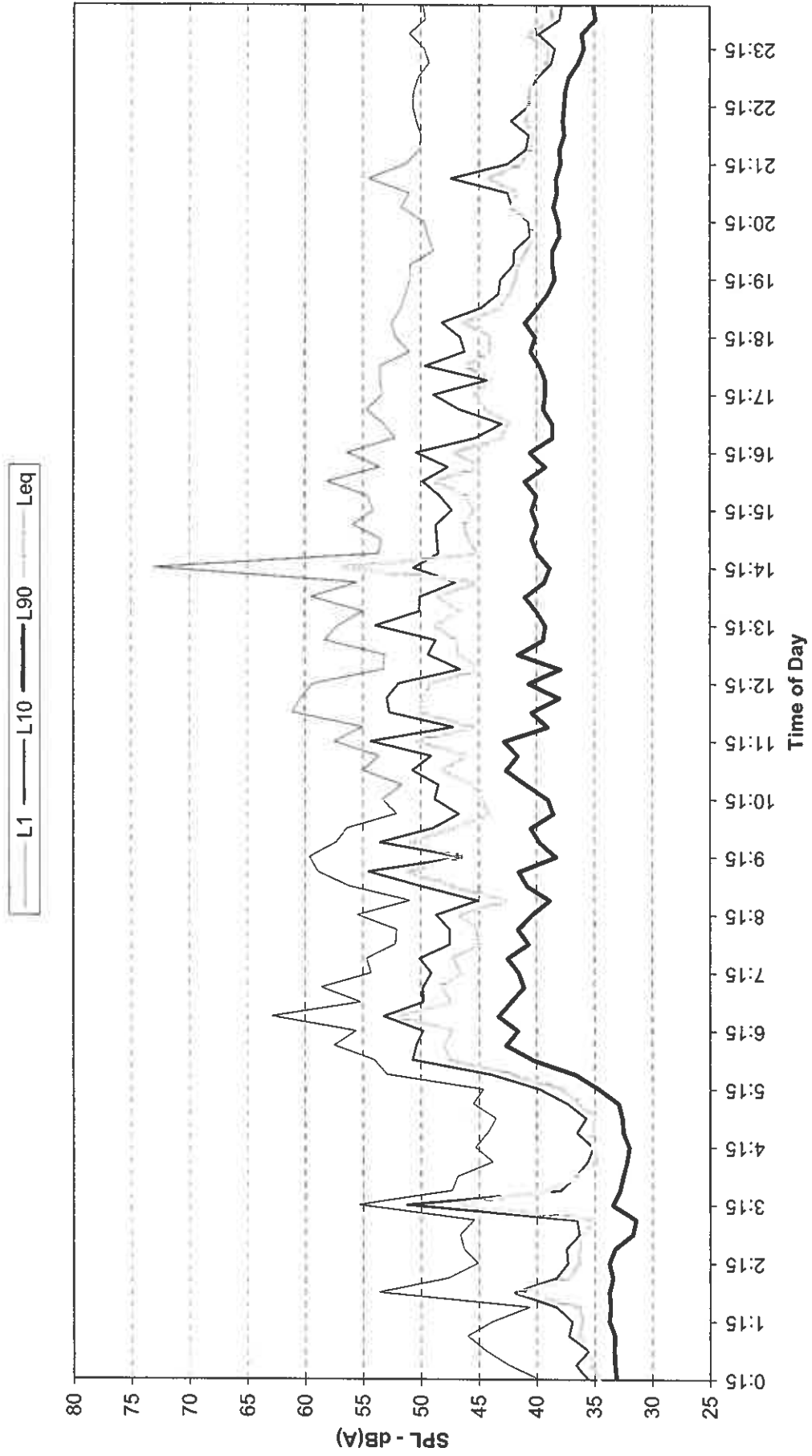
Recorded Statistical Noise Levels - Noise Datalogger Location A - 29 August 2006



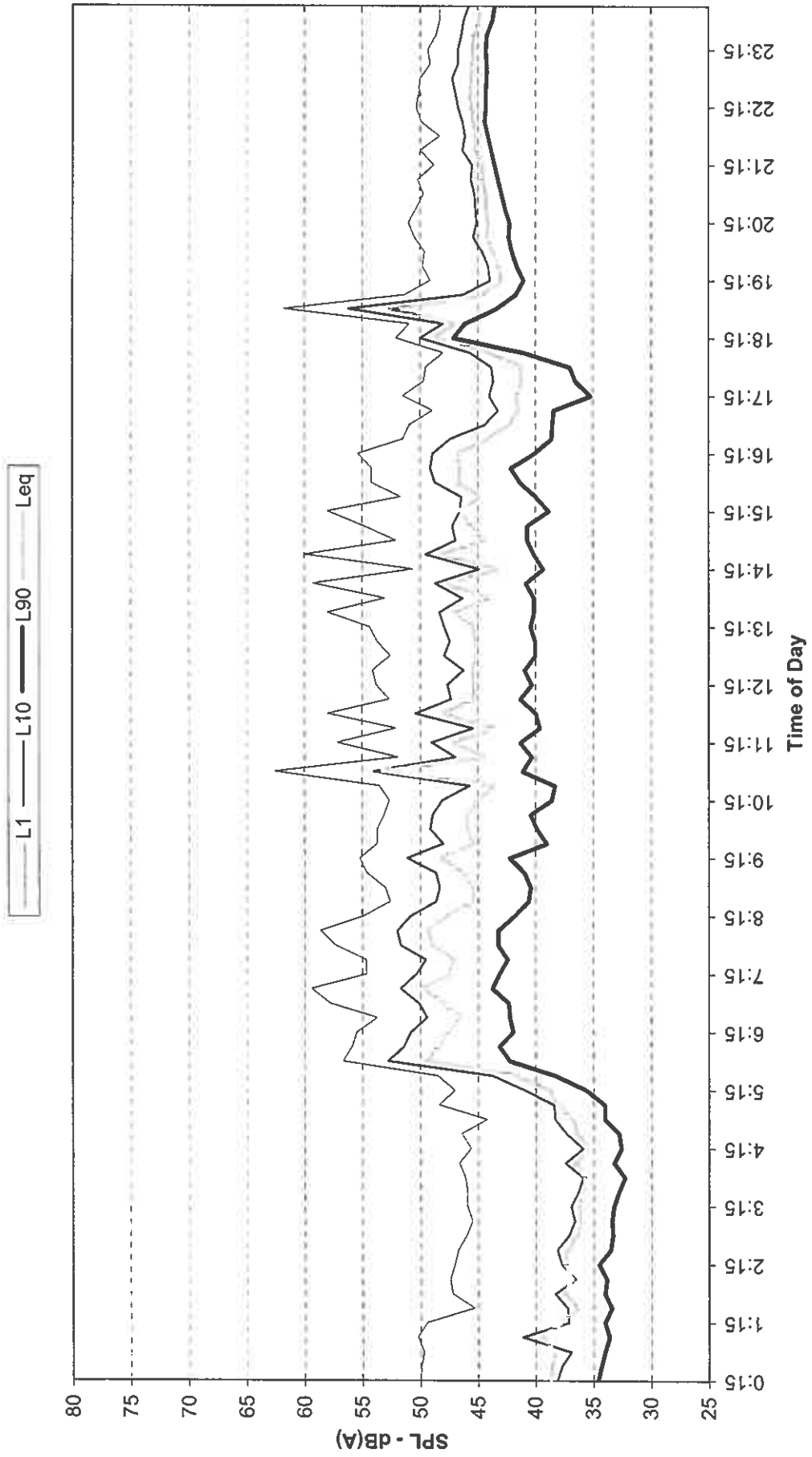
Recorded Statistical Noise Levels - Noise Datalogger Location A - 30 August 2006



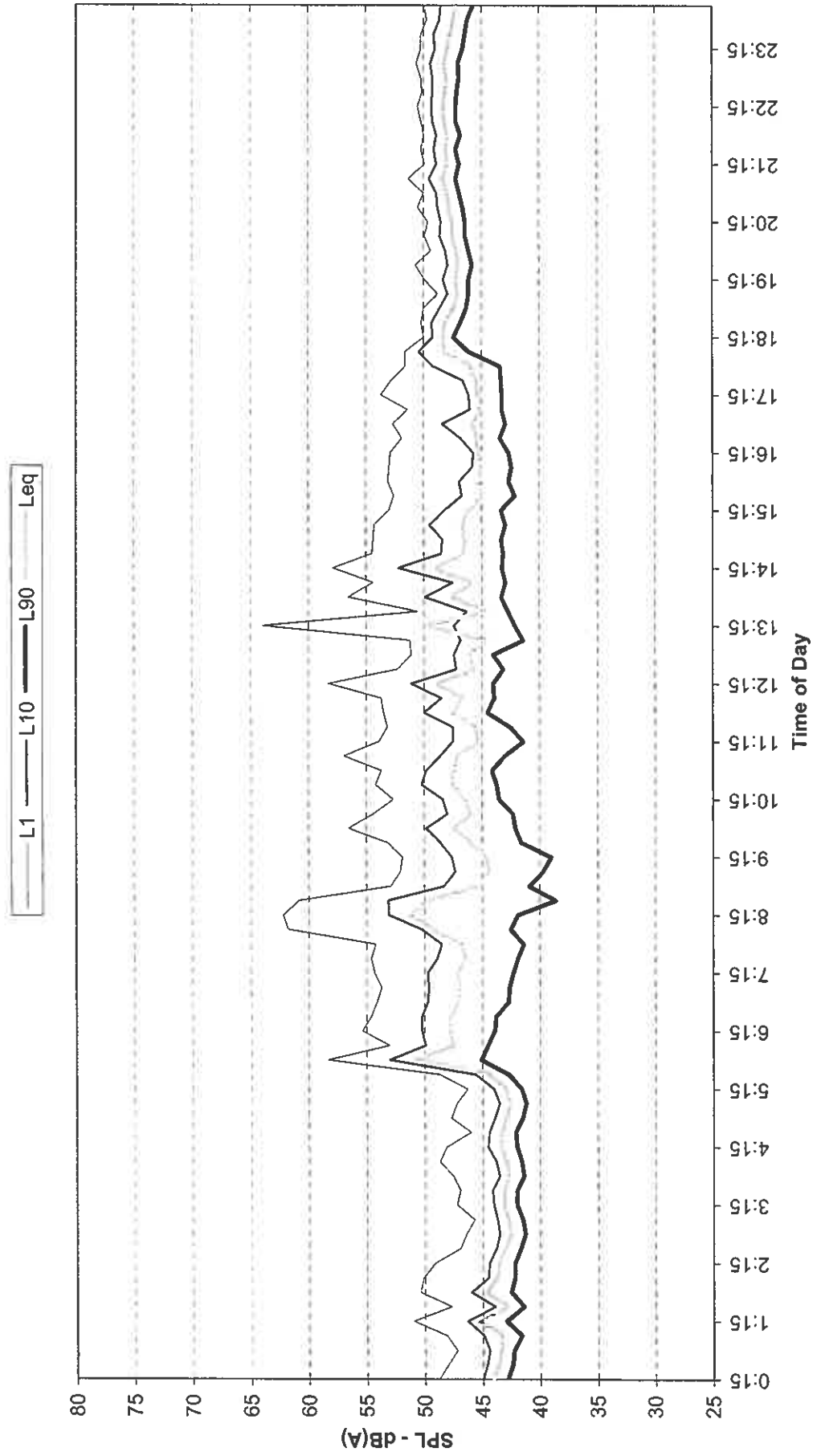
Recorded Statistical Noise Levels - Noise Datalogger Location A - 31 August 2006



Recorded Statistical Noise Levels - Noise Datalogger Location A - 1 September 2006



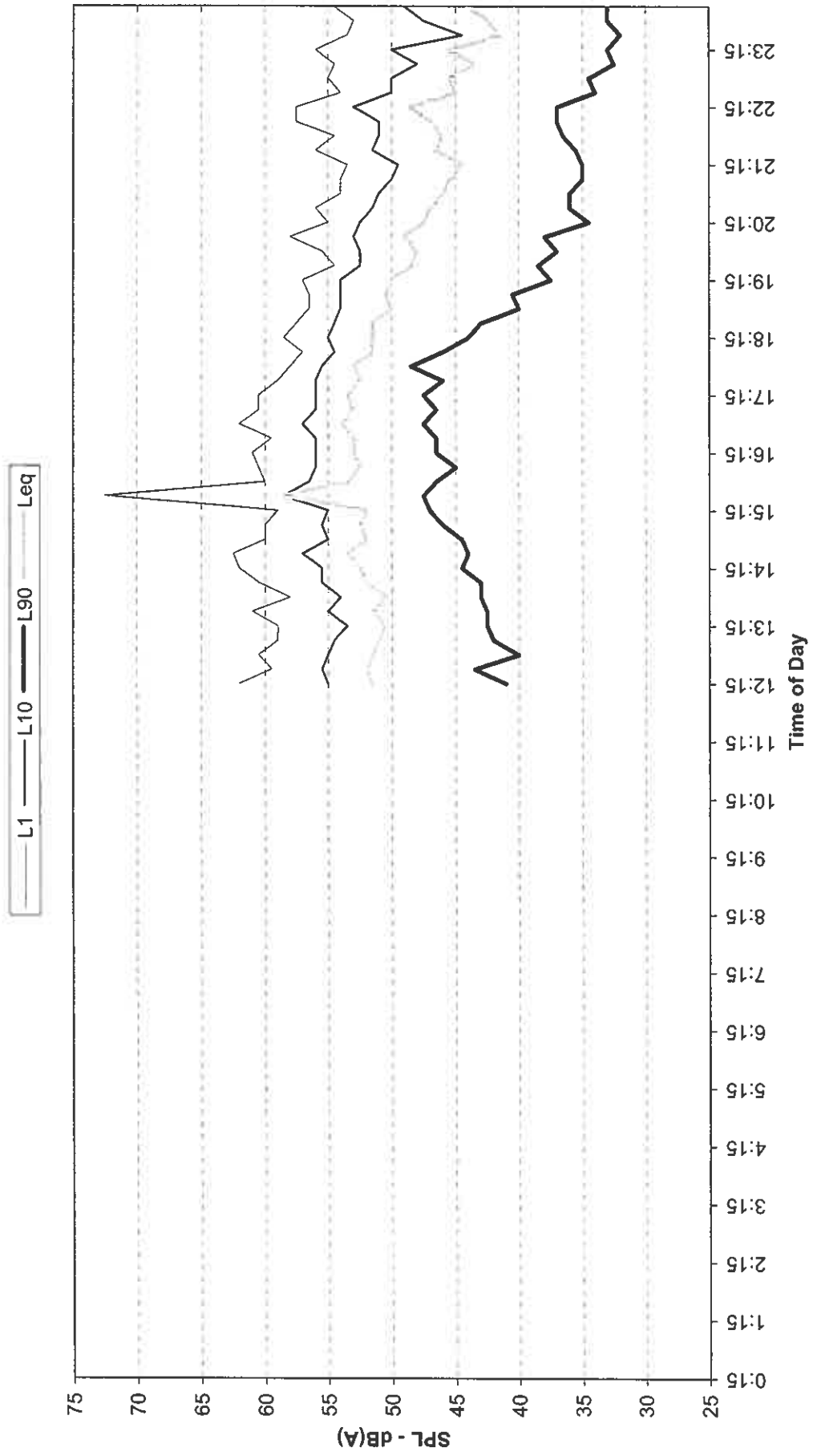
Recorded Statistical Noise Levels - Noise Datalogger Location A - 2 September 2006



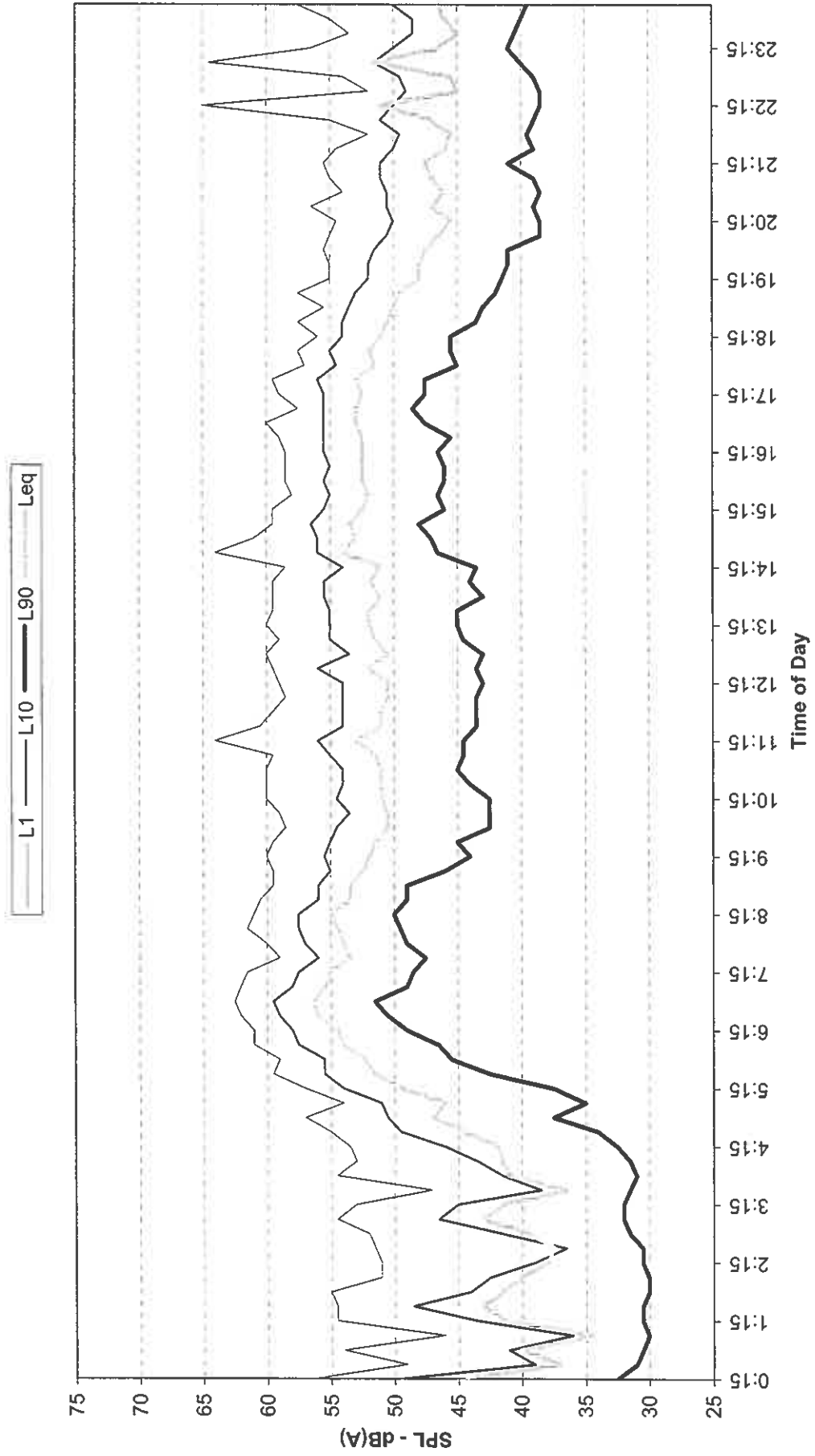
Attachment 5

Noise Datalogger Location B Results

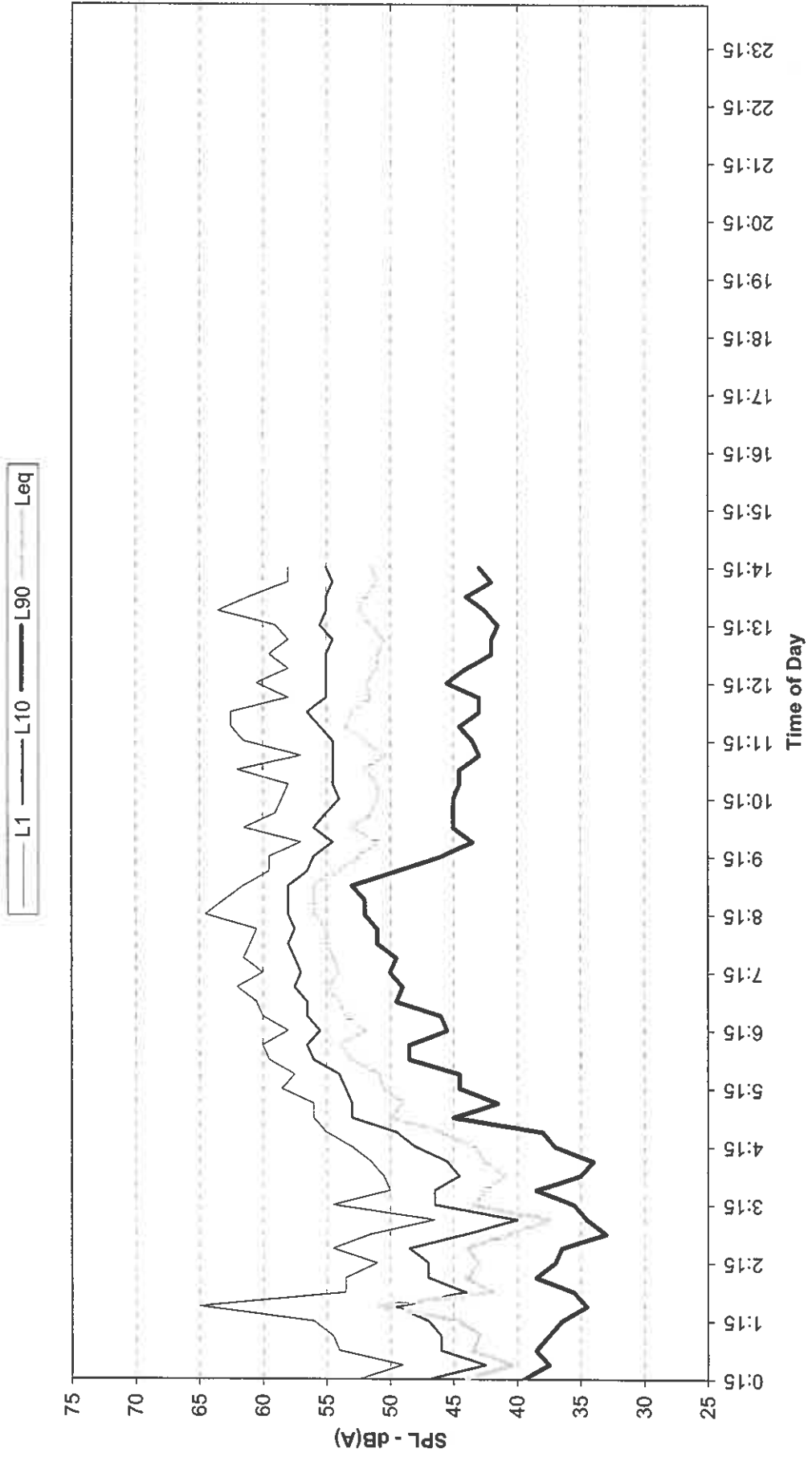
Recorded Statistical Noise Levels - Noise Datalogger Location B - 7 September, 2004



Recorded Statistical Noise Levels - Noise Datalogger Location B - 8 September, 2004



Recorded Statistical Noise Levels - Noise Datalogger Location B - 9 September, 2004



Attachment 6
*Source Noise Data
&
Model Layout*

Signs and symbols

Point receiver

Point source

Acoustic Screen

Line source

Elevation line

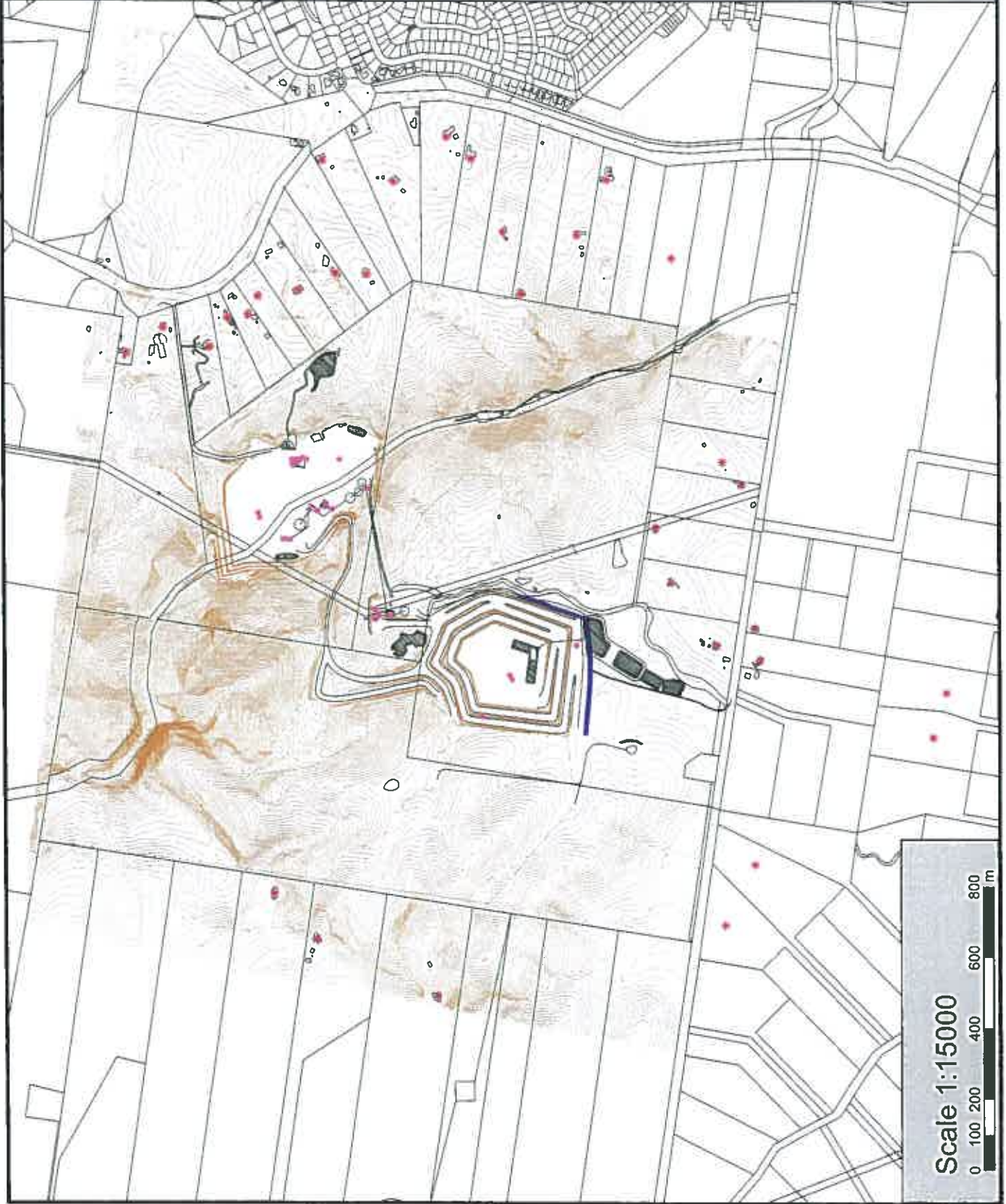
Forest

Ground absorption

Mt Cotton 09-129

Stage 1

Model Layout



Scale 1:15000



Signs and symbols

Point source



Acoustic Screen



Line source



Elevation line



Forest



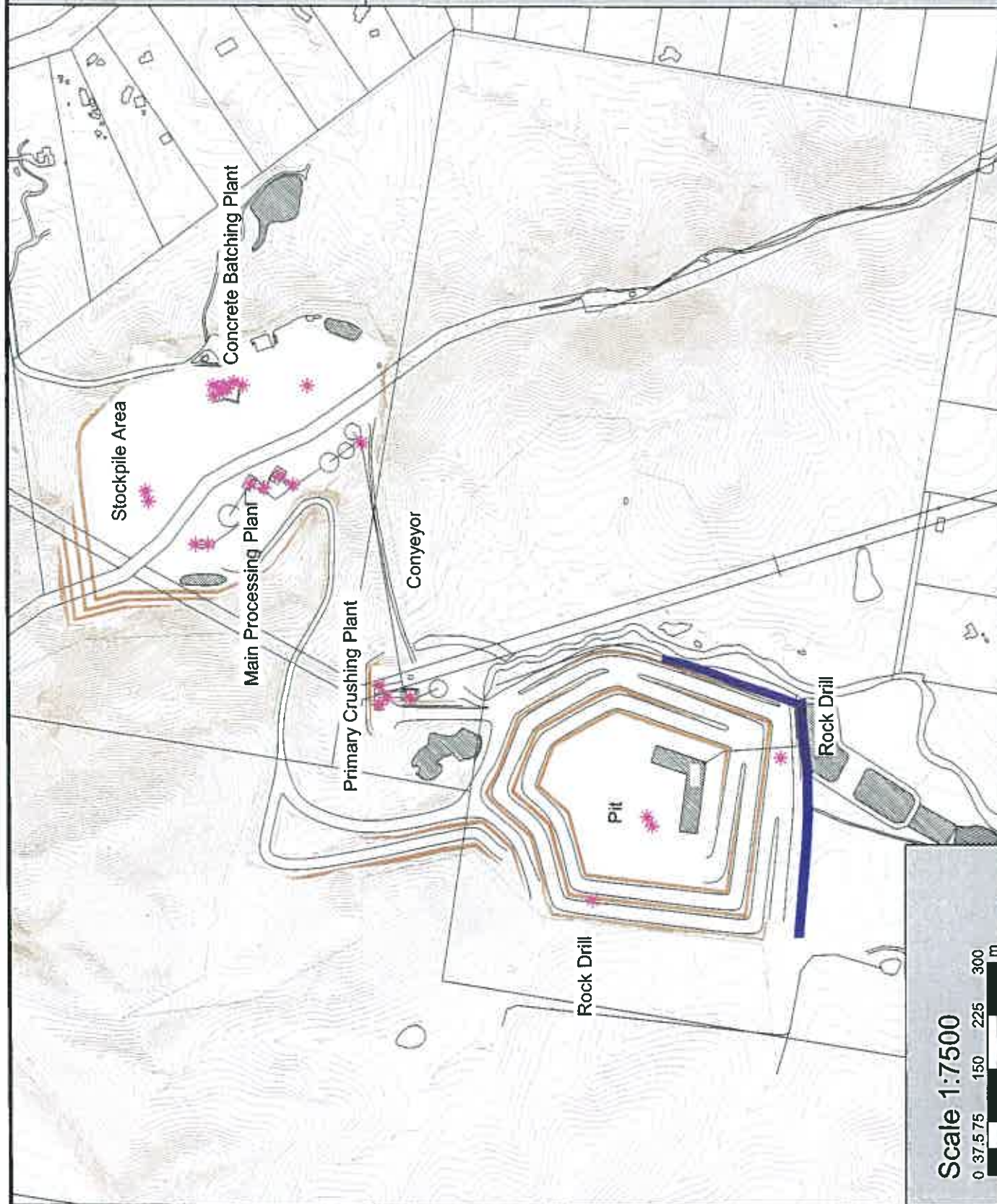
Ground absorption



Mt Cotton 09-129

Stage 1

Source Layout



Scale 1:7500



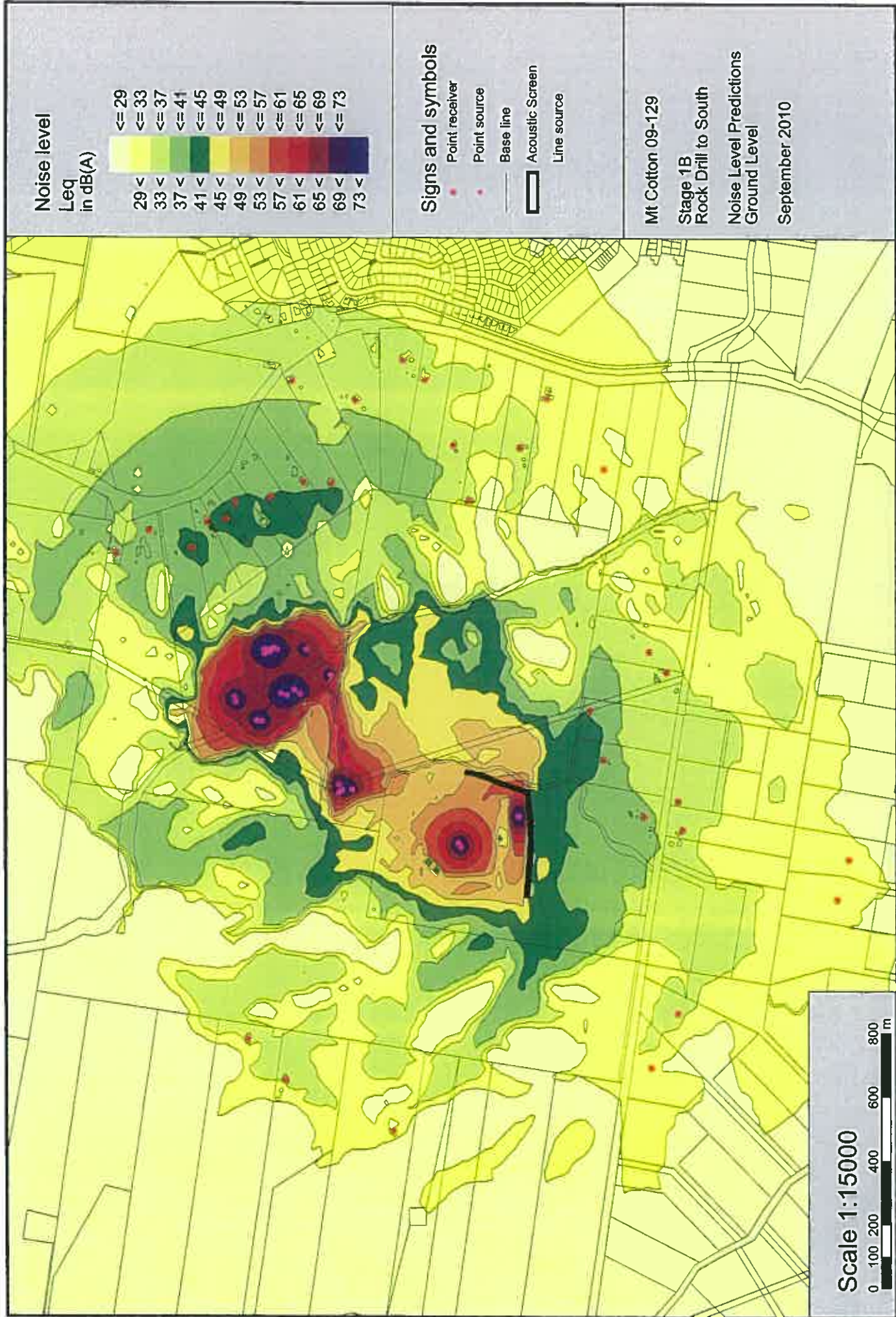
SoundPLAN Emission Library

No.	Element name	Unit	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz	Sum
1	Haul Truck	dB(A)/unit	78.1	81.6	87.8	91.7	97.3	100.8	97.1	91.9	84.6		104.3
2	Rock Drill	dB(A)/unit	72.0	88.1	100.5	102.4	111.7	114.1	117.6	115.5	109.2		121.6
3	Road Truck	dB(A)/unit	41.7	64.6	76.6	86.7	95.4	99.6	99.5	95.3	86.4		104.1
4	Conveyor	dB(A)/meter	0.0	51.0	63.0	67.0	74.0	72.0	72.0	65.0	0.0		78.3
5	Agitator Truck @ Slump Stand	dB(A)/unit		65.8	83.9	87.4	97.8	102.0	105.2	101.0	93.9		108.5
6	Agitator Truck @ Washout Pit	dB(A)/unit		61.8	66.9	81.4	89.8	95.0	96.2	99.0	93.9		102.7
7	Loading of Agitator Truck @ Batching Pt	dB(A)/unit		61.8	86.9	92.4	104.8	109.0	110.2	110.0	107.9		115.8
8	Bag Filter Fan	dB(A)/unit		52.8	62.9	69.4	79.8	80.0	77.2	69.0	60.9		84.3
9	Rock Drill - Quietened (10dB)	dB(A)/unit	62.0	78.1	90.5	92.4	101.7	104.1	107.6	105.5	99.2		111.6
10	Enclosed Loading Agitator Truck @ Batchi	dB(A)/unit		51.8	76.9	82.4	94.8	99.0	100.2	100.0	97.9		105.8
11	Existing Primary Crusher	dB(A)/unit	2.3	41.9	63.8	80.1	93.4	98.5	100.4	97.6	86.5	68.4	109.6
			17.7	51.4	68.2	87.8	96.9	100.4	100.9	96.0	81.8	60.5	
			32.0	57.9	73.7	89.6	98.9	101.1	99.6	91.0	76.0	49.5	
12	Existing Secondary/Tertiary Crushers	dB(A)/unit	4.9	44.9	65.5	82.4	96.1	102.7	104.0	101.9	94.7	75.9	113.2
			21.3	48.9	69.4	85.8	100.7	103.0	104.3	100.2	89.8	65.8	
			33.7	57.0	77.5	91.7	102.4	104.2	103.6	97.3	84.0	55.3	
13	Existing Screen 1	dB(A)/unit	9.2	48.6	65.1	80.7	93.8	101.2	104.5	105.0	96.3	76.2	113.7
			26.8	51.3	71.7	84.5	98.2	102.5	105.1	103.1	91.6	66.5	
			34.2	59.2	77.6	89.3	100.2	103.0	105.3	100.0	84.9	55.1	
14	Existing Screen 2	dB(A)/unit	5.8	37.0	58.5	75.8	92.8	100.9	100.6	98.9	90.9	71.8	110.3
			23.7	42.4	64.2	81.7	98.7	100.2	100.8	96.3	85.6	61.9	
			27.2	49.3	71.6	85.7	100.8	100.9	100.7	93.7	78.7	51.4	
15	Future Primary Crusher Enclosed	dB(A)/unit	0.3	39.9	61.8	78.1	91.4	96.5	98.4	95.6	84.5	66.4	107.6
			15.7	49.4	66.2	85.8	94.9	98.4	98.9	94.0	79.8	58.5	
			30.0	55.9	71.7	87.6	96.9	99.1	97.6	89.0	74.0	47.5	
16	Future Secondary/Tertiary Crusher Enclosed	dB(A)/unit	0.0	39.9	60.5	77.4	91.1	97.7	99.0	96.9	89.7	70.9	108.2
			16.3	43.9	64.4	80.8	95.7	98.0	99.3	95.2	84.8	60.8	
			28.7	52.0	72.5	86.7	97.4	99.2	98.6	92.3	79.0	50.3	
17	Future Quaternary Crusher Enclosed	dB(A)/unit	0.0	38.9	59.5	76.4	90.1	96.7	98.0	95.9	88.7	69.9	107.2
			15.3	42.9	63.4	79.8	94.7	97.0	98.3	94.2	83.8	59.8	
			27.7	51.0	71.5	85.7	96.4	98.2	97.6	91.3	78.0	49.3	
18	Future Screen 1 Enclosed	dB(A)/unit	1.2	40.6	57.1	72.7	85.8	93.2	96.5	97.0	88.3	68.2	105.7
			18.8	43.3	63.7	76.5	90.2	94.5	97.1	95.1	83.6	58.5	
			26.2	51.2	69.6	81.3	92.2	95.0	97.3	92.0	76.9	47.1	
19	Future Screen 2 Enclosed	dB(A)/unit	0.0	31.0	52.5	69.8	86.8	94.9	94.6	92.9	84.9	65.8	104.3
			17.7	36.4	58.2	75.7	92.7	94.2	94.8	90.3	79.6	55.9	
			21.2	43.3	65.6	79.7	94.8	94.8	94.7	87.7	72.7	45.4	
20	Excavator	dB(A)/unit	64.5	82.8	88.1	91.4	99.3	98.2	94.7	89.6	81.6		103.3
21	Dozer	dB(A)/unit	78.8	104.2	101.6	102.8	108.4	109.1	108.2	108.8	97.5		115.5
22	Loading Truck	dB(A)/unit	82.1	93.1	96.8	95.1	98.7	101.7	101.7	95.1	86.5		107.1
23	Loading Truck (-2dB(A))	dB(A)/unit	80.1	91.1	94.8	93.1	96.7	99.7	99.7	93.1	84.5		105.1

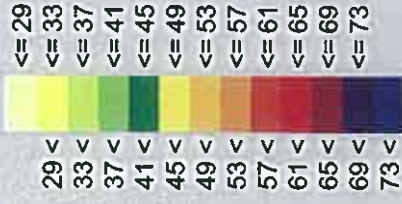
Max Winders and Associates Consulting Engineers and Environmental Scientists

Attachment 7

Predicted Noise Level Results as Grid Noise Maps



Noise level
Leq
in dB(A)



Signs and symbols

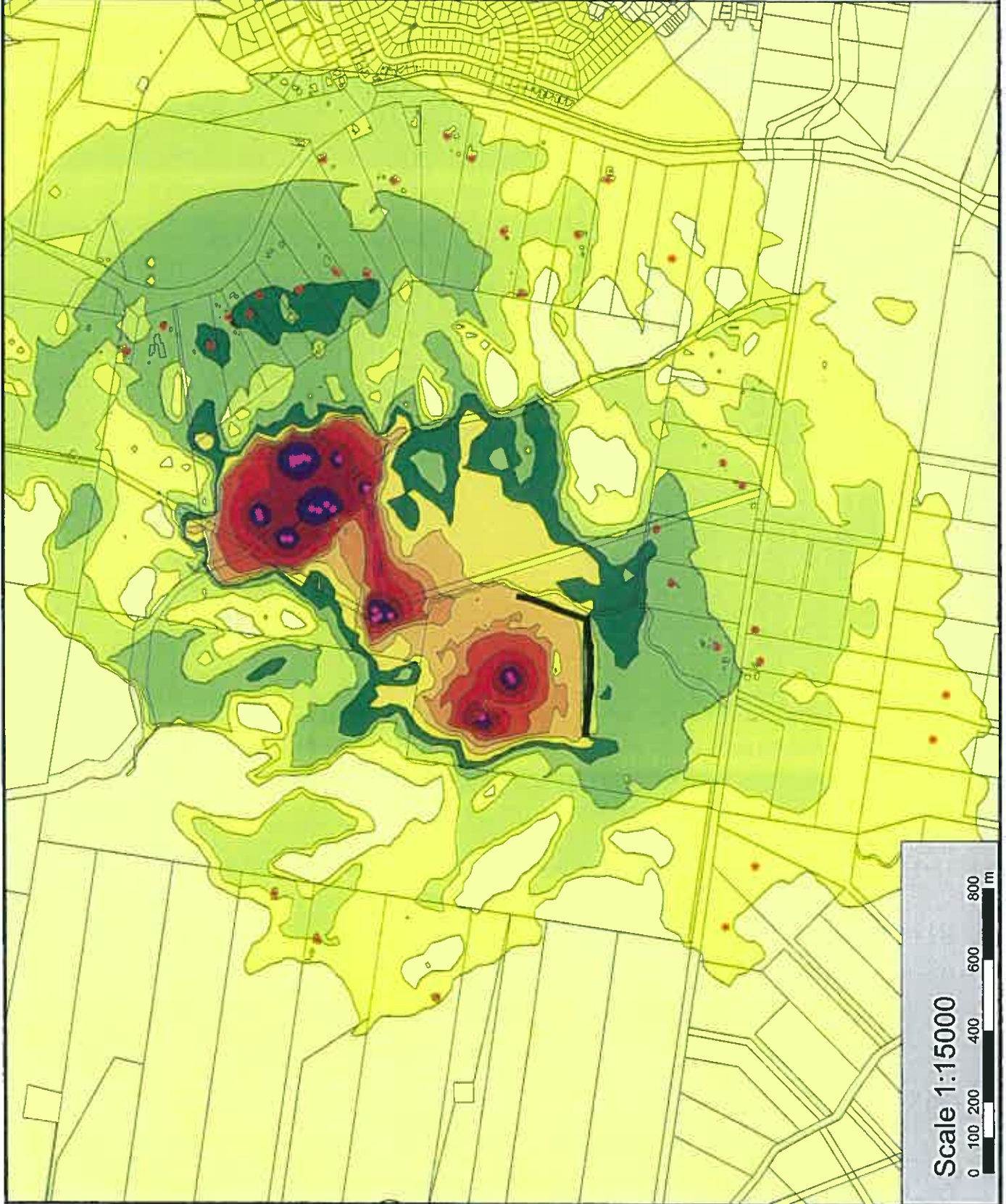
- Point receiver
- Point source
- Base line
- Acoustic Screen
- Line source

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Stage 1B
Rock Drill to West

Noise Level Predictions
Ground Level

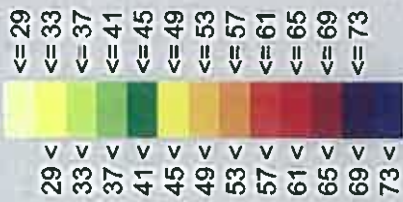
September 2010



Scale 1:15000



Noise level
Leq
in dB(A)



Signs and symbols

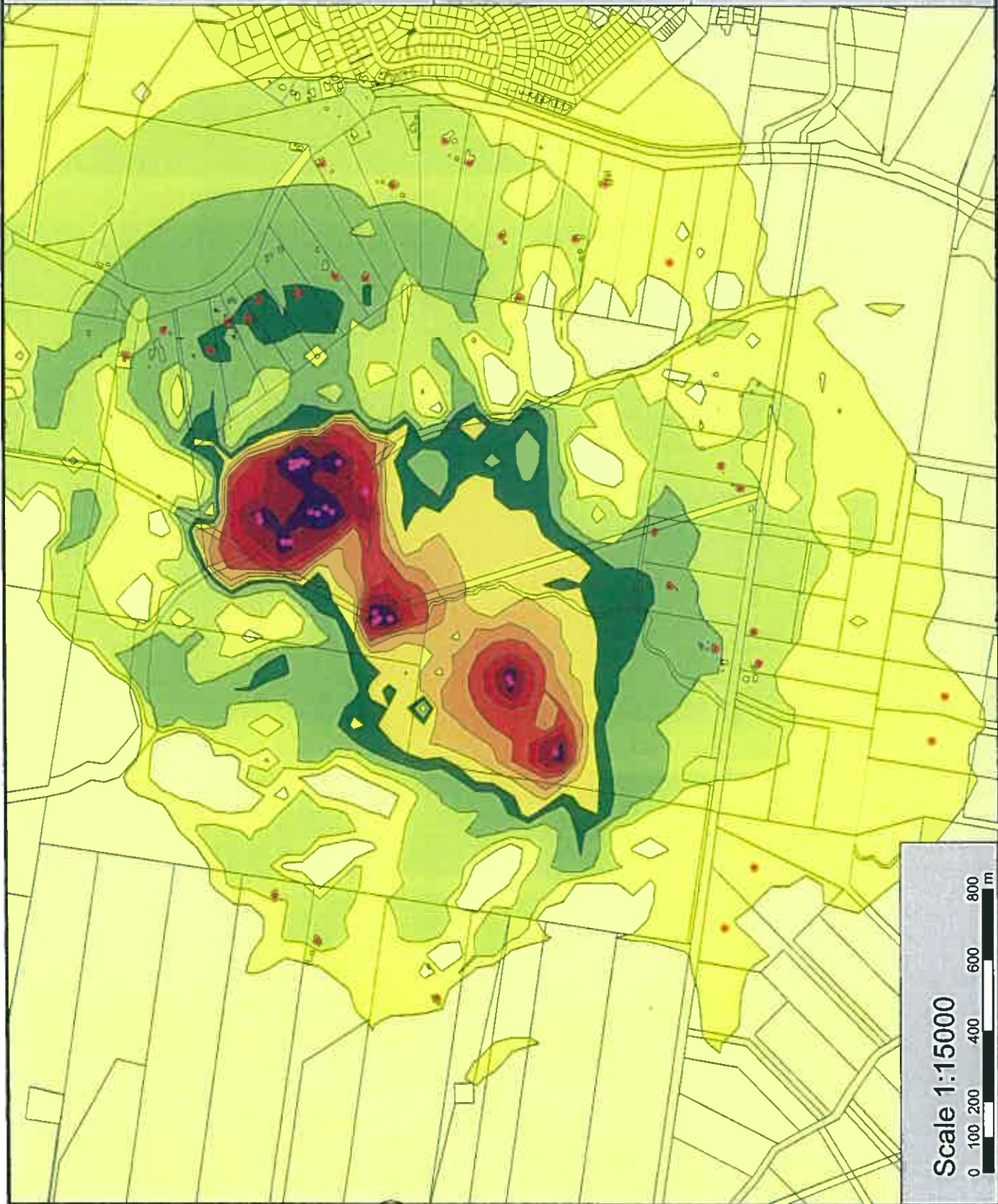
- Point receiver
- Point source
- Base line
- Line source

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Stage 2
Rock Drill to South

Noise Level Predictions
Ground Level

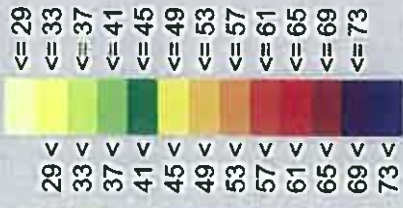
September 2010



Scale 1:15000



Noise level
Leq
in dB(A)



Signs and symbols

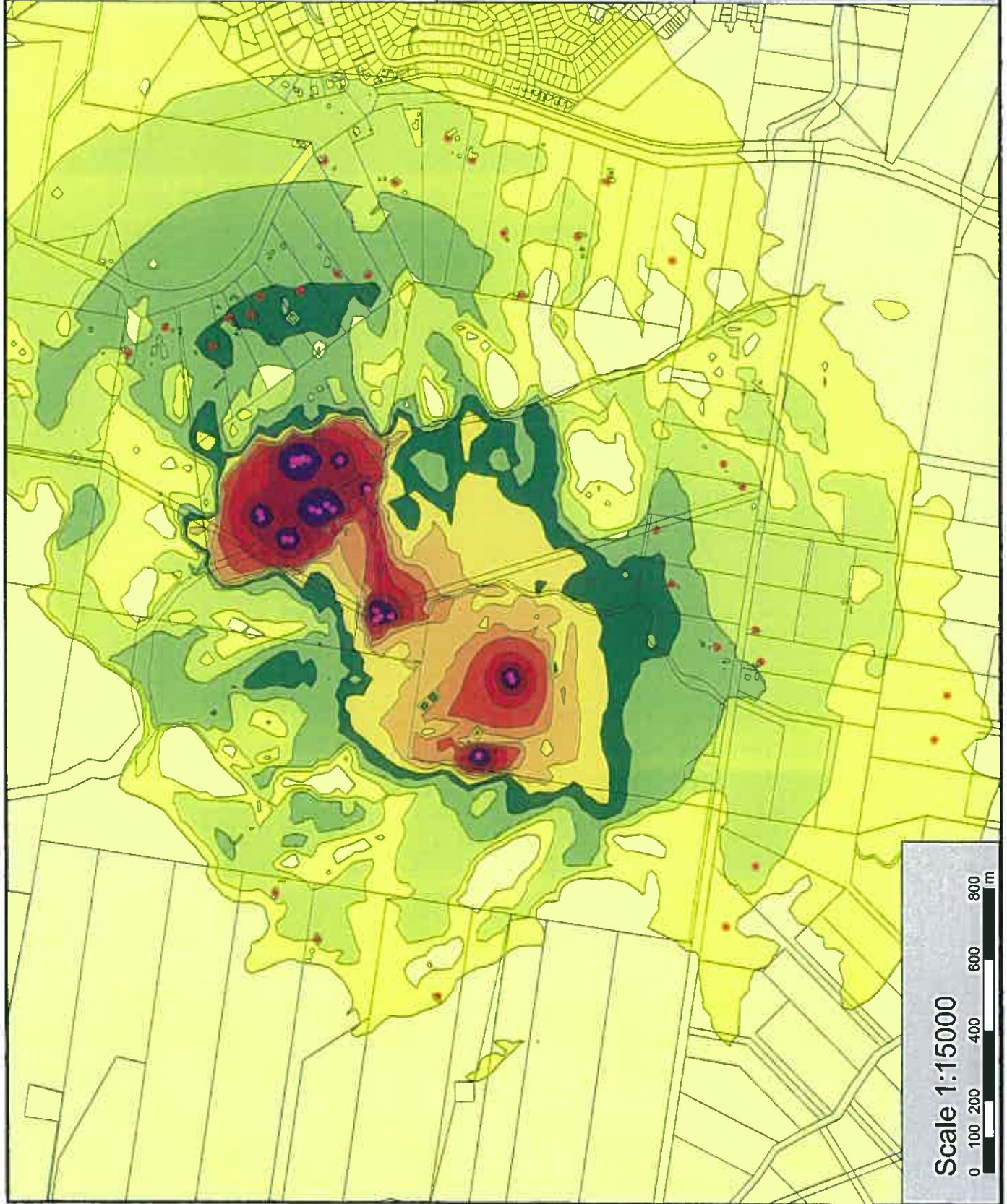
- Point receiver
- Point source
- Base line
- Line source

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Stage 2
Rock Drill to West

Noise Level Predictions
Ground Level

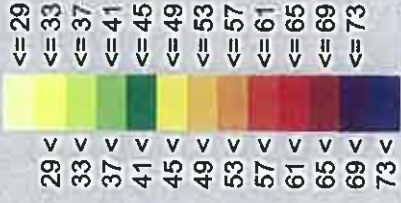
September 2010



Scale 1:15000



Noise level
Leq
in dB(A)



Signs and symbols

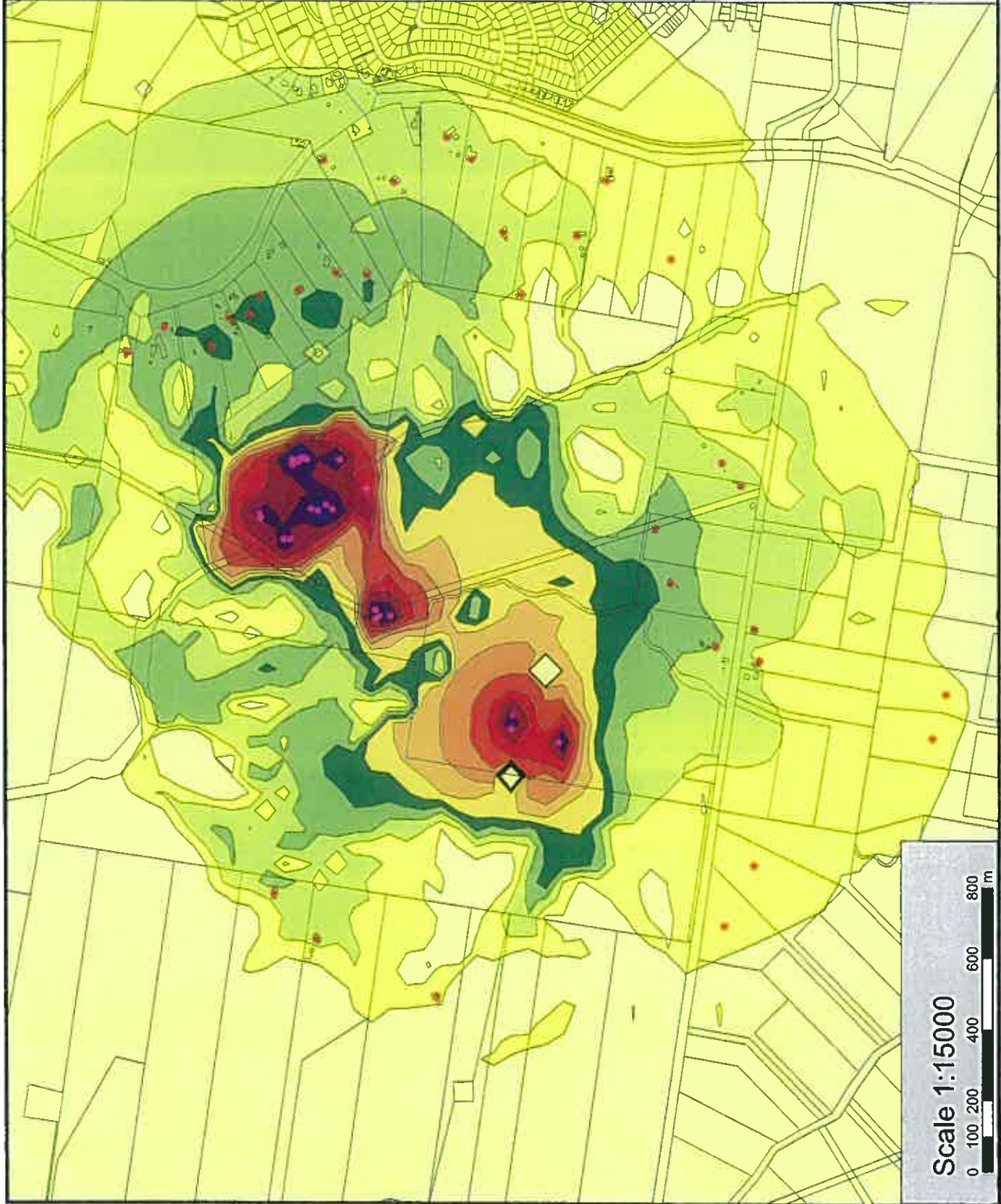
- Point receiver
- Point source
- Base line
- Line source

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Stage 3
Rock Drill to South

Noise Level Predictions
Ground Level

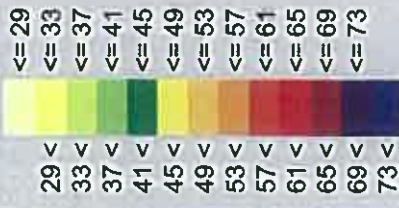
September 2010



Scale 1:15000



Noise level
Leq
in dB(A)



Signs and symbols

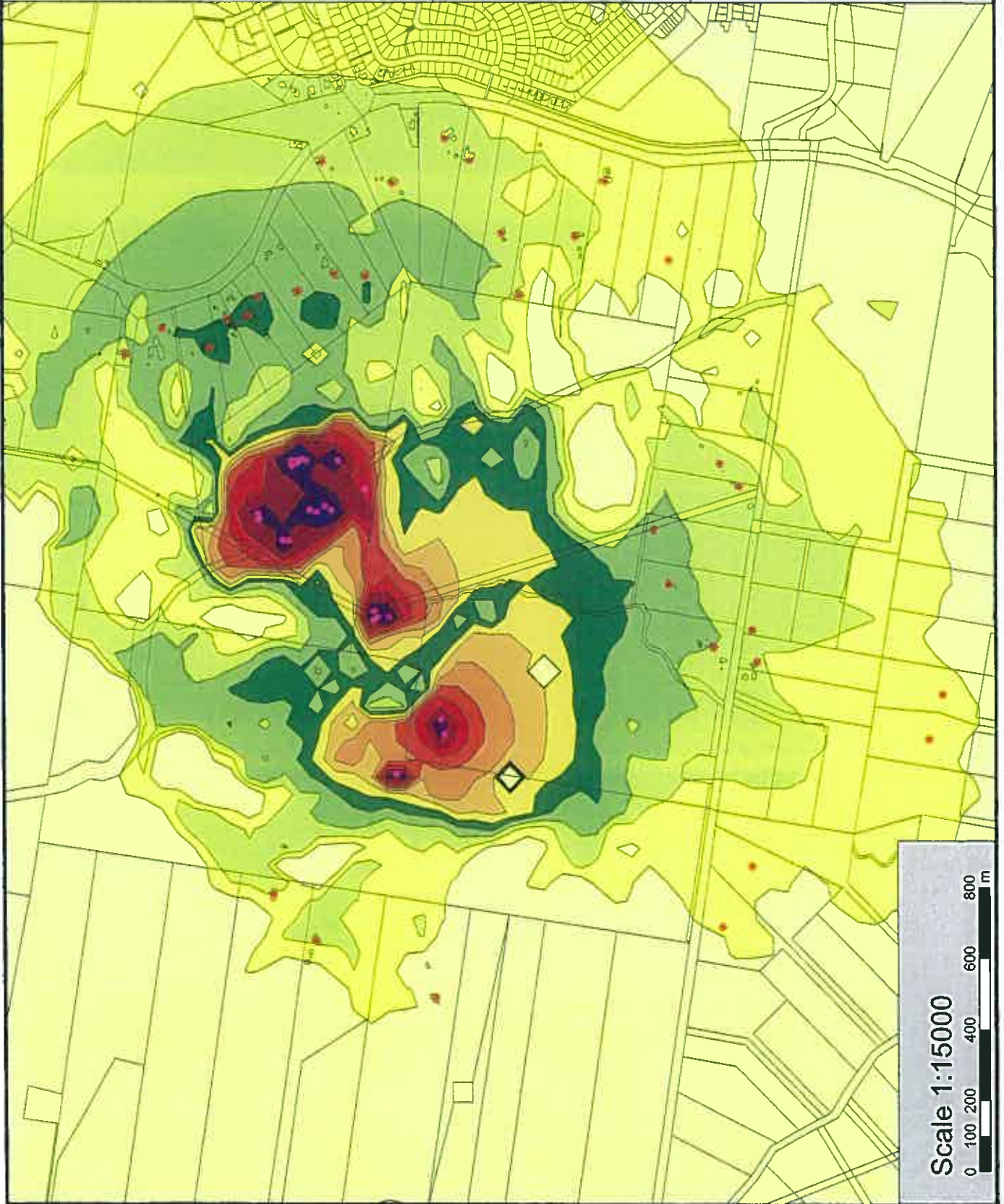
- Point receiver
- Point source
- Base line
- Line source

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Stage 3
Rock Drill to West

Noise Level Predictions
Ground Level

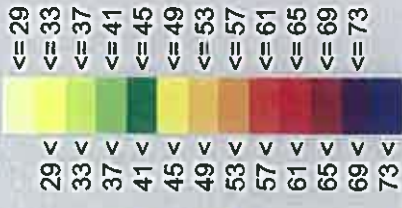
September 2010



Scale 1:15000



Noise level
Leq
in dB(A)



Signs and symbols

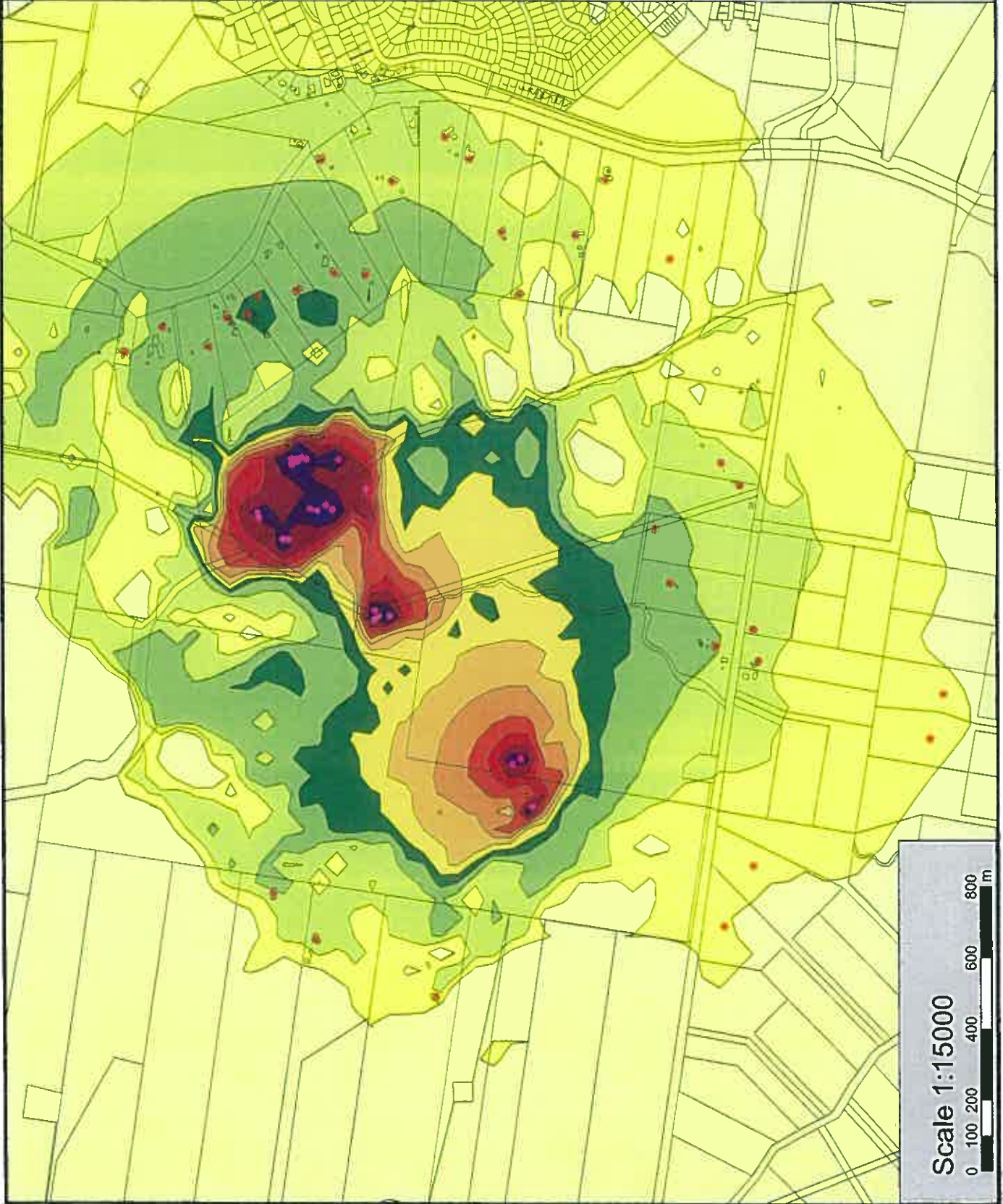
- Point receiver
- Point source
- Base line
- Line source

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Stage 4
Rock Drill to South

Noise Level Predictions
Ground Level

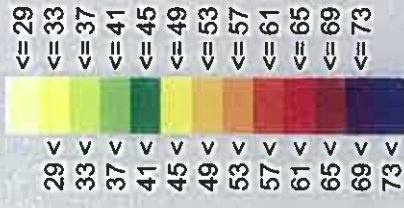
September 2010



Scale 1:15000



Noise level
Leq
in dB(A)



Signs and symbols

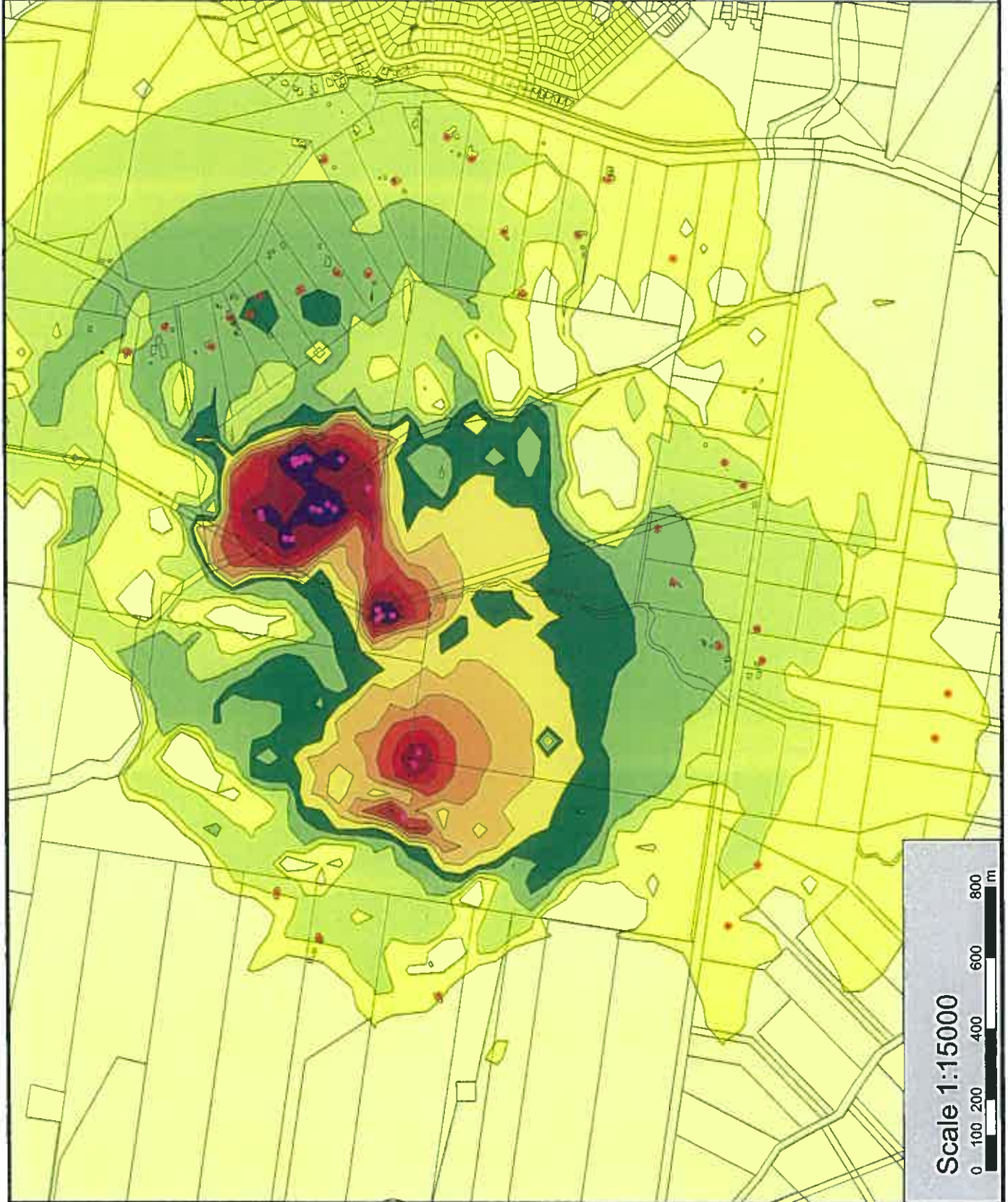
- Point receiver
- Point source
- Base line
- Line source

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Stage 4
Rock Drill to West

Noise Level Predictions
Ground Level

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Scale 1:15000



Attachment 8

Stage 1a Initial Establishment Phase Modelling Results

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Assessed receiver levels - Initial Extraction Scenario -
Ground Level

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Name	Usage	Floor	Leq dB(A)
Receiver 1	GR	1. Floor	39.8
Receiver 2	GR	1. Floor	40.6
Receiver 3	GR	1. Floor	40.3
Receiver 4	GR	1. Floor	39.0
Receiver 5	GR	1. Floor	39.0
Receiver 6	GR	1. Floor	43.3
Receiver 7	GR	1. Floor	39.6
Receiver 8	GR	1. Floor	39.6
Receiver 9	GR	1. Floor	43.7
Receiver 10	GR	1. Floor	44.2
Receiver 11	GR	1. Floor	42.0
Receiver 12	GR	1. Floor	41.6
Receiver 13	GR	1. Floor	39.1
Receiver 14	GR	1. Floor	39.4
Receiver 15	GR	1. Floor	47.2
Receiver 16	GR	1. Floor	47.3
Receiver 17	GR	1. Floor	47.8
Receiver 18	GR	1. Floor	46.8
Receiver 19	GR	1. Floor	47.0
Receiver 20	GR	1. Floor	46.6
Receiver 21	GR	1. Floor	39.7
Receiver 22	GR	1. Floor	41.0
Receiver 23	GR	1. Floor	37.1
Receiver 24	GR	1. Floor	35.9
Receiver 25	GR	1. Floor	43.2
Receiver 26	GR	1. Floor	46.4
Receiver 27	GR	1. Floor	41.3
Receiver 28	GR	1. Floor	41.7
Receiver 29	GR	1. Floor	39.9
Receiver 30	GR	1. Floor	39.4
Receiver 31	GR	1. Floor	37.6
Receiver 32	GR	1. Floor	45.6

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Assessed receiver levels - Initial Extraction Scenario -
Upper Level

21

Name	Usage	Floor	Leq dB(A)
Receiver 1	GR	1. Floor	41.9
Receiver 2	GR	1. Floor	44.4
Receiver 3	GR	1. Floor	44.1
Receiver 4	GR	1. Floor	39.3
Receiver 5	GR	1. Floor	39.4
Receiver 6	GR	1. Floor	44.6
Receiver 7	GR	1. Floor	41.7
Receiver 8	GR	1. Floor	40.1
Receiver 9	GR	1. Floor	45.0
Receiver 10	GR	1. Floor	44.8
Receiver 11	GR	1. Floor	42.5
Receiver 12	GR	1. Floor	42.2
Receiver 13	GR	1. Floor	39.6
Receiver 14	GR	1. Floor	40.0
Receiver 15	GR	1. Floor	47.5
Receiver 16	GR	1. Floor	47.6
Receiver 17	GR	1. Floor	48.1
Receiver 18	GR	1. Floor	47.2
Receiver 19	GR	1. Floor	47.2
Receiver 20	GR	1. Floor	46.9
Receiver 21	GR	1. Floor	40.1
Receiver 22	GR	1. Floor	41.2
Receiver 23	GR	1. Floor	37.2
Receiver 24	GR	1. Floor	37.0
Receiver 25	GR	1. Floor	45.0
Receiver 26	GR	1. Floor	46.7
Receiver 27	GR	1. Floor	41.5
Receiver 28	GR	1. Floor	42.0
Receiver 29	GR	1. Floor	40.2
Receiver 30	GR	1. Floor	42.1
Receiver 31	GR	1. Floor	39.1
Receiver 32	GR	1. Floor	46.0