3 Water Street Red Hill 4059
T: +61 7 3368 1033
E: information@ardent-group.com.au
W: ardent-group.com.au
ABN: 38 609 696 764

Progressive Rehabilitation and Closure Plan – Jackal Renewables Pty Ltd

Title of the Project: Claypave South
Tenure Number: ML 50070
EA Number: EA0001386
EA Holder Name: Jackal Renewables Pty Ltd
EA Holder Contact Details: c/- Ardent Group Pty Ltd, PO Box 320, Red Hill QLD 4059

Document ID Number: JKR-005 PRCP
Version Number: 2.0
Date of Submission: March 2024

Document Control Sheet

Ardent Group Pty Ltd	
Street Address:	3 Water Street, Red Hill Qld 4059
Postal Address:	PO Box 320 Red Hill Qld 4059
Phone:	+61 7 3368 1033
Email:	Information@ardent-group.com.au
Web:	www.ardent-group.com.au

Project:	JKR-005 PRCP	Issue Date:	6 March 2024
Title:	Progressive Rehabilitation and Closure Plan – Jackal Renewables Pty Ltd		
Project Manager:	Richard Davis		
Author:	Lana Shoesmith/Joanne Salmon		
Client:	Jackal Renewables Pty Ltd		
Client Contact:	Rob Howe		

Revision Number	Date
Rev C	27 January 2023
Rev D	31 January 2023
Rev E	3 February 2023
00	
1.0	6 February 2023
2.0	6 March 2024

Number of Copies									
Revision Number	C	D	E		00	01	02	03	04
Ardent Group File	X	X	X			X	X		
Client			X			X	X		
Department						X	X		

1 Table of Contents

1 Table of Contents ii
PART A – REHABILITATION PLANNING PART 8
1. INTRODUCTION 8
1.1 Background 8
1.2 Purpose of the PRCP 8
1.3 Land Outcome Document for the PRCP 9
2 Background Information 10
2.1 Location 10
2.2 Tenure to which PRCP relates 13
2.3 Property Description 13
2.4 ML Layout 13
2.5 Primary Mine Features/Infrastructure on Site 17
2.6 Type of Mining Operation 17
2.7 Proposed Duration of Mining Operation 18
3 Rehabilitation Planning 21
3.1 Baseline Information 21
3.1.1 Climate 21
3.1.2 Topography 22
3.1.3 Geological setting 25
3.1.4 Site Hydrology and Fluvial Networks 28
3.1.5 Flooding 31
3.1.6 Groundwater Levels and Properties 32
3.1.7 Soil Types, Properties and Productivity 34
3.1.8 Land Stability 39
3.1.9 Vegetation Communities and Ecological Data 41
3.1.10 Fauna Presence and Populations 45
3.1.11 Pre-mining Land Use 45
3.1.12 Landholders 47
3.1.13 Sensitive Receptors 47
3.2 Design for Closure 47
3.3 Rehabilitation / Improvement Planning 47
3.3.1 Progressive Rehabilitation 47
3.3.2 Rehabilitation Areas and Relevant Activities 58

3.3.3 Rehabilitation Undertaken to Date 59
4 Community Consultation 61
4.1 Details of Consultation in Developing PRCP 61
4.1.1 Stakeholder Identification 61
4.1.2 Community Consultation Register 61
4.2 Rehabilitation Community Consultation Plan 65
5 Post-Mining Land Use 67
5.1 Overview 67
5.2 Consistency of PMLU and Community Outcomes 67
5.3 Consistency of PMLU and Planned Government Land Outcomes 67
6 Non-Use Management Areas 71
7 Rehabilitation Management Methodology 72
7.1 Rehabilitation Objectives 72
7.2 Rehabilitation Milestones and Criteria 72
8 General Rehabilitation Practices 76
8.1 Hydrogeology 76
8.2 Flooding 76
8.3 Soil and Capping Material Assessment 76
8.4 Soil Management 77
8.4.1 Topsoil 77
8.4.2 Sub-soil 77
8.4.3 Backfill Materials 78
8.5 Contaminated Land Remediation 80
8.6 Waste Characterisation 80
8.7 Landform Design 80
8.8 Cover design 82
8.9 Water Management 83
8.9.1 Overview 83
8.9.2 Drainage Control 83
8.9.3 Erosion and Sediment Control 83
8.9.4 Erosion and Sediment Control Plans 84
8.9.5 Rehabilitation Erosion and Sediment Controls 84
8.9.6 Water Management Infrastructure 84
8.9.7 Water Quality Monitoring 84
8.10 Revegetation Method 86

8.11 Tailings Storage Facilities 92
8.12 Voids 92
8.13 Underground Mining 92
8.14 Built Infrastructure 92
9 Risk Assessment 93
9.1 Risk Assessment Purpose 93
9.2 Risk Assessment Process 93
9.3 Risk Treatment Plan 97
10 Monitoring and Maintenance 100
11 References 108

Maps and Figures

Figure 1 – Mine Location 11
Figure 2 –Mining Lease and Property Boundaries 12
Figure 3 ML Layout 15
Figure 4 Resource Recovery Centre Plan 16
Figure 5 Mean temperature for annual season (based on 1986 to 2005 reference period) 22
Figure 6 Maximum 1-day precipitation for annual season (based on 1986 to 2005 reference period) 22
Figure 7 Pre Surface Mining Site topography 23
Figure 8 ML 50070 Regional topography 24
Figure 9 Site Geology Plan 27
Figure 10 ML50070 Stormwater Features on Site 29
Figure 11 Major Flood Information 31
Figure 12 Site Soil Type 35
Figure 13 Interpreted Topsoil Thickness 38
Figure 14 Historical Mining on Site 40
Figure 15 Regional Ecosystems 42
Figure 16 ESA Map 44
Figure 17 Surrounding land use 46
Figure 18 Kerwick #1 Pit Stage 1 Mining Area 49
Figure 19 Kerwick #1 Pit Stage 2 Mining Area 50
Figure 20 Kerwick #1 Pit Stage 3 Mining Area 51
Figure 21 Kerwick #1 Pit Stage 4 Mining Area 52
Figure 22 Progressive Rehabilitation Stage 1 53
Figure 23 Progressive Rehabilitation Stage 2 54
Figure 24 Progressive Rehabilitation Stage 3 55
Figure 25 Progressive Rehabilitation Stage 4 56
Figure 26 Final Landform ML50070 57
Figure 27 Rehabilitation Areas Summary Map 60
Figure 28 Post Mining Land Use Summary 69
Figure 29 Ipswich City Council Planning Scheme Zoning 70

Tables

Table 1: Mining Tenement Details ML 50070 13
Table 2 Real Property Description Underlying ML 50070 13
Table 3 Proposed Mining Sequence and Duration 20
Table 4 Mining Stages and Estimated Volumes 20
Table 5 Climate data for Ipswich 21
Table 6 Geological Description 26
Table 7 Water Storage Volumes 30
Table 8 Water Quality Monitoring Results 30
Table 9 Hydrogeological Properties 32
Table 10 Insitu Topsoil Analysis Results Comparison 36
Table 11 Soil Stockpile analysis result comparison 37
Table 12 Regional Ecosystems 41
Table 13 Schedule F - Table 2 Final Land Use and Rehabilitation Outcome Schedule 47
Table 14 Rehabilitation Areas and Relevant Activities 58
Table 15 Community Consultation Register 62
Table 16 Community Consultation Plan for PRCP 65
Table 17 Post Mining Land Use 67
Table 18 Rehabilitation Milestones and Criteria 72
Table 19 Rehabilitation Material Balance 79
Table 20 Surface Water Monitoring Locations 85
Table 21 Water Quality Objectives – Six Mile Creek (Lowland, Moderately Disturbed) 85
Table 22 Species endemic to the RE 12.9-10.2 87
Table 23 Revegetation Plan Summary 89
Table 24 Likelihood Definitions 94
Table 25 Consequence Definition 94
Table 26 Risk Level Matrix 95
Table 27 Risk Assessment for Achievement of PMLU 95
Table 28 Risk Treatment 97
Table 29 Rehabilitation Milestone Management and Rehabilitation Criteria Monitoring Program 100

Appendices

Appendix 1 – PRCP Schedule
Appendix 2 – EA0001386 – Land Outcome Document
Appendix 3 – Ecological Studies
Appendix 4 – Mine Planning Report
Appendix 5 – Topsoil Assessment
Appendix 6 – Hydrogeological Assessment

Abbreviations

AQP	Appropriately Qualified Person
AS	Australian Standard
CBR	California Bearing Ratio
CLR	Contaminated Land Register
EA	Environmental Authority EA0001386
EMR	Environmental Management Register
EP Act	*Environmental Protection Act 1994*
ESC	Erosion and Sediment Control
ERA	Environmentally Relevant Activity
ICC	Ipswich City Council
ML	Mining Lease
NUMA	Non-use Management Area
PI	Plasticity Index
PMLU	Post-mining Land Use
PoO	Plan of Operations
PRCP	Progressive Rehabilitation and Closure Plan
RE	Regional Ecosystem
ROM	Run-of-Mine
ROW	Right of Way
RRC	Resource Recovery Centre

PART A – REHABILITATION PLANNING PART

1. INTRODUCTION

1.1 Background

Ardent Group Pty Ltd (Ardent Group) has been engaged by Jackal Renewables Pty Ltd (Jackal Renewables) to prepare a transitional Progressive Rehabilitation and Closure Plan (PRCP) for the "Claypave South" Project (the Project) in accordance with the requirements of the *Environmental Protection Act 1994* (EP Act).

This transitional PRCP is applicable to Mining Lease (ML) 50070. The current version of the Environmental Authority EA0001386 (EA) was issued to Jackal Renewables, the owner and operator of the Project, on 27 July 2018.

The EA authorises carrying out Environmentally Relevant Activity (ERA) 20(a) under Schedule 3 of the *Environmental Protection Regulation 2019*: "clay pit mining, dimension stone mining or mining gemstones (including the material from which gemstones are extracted) - at least 5,000t but not more than 100,000t in a year".

1.2 Purpose of the PRCP

In accordance with the stated purpose outlined under Section 126B of the *Environmental Protection Act 1994* (EP Act), the PRCP:
(a) specifies a plan for how and where environmentally relevant activities will be carried out on land in a way that maximises the progressive rehabilitation of the land to a stable condition; and
(b) provides for the condition to which the holder must rehabilitate the land before the authority may be surrendered.

This PRCP has been prepared to address the requirements of Sections 126C and 126D of the EP Act and has been prepared in accordance with the *Guideline Progressive Rehabilitation and Closure Plans (PRC Plans) (DES 17 March 2021)*.

The PRCP comprises two parts:
Part A – Rehabilitation Planning Part, which includes the following:

- Provide a description of:
  - each resource tenure, including the area of each tenure, that applies to the PRCP.
  - the relevant activities to which the application relates.
  - the likely duration of the relevant activities.
- A description of how and where the mining activities will be carried out.
- Details of consultation undertaken in relation to the preparation of the PRCP and ongoing consultation in relation to any required rehabilitation required under the PRCP.
- Details of how the proposed Post-Mining Land Uses ('PMLUs') are consistent with community consultation and relevant plans for the land of the local government, the State and Commonwealth.
- Proposed methods and techniques for rehabilitating the land to a stable condition in a way that supports the rehabilitation milestones under the proposed PRCP Schedule.

- Identifies any risks of a stable condition for land not being achieved and specifies methods to manage or minimise the identified potential risks.

Part A is to justify and support the proposed PRCP Schedule.

Part B – PRCP Schedule, which includes a proposed PRCP schedule that complies with section 126D of the EP Act and includes the following:

- Nomination of either a PMLU or NUMA for all land within the relevant resource tenures, including land uses for undisturbed land.
- Identification of when land becomes available for rehabilitation or improvement.
- Rehabilitation or management milestones to achieve the PMLU or NUMA outcomes.
- Milestone criteria that demonstrate when each milestone has been completed.
- Completion dates for each milestone to be achieved.
- Any conditions considered necessary or desirable.

The PRCP schedule becomes a legally binding and enforceable instrument with which the Project must comply.

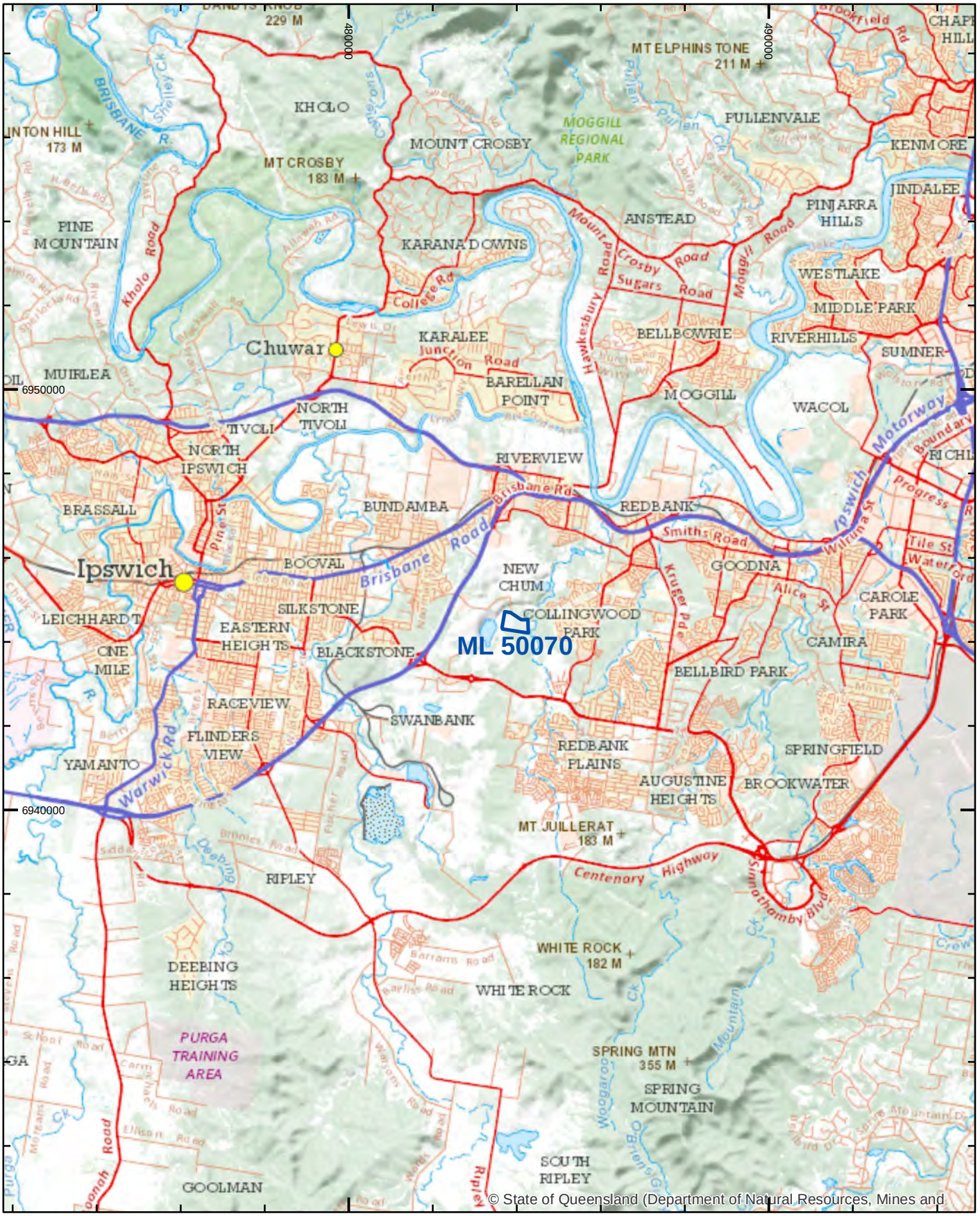
1.3 Land Outcome Document for the PRCP

Environmental Authority EA0001386 dated 27 July 2018 is the Land Outcome Document (LOD) for this PRCP.

2 Background Information

2.1 Location

The Project is a clay-shale mine on ML 50070 located at New Chum, approximately 7km east of Ipswich, in South East Queensland (Figure 1). ML 50070 is located entirely within a parcel of land held in freehold title, Lot 73 on SP128662 (Figure 2), which covers 25.38 Ha in area.



0 1 2 3 4 5

Kilometers

JACKAL RENEWABLES PTY LTD

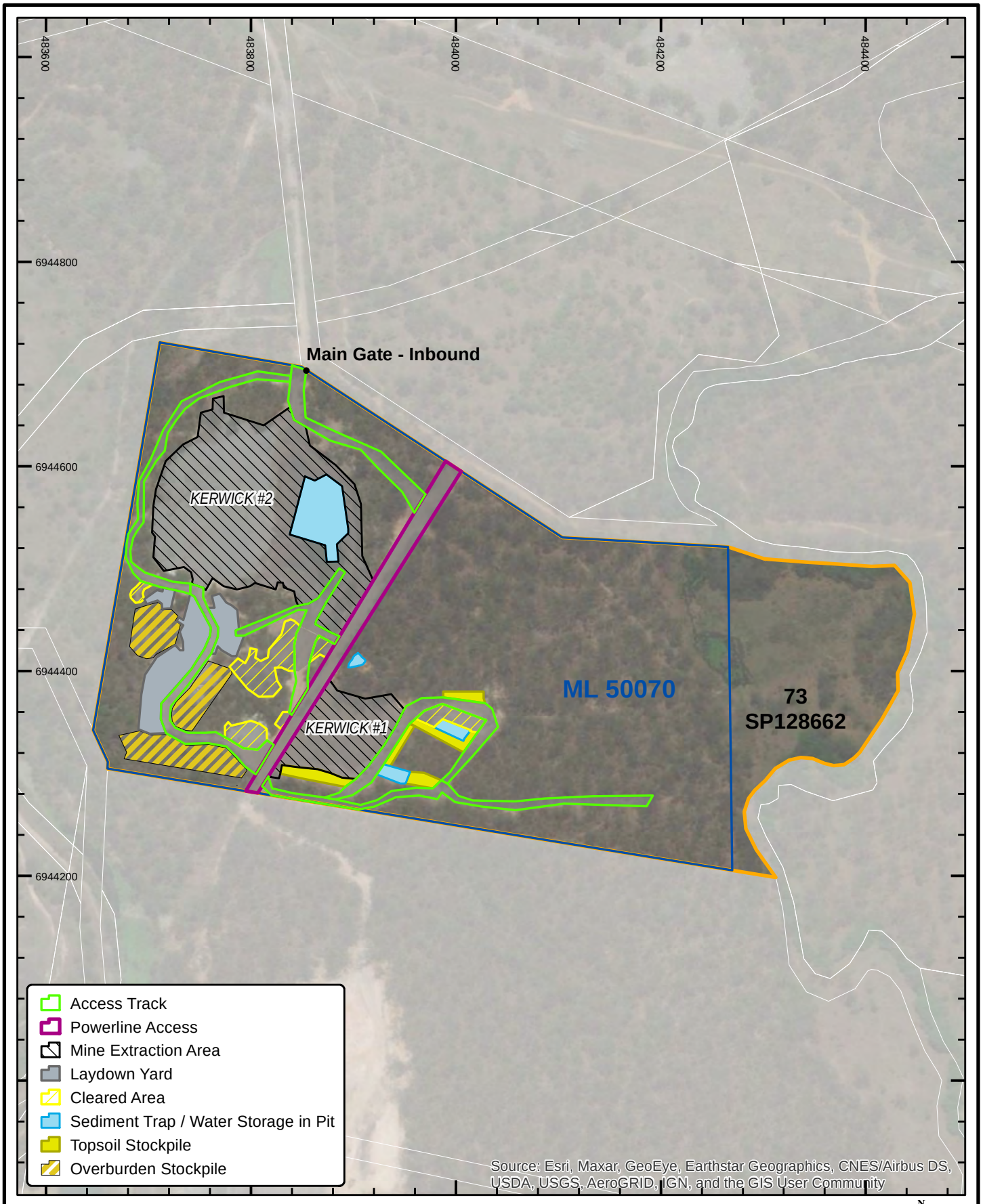
ML 50070

N W E S

GDA94, MGA Zone 56

ARDENT GROUP PTY LTD	**Site Location**	**Legend** ML boundary
Figure 1 **Sheet No.** ADMG_ARD_JKRGEN_MAP_0001_B	**Drawn By:** Chris Schlebusch **Requested by:** Richard Davis **Date:** 6/07/2018	Data sources: Old Department of Natural Resources, Mines & Energy, Geoscience Australia

Path: S:\Plans\Project_Specific\Ardent\JKRGEN\ADMG_ARD_JKRGEN_MAP_0001_B Regional Location Opt B.mxd



JACKAL RENEWABLES PTY LTD

Lot 73 on SP 128662

GDA94, MGA Zone 56

ARDENT GROUP PTY LTD

Current Disturbance

Legend

- 73 SP128662
- ML boundary
- Property boundary

Figure 2

Sheet No.

RTPL_ARD_JKRGEN_MAP_2013_A

Drawn By: Chris Schlebusch

Requested by: Jacob Arnold

Date: 18/12/2020

Data sources:
©Qld Department of Natural Resources, Mines & Energy, ©Geoscience Australia

Path: S:\Plans\Project_Specific\Ardent\JKRGEN\RTPL_ARD_JKRGEN_MAP_2013_A Current Disturbance Dec 2020.mxd

2.2 Tenure to which PRCP relates

Details of the ML, which is the subject of this PRCP, are outlined in Table 1. This PRCP applies to the entire area of this tenure.

Table 1: Mining Tenement Details ML 50070

Specifications	Details
ML Number	50070
Tenement name	Claypave South
Grant Date	24 February 1994
Expiry Date	29 February 2044
Area	21.5800 Ha (Public enquiry Report) 21.52 Ha (Qld State Shapefile Area)
Environmental Authority	EA0001386
Minerals	Clay- Brick Clay Clay – Fire Clay Clay – Pottery / White Ware Shale

2.3 Property Description

The Project is located entirely within a parcel of land held in freehold title. The real property description and current ownership is provided in Table 2.

Table 2 Real Property Description Underlying ML 50070

Specifications	Details
Background Tenure	Lot 73 on SP128662 (Lot 73)
Tenure type	Freehold
Owner	Jackal Renewables Pty Ltd
Local government area	Ipswich City Council
Underlying land parcels	Lot 273 on SP128662

Note that Lot 273 is a volumetric title and lies under Lot 73 but commences approximately 25m below the current ground surface. Lot 273 is unallocated State Land.

2.4 ML Layout

The ML is unequally divided by a power line right of way (ROW) which also provides north-south access across the Lot.

To the east of the power line ROW is the clay mining operation (Kerwick Pit#1). These activities are subject to EA0001386, as specified in Table 1.

To the west of the power line ROW is Kerwick clay Pit#2. Mining in this pit has almost completed and this structure will then be used primarily for water management during mining operations.

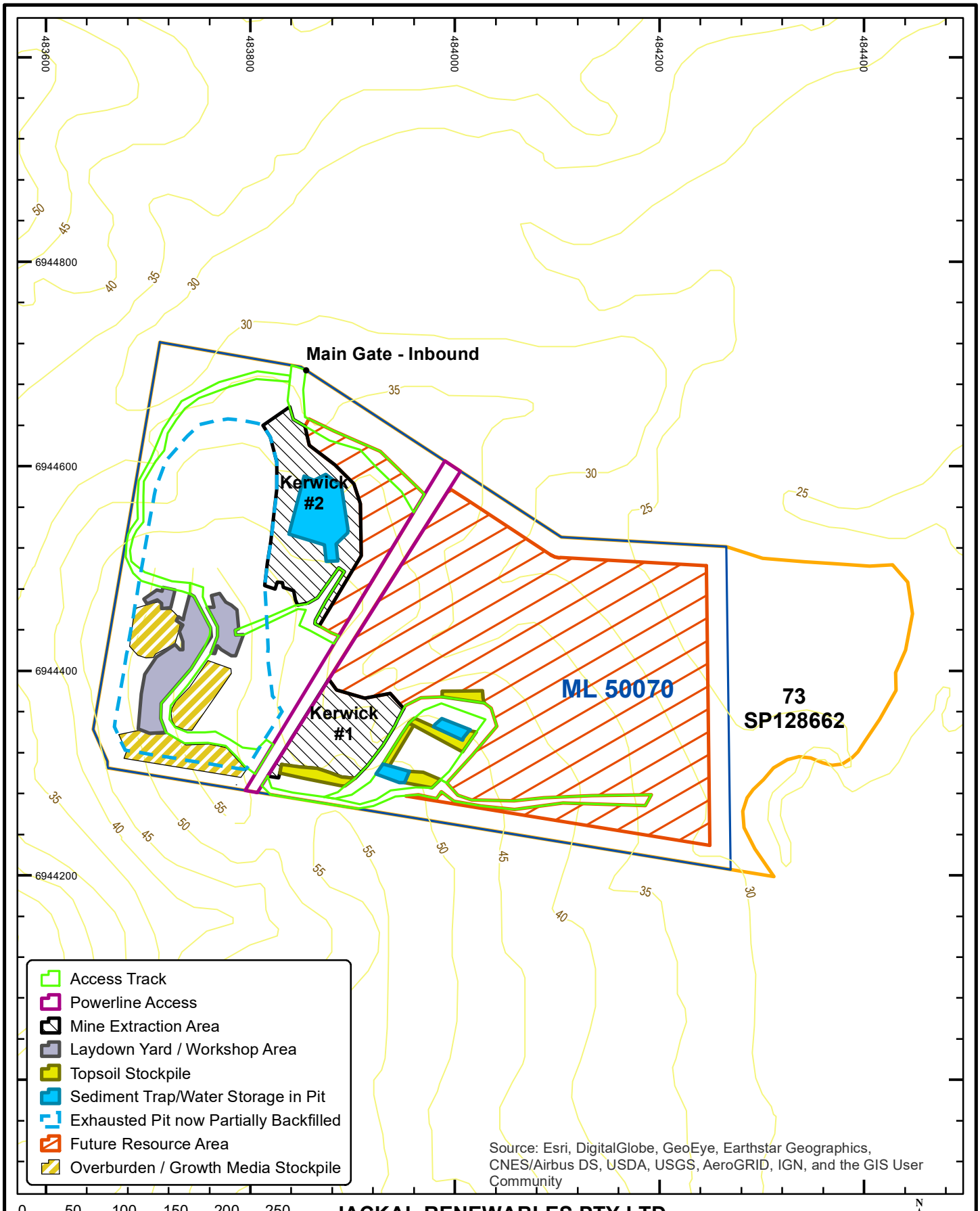
In this western sector is also a Resource Recovery Centre (RRC). This was approved via a negotiated decision notice from Ipswich City Council (ICC) on 4 February 2020 for Development Approval No. 2491/2018/MCU for a Material Change of Use application for Special Industry (Waste recycling and reprocessing – waste transfer station, crushing, milling or grinding), Caretakers Residence and Environmentally Relevant Activities (ERA33, ERA54(1) and ERA62(1)(a)) over Lot 73 on SP128662. These operations are subject to EA0001872 and include the following ERAs:

- ERA 33 - Crushing, milling, grinding or screening, Crushing, grinding, milling or screening more than 5000t of material in a year;
- ERA 54 - Mechanical waste reprocessing, 1: Operating a facility for receiving and mechanically reprocessing, in a year, more than 5,000t of inert, non-putrescible waste or green waste only; and
- ERA 62 - Resource recovery and transfer facility operation, 1: Operating a facility for receiving and sorting, dismantling, baling or temporarily storing-, (a) scrap metal, non-putrescible waste or green waste only.

Figure 3 shows the overall layout of the site.

The plan for the Resource Recovery Centre is that it will be developed slowly in stages, as market opportunities arise. The processing operation at this stage includes processing of fibre cement products and blending to meet customer requirements.

Figure 4 shows the layout of the Resource Recovery Centre. The Resource Recovery - Environmental Authority EA0001872 dated 7 September 2022 does not contain any requirements relating to rehabilitation, however there are specific requirements (Condition WT2) relating to the use of Kerwick #2 Pit for stormwater runoff from disturbed areas and therefore Kerwick #2 Pit must be maintained throughout mining operations.



JACKAL RENEWABLES PTY LTD

Lot 73 on SP 128662

GDA94, MGA Zone 56

[redacted]

Figure 3 - ML Layout

Legend

- 73 SP128662
- ML boundary
- Property boundary
- 5m Regional Contour

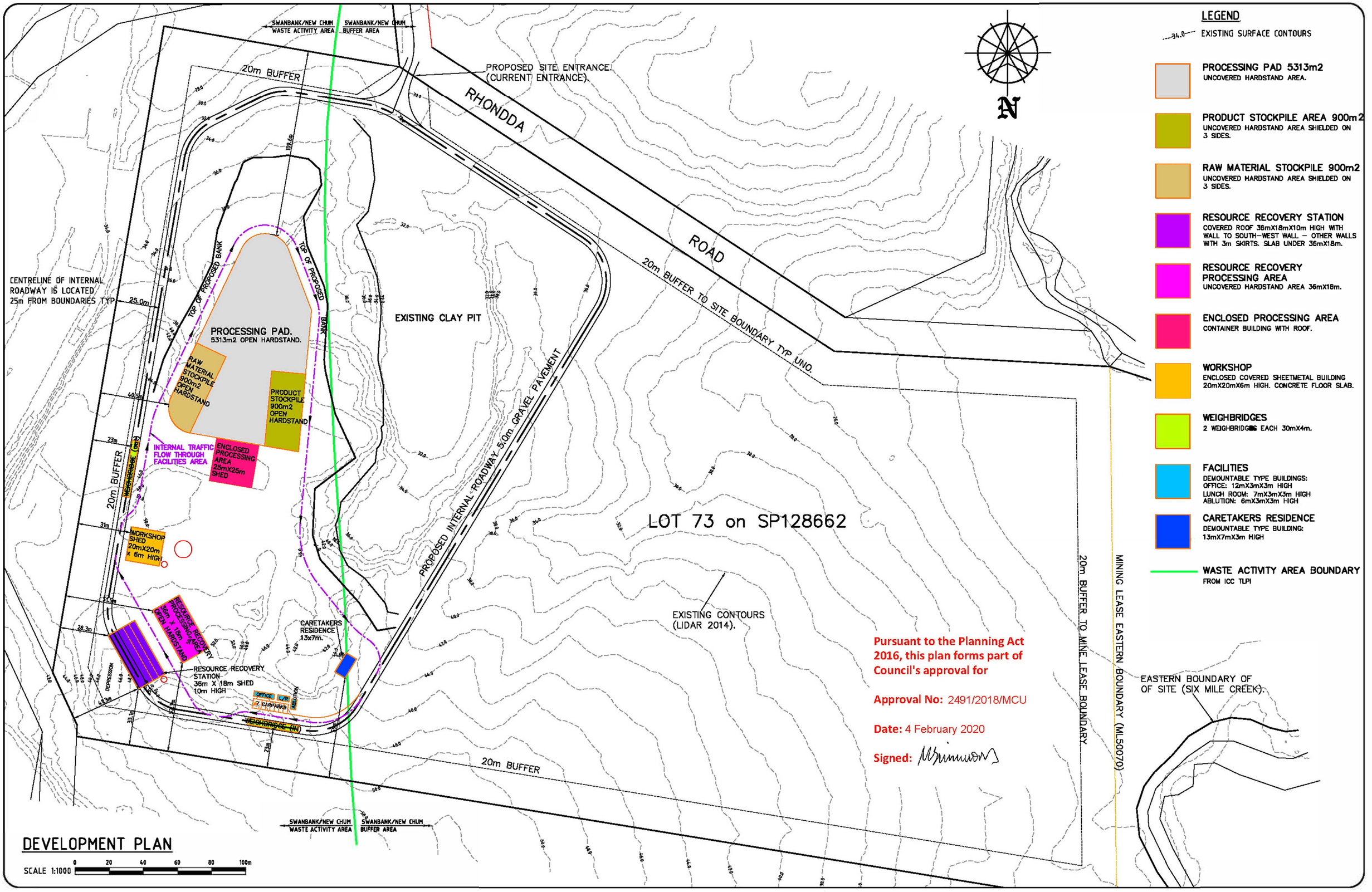
Drawn By:	Chris Schlebusch
Requested by:	Richard Davis
Date:	29/10/2020

Sheet No.

RTPL_ARD_JKRGEN_MAP_2012_B

Data sources:
©Qld Department of Natural Resources, Mines & Energy, ©Geoscience Australia

Path: S:\Plans\Project_Specific\Ardent\JKRGEN\RTPL_ARD_JKRGEN_MAP_2012_B Site Use for ML Purposes.mxd



LEGEND

- EXISTING SURFACE CONTOURS
- **PROCESSING PAD 5313m2** — UNCOVERED HARDSTAND AREA.
- **PRODUCT STOCKPILE AREA 900m2** — UNCOVERED HARDSTAND AREA SHIELDED ON 3 SIDES.
- **RAW MATERIAL STOCKPILE 900m2** — UNCOVERED HARDSTAND AREA SHIELDED ON 3 SIDES.
- **RESOURCE RECOVERY STATION** — COVERED ROOF 36mX18mX10m HIGH WITH WALL TO SOUTH–WEST WALL – OTHER WALLS WITH 3m SKIRTS. SLAB UNDER 36mX18m.
- **RESOURCE RECOVERY PROCESSING AREA** — UNCOVERED HARDSTAND AREA 36mX18m.
- **ENCLOSED PROCESSING AREA** — CONTAINER BUILDING WITH ROOF.
- **WORKSHOP** — ENCLOSED COVERED SHEETMETAL BUILDING 20mX20mX6m HIGH. CONCRETE FLOOR SLAB.
- **WEIGHBRIDGES** — 2 WEIGHBRIDGES EACH 30mX4m.
- **FACILITIES** — DEMOUNTABLE TYPE BUILDINGS: OFFICE: 12mX3mX3m HIGH; LUNCH ROOM: 7mX3mX3m HIGH; ABLUTION: 6mX3mX3m HIGH
- **CARETAKERS RESIDENCE** — DEMOUNTABLE TYPE BUILDING: 13mX7mX3m HIGH
- WASTE ACTIVITY AREA BOUNDARY FROM ICC TLPI

Pursuant to the Planning Act 2016, this plan forms part of Council's approval for

Approval No: 2491/2018/MCU

Date: 4 February 2020

Signed:

DEVELOPMENT PLAN

SCALE 1:1000 (0, 20, 40, 60, 80, 100m)

HUNT MICHEL & PARTNERS
24 DARLING STREET IPSWICH Q 4305
CONSULTING CHARTERED ENGINEERS CIVIL AND STRUCTURAL A.B.N. 75 074 746 599
PH 3812 2399 FAX 3812 1900

CLIENT: JACKAL RENEWABLES PTY LTD

PROJECT: PROPOSED DEVELOPMENT 149 RHONDDA ST NEW CHUM

DRAWING TITLE: FIGURE 4 RESOURCE RECOVERY CENTRE PLAN

REV		DATE	REV		DATE
C	CO-GEN PLANT DELETED	18-9-19	APPROVED:		RPEQ 3766
B	DIMENSIONS ADDED	25-7-19	DIRECTOR HUNT MICHEL & PARTNERS		
A	FACILITIES LAYOUT CHANGES	8-10-18			

DESIGNED: D.A.
DRAWN: D.A.
CHECKED: D.M.
SCALE: 1:1000 AT A1
DATE:

JOB No. 218010

DWG No. C1C

2.5 Primary Mine Features/Infrastructure on Site

Road access to the site is from the Cunningham Highway, via Chum Street / Rhondda Road.

There is no built infrastructure (buildings or processing plant) on the Project site relating to mining activities. However, on the western portion of the ML the industrial activities described in section 2.4 approved under a DA and subject to EA0001872 include an enclosed processing area, workshop, resource recovery station and office building and in the immediate vicinity is a processing pad and product stockpile.

The primary mine features associated with the mining activities are:

- Clay pit Kerwick Pit #1 – operational pit to be progressively mined from west to east on a campaign basis.
- Clay pit Kerwick Pit #2 – pit primarily for stormwater runoff from disturbed mining areas, and water management over life of mine.
- Overburden rock from the mining process is predominantly siltstone, mudstone and sandstone which is used for environmental control works or as backfill in mined areas. Note that there is limited requirement for the stockpiling of overburden during the project.
- Three historical overburden stockpiles onsite, which have naturally revegetated and are currently safe, stable and non-polluting. These stockpiles will be disturbed in the future to facilitate rehabilitation of the site.

Shared infrastructure between the ML activities subject to EA0001386 and the activities approved under the Development Approval subject to EA0001872 includes:

- Access roads.
- Stormwater infrastructure.
- Laydown area and carparking.

Due to the nature of the mining operations, there are no existing or proposed tailings dams or heap leach pads; nor are there any mine water management dams. There is no water, power or sewage connection to the site.

A high voltage transmission power line runs NW to SE, approximately 290m to the north of the site.

A combined 33kV - 11kV power line traverses the subject site, from SW to NE, but does not supply power to the site. This power line is not currently subject to an easement agreement registered on the land title. There is no formal agreement between the ML holder, or landholder, regarding the location of this power line with the power line owner (Energex). Despite this, there is an understanding between the ML holder and land owner, and Energex that this power line alignment must remain clear to enable access for maintenance in accordance with requirements specified under the *Electricity Act 1994*.

2.6 Type of Mining Operation

Mining on ML 50070 has been granted for the following minerals:

- Clay - Brick Clay;

- Clay – Fire Clay;
- Clay – Pottery / White Ware; and
- Shale.

The mining method generally employed on ML 50070 comprises of the following steps:

- Vegetation clearing (limited as necessary);
- Topsoil and overburden stripping (as necessary);
- Clay/shale extraction (in situ) or reclamation (old spoil dumps) (dozer, excavator, front end loader or similar);
- Clay/shale stockpiling; and
- Clay/shale haulage.

Common with other clay pit operations in the area, ML 50070 is worked according to market demand. The type of clay required is based primarily on its firing characteristics and colour. Material is transported off the lease to customers, on demand. Extraction from ML 50070 has been generally 20,000 tonnes per annum; however, it is anticipated that this may be up to approximately 100,000 tonnes per annum based on likely market requirements.

The area to the west of Kerwick #2 pit has almost been exhausted of the clay resource. This area also contains overburden/growth media stockpiles that have been stored for rehabilitation. It is intended that these stockpiles will be used as appropriate during the progressive rehabilitation to achieve the rehabilitation outcomes specified in the Environmental Authority for the mining lease.

This area has been partially backfilled and is now utilised for equipment parking, laydown, workshop and amenities, for mining and also as relevant to the activities relating to the Resource Recovery Centre, shown in Figure 4.

Overburden rock from the mining process is predominantly sandstone which is used for environmental control works or as backfill in mined areas.

Mining will continue within Kerwick Pit #1 and extend from west to east over time to fulfill client orders. Resource drilling is planned in this area to confirm the resource ahead of mining.

2.7 Proposed Duration of Mining Operation

The current mining lease extends until 29 February 2044.

Based on current resource utilisation rates, Jackal Renewables has determined the estimated life of mine is approximately 20 years. This is based on clay and shale mineral resource estimates to the end of 2040, considering current and forecast future mining rates (refer Table 3). The detailed mine plan is included as Appendix 4, for specific details.

The rehabilitation completed date extends beyond the current term of the mining lease, as the time period to achieve a self-sustaining ecosystem is 20 years. We have been previously advised by the Department of Environment Science and Innovation that in preparation of PRC Plans, it can be assumed that the term of the mining lease will be extended at the appropriate time to allow for the completion of rehabilitation.

Table 3 Proposed Mining Sequence and Duration

Mining Area	Resource (m^3)	Commence Mining	Complete Mining	Landform Completed	Rehabilitation Completed
Kerwick #1 Stage 1	124,573	2023	2028	2030	2050
Kerwick #1 Stage 2	142,520	2028	2032	2033	2055
Kerwick #1 Stage 3	158,590	2032	2036	2038	2058
Kerwick #1 Stage 4	108,536	2036	2039	2040	2061

The mine plan has estimated the following volumes of resource, waste rock and topsoil during the planned staged mining of the resource.

Table 4 Mining Stages and Estimated Volumes

Mining Area	Pit Surface Area (m^2)	Pit Design Total Volume (m^3)	Resource Volume (m^3)	Waste Volume (m^3)	Topsoil Volume (m^3)
Kerwick #1 Stage 1	22,619	215,512	124,573	90,939	3,393
Kerwick #1 Stage 2	21,255	246,560	142,520	104,040	3,188
Kerwick #1 Stage 3	23,109	274,361	158,590	115,771	3,466
Kerwick #1 Stage 4	23,399	187,767	108,536	79,231	3,510
Total		**924,199**	**534,218**	**389,980**	**13,557**

There is currently approximately 4,500 m^3 of topsoil in existing stockpiles on site.

3 Rehabilitation Planning

3.1 Baseline Information

3.1.1 Climate

3.1.1.1 Current Climate

The climate of the Project is sub-tropical with warm to hot wet summers and cool dry winters. Climate data was derived from the Ipswich weather station (Station 040101) as this is the closest weather station to the site that has both rainfall and temperature data available (BOM, 2022).

Mean annual rainfall for Ipswich is 878.5mm (1870 – 1994). Rainfall occurs predominantly in the summer months, as shown in Table 5.

In south-east Queensland the annual average potential evaporation is almost 50% greater than the annual average rainfall, which contributes to the depletion of soil moisture (DES, 2019).

Table 5 Climate data for Ipswich

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (°C)	32.0	31.1	29.9	27.5	24. 1	21.5	21.1	22.8	25.9	28.5	30.8	31.9
Mean minimum temperature (°C)	20.0	19.7	18.3	14.7	11.0	8.2	7.0	7.6	10.7	14.2	16.9	18.8
Mean Rainfall(mm)	124.9	119.7	100.6	63.1	50.5	51.1	43.5	33.6	41.4	65.7	78.1	105.6

(BOM, 2022)

3.1.1.2 Long-term Climate Projections

The long-term climate projections are important to understand when planning for rehabilitation. These predictions are documented in the Long Paddock Queensland Future Climate Dashboard Queensland Government (2022). The mean annual temperature for the Ipswich CC is predicted to rise by approximately 1.0° C by 2030 and by approximately 4.1 ° C by 2090, as shown in Figure 5.

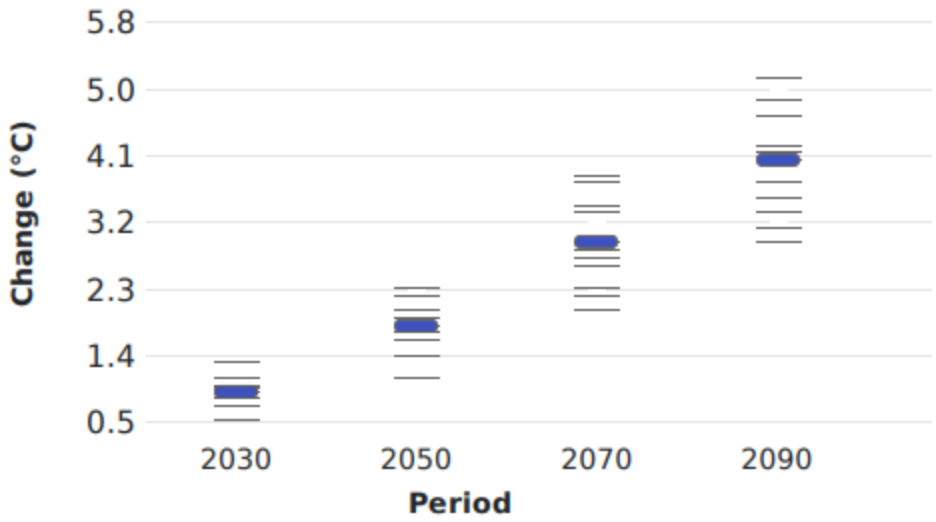


Figure 5 Mean temperature for annual season (based on 1986 to 2005 reference period)

(Queensland Government, 2022)

The maximum 1-day precipitation is predicted to remain similar as shown in Figure 6.

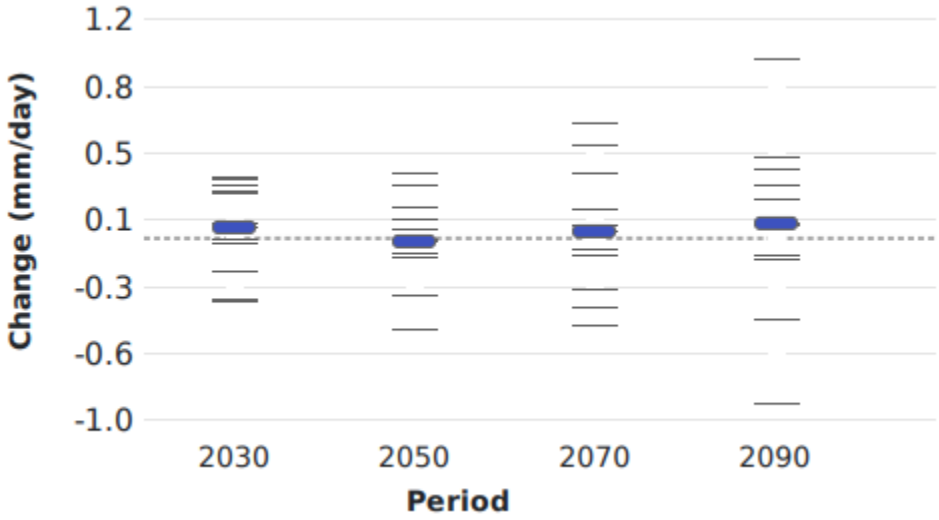
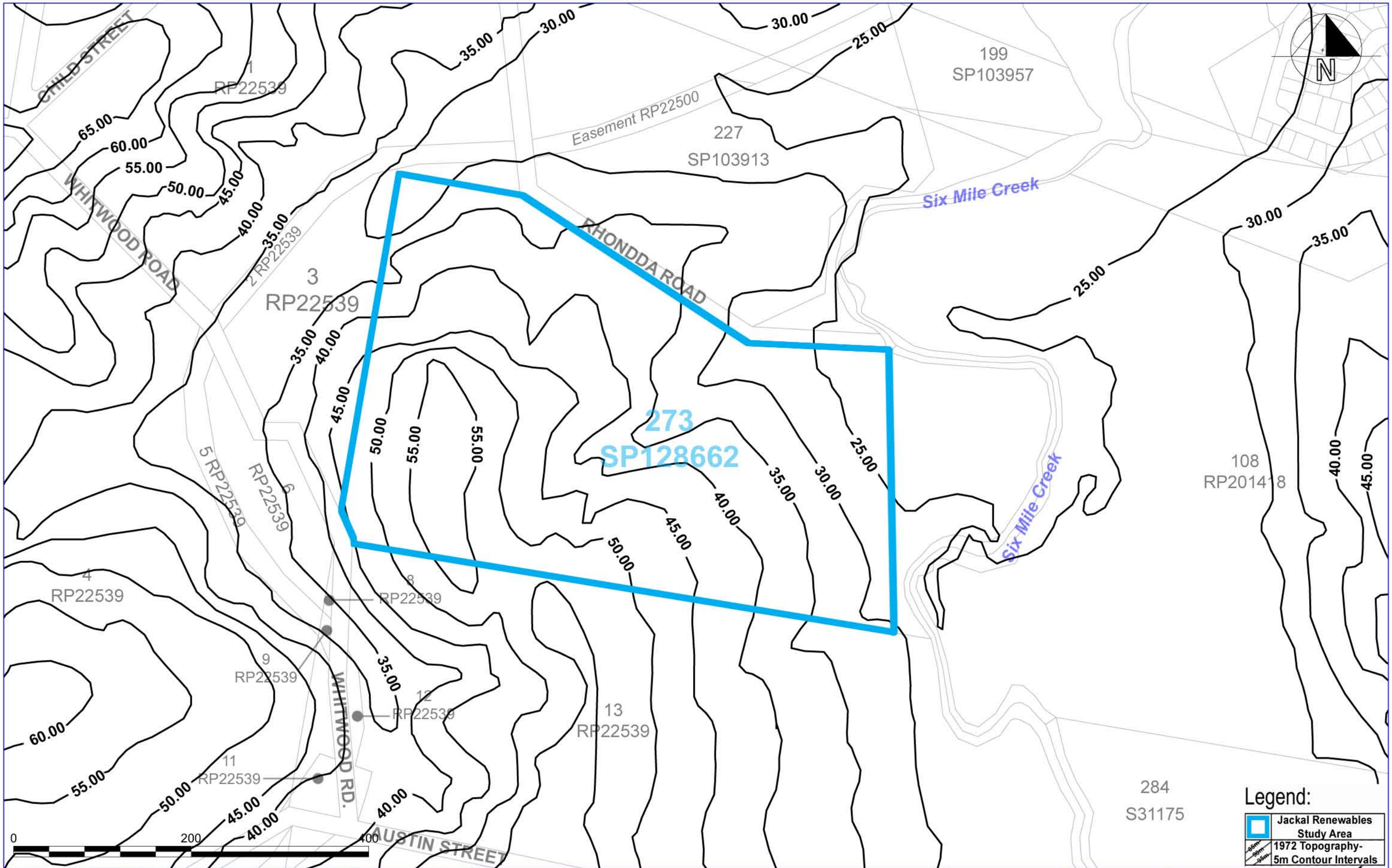


Figure 6 Maximum 1-day precipitation for annual season (based on 1986 to 2005 reference period)

(Queensland Government, 2022)

3.1.2 Topography

Generally, the landform is elevated in the western portion, up to a height of approximately 54m (Australian height datum, AHD). The landform of the western portion of the site is impacted by past and current mining activities, including a sizable excavation subject to clay and shale extraction. The approximate pre-surface mining landform slopes to the east, to a flood plain (at height of approximately 22m AHD), adjacent to Six Mile Creek, as shown in Figure 7. Regional topography is shown in Figure 8 (Moreton Geotechnical Services, 2018).



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

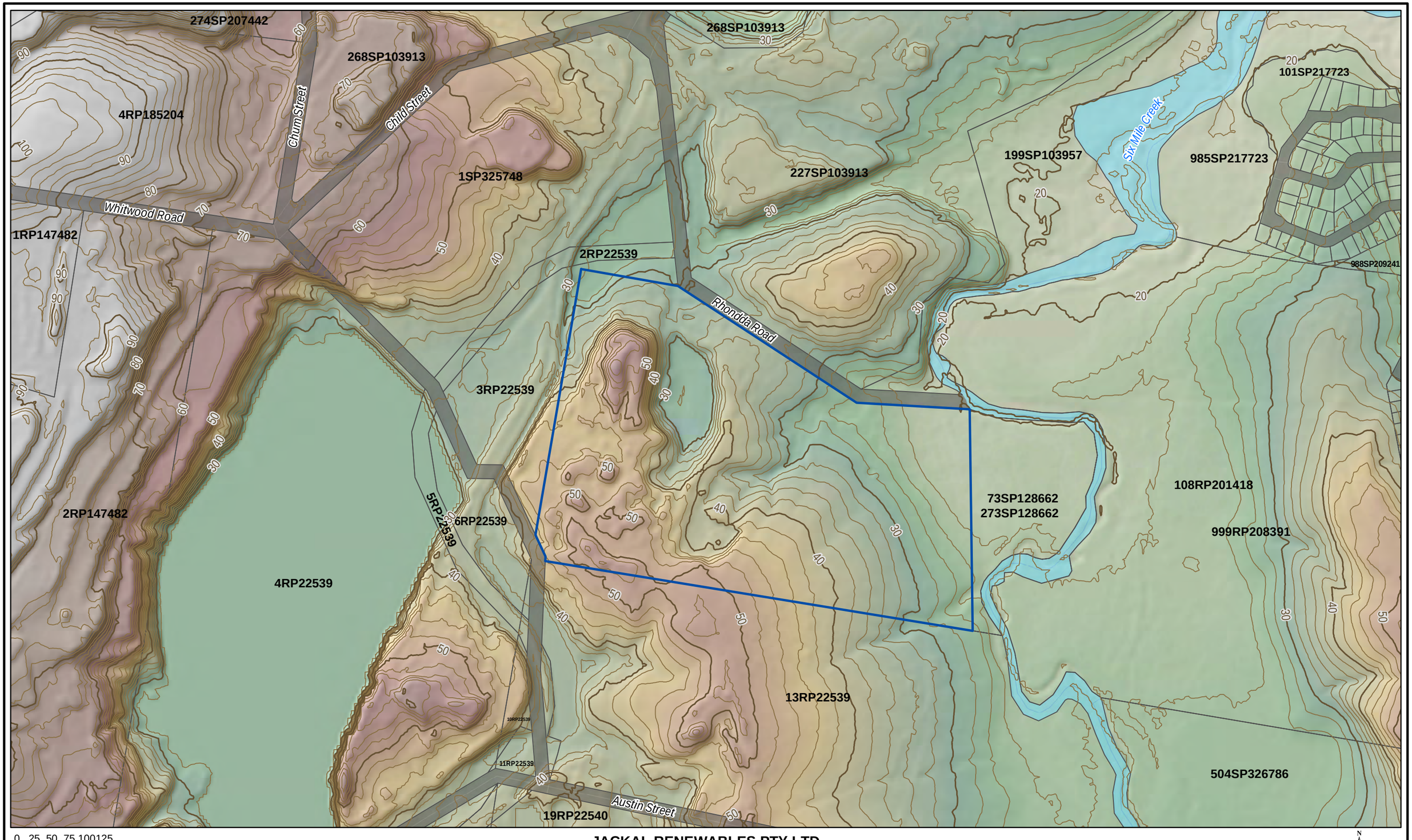
ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 3 - Contour Plan
1972 Map View Contours

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Three (3 of 16)	Folder: 2018.02.09_03

Taylor Mining Services Pty Ltd
Redbank Plains Road
Blackstone QLD 4305
Ph: (07) 3816 2311 Fax: (07) 3816 2377
www.taylorminingservices.com.au

FIGURE 7 Pre Surface Mining Site Topography



0 25 50 75 100125

Meters

JACKAL RENEWABLES PTY LTD

Project Overview

N W E S

GDA2020, MGA Zone 56

ARDENT GROUP PTY LTD

Figure 8 - ML50070

Regional Topography

Drawn By: Chris Schlebusch

Requested by: Richard Davis

Date: 24/01/2023

Sheet No.
RTPL_ARD_STW001_MAP_1018_A

Legend

- ML50070 Boundary
- Property Boundary
- Road Parcel
- Watercourse Parcel
- Contour (2m)
- Contour (10m)

Data sources:
© State of Queensland, Department of Resources

Path: S:\Plans\Project_Specific\Ardent\STW001\RTPL_ARD_STW001_MAP_1018_A A3L Topo ML50070 and Surrounds.mxd

3.1.3 Geological setting

3.1.3.1 Regional Geology

Regionally, the ML50070 is located in the Triassic to Middle Jurassic age Clarence Moreton Basin. This basin extends over approximately 10,000 km^2 of south eastern Queensland and northern New South Wales. In Queensland, the western boundary of the basin continues into the Surat Basin, while the other directions are bounded by older metamorphic and volcanic terrains. The Clarence Moreton Basin is mainly a fluvial - environment basin, with lesser coal swamp and lacustrine facies developed in some areas.

The Clarence Moreton Basin overlies the Ipswich Basin, a Middle Triassic age alluvial, fluvial and lacustrine environment basin, which includes the Ipswich Coal Measures. The Ipswich Coal Measures were the dominant coal resource targeted by historical to recent coal mining in the Ipswich coal field.

3.1.3.2 Site Geology

The local geology (Figure 9) indicates that rocks to the west of ML 50070 which comprise part of the Late Triassic Blackstone Formation (the upper part of the Ipswich Coal Measures – Ipswich Basin), include shale, siltstone, coal (including the Bluff Seam) and sandstone (Cranfield et al, 1989).

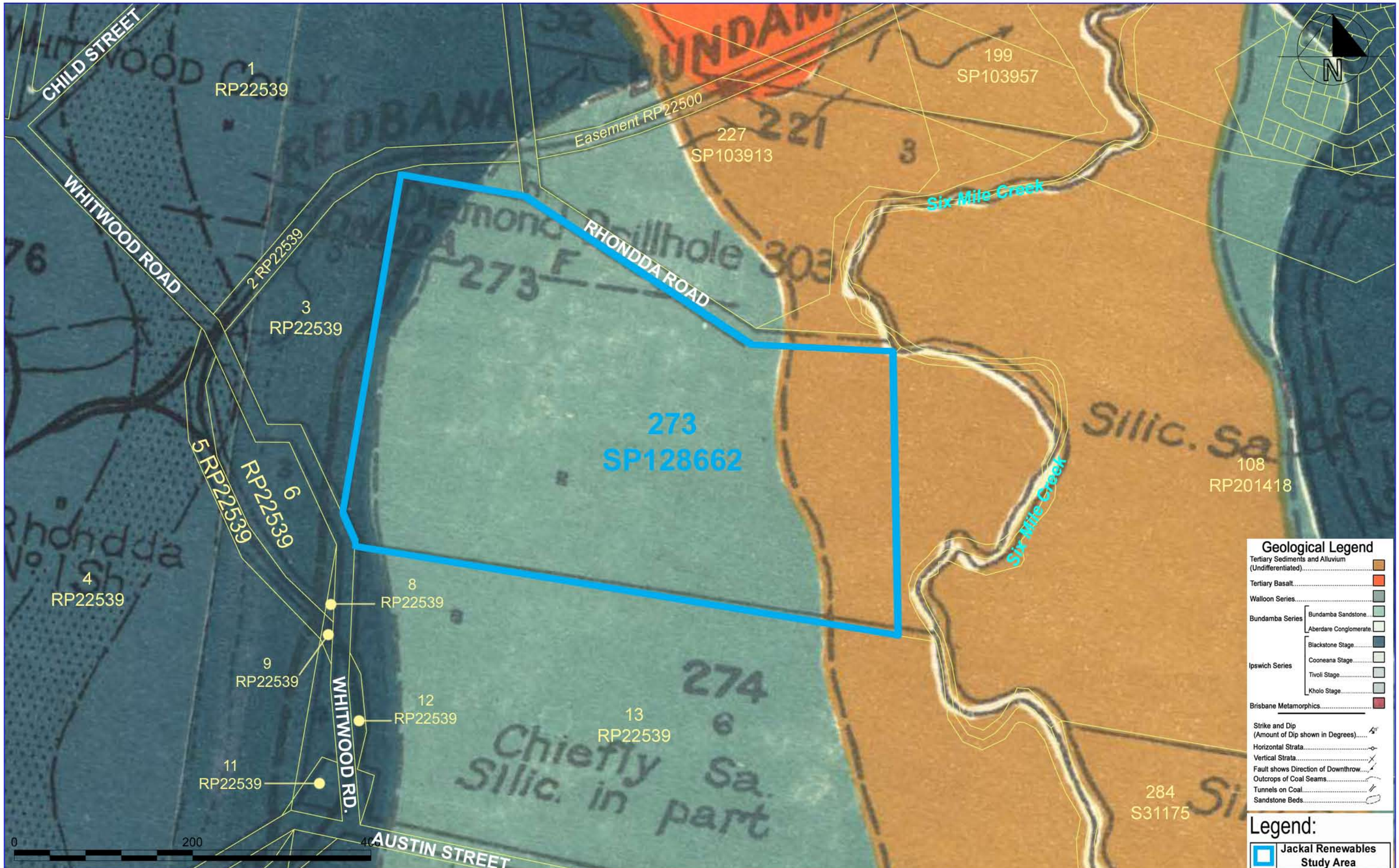
Overlying rocks were part of the Bundamba Group of the Clarence – Moreton Basin (or Woogaroo Subgroup as they are now known (Cranfield and Schwarzbock, 1972)). The constituent formations in this area are the Aberdare Conglomerate and Raceview Formation. The Aberdare Conglomerate, which disconformably overlies the Blackstone Formation does not crop out within the lease but is likely exposed in the high wall of the Kerwick #2 pit. The Raceview Formation consists of fine to medium grained, sub-labile to quartzose sandstone, shale, mudstone, thin coal seams and siltstone. The siltstone is fissile, with plant fragments and mica flakes on the bedding planes. Forming the top of the sequence in the area is the Tertiary Redbank Plains Formation composed of poorly consolidated lacustrine interbedded multi-coloured claystone, shale, and labile sandstone. This unit lies unconformably on the Raceview Formation (Staines, 1961).

The lithological summary for the two formations are as detailed in Table 6 below, as well as showing a smaller formation which covers the north-west and south-east corners of the ML.

Table 6 Geological Description

Rock Unit	Constituents	Age	Dominant Rock	Lithological Summary
Quaternary Alluvial		Quaternary	Alluvium	Clay, silt, sand and gravel; flood-plain alluvium
Redbank Plains Formation		Tertiary	Claystone, shale, sandstone	Claystone, shale, sandstone
Bundamba Sandstone	Raceview Formation Aberdare Conglomerate	Late Triassic	Arenite-Mudrock	Sublabile to quartzose sandstone, shale, mudstone, thin coal seams, siltstone
Blackstone Stage (Formation)	Blackstone Formation Tivoli Formation	Mid Triassic	Arenite-Mudrock	Lacustrine interbedded multi-coloured claystone, shale, labile sandstone

There is extensive open cut overburden material across the western side of the site. An exposed low-wall on the south side of the relict open cut, and part of the exposed highwall on the eastern side of the relict open cut void, also revealed the presence of easterly dipping beds of shale (and some coal) of the Blackstone Stage with a capping of strong sandstone of the Bundamba Sandstone or Aberdare Conglomerate Formations. The strong sandstone is also exposed at ground level around the crestal area in the south west corner of the site. The Bluff Seam was noted to outcrop (come to the surface) to the west of ML50070 in a deep drainage channel that had been previously excavated in the bedrock.



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 5 - Geology Plan
Image Source - Denmead, 1955

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Five (5 of 16)	Folder: 2018.02.09_05

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au

FIGURE 9 - Site Geology Plan

3.1.4 Site Hydrology and Fluvial Networks

The Project area lies within the Brisbane River drainage sub-basin. The environmental values and water quality objectives for the waters located in the Project region are detailed in the 'Sandy, Six Mile, Wolston, Woogaroo and Goodna Creeks environmental values and water quality objectives' as prescribed in Schedule 1 of the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019*.

The environmental values for the Lower Six Mile Creek fresh waters are:

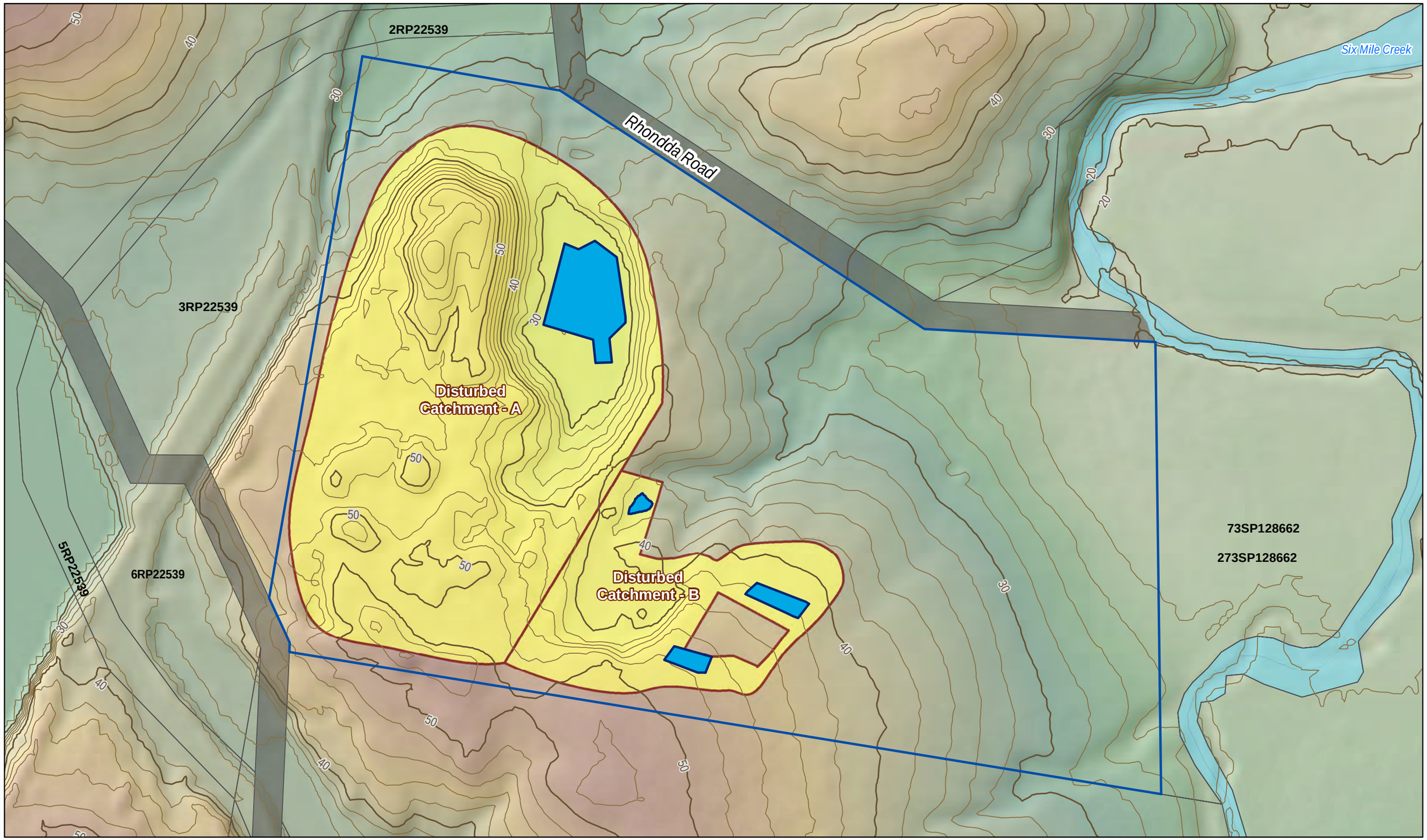
- Aquatic ecosystems;
- Stock water;
- Farm supply / use;
- Secondary recreation;
- Visual recreation;
- Industrial use; and
- Cultural and spiritual values.

There is no processing plant on site that generates a waste water, therefore there are no mine water management dams located on ML 50070. All stormwater runoff from disturbed areas from the western portion of the site are generally captured by the flow into the existing Kerwick #2 clay pit, where they are re-used onsite by the landowner, infiltrated or evaporated. Sediment dams and settling ponds are located at low points to the east of the power line to collect the site's surface water runoff that occurs from the Kerwick #1 pit, to the east of the power line, as shown in Figure 10.

The remainder of the stormwater from the undisturbed portions of the site flows through vegetated areas east towards Six Mile Creek to the east.

Six Mile Creek flows to the north, into the Brisbane River.

Due to the ridge lines within the site, the property has very little external catchment entering the site.



0 10 20 30 40 50
Meters

JACKAL RENEWABLES PTY LTD

Project Overview

N
W E
S

GDA2020, MGA Zone 56

ARDENT GROUP PTY LTD

Figure 10 - ML50070

Stormwater Features on Site

Drawn By:	Chris Schlebusch
Requested by:	Richard Davis
Date:	6/02/2023

Sheet No.
RTPL_ARD_STW001_MAP_1019_C

Legend

- ML50070 Boundary
- Property Boundary
- Road Parcel
- Watercourse Parcel
- Water Storage and Sediment Pond
- Contour (2m)
- Contour (10m)
- Disturbed Catchment (catchment boundaries approximate)

Data sources:
© State of Queensland, Department of Resources

Path: S:\Plans\Project_Specific\Ardent\STW001\RTPL_ARD_STW001_MAP_1019_C A3L ML50070 and Disturbed Catchments.mxd

The estimated volumes of the water storage / sediment dams are as provided below in Table 7.

Table 7 Water Storage Volumes

Sediment / Water Storage Dam	Approximately Volume (m^3)
Kerwick #2 Pit	2,300
Sediment Dam	1,470
Sediment Dam	915
Kerwick #1 Sediment Dam	700

The water collected in the clay pit and sediment dams is not particularly acidic or saline and does not require treatment for reuse on site. Water monitoring is undertaken on a regular basis and results from the latest round of monitoring undertaken on 19 December 2022 is presented in Table 8. This data is representative of the water in Kerwick #2 Pit. The other water storages identified above in Table 7 are existing sediment control structures of relatively small volume and will be relocated and/or removed as mining operations progress.

Table 8 Water Quality Monitoring Results

Parameter	Units	Result
pH (Field Test)	pH unit	8.22
EC (Field Test)	µS/cm	1098
Suspended Solids	mg/L	11
Turbidity	NTU	2.7
Nitrite + Nitrate as N	mg/L	<0.1
Total Kjeldahl Nitrogen as N Calculated	mg/L	0.2
Total Nitrogen as N	mg/L	0.2
Total Phosphorous as P	mg/L	<0.01
Arsenic as As	mg/L	0.001
Cadmium as Cd	mg/L	<0.0001
Chromium as Cr	mg/L	<0.001
Copper as Cu	mg/L	0.003
Lead as Pb	mg/L	<0.001
Nickel as Ni	mg/L	0.003
Zinc as Zn	mg/L	<0.005
Mercury as Hg	mg/L	<0.0001

3.1.5 Flooding

Ipswich City Council records indicate that the property was not subject to recent major flood events, as shown in Figure 11. Therefore, there is no flood plain defined within the mining lease area.

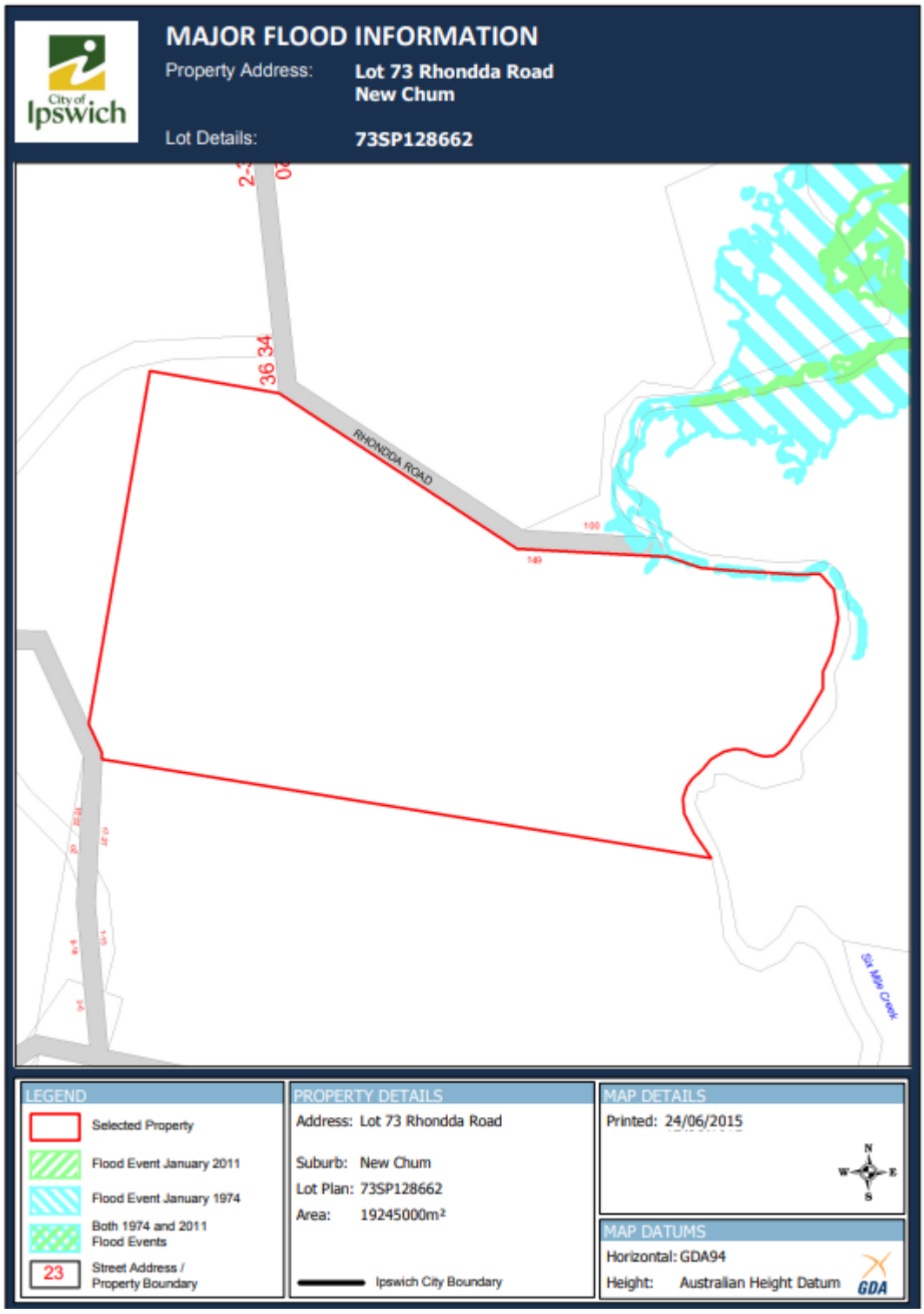


Figure 11 Major Flood Information

3.1.6 Groundwater Levels and Properties

The environmental values for groundwater are also detailed in the 'Sandy, Six Mile, Wolston, Woogaroo and Goodna Creeks environmental values and water quality objectives." The groundwater environmental values for the Sandy, Six Mile, Wolston, Woogaroo and Goodna Creeks catchment waters are:

- Aquatic ecosystems;
- Irrigation;
- Farm supply/use;
- Stock water; and
- Drinking water.

A detailed hydrogeological assessment has been conducted of the site and surrounds and is included as Appendix 6. The results are summarised below.

Due to the extensive past mining activities, both underground and surface, within the site and surrounds, the regional hydrogeological conditions are complex. Within the site, the hydrogeological conditions are influenced by the presence of underground workings that extend across the majority of the site, with workings directly connected through tunnels and shafts. Groundwater within the site is hosted within two discrete zones, being in situ basement sequences and underground mine workings.

The geology of the site can be assigned to four main hydrogeological units:
Unit 1 – Alluvium; near surface sands, clays, gravels, associated with local creeks.
Unit 2 – Raceview Formation; claystone, shale, minor sandstone, Clarence – Moreton Basin.
Unit 3 – Bundamba Sandstone; sandstone and conglomerate, clay shale, Clarence – Moreton Basin.
Unit 4 – Blackstone Stage; complex unit of sandstone, siltstone, coal seams – Ipswich Basin.

The clay-shale resource that is the target of this mining lease, is the Raceview Formation, part of the Clarence Moreton Basin sequence.

There has been no site-specific test work of aquifer hydraulic properties on the site. A search of publicly available information in the region has also not revealed any readily available information.
Hydraulic properties (Table 9) have been inferred, based on reference to relevant subject textbooks (i.e. Freeze and Cherry 1979).

Table 9 Hydrogeological Properties

Age	Unit	Aquifer Behaviour	Confined/ Unconfined	Inferred Hydraulic Conductivity (K, m/s)	Comment
Tertiary	**Unit 1 – Alluvium**	Aquifer (in sand & gravel dominated lithology units)	Unconfined	10^{-5}	Unconsolidated alluvium
Jurassic to Late Triassic	**Unit 2 – Raceview Formation**	Aquitard	n/a	10^{-9} shales	Target formation for clay-shale mining

Age	Unit	Aquifer Behaviour	Confined/ Unconfined	Inferred Hydraulic Conductivity (K, m/s)	Comment
Bundamba Group	**Unit 3 – Bundamba Sandstone**	Aquifer overall	Unconfined in the subject site	10^{-7} sandstone	
Late Triassic Ipswich Coal Measures	**Unit 4 – Blackstone Stage**	Mixed aquifer and aquitard, depending on lithology	Confined, artesian	10^{-7} sandstone 10^{-9} shales	Mine workings impact on aquifer behaviour (increased permeability in underground workings)

There are no groundwater monitoring bores on site. Based on ATC Williams 2018, there is a bore, MW3 (not a registered bore), located approximately 100m to the southwest of the site, on the BMI site (ML 50115) and standing water level (pressure level) is 28.11 m AHD, within shales. This report concluded that the water level in MW3 correlated with the water level in the adjacent Wattle Glen North open pit (~ 30m AHD).

Bore RN181903 was drilled a few hundred metres north of the site, and intersected groundwater in shales, at a depth of 36m below ground level (approximately -6m AHD). The aquifer is interpreted to be within the Raceview Formation. The standing water level (pressure level) recorded is 27m AHD, indicating a significant pressure head on this aquifer. There are no groundwater quality details available from this bore.

Bore CS4 is located in the southeast corner of the ML, and is artesian (flows at surface), with the water level at 23m AHD (also ground level). This bore is not registered. There are no drill logs available for this drill hole (it is not noted in the Qld Bore Register), information from Hugh Taylor (per comm 2017) indicated a total depth of 324m, and intersection of the Cochrane Seam at approximately 268m. The Cochrane seam is in the formation below the Blackstone Stage. This drill hole is likely to be responding to water under pressure in underground coal workings, deep in the Ipswich Coal Measures – Blackstone Stage (i.e. from depths of over 50m below ground level).

The conclusion from the Hydrogeological Assessment is that the shallowest aquifer beneath the mining area is the Raceview Formation, with groundwater intersected at approximately -6m AHD. This aquifer is sub-artesian (under pressure).

There is minimal and insufficient data on groundwater quality for the site and more regionally. In October 2023, the Department of Environment and Science (DES) released a draft report "*Regional groundwater chemistry zones: South East Queensland region summary and results*" which forms a technical basis for the development of groundwater environmental values (EVs), water quality objectives (WQOs) and management intent mapping in the South East Queensland region pursuant to the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP Water).

From this comprehensive assessment, there was insufficient data to determine water quality trends and groundwater quality characteristics for the 'Ipswich coal measures', 'Sediments overlying coal measures' and 'Toowoomba Region Basalts Weathered'.

It would be anticipated that groundwater recharge occurs from incident rainfall within the surrounding area into the sandstones of the Ipswich Basin and Moreton Basin outcropping areas. In addition, some groundwater recharge may take place from the base of exhausted mine pits in the region. Groundwater discharge areas (soaks) are not locally known, unless artificially created by uncapped artesian bores. It is likely that groundwater provides some base flow to the Brisbane River, approximately 3.5km north of the site. Groundwater flow direction in shallow sedimentary aquifers is likely to follow general topography towards the northeast, from the site.

Based on this hydrogeological assessment, the shallowest groundwater intersection in the Raceview Formation (adjacent to the subject site) is at a depth of approximately -6m AHD. This is supported by the observation that the exploration drillholes drilled to the base of the proposed Kerwick #1 pit (approximately 14m AHD) throughout the clay deposit in the eastern area of the mining lease did not detect or intersect groundwater.

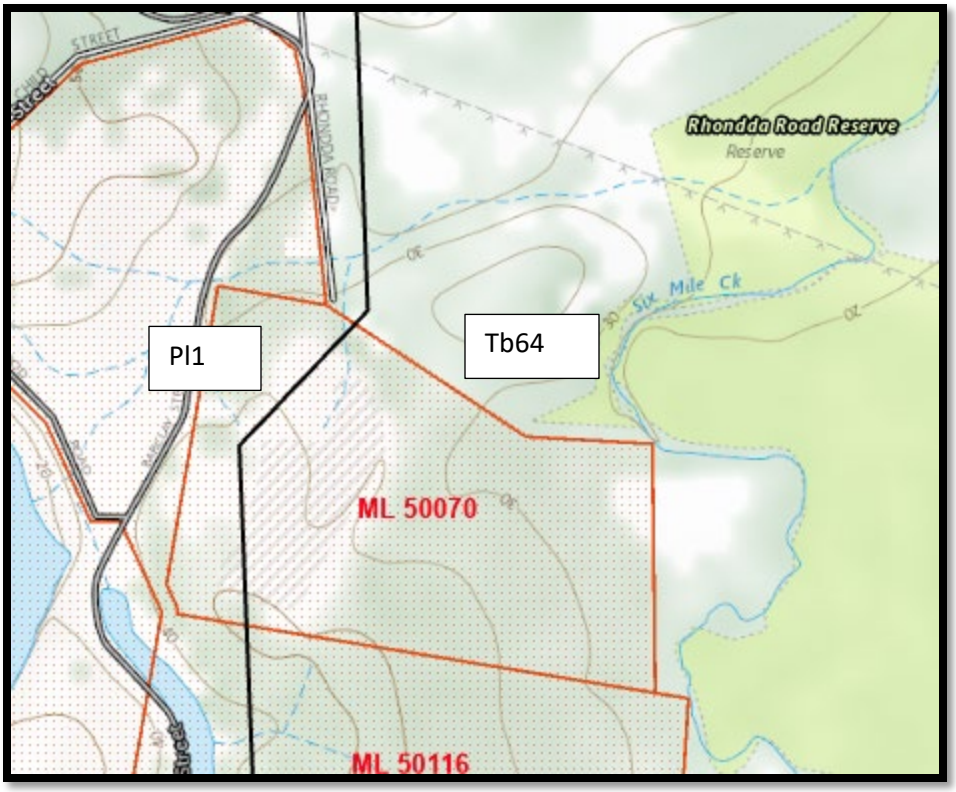
In addition no groundwater was detected in exploration bores and the current mine plan will not exceed the depth of the exploration drillholes, mining is likely to be above groundwater level and the mineral extraction is not likely to interfere with groundwater on the subject site. Therefore, no impacts on groundwater by the proposed mining activity are currently predicted.

3.1.7 Soil Types, Properties and Productivity

Soils are relatively thin and sandy over arenite, deeper and more clay rich over mudstone. The soil is characterised as erosive.

In the Atlas of Australian Soils, the main soil type in the area is classified as “Tb64 - Hard pedal mottled-yellow duplex soil”. There is a narrow north south trending sliver of soil “ Pl1 - Hard pedal mottled-red duplex soils” in the western portion of the mining lease, as shown in Figure 12.

Elevation of the land is approximately 40m AHD and is therefore considered “low risk” under the Queensland Acid Sulfate Soil Technical Manual. The nearest recorded acid sulfate soil site is in grey dermosol soils located 3.5km to the north on the banks of the Brisbane River.



(source – Qld Globe)

Figure 12 Site Soil Type

Detailed topsoil depth survey over Kerwick #1 Pit area has been completed and is included in Appendix 5. In summary the topsoil depth varies from 10cm thick over the majority of the pit area, is noted at 15cm thick in a shallow gully, and then reaches 20cm thick in the flatter area closer to Six Mile Creek. This topsoil thickness is illustrated in Figure 13.

Soil analysis has been undertaken on in-situ topsoil across the Kerwick #1 Pit area, and is included in Table 10. The results indicated that the topsoils could be amended with fertiliser to lift nutrient levels, as well as the addition of gypsum to improve low calcium levels to improve rehabilitation outcomes.

Table 10 Insitu Topsoil Analysis Results Comparison

Property		Criteria in AS 4419 (Low Organic, Low Phosphorous Soils)	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12
EC (µS/cm)		<750	12	10	17	6	34	34	18	18	22	32	23	36
Na (% of ECEC)	No pre-treatment for soluble salts	<20	0.3	0.1	0.7	<0.1	0.5	0.4	0.2	<0.1	<0.1	0.1	0.1	0.3
K (% of ECEC)		3-15	5.6	7.7	5.2	11.1	5.6	4.3	10.2	6.3	8.0	11.4	10.7	5.0
Ca (% of ECEC)	Acid and neutral soils	50-80	18.5	43.1	19.8	33.3	19.1	10.0	24.5	22.9	<LOR	31.8	25.0	38.8
Mg (% of ECEC)		10-30	51.9	38.5	51.7	36.1	52.8	48.6	32.7	16.7	16.0	36.4	32.1	46.3
Available P (mg/kg)		<30	-	-	-	-	-	-	-	<5	<5	<5	<5	<5
Organic Matter (%dwb)		3-6	-	-	-	-	-	-	-	2	1.7	4.1	2.1	5.4
Total available N (NO_3 + NH_4) (mg/kg)		>20	0.4	1	0.4	0.6	0.7	0.2	0.5	-	-	-	-	-

Note: <LOR denotes that the laboratory result was below the limit of reporting. "-" = not analysed

An estimated 4,500m^3 of topsoil is currently available on site for rehabilitation across several stockpiles. These stockpiles are all located within 450m of the areas requiring growth media application for rehabilitation.

Analysis of available growth media material on site has been conducted (TSS samples). These results have been reviewed against relevant criteria from *'AS 4419-2018: Soils for Landscaping and Garden Use'*, as shown in Table 11.

This comparison shows that the available material requires amendment with fertiliser to improve nutrient levels. Low phosphorus content also poses less of an issue for native species, as they are generally not tolerant of high phosphorus levels.

The pH results of the soil samples were 5.0 – 5.6, which is in the correct range for native plant growth. Low calcium levels may be amended by the addition of gypsum, so as not to increase the soil pH. Additionally, low organic matter content may be amended by top dressing with biosolids.

Table 11 Soil Stockpile analysis result comparison

Property		Criteria in AS 4419 (Low Organic, Low Phosphorous Soils)	TSS1	TSS2	TSS3	TSS4
EC (dS/m)		<0.75	0.061	0.066	0.082	0.013
Na (% of ECEC)	No pre-treatment for soluble salts	<20	9.1	15.3	20.8	13.6
K (% of ECEC)		3-15	5.26%	5.26%	2.33%	1.79%
Ca (% of ECEC)	Acid and neutral soils	50-80	6.58%	8.77%	<LOR	<LOR
Mg (% of ECEC)		10-30	28.95%	38.6%	41.86%	33.93%
Available P (mg/kg)		<30	<1	<1	<1	<1
OM (%dwb)		3-6	4.3	5	2	0.7
Total available N (NO_3 + NH_4) mg/kg		>20	1.3	1.8	1.1	0.3

Note: <LOR denotes that the laboratory result was below the limit of reporting.



0 10 20 30 40 50

m

JACKAL RENEWABLES PTY LTD

Project Overview

N
W E
S

GDA2020, MGA Zone 56

ARDENT GROUP PTY LTD

Figure 13

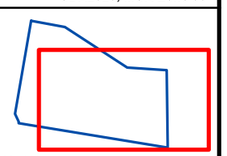
Interpreted Topsoil Thickness

Drawn By:	Chris Schlebusch
Requested by:	Joseph Castellan
Date:	11/12/2023

Sheet No.
RTPL_ARD_STW001_MAP_1028_A

- ML50070 Boundary
- Property Boundary
- Contour (2m)
- Contour (10m)
- Survey Boundary

Interpreted Topsoil Thickness
- 10cm
- 15cm
- 20cm



Data sources:
© State of Queensland, Department of Resources

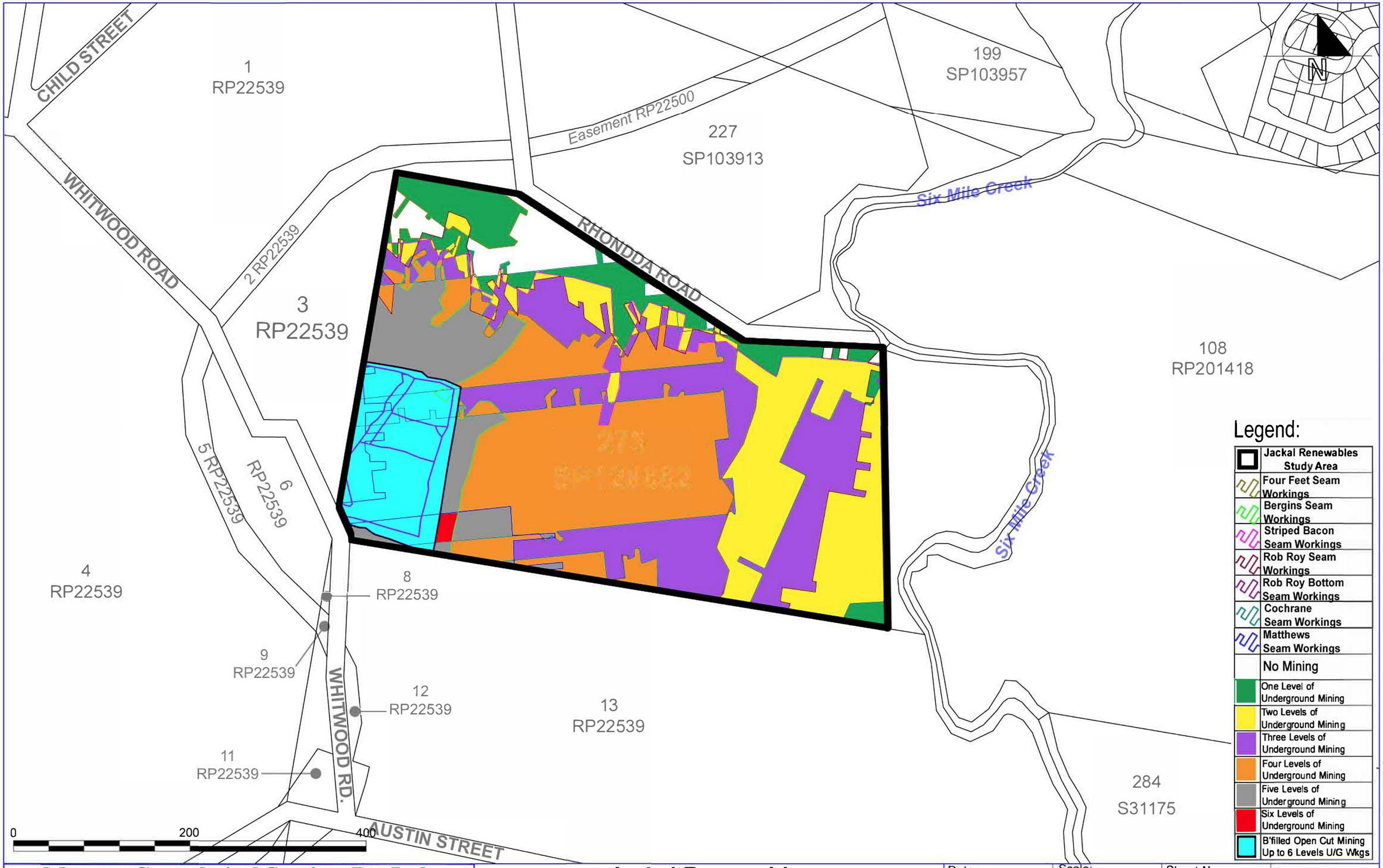
Path: S:\Plans\Project_Specific\Ardent\STW001\RTPL_ARD_STW001_MAP_1028_A A3L ML50070 and Interpreted Topsoil Thickness.mxd

3.1.8 Land Stability

A desktop study was conducted in 2018 (Moreton Geotechnical Services, 2018) which summarised the historical mining conditions on the site and is shown in Figure 14.

The site has been subject to underground mining of the Four Foot, Bergins, Striped Bacon, Rob Roy, Cochrane and Matthews Seams; and has been open cut mined along the Bluff Seam prior to substantial backfilling of the void. Subsequent quarrying for shale for paver making has also slightly modified the backfilled open cut landform including extending on the initial open cut coal mine void.

Settlement, and particularly differential settlement, of fill along the line of open cut walls that are buried or proposed to be buried represents the main potential settlement issue; whereas potential subsidence from the multilevel underground flooded mine levels represent a secondary consideration.



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 16 - Constraints Plan

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Sixteen (16 of 16)	Folder: 2018.02.09_16

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au

Figure 14 - Historical Mining on Site

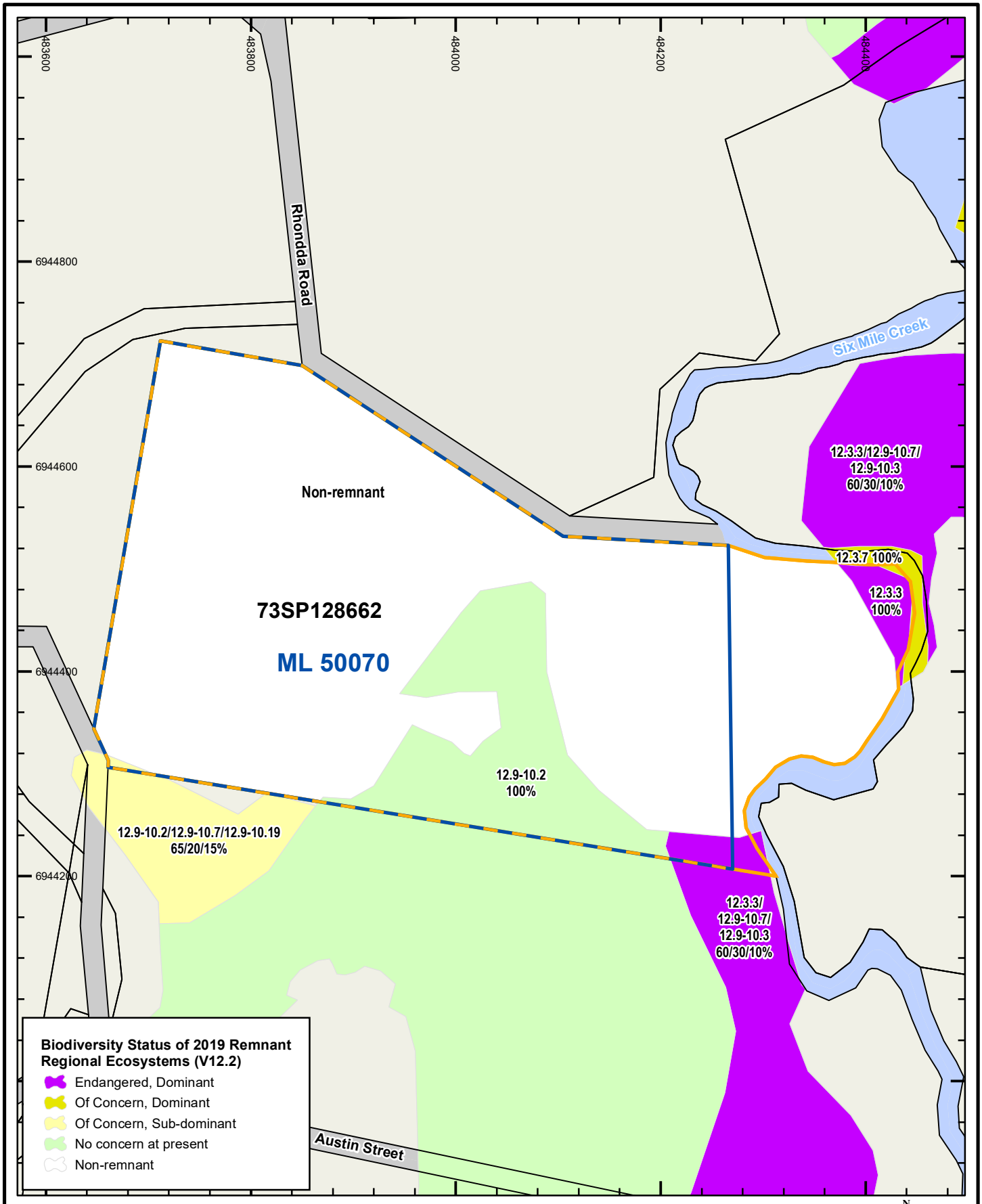
3.1.9 Vegetation Communities and Ecological Data

ML 50070 is located within the south-east Queensland bioregion and the Moreton Region sub-basin.

Table 12 and Figure 15 detail the regional ecosystems within ML 50070 and their biodiversity status.

Table 12 Regional Ecosystems

RE	Short Description	Biodiversity Status
12.3.3	*Eucalyptus tereticornis* woodland on Quaternary alluvium	Endangered
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca spp*. fringing woodland	Of concern
12.9-10.19	*Eucalyptus fibrosa* subsp. *fibrosa* woodland on sedimentary rocks	No concern at present
12.9-10.2	*Corymbia citriodora* subsp. variegata +/- *Eucalyptus crebra* open forest on sedimentary rocks	No concern at present
12.9-10.3	*Eucalyptus moluccana* open forest on sedimentary rocks	Of concern
12.9-10.7	*Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp. and E. melanophloia* woodland on sedimentary rocks	Of concern
Non-remnant	None	None



JACKAL RENEWABLES PTY LTD

Lot 73 on SP 128662

GDA2020, MGA Zone 56

[redacted]

Regional Ecosystems (Biodiversity Status)

Figure 15

Legend

- ML 50070
- 73 SP128662
- Property boundary
- Road Parcel
- Watercourse Parcel

Drawn By: Chris Schlebusch

Requested by: Richard Davis

Date: 18/01/2023

Sheet No.

RTPL_ARD_STW001_MAP_1016_B

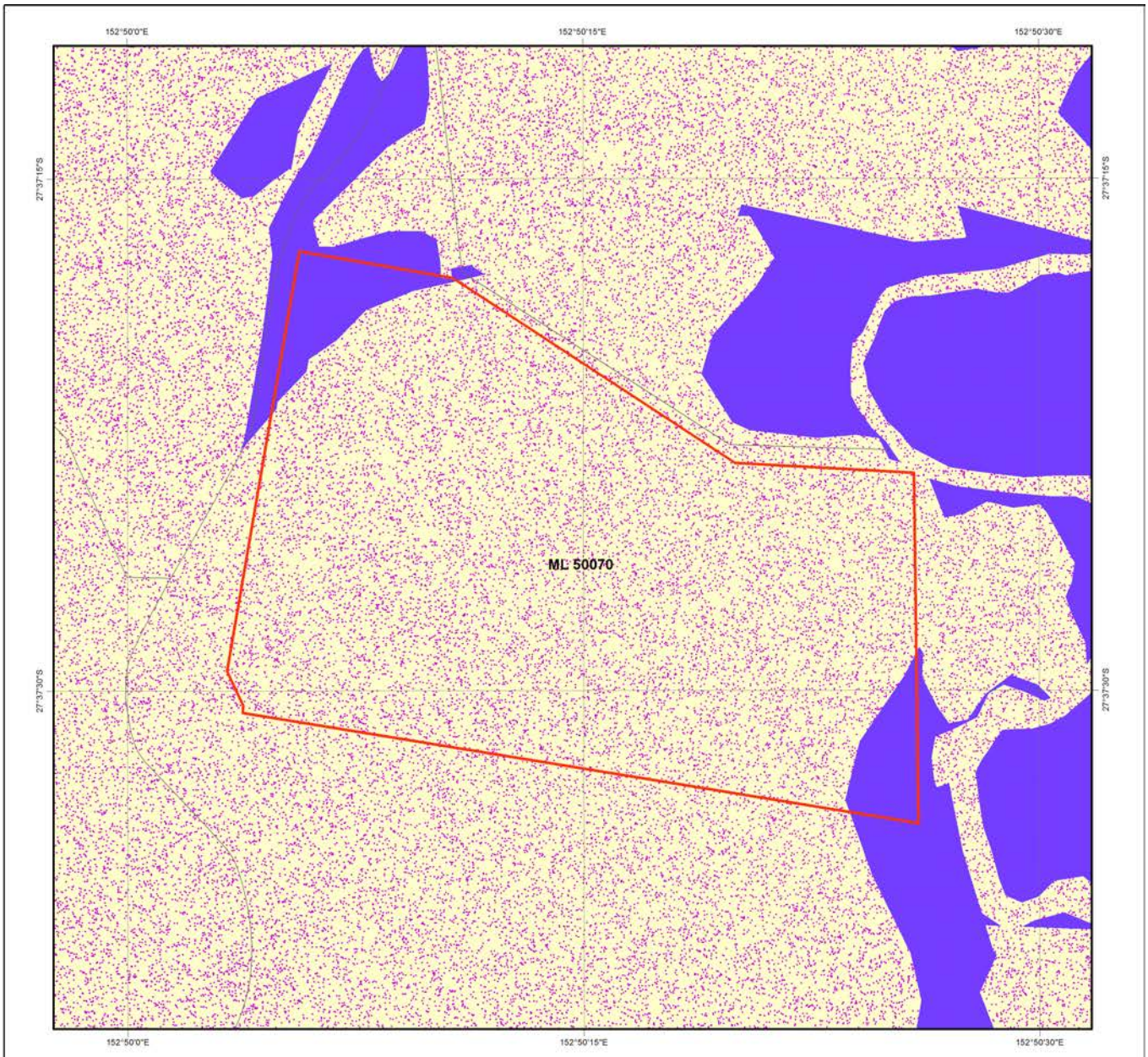
Data sources:
©State of Queensland, Department of Resources

Path: S:\Plans\Project_Specific\Ardent\STW001\RTPL_ARD_STW001_MAP_1016_B ML50070 and Biodiv Status RE.mxd

There is only a limited area of Category B ESA in the south east and north west corner of ML50070, as shown in Figure 16.

Parts of ML 50070 are mapped within a high-risk area for protected plants. An ecological survey was undertaken in 2018, and again in specific areas during 2021 which concluded that protected plants were not present (Sticks & Stones, 2018; BAAM, 2021). The 2018 survey also confirmed no EVNT plant species were on site (Appendix 3).

Vegetation is currently authorised to be cleared within ML 50070 (excluding the 20m vegetation buffer) for mining activities.



ENVIRONMENTALLY SENSITIVE AREAS - Mining Activities

- Selected Mining Lease (ML)

CATEGORY A
- National Parks
- Conservation Parks
- Forest Reserves
- Special Wildlife Reserve
- Wet Tropics World Heritage Area
- Great Barrier Reef Marine Park Area
- Marine Parks other than General Use Zones

CATEGORY B
- Queensland Heritage Register Places
- Ramsar Sites
- Cultural Heritage Registered Areas and DLA's other than Stanbroke
- Special Forestry Areas
- Seaward Side of Highest Astronomical Tide
- Fish Habitat Areas
- Coordinated Conservation Areas
- Endangered Regional Ecosystems - regrowth and remnant (Biodiversity Status)
- General Use Zones of Marine Parks
- Marine Plants

CATEGORY C
- Nature Refuges
- Resources Reserve
- State Forests
- Timber Reserves
- River Improvement Areas
- Stanbroke DLA
- Coastal Management District
- Dams and Weirs

OTHERS
- Towns
- Roads
- Repealed Wild River Nominated Waterways
- Repealed Wild River Preservation Areas
- Repealed Wild River High Preservation Areas
- Mahogany Glider Habitat
- Directory of Important Wetlands
- Queensland

LOCALITY DIAGRAM

N

0 50 100 150 200 250 m

This product is projected into GDA 1994 MGA Zone 56

Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, The State of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

The State of Queensland disclaims all responsibility for information contained in this product 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.

NOTE TO USER: Themes presented in this map are indicative only. Field survey may be required to verify the 'true' spatial extent and value. Not all environmentally sensitive areas are presented in this map. A user should refer to the particular circumstances relevant to their situation to assess the 'completeness' of themes provided.

The user should note that some boundaries and indicated values are ambient and may change over time (e.g. regional ecosystem boundaries and conservation status, watercourse mapping etc).

The user should be aware that due to multiple overlapping themes/ layers present, some themes/layers may be obscured by others. Ordering in the Legend does not accurately reflect the order by which themes/layers are displayed.

© The State of Queensland, 2023

FIGURE 16 ESA Map

Queensland Government

3.1.10 Fauna Presence and Populations

An ecological survey was conducted in October 2018 which reports no animals listed as Conservation Significant were observed during the survey, and there was no evidence of the presence of Conservation Significant animals on the site.

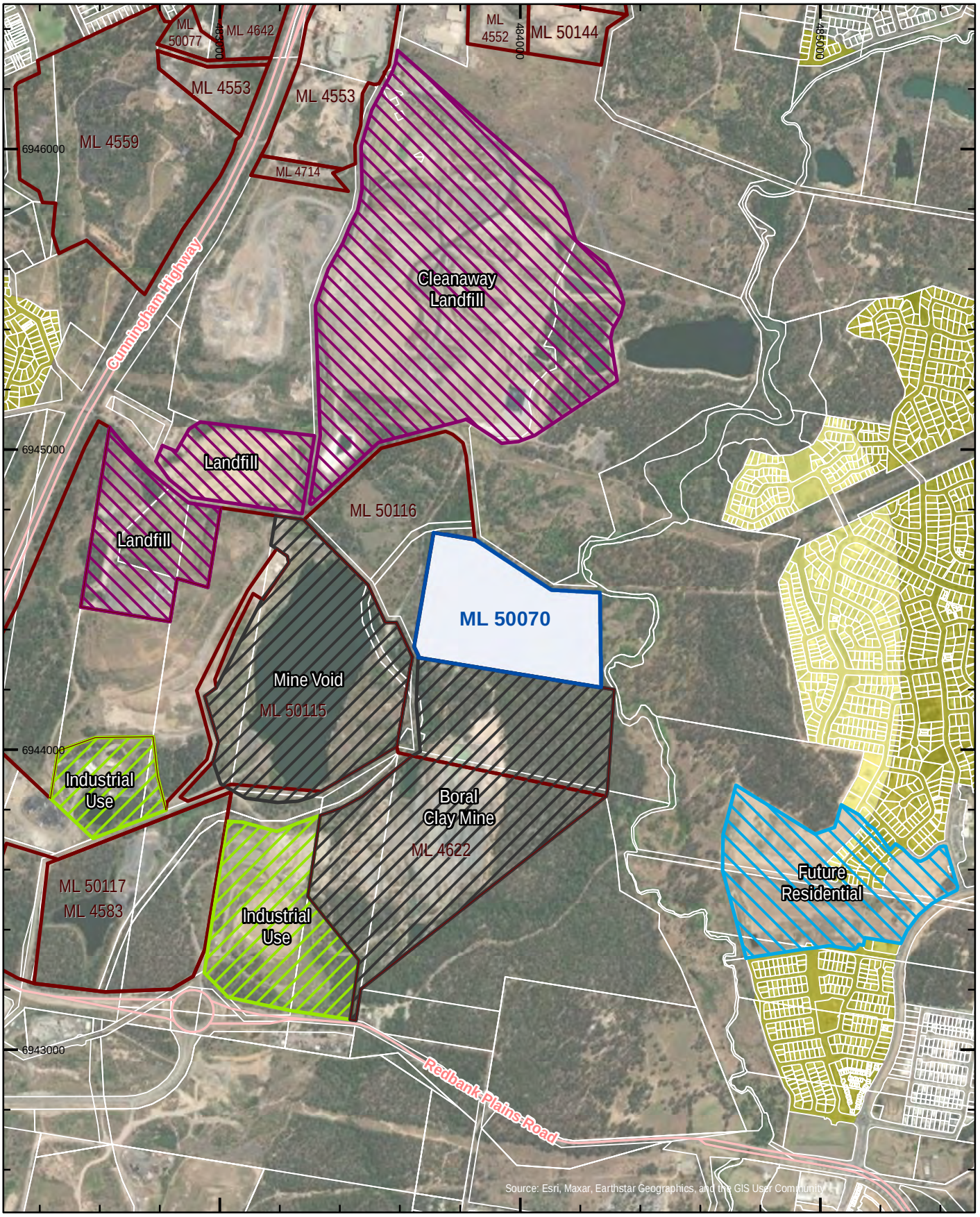
The preferred habitat for protected fauna potentially present on site was reviewed in the 2018 ecological survey (Sticks and Stones, 2018). An analysis of the animals' preferred habitat and the degree of disturbance that the site has been subjected to, suggested that: it is unlikely that any of the pelagic or coastal birds would be present on site; it would be possible although not probable for most of the other indicated birds to be occasionally on site, for example, when travelling through or over the site; it would be unlikely for many of the protected terrestrial animal species to be present on site. A SAT survey was conducted for Koala in and adjacent to the proposed development site. No signs or indications of Koala presence or use were recorded during the survey. No protected animals or their signs were observed or recorded during the survey. Appendix 3 contains the Ecological Survey Report.

3.1.11 Pre-mining Land Use

ML 50070 is located within a setting which has been extensively modified by coal mining activities since the 1800s. Open-cut coal mining followed the original underground operations and created large voids and spoil heaps which have disturbed and modified the original landscape and drainage system.

The site has experienced extensive underground and open cut mining from the commencement of Rhondda Collieries Pty Ltd operations in 1900 to the last mining in 1996. Substantial back filling of the void has occurred (Moreton Geotechnical Services Pty Ltd, 2018). Mining for clay shale commenced in 1994.

The ML is surrounded by mine sites, some of which are still active, some of which are being used for other industrial purposes such as landfill or broadscale industrial activities, as shown in Figure 17.



0 0.2 0.4 0.6 0.8 1

Kilometers

JACKAL RENEWABLES PTY LTD

Lot 73 on SP 128662

N W E S

GDA2020, MGA Zone 56

ARDENT GROUP PTY LTD

Figure 17 - ML50070

Surrounding Land Use

Legend

- ML 50070
- Property boundary
- Industrial
- Landfill
- Mine
- Residential
- Residential lots within 1km
- Residential lots within 2km

Drawn By:	Chris Schlebusch
Requested by:	Richard Davis
Date:	6/02/2023

Sheet No.

RTPL_ARD_STW001_MAP_1017_B

Data sources:
©State of Queensland, Department of Resources

Path: S:\Plans\Project_Specific\Ardent\STW001\RTPL_ARD_STW001_MAP_1017_B ML50070 Surrounding Land Use.mxd

3.1.12 Landholders

As noted in Section 2.3, ML is entirely within Lot 73 on SP128662, freehold land owned by Jackal Renewables Pty Ltd. This lot is depth restricted, to approximately 30m below existing ground level.

Below this lot is Lot 273 SP128662, unallocated State Land leasehold land, owned by The State of Queensland.

3.1.13 Sensitive Receptors

Sensitive receptors are located at varying distances to the north, east, south and west of the ML50070. Figure 17 illustrates these locations.

3.2 Design for Closure

As this is a Transitional PRCP, there is no requirement to demonstrate how aspects of the mine site have been designed for closure for existing or approved disturbance (section 3.1, PRC Plan Guideline). The rehabilitation / improvement planning includes detail from when mining was first undertaken by Jackal up until planned surrender, as described in the mining plan, as there is no detailed information from the previous owners.

3.3 Rehabilitation / Improvement Planning

3.3.1 Progressive Rehabilitation

Consistent with Environmental Authority EA0001386, the approved PMLU is Native Ecosystem.

This outcome is specified in EA0001386 (Schedule F – Table 2) and is replicated below in Table 13.

Table 13 Schedule F - Table 2 Final Land Use and Rehabilitation Outcome Schedule

Tenure ID	Disturbance Type	Projective Surface Area (Ha)	Rehabilitation Outcome
ML50070	Backfilled / rehabilitated old coal mining void (western sector of lease)	2.5	Native ecosystem
	Old coal mining spoil dump (western sector of lease)	0.7	Native ecosystem
	Mine excavation area	13.0	Native ecosystem

In line with condition F6-1 Rehabilitation Outcome – Native Ecosystem *For the purposes of Schedule F – Table 2 (Final Land Use and Rehabilitation Outcome Criteria), areas that are to be rehabilitated to native ecosystem must comply with the following outcomes:*

(a) Achievement of a self-sustaining native ecosystem with a species composition and distribution similar to the pre-mining species composition and distribution; and

(b) The landform must be suitable to support he ecosystem in (F5-1) a) and be stable and non-polluting.

To facilitate progressive rehabilitation on site, the mine planning process has aimed to maximise progressive rehabilitation by scheduling the commencement and completion of rehabilitation as soon as practicable after land becomes available. This will be achieved by moving from west to east, in four stages, allowing rehabilitation to occur behind the pit.

The Kerwick #2 Pit will be retained until late in the mine life to provide for water / stormwater management together with overburden and / or topsoil storage areas, as required.

A small area (0.4963 Ha) will have a PMLU of Retained Infrastructure which will consist of the powerline and powerline access track. This is necessitated by obligations under the *Electricity Act 1994.*

The mining and progressive rehabilitation stages are shown in Figure 18 to Figure 25.

The final landform is shown in Figure 26.

Figure 18 – Kerwick #1 Pit Stage 1 Mining Area (from Ausrocks, 2023)



Figure 19 – Kerwick #1 Pit Stage 2 Mining Area (from Ausrocks, 2023)



Figure 20 – Kerwick #1 Pit Stage 3 Mining Area (from Ausrocks, 2023)

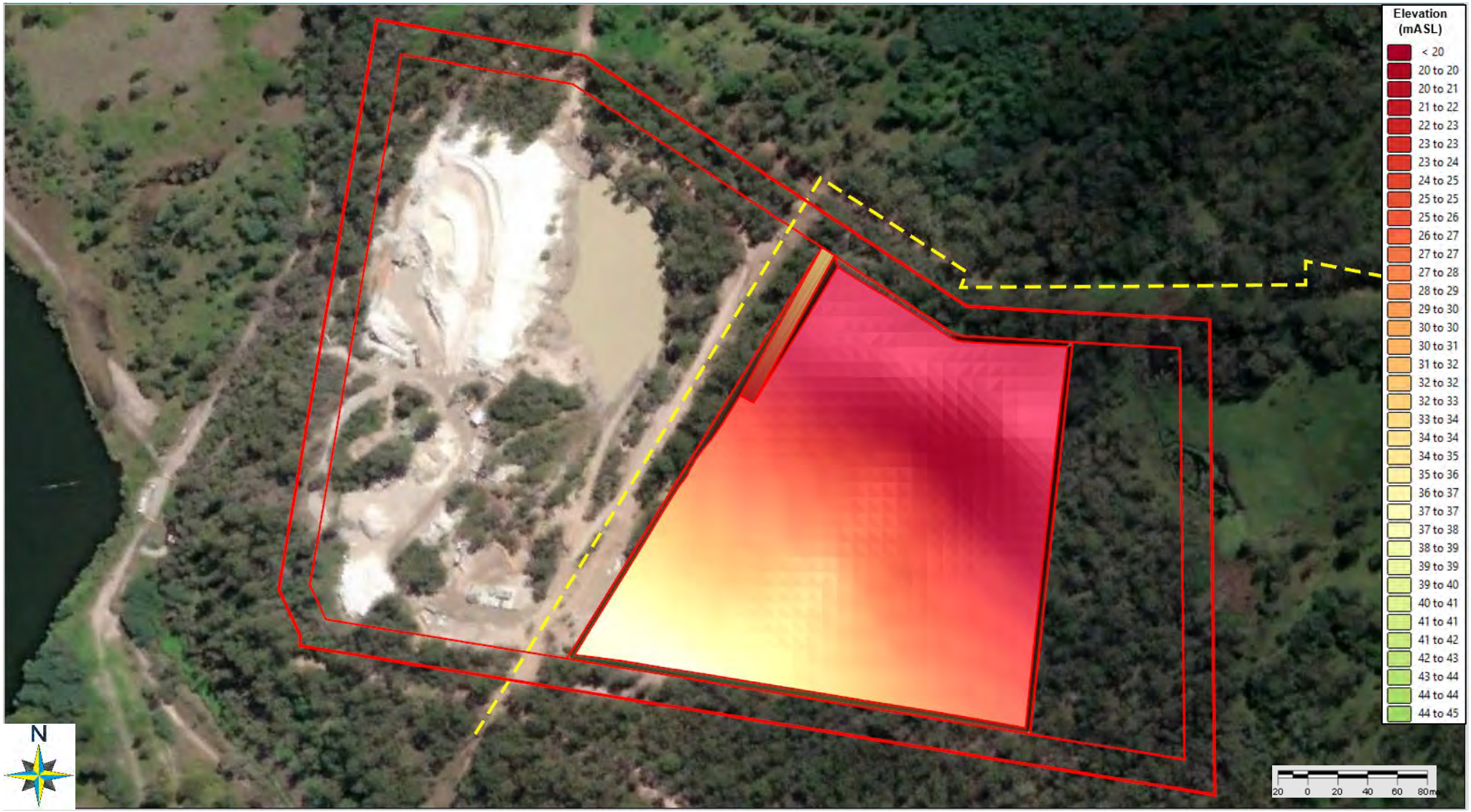


Figure 21 – Kerwick #1 Pit Stage 4 Mining Area (from Ausrocks, 2023)

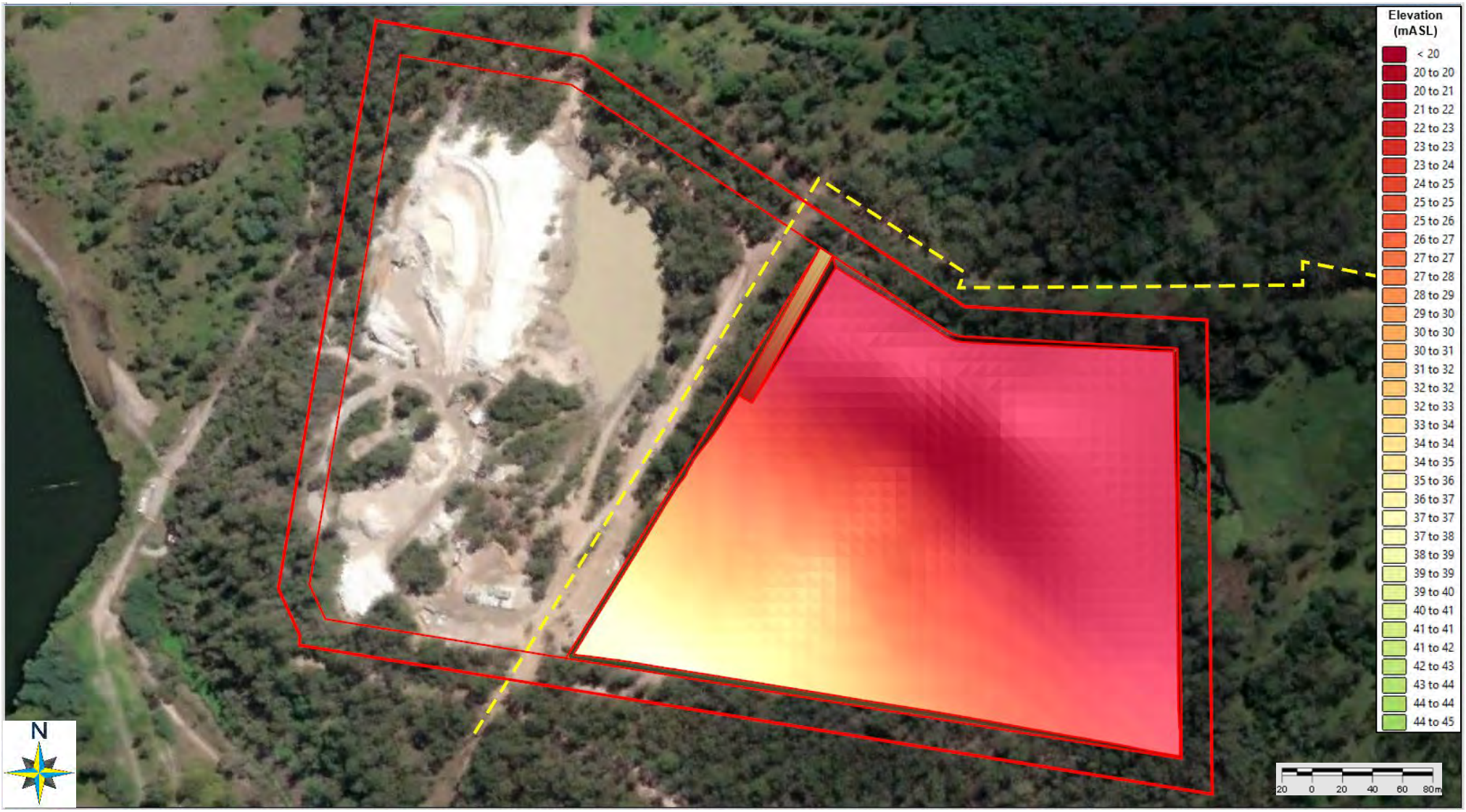


Figure 22 – Progressive Rehabilitation Design – Stage 1 (from Ausrocks, 2023)

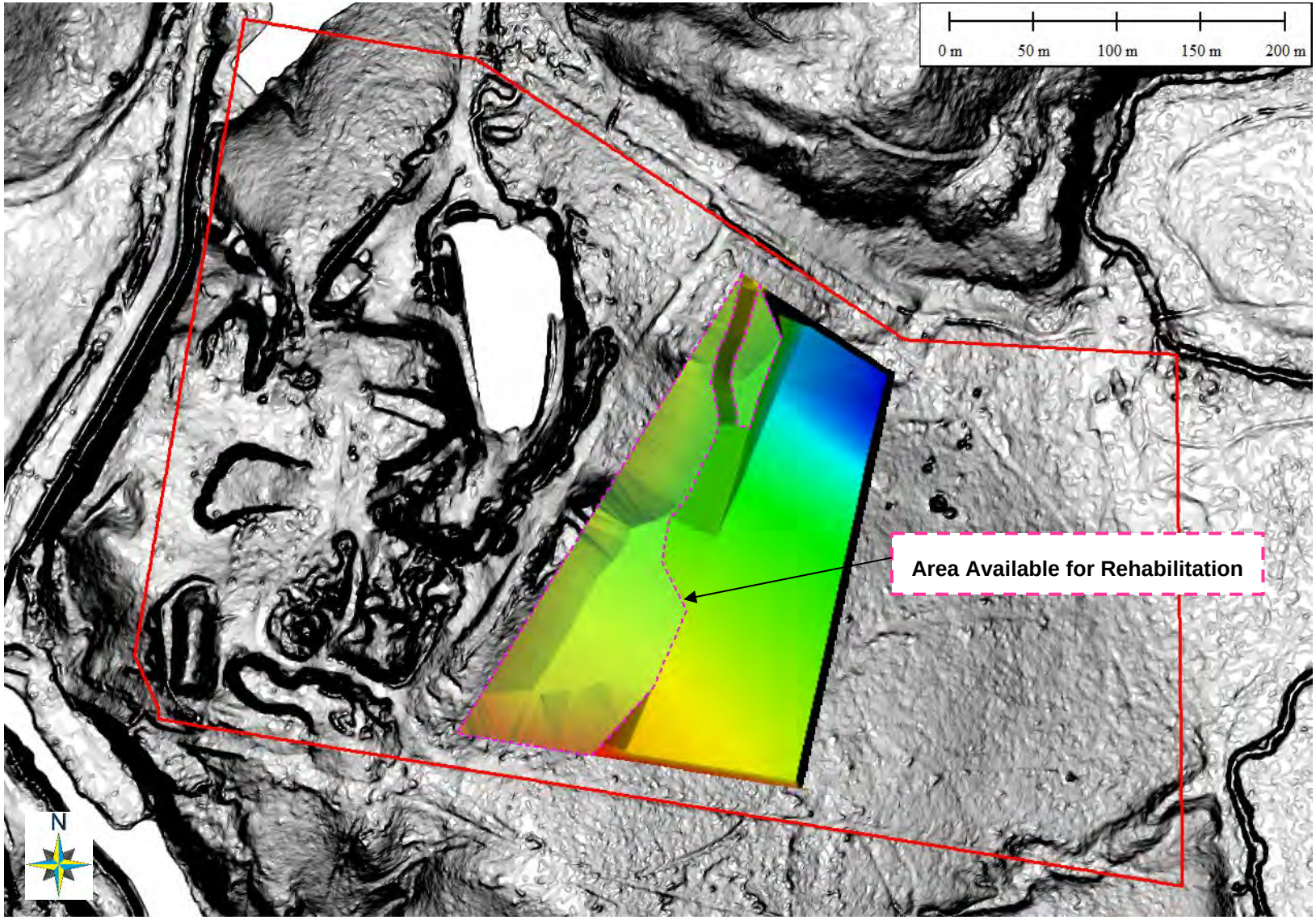


Figure 23 – Progressive Rehabilitation Design – Stage 2 (from Ausrocks 2023)

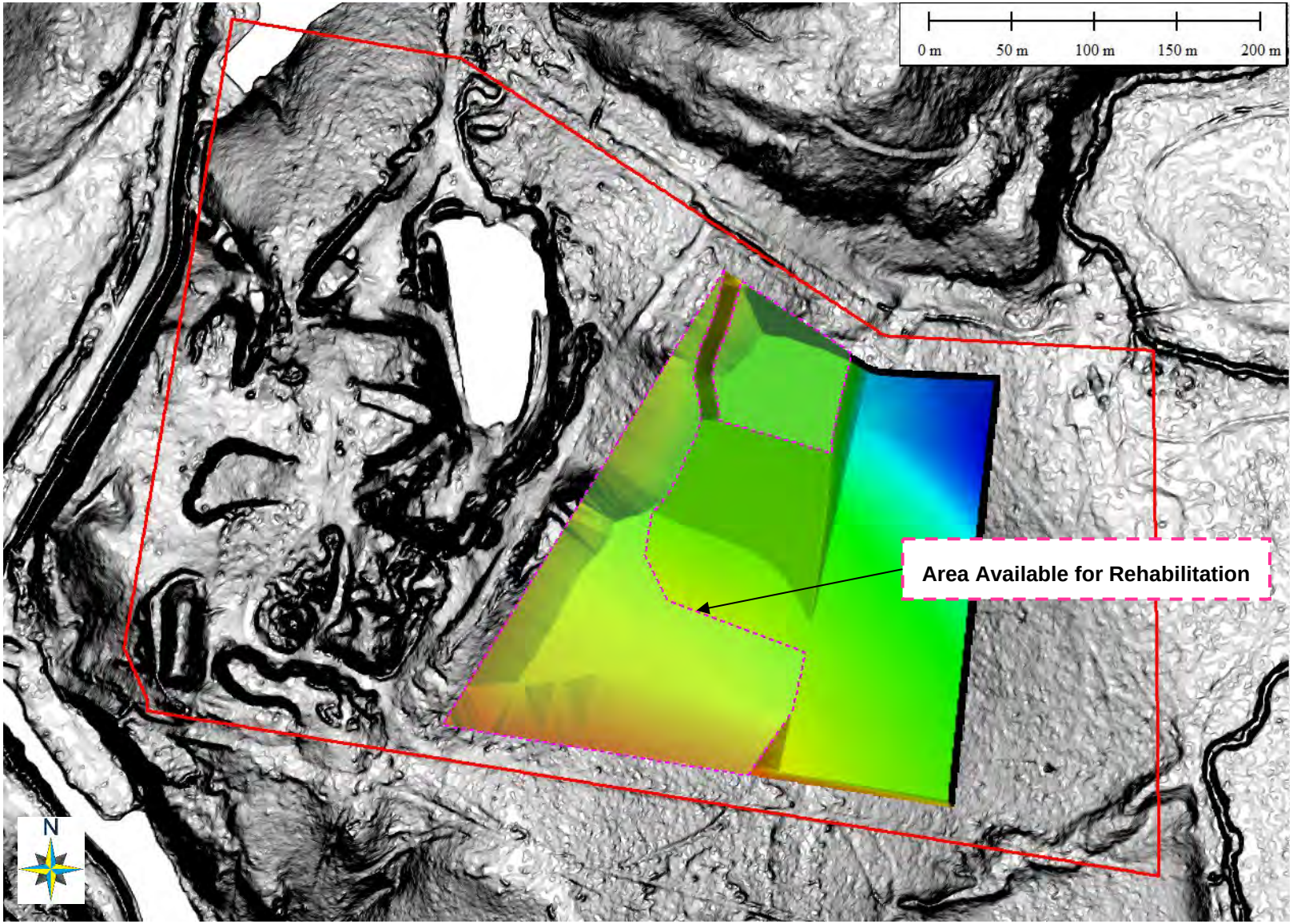


Figure 24 – Progressive Rehabilitation Design – Stage 3 (from Ausrocks 2023)

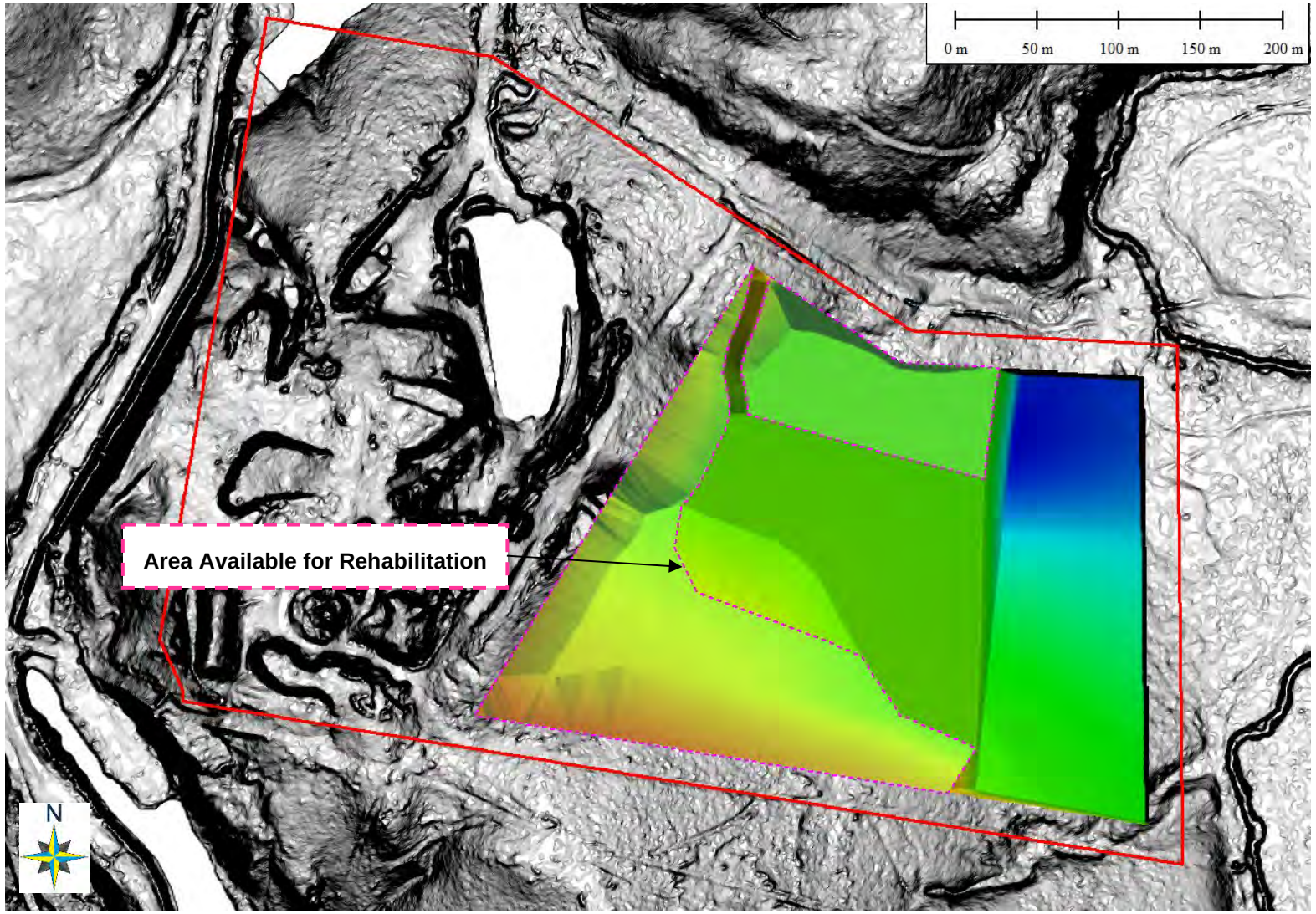


Figure 25 – Progressive Rehabilitation Design – Stage 4 (from Ausrocks, 2023)

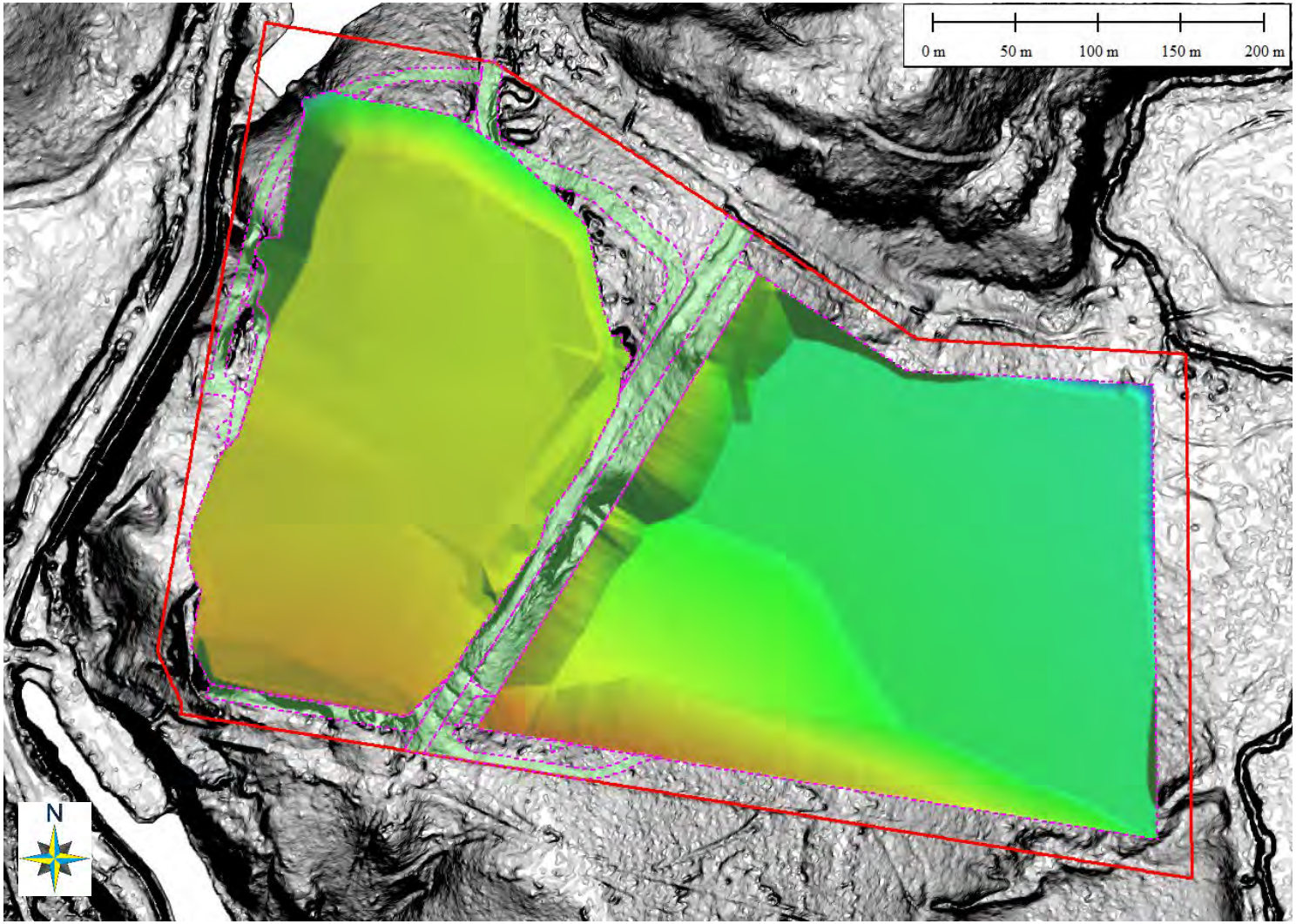
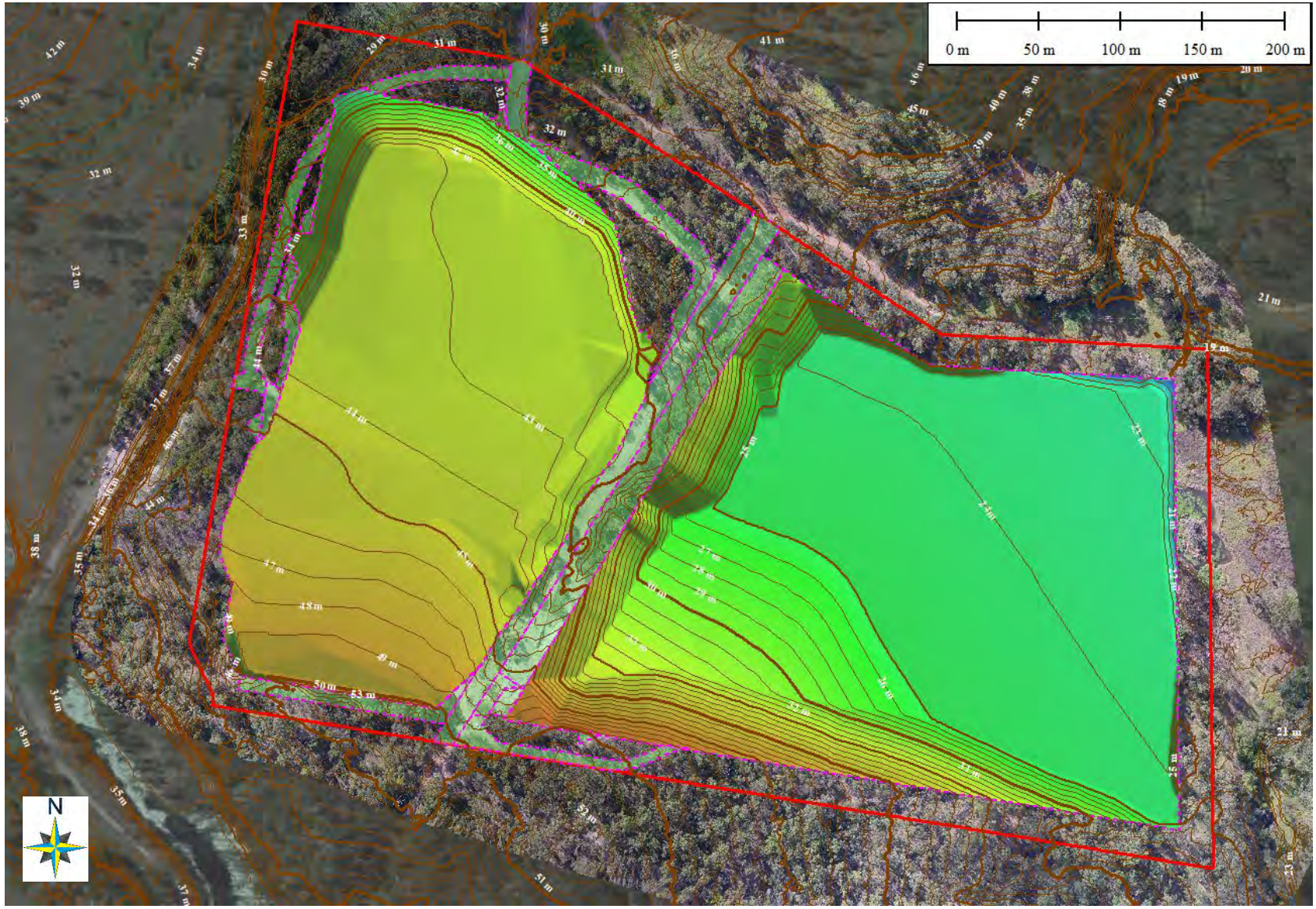


Figure 26 – Final Landform Design – ML50070 (from Ausrocks, 2023)



3.3.2 Rehabilitation Areas and Relevant Activities

For the purpose of this PRCP, Rehabilitation Areas have been defined and shown in Table 14. The mining duration is specified.

Each pit area will be available for rehabilitation once resources have been mined for that stage. It is anticipated that landform development, surface preparation and revegetation will take approximately 2 years from the cessation of mining activity, as described in section 7.2. Revegetation to the extent of achieving a self-sustaining native ecosystem is estimated to be completed within 20 years. The power line infrastructure area (RA5) becomes available for rehabilitation following completion of all earthworks associated with RA4 (and confirmation of a stable landform in the RA4 areas.

Dates in the PRCP schedule have been selected based on the mine plan (Appendix 4).

Table 14 Rehabilitation Areas and Relevant Activities

Rehabilitation Area Name	Pit Name	Relevant Activity	Duration of Relevant Activity (Calendar Year)	Size/extent of Rehabilitation Area (Ha)	Progressive Rehabilitation Possible
RA1	Kerwick #1 Stage 1	Clay mining	2023-2028	1.6454	Yes
RA2	Kerwick #1 Stage 2	Clay mining	2028-2032	1.2619	Yes
RA3	Kerwick #1 Stage 3	Clay mining	2032-2036	0.9877	Yes
RA4	Kerwick #1 Stage 4	Clay mining	2036-2039	13.2306	Yes
	Kerwick #2	Clay Mining / water storage	Life of Mine		No
	n/a	Includes laydown/hardstand area, cleared area, access tracks.	Life of Mine		No
RA5	n/a	Powerline and powerline access track	Life of Mine	0.4963	No

The summary map of the rehabilitation areas in included as Figure 27.

3.3.3 Rehabilitation Undertaken to Date

As required under section 126C(1)(j) of the EP Act, transitional PRCP's must include detail relating to the existing rehabilitation already completed.

No rehabilitation undertaken to date on site has been applied for or approved as progressively certified under the EP Act.

The history of the site is that is has been utilised for mining, stockpiling and re-mining over decades. There are few if any reliable records to help determine the history of many of the landforms. At the time of purchase of the site by Jackal in 2018, there were some backfilled voids, and levelled old voids and a high wall for the Kerwick #2 pit. Most of these areas are now in use as laydown areas, tracks, topsoil and overburden stockpiles, as well as stormwater storage and therefore have not been identified in this PRCP as an existing rehabilitated area (hence no shape file has been provided).

There were three historical overburden stockpiles onsite, which have naturally revegetated and are currently safe, stable and non-polluting. These historical overburden stockpiles are not considered a disturbance onsite that would in its current state require rehabilitation. These revegetated overburden stockpiles will be used during any future progressive landform management rehabilitation activities. If the overburden stockpiles are used in future landform management, these remaining areas will require ripping and amendment, prior to seeding.



LEGEND

RA1 RA4 ML50070
RA2 RA4
RA3 RA5

N

AUSROCKS
CONSULTING MINING ENGINEERS
Ausrocks Pty Ltd
PO Box 359
Virginia BC, QLD 4014
Phone: (07) 3161 4108
www.ausrocks.com.au
ABN: 64 056 939 014

Title: Jackal Renewables ML50070
Figure 27 - Rehabilitation Areas Summary Map

Project No	AUQ00209	Drawing No	00209_RAP
Drawn	CM	Checked	NV
Scale	1:2,500 (A3)	Datum	GDA2020
Date	02/02/2023	Status	Version 1

4 Community Consultation

4.1 Details of Consultation in Developing PRCP

4.1.1 Stakeholder Identification

The application for ML and the accompanying EA (mining approval) was made in 1994 and the site has been operational since that time. A transfer of ownership most recently took place in 2018. Records relating to community consultation in relation to the mining activities and associated rehabilitation requirements are not available.

In 2018, an application was lodged for an MCU and was approved via a negotiated decision notice from Ipswich City Council (ICC) on 4 February 2020 for Development Approval No. 2491/2018/MCU for a Material Change of Use application for Special Industry (Waste recycling and reprocessing – waste transfer station, crushing, milling or grinding). As a part of this process, community consultation was required and the following primary stakeholders were identified:

- Landholder - owner
- DESI
- Ipswich City Council
- Energex
- Adjacent landholders – Cleanaway (North), BMI (West), Boral (south), landowner (East)
- Community groups.

4.1.2 Community Consultation Register

In order to comply with section 126C(1)(c)(iii) of the EP Act, the rehabilitation planning part of this PRCP must include a community consultation register identifying the consultation undertaken in relation to developing the PRCP. This must include:

- Consultation date(s)
- Identification of each community member
- Description of consultation type
- Information provided to the community
- Issues raised and discussed by the community
- How issues have been considered
- Decisions/outcomes of the engagement
- Commitments made.

The Community Consultation Register is shown in the table below.

Table 15 Community Consultation Register

Date	Community Member / Stakeholder	Type	Information Provided	Issues Raised	How issues were considered	Decisions / Outcomes	Commitments
Ongoing	Directly and indirectly affected landholders (neighbors)	Conversations	Discussions on mining operation progress and development of resource recovery centre Identification of concerns	No specific issues or concerns raised relating to rehabilitation or mine closure	Not applicable	Continue engagement with landholders, as required	Continue engagement with landholders, as required
2022	Regulatory Body	Meeting with DESI related to PMLU	Review conditions relating to rehabilitation outcomes in EA0001386. Draft EA amendment Application	Confirmed PMLU native ecosystem	Reviewed legislative framework to decide on actions required	PRCP to document PMLU as native ecosystem	Submit PRCP by due date 6 February 2023
September 2021	Regulatory Body	Meeting with DESI to discuss PRC Planning	Summary of operations and future plans	No specific issues raised	Not applicable	Jackal to prepare and lodge a PRC Plan in accordance with legislative requirements	Submit PRCP by due date 6 February 2023
2018 -2022	Regulatory Bodies	Annual reporting ERC meetings, discussions and applications	Legislated annual reporting requirements ERC calculations and financial assurance requirements	Discussed ERC calculations and transition from financial assurance framework	By discussion	ERC calculations	Jackal Renewables to transition to new ERC framework.

Date	Community Member / Stakeholder	Type	Information Provided	Issues Raised	How issues were considered	Decisions / Outcomes	Commitments
2018-2020	Regulatory Bodies	Ipswich City Council MCU Application	Development Application	No specific issues or concerns raised relating to rehabilitation or mine closure	No specific issues raised	Continue to keep Council informed	Jackal to provide updates to Council
2019	Community Submissions	Ipswich City Council MCU Application	Submission letters from the Community on the MCU application	No specific issues or concerns raised relating to rehabilitation or mine closure	No specific issues raised	No specific decision or outcomes	No specific commitments
2018	Energex	Land and ML purchase	Letter	Power line access to remain clear, power line to be protected from potential mining impact by buffer zone	Mine plan will retain a buffer to the power line and power line access track	Mining Plan amended to protect power line corridor	No specific commitment
27 July 2018	Regulatory Body	Transfer of EA	Transfer Application	No specific issues or concerns raised relating to rehabilitation	No specific issues raised	No specific decision or outcomes	EA0001386 transferred to Jackal Renewables

Date	Community Member / Stakeholder	Type	Information Provided	Issues Raised	How issues were considered	Decisions / Outcomes	Commitments
				or mine closure			

4.2 Rehabilitation Community Consultation Plan

In order to comply with section 126C(1)(c)(iv) of the EP Act, the rehabilitation planning part of this PRCP must include a community consultation plan detailing how ongoing consultation will be carried out in relation to the rehabilitation to be carried out under the PRCP.

The objectives for community consultation, method of community engagement, frequency, information to be released and consideration of feedback and comments are included, as required, and documented in the Community Consultation Plan.

Information will include the final landform design implementation and rate, primarily with the key government stakeholders. Progress toward milestone criteria will be shared. Any issues arising will be managed through a process of: regular communication; feedback and follow-up on issues raised; and close out of issues raised with the stakeholder.

As the Project progresses with the rehabilitation activities for the site, a series of engagement phases will be initiated with the primary stakeholders for the project, as required. The objective of this engagement will be to inform the stakeholders of the near future and long-term activities on the site to gauge their level of interest and to identify any local experience and knowledge relevant to the rehabilitation methodology.

As described in section 2.3, Jackal Renewables is the owner of the free hold land parcel to which this PRCP applies.

Table 16 outlines the consultation program for this PRCP.

Table 16 Community Consultation Plan for PRCP

Objective	Engagement Type	Proposed consultation frequency	Released information
Inform primary stakeholders	Letter to present information on the project and timeframes for activities	On an as required basis	Dependent on contact, but may involve maps and relevant specialist information
Maintain contact with key state government stakeholders (DES and Department of Resources) to maintain understanding of project developments	Regulatory authority information	Annual	Phone call to delegates on project status
Inform wider community of changes to Post Mining Land Use or schedule	Media release News on website	In the event of significant milestones or change to post mine land use	Maps and summary information relevant to the community

Objective	Engagement Type	Proposed consultation frequency	Released information
		that may have interest to the local region.	
Fulfil reporting obligations under PRCP	Statutory reporting	Annual	Compile and present annual report to DES
Ensure Local Government is informed of any proposed changes to Post Mining Land Use or schedule	Phone call and meeting with relevant Planning Department	As required basis	Phone and discussions at meetings, maps
Ensure Local Councillor and State Member of Parliament is informed of any changes proposed to Post Mining Land Use or schedule	Phone call and follow up meeting with relevant Councillor / MP	As required basis	Phone and discussions at meetings, maps

Feedback and comments received from the Community Consultation will be considered in the following way;

1. Feedback will be summarised and key themes identified.
2. Feedback will be reviewed by management and key site personnel.
3. Assessment on how the feedback can be used to improve the relevant outcomes or site management, considering the relevant business needs, approval conditions and legislative requirements.
4. Decision by management on the implementation
5. Response provided to the stakeholder, using appropriate communication channels.

5 Post-Mining Land Use

5.1 Overview

The Post Mining Land Use for ML50070 is outlined in Table 17 the table below, and illustrated in Figure 28.

Table 17 Post Mining Land Use

Post Mining Land Use	Area (Ha)	Comment
Native Ecosystem	17.1257	Rehabilitated Areas
Native Ecosystem	3.8998	Buffer and undisturbed areas
Retained Infrastructure	0.4963	Power line and access track
Total	21.5218	

The vegetated buffer area (20m to the ML boundary) remains in its current vegetated state.

The entire area of ML50070 is proposed in the final site design as planned for surrender.

5.2 Consistency of PMLU and Community Outcomes

The land outcome identified in EA0001386 for the ML50070 area is Native Ecosystem. To address obligations under the *Electricity Act* 1994, a small area (0.4963Ha) will have a PMLU of Retained Infrastructure to ensure the maintenance of the power line and power line access track. Consistent with the process outlined in the PRCP Guideline, Jackal has transitioned the approved PMLU for the site PRCP and PRCP Schedule and is not required to complete the information requirements under section 126C(1)(j) of the EP Act.

Consultation has been undertaken with the relevant stakeholders in the preparation of this PRCP and PRCP Schedule. The approved PMLU of natural ecosystem is consistent with the outcomes of the community consultation undertaken to date as there were no queries or issues raised by adjacent landholders or other members of the local community.

No queries or issues were raised relating to the PMLU of retained infrastructure for the area under the power line easement.

5.3 Consistency of PMLU and Planned Government Land Outcomes

The South East Queensland Regional Plan 2017 identifies the area of the ML as “regional economic cluster”, with “urban footprint” land. The ML has been identified as within “urban footprint” land since the first SEQ Regional Plan was published in 2005.

The current Ipswich City Council (ICC) Planning Scheme, which was prepared after the granting of the ML, identifies the majority of ML 50070 as being located in the ‘Regional Business and Industry Investigation’

zone within the 'Regionally Significant Business Enterprise and Industry Area' (Figure 29). Under the ICC Planning Scheme, the Regional Business and Industry Investigation zone has the overall outcome of providing regional business enterprise and industry employment opportunities subject to resolution of applicable constraints such as potential amenity impacts on nearby residential areas, mining, flooding and availability of services. The remainder of the ML on the eastern side is zoned as 'Recreation and Open Space', as outlined in Figure 29.

The western sector of ML 50070 is being used by the landowner (who is also the ML holder) for industrial purposes under Development Approval 2491_2018_MAMC_B issued by the ICC and EA0001872 issued by DES. The land in the western sector will continue to be used for industrial purposes as well as mining activities until the expiry of the mining lease. The development approval with permit EA0001872 requires the old clay mining void (Kerwick #2 Pit) to be retained as a stormwater control structure for the duration of the activity. In addition, the Kerwick #2 pit will be utilised for stormwater management on the mining lease, water balance management for active mining areas, and stockpiling of overburden and/or topsoil during ongoing mining activities.

The PMLU of native ecosystem is not consistent with the Local Government Town Plan, or the State Government Regional Plan. However, to change the PMLU outcome requires an EA amendment. Consultation with the DES on this amendment indicated that this would be a major amendment. There was not enough time to complete a major amendment process before the PRC Plan was required to be lodged.

A small area (0.4963 Ha) traversing the power line easement is allocated a PMLU of Retained Infrastructure. In accordance with the *Electricity Act 1994*, there is an entitlement to unrestricted access to an electricity entity's works (s98) and it is an offence to interfere with an electricity entity's works (s230). Therefore there is a legal requirement to ensure that the area under the power line remains clear, hence the PMLU of Retained Infrastructure is consistent with the legislation.



LEGEND

- PMLU Native Ecosystem
- PMLU Native Ecosystem (undisturbed)
- PMLU Retained Infrastructure

N

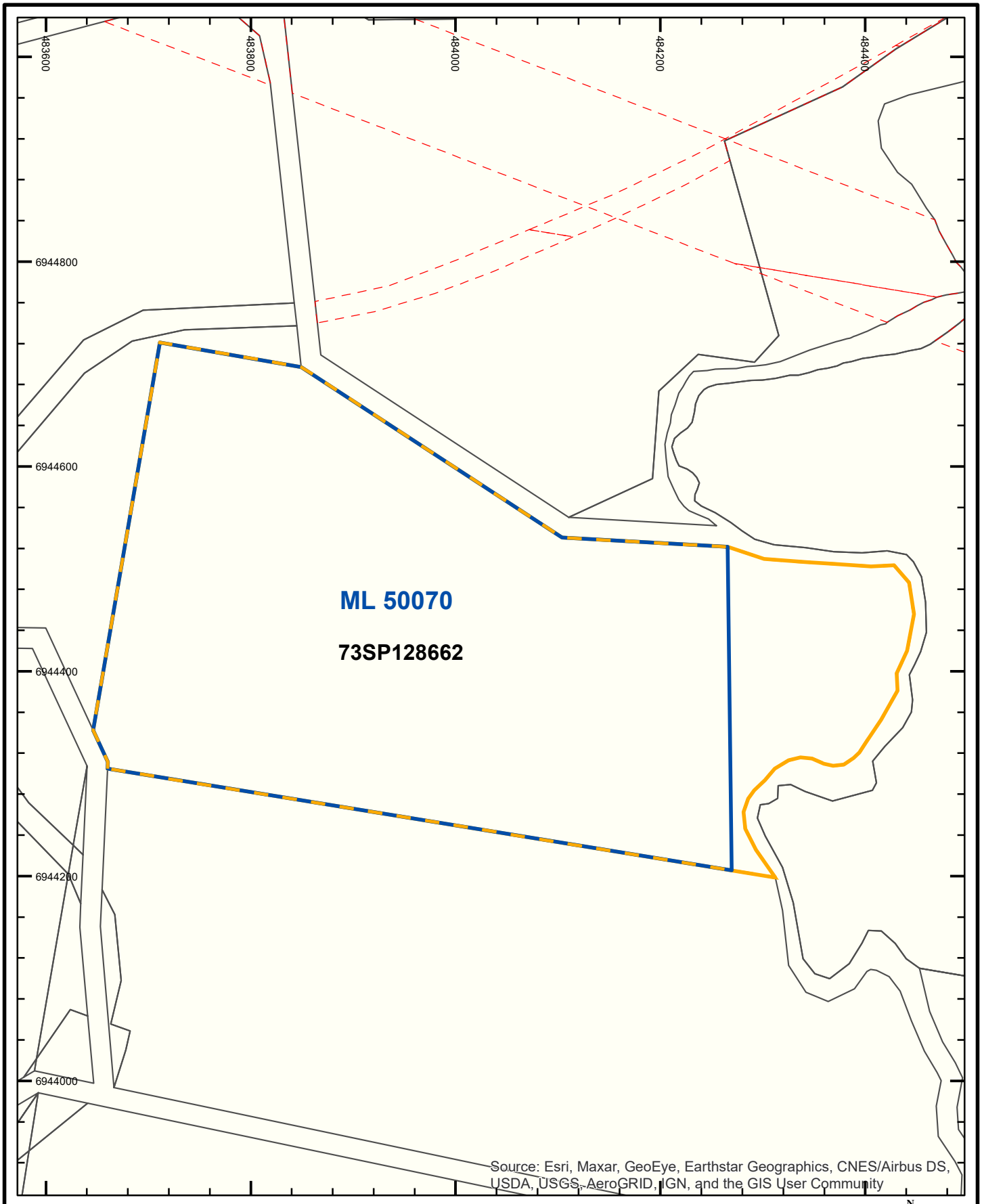
AUSROCKS
CONSULTING MINING ENGINEERS

Ausrocks Pty Ltd
PO Box 359
Virginia BC, QLD 4014

Phone: (07) 3161 4108
www.ausrocks.com.au
ABN: 64 056 939 014

Title: Jackal Renewables ML50070
Figure 28 - Post-Mining Land Use Plan

Project No	AUQ00209	Drawing No	00209_PMLUP
Drawn	CM	Checked	NV
Scale	1:2,500 (A3)	Datum	GDA2020
Date	02/02/2023	Status	Version 1



JACKAL RENEWABLES PTY LTD

Lot 73 on SP 128662

GDA94, MGA Zone 56

[redacted]

Ipswich City Council Planning Scheme Zoning

Legend

- ML 50070
- 73 SP128662
- Property boundary
- Easement

ICC Planning Scheme (at 2020)

- Regional Business and Industry Investigation (RBIA2)
- Recreation and Open Space (REC)
- Special Uses (SU15)

Figure 29

Sheet No.

RTPL_ARD_STW001_MAP_1002_A

Drawn By: Chris Schlebusch

Requested by: Jacob Arnold

Date: 20/10/2021

Data sources:
©Queensland Department of Resources
©Ipswich City Council

Path: S:\Plans\Project_Specific\Ardent\STW001\RTPL_ARD_STW001_MAP_1002_A ML50070 and Ipswich Planning Scheme.mxd

6 Non-Use Management Areas

A non-use management area (NUMA) is an area of land that cannot be rehabilitated to a stable condition after all the relevant activities for the PRCP carried out on the land have ended (s112 EP Act).

There are no non-use management areas proposed as it is planned for the entire area to be rehabilitated to a stable condition once the relevant activities carried out on the land have ended.

7 Rehabilitation Management Methodology

7.1 Rehabilitation Objectives

The EP Act requires that mine rehabilitation by conducted for land disturbed by mining activities to ensure that:

- The land is safe and structurally stable;
- There is no environmental harm being caused by anything on or in the land; and
- The land can sustain a post-mining land use.

7.2 Rehabilitation Milestones and Criteria

The following milestones (Table 18) are applicable to any of the disturbance areas and are numbered in sequence of application and expected achievement. Milestones are to be:

- Outcome based
- Flexible to changing circumstances
- Include metrics
- Be reviewed
- Measurement to demonstrate achievement of milestone.

In the absence of suitable analogue sites being identified, a pre-disturbance baseline assessment of the vegetation will be undertaken to establish key metrics / milestone criteria for demonstrating achievement of the relevant milestone. This pre-disturbance baseline assessment will be completed before 1 December 2024.

Table 18 Rehabilitation Milestones and Criteria

Milestone Reference	Applicable Rehabilitation Area	Rehabilitation Milestone	Milestone Criteria
RM1 Infrastructure Removal	RA1, RA2, RA3, RA4	No mine infrastructure equipment or materials not required for PMLU.	1. All buildings demolished and removed 2. All concrete, bitumen and gravel removed, where not required 3. All non-required fencing removed 4. All machinery and equipment removed 5. All non-required surface water drainage infrastructure removed 6. All waste removed
RM2 Remediation of Contaminated Land	RA4, RA5	Remediation of contaminated land	1. A preliminary contaminated land investigation is undertaken, and a report is prepared by an Appropriately Qualified Person (AQP)1. 2. All hazardous and contaminated materials have been assessed and identified by an AQP, and disposed of lawfully

			3. A contaminated land investigation document has been prepared by an AQP containing a site suitability statement confirming that land is not contaminated and is suitable for the proposed PMLU.
RM3 Landform development and reshaping / reprofiling	RA1, RA2, RA3, RA4	Landform development and reshaping / reprofiling	1. Batter slopes achieve approx. 1 in 3 slope angle for final landform design 2. Floor of pits achieve design slope 3. All major earthworks completed
RM4 Land Surface Preparation	RA1, RA2, RA3, RA4	Appropriate landform surface preparation including contour ripping, topdressing, application of ameliorants (where required).	1. Water stored in Kerwick #2 pit will be tested and confirmed suitable for use in rehabilitation. If not suitable, treatment to rectify issues completed prior to use. 2. Earthworks completed 3. Adequate topsoil material spread over shaped surfaces (~15cm depth) 4. Ameliorants applied where required to address soil quality 5. Ripping and discing completed
RM5 Revegetation	RA1, RA2, RA3, RA4,	Revegetation including seeding and planting, as required. Seed germination and establishment of groundcover.	1. Completed seeding of target species using a combination of tree, shrub, and ground cover species as per rates specified in section 3.4.4. for RE 12.9-10.2 2 (a). Germination success 70% germination of groundcover species (seed) and 70% planted specimens (tubestock) have survived 2 (b). Weeds are at a maximum of 10% of vegetation cover
RM6 **Stable** Landform	RA1, RA2, RA3, RA4	As per final design for landform slope Geotechnical assessment completed by appropriately qualified person assessing safety of final landform Drainage design determined by appropriately qualified person	1. 90% of the landform achieves slope gradients of 30% or less and 80% of the final landform achieves slope gradients of 20% or less 2. Stable final landform that has been geotechnically assessed by an AQP as stable with FoS ≥1.5 3. Drainage meets design criteria
RM7 **Achievement of Surface Requirements (Native Ecosystem)**	RA1, RA2, RA3, RA4	Vegetation cover determined via rehabilitation monitoring and maintenance program Erosion classification based on results of rehabilitation	1. Monitoring of rehabilitation showing successful revegetation in line with targets: (a). 80% of the area achieves species density and diversity that is greater than 60% of the reference sites (b). New recruits are occurring from 60% of the understorey species (shrub and ground cover).

		monitoring and maintenance program	(c). A minimum of five target canopy species present (as per RE 12.9-10.2 species list): Minimum of 4 m height for any NJKHT species. (d). Weed presence is at a maximum of 10 % of total vegetation cover (e). No new invasive plants and infestation density of invasive plants in the area are contained or reduced and consistent with reference sites (f). Evidence of fauna habitat features for invertebrate and vertebrate species (e.g. logs, rock piles, nest boxes, bird nests or perches) 2. Landform shows suitable slope gradients as defined in RM6 3. No erosion classification of Severe or Extreme 4. Surface water quality monitored monthly during flow at, but not limited to, downstream locations specified in Table 1 must not exceed the limits in Table 2, for a minimum of 2 consecutive years. 5. If the surface water quality exceeds criteria 4 above, the applicable reference site result must be compared to the downstream site result; and quality measured at a downstream site must be equal to or less than the quality measured at the applicable reference site.
RM8 **Achieved** PMLU (Native Ecosystem)	RA1, RA2, RA3, RA4	Vegetation cover and species diversity determined via rehabilitation monitoring and maintenance program Erosion classification based on results of rehabilitation monitoring and maintenance program	1. Monitoring of rehabilitation showing successful revegetation in line with targets: (a). An average of >250 stems / ha dominant tree canopy, of which at least 100 are eucalypt species (NJKHT) (b). NJKHT to have a minimum DBH of 10 cm (c). The measurable presence of a minimum 15 target vegetation species representative of RE 12.9-10.2 within the BioCondition transect comprising: >3 species of grasses (native, not introduced pasture grasses) and forbs >7 mid-storey (shrub) species ≥5 canopy species, including - *Corymbia citriodora* - *Eucalyptus crebra* - *Eucalyptus tereticornis* - *Eucalyptus moluccana* - *Corymbia intermedia* (d). Canopy cover species to be self-sustaining (bearing viable seed, as evidenced by recruitment occurring over at least 60 % of the revegetation area) and with a minimum of 40 %

			dominant canopy vegetation (with a minimum of 2 NJKHT species) (e). Weeds are at a maximum of 10% of vegetation cover. No new invasive plants and infestation density of invasive plants in the area are contained or reduced and consistent with reference sites (f). 80% of the area has a vegetative groundcover of >70% for areas of low rock and logs, and >50% for areas of high rock and log content (g). Native bushland established that provides habitat opportunities for native invertebrate and vertebrate including: - Evidence of key invertebrate groups (e.g. ants, beetles and spiders) and soil faunal communities - Evidence of key native vertebrate groups (e.g. bird, mammal, reptile and amphibian) in the form of fauna spotting, spotlighting, scats and tracks 2. No erosion classification of Severe or Extreme
RM9 **Achieved** PMLU Retained Infrastructure	RA5	Absence of mine equipment and materials not required. Absence of contaminating materials. Erosion classification based on results of rehabilitation monitoring and maintenance program. Stable landform development. Hazard and Safety Assessment by an appropriately qualified person.	1. Final landform survey confirms no structures or equipment remain other than those documented in a landholder agreement, or specified by the *Electricity Act 1994*. 2. All contaminants removed or remediated. 3. No erosion classification of Severe or Extreme. 4. Landform shows suitable slope gradients e.g. <20% except to connect with surrounding natural topography. 5. Hazard and Safety Assessment completed by an appropriately qualified person demonstrating hazards in rehabilitation areas are consistent with the nature and severity of hazards typical of neighboring equivalent land use. Identified residual hazards are low risk with no significant increase in risk expected over time. 6. Agreement with Energex regarding maintenance of power line easement

8 General Rehabilitation Practices

8.1 Hydrogeology

There are no groundwater monitoring bores on site. The Hydrogeological Assessment has concluded that the shallowest groundwater intersection in the Raceview Formation (adjacent to the subject site) is at a depth of approximately -6m AHD.

This is supported by the observation that the exploration drillholes drilled to the base of the proposed pit throughout the clay deposit in the eastern area of the mining lease did not detect or intersect groundwater.
Since no groundwater was detected in exploration bores and the current mine plan will not exceed the depth of the exploration drillholes, mining is likely to be above groundwater level and the mineral extraction is not likely to interfere with groundwater on the subject site.
Therefore, no impacts on groundwater by the proposed mining activity are currently predicted. For this reason, no groundwater monitoring is recommended by this PRC Plan.

8.2 Flooding

Flood plain modelling is not required as there are no voids located within a flood plain being rehabilitated.

As shown in Figure 11 the flood risk profile is low.

Rehabilitated areas will be re-contoured to achieve a safe and stable landform. Permanent surface water diversions will be incorporated into the final landform to ensure that surface waters are directed into the surrounding drainage lines. The stockpiled overburden may be re-used to assist in achieving the final landform.

8.3 Soil and Capping Material Assessment

The material to be mined is oxidised benign clay and clay-shale. The overburden rock is oxidised and benign sandstone. For this reason, there are no contamination, acid or neutral mine drainage concerns and therefore a specific capping material assessment is not required.

During the development of extraction areas in areas that have been undisturbed, all topsoil/subsoil will be selectively lifted and stored for later use in the rehabilitation stage of the project. These materials will be located such that they are readily accessible for rehabilitation works.

When mining is complete, extraction areas will be profiled to the final desired landform specifications to ensure that is safe and stable. Progressive rehabilitation of extraction areas will be a priority, as and when they become available. Subsoil and topsoil will be replaced on the profiled landform in the reverse order to which it was stripped; that is the subsoil is placed on top of any returned overburden and the topsoil on top of the subsoil at an appropriate thickness.

Before the topsoil is spread, the profiled landform will be scarified parallel to the contour to a nominal depth of 50 to 100mm to break up any hard setting surfaces and prevent lamination of the topsoil and profiled landform.

Where required, contour banks will be progressively installed to minimise rill erosion and direct water off the profiled landform to either a stabile surface or dedicated stabilised drainage paths or flumes constructed on the final landform. The heights and depths of these contour banks will be determined through ongoing landform design. At the finalisation of this process a pre-vegetation landform will have been constructed. Finalised landforms will be sown with a cover crop and grass species to provide erosion protection before the native species become established.

8.4 Soil Management

8.4.1 Topsoil

Topsoils are thinly developed over the sandstones and interbedded siltstones of the Bundamba Sandstone which underlies the western portion of the site. Topsoils thickness is illustrated in Figure 13, and is approximately 10cm thick over the majority of the Kerwick #1 Pit area, with thickness reaching 15cm in narrow gullies, and 20cm on the flatter areas closer to Six Mile Creek. Prior to stripping, all vegetation would be progressively cleared to the minimum extent required for the impending future works. Supervisors and earthmoving plant operators will be trained to visually identify the topsoil layers to ensure that stripping operations are conducted in accordance with stripping plans and in situ soil conditions. Care will be taken to ensure soil moisture conditions are appropriate for stripping and stockpiling.

Topsoil will be stripped to a depth that correlates with the mapped thickness of topsoil (between 100mm and 200mm, depending on location). Ideally soil will not be stockpiled but will be lifted, transported and spread on a re-contoured area in one operation. There is limited requirement for the stockpiling of overburden during the project however if weather conditions or rehabilitation timing do not allow for direct transfer, topsoil may be temporarily stockpiled. Topsoil stockpiles will be vegetated and stabilised. These will be formed in low mounds with a height up to 2.5 metres. These stockpiles may be temporarily located within active pit areas.

An inventory of available soils will be maintained to ensure adequate materials are available for planned rehabilitation activities. The current estimated volume of stockpiled topsoil on site within and adjacent extraction areas is 4,500m^3, this volume will increase as new areas are pre-stripped before mining.

8.4.2 Sub-soil

Material that has been stockpiled for reuse will be protected from excessive disturbance or traffic and stockpiled away from any drainage lines. Drainage will be constructed to manage or divert surface water flows around stockpiles and maintained to ensure proper functioning.

In the event that long-term stockpiles are required (present for greater than six months) they will be deep ripped and provided with a vegetative cover to maintain the soil heath, maintain biological activity and minimise erosion potential. Stockpiled material will be constructed with batters or gradients of 1:4 wherever possible. Appropriate sediment controls will be installed to prevent soil loss; and weeds and pests will be monitored and controlled as required. These stockpiles may be temporarily located within active pit areas.

8.4.3 Backfill Materials

As outlined in section 2.7 there will be 408,537m^3 available in situ topsoil, sub-soil and competent rock on the site to address the rehabilitation requirements. A materials balance for the site is provided in Table 19, which shows that, after assuming a swell factor of ~15% for material excavated from the site, there is a shortfall of approximately ~171,913m^3 for the total volume required for rehabilitation.

It is expected that no material will be imported on to site to complete the rehabilitation of the Kerwick Pit #1 to the east of the power line. Due to the small size of the site, minimal haul distances apply.

The rehabilitated landform in Kerwick #1 is intended to be a flat area, self-draining, with a batter on the western side, meeting the natural landform on the eastern side of the pit. This means that the fill volumes required for rehabilitation are less than the volume excavated from the pit.

Achievement of the final landform in Kerwick #2 pit will likely require the import of suitable backfill materials. The subsurface pit fill works will be managed as a single campaign due to the requirement for dewatering the pit and the increased depth of fill required. These works will be subcontracted to a civil construction company to ensure appropriate controls are in place for the duration of the works. Fill for this area will be sourced from clean, earthen sources in the local area. It is noted that several land development projects are active in the region and the availability of quality fill materials in the required quantity is considered highly likely. A quality control process will be established to ensure the process complies with the following requirements:

- Source material:
  - Is free from contaminants and not sourced from any site listed on the EMR/CLR
  - Is inspected by the Site Supervisor prior to placement
  - Plasticity Index (PI) <50%
  - Similar composition to the virgin ground conditions of the fill location (grading, material type)
  - Non-acid forming
- General earthworks to be carried out in accordance with AS3798.
- Earthworks to be carried out in the dry season with upslope diversions in place.
- Maximum thickness of uncompacted layer to be ≥2x maximum rock size.
- Mechanical compaction methods such as a Padfoot drum roller to be used.
- The compaction of material below natural ground, within the Kerwicks #2 Pit will be verified through compaction testing to AS1289.5.4.1.
- Fill Material shall have a minimum four-day soaked CBR of 3% when tested at 97% standard compaction and optimum moisture.
- Final surface to be free draining (no ponding of water)

Table 19 Rehabilitation Material Balance

Rehabilitation Stages	Rehabilitation Area (RA)	Surface Area (m^2)	Rehabilitation Cut (m^3)	Rehabilitation Fill (m^3)	Rehabilitation Total (m^3)	Topsoil Volume (m^3)
Stage 1	RA1	16,454	0	79,385	79,385	2,468
Stage 2	RA2	12,619	0	67,177	67,177	1,893
Stage 3	RA3	9,877	0	117,987	117,987	1,482
Stage 4 (Kerwick Pit #1)	RA4	51,435	0	165,414	165,414	7,715
Stage 4 (Laydown/hardstand area, cleared area & access tracks)		80,871	36,070	267,977	231,907	12,131
Powerline	RA5	4,963	-	-	-	-
	Total	**176,219**	**36,070**	**697,940**	**661,870**	**25,688**

Soil testing of stockpiled grown media on site has occurred that shows available material requires amendment with fertiliser to improve nutrient levels. Low phosphorus content also poses less of an issue for native species, as they are generally not tolerant of high phosphorus levels. The pH results of the soil samples were 5.0 – 5.6, which is in the correct range for native plant growth. Low calcium levels may be amended by the addition of gypsum, so as not to increase the soil pH. Additionally, low organic matter content may be amended by top dressing with biosolids.

Soil testing of in-situ topsoil have revealed similar results to the stockpiled topsoil resources. That is, that amendment with fertiliser and gypsum will likely improve the rehabilitation outcomes

As the soil will be used from the site, there will be no concerns relating to supporting the vegetation ecosystem to support for PMLU.

8.5 Contaminated Land Remediation

No hazardous contaminant use is associated with the mining activities as no mineral processing occurs onsite. Potential sources of land contamination are anticipated to be limited to minor volumes of hydrocarbon and chemical handling/storage. Prior to site closure, a preliminary contaminated land assessment will be conducted by an appropriately qualified person. This assessment is to be undertaken and managed in accordance with the following, as required:

- National Environment Protection (Assessment of Site Contamination) Measure 1999 (amended 2013)
- AS 4482.1-2005 - Guide to the sampling and investigation of potentially contaminated soil. Part 1 – Non-volatile and Semi-volatile compounds (Standards Australia 2005a).
- AS 4482.2-2005 - Guide to the sampling and investigation of potentially contaminated soil. Part 2 – Volatile Compounds (Standards Australia 2005b).

Should the assessment identify sources and/or areas of contamination onsite, these are to be remediated in accordance with the AQP's recommendations and materials disposed of lawfully, as required. The site is to be validated to ensure the site is suitable for the future use as demonstrated by a site suitability statement prepared by an AQP.

8.6 Waste Characterisation

There are no waste rock dumps or leach pads on site. The overburden rock is predominantly weathered and oxidised sandstone.

There are no tailings on site as all excavated material is sold "as is" and overburden materials are re-used in rehabilitation.

Therefore, no specific waste characterisation is required to guide the preparation of this PRCP.

8.7 Landform Design

The following factors were considered when determining the appropriate design parameters for the mine:

- Geological factors and geotechnical stability of the materials (topsoil, sandstone, shale, clay, mudstone and gravel).
- Groundwater runoff (assuming water table is below the pit floor).
- Site specific boundaries (property and mining lease boundaries) and buffers (power line).
- Final land use.

The Mine Plan in Appendix 4 contains specific details on the landform design and 3D models.

In summary, the landform design has been created within the following design parameters:

- Road width 10m based on two road truck width with standard including provision for drainage and bunding.
- Road gradient 1 in 10 which is suitable for road trucks.
- Power line track 25m width.
- Bench height less than 12m as risk assessment is required if the height is greater. Forward planning restricts bench height to this level.
- Batter angle for benches is 70 degrees which is consistent with similar operations. This is a low geotechnical risk.
- Final landform batter angle is 1 in 3 which is a geotechnically stable final landform.
- The pit floor is backfilled to RL25 to achieve a free draining final landform.
- Floor slope is 2% so that the pit floor is backfilled with a gentle slope towards the north to achieve a free draining final landform.
- The buffer to the ML boundary of at least 20m is maintained.

The 3-D model of the mine plan is included within Appendix 4.

The total depth of backfill will be up to 12m against the pit walls, reducing to several metres at the base of the pit at a 1 in 3 slope. During the initial stages of rehabilitation, a trial will be conducted to assess the rate of subsidence observed on the slope by comparing drone survey data from placement to completion. Using the findings from this trial the future slopes will be overfilled by the approximated level of subsidence to offset any long-term landform slope changes.

The design assumption of 1V in 3H for geotechnical stability has been selected by assessing the local landscape in the immediate vicinity of the site for natural and man-made landscapes. The region contains significant coal mining disturbances which date back over 100 years, with spoil piles providing an example of landform stability. Whilst waste dumps have been observed to the north of site with slopes up to 45%, this is considered to pose a significant risk to the longevity of the final landform. East of the site there are slopes with mature remnant vegetation up to 40% over elevation rises of 10m.

These slopes are examples of the possibilities, however the conservative 1V:3H slope (33%) has been selected for the site which is considered to be an industry average for similar landforms. Provided there are appropriate controls for the placement of fill material or controls over excavation conditions a 1 in 3 slope over 10-15m vertical distance is considered low risk to the overall landform stability. A geotechnical assessment will be conducted by an AQP to ensure that the batters are stable with a Factor of Safety of at least 1.5.

The final landform design is consistent with similar locations within the region for either mine, quarry or civil development and therefore trials are not considered necessary at this stage to verify the predicted success of the proposed landform.

8.8 Cover design

No specific cover design is required over the rehabilitated area, as the materials to be used to create the post mining landform are benign weathered oxidised sandstones and clay-shales from the overburden.

The rehabilitated areas will be covered by a topsoil cover of minimum 150mm thickness on slopes and batters. This topsoil will be sourced from existing stockpiles, pre-stripped topsoil in advance of mining, and in the event of a shortfall, purchased from nearby suppliers. The objective of the cover system is to provide a growth media for the re-establishment of vegetation over the rehabilitated area.

Prior to soil movement, any stockpiles that have evidence of any weed growth will be treated prior to the use in rehabilitation. Movement and handling from stockpiles to be conducted to minimise structural degradation such as compaction. The cover will be constructed by end dumping topsoil over the area to be covered, spreading by grader to the nominated minimum thickness.

The soil will be ripped if compacted, otherwise will have the surface roughened and then seeded. Contour ripping may be conducted on sloped areas to encourage soil keying, water infiltration and minimise runoff.

Mulch, jute netting or other temporary soil covers may be used in selected areas during the revegetation program to reduce the risk of heavy rain eroding the seed bed soil. In addition, slope drainage control features may be used to minimize erosion, together with catch dams to collect runoff and remove suspended solids.

Where rehabilitation trials or chemical and physical tests suggest surface media has undesirable properties for plant growth, soil ameliorants may be used (e.g. gypsum, for sodicity). Fertiliser may also be used.

Logs and rocks retained for fauna habitat will be moved into rehabilitated areas at the final stage of surface preparation.

Specific QA/QC requirements will be documented at the appropriate time by and RPEQ. These requirements may include (but not be limited to); testing of soils to confirm chemical and physical specification is met (where not met, the use of soil ameliorants will be incorporated), confirmation of thickness of soil cover and confirmation of slope angles.

Vegetation which has been stockpiled as a result of clearing activities will be mulched on site and this will also be incorporated into the rehabilitation activities.

8.9 Water Management

8.9.1 Overview

The transport of sediment has the potential to impact the environmental values of both waters and land and is dependent on the scale and location of the activity, its proximity to sensitive receiving environments and the site ESC response.

Erosion and sediment transport risk exists throughout the lifecycle of mining activities, including earthworks and reducing through operational project phases to decommissioning; as disturbances are increasingly stabilised and progressively rehabilitated. Accordingly, erosion and sediment control measures differ during different phases of the project and are dependent on generally consistent seasonal patterns. Ground disturbing activities beyond mining should be planned to occur during the dry season to limit the potential for erosion and sedimentation.

Due to the nature of operation, there is no seepage and infiltration intervention requirements. Dewatering requirements are not expected.

8.9.2 Drainage Control

There is a range of potential drainage controls that will be used in site-specific mitigation methods depending on site-specific characteristics. These potential drainage controls include the following:

- diversion of up-slope stormwater runoff around disturbed areas including stockpiles and waste storage areas;
- installation of lateral catch drains or flow diversion banks to minimise rill erosion along steep continuous slopes (i.e. >10%) especially associated with linear infrastructure construction (i.e. roads, tracks and power lines);
- placement of velocity control structures such as rock check dams to reduce the flow velocity in channels; and/or
- lining of channel with scour resistant materials including erosion control matting or rock lining; and use of energy dissipation structures at the outlets of banks, drains and chutes.

8.9.3 Erosion and Sediment Control

The following are a range of potential erosion and sediment controls that will be used in site-specific erosion and sediment control plans depending on site- specific characteristics. These potential erosion and sediment controls include the following:

- Prioritising drainage and erosion control measures, rather than allowing erosion to occur and trying to trap the resulting sediment;
- Spreading mulch or retained native vegetation over disturbed areas as soon as practicable after construction to reduce splash impact erosion and to stabilise disturbed landforms;
- Use of erosion blankets (i.e. jute and coir matting or geosynthetics) as an alternative to mulching in drainage channels or areas of strong winds or overland flow;
- Use of sediment traps (i.e. sheet flow and field inlet sediment traps) and sediment basins;
- Amelioration of problem soils (i.e. gypsum treatment of sodic soils);
- Use of ‘ripping’ or similar techniques on finished soil surfaces to encourage revegetation where required;
- Use of binding polymers; and/or
- Programming and scheduling of works to suit climatic conditions.

8.9.4 Erosion and Sediment Control Plans

Erosion and sediment control plans must be implemented and are to consider potential for environmental impacts within the documents. These should include:

- Quality and quantity of water stored in pit and sediment controls;
- Management of rainwater from cleared areas;
- Installation of permanent drainage structures including diversion drains, culverts and flow control e.g. rock checks;
- Propagation of native matting grasses and vegetation on batters and in drains, if required;
- Stabilisation of batters.

8.9.5 Rehabilitation Erosion and Sediment Controls

Achieving and maintaining groundcover is key to reducing erosion. Progressive stabilisation and rehabilitation of disturbed areas will be undertaken to reduce erosion and sediment risk. Stabilisation / rehabilitation will be undertaken to achieve the rehabilitation objectives of the approved Progressive Rehabilitation and Closure Plan.

Typical post-mine use rehabilitation strategies aimed at long term ESC include:

- Backfilling of open pit excavations;
- Reprofiling disturbed areas to be consistent with pre-mining topography;
- Reshaping disturbed areas into stable landforms;
- Permanent stabilisation of any remaining batters/roads;
- Revegetation of disturbed areas with indigenous plant species contiguous with the surrounding landscape;
- Reinstatement of stockpiled topsoil;
- Installation of permanent infrastructure e.g. rock checks, whoa boys and drainage to slow water flow rates without requiring ongoing maintenance or inspection.

8.9.6 Water Management Infrastructure

Currently Kerwick #2 pit provides enough water storage capacity for operation requirements and can accommodate all the stormwater from existing mined areas in the case of a storm event (as demonstrated by not overflowing despite record rainfalls received in February 2022). As the Kerwick #1 pit is opened up, a suitably sized sediment pond (or ponds) will be incorporated in the design to detain stormwater from mining areas.

8.9.7 Water Quality Monitoring

All erosion and sediment controls will be maintained in a functioning condition until individual areas have been certified as rehabilitated. Where controls are observed to be not functioning correctly, the controls are restored to meet the required standard.

Sediment control structures, e.g. sediment basins, rock check dams, sediment fences, drainage controls etc will be inspected for capacity and structural integrity on a monthly basis and/or following rainfall events ≥ 20 mm/day.

These inspections shall be documented on a site inspection form and photographed for evidence of condition. Water from sediment control structures may be tested for pH, EC and total suspended solids

(TSS), assess the effectiveness of the sediment control structures. Results from water monitoring will be compared with the Water Quality Objectives (WQO's) for Six Mile Creek, as outlined in Table 21.

Actions shall be raised from each inspection should maintenance or repair be required, with the action assigned formally to an appropriate person in the management structure and an appropriate and realistic timeframe assigned for rectification of the erosion and sediment control measure.

Surface water monitoring will be conducted quarterly during flow release from the mining area, at a location downstream of the site and results will be compared with the WQO's for Six Mile Creek, as outlined in Table 21. This monitoring will continue for a minimum of two consecutive years following the completion of landform development, in line with rehabilitation milestone 7. If the surface water quality exceeds the WQO's, an upstream (background) reference site result must be compared to the downstream site result; and quality measured at a downstream site must be equal to or less than the quality measured at the applicable reference site.

Table 20 Surface Water Monitoring Locations

Monitoring Locations	Description	Latitude / Northing	Longitude / Easting	Monitoring Frequency
SW1	Upstream of ML50070	-27.626129° 6,944,202	152.840918° 484,305	Quarterly during flow
SW3	Downstream of ML50070	-27.623285° 6,944,517	152.840801° 484,293	Quarterly during flow

Table 21 Water Quality Objectives – Six Mile Creek (Lowland, Moderately Disturbed)

Parameter	Unit	Low Flow[1]	High Flow[2]
pH	***pH. units***	6.5 – 8.0	6.5 – 8.0
EC	***uS/cm***	380	290
Turbidity	***NTU***	11	14
TSS	***mg/L***	7.0	8.0
Dissolved Oxygen	***% saturation***	85 - 110	85 - 110
Ammonia	***ug/L***	15	11
Oxidised Nitrogen	***ug/L***	25	45
Total Nitrogen	***ug/L***	650	310
Filterable Reactive Phosphorus	***ug/L***	6.0	30
Total Phosphorus	***ug/L***	65	60
Chlorophyll-a	***ug/L***	3.0	5.0

Source: Environmental Protection (Water and Wetland Biodiversity) Policy 2019: Sandy, Six Mile, Wolston, Woogaroo, and Goodna Creeks Environmental Values and Water Quality Objectives, DES 2022

[1]No gauges occur within the schedule area, 143113A is the nearest gauge to represent flow conditions. <0.14m3/s (cumecs) gauge 143113A

[2]No gauges occur within the schedule area, 143113A is the nearest gauge to represent flow conditions ≥0.14m3 /s (cumecs) gauge 143113A

As outlined in section 8.1 above, no groundwater monitoring has been included in this PRC Plan as the conclusion of the Hydrogeological Assessment was that the clay-shale mining pit will not intersect the aquifer within the Raceview Formation.

8.10Revegetation Method

A revegetation plan has been prepared for the project (BAAM, 2024) and is provided in Appendix 3. A summary of this plan is outlined in Table 23 below. For this revegetation plan, the restoration of natural ecosystems is the goal of rehabilitation in the assigned PMLU of 'native ecosystem'. The species composition and relative abundances have been selected based on the pre-clear mapping of RE 12.9-10.2, which is the most prevalent RE both in single stand remnant and in percentage of the mixed polygons identified on and in the immediate area around the site. Due to the nature of mining operations, it is considered that the revegetation works be structured towards achieving a natural condition, in line with that present in the local area, rather than attempting to achieve benchmark RE's. In order to benchmark the success of the rehabilitation, a minimum of two analogue sites should be established, and measurable data between the two be averaged.

There are currently five RE types found across the mining lease, with the most dominant being RE 12.9-10.2. Several possible analogue sites exist within and around the mining lease, including the remnant vegetation within the mining lease. However, this is within the potential mining footprint so may be cleared in the future, rendering it unsuitable for long-term monitoring and comparison to rehabilitation areas

Suggested offsite analogue sites of mapped remnant RE 12.9-10.2 for the purpose of rehabilitation benchmark scoring adjacent to the mining lease include areas to the south of the mining lease that are contiguous to the remnant vegetation on the mining lease, as well as mapped remnant RE12.9-10.5 on Rhondda Road Reserve to the north and existing uncleared bushland off Schutt Street to the south. It should be noted that these possible analogue sites are not protected and, as such, require investigation into securing the areas for long-term monitoring.

Alternatively, White Rock Conservation Park is approximately 6 km to the south-east of the mining lease and contains remnant vegetation of mixed polygon RE 12.9-10.2/12.9-10.7/12.9-10.19, which is the RE type that the majority of the regrowth vegetation on the mining lease is mapped as. As the Conservation Park has a level of protection from future disturbance, it may be a suitable long-term option for monitoring and comparison.

Assessment and selection of suitable analogue sites will be conducted by an AQP prior to the commencement of rehabilitation works onsite. Should analogue sites not be identified as satisfactory for the purpose required, or should analogue site data be otherwise unavailable, the official Biocondition benchmarks for RE 12.9-10.2 could be used. However, this method of comparison is not ideal, and will only be used if analogue site data is unobtainable or unavailable.

Assisted vegetation rehabilitation methodology techniques, in the form of seeding and potentially tubestock planting, will be undertaken to achieve the desired end point outcomes of a "Return to Native Ecosystem" PMLU at the Claypave South mining lease. A summary of required revegetation actions and rationale is provided in Table 23.

Revegetation planting will complement the existing vegetation on site. Table 22 comprises a list of frequent species endemic to RE 11.9-10.2, which is the most prevalent RE currently identified on the mining lease. Species will be selecting for seeding/planting based on the pre-clearing RE technical descriptions, as well as the mapped remnant vegetation identified during the establishment of the analogue site/s, and the species recorded on site.

Should any species be commercially unavailable, the rehabilitation contractor should (with approval by an AQP) select alternative, suitable species that are native to the locality, prior to planting. A suggested planting pallet for lacustrine systems has also been included for any return to natural ecosystem rehabilitation works that are to occur around the final voids, which will hold water at the end of mine use.

Table 22 Species endemic to the RE 12.9-10.2

RE	Trees	Shrubs	Grasses & Forbs
11.9-10.2	*Corymbia citriodora subsp. variegata* *Angophora leiocarpa* *Eucalyptus crebra Eucalyptus tereticornis Corymbia tessellaris Eucalyptus moluccana* *Eucalyptus melanophloia*	*Acacia disparrima subsp. disparrima* *Acacia maidenii* *Acacia leiocalyx* *Alstonia constricta* *Allocasuarina torulosa Alphitonia excelsa* *Jacksonia scoparia* *Hibiscus sturtii* *Hovea acutifolia*	*Entolasia stricta Cymbopogon refractus, Themeda triandra Eremochloa bimaculata Imperata cylindrica* *Panicum effusum Heteropogon contortus* *Dianella revoluta* *Eustrephus latifolius* *Dianella caerulea* *Lomandra multiflora* *Lomandra longifolia*
Lacustrine system	*Eucalyptus tereticornis* *Melaleuca bracteata* *Lophostemon suaveolens* *Eucalyptus moluccana*	*Melaleuca viminalis* *Mallotus philippensis* *Acacia sp.* *Eremophila bignoniiflora*	*Fimbristylis dichotoma* *Cyperus gracilis* *Philydrum lanuginosum* *Eleocharis sp.* *Oryza meridionalis* *Persicaria decipiens*

Direct seeding will be carried out in all rehabilitation areas to achieve germination and establishment and may be conducted mechanically or by hand. Prior to revegetation, all weeds will be controlled, and a good soil moisture profile depth ensured. Ripping of the soil to a depth of 30 to 60cm will be conducted where possible to root development by re-aerating clay-loams, clay soils, hardpans, or compacted soils. Ripping will not be undertaken in waterlogged areas or wet soils, deep soils, stream ides/streambanks, cracking clays, and sites where there is a high level of intact native ground flora, or within root protection zones of existing native trees. In areas identified as clay or sodic soils, gypsum will be applied before chisel ploughing.

Seeding rates will be determined by future revegetation trials at the site, however it is anticipated these will be in line with industry standard practices of between 1-3kg/ha for the native tree and shrub

species and 10-20kg/ha for native grasses. Seeds will be sown immediately before the expected onset of reliable rains, with December through to March identified as the months of highest precipitation at the site.

If tubestock planting is undertaken, this will be planted at a stem density ratio as described in the technical descriptions for the proposed return RE (refer to Revegetation Plan at Appendix 3). Tree tube stock will be mulched and have tree guards installed to prevent grazing macropods from impacting the plantings. Planting will be undertaken during the predicted wet season after an initial significant rain event, after ensuring a full moisture profile is evident, wherever possible. Watering post-planting will be dependent on weather conditions and visible plant health.

Monitoring and maintenance of revegetation areas will be undertaken in accordance with the Revegetation Plan, as summarised in Table 23.

Table 23 Revegetation Plan Summary

Timeline/Stage	Action	Rationale
1.0 Delineation of revegetation areas *Aim: To define the revegetation areas as they become available during progressive rehabilitation determining what revegetation technique will be undertaken and the amount of preparation required prior to ensure suitable areas for re-establishing RE12.9-10.2* *Note, PMLU is 'Return to Natural Ecosystem'*	1.1 Determine revegetation area	Identify and physically mark out the areas that will be rehabilitated as they become available for rehabilitation.
	1.2 Evaluate imagery and vegetation of mine lease and surrounds	Collate and evaluate vegetation data in relation to mapping of remnant vegetation communities across the wider region to assist in validation of rehabilitation RE choice, and compared with ground truthing. Identify local species and stem density in remnant vegetation at analogue sites.
	1.3 Soil testing, surveying and mapping in revegetation areas	Undertake soil testing to determine soil conditions: pH, electrical conductivity (EC), available Bray phosphorus, Emerson Aggregate Test, organic carbon, plant available water-holding capacity (PAWC), hydraulic conductivity (Ksat), and particle size distribution. Consideration may need to be given to testing for macro and microelements, heavy metals, and persistent organochloride pesticides (Dieldrin). This will provide information on possible required ameliorants. All methods to be undertaken as per the *Australian Soil and Land Survey Field Handbook* (National Committee on Soil and Terrain, 2009) and *Guidelines for Surveying Soil and Land Resources* (McKenzie et al., 2008).
	1.4 Identify analogue sites	Conduct field surveys to locate potential analogue sites (in the required RE) to use as a benchmark for comparison with rehabilitated areas that are earmarked for return to native ecosystem rehabilitation. Species lists to be determined for identification of future seed or tubestock required for revegetation of RE. Analogue plot set up including photo point and finessing site attribute scoring criteria to be undertaken as per Queensland Herbarium *Method for the Establishment and Survey of Reference Sites for BioCondition, Vol 3.* **If no analogue site available, RE remnant benchmark attributes to be used as comparable scoring alternative**
2.0 Site preparation *Aim: To prepare site for revegetation activities*	2.1 Weed management	Weed and exotic pasture grass management is to be conducted, and Weeds of National Significance and State listed Category 3 restricted plants (refer PCRP, Section 5.2) are to be controlled, in revegetation areas prior to revegetation.
	2.2 Ground preparation	Rows should be ripped according to individual site conditions (e.g., rotary hoeing or equivalent may be required if clodding is apparent).
	2.3 Soil amelioration	Soil amelioration may be required if recommended by an appropriately qualified person following soil testing and mapping.
	2.4 Row preparation	Following ripping and soil amelioration (if required), rows are to be prepared for planting tubestock or direct seeding. Tubestock is to be mulched directly around planted individuals, with plants positioned at a distance derived from the density indicated in the RE technical descriptions. Consideration of row dimensions to allow for weed control of re-emerging exotic grasses and weeds through mechanical slashing and spraying between rows (if required).

Timeline/Stage	Action	Rationale
3.0 Revegetation *Aim: To reinstate predetermined RE*	3.1 Priority species selection for RE, determined by prior collated species and technical description	Species have been selected considering both the technical description for the RE, the analogue site assessments and the native species detected on site during field surveys. The latter are particularly relevant as these species are able to persist in the current conditions of the site. The technical description for RE 12.9-10.2 is provided in **Appendix 1** of the Revegetation Plan, which provides species found in this RE. The final restoration target density is also provided (stem density), with the planting density to be determined based on environmental and climatic considerations, as well as the form of plantings (tubestock vs seeding). In particular, increased planting density (compared to target density) is required to account for seedling or sapling mortality; however, each site needs to consider mortality factors such as current weather conditions (e.g. drought), capacity/requirement to provide on-going watering, weed management and pest management.
	3.2 Seed collection and trials	Seed collection and storage is required to be undertaken every 1-2 years to ensure quantities and seed capture of endemic species with irregular seed set cycles (e.g. those that only flower every two years). Trials are required to determine viability of seeds and if any they require dormancy breaking. This will also assist in determining rates of required seed sowing.
	3.3 Planting - General	Revegetation areas are to be sprayed with a suitable herbicide prior to planting. Herbicides must be registered by the Australian Pesticides and Veterinary Medicine Authority for use within proximity to waterways, be used in strict accordance with the product label directions and applied by an appropriately qualified person in accordance with the *Agricultural Chemicals Distribution Control Act 1996*. Planting is to be carried out at the beginning of the growing season to allow maximum growing time prior to extreme temperatures, particularly summer heat. Planting must be undertaken in the morning or late afternoon to avoid heat/desiccation stress and must be within seven days of at least 25 mm of rainfall. Species can be seeded over ripped rows or planted as tubestock. If using tubestock, these must be sun-hardened prior to planting, and tree mulch rings are recommended. Tree guards are required to prevent herbivory by native or pest animals (e.g. Eastern Grey Kangaroo, European Hare).
	3.4 Watering regime	All plants must be watered in their pots prior to planting, as well as after placement in the soil. Watering must be with low pressure water stream only. The method of water delivery and distribution is to be determined based on the most suitable methods for the site conditions. Further watering will be subject to weather conditions and planting season (more watering required during dry weather). Plant health and soil moisture levels must be assessed by site inspection at least weekly in the first month after planting; a water schedule is provided in **Table 3.3** in the Revegetation Plan.
4.0 Monitoring and management *Aim: To monitor revegetation areas to*	4.1 Monitor revegetation areas to guide management actions	Monitoring is to include: • Weed species present and spatial spread (to guide weed control requirements), including weed monitoring at analogue sites • Revegetation health (to provide information on whether additional plants, water or other revegetation requirements are needed) • Presence and extent of erosion (to provide information for additional site stability works, if required)

Timeline/Stage	Action	Rationale
guide management activities		Monitoring timeframes are provided in **Table 4.1** in the Revegetation Plan.
	4.2 Weed management	Undertake weed management activities on and adjacent to revegetation areas to ensure no detrimental impact on plants, until the revegetation meets the RE criteria.
	4.3 Fire management	Fire breaks will be required to be established and maintained around revegetation areas. Fire is to be excluded from within the revegetation areas for a minimum of 15-20 years, or until it meets the RE criteria.
	4.4 Monitoring revegetation for progress of rehabilitation at annual intervals	Monitoring transects are to be established at the time of first planting, and permanently identified by both GPS and survey markers (e.g. star picket with yellow caps at centre and end points) to ensure consistent monitoring and photo locations over time. Annual monitoring is to follow the BioCondition survey process used when analogue sites were established to ensure consistent data collection, assessment, and reporting. In addition to data, this includes standardised photos of each plot locations (see Attachment 2 of the *BioCondition Assessment Manual*). Tree density counts are also to be undertaken. This data will be disseminated and produced as a report for relevant stakeholders. An adaptive management approach should be undertaken following each monitoring event, whereby management and revegetation activities are modified if necessary to ensure the revegetation areas are progressing towards the intended target (e.g. replacement plantings, etc).

8.11 Tailings Storage Facilities

There are no tailings storage facilities on site and none will be created throughout the life of mine. This section is therefore not applicable to the PRC Plan.

8.12 Voids

The open pit Kerwick #2 will be used for water storage until the end of mine life. This open pit will provide water to support the rehabilitation programs across the site, as well as providing additional stormwater storage capacity; which is specified in EA0001872.

At the conclusion of mining, it is planned that Kerwick #2 will be backfilled, and achieve the native ecosystem PMLU.

8.13 Underground Mining

Underground coal mining has historically occurred however the depth to the underground mining is at least 90m below ground level at this location (i.e. at least 60m below the base of the designed pit). Therefore, underground mining does not need to be considered in the preparation of this PRCP.

8.14 Built Infrastructure

There is no built infrastructure (current or planned) on site for mining activities so no decommissioning is required in relation to the mining activity.

The decommissioning requirements of the Resource Recovery Centre in the western sector of the site will be defined in more detail as the project progresses.

9 Risk Assessment

9.1 Risk Assessment Purpose

Section 1236C(1)(f) of the EP Act requires the PRCP to identify the risks for each PMLU of a stable condition not being achieved, and how the applicant intends to manage or minimise the risk.

The purpose of the risk assessment was to identify and assess the risks of a stable condition for the land not being achieved for the agreed PMLU of native ecosystem and any related potential for environmental harm. The purpose of the risk assessment is to also identify that action to be taken to manage and minimise any identified high risk.

The scope of the risk assessment is restricted to rehabilitation matters including the potential risks associated with the period following rehabilitation and mine closure. The scope covers risks that affect the successful achievement of PMLU type (native ecosystem).

9.2 Risk Assessment Process

The risk assessment has been conducted in accordance with the principles outlined in AS/NZS ISO 31000:2018 *Risk Management – Guidelines* (Standards Australia, 2018).

Potential hazards were identified and considered for each rehabilitation area for the Project.

A risk assessment has been undertaken in accordance with the principles outlined in ISO31000:2018 taking into account the areas of impact, events and their causes and potential consequences for the period following mine closure. An assessment of likelihood and consequence of associated risks have been made based to determine unmitigated risk. Definitions of likelihood and consequence of the risk are shown in Table 24 and Table 25.

Table 26 describes how the overall risk level is determined.

A risk assessment relating to mine closure is shown in Table 27. Proposed mitigation measures are specified. The residual risk based on effective and ongoing implementation of the mitigation measures is also included.

Table 24 Likelihood Definitions

Likelihood	Definition
Almost Certain; >90%; (5)	Greater than 90% likelihood of occurring. Has happened, will probably happen during the mine life and there is no reason to suspect it will not happen in the post-closure period.
Likely; 30% - 90%; (4)	Likelihood of occurring is equal to or more than 30% and less than 90%. This consequence is not uncommon in the mining industry/local area
Possible 10-29%; (3)	Likelihood of occurring is equal to or more than 10% and less than 30%. There is a possibility of this risk occurring as it has occurred before (albeit infrequently) in the mining industry/local area
Unlikely; 3% - 9% (2)	Likelihood of occurring is more than or equal to 3% and less than 10%. There are no specific circumstances to suggest this could happen.
Improbable; <3%; (1)	Likelihood of occurring is less than 3%. It would require a substantial change in circumstances to create an environment for this to occur, and even then, this is a rare occurrence.

Table 25 Consequence Definition

Consequence Type	Insignificant (1)	Minor (2)	Moderate (3)	High (4)	Major (5)
PMLU not being achieved	Lasting days or less; affecting small area (metres); groundcover affected with no loss of stability.	Lasting weeks; affecting limited area (tens of metres); groundcover affected on rehabilitated surfaces only and/or land slip of rehabilitated surface/profile or one incident of surface water quality deterioration.	Lasting months; affecting extended area (hundreds of metres); groundcover affected within Mine Activity Area only and/or erosion or slumping of rehabilitated surface/profile or successive incidents of surface water quality deterioration.	Lasting years; affecting area on ML area beyond the Mine Activity Area and undisturbed land; landform failure requiring re-mobilisation of rehabilitation efforts. Off lease impacts potential to cause environmental harm.	Permanent impact; affecting area beyond ML area and landholder property, reducing productivity of affected land permanently.

Table 26 Risk Level Matrix

Likelihood	Consequence Scale				
	Insignificant (1)	Minor (2)	Moderate (3)	High (4)	Major (5)
Almost Certain; >90%; (5)	5 (Medium)	10 (Significant)	15 (Significant)	20 (High)	25 (High)
Likely; 30% - 90%; (4)	4 (Medium)	8 (Medium)	12 (Significant)	16 (High)	20 (High)
Possible 10-29%; (3)	3 (Low)	6 (Medium)	9 (Medium)	12 (Significant)	15 (Significant)
Unlikely; 3% - 9% (2)	2 (Low)	4 (Medium)	6 (Medium)	8 (Medium)	10 (Significant)
Improbable; <3%; (1)	1 (Low)	2 (Low)	3 (Low)	4 (Medium)	5 (Medium)

The risk assessment outcome, including proposed mitigation measures are shown in Table 27.

Table 27 Risk Assessment for Achievement of PMLU

C = Consequence L= Likelihood R = Risk

RISK TO PMLU OUTCOME		Unmitigated Risk			Residual Risk			
Event	Cause	C	L	R	Mitigation	C	L	R
Revegetation fails	Weed invasion of rehabilitated areas	3	4	12	Complete weed eradication from topsoil stockpile prior to use. Ensure fertiliser use is slow release to allow native species to out compete weeds. Keep weed hygiene measures in place for entire rehabilitation activity schedule. Consider weed control on areas adjacent to the Mine Activity Area. Selective weed eradication on revegetated areas based on weed type and control susceptibility.	2	3	6
	Unsuitable seed blend used	3	3	9	Reseed area with appropriate seed mix if inundation or persistent water accumulation.	2	3	6
	Extended drought event	3	3	9	Reseed area in the first available wet season following extended drought.	2	2	4
	Vehicle access prior to appropriate timing	3	3	9	Maintain fence until rehabilitation achieved.	2	2	4
	Native fauna access prior to rehabilitation achievement	3	3	9	Install tree guards around base of immature tree/shrubs in critical areas.	2	2	4
Instability of landform surface	Soil loss from topsoiled areas	3	3	9	Installation of runoff controls to limit the potential for erosive events. Confirmation of final design profile over backfilled and topsoiled areas. Maintain fence until rehabilitation criteria met.	2	2	4
	Slumping of placed materials on slope	3	3	9	Confirmation of final design profile over backfilled and topsoiled areas. Where placed material meets in situ materials key into slope and install water management to direct runoff to dedicated structures and away from placed materials.	2	2	4
	Erosion and Sediment Control management controls fail	3	3	9	Maintain erosion and sediment control management installations throughout rehabilitation schedule and annually prior to each wet season. Inspect status of installations following wet season.	2	2	4
	Final landform design not suitable	3	3	9	Geotechnical assessment to confirm available material can be installed as stable and if not include benching to final profile to decrease slope angle and length.	2	2	4

9.3 Risk Treatment Plan

The basis for selection of the various risk treatments are recorded in Table 28. The risk mitigations are presented in approximate sequence of application for each cause. It is possible that early treatments may be sufficient for risk eradication and that the full range of options may not be necessary for the mitigative effect to be completed.

Table 28 Risk Treatment

RISK TO PMLU OUTCOME		Treatment of Risk		
Cause	Mitigation	Selection rationale	Actions and Performance measures	Reporting/Monitoring/Timing
Revegetation fails				
Weed invasion of rehabilitated areas	Complete weed eradication from topsoil stockpile prior to use.	Timely application of control in rehabilitation schedule	Apply suitable herbicide to weed infested areas seasonally.	Record weed status of stockpiled soils prior to re-spreading on regraded landforms.
	Ensure fertiliser use is slow release to allow native species to out compete weeds.	Meets native species recommended outcome	Source suitable fertiliser for use throughout rehabilitation period	Record rate of use and weed emergence.
	Apply weed hygiene measures for entire rehabilitation activity schedule.	Protection of surrounding environment	Keep operational weed hygiene measures in place for entire rehabilitation activity schedule.	Record equipment and maintain hygiene records
	Selective weed eradication on revegetated areas based on weed type and control susceptibility.	Protection of surrounding environment	Surveillance of rehabilitation areas for weed emergence	Record weed emergence

RISK TO PMLU OUTCOME		Treatment of Risk		
Cause	Mitigation	Selection rationale	Actions and Performance measures	Reporting/Monitoring/Timing
Extended drought event	Reseed area in the first available wet season following extended drought.	Cost-benefit in post-closure period.	Check Ipswich rainfall records to confirm suitable conditions	Record timing and rate of seed application.
Vehicle access prior to rehabilitation achievement	Maintain fence or demarcation until rehabilitation criteria are met.	Timely application of control in rehabilitation schedule	Maintenance inspections to ensure integrity of fence.	Implement prior to completion of rehabilitation works.
Native fauna access prior to rehabilitation achievement	Install tree guards around base of immature tree/shrubs in critical areas.	Cost-benefit in post-closure period	Observations of growth and groundcover to include signs of predation on emerging vegetation	Photo-monitoring of emerging tree/shrubs
Instability of regraded surface				
Soil loss from topsoiled areas	Installation of runoff controls to limit the potential for erosive events.	Timely application of control in rehabilitation schedule	Final landform design plan/schematic to include location and materials for installation	Photo-monitoring of installed feature
	Confirmation of final design profile over backfilled and topsoiled areas	Timely application of control in rehabilitation schedule	Measure profiles as installed, prior to topsoiling and revegetating final landforms	Photo-monitoring of completed earthworks

Slumping of placed materials on slope	Confirmation of final design profile over backfilled and topsoiled areas	Timely application of control in rehabilitation schedule	Measure profiles as installed, prior to topsoiling and revegetating final landforms	Photo-monitoring of completed earthworks
	Where placed material meets in situ materials key into slope and install water management to direct runoff to dedicated structures and away from placed materials.	Timely application of control in rehabilitation schedule	Final landform design plan/schematic to include areas for keying and locations for installation of water management structures	Photo-monitoring of completed earthworks

10 Monitoring and Maintenance

The program of monitoring and maintenance of the milestones and milestone criteria are presented in Table 29. Monitoring will occur after the completion of actions specified in the milestone criteria.

Table 29 Rehabilitation Milestone Management and Rehabilitation Criteria Monitoring Program

Milestone Reference	Rehabilitation Milestone	Milestone Criteria	Method of monitoring
RM1	RM1 Infrastructure Removal	1. All buildings demolished and removed 2. All concrete, bitumen and gravel removed, where not required 3. All non-required fencing removed 4. All machinery and equipment removed 5. All non-required surface water drainage infrastructure removed 6. All waste removed	Photo of location with date
RM2	RM2 Remediation of Contaminated Land	1. A preliminary contaminated land investigation is undertaken, and a report is prepared by an Appropriately Qualified Person (AQP)1. 2. All hazardous and contaminated materials have been assessed and identified by an AQP, and disposed of lawfully 3. A contaminated land investigation document has been prepared by	Assessment report prepared by AQP. Disposal records and validation report by AQP if material removed from site.

Milestone Reference	Rehabilitation Milestone	Milestone Criteria	Method of monitoring
		an AQP containing a site suitability statement confirming that land is not contaminated and is suitable for the proposed PMLU.	
RM3	RM3 Landform development and reshaping / reprofiling	1. Batter slopes achieve approx. 1 in 3 slope angle for final landform design 2. Floor of pits achieve design slope 3. All major earthworks completed	Site survey records Photo of location with date
RM4	RM4 Land Surface Preparation	1. Water stored in Kerwick #2 pit will be tested and confirmed suitable for use in rehabilitation. If not suitable, treatment to rectify issues completed prior to use. 2. Earthworks completed 3. Adequate topsoil material spread over shaped surfaces (~15cm depth) 4. Ameliorants applied where required to address soil quality 5. Ripping and discing completed	Sampling field record and laboratory analysis certificate Photo of location with date Topsoil depth measurement every 100m Record of ameliorants applied
RM5	RM5 Revegetation	1. Completed seeding of target species using a combination of tree, shrub, and ground cover species as per rates specified in section 3.4.4. for RE 12.9-10.2 2 (a). Germination success 70% germination of groundcover species (seed) and 70% planted specimens (tubestock) have survived	Record of actions and amount applied Field assessment by suitably qualified person Record of rehabilitation monitoring

Milestone Reference	Rehabilitation Milestone	Milestone Criteria	Method of monitoring
		2 (b). Weeds are at a maximum of 10% of vegetation cover	
RM6	RM6 **Stable** Landform	1. 90% of the landform achieves slope gradients of 30% or less and 80% of the final landform achieves slope gradients of 20% or less 2. Stable final landform that has been geotechnically assessed by an AQP as stable with FoS ≥1.5 3. Drainage meets design criteria	Statement by AQP Geotechnical assessment by AQP
RM7	RM7 **Achievement of Surface Requirements (Native Ecosystem)**	1. Monitoring of rehabilitation showing successful revegetation in line with targets: (a). 80% of the area achieves species density and diversity that is greater than 60% of the reference sites (b). New recruits are occurring from 60% of the understorey species (shrub and ground cover). (c). A minimum of five target canopy species present (as per RE 12.9-10.2 species list): Minimum of 4 m height for any NJKHT species. (d). Weed presence is at a maximum of 10 % of total vegetation cover	Field assessment by suitably qualified person Record of rehabilitation monitoring Statement by suitably qualified person Photo of location with date Water quality monitoring records, laboratory reports

Milestone Reference	Rehabilitation Milestone	Milestone Criteria	Method of monitoring
		(e). No new invasive plants and infestation density of invasive plants in the area are contained or reduced and consistent with reference sites (f). Evidence of fauna habitat features for invertebrate and vertebrate species (e.g. logs, rock piles, nest boxes, bird nests or perches) 2. Landform shows suitable slope gradients as defined in RM6 3. No erosion classification of Severe or Extreme 4. Surface water quality monitored monthly during flow at, but not limited to, downstream locations specified in Table 1 must not exceed the limits in Table 2, for a minimum of 2 consecutive years. If the surface water quality exceeds criteria 4 above, the applicable reference site must be compared to the downstream site result; and quality measured at a downstream site must be equal to or less than the quality measured at the applicable reference site.	

Milestone Reference	Rehabilitation Milestone	Milestone Criteria	Method of monitoring
RM8	RM8 **Achieved** PMLU (Native Ecosystem)	1. Monitoring of rehabilitation showing successful revegetation in line with targets: (a). An average of >250 stems / ha dominant tree canopy, of which at least 100 are eucalypt species (NJKHT) (b). NJKHT to have a minimum DBH of 10 cm (c). The measurable presence of a minimum 15 target vegetation species representative of RE 12.9-10.2 within the BioCondition transect comprising: >3 species of grasses (native, not introduced pasture grasses) and forbs >7 mid-storey (shrub) species ≥5 canopy species, including - *Corymbia citriodora* - *Eucalyptus crebra* - *Eucalyptus tereticornis* - *Eucalyptus moluccana* - *Corymbia intermedia* (d). Canopy cover species to be self-sustaining (bearing viable seed, as evidenced by recruitment	Field assessment by suitably qualified person Record of rehabilitation monitoring Statement by suitably qualified person Photo of location with date

Milestone Reference	Rehabilitation Milestone	Milestone Criteria	Method of monitoring
		occurring over at least 60 % of the revegetation area) and with a minimum of 40 % dominant canopy vegetation (with a minimum of 2 NJKHT species) (e). Weeds are at a maximum of 10% of vegetation cover. No new invasive plants and infestation density of invasive plants in the area are contained or reduced and consistent with reference sites (f). 80% of the area has a vegetative groundcover of >70% for areas of low rock and logs, and >50% for areas of high rock and log content (g). Native bushland established that provides habitat opportunities for native invertebrate and vertebrate including: - Evidence of key invertebrate groups (e.g. ants, beetles and spiders) and soil faunal communities - Evidence of key native vertebrate groups (e.g.	

Milestone Reference	Rehabilitation Milestone	Milestone Criteria	Method of monitoring
		bird, mammal, reptile and amphibian) in the form of fauna spotting, spotlighting, scats and tracks 2. No erosion classification of Severe or Extreme	
RM9	RM9 **Achieved** PMLU Retained Infrastructure	1. Final landform survey confirms no structures or equipment remain other than those documented in a landholder agreement, or specified by the *Electricity Act 1994*. 2. All contaminants removed or remediated. 3. No erosion classification of Severe or Extreme. 4. Landform shows suitable slope gradients e.g. <20% except to connect with surrounding natural topography. 5. Hazard and Safety Assessment completed by an appropriately qualified person demonstrating hazards in rehabilitation areas are consistent with the nature and severity of hazards typical of neighboring equivalent land use. Identified residual hazards are low risk with no significant increase in risk expected over time.	Statement from suitably qualified person Photo of location with date Landholder Agreement Hazard and Safety Assessment Agreement from DEPW

Milestone Reference	Rehabilitation Milestone	Milestone Criteria	Method of monitoring
		6. Agreement with Energex regarding maintenance of power line easement	

11 References

ATC Williams 2018, Ipswich Resource Recovery Facility – Hydrogeology Assessment Report

BOM 2022, Climate Data Online – Station Number 040101 Australian Government Bureau of Meteorology, viewed 23 August 2022 www.bom.gov.au/climate/data

Cranfield, L.C., Hutton, L.J., and Green, P.M., 1989: 1:100 000 Geological Map Commentary - Ipswich Sheet 9442, Queensland. Queensland Department of Mines.

Cranfield, L.C., and Schwarzbock, H., 1972: Nomenclature of some Mesozoic rocks in the Brisbane and Ipswich area, Queensland. Queensland Government Mining Journal, 414 - 416.

DES 2019, Climate change in the South East Queensland region–Version 1, Department of Environment of Science, Queensland Government, Brisbane.

Freeze and Cherry 1979,Groundwater, Prentice Hall.

Hunt Michael and Partner 2018, Proposed Industrial Development at 149 Rhondda Road, New Chum for Jackal Renewables Pty Ltd Conceptual Stormwater Management Plan.

Moreton Geotechnical Services Pty Ltd, 2018. Desktop mining study on part of Lot 273 SP 128662 Rhondda Road New Chum.

Staines, H.R.E., 1961: Coal Resources West Moreton (Ipswich) Coalfield - Part 14 P.D.T.S Nos 11,12 and 14 mine areas, Rhondda. Geological Survey of Queensland Publication 298.

Staines, H.R.E., 1964: Stratigraphic nomenclature of the Bundamba Group in the Ipswich area. Queensland Government Mining Journal, 33-35.

Standards Australia, 2018. AS/NZS ISO 31000:2018 *Risk Management – Guidelines.*

Sticks & Stones Environmental, 2018, Ecological Report for Lot 73 on SP128662, 149 Rhondda Road, New Chum V01.

Queensland Government 2022, The Long Paddock, Queensland Future Climate Dashboard viewed 11 November 2022. https://www.longpaddock.qld.gov.au/qld-future-climate/dashboard/#responseTab1

PART B – ATTACHMENTS PRCP SCHEDULE

Appendix 1 – PRCP Schedule
Appendix 2 – EA0001386 – Land Outcome Document
Appendix 3 – Ecological Studies
Appendix 4 – Mine Planning Report
Appendix 5 – Topsoil Assessment
Appendix 6 – Hydrogeological Assessment

Appendix 1 – PRCP Schedule

Jackal Renewables Pty Ltd; ML50070

Appendix 2 – EA0001386 – Land Outcome Document

Appendix 3 – Ecological Studies

Jackal Renewables Pty Ltd; ML50070

Appendix 4 – Mine Planning Report

Appendix 5 – Topsoil Assessment

Jackal Renewables Pty Ltd; ML50070

Appendix 6 – Hydrogeological Assessment

PART B – ATTACHMENTS PRCP SCHEDULE

Appendix 1 – PRCP Schedule
Appendix 2 – EA0001386 – Land Outcome Document
Appendix 3 – Ecological Studies
Appendix 4 – Mine Planning Report
Appendix 5 – Topsoil Assessment
Appendix 6 – Hydrogeological Assessment

Jackal Renewables Pty Ltd; ML50070

Appendix 2 – EA0001386 – Land Outcome Document

Permit

Environmental Protection Act 1994

Environmental authority EA0001386

This environmental authority is issued by the administering authority under Chapter 5 of the Environmental Protection Act 1994.

Environmental authority number: EA0001386

Environmental authority takes effect on 27 July 2018

Environmental authority holder(s)

Name(s)	Registered address
JACKAL RENEWABLES PTY LTD	149 Rhondda Rd NEW CHUM QLD 4303 Australia

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
Resource Activity, Schedule 2A, 20: Clay pit mining, dimension stone mining or mining gemstones (including the material from which gemstones are extracted), (a) at least 5,000t but not more than 100,000t in a year	ML50070

Additional information for applicants

Environmentally relevant activities

The description of any environmentally relevant activity (ERA) for which an environmental authority (EA) is issued is a restatement of the ERA as defined by legislation at the time the EA is issued. Where there is any inconsistency between that description of an ERA and the conditions stated by an EA as to the scale, intensity or manner of carrying out an ERA, the conditions prevail to the extent of the inconsistency.

An EA authorises the carrying out of an ERA and does not authorise any environmental harm unless a condition stated by the EA specifically authorises environmental harm.

A person carrying out an ERA must also be a registered suitable operator under the Environmental Protection Act 1994 (EP Act).

Contaminated land

It is a requirement of the EP Act that an owner or occupier of contaminated land give written notice to the administering authority if they become aware of the following:

- the happening of an event involving a hazardous contaminant on the contaminated land (notice must be given within 24 hours); or
- a change in the condition of the contaminated land (notice must be given within 24 hours); or
- a notifiable activity (as defined in Schedule 3) having been carried out, or is being carried out, on the contaminated land (notice must be given within 20 business days);

that is causing, or is reasonably likely to cause, serious or material environmental harm.

Department of Environment and Science
www.ehp.qld.gov.au ABN 46 640 294 485

Queensland Government

For further information, including the form for giving written notice, refer to the Queensland Government website www.qld.gov.au, using the search term 'duty to notify'.

Take effect

Please note that, in accordance with section 200 of the EP Act, an EA has effect:

a) if the authority is for a prescribed ERA and it states that it takes effect on the day nominated by the holder of the authority in a written notice given to the administering authority-on the nominated day; or
b) if the authority states a day or an event for it to take effect-on the stated day or when the stated event happens; or
c) otherwise-on the day the authority is issued.

However, if the EA is authorising an activity that requires an additional authorisation (a relevant tenure for a resource activity, a development permit under the Sustainable Planning Act 2009 or an SDA Approval under the State Development and Public Works Organisation Act 1971), this EA will not take effect until the additional authorisation has taken effect.

If this EA takes effect when the additional authorisation takes effect, you must provide the administering authority written notice within 5 business days of receiving notification of the related additional authorisation taking effect.

If you have incorrectly claimed that an additional authorisation is not required, carrying out the ERA without the additional authorisation is not legal and could result in your prosecution for providing false or misleading information or operating without a valid environmental authority.

Dannielle Tela
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Date issued: 27 July 2018

Enquiries:
Minerals Business Centre
Department of Environment and Science
Phone: 07 4222 5352
Email: ESCairns@des.qld.gov.au

Conditions of environmental authority

Schedule A – General conditions

Prevent and /or Minimise Likelihood of Environmental Harm

(A1-1) In carrying out the environmentally relevant activities, you must take all reasonable and practicable measures to prevent and / or to minimise the likelihood of environmental harm being caused. Any environmentally relevant activity, that, if carried out incompetently, or negligently, may cause environmental harm, in a manner that could have been prevented, shall be carried out in a proper manner in accordance with the conditions of this authority.

NOTE: This authority authorises the environmentally relevant activity. It does not authorise environmental harm unless a condition contained within this authority explicitly authorises that harm. Where there is no condition or the authority is silent on a matter, the lack of a condition or silence shall not be construed as authorising harm.

Maintenance of Measures, Plant and Equipment

(A2-1) The holder must:

(a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority; and

(b) maintain such measures, plant and equipment in a proper and efficient condition; and

(c) operate such measures, plant and equipment in a proper and efficient manner.

Monitoring

(A3-1) Record, compile and keep for a minimum of five (5) years all monitoring results required by this environmental authority and make available for inspection all or any of these records upon request by the administering authority.

(A3-2) Where monitoring is a requirement of this environmental authority, ensure that a competent person(s) conducts all monitoring.

Storage and Handling of Flammable and Combustible Liquids

(A4-1) Spillage of all flammable and combustible liquids must be contained within an on-site containment system and controlled in a manner that prevents environmental harm and storage of such liquids shall comply with *AS 1940 - Storage and Handling of Flammable and Combustible Liquids of 1993*.

Integrated Environmental Management System (IEMS)

(A5-1) The holder of this environmental authority must:

(a) develop an Integrated Environmental Management System (IEMS) which provides for the effective management by the registered operator of the actual and potential environmental impacts resulting from the carrying out of the ERAs; and

(b) implement and maintain the IEMS for carrying out the ERAs and;

(c) for the purposes of condition (A5-1) an IEMS includes the document entitled "Environmental Management Overview Strategy incorporating Integrated Environmental Management System (Mining and Manufacturing Activities), Claypave Pty Ltd, October 2002 lodged in connection with the relevant application.

(A5-2) The IEMS must provide for at least the following functions:

(a) Training staff in the awareness of environmental issues related to carrying out the ERAs, which must include at least:

- The environmental policy of the registered operator, so that all persons that carry out the ERAs are aware of all relevant commitments to environmental management;
- Any relevant environmental objectives and targets, so that all staff are aware of the relevant performance objectives and can work towards these;
- Control procedures to be implemented for routine operations for day to day activities to minimise likelihood of environmental harm, however occasioned or caused;
- Contingency plans and emergency procedures to be implemented for non-routine situations to deal with foreseeable risks and hazards including corrective responses to prevent and mitigate environmental harm (including any necessary site rehabilitation);
- Organisational structure and responsibility to ensure that roles, responsibilities and authorities are appropriately defined to manage environmental issues effectively;
- Effective communication to ensure two-way communication on environmental matters between operational staff and higher management; and
- Their obligations in respect of monitoring, notification and record keeping obligations under the IEMS and relevant environmental authorities and/or environmental authority;

(b) Monitoring of the release of contaminants into the environment including procedures, methods, record keeping and notification of results;

(c) Mining without explosive blasting;

(d) Conducting assessment of the environmental impact of any release of contaminants into the environment;

(e) Periodic conduct of energy audits and review of environmental performance and procedures adopted, not less frequently than annually;

(f) Waste prevention, treatment and disposal; and

(g) A program for continuous improvement.

(A5-3) The holder of this environmental authority must not implement or amend an IEMS (including any environmental management plan) that contravenes any condition of this environmental authority or any development condition applicable to carrying out the ERAs.

Definitions

(A6-1) Words and phrases used throughout this environmental authority are defined in Schedule H – Definitions. Where a definition for a term used in this integrated authority is sought and the term is not defined within this integrated authority, the definitions in the *Environmental Protection Act 1994*, its Regulations and Environmental Protection Policies must be used.

Financial Assurance

(A7-1) Provide a financial assurance in the amount and form required by the administering authority prior to the commencement of activities proposed under this environmental authority.

NOTE: The calculation of financial assurance for condition (A7-1) must be in accordance with Guideline 17 and may include a performance discount. The amount is defined as the maximum total rehabilitation cost for complete rehabilitation of all disturbed areas, which may vary on an annual basis due to progressive rehabilitation. The amount required for the financial assurance must be the highest Total Rehabilitation Cost calculated for any year of the Plan of Operations and calculated using the formula: (Financial Assurance = Highest Total Annual Rehabilitation Cost x Percentage Required)

(A7-2) The financial assurance is to remain in force until the administering authority is satisfied that no claim on the assurance is likely.

NOTE: Where progressive rehabilitation is completed and acceptable to the administering authority, progressive reductions to the amount of financial assurance will be applicable where rehabilitation has been completed in accordance with the acceptance criteria defined within this environmental authority.

Environmentally Sensitive Areas

(A8-1) Mining activities must not be carried out in a Category B Environmentally Sensitive Area.

End of Conditions for Schedule A

Schedule B – Air

Dust nuisance

(B1-1) The release of dust and/or particulate matter resulting from the ERAs must not cause an environmental nuisance at any dust sensitive place.

(B1-2) Exceedance of any of the following levels when measured at any dust sensitive place is an environmental nuisance for the purposes of condition (B1-1).

(a) Dust deposition of 120 milligrams per square metre per day, when monitored in accordance with Australian Standard AS 3580.10 of 1991; OR

(b) A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometre (µm) (PM10) suspended in the atmosphere of 150 micrograms per cubic metre over a twenty-four (24) hour averaging time, at a dust sensitive place downwind of the site, when monitored in accordance with:

- Australian Standard AS 3580.9.6 'Ambient air - Particulate matter - Determination of suspended particulate PM10 high-volume sampler with size-selective inlet - Gravimetric method'; or
- any alternative method of monitoring PM10 which may be permitted by the 'Air Quality Sampling Manual' as published from time to time by the administering authority.

(B1-3) When requested by the Administering Authority, dust and particulate monitoring must be undertaken to investigate any complaint of environmental nuisance caused by dust and/or particulate matter, and the results notified within fourteen (14) days to the administering authority following completion of monitoring. Monitoring must be carried out at a place(s) relevant to the potentially affected dust sensitive place and at upwind control site and must include:

(a) for a complaint alleging dust nuisance, dust deposition; and

(b) for a complaint alleging adverse health effects caused by dust, the concentration per cubic metre of particulate matter with an aerodynamic diameter of less than 10 micrometre (µm) (PM10) suspended in the atmosphere over a twenty-four (24) hour averaging time.

(B1-4) If monitoring indicates exceedance of the relevant limits in Condition (B1-2), then the environmental authority holder must:

(a) address the complaint including the use of appropriate dispute resolution if required; or

(b) immediately implement dust abatement measures so that emissions of dust from the ERAs do not result in further environmental nuisance.

Odour nuisance

(B2-1) Subject to condition (B2-2), the release of noxious or offensive odour(s) or any other noxious or offensive airborne contaminant(s) resulting from the ERAs must not cause an environmental nuisance at any sensitive or commercial place.

(B2-2) When requested by the administering authority, odour monitoring must be undertaken within a reasonable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of an authorised person) of environmental nuisance at any sensitive or commercial place, and the results must be notified within fourteen (14) days to the administering authority following completion of monitoring.

(B2-3) If monitoring indicates Condition (B2-2) is not being met then the environmental authority holder must:

(a) address the complaint including the use of appropriate dispute resolution if required; or

(b) immediately implement odour abatement measures so that emissions of odour from the ERAs do not result in further environmental nuisance.

End of Conditions for Schedule B

Schedule C – Water

Release to Waters and Monitoring

(C1-1) Contaminants must not be released from the site to any waters or the bed and banks of any waters.

Stormwater management

(C2-1) There must be no release of stormwater runoff that has been in contact with any contaminants at the site to any waters, roadside gutter or stormwater drain.

End of Conditions for Schedule C

Schedule D - Noise

Noise nuisance

(D1-1) Subject to Conditions (D1-2) and (D1-3) noise from the ERAs must not cause an environmental nuisance, at any sensitive or commercial place.

(D1-2) When requested by the administering authority, noise monitoring must be undertaken within a reasonable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of an authorised person) of environmental nuisance at any sensitive or commercial place, and the results must be notified within fourteen (14) days to the administering authority following completion of monitoring.

(D1-3) Where the noise limits defined in Schedule D - Table 1 are not being exceeded by the conduct of the ERAs, then condition (D1-1) is not breached. For the purposes of this condition, noise monitoring must include:

(a) $L_{A, max\ adj, T}$; and

(b) the level and frequency of occurrence of impulsive or tonal noise; and

(c) atmospheric conditions including wind speed and direction; and

(d) location, date and time of recording.

(D1-4) If noise monitoring indicates exceedance of the limits in Schedule D - Table 1, then the environmental authority holder must:

(a) address the complaint including the use of appropriate dispute resolution if required; or

(b) immediately implement noise abatement measures so that emissions of noise from the ERAs do not result in further environmental nuisance.

Schedule D - Table 1 (Noise limits)

Noise level dB(A) measured as	***Monday to Saturday***			***Sundays and public holidays***		
	7am - 6pm	***6pm – 10pm***	***10pm - 7am***	***9am - 6pm***	***6pm - 10pm***	***10pm - 9am***
	Noise measured at a 'Noise sensitive place'					
L_{A10}, adj, 10 mins	*50*	*45*	*35*	*50*	*45*	*35*
L_{A1}, adj, 10 mins	*55*	*50*	*40*	*55*	*50*	*40*
	Noise measured at a 'Commercial place'					
L_{A10}, adj, 10 mins	*55*	*50*	*40*	*55*	*50*	*40*
L_{A1}, adj, 10 mins	*60*	*55*	*45*	*60*	*55*	*45*

Note: The method of measurement and reporting of noise levels must comply with the latest edition of the Environmental Protection Agency's Noise Manuals.

End of Conditions for Schedule D

Schedule E – Waste

General

(E1-1) The holder of this environmental authority must not:

(a) burn waste at or on the site; nor

(b) allow waste to burn or be burnt at or on the site; nor

(c) remove waste from the site and burn such waste elsewhere.

(E1-2) Records of agreements for disposal, treatment or transport of waste must be made available for inspection on request.

Notification of Improper Disposal of Regulated Waste

(E2-1) If the holder of this environmental authority becomes aware that a person has removed regulated waste from the site and disposed of the regulated waste in a manner which is not authorised by this environmental authority, or is improper or unlawful, then the registered operator of this environmental authority must, as soon as practicable, notify the administering authority of all relevant facts, matters and circumstances known concerning such removal or disposal.

On site waste disposal

(E3-4) Any waste which is not authorised to be disposed of on the site must be disposed of at a facility that lawfully accepts such waste, or removed from the site for lawful recycling.

Storage of waste on the site

(E4-1) Waste stored on the site must be stored in a manner sufficient to prevent any unauthorised environmental contamination.

End of Conditions for Schedule E

Schedule F - Land

Buffer zones

(F1-1) There must be no mining activities conducted in the buffer zones identified on figure 1 of Schedule I of this environmental authority, other than for the construction or removal of amenity banks, environmental control works, and activities involved with access or provision of services to the lease areas.

Rehabilitation landform criteria

(F3-1) All areas significantly disturbed by mining activities must be rehabilitated in accordance with Schedule F – Table 2.

Schedule F - Table 2 (Final Land Use and Rehabilitation Outcome Schedule)

Tenure ID	Disturbance Type	Projective Surface Area (ha)	Rehabilitation Outcome
ML50070	Backfilled/rehabilitated old coal mining void (western sector of lease)	2.5	Native ecosystem
	Old coal mining spoil dump (western sector of lease)	0.7	Native ecosystem
	Mine excavation area	13.0	Native ecosystem

Rehabilitation Outcome – Native Ecosystem

(F6-1) For the purposes of Schedule F – Table 2 (Final Land Use and Rehabilitation Outcome Criteria), areas that are to be rehabilitated to native ecosystem must comply with the following outcomes:

(a) achievement of a self-sustaining native ecosystem with a species composition and distribution similar to the pre-mining species composition and distribution; and

(b) the landform must be suitable to support the ecosystem in (F5-1) a) and be stable and non-polluting.

(F6-2) Complete an investigation into rehabilitation of disturbed areas and submit a report to the administering authority proposing acceptance criteria for the outcomes in (F5-1). A report on that investigation and acceptance criteria must be submitted to the administering authority by 30 June 2010.

Rehabilitation Outcome – water storage

(F8-1) Complete an investigation into rehabilitation of disturbed areas for a water storage outcome and submit a report to the administering authority proposing rehabilitation acceptance criteria. A report on that investigation and acceptance criteria must address:

(a) water quality to be achieved in the water filled void;

(b) water quality to be achieved for any discharges from the void;

(c) revegetation standards to be met for the fringes of the void; and

(d) and the report must be submitted to the administering authority at least 24 months prior to the expiry date or proposed surrender, whichever is sooner, of the relevant tenure.

Progressive Rehabilitation

(F8-1) Progressive rehabilitation must commence within three years of areas become available within the operational land.

Infrastructure

(F9-1) All infrastructure, constructed by or for the environmental authority holder during the mining activities including water storage structures, must be removed from the site prior to mining lease surrender, except where agreed in writing by the post mining land owner / holder.
NOTE: This is not applicable where the landowner / holder is also the environmental authority holder.

End of Conditions for Schedule F

Schedule G - Community

Complaint response

(G1-1) All complaints received must be recorded including investigations undertaken, conclusions formed and action taken. This information must be made available to the administering authority on request.

End of Conditions for Schedule G

Schedule H - Definitions

"acceptance criteria" means the measures by which the actions implemented to rehabilitate the land are deemed to be complete. The acceptance criteria indicate the success of the rehabilitation outcome or remediation of areas which have been significantly been disturbed by the mining activities. Acceptance criteria may include information regarding:

- vegetation establishment, survival and succession;
- vegetation productivity, sustained growth and structure development;
- fauna colonisation and habitat development;
- ecosystem processes such as soil development and nutrient cycling, and the recolonisation of specific fauna groups such as collembola, mites and termites which are involved in these processes;
- microbiological studies including recolonisation by mycorrhizal fungi, microbial biomass and respiration;
- effects of various establishment treatments such as deep ripping, topsoil handling, seeding and fertiliser application on vegetation growth and development;
- resilience of vegetation to disease, insect attack, drought and fire;
- vegetation water use and effects on ground water levels and catchment yields.

"administering authority" means the Environmental Protection Agency or its successor.

"ambient (or total) noise" at a place, means the level of noise at the place from all sources (near and far), measured as the Leq for an appropriate time interval.

"annual return" means the return required by the annual notice (under section 316 of the *Environment Protection Act, 1994*) for the section 86(2) environmental authority that applies to the environmental authority.

"authority" means environmental authority (mining activities) under the *Environmental Protection Act 1994*.

"commercial place" means a place used as an office or for business or commercial purposes, other than a place within the boundaries of the land the subject of this environmental authority.

"competent person" means a person with the demonstrated skill and knowledge required to carry out the task to a standard necessary for the reliance upon collected data or protection of the environment.

"dam" means a containment or proposed containment whether permanent or temporary, which is designed to contain, divert or control flowable substances. However this does not include a fabricated or manufactured tank or container designed to a recognised standard.

"dust sensitive place" means -

- a dwelling, mobile home or caravan park, residential marina or other residential place;
- a motel, hotel or hostel;
- a kindergarten, school, university or other educational institution;
- a medical centre or hospital;
- a protected area;
- a park or gardens; or
- a place used as an office or for business or commercial purposes.
- and includes the curtilage of any such place.

"dwelling" means any of the following structures or vehicles that is principally used as a residence-

- a house, unit, motel, nursing home or other building or part of a building;
- a caravan, mobile home or other vehicle or structure on land;
- a water craft in a marina.

"environmental authority registered operator" means the registered operator of this environmental authority.

"event release" means when water is released or at least four times a year.

"hazardous waste" means any substance, whether liquid, solid or gaseous, derived by or resulting from, the processing of minerals that tends to destroy life or impair or endanger health.

"$L_{A\ 10,\ adj,\ 10\ mins}$" means the A-weighted sound pressure level, *(adjusted for tonal character and impulsiveness of the sound)* exceeded for ten percent (10%) of any 10-minute measurement period, using Fast response.

"$L_{A\ 1,\ adj,\ 10\ mins}$" means the A-weighted sound pressure level, *(adjusted for tonal character and impulsiveness of the sound)* exceeded for one percent (1%) of any 10-minute measurement period, using Fast response

"$L_{A,\ max\ adj,\ T}$" means the average maximum A-weighted sound pressure level, adjusted for noise character and measured over any 10 minute period, using Fast response.

"land" in the "land schedule" of this document means land excluding waters and the atmosphere.

"land use" term to describe the selected post mining use of the land, which is planned to occur after the cessation of mining operations.

"mg/L" means milligrams per litre.

"µs/cm" means micro semen per centimetre.

"mineral" means a substance which normally occurs naturally as part of the earth's crust or is dissolved or suspended in water within or upon the earth's crust and includes a substance which may be extracted from such a substance, and includes—

(a) clay if mined for use for its ceramic properties, kaolin and bentonite;
(b) foundry sand;
(c) hydrocarbons and other substances or matter occurring in association with shale or coal and necessarily mined, extracted, produced or released by or in connection with mining for shale or coal or for the purpose of enhancing the safety of current or future mining operations for coal or the extraction or production of mineral oil therefrom;
(d) limestone if mined for use for its chemical properties;
(e) marble;
(f) mineral oil or gas extracted or produced from shale or coal by in situ processes;
(g) peat;
(h) salt including brine;
(i) shale from which mineral oil may be extracted or produced;
(j) silica, including silica sand, if mined for use for its chemical properties;
(k) rock mined in block or slab form for building or monumental purposes;

but does not include—

(l) living matter;
(m) petroleum within the meaning of the *Petroleum Act 1923*;
(n) soil, sand, gravel or rock (other than rock mined in block or slab form for building or monumental purposes) to be used or to be supplied for use as such, whether intact or in broken form;
(o) water.

"noxious" means harmful or injurious to health or physical well being, other than trivial harm.

"nuisance sensitive place" includes -

- a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- a motel, hotel or hostel; or
- a kindergarten, school, university or other educational institution; or
- a medical centre or hospital; or
- a protected area under the *Nature Conservation Act 1992*, the *Marine Parks Act 1992* or a World Heritage Area; or
- a public thoroughfare, park or gardens; or
- a place used as a workplace, an office or for business or commercial purposes.

and includes a place within the curtilage of such a place reasonably used by persons at that place.

"odour sensitive place" has the same meaning as a "dust sensitive place"

"offensive" means causing reasonable offence or displeasure; is disagreeable to the sense; disgusting, nauseous or repulsive, other than trivial harm.

"progressive rehabilitation" means rehabilitation (defined below) undertaken progressively or a staged approach to rehabilitation as mining operations are ongoing.

"reference site" (or analogue site) may reflect the original location, adjacent area or another area where rehabilitation success has been completed for a similar biodiversity. Details of the reference site may be as photographs, computer generated images and vegetation models etc.

"rehabilitation" the process of reshaping and revegetating land to restore it to a stable landform and in accordance with the acceptance criteria set out in this environmental authority and, where relevant, includes remediation of contaminated land.

"representative" means a sample set which covers the variance in monitoring or other data either due to natural changes or operational phases of the mining activities.

"self sustaining" means an area of land which has been rehabilitated and has maintained the required acceptance criteria without human intervention for a period nominated by the administering authority.

"sensitive place" means;

- a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- a motel, hotel or hostel; or
- an educational institution; or
- a medical centre or hospital; or
- a protected area under the *Nature Conservation Act 1992*, the *Marine Parks Act 1992* or a World Heritage Area; or
- a public park or gardens; or
- a place used as a workplace, an office or for business or commercial purposes which is not part of the mining activity and does not include employees accommodation or public roads.

"site" means the place to which this environmental authority relates or the premises to which this environmental authority relates.

“stable” means geotechnical stability of the rehabilitated landform where instability related to the excessive settlement and subsidence caused by consolidation / settlement of the wastes deposited, and sliding / slumping instability has ceased.

"this authority" means this environmental authority/environmental authority.

“trivial harm” means environmental harm which is not material or serious environmental harm and will not cause actual or potential loss or damage to property of an amount of, or amounts totalling more than $5,000.

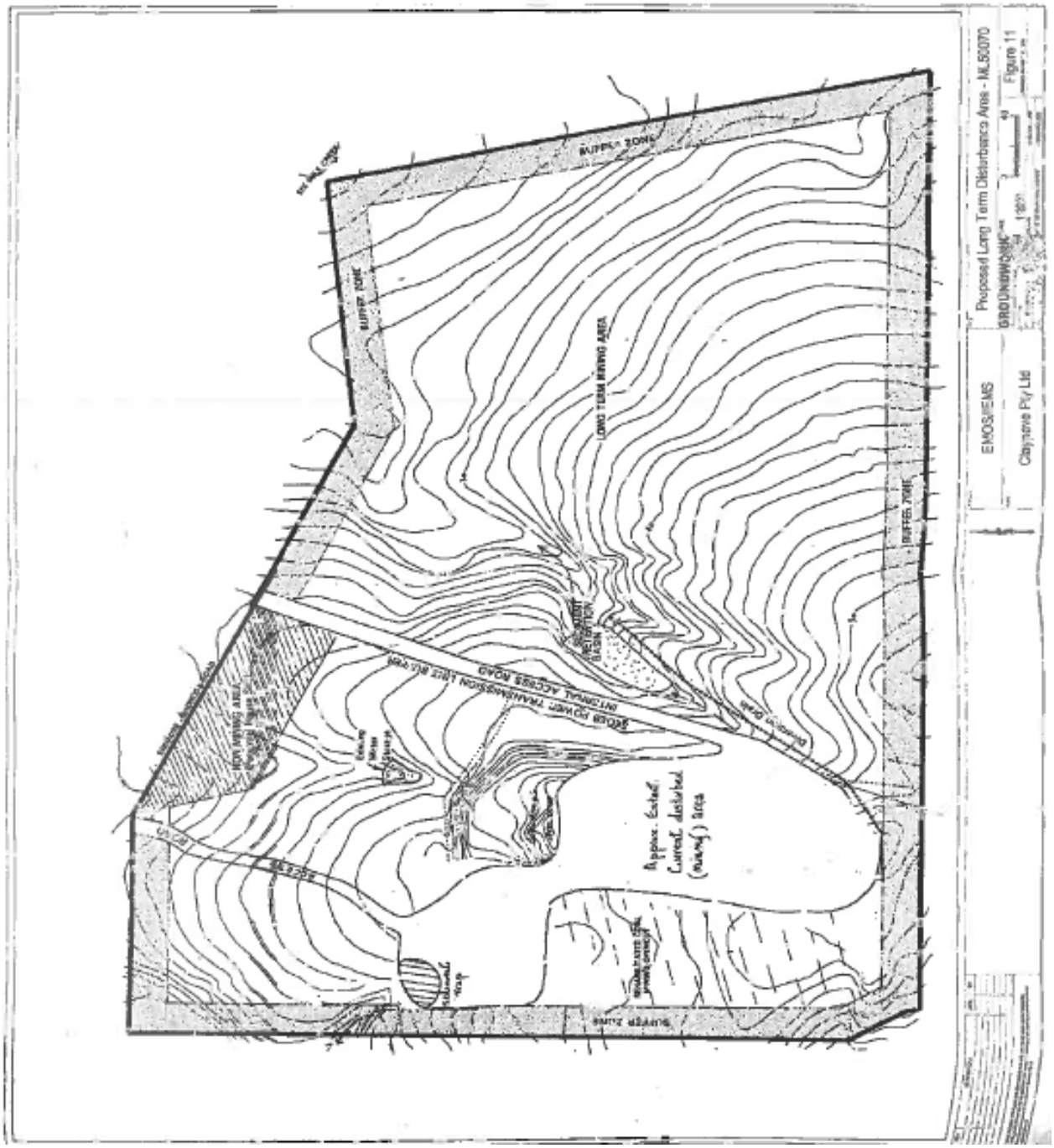
"you" means the registered operator of this environmental authority or owner / occupier of the land which is the subject of this environmental authority.

"waters" includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water natural or artificial watercourse, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and groundwater and any part-thereof.

End of Conditions for Schedule H

Schedule I - Maps / Plans

Figure 1 – ML50070 Buffer Zones.



End of Conditions for Schedule I

END OF ENVIRONMENTAL AUTHORITY

PART B – ATTACHMENTS PRCP SCHEDULE

Appendix 1 – PRCP Schedule
Appendix 2 – EA0001386 – Land Outcome Document
Appendix 3 – Ecological Studies
Appendix 4 – Mine Planning Report
Appendix 5 – Topsoil Assessment
Appendix 6 – Hydrogeological Assessment

Jackal Renewables Pty Ltd; ML50070

Appendix 3 – Ecological Studies

Ecological Report for Lot 73 on SP128662, 149 Rhondda Road, New Chum

Ardent Group Pty Ltd

31st October 2018

Sticks & Stones Environmental
ABN 69108 199 254

DOCUMENT CONTROL SHEET

Street Address:	323 Candle Mountain Drive Peachester 4519
Postal Address:	PO Box 458 Beerwah Queensland 4519
Phone:	0412 936 361
Email:	sticksandstonesenv@bigpond.com
Web:	http://www.sticksandstonesenv.com.au/

Project:	Material Change of Use - Special Industry (Waste recycling and reprocessing – waste transfer station, crushing, milling or grinding), Minor Utility, Caretakers Residence and Environmentally Relevant Activities (ERA33, ERA61 (B) and ERA62)	**Issue Date:**	16/10/2018
Title:	Ecological Report for Lot 73 on SP128662, 149 Rhondda Road, New Chum		
Project Manager:	Michele Deveze		
Author:	Michele Deveze		
Client:	Ardent Group Pty Ltd		
Client Contact:	Richard Davis, 07 3368 1033		

Revision Number	Date	Description	To	Prepared by	Approved by
Rev A	28/09/2018	Draft	Internal	MD	MD
Rev B	03/10/2018	Draft for Client	Client - Ardent	MD	MD
Rev C	08/10/2018	Draft for Client	Client - Jackal	MD	MD
00	19/10/2018	Draft for Client	Client - Jackal	MD	MD
01	31/10/2018	Final	Client - Jackal	MD	MD
02					
03					
04					

ECOLOGICAL REPORT FOR LOT 73 ON SP128662, 149 RHONDDA ROAD, NEW CHUM

EXECUTIVE SUMMARY

Sticks & Stones Environmental was commissioned by Ardent Group Pty. Ltd., to undertake a vegetation, fauna and flora survey of the location of a proposed development site at Lot 73 on SP128662 (149 Rhondda Road, New Chum). The survey was conducted on September 27th 2018 and found that no conservation significant plants or animals were observed during the survey; and that no Endangered Regional Ecosystems or Threatened Ecological Communities were observed during the survey. It was considered that in general the Lot provides some habitat opportunity for animals, birds and reptiles; however, within the Lot the proposed development site has limited habitat opportunity available, and that it is unlikely that the proposed development will have an adverse impact on any protected plant or animal species or vegetation associations.

Statement of Limitations

This report has been prepared in accordance with the agreement between Ardent Group Pty. Ltd. and Sticks & Stones Environmental.

Within the limitations of the agreed upon scope of services, this work has been undertaken and performed in a professional manner, in accordance with generally accepted practices, using a degree of skill and care ordinarily exercised by members of its profession and consulting practice. No other warranty, expressed or implied, is made.

This report is solely for the use of Ardent Group Pty. Ltd. and Jackal Renewables Pty Ltd and any reliance on this report by third parties shall be at such parties' sole risk and may not contain sufficient information for the purposes of other parties or for other uses. This report shall only be presented in full and may not be used to support any other objective than those set out in the report, except where written approval with comments are provided by Sticks & Stones Environmental.

Table of Contents

DOCUMENT CONTROL SHEET ii

Executive Summary iii

1 Introduction 1

1.1 Objectives and Scope 1

1.2 Proposed Disturbance 2

1.3 Description of the Development Site 2

2 Legislation and Planning 7

2.1 International Agreements 7

2.1.1 Ramsar Convention on Wetlands 1971 7

2.2 Commonwealth Legislation 7

2.2.1 Environment Protection and Biodiversity Conservation Act 1999 7

2.2.2 Red Imported Fire Ant 8

2.3 State Legislation 8

2.3.1 Vegetation Management Act 1999 8

2.3.2 Referable Wetlands 9

2.3.3 Nature Conservation Act 1992 9

2.3.4 South-East Queensland Koala Conservation State Planning Regulatory Provisions 10

2.3.5 Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016 11

2.3.6 The *Environmental Offsets Act 2014* and subordinate Legislation 11

2.3.7 Biosecurity Act 2014 12

2.3.8 Red Imported Fire Ants 13

2.4 Ipswich City Council Planning Scheme 13

2.4.1 Desired Environmental Outcomes and Performance Indicators 13

2.4.2 Implementation Guideline No. 19 Vegetation Retention 14

2.4.3 Fact Sheet No 4 Vegetation Management 14

3 Method 15
3.1 Desktop Study 15
3.2 Field Survey 16
3.2.1 Vegetation Survey 16
3.2.2 Protected Plant Survey 16
3.2.3 Fauna Survey 16
3.2.4 Spot Assessment Technique Survey 17
3.2.5 Weed and Pest Survey 17
3.3 Survey Limitations 17
3.3.1 Flora and Vegetation 17
3.3.2 Fauna 17
4 Results 18
4.1 Desktop Study 18
4.2 Desktop Study – Flora and Vegetation Associations 18
4.3 Desktop Study – Fauna 27
4.4 Desktop Study – Other State Government Matters 45
4.4.1 Vegetation Management Property Report – Essential Habitat 45
4.4.2 SPP Biodiversity. 45
4.4.3 DA Vegetation Mapping 45
4.4.4 SPP Bushfire Hazard. 45
4.4.5 Red Imported Fire Ants 45
4.5 Desktop Study – Ipswich City Council Planning Scheme 46
4.6 Desktop Study Discussion 46
5 Results – Field Study 47
5.1 Field Survey – Vegetation Associations 47
5.2 Field Survey – Protected Plants 53
5.3 Field Survey – Weeds 53
5.4 Field Survey – Fauna 53

5.5 Koala Survey.....59
5.6 Habitat and Connectivity.....59
6 Discussion 67
6.1 Vegetation, Vegetation Associations and Habitat 67
6.2 Protected Flora 68
6.3 Protected Fauna 68
6.4 Weeds and Pest Animals.....68
7 Ipswich City Council Assessment Requirements 70
7.1 Vegetation Management Code.....70
7.2 Ipswich Planning Scheme.....70
8 Potential Impacts 72
9 Recommendations 73
References 74

Figures..... 75
Figure 1 The Location of the Proposed Development at 149 Rhondda Road, New Chum 75
Figure 2 Surrounding Landuse of the Proposed Development Site.....75
Figure 3 Landscape Context of the Proposed Development Site.....75
Figure 4 Field Survey Traverse.....75

Appendix I..... 76
IPSWICH CITY COUNCIL CITY PLAN REPORT AND MAPS 76
APPENDIX II 77
SITE LAYOUT PLAN FOR 149 RHONDDA ROAD, NEW CHUM, DRAWING NUMBER C1 DEVELOPMENT PLAN.....77

APPENDIX III 78
MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE UNDER THE EPBC ACT .78
APPENDIX IV 79
WILDNET ONLINE REPORT 79
APPENDIX V 80
VEGETATION MANAGEMENT REPORT AND PRE-CLEARING MAPPING 80
APPENDIX VI 81
STATE PLANNING POLICY AND DEVELOPMENT ASSESSMENT MAPPING 81
APPENDIX VII 82
RED IMPORTED FIRE ANT MAPPING 82

Table 1 EVNT Plant Species Listed in On-Line Data-Searches as Potentially Present on Site and Preferred Habitat 21
Table 2 EVNT Animal Species Listed in On-Line Data-Searches as Potentially Present on Site and their Preferred Habitat 28
Table 3 Migratory Species Protected Under International Agreements Potentially Present on Site 44
Table 4 Terrestrial Plants Recorded during the Survey 50
Table 5 Bird Species Observed During the Survey 53

1 INTRODUCTION

1.1 OBJECTIVES AND SCOPE

Sticks & Stones Environmental was commissioned by Ardent Group Pty. Ltd., to undertake a vegetation, fauna and flora survey of the location of a proposed development site at Lot 73 on SP128662 (149 Rhondda Road, New Chum (the Lot)) (the proposed development site) (**Figure 1**). The Lot is zoned RBIA02 - Regional Bus & Industry Investigation (New Chum) and REC - Recreation (**Appendix I**) under the 2006 Consolidated Ipswich City Council Planning Scheme. The Lot largely is co-incident with Mining Lease ML 50070, also held by the land owner and project proponent, Jackal Renewables Pty Ltd.

The scope of this report is as follows:

- Describe the methods used to survey the vegetation associations, flora, fauna and habitat present on site;
- On the basis of desktop and field ecological surveys of the site -
    - Describe the vegetation associations, flora, fauna and habitat present on site, and potentially present on site – with particular reference to vegetation associations, fauna, and flora protected by Commonwealth, State or Local legislation, and demonstrating the presence or absence of Koala on the site;
    - Identify the biodiversity values on and neighbouring the site including important linkages;
    - Describe ecological functionality and habitat values such as hollows, fire scars, nests, canopy size, foraging resources, stags, or fallen timber;
- Analyse the results of the surveys and present the findings;
- Discuss the potential impacts on identified site ecological values, that may be caused by the proposed development;
- Recommend measures to conserve and link important habitat for significant species with potential habitat on the site; and
- Provide a summary of the findings and recommendations for ecological management of the site before, during, and after development activities occur.

1.1.1 The Need for this Survey

The need for this survey has come from the Council information request dated 26 April 2018. The request included;

> 6. Ecological Report
>
> Arial photography of the site indicates that approximately 1 hectare of native vegetation along the western property boundary has already been cleared to

accommodate the footprint of this development. This vegetation borders onto a Stream Order 2. Further, Ipswich City Council (ICC) has several koala siting records from nearby locations.

(a) Therefore, in accordance with the TLPI No.1/2018 (Waste Activity Regulation) and the Specific Outcome 1 in Table 12.4.1 of the Ipswich City Council Vegetation Management Code, the applicant is requested to demonstrate how "clearing of vegetation does not cause or exacerbate land degradation within environmentally sensitive areas including steeply sloping land, areas prone to erosion or salinity, riparian corridors, wetlands or water catchment areas". The applicant is therefore requested to submit a vegetation survey in order to demonstrate compliance with sections 4.3.3 (4)(f); 4.3.3(4)(g) of the Urban Areas Code. (note this reference was subsequently corrected to section 6.7 (j) (a)(d) by ICC.)

1.2 Proposed Disturbance

The proposed disturbance is a Material Change of Use - Special Industry (Waste recycling and reprocessing – waste transfer station, crushing, milling or grinding), Minor Utility, Caretakers Residence and Environmentally Relevant Activities (ERA33, ERA61 (B) and ERA62), and involves battering and levelling the existing fibre cement sheet stockpile area and part of the relict mine overburden and topsoil storage area, constructing a ring road, and constructing ancillary infrastructure. The development proposal is shown in **Appendix II**. As far as practical it is intended to use existing roads, tracks and other cleared areas for infrastructure development.

1.3 Description of the Development Site

The Site

The Lot covers 25.38ha with access frontage on Rhondda Road and frontage to Six Mile Creek to the to the east (**Figure 1**). The Lot is in the New Chum mining area and generally is heavily disturbed with relict open cut pits, excavations, trenches and piles of mine overburden and topsoil (**Plates 1** and **2**). The proposed development will be largely located on an area of reject fibre cement-sheet and fibre cement-sheet by-product (**Plate 3**), and on levelled and battered relict mine overburden stockpiles (**Plates 2** and **10**). The Lot is unequally divided by a power line right of way which also provides a north-south access synonymous with the east part of the proposed ring road (**Figure 1**). The open cut pit and land-fill area is to the west of the power easement – this area generally is the area proposed for development. To the east of the power line right of way, and outside the proposed development footprint, is an active clay pit (**Figure 1**, **Plate 4**).

Historical aerial photography shows that, although surrounded by active mining, the Lot was largely undeveloped until the early 1980s. Since that time the pit has remained active, unfilled, or otherwise unrehabilitated (**Plates 5**, **6** and **7**) [For note, because the 'QImagery' rectification process is predominantly automated, the location of the Lot on the aerial photography, as provided by the Queensland Department of State Development, is not precise]. However, it appears that parts of the eastern portion of the Lot were cleared in 1971, but over intervening decades it has started to regenerate. Although aerial photography does not indicate disturbance

on the site until the early 1980s, there is evidence of extensive minor disturbance across the entire site, including excavations, drill holes, temporary camp/accommodation infrastructure, and limited fly tipping.



Plate 1 The Clay-Shale Mine Pit



Plate 2 Acacia and Eucalypt Natural Regeneration on Topsoil Stockpile



Plate 3 Fibre Cement Sheet Stockpile Adjacent to the Clay-Shale Mine Pit



Plate 4 Clay Pit Outside the Proposed Development Area

Adjoining Properties

The Lot is surrounded by mine sites, some of which are still active, some of which are being used for other industrial purposes such as landfill or broadscale industrial activities such as compost preparation, or clay extraction and masonry production; other areas are holding water or are actively or naturally regenerating (**Figure 2**).

A small wetland, assumed to be an inundated mine pit, adjoins the Lot to the north-west, and a larger wetland, also assumed to be a relict mine pit, runs parallel to the southern and western boundaries of the Lot (**Figure 1**). Six Mile Creek, which forms the eastern boundary of the Lot is in the northernmost part of a relatively contiguous corridor that runs from slightly south of Ipswich Motorway to an extensive area of native vegetation south of Centenary Highway (**Figure 3**). However, urban development surrounds the corridor to the east and west, consequently, although of local significance, the corridor along Six Mile Creek has limited regional importance.



Plate 5 QAP 2258 Frame 24 May 1971



Plate 6 QAP 4019 Frame 128 May 1982

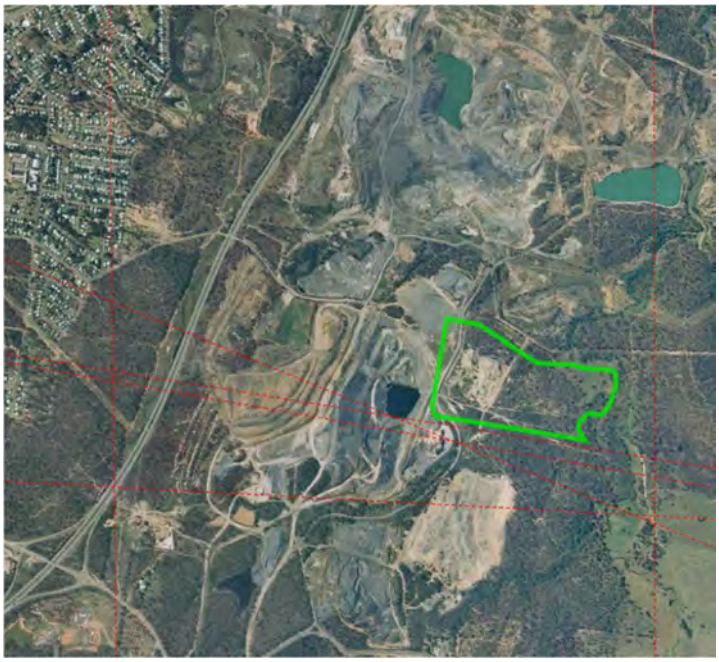


Plate 7 QAP 5588 Frame 28 October 1997

2 LEGISLATION AND PLANNING

This Section provides an overview of legislation and agreements that generally apply to development where vegetation needs to be cleared in the Brisbane Region. Reference to any piece of legislation or policy does not infer that that piece of legislation or policy is triggered by the proposed development. The findings of the desktop and field survey will be assessed against the following legislative requirements.

2.1 INTERNATIONAL AGREEMENTS

2.1.1 RAMSAR CONVENTION ON WETLANDS 1971

The aims of the Ramsar Convention on Wetlands 1971 are to halt the worldwide loss of wetlands and to conserve those that remain. The Ramsar Convention encourages the designation of sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity. Once designated, these sites are added to the Convention's List of Wetlands of International Importance and become known as Ramsar sites. In designating a wetland as a Ramsar site, countries agree to establish and oversee a management framework aimed at conserving the wetland and ensuring its wise use. Australia currently has 65 Wetlands of International Importance listed under the Ramsar Convention.

In Australia, primary responsibility for managing wetlands and their associated flora and fauna is vested in the appropriate landholders or land managers. National Guidelines for Ramsar Wetlands are being developed by the Commonwealth Department of the Environment to facilitate improved management of Ramsar sites in line with Australia's commitments under the Ramsar Convention and responsibilities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

2.2 COMMONWEALTH LEGISLATION

2.2.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places as defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The nine Matters of National Environmental Significance which the EPBC Act applies to are:

- World heritage properties,
- National heritage places,
- Wetlands of international importance (called 'Ramsar' wetlands),
- Nationally threatened species and ecological communities,
- Migratory species,
- Commonwealth marine areas,

- The Great Barrier Reef marine park,
- Nuclear actions (including uranium mining), and
- A water resource in relation to coal seam gas development and large coal mining development.

An on-line database, 'EPBC Act Protected Matters Report', provides geospatial information of the sightings or locations of MNES. If MNES are, or are likely, to be affected by a proposed development, the matter must be referred to the Commonwealth Department of the Environment (DotE). On the basis of the Referral, the Commonwealth Minister for the Environment will determine if the project is a 'Controlled Action'. The Referral includes an assessment of the Significance of the Impact on any MNES present, or likely to be present, in the impact area. If an action is considered to be a Controlled Action there may be a requirement to provide offsets under the *EPBC Act Environmental Offsets Policy 2012*.

2.2.2 Red Imported Fire Ant

Under the EPBC Act the Australian Government, in consultation with the States and Territories and other key stakeholders, has developed a threat abatement plan to provide a national framework to mitigate the potential impact of the group of ants known as tramp ants, including the Red Imported Fire Ant. The National Red Imported Fire Ant Eradication Program is administered in Queensland by Biosecurity Queensland, Department of Agriculture and Fisheries (**Section 2.3.8**).

2.3 State Legislation

2.3.1 Vegetation Management Act 1999

Clearing native vegetation in Queensland is regulated by the *Vegetation Management Act 1999* (VM Act), and subordinate legislation, Policies and Codes. The purpose of the VM Act is to regulate the clearing of Endangered, Of Concern and Least Concern Regional Ecosystems (REs), to manage the environmental effects of clearing, to prevent land degradation and loss of biodiversity, and to maintain ecological processes. This is achieved by developing a decision-making framework, preparing Codes which relate to the assessment of vegetation clearing, and protecting some regrowth vegetation in certain circumstances.

Many routine clearing activities can be undertaken under an exemption or by simply notifying the Department of Natural Resources and Mines (DNRM). Whether or not a permit will be needed depends on the type of vegetation, the land tenure of the land, and the location, extent and purpose of the proposed clearing. Self-assessable Codes apply to a range of activities such as fodder harvesting and weed control; the practices listed in the Code must be followed and DNRM must be notified before clearing starts. Area Management Plans which apply to certain clearing activities can be prepared by groups of landholders or rural organisations.

Development approvals may be required if the clearing cannot be conducted under an exemption, self-assessable Code, or Area Management Plan. Any Remnant Vegetation on freehold or leasehold land tenure, and any High Value Regrowth vegetation on leasehold land, may only be cleared under a Development Authority (DA) for Operational Works – Vegetation

Clearing. The application for a DA is assessed against State Development Assessment Provisions (SDAP) Module 8 under the *Sustainable Planning Act 2009* (SP Act).

Geospatially referenced mapping of Remnant Vegetation and Regional Ecosystems is available on-line. The mapping indicates areas of Endangered, Of Concern and Least Concern vegetation under the VM Act; it also indicates areas of High Value Regrowth and of known Essential Habitat.

It is noted that clearing vegetation for a resource activity under the Environmental Protection Act is exempt under Schedule 21, Part 1 (6) of the *Planning Regulation 2017*. Jackal Renewables has advised that the proposed development the subject of the MCU application will be located in an area cleared during the mining activities on ML 50070.

2.3.2 Referable Wetlands

The map of Referable Wetlands identifies the location of wetland protection areas (WPA) in Great Barrier Reef catchments. The Queensland wetland mapping was produced using existing information including water body mapping derived from Landsat satellite imagery, regional ecosystem mapping, topographic data, and a springs database. The result is a consistent wetland map for the whole of Queensland.

High impact earthworks within WPAs indicated on the map of referable wetlands are regulated under the SP Act. SDAP Module 11 regulates development in and near wetlands in a WPA. Development applications for Material Change of Use, Reconfiguring a Lot or Operational Works involving high impact earthworks either wholly or partly within a WPA are assessed by Local Government or the Department of State Development (DSD) as an assessment manager or referral agency. High impact earthworks include the construction of new drains, placing fill, or constructing levies that will significantly alter the hydrology of a WPA wetland.

2.3.3 Nature Conservation Act 1992

Much of Queensland's native wildlife is protected under the *Nature Conservation Act 1992* (NC Act) to ensure its survival and to protect biodiversity. All native birds, reptiles, mammals and amphibians are protected in Queensland, as well as a limited range of invertebrates, freshwater fish, and the grey nurse shark. All plants that are indigenous to Australia are protected. A licensing system helps protect native wildlife from over-exploitation and from the impacts of exotic species. These controls ensure that viable wild populations of plants and animals are maintained and that taking, keeping, using or moving wildlife for commercial, recreational or other purposes is monitored.

In Queensland, all plants that are native to Australia are protected plants under the NC Act. The *Nature Conservation (Wildlife) Regulation 2006* schedules plants and animals that are protected under statutory provisions in Queensland. These include Extinct in the Wild, Endangered, Near Threatened, Vulnerable, Special Least Concern, and Least Concern (EVNT, SLC and LC)

The NC Act endeavours to ensure that protected plants (whole plants or protected plant parts) and protected animals are not illegally removed from the wild, or illegally traded. The *Nature Conservation (Wildlife Management) Regulation 2006* regulates the clearing, growing, harvesting and trade of protected plants in Queensland. In most instances, commonly occurring native plants can be taken and used for a range of commercial, operational and recreational purposes in Queensland without a license or permit. However, a license, permit or authority

may be required to take and use native plants or animals listed as Special Least Concern (SLC), Endangered, Vulnerable or Near Threatened (EVNT) under the *Nature Conservation Act 1992*.

An on-line database, 'Wildlife On-line', provides geospatial information of the sightings of plants and animals. Geospatially referenced mapping of Remnant Vegetation and Regional Ecosystems also indicates areas of known Essential Habitat. The 'Protected Plants Flora Survey Trigger Map' indicates areas of known protected plant habitat. If a proposed impact site falls within the 'Protected Plants Flora Survey Trigger Map' a survey of the site must be done to determine if any EVNT plants are present on that site. (*HTTP://WWW.EHP.QLD.GOV.AU/LICENCES-PERMITS/PLANTS-ANIMALS/PROTECTED-PLANTS/FRAMEWORK-GUIDE.HTML*).

2.3.4 South-East Queensland Koala Conservation State Planning Regulatory Provisions

The South-East Queensland Koala Conservation State Planning Regulatory Provisions (SPRP) is an overarching state planning instrument that regulates new development at the development assessment stage. The SPRP covers areas of the highest priority for koala conservation action. This incorporates Priority Koala Assessable Development Areas which are made up of the Koala Coast and Pine Rivers areas, and Koala Assessable Development Areas which are made up of areas managed under previous State Koala conservation initiatives.

The SPRP prohibits clearing bushland habitat in the priority areas of Koala Coast and Pine Rivers, and in areas outside the urban footprint. Urban development is also prohibited in conservation, open space, rural and rural-residential zones within the Koala Coast and Pine Rivers areas. This approach aims to support habitat for the koala populations at risk. The SPRP provides requirements for all development activity to minimise its impact on koalas. Depending on the development type and koala habitat type, requirements may include:

- Avoiding, minimising or offsetting clearing non-juvenile koala habitat trees,
- Site design that provides safe koala movement opportunities appropriate to the development type and habitat connectivity values of the site,
- Construction phases that do not increase the risk of death or injury to koalas,
- Clearing native vegetation sequentially, and
- Clearing koala habitat trees in the presence of a koala spotter.

Koala Habitat for South-East Queensland Local Government Authorities includes:

Non-juvenile koala habitat tree means a tree of any of the following genera:

- Angophora,
- Corymbia,
- Eucalyptus,
- Lophostemon,
- Melaleuca,

which is more than 4m high; or has a trunk with a circumference of more than 31.5cm at 1.3m above the ground (*Nature Conservation (Koala) Conservation Plan 2006*).

Essential habitat is an area of essential habitat on the essential habitat map for an animal that is endangered wildlife or vulnerable wildlife or a plant that is endangered wildlife or vulnerable wildlife.

Habitat for koalas as a Matter of State Environmental Significance (MSES).

2.3.5 Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016

The Koala Plan, in relation to planning and development assessment, has now been replaced by the SPRP. Other elements of the Koala Plan, such as policies relating to sequential clearing, use of a koala spotter, the rehabilitation of injured or sick koalas and translocation remain in place. The Koala Conservation Plan established three Koala Districts (A, B and C) (**Plate 8**). The boundaries of the districts have been determined on the basis of the conservation status of the species and the significance of threatening processes affecting the species. Sequential clearing requirements of Koala Habitat Trees defined under the NC Act is in place in Koala Districts A and B, and koala spotters are required in Koala Habitat Areas in district A.

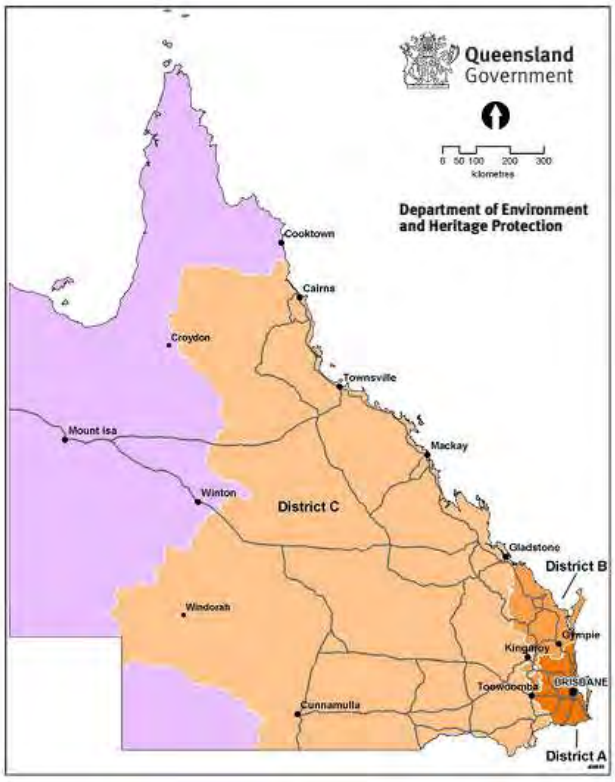


Plate 8 Koala Districts A, B and C (Koala Conservation Plan)

2.3.6 The *Environmental Offsets Act 2014* and subordinate Legislation

Under a number of existing Queensland laws, if there is an unavoidable impact on significant environmental values, offsets may be required for certain developments. Offset actions, which can include improvement and protection of alternative sites and/or actions that improve environmental viability, can provide a conservation outcome that is equivalent to the environmental value being lost. The *Environmental Offsets Act 2014* (EO Act) is the overarching legislative instrument that administers Environmental Offsets for matters which require offsetting under some Queensland legislation.

The EO Act has provision for Offsets to be provided under the VM Act, the NC Act, the SPRP and the *Fisheries Act 1994*. Section 2.3.1.6 of the Queensland Environmental Offsets Policy (Version 1.1) December 2014 details requirements for offsetting Koala habitat. The EO Act also makes provision for Local Government to nominate Matters of Local Environmental Significance (MLES) and gives Local Governments the authority to require offset arrangements for MLES that may be affected by development or disturbance.

2.3.7 BIOSECURITY ACT 2014

The Queensland *Biosecurity Act 2014* (Biosecurity Act) which commenced in July 2016, refers to 'Designated Biosecurity Matter' which includes pest plants and animals. These are further classified as either 'Prohibited' or 'Restricted':

- Prohibited Matter is biosecurity matter not currently present or known to be present in Queensland. It is prohibited because it may have a significant adverse effect on a biosecurity consideration if it did enter Queensland, and
- Restricted Matter is biosecurity matter found in Queensland that may have adverse effects on a biosecurity consideration if conditions or restrictions under the Act were not imposed.

Prohibited Plants are listed in Schedule 1 Part 3 of the Biosecurity Act, and Prohibited Animals are listed in Schedule 1 Part 4 of the Biosecurity Act. Restricted Plants and Restricted Animals are listed in Schedule 2 Part 2 of the Biosecurity Act.

Restricted Plants and Animals may be allocated one or more 'Categories':

> **Category 1** includes red imported fire ants, electric ants, Asian honey bees, and certain animal diseases, aquatic diseases and pathogens. Category 1 restricted matter must be reported to an inspector within 24 hours.
>
> **Category 2** restricted matter includes certain noxious fish, weeds and pest animals such as spotted gar and red-eared slider turtle. Category 2 restricted matter must be reported to an inspector or authorised person within 24 hours.
>
> **Category 3** includes weeds, pest animals and noxious such as: gambusia, dingoes, or yellow crazy ants. This restricted matter must not be distributed: it must not be given as a gift, sold, traded or released into the environment unless the distribution or disposal is authorised in a regulation or under a permit. Deliberate human distribution or disposal contrary to the legislation is a key source of spread into other areas of the state.
>
> **Category 4** includes specific weeds, pest animals and noxious fish such as: the bitou bush, feral pig or giant cichlid. To ensure that it does not spread into other areas of the state this restricted matter must not be moved.
>
> **Category 5** includes weeds, pest animals and noxious fish such as: Mexican feather grass, rabbits and carp. This restricted matter cannot be possessed or kept under your control. These pests have a high risk of having a negative impact on the environment.

This restricted matter may only be kept under a permit of the *Biosecurity Act 2014* or another Act.

Category 6 includes invasive animals such as: feral deer, foxes, rabbits and wild dogs and noxious fish such as carp, gambusia and tilapia. This category of restricted matter cannot be purposefully or intentionally fed. Feeding this restricted matter may cause their numbers to increase and have a negative impact the economy or the environment. Feeding for the purpose of preparing for or undertaking a control program is exempted.

Category 7 includes noxious fish such as: carp, weatherloach, climbing perch, gambusia and tilapia. These animals may not be kept. They must be killed and the carcass disposed of by burying the whole carcass, with no parts removed, in the ground above the high tide water mark, or by placing it in a waste disposal receptacle.

2.3.8 Red Imported Fire Ants

The National Red Imported Fire Ant Eradication Program (NRIFAEP) is a nationally funded program which aims to eradicate this exotic pest (**Section 2.2.2**). In Queensland the NRIFAEP is administered under provisions in the *Plant Protection Act 1989*, and subordinate legislation. Within a High Risk Restricted Area for Red Imported Fire Ants, movement of restricted items is controlled, and an Approved Risk Management Plan or an Inspector's Approval is required to move restricted items from the site. The National Red Imported Fire Ant Eradication Program is administered in Queensland by Biosecurity Queensland, Department of Agriculture and Fisheries.

2.4 Ipswich City Council Planning Scheme

2.4.1 Desired Environmental Outcomes and Performance Indicators

The Ipswich City Councils Desired Environmental Outcomes and Performance Indicators under the Ipswich Planning Scheme requires:

> The desired environmental outcomes for the Local Government area are as follows—
>
> (a) the values of significant natural features, including the principal conservation areas are not compromised;
>
> (b) adverse effects on the natural environment are minimised or prevented with respect to the loss of natural vegetation and associated habitat, soil degradation, air pollution and water pollution owing to erosion, chemical contamination, acidification, salinity, sewage and wastewater treatment, management and effluent disposal and the like...

Performance Indicators listed are:

> Where development has occurred, has it—
>
> (a) adversely affected the significant natural features in the local government area;
>
> (b) resulted in soil degradation, water pollution, air pollution or inappropriate clearing of natural vegetation.

2.4.2 Implementation Guideline No. 19 Vegetation Retention

The Ipswich City Councils Implementation Guideline No.19 Vegetation, under the Ipswich Planning Scheme states:

> The purpose of this guideline is to create opportunities and provide solutions to retain vegetation on land identified as suitable for development. Where Council accepts that the retention of vegetation is not appropriate or feasible (e.g. on part or all of the site), the development should provide for nil net loss of vegetation in the general locality.

However, the Guideline further states:

> The guideline does not apply in respect to land which is zoned for dense forms of development, such as Residential Medium and High Density, Commercial, Retail, Business and Industry and similar zoned areas except where vegetation clearing is proposed within greenfield locations.

Therefore this guideline does not apply to the proposed development (as it is zoned Regional Business and Industry Investigation) and has not been addressed in this report.

Ipswich Planning Scheme – Part 12 Division 4 Vegetation Management Code

The specific outcomes for the management of vegetation are set out in Table 12.4.1 of this Code. Council has advised in the information request that consideration needs to be given to achieving specific outcome 1 of Table 12.4.1, namely "*the clearing of vegetation does not cause or exacerbate land degradation within environmentally sensitive areas including steeply sloping land, areas prone to erosion or salinity, riparian corridors, wetlands or water catchment areas*".

2.4.3 Fact Sheet No 4 Vegetation Management

The Ipswich City Councils Fact Sheet No 4 Vegetation Management, under the Ipswich Planning Scheme summarises Commonwealth and State Government legislation relevant to vegetation clearing, and details Ipswich City Councils vegetation management arrangements. Table 5.1 of the Fact Sheet states that for Regional Business and Industry Investigation zoning, if the clearing is less than 0.5ha in a five year period it is Self-Assessable, however if more than 0.5ha are to be cleared the clearing is Code Assessable and planning approval is required.

3 METHOD

3.1 DESKTOP STUDY

The desktop study drew from information derived from publicly available datasets. The information was collected and collated to provide a detailed overview of Commonwealth, State and Local environmentally significant matters potentially present on site.

A desktop study of Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and potentially present on site, was downloaded from:
HTTP://WWW.ENVIRONMENT.GOV.AU/WEBGIS-FRAMEWORK/APPS/PMST/PMST-COORDINATE.JSF (27/09/2018) (**Appendix III**);

A desktop study of Protected Plants and Animals under the NC Act, and potentially present in the proposed disturbance area was downloaded from:
HTTPS://ENVIRONMENT.EHP.QLD.GOV.AU/REPORT-REQUEST/SPECIES-LIST/ (29/09/2018) (**Appendix IV**);

Vegetation Management maps and data and the Protected Plants Flora Survey Trigger Map were downloaded from:
HTTPS://WWW.DNRM.QLD.GOV.AU/QLD/ENVIRONMENT/LAND/VEGETATION/VEGETATION-MAP-REQUEST-FORM (04/09/2018) and *HTTPS://ENVIRONMENT.EHP.QLD.GOV.AU/MAP-REQUEST/RE-BROAD-VEG-GROUP/* (29/09/2018) (**Appendix V**);

State Planning Policy and Development Assessment mapping were viewed on-line, and relevant maps were downloaded from:
HTTPS://PLANNING.DSDMIP.QLD.GOV.AU/MAPS (28/09/2018) (**Appendix VI**);

Archival Aerial Photography was downloaded from:
HTTPS://QIMAGERY.INFORMATION.QLD.GOV.AU/ (28/09/2018) (**Figures 5, 6** and **7**);

Red Imported Fire Ant Mapping was downloaded from:
HTTPS://WWW.DAF.QLD.GOV.AU/__DATA/ASSETS/PDF_FILE/0006/1384476/FIRE_ANT_BIOSECURITY_ZONE_MAP.PDF (**Appendix VII**), and

Ipswich City Council City Plan 2014 mapping – overlays were viewed on-line, and relevant maps were downloaded from:
HTTP://PDONLINE.IPSWICH.QLD.GOV.AU/PDONLINE/USER/HOME/DEFAULT.ASPX?PAGE=WELCOME (28/09/2018) (**Appendix I**).

Information on the distribution, ecology, and preferred habitat of EVNT plant species and protected vegetation potentially present on site, was collated, reviewed, and used to determine the field survey methods.

The information collated is summarised in **Section 4.2**, **Section 4.3**, **Section 4.4** and **Section 4.5**, and discussed in **Section 4.6**. The results of the desk-top study were used to focus the ecology field surveys.

3.2 Field Survey

An ecology, and protected plant survey in accordance with Queensland State Guidelines, and to meet requirements under Ipswich City Council's guidelines, was conducted of the site on the 27th of September 2018 by Sticks & Stones Environmentals' Principal Ecologist Michele Deveze.

Michele Deveze has over 25 years' experience in ecological management and assessment. Her area of expertise includes: fauna and flora survey and identification, Regional Ecosystem verification, Biocondition Assessment, and vegetation management planning.

The weather on the day of the survey was warm and generally overcast with a maximum temperature of 27°C and a very light breeze. There had been consistently light and irregular rainfall during the six months preceding the survey, consequently, although the waterbodies surrounding the Lot were well filled, the groundcover and shrubs were generally desiccated, grasses had no inflorescence or seed, and in many instances shrubs were completely or partially defoliated.

3.2.1 Vegetation Survey

The details of all observed shrub and tree species within the proposed development site were recorded during the survey. Collections were made of unfamiliar plants for later identification.

Details including: component species, structure, density, and the predominant height of strata were recorded for all vegetation associations on the proposed development site, and in accordance with Neldner *et al* (2012). The information recorded was used to determine the accuracy of existing vegetation mapping.

3.2.2 Protected Plant Survey

The method employed for the survey followed the preferred method in 'Flora Survey Guidelines - Protected Plants *Nature Conservation Act 1992*' (2014), based on the 'Timed Random Meander' survey method designed by Cropper (1993), and Goff *et al*. (1982).

The ecology of the EVNTs listed as potentially present on site was reviewed (**Table 1**) and descriptions were obtained of each of the species potentially present in the proposed impact area. A record was made of each species observed during the survey (**Table 4**). Any species not able to be identified in the field and any potential threatened species found during the survey were collected for positive identification. The survey ceased when either no new species was recorded for 30 minutes or when the entire area of habitat type was surveyed.

The timed meander method has been demonstrated as a means of discovering threatened and endangered species that have low incidence or an uneven distribution across a site, and as a means of documenting a low probability of occurrence of such species if they have not been found during the procedure (Goff *et al.*, 1982).

3.2.3 Fauna Survey

Information was also collected on fauna observed on site, and signs and indicators of fauna – including scratch marks and faeces, hollows and nests, and other indicators of the presence or use of fauna on site, such as trails, and diggings. The quality of potential terrestrial habitat and connectivity was assessed.

3.2.4 Spot Assessment Technique Survey

The Spot Assessment Technique (SAT) survey method of indirect survey was used to assess the probability and intensity of Koala use of the site. The method quickly establishes presence of Koalas and activity levels within a survey area (Phillips and Callaghan, 2011). The method requires a centre tree to be selected, and a one metre radius around it to be searched for two person minutes for Koala pellets.

3.2.5 Weed and Pest Survey

Other information collected during the survey included the presence, distribution and abundance of weeds and pest plants, and any indication of the presence of feral animals. To complete the vegetation survey, the natural and physical environment, the topography, and soils and geology of the site and the surrounding area was described.

3.3 Survey Limitations

3.3.1 Flora and Vegetation

The Lot is generally heavily disturbed and some parts are inaccessible by foot or vehicle. Much of the generally undeveloped area is scattered with relict earthworks and excavations which provide access hazards. Some parts of the site have a dense and impenetrable Lantana (*Lantana camara**) cover, or are covered with tall rank grasses. Given the access restrictions, a complete survey of the site was not possible.

Generally, the site was very dry. It is possible that cryptic or ground dwelling plant species present may not have been recorded because they were not evident under the weather conditions, or were concealed by dense Lantana or grass growth. Repeat assessments to address seasonality were not included in the survey.

3.3.2 Fauna

The fauna survey was dependent on direct observation, and observation of tracks, scats or signs and did not employ quantitative ecological assessment techniques, such as fauna trapping. Also, repeat assessments to address seasonality were not included in the survey.

4 RESULTS

4.1 DESKTOP STUDY

The results of the searches described in **Section 3.1** are summarised in **Section 4.2**, **Section 4.3**, **Section 4.4** and **Section 4.5**, and are discussed in **Section 4.6** .

4.2 DESKTOP STUDY – FLORA AND VEGETATION ASSOCIATIONS

The desktop study for flora and vegetation associations is based on the Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (**Appendix III**), the 'Wildlife On-Line Report' (**Appendix IV**), and the Vegetation Management Property Report (**Appendix V**).

Three Threatened Ecological Communities (TEC) listed under the EPBC Act were indicated as potentially present on the site (**Appendix III**):

- Lowland Rainforest of Subtropical Australia Critically Endangered Community may occur within the area
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community Endangered community likely to occur within area
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Community may occur within the area

A small area of mapped Category C Regional Ecosystem (RE) 12.3.3 is mapped in the north-western corner of the Lot, and the proposed development site is generally surrounded by Category C RE 12.9-10.2, 12.9-10.7, and 12.9-10.19. A small area of RE 12.9-10.2 is mapped on the south-eastern part of the proposed development site and extends into the eastern part of the Lot, as does the RE 12.9-10.2, 12.9-10.7 mixed polygon. the mapping for Six Mile Creek and the adjacent creek flats shows Category C Regional Ecosystem (RE) 12.3.3 (**Appendix V**).

RE 12.3.3 (Endangered) is described as:

> *Eucalyptus tereticornis* woodland on Quaternary alluvium
>
> *Eucalyptus tereticornis* woodland. *Eucalyptus crebra* and *E. moluccana* are sometimes present and may be relatively abundant in places, especially on edges of plains and higher level alluvium. Other species that may be present as scattered individuals or clumps include *Angophora subvelutina* or *A. floribunda, Corymbia clarksoniana, C. intermedia, C. tessellaris, Lophostemon suaveolens* and *E. melanophloia*. Occurs on Quaternary alluvial plains, terraces and fans where rainfall is usually less than 1000mm/y. (BVG1M: 16c)
>
> Vegetation communities in this regional ecosystem include:
>
> 12.3.3a: *Eucalyptus crebra, C. tessellaris* woodland to open forest. Other species that may be present as scattered individuals or clumps include *Corymbia clarksoniana, Eucalyptus melanophloia, E. tereticornis* and *C. citriodora* subsp. *variegata*. Occurs on

high level alluvial plains often of Pleistocene age, terraces and fans where rainfall is usually less than 1000mm/y. Floodplain (other than floodplain wetlands). (BVG1M: 18b)

12.3.3b: [Not in RE version 10.1][2]: Open forest to woodland of *Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra*, with a sparse to mid-dense understorey of *Melaleuca irbyana*. Occurs on margins of Quaternary alluvial plains. Floodplain (other than floodplain wetlands). (BVG1M: 13d)

12.3.3c: [Not in RE version 10.1][2]: *Melaleuca irbyana* low open forest or thicket. Emergent *Eucalyptus moluccana, E. crebra, E. tereticornis* or *Corymbia citriodora* subsp. *variegata* may be present. Occurs on Quaternary alluvial plains where drainage of soils is impeded. Palustrine wetland (e.g. vegetated swamp). (BVG1M: 21b)

12.3.3d: *Eucalyptus moluccana* woodland. Other frequently occurring species include *Eucalyptus tereticornis, E. crebra, E. siderophloia, Corymbia citriodora* subsp. *variegata, Angophora leiocarpa* and *C. intermedia*. Occurs on margins of Quaternary alluvial plains often adjacent sedimentary geologies. May also occur on stranded Pleistocene river terraces. Floodplain (other than floodplain wetlands). (BVG1M: 13d)

[2] Superseded: Revision of the regional ecosystem classification removed this regional ecosystem code from use in version 10 RE mapping. It is included in the regional ecosystem description database because the RE code may appear in older versions of RE mapping and regulation.

12.9-10.2 (Least Concern) is described as:

Corymbia citriodora subsp. *variegata* +/- *Eucalyptus crebra* open forest on sedimentary rocks

Corymbia citriodora subsp. *variegata* open forest or woodland usually with *Eucalyptus crebra*. Other species such as *Eucalyptus tereticornis, E. moluccana, E. acmenoides* and *E. siderophloia* may be present in scattered patches or in low densities. Understorey can be grassy or shrubby. Shrubby understorey of *Lophostemon confertus* (whipstick form) often present in northern parts of bioregion. Occurs on Cainozoic and Mesozoic sediments. (BVG1M: 10b)

12.9-10.7 (Of Concern) is described as:

Eucalyptus crebra +/- *E. tereticornis, Corymbia tessellaris, Angophora* spp., *E. melanophloia* woodland on sedimentary rocks

Eucalyptus crebra +/- *E. tereticornis, Corymbia tessellaris, Angophora leiocarpa, E. melanophloia* woodland. Occurs on Cainozoic and Mesozoic sediments. (BVG1M: 13c)

Vegetation communities in this regional ecosystem include:

12.9-10.7a: *Eucalyptus siderophloia, Corymbia intermedia* +/- *E. tereticornis* and *Lophostemon confertus* open forest. Occurs on Cainozoic and Mesozoic sediments in near coastal areas. (BVG1M: 12a)

12.9-10.19 (Least Concern) is described as:

Eucalyptus fibrosa subsp. *fibrosa* woodland on sedimentary rocks

Eucalyptus fibrosa subsp. *fibrosa* woodland +/- *Corymbia citriodora* subsp. *variegata*, *E. acmenoides* or *E. portuensis, Angophora leiocarpa, E. major*. Understorey often sparse. Localised occurrences of *Eucalyptus sideroxylon*. Occurs on Cainozoic and Mesozoic sediments. (BVG1M: 12a)

Vegetation communities in this regional ecosystem include:

12.9-10.19a: *Corymbia henryi* and/or *Eucalyptus fibrosa* subsp. *fibrosa* open forest. Other commonly associated species include, *Corymbia citriodora* subsp. *variegata, E. carnea, E. siderophloia, E. crebra* and *E. major*. Occurs in coastal areas on Cainozoic and Mesozoic sediments. (BVG1M: 10b)

Pre-clearing Regional ecosystems mapped for the site include 12.3.3, 12.9-10.2, 12.9-10.7, and 12.9-10.19. (**Appendix V**).

The Vegetation Management Report also indicated that the proposed development site is mapped as a High Risk Area on the Protected Plants Flora Survey Trigger Map (**Appendix V**). Consequently, a Protected Plant survey was conducted in accordance with the Flora Survey Guidelines - Protected Plants prepared under the *Nature Conservation Act 1992*.

EVNT plants listed in the two on-line reports (**Appendix III** and **Appendix IV**) are presented in **Table 1**.

Table 1 EVNT Plant Species Listed in On-Line Data-Searches as Potentially Present on Site and Preferred Habitat

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
Bosistoa transversa	Three-leaved Bosistoa, Yellow Satinheart	small tree		Vulnerable	Species or species habitat likely to occur within area	*Bosistoa transversa* grows in wet sclerophyll forest, dry sclerophyll forest and rainforest up to 300 m in altitude. Associated vegetation includes *Argyrodendron trifoliolatum, Syzygium hodgkinsoniae, Endiandra pubens, Dendrocnide photinophylla, Acmena ingens, Diploglottis australis* and *Diospyros mabacea*. *HTTP://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?BOSISTOA-TRANSVERSA*
Callitris baileyi	Bailey's cypress		Near Threatened			*Callitris baileyi* grows on rocky slopes, hilly or mountainous areas, in shallow and often clay soils. It is found in eucalypt woodland, commonly associated with ironbark, blue gum and spotted gum. *HTTPS://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?CALLITRIS-BAILEYI*
Cycas ophiolitica				Endangered	Species or habitat likely to occur within area	*Cycas ophiolitica* grows on hills and slopes in sparse, grassy open forest at altitude ranges from 80–400 m above sea level. Although this species reaches its best development on red clay soils near Marlborough, it is more frequently found on shallow, stony, infertile soils, which are developed on sandstone and serpentinite, and is associated with species such as *Corymbia dallachiana, C. erythrophloia, C. xanthope* and *Eucalyptus fibrosa*. *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=55797*
Dichanthium setosum	Bluegrass			Vulnerable	Species or species habitat likely to occur within area	*Dichanthium setosum i*s associated with heavy basaltic black soils and red-brown loams with clay subsoil (NSW OEH 2013a). Associated species include White Box *(Eucalyptus albens),* Silver-

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
						leaved Ironbark *(Eucalyptus melanophloia),* Yellow Box *(Eucalyptus melliodora),* Manna Gum *(Eucalyptus viminalis),* Amulla *(Myoporum debile),* Purple Wire-grass *(Aristida ramosa),* Kangaroo Grass *(Themeda triandra),* Fine-leaved Tussock-grass *(Poa sieberiana),* Red-leg Grass *(Bothriochloa ambigua),* Pitted Blue-grass *(Bothriochloa decipiens), Macrozamia stenomera,* Small Woolly Burr-medic *(Medicago minima),* Scaly Buttons *(Leptorhynchos squamatus), Lomandra* aff. *longifolia,* Australian Bugle *(Ajuga australis),* Bogan-flea *(Calotis hispidula)* and *Austrodanthonia* spp., *Dichopogon spp., Brachyscome* spp., *Vittadinia* spp., *Wahlenbergia* spp. and *Psoralea* spp. (Ayers *et al.* 1996; NSW OEH 2013a). *Dichanthium setosum* is often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. It is often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched. The species may tolerate or benefit from disturbance, otherwise, disturbance is indicative of threatening processes in its habitat (NSW OEH 2013a). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=14159*

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
Eucalyptus curtisii	Plunkett Mallee		Near Threatened			*Eucalyptus curtisii* has two growth forms that occur in different habitats. The shorter mallee form is more likely to occur as the only eucalypt species on poorly drained lowland sites in shrubland dominated by banksia, with an understorey of heath plants, and sometimes *E. conglomerata* may also be present. The larger growth form occurs as scattered individuals on better drained soils in the more open areas of mixed eucalypt forests. Commonly associated species include *Corymbia citriodora* subsp. *variegata*, *C. trachyphloia* and *Callitris endlicheri*, less commonly associated with *E. fibrosa*, *E. planchoniana* and *E. acmenoides*. *E. curtisii* occurs on sandy podsoils with impeded drainage, shallow stony soils, clay loams and stony clays with a surface layer of loose stones. *HTTPS://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?EUCALYPTUS-CURTISII*
Hernandia bivalvis	Cudgerie		Near Threatened			*Hernandia bivalvis* mainly grows in rainforest on rock pavements and outcrops with shallow soils. Most Queensland Herbarium records are from either vine thicket or microphyll vine forest. It occurs up to 620 m altitude. *HTTPS://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?HERNANDIA-BIVALVIS*
Lilaeopsis brisbanica			Endangered			*Lilaeopsis brisbanica* grows along tidal riverbanks in grey saline mud, in association with mangrove trees. Although occurring naturally in areas near saline waters, fresh water is satisfactory for the growth of *Lilaeopsis brisbanica*. *HTTPS://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?LILAEOPSIS-BRISBANICA*

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
Marsdenia coronata	Slender Milkvine		Vulnerable			*Marsdenia coronata* is restricted to south-east Queensland where it commonly grows in rainforest or moist areas of open forest, especially in eucalypt forest. It has been observed on rainforest margins. Also recorded from an area of natural grassland on the top of Mt Kandanga, Imbil State Forest. The vine has been found between 40 and 780 m asl, and usually occurs on sandstone or stony soils. Associated vegetation includes: eucalypt open forest with *Corymbia maculata* and *Eucalyptus crebra*; tall open forest of *E. propinqua* and *E. siderophloia* with developing shrubby vineforest understorey; open forest of *E. pilularis*, *E. microcorys*, *Corymbia intermedia*; grassy open forest of *E. propinqua*, *E. carnea*, and *Themeda*; Open, grassy forest 25-30m high of *Lophostemon confertus*, *C. intermedia*, *E. acmenoides*, *Casuarina littoralis*, *Banksia integrifolia*; in open forest with *E. carnea* and *E. propinqua*; open forest of *Eucalyptus siderophloia*, *E. propinqua*, *Lophostemon confertus*; woodland of *E. tindaliae* with *Corymbia* and *E. carnea* with shrubby understorey dominated by *Pultenaea euchila*. *HTTPS://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?MARSDENIA-CORONATA*
Notelaea ipsviciensis	Cooneana Olive		Endangered	Critically Endangered	Species or species habitat likely to occur within area	The Cooneana Olive survives as an understorey plant in degraded, eucalypt dominated dry sclerophyll vegetation communities. Soils in the area are of low fertility, depauperate and sandstone-based. This species prefers open woodland communities with open canopies. The known population is adjacent to subdivided, modified and developed land. *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=81858*

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
Notelaea lloydii	Lloyd's Olive		Vulnerable	Vulnerable	Species or species habitat likely to occur within area	The species occurs on undulating to hilly terrain either in moist gullies or on gentle to steep dry slopes, but is rarely found on rocky outcrops. Soil types are mostly shallow, well drained and stony to very rocky in texture. Lloyd's Olive is found in the ecotone between eucalypt open forests and vine thickets at 80-480 m above sea level (asl). The more frequent tree species recorded with this species are Narrow-leaved Ironbark (*Eucalyptus crebra*), Spotted Gum (*Corymbia maculata*), White Mahogany (*E. acmenoides*), Lemon-scented gum (*C. citriodora*) and Curracabah (*Acacia concurrens*) with associated trees and shrubs of Kurrajong (*Brachychiton populneus*), Red Ash (*Alphitonia excelsa*), Brown Salwood (*A.aulacocarpa*), Burra (*A. falcata*) and Ebony (*Diospyros ferrea* var. *geminata*). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=15002*
Phaius australis	Lesser Swamp-orchid	ground orchid		Endangered	Species or species habitat may occur within area	*Phaius australis* grows in areas where soils are almost always damp, but not flooded for lengthy periods. Sands are generally the underlying soil type. *P. australis* are usually found in coastal habitats between swamps and forests or in suitable areas further inland. This includes swampy sclerophyll forest dominated by melaleucas, swampy forest that often have scleorphyll emergents, or fringing open forest and melaleuca swamp forest associated with rainforest species. *P. australis* has also been recorded in wallum, sedgeland, rainforest and closed forest. They often grow in deep shade, but can also occur in full sun. This species occurs at higher altitudes in northern Queensland. *HTTP://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?PHAIUS-AUSTRALIS*

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
Plectranthus habrophyllus			Endangered	Endangered		Plants have been recorded growing on chert or sandstone outcrops, in open woodlands often in shaded situations near vine forest. *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=64589*
Samadera bidwillii	Quassia	small shrub or tree		Vulnerable	Species or species habitat likely to occur within area	Lowland rainforest or on rainforest margins, but it can also be found in other forest types, such as open forest and woodland. Quassia is commonly found in areas adjacent to both temporary and permanent watercourses in locations up to 510 m altitude. The species occurs on lithosols, skeletal soils, loam soils, sands, silts and sands with clay subsoils. *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=29708*
Thesium australe	Austral Toadflax, Toadflax	erect herb		Vulnerable	Species or species habitat may occur within area	*Thesium australe* grows in grassland or woodland, often in damp sites. Examples of associated vegetation includes: open woodland with *Eucalyptus tereticornis* and *E. tindaliae* on skeletal soils; on heavy alluvium soil in grassy *E. populnea* woodland; on black cracking clay in grassland of *Dichanthium sericeum*; and grassland dominated by *Themeda triandra* and *Heteropogon contortus* on basaltic, rocky soils. *HTTP://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?THESIUM-AUSTRALE*

4.3 DESKTOP STUDY – FAUNA

EVNT fauna listed in the two on-line reports (**Appendix III** and **Appendix IV**) for the proposed development site are presented in **Table 2**. Migratory species protected under international agreements are presented in **Table 3**.

Table 2 EVNT Animal Species Listed in On-Line Data-Searches as Potentially Present on Site and their Preferred Habitat

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
Birds					
Actitis hypoleucos	Common Sandpiper	Special Least Concern			**Salt-water and fresh-water ecosystems** The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags (Geering et al. 2007; Higgins & Davies 1996). **Foraging environments** Generally the species forages in shallow water and on bare soft mud at the edges of wetlands; often where obstacles project from substrate, e.g. rocks or mangrove roots. Birds sometimes venture into grassy areas adjoining wetlands (Higgins & Davies 1996). **Roost sites** Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks (Higgins & Davies 1996).

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=59309
Anthochaera phrygia	Regent Honeyeater		Critically Endangered	Foraging, feeding or related behavior likely to occur within area	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. *HTTP://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10841*
Botaurus poiciloptilus	Australasian Bittern		Endangered	Species or species habitat likely to occur within area	The Australasian Bittern inhabits shallow (less than 30cm deep), permanent freshwater and brackish swamps or lagoons that are densely vegetated (e.g. tall reeds, sedges, lignum). They also inhabit bore drains with tussocky vegetation and occasionally saltmarsh. They use temporary pools when population densities are high and deep swamps when breeding. *HTTP://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?BOTAURUS-POICILOPTILUS*
Calidris acuminata	Sharp-tailed Sandpiper	Special Least Concern			In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. They may be attracted to mats of algae and water weed either floating or washed up around terrestrial wetlands, and coastal areas with much beachcast seaweed. Sometimes they occur on rocky shores and rarely on exposed reefs (Higgins & Davies 1996). **Foraging** They forage at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water. They also forage among inundated vegetation of saltmarsh, grass or sedges. They forage in sewage ponds, and often in hypersaline environments. After rain, they may forage in paddocks of short grass, well away from water. They may forage on coastal mudflats at low tide, and move to freshwater wetlands near the coast to feed at high tide. Occasionally they forage on wet or dry mats of algae and among rotting beachcast seagrass or seaweed, and sometimes they are recorded foraging around the edges of stony wetlands or among rocks in water, and rarely on exposed reef (Higgins & Davies 1996). **Roosting** Roosting occurs at the edges of wetlands, on wet open mud or sand, in shallow water, or in short sparse vegetation, such as grass or saltmarsh. Occasionally, they roost on sandy beaches, stony shores or on rocks in water (Higgins & Davies 1996). They have also been recorded roosting in mangroves (Minton & Whitelaw 2000). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=874*

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
Calidris ferruginea	Curlew Sandpiper		Critically Endangered	Species or species habitat known to occur within area	Intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. *HTTP://WWW.ENVIRONMENT.GOV.AU/BIODIVERSITY/THREATENED/SPECIES/PUBS/856-CONSERVATION-ADVICE.PDF*
Cuculus optatus	Oriental Cuckoo	Special Least Concern			It mainly inhabits forests, occurring in coniferous, deciduous and mixed forest. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground. It is usually secretive and hard to see. *HTTPS://EN.WIKIPEDIA.ORG/WIKI/ORIENTAL_CUCKOO*
Dasyornis brachypterus	Eastern Bristlebird		Endangered	Species or species habitat may occur within area	Habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone. *HTTP://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10206*
Erythrotriorchis radiatus	Red Goshawk	Endangered	Vulnerable	Species or species habitat likely to occur within area	Found in coastal and sub-coastal areas with tall open forest, woodland, lightly treed savannah and at the edge of rainforest. However, the breeding habitat is much more specific, with nesting only occurring in very tall trees, close to water. *HTTP://WWW.ARKIVE.ORG/RED-GOSHAWK/ERYTHROTRIORCHIS-RADIATUS/*
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Special Least Concern			In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level (Chapman 1969; Naarding 1981). They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands,

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					around bogs and other water bodies) (Frith et. al. 1977; Naarding 1983; Weston 2006, pers. comm.). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity (Frith et al. 1977; Naarding 1983). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=863*
Geophaps scripta scripta	Squatter Pigeon (southern)		Vulnerable	Species or species habitat may occur within area	Their habitat is dominated by a canopy of Eucalyptus, Corymbia, Acacia or Callitris species. They can also be found in regrowth or partially modified vegetation. Squatter pigeons are only found within 3 km of a water body or water course, and when breeding must be within 1 km. Their breeding habitat is in well-drained gravelly, sandy or loamy soil, where they nest in a shallow depression lined with grass and leaves. *HTTP://REEFCATCHMENTS.COM.AU/SPECIES_ECOSYSTEMS/SQUATTER-PIGEON-SOUTHERN/*
Grantiella picta	Painted Honeyeater		Vulnerable	Species or species habitat may occur within area	Inhabits Boree/ Weeping Myall (Acacia pendula), Brigalow (A. harpophylla) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema. Insects and nectar from mistletoe or eucalypts are occasionally eaten. *HTTPS://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10357*
Hirundapus caudacutus	White Throated Needletail	Special Least Concern			In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground (Coventry 1989; Tarburton 1993; Watson 1955). Because

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					they are aerial, it has been stated that conventional habitat descriptions are inapplicable (Cramp 1985), but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland (Higgins 1999). They also commonly occur over heathland (Cooper 1971; Learmonth 1951; McFarland 1988), but less often over treeless areas, such as grassland or swamps (Cooper 1971; Gosper 1981; Learmonth 1951). When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks (Emison & Porter 1978; Friend 1982; Tarburton 1993). In coastal areas, they are sometimes seen flying over sandy beaches or mudflats (Cooper 1971; Crompton 1936; Davis 1965), and often around coastal cliffs and other areas with prominent updraughts, such as ridges and sand-dunes (Cooper 1971; Dawson et al. 1991; Loyn 1980; Mitchell et al. 1996; Schulz & Kristensen 1994). They are sometimes recorded above islands well out to sea (Brandis et al. 1992; Cooper 1971; Warham 1957). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=682*
Lathamus discolor	Swift Parrot	Endangered	Critically Endangered	Species or species habitat may occur within area	On the mainland, it lives in eucalypt forest and woodlands, mainly box-ironbark habitats on the inland slopes of the Great Dividing Range. In some years, urban landscapes containing indigenous or non-local flowering eucalypts are also readily used. The importance of larger trees as a food source has been shown in this species' breeding range and wintering range, as such trees tend to offer a more reliable

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					and abundant source of nectar. HTTP://WWW.BIRDLIFE.ORG/DATAZONE/SPECIESFACTSHEET.PHP?ID=1488
Limosa limosa	Black Tailed Godwit	Special Least Concern			In Australia the Black-tailed Godwit has a primarily coastal habitat environment. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets. The use of habitat often depends on the stage of the tide. It is also found in shallow and sparsely vegetated, near-coastal, wetlands; such as saltmarsh, saltflats, river pools, swamps, lagoons and floodplains. There are a few inland records, around shallow, freshwater and saline lakes, swamps, dams and bore-overflows. They also use lagoons in sewage farms and saltworks (Higgins & Davies 1996). HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=845
Monarcha melanopsis	Black-faced Monarch	Special Least Concern			The Black-faced Monarch is found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. HTTP://WWW.BIRDSINBACKYARDS.NET/SPECIES/MONARCHA-MELANOPSIS
Myiagra cyanoleuca	Satin Flycatcher	Special Least Concern			Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests (Blakers et al. 1984; Emison et al. 1987; Officer 1969). HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=612
Ninox strenua	Powerful Owl	Vulnerable			The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him. *HTTPS://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10562*
Numenius madagascariensis	Eastern Curlew	Vulnerable	Critically Endangered		During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Zosteraceae). Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes within the mangroves. The birds are also found in coastal salt works and sewage farms. *HTTP://WWW.ENVIRONMENT.GOV.AU/BIODIVERSITY/THREATENED/SPECIES/PUBS/847-CONSERVATION-ADVICE.PDF*

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
Phaethon lepturus	White-Tailed Tropicbird	Special Least Concern			At the species level, the White-tailed Tropicbird occupies marine habitats in tropical waters with sea-surface temperatures of more than 22°C. The tropicbird breeds on islands and atolls, where it nests in a variety of habitats including on bare sandy ground, in closed-canopy rainforest, on rocky cliffs and in quarries. In Australia, the White-tailed Tropicbird (Indian Ocean) nests in Pisonia trees amongst Pisonia-coconut vegetation, and on sandy ground. *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=66986*
Plegadis falcinellus	Glossy Ibis	Special least Concern			The Glossy Ibis' preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons (del Hoyo et al. 1992; Hancock et al. 1992; Marchant & Higgins 1990). Within Australia, the largest contiguous areas of prime habitat is inland and northern floodplains. The Glossy Ibis is commonly in largest numbers in drying Top End grass/sedge swamps and Channel Country grass/forb meadows. The species is sometimes recorded in wooded swamps, artificial wetlands (such as irrigated fields), and in mangroves for breeding (Chatto 2000; Marchant & Higgins 1990). The species may retreat to permanent wetlands and/or coastal areas (including tidal wetlands) during drought (Marchant & Higgins 1990). Glossy Ibis roost in trees or shrubs usually near, but sometimes far, from water bodies (Brown et al. 1982; Marchant & Higgins 1990). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=991*

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
Poephila cincta cincta	Southern Black-throated Finch		Endangered	Species or species habitat may occur within area	The Black-throated Finch (southern) occurs mainly in grassy, open woodlands and forests, typically dominated by *Eucalyptus*, *Corymbia* and *Melaleuca*, and occasionally in tussock grasslands or other habitats (for example freshwater wetlands), often along or near watercourses, or in the vicinity of water (Baldwin 1976; Britton & Britton 2000; BTF Recovery Team 2004; Ley & Cook 2001; NRA 2005; Wieneke 1989). Almost all recent records of the finch from south of the tropics have been in riparian habitat (Baldwin 1976; BTF Recovery Team 2004; Ley & Cook 2001). The subspecies is thought to require a mosaic of different habitats in which it can find seed during the wet season (Mitchell 1996). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=64447*
Rhipidura rufifrons	Rufous Fantail	Special Least Concern			In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (*Eucalyptus microcorys*), Mountain Grey Gum (*E. cypellocarpa*), Narrow-leaved Peppermint (*E. radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); usually with a dense shrubby understorey often including ferns. They also occur in subtropical and temperate rainforests; for example near Bega in south-east NSW, where they are recorded in temperate Lilly Pilly (*Acmena smithi*) rainforest, with Grey Myrtle (*Backhousia myrtifolia*), Sassafras (*Doryphora sassafras*) and Sweet Pittosporum (*Pittosporum undulatum*) subdominants. They occasionally occur in secondary regrowth, following logging or disturbance in forests or rainforests. When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands, including Spotted Gum (*Eucalyptus maculata*), Yellow Box (*E. melliodora*), ironbarks or stringybarks,

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					often with a shrubby or heath understorey. They are also recorded from parks and gardens when on passage. In north and north-east Australia, they often occur in tropical rainforest and monsoon rainforests, including semi-evergreen mesophyll vine forests, semi-deciduous vine thickets or thickets of Paperbarks (*Melaleuca* spp.) (Higgins et al. 2006). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=592*
Rostratula australis	Australian Painted Snipe	Vulnerable	Endangered	Species or species habitat likely to occur within area	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. *HTTP://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10734*
Sternula albifrons	Little Tern	Special Least Concern			In Australia, Little Terns inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches. Little Terns are widespread on islands off the Northern Territory coast but appear to be less often on offshore continental islands or coral cays off Queensland (Chatto 2001; Higgins & Davies 1996; Hill et al. 1988; Johnstone & Storr 1996; NSW National Parks and Wildlife Service 2003). In the Northern Territory, Little Terns are commonly seen in sandy coastal habitats and in mangrove-mudflat habitats along the coast or in bays and estuaries, but not recorded on wetlands more than 1 km from the coast (Chatto 2001). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=813*
Tringa nebularia	Common Greenshank, Greenshank	Special Least Concern			The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. The edges of the wetlands used are generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees. It was once recorded with Black-winged Stilts (*Himantopus himantopus*) in pasture, but are generally not found in dry grassland (Higgins & Davies 1996). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=832*
Turnix melanogaster	Black-breasted Button-quail	Vulnerable	Vulnerable	Species or species habitat likely to occur within area	The Black-Breasted Buttonquail inhabits rainforests and forests. They prefer forest with an annual rainfall of 770 – 1,200 mm, a largely closed canopy and a deep layer of leaf litter. However, they can also be found in low, dense thickets, of the flowering plant Lantana, and in vegetation behind sand dunes. *HTTP://WWW.ARKIVE.ORG/BLACK-BREASTED-BUTTONQUAIL/TURNIX-MELANOGASTER/*
Mammals					
Chalinolobus dwyeri	Large-eared Pied Bat		Vulnerable	Species or species habitat likely to occur within area	Sandstone cliffs and fertile woodland valley habitat within close proximity of each other is habitat of importance to the Large-eared Pied Bat. Rainforest and moist eucalypt forest habitats on other geological substrates (rhyolite, trachyte and basalt) at high elevation are of similar importance to the species.

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=183
Dasyurus hallucatus	Northern Quoll		EWndangered	Species or species habitat may occur within area	This quoll species is most abundant in rocky ranges and open eucalypt forest.
Dasyurus maculatus maculatus	Spotted-tail Quoll		Endangered	Species or species habitat likely to occur within area	The Spot-tailed Quoll has a preference for mature wet forest habitat, especially in areas with rainfall 600 mm/year. Unlogged forest or forest that has been less disturbed by timber harvesting is also preferable. This subspecies has been recorded from a wide range of habitats, including: temperate and subtropical rainforests in mountain areas, wet schlerophyll forest, lowland forests, open and closed eucalypt woodlands, inland riparian and River Red Gum (*Eucalyptus camaldulensis*) forests, dry 'rainshadow' woodland, sub-alpine woodlands, and coastal heathlands. HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=75184
Petauroides volans	Greater Glider	Vulnerable	Vulnerable	Species or species habitat likely to occur within area	It is a strictly nocturnal, and largely solitary, arboreal species of various undisturbed eucalypt-dominated woodland and forest habitat types. It does not inhabit rainforest or pine plantations. It requires large tree hollows so it is therefore dependent on mature forest. HTTP://WWW.IUCNREDLIST.ORG/DETAILS/40579/0
Petrogale penicillata	Brush-tailed Rock-wallaby		Vulnerable	Species or species habitat may occur within area	This species prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks (Murray et al. 2008; Short 1982). It also utilises tree limbs (Maxwell et al. 1996; Sharman & Maynes 1983). While it appears that most Brush-tailed Rock-wallaby colonies are on north-facing slopes and cliff lines (Short 1982), colonies have been found on south-facing

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					cliffs in Kangaroo Valley (Kutzner & Dodd 1996; Wong 1997), in the Macleay River Gorge (Bayne 1994), in the Warrumbungles and at Mt Kaputar (Soderquist undated, pers. comm., cited in NSW NPWS 2003a), although usually in lower densities. Rocky outcrops appear crucial to current habitat selection by rock-wallabies, however, vegetation structure and composition is also considered to be an important factor (Bugg 1995; Lim & Giles 1987; Pearson 1992). In many parts of their range, including at the Warrumbungles, rock-wallabies are closely associated with dense arboreal cover, especially fig trees (NSW NPWS 2003a). The vegetation on and below the cliff appear to be important to this species as a source of food and shelter and in some cases may provide some protection from predation (Wong 1993; 1997). A range of vegetation types are associated with Brush-tailed Rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest (Murray et al. 2008). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=225*
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	Koala (combined populations of Queensland, New South Wales and the Australian	Vulnerable	Vulnerable	Species or species habitat known to occur within area	Koalas occupy forests and woodlands where there are acceptable food trees. They are largely nocturnal and feed almost exclusively on eucalypts, but preferred food tree species vary with locality and there are quite distinct regional preferences. They are able to persist in fragmented habitats, and even survive in isolated trees across a predominantly agricultural landscape. *HTTP://WWW.IUCNREDLIST.ORG/DETAILS/16892/0*

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
	Capital Territory)				
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)		Vulnerable	Species or species habitat may occur within area	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. *HTTP://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10662*
Pteropus poliocephalus	Grey-headed Flying-fox		Vulnerable	Foraging, feeding or related behaviour known to occur within area	Urban areas, forests and woodlands, intertidal mangroves. *HTTP://AUSTRALIANMUSEUM.NET.AU/GREY-HEADED-FLYING-FOX* Occurs in "subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species. *HTTP://WWW.ENVIRONMENT.NSW.GOV.AU/RESOURCES/NATURE/TSPROFILEGREYHEADEDFLYINGFOX.PDF*
Tachyglossus aculeatus	Short Beaked Echidna	Special Least Concern			In Australia, they are most common in forested areas with abundant, termite-filled, fallen logs. In agricultural areas, they are most likely to be found in uncleared scrub; they may be found in grassland, arid areas, and in the outer suburbs of the capital cities. *HTTPS://EN.WIKIPEDIA.ORG/WIKI/SHORT-BEAKED_ECHIDNA*
Amphibians					
Adelotus brevis	Tusked Frog	Vulnerable			Inhabits wet eucalypt forest, rainforest, and sometimes dry eucalypt forest, where it can be found in close proximity to suitable breeding habitat such as ponds and slow-moving sections of streams (Cogger 2000; Meyer et al. 2001; Hines 2012)

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					HTTPS://WWW.QLD.GOV.AU/ENVIRONMENT/ASSETS/DOCUMENTS/PLANTS-ANIMALS/BIODIVERSITY/TUSKED-FROG.PDF
Insects					
Argynnis hyperbius inconstans	Australian Fritillary		Critically Endangered	Species or species habitat may occur within area	The Australian fritillary usually occurs around river estuaries or open, swampy coastal regions. While the Australian fritillary has been successfully reared on *Viola hederaceae* in captivity, the subspecies is believed to be host-plant specific in the wild and therefore only occurs in areas where its larval food plant, the arrowhead violet, occurs. The arrowhead violet is a small perennial herb which usually grows in damp niches in open habitats. It often grows beneath grasses and other plants, often in association with *Lomandra longifolia* (long leaved matrush) and *Imperata cylindrica* (bladey grass). HTTP://WWW.ENVIRONMENT.GOV.AU/BIODIVERSITY/THREATENED/SPECIES/PUBS/88056-CONSERVATION-ADVICE-15082017.PDF
Reptiles					
Delma torquata	Collared Delma		Vulnerable	Species or species habitat may occur within area	This species occurs on rocky outcroppings in dry, open eucalyptus-acacia woodlands with an under-storey of grass and shrubs. It is known to inhabit leaf litter and has also been found under logs and stones. HTTP://WWW.IUCNREDLIST.ORG/DETAILS/6317/0
Furina dunmalli	Dunmall's Snake		Vulnerable	Species or species habitat may occur within area	A broad range of habitats, including: Forests and woodlands on black alluvial cracking clay and clay loams dominated by Brigalow (*Acacia harpophylla*), other Wattles (*A. burowii, A. deanii, A. leioclyx*), native Cypress (*Callitris* spp.) or Bull-oak (*Allocasuarina luehmannii*); and various Blue Spotted Gum (*Corymbia citriodora*), Ironbark (*Eucalyptus crebra* and *E. melanophloia*), White Cypress Pine (*Callitris glaucophylla*) and Bulloak open forest and woodland associations on sandstone derived soils. HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=59254

Table 3 Migratory Species Protected Under International Agreements Potentially Present on Site

Scientific Name	Common Name	EPBC Status	Comments
Migratory Marine Birds			
Apus pacificus	Fork-tailed Swift	Vulnerable	Species or species habitat likely to occur within area
Migratory Terrestrial Species			
Cuculus optatus	Oriental Cuckoo, Horsfield's Cuckoo		Species or species habitat may occur within area
Hirundapus caudacutus	White-throated Needletail		Species or species habitat known to occur within area
Monarcha melanopsis	Black-faced Monarch		Species or species habitat known to occur within area
Monarcha trivirgatus	Spectacled Monarch		Species or species habitat known to occur within area
Myiagra cyanoleuca	Satin Flycatcher		Species or species habitat known to occur within area
Rhipidura rufifrons	Rufous Fantail		Species or species habitat known to occur within area
Migratory Wetlands Species			
Actitis hypoleucos	Common Sandpiper		Species or species habitat may occur within area
Calidris acuminata	Sharp-tailed Sandpiper		Species or species habitat may occur within area
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos	Pectoral Sandpiper		Species or species habitat may occur within area
Gallinago hardwickii	Latham's Snipe, Japanese Snipe		Species or species habitat may occur within area
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus	Osprey		Species or species habitat known to occur within area

Scientific Name	Common Name	EPBC Status	Comments
Tringa nebularia	Common Greenshank, Greenshank		Species or species habitat likely to occur within area

4.4 Desktop Study – Other State Government Matters

4.4.1 Vegetation Management Property Report – Essential Habitat

The Vegetation Management Property Report (**Appendix V**) shows almost all of the Lot and most of the vegetated area in the proposed development site as Essential Habitat. Species listed in the Report are: *Phascolarctos cinereus* (Koala), *Petauroides Volans* (Greater Glider), *Ninox strenua* (Powerful Owl), *Notelaea ipsviciensis* (Cooneana Olive), and *Marsdenia coronata* (Slender Milkvine).

4.4.2 SPP Biodiversity.

The SPP Biodiversity mapping (**Appendix VI**) indicated that there is wildlife habitat, regulated vegetation (Category C), and regulated vegetation intersecting a watercourse on the proposed development site. The area of regulated vegetation is synonymous with that marked in the Vegetation Management Property Report (**Section 4.2**). A part of the Category B area to the east of the power-line easement is mapped as Essential Habitat; this area is not consistent with the area mapped as Essential Habitat in the Vegetation Management Property Report.

4.4.3 DA Vegetation Mapping

The DA Vegetation mapping (**Appendix VI**) shows Category C Regulated Vegetation and Essential Habitat on the proposed development site. The area of regulated vegetation is synonymous with that marked in the Vegetation Management Property Report (**Section 4.2**). The Essential Habitat area is inconsistent with the wildlife habitat area mapped in the SPP Biodiversity mapping but is consistent with that marked in the Vegetation Management Property Report.

4.4.4 SPP Bushfire Hazard.

The SPP Natural Hazard mapping (**Appendix VI**) indicates that there is Medium and High Potential Bushfire Intensity Hazard and Potential Impact Buffer mapped on or adjacent to the proposed development site. The Bushfire Hazard area is associated with the mapped native vegetation cover, generally with High Potential Bushfire Intensity Hazard in the Category A or B Regulated Vegetation areas, and the Medium Potential Bushfire Intensity Hazard correlates with the Category C Regulated Vegetation.

4.4.5 Red Imported Fire Ants.

The site is in Fire Ant Biosecurity Zone 1 (**Appendix VII**). To move soil from a property within Biosecurity Zone 1 you must have a Biosecurity Instrument Permit unless the soil remains within Zone 1 or the soil is moved to a waste facility within Zone 1 or Zone 2. To move mulch, manure, baled hay or straw, potted plants or turf or other fire ant carriers such as mining or quarrying products or compost, from a property within biosecurity Zone 1 you must either follow procedures outlined in the *Biosecurity Regulation 2016*; or move the material to a waste facility within Zone 1 or 2; or move the material within 24 hours of being

on the property. If you are unable to fulfil the above conditions then you must request a Biosecurity Instrument Permit from an inspector.

4.5 Desktop Study – Ipswich City Council Planning Scheme

The Planning Scheme Property Report (**Appendix I**) shows the subject Lot as RBIA02 - Regional Bus & Industry Investigation (New Chum) and REC - Recreation. The Property Report and mapping did not show any ecological attributes or bushfire hazard for the proposed development site and surrounding areas.

4.6 Desktop Study Discussion

Fourteen plant species listed as Endangered, Vulnerable or Near Threatened under State and/or Commonwealth Legislation were indicated for the site (**Table 1**), and 26 bird species, ten mammal species, one amphibian, one insect and two reptile species listed in State and/or Commonwealth legislation as Endangered, Vulnerable, Near Threatened or Special Least Concern conservation status, were indicated as potentially present on site (**Table 2**). Another 15 migratory bird species, protected under international conventions, were also indicated as potentially present on site.

With the exception of the existing excavation and fill sites, the Lot is generally covered with *Vegetation Management Act 1999* regulated remnant vegetation, however, with the exception of the north-east corner the Lot is vegetated with Category C vegetation. The majority of the mapped vegetation on the proposed development site is vegetated with Category C Of Concern vegetation, however the north-west corner is mapped as Category C Endangered vegetation. The entire Lot is mapped as a Protected Plant Survey Trigger Area.

The State Planning Policy mapping shows a Matter of State Environmental Significance – 'regulated vegetation intersecting a watercourse' generally in the location of the power-line easement and associated track, however the Property Vegetation Management Report describes this only as 'watercourse and drainage features on the vegetation management watercourse and drainage features map'.

The Vegetation Mapping and the DA mapping indicate almost all of the Lot and most of the vegetated area in the proposed development site as Essential Habitat, while the SPP Biodiversity Mapping only indicates the north-west corner and the Category B area to the east of the power-line easement, part of which is also mapped on the SPP Biodiversity Mapping, as Essential Habitat.

The State Planning Policy mapping show the Lot and adjoining areas to be Medium and High Potential Bushfire Intensity Hazard and Potential Impact Buffer however the Ipswich City Council mapping shows no Bushfire Hazard in or near the proposed development site (**Appendix VI**).

5 RESULTS – FIELD STUDY

5.1 FIELD SURVEY – VEGETATION ASSOCIATIONS

The field survey traverse is illustrated in **Figure 4** and a list of all plant species recorded during the survey is presented in **Table 4.** There are numerous mature trees on the Lot; however, the majority are to the east of the power-line right of way and are outside the proposed development area. Historic aerial imagery indicates that the proposed development site remained generally vegetated until the 1980s, when the existing mine was established on the site, however the eastern creek flats were cleared in the 1970s and have gradually regenerated over the intervening years (Habitat Area 5 on **Figure 4**).

The proposed development site is very degraded and heavily disturbed. A large portion of the site has been raised by stockpiling of fibre cement sheet (**Plate 3**), and the area immediately adjacent and to the east of this is an existing open cut mine (**Plate 1**). The area under the power lines is clear of woody vegetation and is used as a road (**Plate 9**). The area to the south-west of the existing disturbance appears to comprise stockpiled topsoil (**Plate 2**) and mine overburden (**Plate 10**), and is supporting naturally regenerated vegetation comprising almost entirely of *Acacia disparrima* with a few scattered juvenile *Eucalyptus fibrosa* (Habitat Area 3 on **Figure 4**).



Plate 9 Cleared Road Under Power-Line Easement



Plate 10 Acacia Growing on Relict Mine Spoil

The area to the north-west and to the north-east of the proposed development site is supporting better developed and more intact native vegetation (Habitat Area 1 and 2 on **Figure 4**), however the site is evidently very disturbed with indications of minor excavations through the vegetation, and areas of domestic and industrial fly tipping. There is a small amount of dead timber on the ground, sufficient to provide habitat for small reptiles.

Dominant and structural species recorded in this area include:

Corymbia citriodora subsp. *variegata*
Corymbia intermedia
Corymbia tessellaris
Eucalyptus acmenoides
Eucalyptus crebra
Eucalyptus fibrosa
Eucalyptus major
Eucalyptus moluccana
Eucalyptus tereticornis
Lophostemon confertus
Lophostemon suaveolens

The area to the north-east of the proposed development site mapped as supporting the Endangered Regional Ecosystem 12.3.3 has been inundated and the Eucalypts are all dead although most are still

standing (Habitat Area 1a on **Figure 4**). The inundation appears to have occurred many years ago, possibly as a result of change to flow regimes during historical mining activities.

Within the constraints of allocating regenerating heavily disturbed vegetation to a Regional Ecosystem, the vegetation to the north and east of the proposed development site best meets the description of 12.9-10.19 (Least Concern) and 12.9-10.2 (Least Concern).

Approximately 87 Eucalypt, Corymbia and Lophostomen trees with a diameter over bark at breast height (DBHOB) of 20cm or greater were recorded in the vicinity of the development site. Because of access constraints, the tree count is not precise and trees were not marked. It is understood that the majority of the clearing for the proposed development will occur in the area immediately to the south and west of the existing disturbance. This area generally comprises relict spoil heap from earlier mining operations, and is predominantly vegetated with regrowth Acacia (Habitat Area 3 on **Figure 4**).

It is not anticipated that 87 trees will be cleared for the proposed development – the only clearing that is planned for the area to the north and east of the existing disturbance, where the trees are larger, is widening and forming the existing road around the proposed disturbance site. When a final site layout is confirmed, an accurate survey of all Eucalypt, Corymbia, Lophostomen and Angophora trees larger than 20cm DBHOB in the disturbance footprint will be conducted, and subsequently this report will be updated.

Table 4 Terrestrial Plants Recorded during the Survey

Species	Common Name	Exotic	Biosecurity Act Listing	WONs
Acacia amblygona				
Acacia complanata	Flat Stemmed Wattle			
Acacia disparrima	Hickory Wattle			
Acacia fimbriata	Brisbane Wattle			
Acacia spectablis	Glory Wattle			
*Ageratum houstonianum**	Billy goat weed	*		
Allocasuarina torulosa	Forest Oak			
Alphitonia excelsa	Pink Ash			
*Asparagus aethiopicus**	Sprengeri Fern	*	Restricted Invasive 3	WoNS
*Baccharis halimifolia**	Groundsel	*	Restricted Invasive 3	
Breynia oblongifolia				
Bryophyllum delagoense syn. Bryophyllum tubiflorum, (Kalanchoe delagoensis)	Mother Of Millions	*	Restricted Invasive 3	
Casuarina glauca	Swamp She Oak			
*Celtis sinensis**	Chinese Celtis	*	Restricted Invasive 3	
*Cestrum parqui**	Green Cestrum	*	Invasive	
Chloris sp.*		*		
*Cirsium vulgare**	Spear Thistle	*		
Clerodendrum floribundum	Lolly Bush			
Corymbia citriodora subsp. *variegata*	Spotted Gum			
Corymbia intermedia	Pink Bloodwood			
Corymbia tessellaris	Moreton Bay Ash			
Corymbia torelliana	Cadaghi			
Daviesia sp.				

Species	Common Name	Exotic	Biosecurity Act Listing	WONs
Dianella sp.	Flax Lilly			
Dodonaea viscosa ssp. *cuneata*				
Duboisia myoporoides	Dubosia			
*Duranta repens**	Duranta	*	Invasive	
Eucalyptus acmenoides	White Mahogany			
Eucalyptus crebra	Narrow Leaved Ironbark			
Eucalyptus fibrosa	Broad-Leaved Red Ironbark			
Eucalyptus major	Grey Gum			
Eucalyptus moluccana	Gum Topped Box			
Eucalyptus tereticornis	Forest Red Gum			
Eustrephus latifolius	Wombat Vine			
Flindersia collina	Leopard Ash			
*Heliotropium amplexicaule**	Buke Heliotrope	*		
Heteropogon contortus	Black Spear Grass			
*Imperata cylindrica**	Blady Grass	*		
Indigofera sp.	Native Indigo			
*Ipomoea cairica**	Mile a Minute	*	Invasive	
*Lantana camara**	Lantana	*	Restricted Invasive 3	WoNS
*Lantana montevidensis **	Creeping Lantana	*	Restricted Invasive 3	
*Leucaena leucocephala **	Leucaena	*	Invasive	
Lomandra sp.	Lomandra			
Lophostemon confertus	Brush Box			
Lophostemon suaveolens	Swamp Box			
*Ludwigia peploides**		*		
Maclura cochinchinensis	Cockspur			

Species	Common Name	Exotic	Biosecurity Act Listing	WONs
Melaleuca salicina syn *Callistemon salignus*	White Bottlebrush			
Melaleuca viminalis syn. *Callistemon viminalis*	Weeping Red Bottlebrush			
*Neontonia wightii**	Glycine	*	Invasive	
Nymphea caerulea	Blue Water Lilly			
*Opuntia stricta**	Prickly Pear	*	Restricted Invasive 3	WoNS
Panicum decompositum	Native Millet			
Parsonsia straminea	Monkey Rope			
*Passiflora foetida**	Stinking Passionfruit	*	Invasive	
Petalostigma triloculare	Quinine			
Phragmites australis	Common Reed			
Pimelea sp.*	Pimelea			
Pinus sp.*		*		
Pteridium sp.	Bracken			
Rumex sp.*	Dock Weed	*		
*Schinus terebinthifolius**	Broad Leafed Pepper Tree	*	Restricted Invasive 3	
*Senecio madagascariensis**	Fireweed	*	Restricted Invasive 3	
*Sida cordifolia**	Flannel Weed	*		
Themeda australis	Kangaroo Grass			
*Tipuana tipu**	Pride Of Bolivia	*		
Typha sp.	Bullrush. Cumbungi			
*Verbena bonariensis**		*		
Westringia eremicola				
Xanthorrhoea sp.	Grass tree			

5.2 Field Survey – Protected Plants

A review of the preferred habitats of EVNT Plant Species potentially present on site (**Table 1**) suggests that of the 14 plants listed as potentially present, only two species – *Notelaea ipsviciensis* and *Thesium australe* were considered to potentially be present. No EVNT plant species were recorded during the survey.

5.3 Field Survey – Weeds

The survey recorded 26 exotic plant species (**Table 4**). Of those, 15 are listed as either Restricted or Invasive plants under the *Biosecurity Act 2014*, and three are listed as Weeds of National Significance (WoNS). The remainder of the exotic species recorded during the survey are either low risk weeds or garden escapees.

5.4 Field Survey – Fauna

A review of the preferred habitats of Conservation Significant Animal Species potentially present on site (**Table 2**) suggests that of the listed birds only *Anthochaera phrygia, Botaurus poiciloptilus, Calidris acuminate, Erythrotriorchis radiatus, Gallinago hardwickii, Poephila cincta cincta, Rostratula australis* and *Tringa nebularia* could potentially be present. Of the animals it was considered possible that *Adelotus brevis, Delma torquata, Phascolarctos cinereus,* and *Tachyglossus aculeatus* could be present.

Bird species observed during the survey are listed in **Table 5**. It should be noted that the weather at the time of the survey was warm to hot and overcast, consequently the full range of bird species using the site may not have been active and readily observed at the time of the survey. The majority of birds recorded were seen on or near the two waterbodies, with the Darter, Great Egret, Dusky Moor Hen, Little Pied Cormorant, Royal Spoonbill and Purple Swamp Hen (**Plates 12** to **17**) all found in the wetland to the north-west of the Lot.

Table 5 Bird Species Observed During the Survey

Species	Common Name
Anas supersciliosa	Pacific Black Duck
Anhinga melanogaster	Darter
Ardea alba	Great Egret
Corvus orru	Torresian Crow
Coturnix ypsilophora	Brown Quail
Dacelo novaeguineae	Kookaburra

Species	Common Name
Gallinula tenebrosa	Dusky Moor Hen
Malurus sp.	Fairy Wren
Phalacrocorax melanoleucos	Little Pied Cormorant
Platalea regia	Royal Spoonbill
Porphyrio porphyrio	Purple Swamp Hen
Rhipidura leucophrys	Willy Wagtail



Plate 12 Darter *Anhinga melanogaster*



Plate 13 Great Egret *Ardea alba*



Plate 14 Dusky Moor Hen *Gallinula tenebrosa*



Plate 15 Little Pied Cormorant *Phalacrocorax melanoleucos*



Plate 16 Royal Spoonbill *Platalea regia*



Plate 17 Purple Swamp Hen *Porphyrio porphyrio*

Two Eastern Grey Kangaroos (*Macropus giganteus*) were observed during the survey. There were several sightings of two animals, but it is believed that the sightings were of the same animals. They were observed on the flats adjacent to Six Mile Creek (Habitat Area 5 on **Figure 4**), and in the native forest adjacent to the flats (Habitat Area 4 on **Figure 4**).

Only one tree, a *Eucalyptus major*, was observed to have scratch marks on it (**Plate 18**); the scratch marks were inconsistent with those normally made by Koala, and were probably made by possums (*Trichosurus vulpecula* (Brushtail Possum) or *Pseudocheirus peregrinus* (Ringtail Possum)). No other mammals were observed during the survey, and with the exception of scattered macropod scats, no other signs of mammals were observed during the survey.

Some old diggings were observed, potentially made by either *Tachyglossus aculeatus* (Echidna) or *Varanus* sp. (Monitor Lizard). No fresh diggings were observed. A Water Dragon (*Intellagama lesueurii*) was observed in the waterhole to the south-west of the Lot (**Plate 19**), and the Skink *Lampropholis guichenoti* was observed on trees in the mapped vegetation to the east of the power-line easement.

No animals listed as Conservation Significant were observed during the survey, and there was no evidence of the presence of Conservation Significant animals on the site.



Plate 18 Scratch Marks on *Eucalyptus major*



Plate 19 Water Dragon *Intellagama lesueurii*

5.5 KOALA SURVEY

The SAT survey method was used to determine the presence and abundance of Koala in and around the proposed disturbance area. Six Koala Habitat Trees (KHTs), including a *Eucalyptus major* with extensive scratch marks on the trunk (**Plate 18**), were selected at random locations within the proposed disturbance area for Spot Assessment. No Koala pellets were found in the vicinity of any of the trees, and no Koala pellets or other evidence of Koala presence was observed during the survey. Although absence of evidence does not constitute evidence of absence, it is considered highly unlikely that Koala recently or regularly uses the site.

5.6 HABITAT AND CONNECTIVITY

The areas on the Lot supporting the heaviest vegetation are:

- The area to the north-west of the current disturbance area (Habitat Area 1a and 1b on **Figure 4**),
- The area to the north and north-east of the current disturbance area (Habitat Area 2 on **Figure 4**), and
- The area east of the power-line right of way, which is not in the proposed development site (Habitat Area 4 on **Figure 4**).

<u>The area to the north-west of the current disturbance area</u>

Within the Lot the habitat in area to the north-west of the current disturbance area is limited in extent, however, it borders the wetland to the north of the site, where the majority of the water birds were observed (**Plate 20**). The wetland appears to be an important resource for native and feral birds and terrestrial animals in the area.



Plate 20 Wetland to the North of the Lot

To the west of this area is a track formed on a gazetted road and bordered on both sides by dense exotic and native vegetation. The thick grass had evidence of extensive use by animals, however, no scats, nests or other evidence of species using the area were observed. The tracks may have been made by the local population of Eastern Grey Kangaroo, or by feral animals such a Pig (*Sus scrofa*) or Dog (*Canis lupus*) (**Plate 21**).

There is light fallen timber throughout this area, sufficient to provide habitat to small reptiles and mammals, and an excavation to the west, and draining into the wetland, has been filled with large rocks, which may also provide habitat to reptiles (**Plate 22**).



Plate 21 Animal tracks through long grass



Plate 22 Excavation filled with large rocks

The area to the north and north-east of the current and proposed disturbance area

The habitat in this area is well developed and complex with light fallen timber cover on the ground (**Plate 23**), however, being bordered to the north and east by a road and powerline and with adjoining lands to the north being generally cleared, its habitat value is limited by its extent and it is considered to only have habitat value to small birds, reptiles and mammals, with larger animals only using the area from time to time for foraging or access to the wetland to the north of the site.



Plate 23 Well Developed and Complex Habitat in the Area to the North and North-East of the Current and Proposed Disturbance Area

The area east of the power-line right of way

The area east of the power-line right of way is not in the proposed development site, however it has linkages to the area to the north-east of the current and proposed disturbance area and consequently to the wetland to the north of the site; and it connects these areas to Six Mile Creek and associated creek flats. The vegetation in this area is generally well developed and complex, with evidence of timber harvesting activities, large fallen logs and standing trees with extensive hollow development (**Plate 24**) consequently offering habitat opportunity to a wide range of terrestrial reptile, mammal and bird species. The creek flats are generally open with a dense grass layer, while the slopes, although disturbed provides open forest habitat, and open forest with a dense shrub layer of Acacia, Lantana or Dodonaea (**Plate 25** and **26**).



Plate 24 Spotted Gum (*Corymbia citriodora* subsp. *variegata*) with Hollow Development in the Area Outside the Proposed Development Footprint

Six Mile Creek provides continuous habitat corridor that runs from slightly south of Ipswich Motorway to an extensive area of native vegetation south of Centenary Highway (**Figure 3**) (**Section 1.3**). The vegetation and adjacent to Six Mile Creek comprises predominantly *Melaleuca viminalis, Eucalyptus tereticornis* and *Celtis sinensis* (**Plate 27**). Because of urban encroachment, although of local significance, the corridor along Six Mile Creek has limited regional importance.



Plate 25 Open Forest with a Dense Shrub Layer of Acacia and Lantana in the Area East of the Power-Line Easement



Plate 26 Open Forest with a Dense Shrub Layer of Acacia and Dodonaea in the Area East of the Power-Line Easement



Plate 27 Vegetation on Six Mile Creek

The area to the south-west of the Lot

To the south-west of the proposed development site is an extensive area of excavation and rehabilitated mines (**Plate 28**). An elongated wetland, understood to be an inundated relict mine open pit, runs along the boundary and outside of the subject Lot (**Plate 29**). The wetland supported a large number of water birds, however, at the time of the survey the diversity of water birds was greater on the wetland to the north-east of the Lot. Nevertheless, it is apparent that this wetland is an important resource for native and feral animals in the area.



Plate 28 Naturally Regenerated Acacia and Eucalypt on Mine Spoil to the South of the Proposed Disturbance Area



Plate 29 Wetland to the South of the Lot

Overall, with the exception of the vegetation between the proposed development site and the waterbody to the north, and the waterbody itself – which is not in the development footprint, the vegetation in and near the proposed development site offered little fauna habitat opportunity and limited connectivity to other areas of habitat. However, the area to the east of the powerline, and not in the development footprint, provides complex fauna habitat and connectivity to the Six Mile Creek corridor.

6 DISCUSSION

6.1 VEGETATION, VEGETATION ASSOCIATIONS AND HABITAT

During the survey 71 plant species were recorded, of which 26 were exotic species and 1 native species (*Corymbia torelliana*) was thought to be an off-site native species. Of the exotic species, 15 are 'Invasive' or 'Restricted Invasive 3' plants under the *Biosecurity Act 2014*, and three species are WoNS. Forty-four native and endemic plant species were recorded across the site. Generally, the native species recorded during the survey were consistent with the current and pre-clearing Regional Ecosystems mapped for the location (**Section 4.2**, **Appendix V**).

None of the Threatened Ecological Communities identified in the EPBC Protected Matters Report (**Appendix III**) were observed in the proposed development area and the observed ecological characteristics of the site are unlikely to support those communities. The existing vegetation does not consist of regionally or locally significant species, protected species or ecosystems, plants and plant communities that have heritage or landscape significance.

The proposed development will remove a small area of the regenerating Acacia dominated vegetation to the south-west of the current disturbance area, and a small area of the structurally more complex vegetation to the north of the existing disturbance (**Figure 1**). It is considered that the proposed vegetation clearing will not have a significant impact on the habitat and connectivity values of the Lot or surrounding areas, however, it is recommended that the habitat values associated with the two wetlands adjoining the proposed development site are protected. With appropriate weed control and rehabilitation management the habitat values of the vegetation on the remainder of the Lot would be enhanced.

The proposed disturbance site does not have important habitat or biodiversity values, however the two waterbodies adjacent to the Lot provide habitat to water birds and terrestrial reptiles and mammals. The proposed disturbance site does not have old or dead trees with hollows or nests that potentially could be used by hollow dwelling fauna, however old hollow-bearing trees were observed in the vegetation to be retained to the east of the development site (**Plate 24**). Generally, the existing vegetation does enhance the landscape amenity of the site although it does not comprise visually prominent hillsides, or ridgelines. However, the vegetation proposed to be cleared is Acacia regrowth on the relict mine spoil heaps to the south of the current disturbance, which do not provide visual amenity.

In places the landform underlying vegetation proposed to be cleared, is over 15% slope. However, this is local and artificial landform, largely comprising relict mine spoil heaps, and will be levelled and stabilised for the proposed development. The existing vegetation proposed to be cleared does not assist in the stabilisation of creeks and natural drainage paths. The catchment of the proposed development is draining into the two artificial waterbodies thought to be inundated mine excavations, those waterbodies are isolated from the local drainage system, consequently the vegetation proposed to be cleared does not contribute to water quality management and the natural behaviour of the catchment. Rainfall falling on the eastern portion of the site drains into the Six Mile Creek catchment, however, this area is not proposed to be cleared for this development.

6.2 PROTECTED FLORA

No EVNT plant species were recorded during the survey.

6.3 PROTECTED FAUNA

The preferred habitat for protected fauna potentially present on site was researched and is tabulated in **Table 2**. Analysis of the animals' preferred habitat and the degree of disturbance that the site has been subjected to, suggests that:

- It is unlikely that any of the pelagic or coastal birds listed in **Table 2** would be present on site;
- It would be possible although not probable for most of the other indicated birds to be occasionally on site, for example, when travelling through or over the site;
- It would be unlikely for many of the protected terrestrial animal species to be present on site.

A SAT survey was conducted for Koala in and adjacent to the proposed development site. No signs or indications of Koala presence or use were recorded during the survey.

No protected animals or their signs were observed or recorded during the survey.

6.4 WEEDS AND PEST ANIMALS

The survey recorded 26 exotic species of which, 15 are 'Invasive' or 'Restricted Invasive 3' plants under the Biosecurity Act 2014, and three species are Weeds of National Significance. Under the *Biosecurity Act 2014* Restricted Invasive Plants and Animals must not be kept, moved, fed, given away, sold, or released into the environment, without a permit, and everyone must take all reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control.

It is recommended that a pest control program is undertaken to manage and control:

*Asparagus aethiopicus**	Sprengeri Fern
Baccharis halimifolia	Groundsel
Bryophyllum delagoense syn. Bryophyllum tubiflorum	Mother Of Millions
Celtis sinensis	Chinese Celtis
*Lantana camara**	Lantana
Lantana montevidensis	Creeping Lantana
*Opuntia stricta**	Prickly Pear
Schinus terebinthifolius	Broad Leafed Pepper Tree
Senecio madagascariensis	Fireweed

All of the above species are Restricted Invasive Plants under the *Biosecurity Act 2014*. Those marked with an asterix (*) are also WoNS.

No Restricted Invasive Animals were observed or recorded during the survey, although it is likely that feral cats (*Felis catus*) and possibly foxes (*Vulpes vulpes*), feral pigs and wild dogs are present. It is not

considered appropriate to undertake a targeted control program for feral cat, dog, pig or fox on this site, nevertheless, it should be noted that during and after construction, feral animals should not be encouraged, kept or fed by employees, contractors or occupants.

The site is in Fire Ant Biosecurity Zone 1. Consequently, the movement of biosecurity matter off the property must be in accordance with the *Biosecurity Regulation 2016* or under a Biosecurity Instrument Permit from an inspector.

7 IPSWICH CITY COUNCIL ASSESSMENT REQUIREMENTS

7.1 VEGETATION MANAGEMENT CODE

Assessment of the proposed development against Specific Outcome 1 of Table 12.4.1 of the Vegetation Management Code is outlined below.

Specific Outcomes	Acceptable / Probable Solutions	How the Proposed Development Meets the Code Provisions
Environmentally Sensitive Areas **(1) The clearing of vegetation does not cause or exacerbate land degradation within environmentally sensitive areas including steeply sloping land, areas prone to erosion or salinity, riparian corridors, wetlands or water catchment areas.**	Environmentally Sensitive Areas (1) The clearing does not involve the removal of native vegetation from— (a) land with a slope of 15% or more; or (b) land within a Designated Watercourse or land within 30m of a Designated Watercourse or within 10 metres of the top of the bank of a Designated Watercourse where the slope of the bank exceeds 15%.	With the exception of the removal of vegetation from relict spoil heaps, which will be subsequently levelled and stabilised for the development, the clearing will not involve the removal of native vegetation from land with a slope of 15% or more; or land within a Designated Watercourse or land within 30m of a Designated Watercourse or within 10 metres of the top of the bank of a Designated Watercourse where the slope of the bank exceeds 15%

7.2 IPSWICH PLANNING SCHEME

Part 6(a) of the Information Request issued by Ipswich City Council on 26 April 2018 required that:

'…the applicant is requested to demonstrate how "clearing of vegetation does not cause or exacerbate land degradation within environmentally sensitive areas including steeply sloping land, areas prone to erosion or salinity, riparian corridors, wetlands or water catchment areas". The applicant is therefore requested to submit a vegetation survey in order to demonstrate compliance with sections 4.3.3 (4)(f); 4.3.3(4)(g) of the Urban Areas Code.'(note this reference was subsequently corrected to section 6.7 (j)(a)(d) by ICC).

The only steeply sloping land that will be cleared is relict mine spoil heaps, which are only locally steep as an artifact of their construction. This area will be levelled and stabilised to provide building pads and operational areas for the proposed activities.

No riparian areas or wetlands will be cleared for the proposed development; however, it is recommended that erosion and sedimentation controls are erected to protect the identified waterbodies on adjoining

properties from siltation during construction. The road that passes close to the waterbody to the north of the proposed development site should be formed, battered and drained to protect the waterbody from siltation.

No historic buildings, large mature trees, significant stands of vegetation, skyline elements, vegetated ridgelines or significant views will be affected by the proposed development.

The waterbodies on adjoining Lots will not be directly affected by the proposed activities, and will be protected from siltation and sedimentation during construction and operation of the proposed development.

8 POTENTIAL IMPACTS

No conservation significant plants or animals were observed during the survey. No Endangered Regional Ecosystems or Threatened Ecological Communities were observed during the survey. Generally, the proposed development site provides little habitat opportunity for animals other than small mammals and reptiles, and opportunistic arboreal mammals and scavenger birds.

However, the wetlands adjoining the Lot, and the vegetation on the Lot between the power-line right of way and Six Mile Creek offer habitat and connectivity to a range of terrestrial, arboreal and aquatic animals.

These areas will not be affected by the proposed development. It is unlikely that the proposed development will have an impact on any protected plant or animal species or vegetation association; and it is considered that appropriate management of the undisturbed portion of the site will enhance habitat opportunities for aquatic, terrestrial and arboreal animal species.

9 RECOMMENDATIONS

It is not considered likely that the proposed development will have a significant impact on the ecological values of the site, and will not have an adverse impact on any important local or regional habitat linkages. However, to improve the ecological values on the undeveloped portions of the site it is recommended that:

- Water quality and aquatic habitat values of the dam are protected and maintained through erosion and sediment control measures, and by managing surface runoff contamination and other potential water contamination sources;
- Retained vegetation on the batter and foot slopes of the existing development fill, and within and adjacent to the development site, is protected during construction and development works by a temporary fence and 'no-go' zone;
- A weed control program is implemented to manage State Government listed species on the site, in particular in the vegetation adjacent to the proposed development.

REFERENCES

Clayton P.D., Fielder D.P., Howel, S. and Hill C.J. (2006*). Aquatic Biodiversity Assessment and Mapping Method (AquaBAMM): a conservation values assessment tool for wetlands with trial application in the Burnett River catchment*. Published by the Environmental Protection Agency, Brisbane.

Cropper, S.C. (1993), *Management of Endangered Plants*. CSIRO, East Melbourne.

Department of the Environment, Water, Heritage and the Arts, 2010, Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*

Department of the Environment, Water, Heritage and the Arts, 2010 Survey guidelines for Australia's threatened reptiles: Guidelines for detecting bats listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*

Department of the Environment, Water, Heritage and the Arts, 2010, Survey guidelines for Australia's threatened reptiles: Guidelines for detecting frogs listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*

Department of the Environment, Water, Heritage and the Arts, 2011, Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*

Department of the Environment, Water, Heritage and the Arts, 2011, Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*

Eyre TJ, Ferguson DJ, Hourigan CL, Smith GC, Mathieson MT, Kelly, AL, Venz MF & Hogan, LD. (2012). *Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland*. Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J., 2015, *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2*. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane.

Goff, F.G., Dawson, G.A. and Rochow, J.J. (1982), *Site examination for threatened and endangered plant species*. Environmental Management 6: 307-316.

Neldner, V.J, Wilson, B.A, Thompson, E.J Dillewaard, H.A (2012), *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland,* Department of Science, Information Technology, Innovation and the Arts, Brisbane

Neldner, V.J., Wilson, B.A., Thompson, E.J. and Dillewaard, H.A. (2012) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland. Version 3.2*. Updated August 2012. Queensland Herbarium, Queensland Department of Science, Information Technology, Innovation and the Arts, Brisbane.

Phillips, S, and Callaghan, J, (2011), *The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus*. Zoologist, Vol35 (3) pp 774 – 780.

Slater, P, Slater, P, and Slater, R, 2012 *The Slater Field Guide to Australian Birds, Second Edition*. New Holland Publishers (Australia) Pty. Ltd., Sydney, Australia.

FIGURES

FIGURE 1 THE LOCATION OF THE PROPOSED DEVELOPMENT AT 149 RHONDDA ROAD, NEW CHUM

FIGURE 2 SURROUNDING LANDUSE OF THE PROPOSED DEVELOPMENT SITE

FIGURE 3 LANDSCAPE CONTEXT OF THE PROPOSED DEVELOPMENT SITE

FIGURE 4 FIELD SURVEY TRAVERSE

149 Rhondda Road Lot 273 on SP 128662

Site Details

27°37'14"S 152°50'1"E

27°37'14"S 152°50'35"E



27°37'38"S 152°50'1"E

27°37'38"S 152°50'35"E

A product of Queensland Globe



N

100 metres

Print Date: 29/9/2018
Paper Size: A4

Imagery

includes material © CNES reproduced under licence from Airbus DS, all rights reserved, © 21AT © Earth-i, all rights reserved, 2018

Queensland Government

© State of Queensland 2018
You are responsible for ensuring that the map is suitable for your purposes.
The State of Queensland makes no representation or warranties in relation to the map contents and disclaims all liability.

149 Rhondda Road Lot 273 on SP 128662

Site Details

Legend

Road crossing
- Bridge
- Tunnel

Road
- Highway
- Main
- Local
- Private

Railway

Coastline

Lake

Reservoir

Canal line

Canal area

Watercourse line
- Minor Watercourse
- Major Watercourse
- Minor Culvert
- Major Culvert

Watercourse area
- Perennial
- Non Perennial

Water area edge

Land parcel
- Parcel

Land parcel label

Attribution

DigitalGlobe

includes material © CNES reproduced under licence from Airbus DS, all rights reserved, © 21AT © Earth-i, all rights reserved, 2018

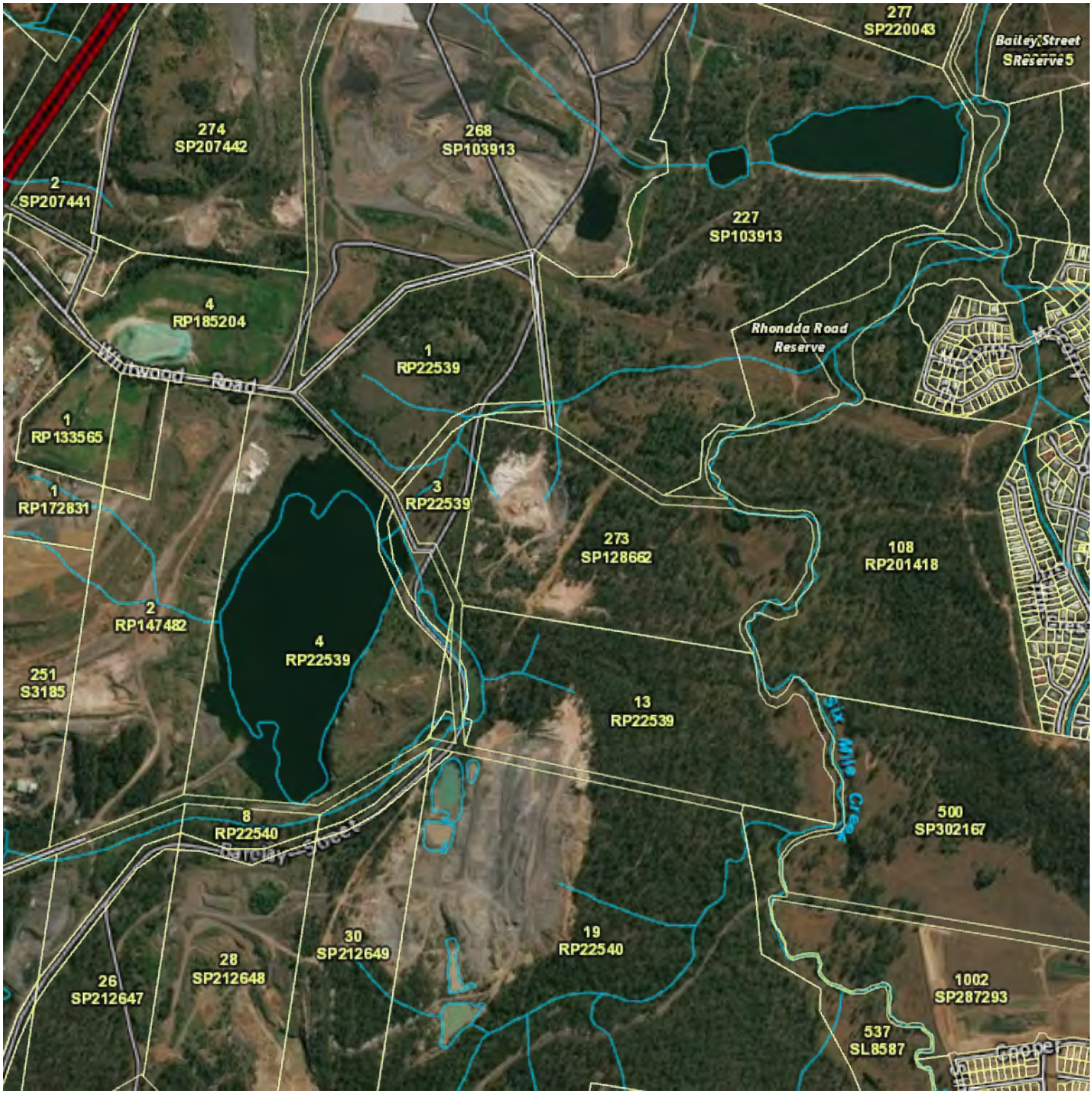
© State of Queensland (Department of Natural Resources, Mines and Energy) 2018

© State of Queensland (Department of Natural Resources and Mines), 2016

149 Rhondda Road

Surrounding Landuse Lot 273 on SP128662

27°36'47"S 152°49'26"E 27°36'47"S 152°50'54"E



27°38'5"S 152°49'26"E 27°38'5"S 152°50'54"E

A product of Queensland Globe



N

250 metres

Print Date: 29/9/2018
Paper Size: A4

Imagery

includes material © CNES reproduced under licence from Airbus DS, all rights reserved, © 21AT © Earth-i, all rights reserved, 2018

Queensland Government

© State of Queensland 2018
You are responsible for ensuring that the map is suitable for your purposes.
The State of Queensland makes no representation or warranties in relation to the map contents and disclaims all liability.

149 Rhondda Road

Surrounding Landuse Lot 273 on SP128662

Legend

Road

- Highway
- Main
- Local
- Private

Coastline

Lake

Reservoir

Canal line

Canal area

Watercourse line

- Minor Watercourse
- Major Watercourse
- Minor Culvert
- Major Culvert

Water area edge

Watercourse area

- Perennial
- Non Perennial

Railway

Land parcel

- Parcel

Land parcel label

Cities and Towns

Attribution

DigitalGlobe

© State of Queensland (Department of Natural Resources, Mines and Energy) 2018

© State of Queensland (Department of Natural Resources and Mines), 2016

149 Rhondda Road

Broad Environmental Context

27°35'47"S 152°47'58"E 27°35'47"S 152°55'17"E



27°42'16"S 152°47'58"E 27°42'16"S 152°55'17"E

A product of Queensland Globe



N

1 km

Print Date: 29/9/2018
Paper Size: A4

Imagery

includes material © CNES reproduced under licence from Airbus DS, all rights reserved, © 21AT © Earth-i, all rights reserved, 2018

Queensland Government

© State of Queensland 2018
You are responsible for ensuring that the map is suitable for your purposes.
The State of Queensland makes no representation or warranties in relation to the map contents and disclaims all liability.

149 Rhondda Road

Broad Environmental Context

Legend

Road

- Highway
- Main
- Local
- Private

Coastline

Lake

Reservoir

Canal area

Watercourse line

- Minor Watercourse
- Major Watercourse
- Minor Culvert
- Major Culvert

Watercourse area

- Perennial
- Non Perennial

Land parcel label - gt 1 ha

Water area edge

Railway

Land parcel - gt 1 ha

- Parcel

Cities and Towns

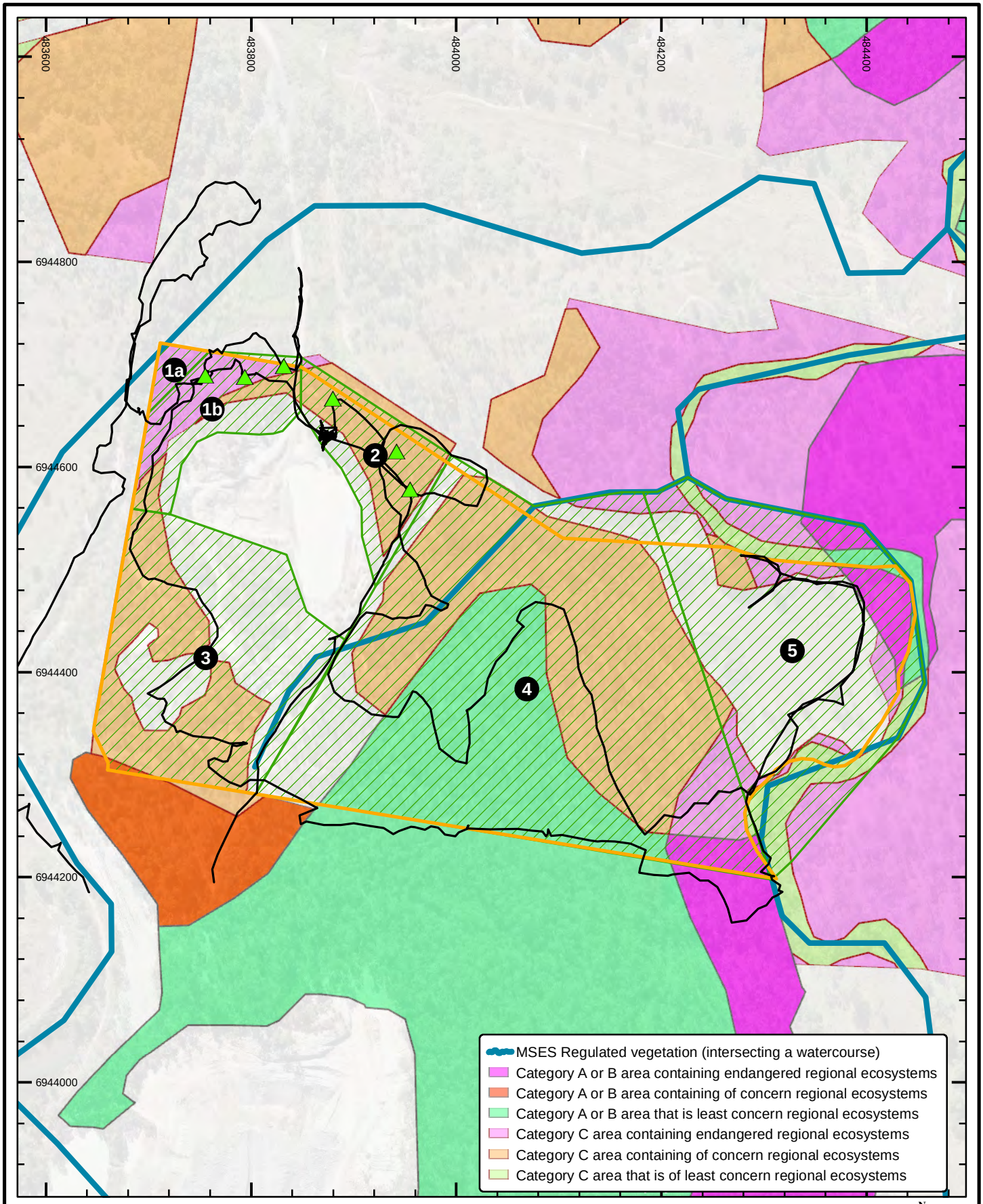
Attribution

Earthstar Geographics

includes material © CNES reproduced under licence from Airbus DS, all rights reserved, © 21AT © Earth-i, all rights reserved, 2018

© State of Queensland (Department of Natural Resources, Mines and Energy) 2018

© State of Queensland (Department of Natural Resources and Mines), 2016



JACKAL RENEWABLES PTY LTD

Lot 73 on SP 128662

GDA94, MGA Zone 56

ARDENT GROUP PTY LTD

Field and Habitat Assessment

Figure 4

Sheet No. ADMG_ARD_JKRGEN_MAP_0015_B

Drawn By: Chris Schlebusch

Requested by: Richard Davis

Date: 18/10/2018

Legend

- 73 SP128662
- Property boundary
- GPS Tracklog (2018-09-28)
- Habitat Area (boundaries approximate)
- SAT Survey Site

Data sources:
Qld Department of Natural Resources, Mines & Energy, Geoscience Australia

Path: S:\Plans\Project_Specific\Ardent\JKRGEN\ADMG_ARD_JKRGEN_MAP_0015_B Field and Habitat Assessment.mxd

APPENDIX I

IPSWICH CITY COUNCIL CITY PLAN REPORT AND MAPS

Property Details

149 Rhondda Road NEW CHUM QLD 4303

Details

Property Number: 245135
Lot RPD: Lot 273 SP 128662
Land Number(s): **123721**
Division 3

Valuations

Land Valuation:

Dimension

Area: 25.38 Ha

Zoning

RBIA02 - Regional Bus & Industry Investigation (New Chum)
REC - Recreation

Applications

No applications recorded against this property.

Constraints

Constraints applied against a property or land.
Parcel Conditions
OV2-Key Resource Area Overlay - 18/10/2006
OV2-Known Resources Overlay - 18/10/2006
OV2-Mining Leases - 20/11/2013
OV3-Mining Influence Area Overlay - 05/04/2004
OV4-Difficult Topography Overlay - 05/04/2004
OV5-Adopted Flood Regulation Line - 29/09/2014
OV5-Flood Development Line 1 in 20 - 29/09/2014
OV5-Urban Catchment Flow Path - 29/09/2014
OV7A-90m Building Height Restriction Overlay - 05/04/2004

Map

Select map layers from the drop-down list below:

1 - Base Map



To Print: Right click on map image and select "Print Picture..."

To obtain a property certificate for this property, click the link below:

Property Certificate

Contact us

APPENDIX II

SITE LAYOUT PLAN FOR 149 RHONDDA ROAD, NEW CHUM, DRAWING NUMBER C1 DEVELOPMENT PLAN

20m BUFFER

PROPOSED SITE ENTRANCE.
(CURRENT ENTRANCE).

RHONDDA ROAD

20m BUFFER TO SITE BOUNDARY TYP UNO.

CENTRELINE OF INTERNAL ROADWAY IS LOCATED 25m FROM BOUNDARIES TYP

25.0m

TOP OF PROPOSED BANK

TOP OF PROPOSED BANK

EXISTING CLAY PIT

PROPOSED PROCESSING PAD.
7100m2 OPEN HARDSTAND.

INTERNAL TRAFFIC FLOW

20m BUFFER

WEIGHBRIDGE (OUT)

COGENERATION AREA 60mX30mX6m HIGH COVERED ROOF

WORKSHOP SHED 20mX20m x 6m HIGH

PROPOSED INTERNAL ROADWAY 5.0m GRAVEL PAVEMENT

LOT 73 on SP128662

EXISTING CONTOURS (LIDAR 2014).

PROCESSING AREA 36m X 18m OPEN HARDSTAND

RESOURCE RECOVERY STATION 36m X 18m SHED 10m HIGH

DEPRESSION

CARETAKERS RESIDENCE 13x7m.

OFFICE

W/R

47 CARPARKS

WEIGHBRIDGE (IN)

20m BUFFER

20m BUFFER TO MINE LEASE BOUNDARY.

MINING LEASE EASTERN BOUNDARY (ML50070)

EASTERN BOUNDARY OF OF SITE (SIX MILE CREEK).

N

LEGEND

34.0 EXISTING SURFACE CONTOURS

PROCESSING PAD 7100m2
UNCOVERED HARDSTAND AREA.

COGEN PLANT AREA
COVERED ROOF 60mX30mX6m HIGH
OPEN WALLS. BUNDED CONCRETE
SLAB UNDER 60mX30m.

RESOURCE RECOVERY STATION
COVERED ROOF 36mX18mX10m HIGH WITH
WALL TO SOUTH–WEST WALL – OTHER WALLS
WITH 3m SKIRTS. SLAB UNDER 36mX18m.

PROCESSING AREA
UNCOVERED HARDSTAND AREA 36mX18m.

WORKSHOP
ENCLOSED COVERED SHEETMETAL BUILDING
20mX20mX6m HIGH. CONCRETE FLOOR SLAB.

WEIGHBRIDGES
2 WEIGHBRIDGES EACH 30mX4m.

FACILITIES
DEMOUNTABLE TYPE BUILDINGS:
OFFICE: 12mX3mX3m HIGH
LUNCH ROOM: 7mX3mX3m HIGH
TOILETS: 6mX3mX3m HIGH

CARETAKERS RESIDENCE
DEMOUNTABLE TYPE BUILDING:
12mX7mX3m HIGH

DEVELOPMENT PLAN

SCALE 1:1000 0 20 40 60 80 100m

HUNT MICHEL & PARTNERS
24 DARLING STREET IPSWICH Q 4305
CONSULTING CHARTERED ENGINEERS
CIVIL AND STRUCTURAL
A.B.N. 75 074 746 599
PH 3812 2399
FAX 3812 1900

CLIENT
JACKAL RENEWABLES PTY LTD

PROJECT
PROPOSED DEVELOPMENT
149 RHONDDA ST NEW CHUM

DRAWING TITLE
DEVELOPMENT PLAN
SITE LAYOUT PLAN

REV		DATE	REV		DATE

APPROVED: RPEQ 3766
DIRECTOR HUNT MICHEL & PARTNERS

DESIGNED:	D.A.	JOB No.	218010
DRAWN:	D.A.		
CHECKED:	D.M.	DWG No.	C1
SCALE:	1:1000 AT A1		
DATE:			

APPENDIX III

MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE UNDER THE EPBC ACT

Australian Government
Department of the Environment and Energy

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.

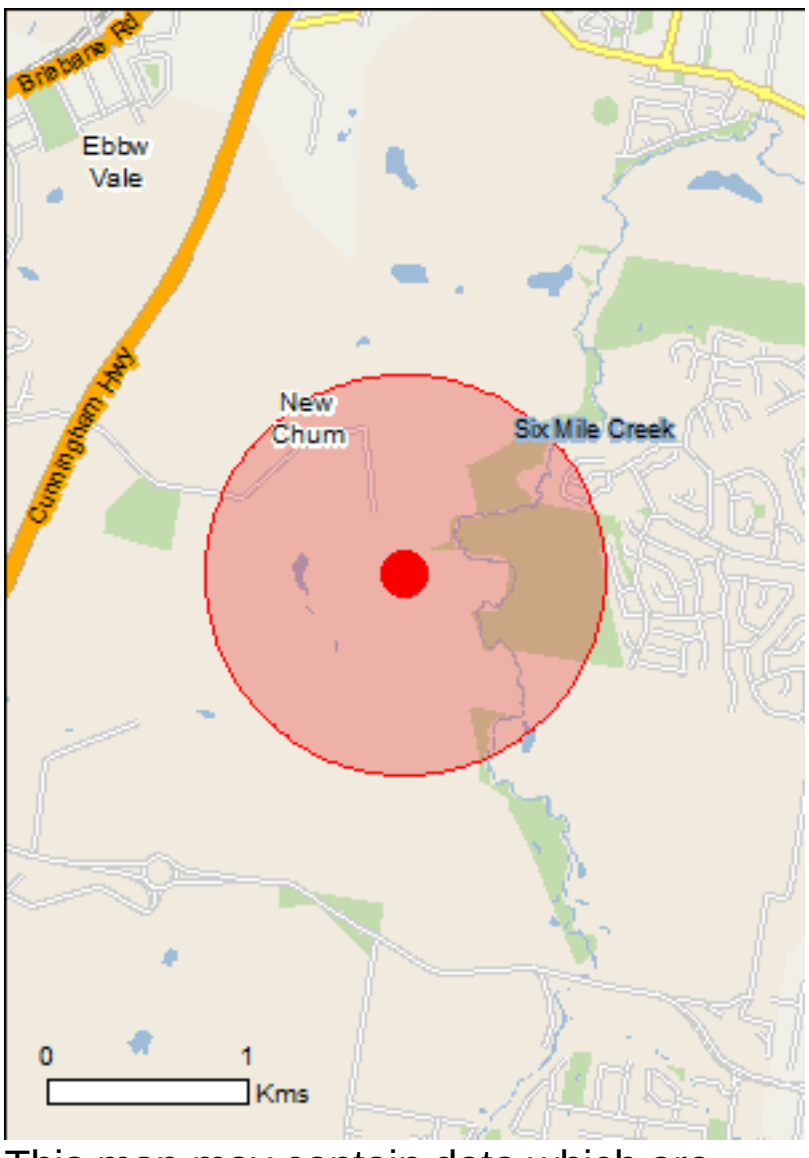
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 27/09/18 08:36:18

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

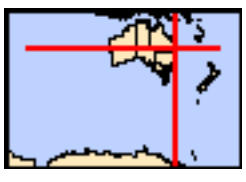
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 1.0Km



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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	31
Listed Migratory Species:	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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

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.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	22
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	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:	None
Regional Forest Agreements:	None
Invasive Species:	33
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

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.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Insects		
Argynnis hyperbius inconstans Australian Fritillary [88056]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Bosistoa transversa Three-leaved Bosistoa, Yellow Satinheart [16091]	Vulnerable	Species or species habitat likely to occur within area
Cycas ophiolitica [55797]	Endangered	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Notelaea ipsviciensis Cooneana Olive [81858]	Critically Endangered	Species or species habitat likely to occur within area
Notelaea lloydii Lloyd's Olive [15002]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Samadera bidwillii		
Quassia [29708]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Delma torquata		
Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat likely to occur within area
Furina dunmalli		
Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata		
Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		

Name	Status	Type of Presence
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat may occur within area

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 and National Heritage properties, Wetlands of International and National 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.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

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.

Coordinates

-27.624 152.8378

Acknowledgements

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

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-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, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

© Commonwealth of Australia
Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

APPENDIX IV

WILDNET ONLINE REPORT

Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Status: All
Records: All
Date: All
Latitude: -27.624
Longitude: 152.8378
Distance: 5
Email: sticksandstonesenv@bigpond.com
Date submitted: Saturday 29 Sep 2018 11:53:00
Date extracted: Saturday 29 Sep 2018 12:00:02

The number of records retrieved = 1000

Disclaimer

As the DSITIA 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	Bufonidae	*Rhinella marina*	cane toad	Y			51/1
animals	amphibians	Hylidae	*Litoria nasuta*	striped rocketfrog		C		8
animals	amphibians	Hylidae	*Litoria dentata*	bleating treefrog		C		9
animals	amphibians	Hylidae	*Litoria peronii*	emerald spotted treefrog		C		3
animals	amphibians	Hylidae	*Litoria rubella*	ruddy treefrog		C		17
animals	amphibians	Hylidae	*Litoria wilcoxii*	eastern stony creek frog		C		1
animals	amphibians	Hylidae	*Litoria gracilenta*	graceful treefrog		C		23
animals	amphibians	Hylidae	*Litoria latopalmata*	broad palmed rocketfrog		C		7
animals	amphibians	Hylidae	*Litoria brevipalmata*	green thighed frog		C		3
animals	amphibians	Hylidae	*Cyclorana alboguttata*	greenstripe frog		C		1
animals	amphibians	Hylidae	*Litoria fallax*	eastern sedgefrog		C		40
animals	amphibians	Hylidae	*Litoria caerulea*	common green treefrog		C		48
animals	amphibians	Limnodynastidae	*Limnodynastes tasmaniensis*	spotted grassfrog		C		4
animals	amphibians	Limnodynastidae	*Limnodynastes terraereginae*	scarlet sided pobblebonk		C		15
animals	amphibians	Limnodynastidae	*Platyplectrum ornatum*	ornate burrowing frog		C		23
animals	amphibians	Limnodynastidae	*Limnodynastes peronii*	striped marshfrog		C		27
animals	amphibians	Limnodynastidae	*Adelotus brevis*	tusked frog		V		6
animals	amphibians	Myobatrachidae	*Pseudophryne raveni*	copper backed broodfrog		C		4/1
animals	amphibians	Myobatrachidae	*Crinia parinsignifera*	beeping froglet		C		11
animals	amphibians	Myobatrachidae	*Mixophyes fasciolatus*	great barred frog		C		5
animals	amphibians	Myobatrachidae	*Pseudophryne coriacea*	red backed broodfrog		C		2
animals	amphibians	Myobatrachidae	*Uperoleia sp.*					1
animals	amphibians	Myobatrachidae	*Uperoleia rugosa*	chubby gungan		C		2
animals	amphibians	Myobatrachidae	*Crinia signifera*	clicking froglet		C		2
animals	amphibians	Myobatrachidae	*Uperoleia fusca*	dusky gungan		C		2
animals	amphibians	Myobatrachidae	*Pseudophryne major*	great brown broodfrog		C		1
animals	birds	Acanthizidae	*Smicrornis brevirostris*	weebill		C		30
animals	birds	Acanthizidae	*Chthonicola sagittata*	speckled warbler		C		15
animals	birds	Acanthizidae	*Acanthiza nana*	yellow thornbill		C		2
animals	birds	Acanthizidae	*Gerygone mouki*	brown gerygone		C		3
animals	birds	Acanthizidae	*Acanthiza chrysorrhoa*	yellow-rumped thornbill		C		9
animals	birds	Acanthizidae	*Acanthiza pusilla*	brown thornbill		C		5
animals	birds	Acanthizidae	*Gerygone olivacea*	white-throated gerygone		C		46
animals	birds	Acanthizidae	*Acanthiza reguloides*	buff-rumped thornbill		C		8
animals	birds	Acanthizidae	*Sericornis frontalis*	white-browed scrubwren		C		21
animals	birds	Acanthizidae	*Acanthiza lineata*	striated thornbill		C		2
animals	birds	Accipitridae	*Milvus migrans*	black kite		C		6
animals	birds	Accipitridae	*Erythrotriorchis radiatus*	red goshawk		E	V	1
animals	birds	Accipitridae	*Accipiter novaehollandiae*	grey goshawk		C		4
animals	birds	Accipitridae	*Aquila audax*	wedge-tailed eagle		C		26
animals	birds	Accipitridae	*Haliastur indus*	brahminy kite		C		12
animals	birds	Accipitridae	*Circus assimilis*	spotted harrier		C		1
animals	birds	Accipitridae	*Elanus axillaris*	black-shouldered kite		C		20
animals	birds	Accipitridae	*Circus approximans*	swamp harrier		C		3
animals	birds	Accipitridae	*Lophoictinia isura*	square-tailed kite		C		2
animals	birds	Accipitridae	*Accipiter fasciatus*	brown goshawk		C		12

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Accipitridae	*Aviceda subcristata*	Pacific baza		C		10
animals	birds	Accipitridae	*Haliastur sphenurus*	whistling kite		C		17
animals	birds	Accipitridae	*Haliaeetus leucogaster*	white-bellied sea-eagle		C		13
animals	birds	Accipitridae	*Hieraaetus morphnoides*	little eagle		C		1
animals	birds	Accipitridae	*Accipiter cirrocephalus*	collared sparrowhawk		C		4
animals	birds	Acrocephalidae	*Acrocephalus australis*	Australian reed-warbler		C		25
animals	birds	Aegothelidae	*Aegotheles cristatus*	Australian owlet-nightjar		C		12
animals	birds	Alcedinidae	*Ceyx azureus*	azure kingfisher		C		16
animals	birds	Anatidae	*Anas sp.*					2
animals	birds	Anatidae	*Anas castanea*	chestnut teal		C		4
animals	birds	Anatidae	*Anas gracilis*	grey teal		C		13
animals	birds	Anatidae	*Cygnus atratus*	black swan		C		10
animals	birds	Anatidae	*Anas rhynchotis*	Australasian shoveler		C		1
animals	birds	Anatidae	*Aythya australis*	hardhead		C		16
animals	birds	Anatidae	*Anas superciliosa*	Pacific black duck		C		67
animals	birds	Anatidae	*Chenonetta jubata*	Australian wood duck		C		78
animals	birds	Anatidae	*Anas platyrhynchos*	northern mallard	Y			1
animals	birds	Anatidae	*Dendrocygna eytoni*	plumed whistling-duck		C		3
animals	birds	Anatidae	*Dendrocygna arcuata*	wandering whistling-duck		C		2
animals	birds	Anatidae	*Stictonetta naevosa*	freckled duck		C		1
animals	birds	Anhingidae	*Anhinga novaehollandiae*	Australasian darter		C		25
animals	birds	Anseranatidae	*Anseranas semipalmata*	magpie goose		C		6
animals	birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail		SL		4
animals	birds	Ardeidae	*Egretta garzetta*	little egret		C		4
animals	birds	Ardeidae	*Butorides striata*	striated heron		C		2
animals	birds	Ardeidae	*Ardea intermedia*	intermediate egret		C		13
animals	birds	Ardeidae	*Ardea pacifica*	white-necked heron		C		13
animals	birds	Ardeidae	*Bubulcus ibis*	cattle egret		C		48
animals	birds	Ardeidae	*Ardea alba modesta*	eastern great egret		C		7
animals	birds	Ardeidae	*Egretta novaehollandiae*	white-faced heron		C		38
animals	birds	Ardeidae	*Nycticorax caledonicus*	nankeen night-heron		C		5
animals	birds	Artamidae	*Cracticus tibicen*	Australian magpie		C		147
animals	birds	Artamidae	*Strepera graculina*	pied currawong		C		17
animals	birds	Artamidae	*Artamus cyanopterus*	dusky woodswallow		C		6
animals	birds	Artamidae	*Cracticus torquatus*	grey butcherbird		C		61
animals	birds	Artamidae	*Artamus superciliosus*	white-browed woodswallow		C		2
animals	birds	Artamidae	*Artamus leucorynchus*	white-breasted woodswallow		C		9
animals	birds	Artamidae	*Cracticus nigrogularis*	pied butcherbird		C		95
animals	birds	Burhinidae	*Burhinus grallarius*	bush stone-curlew		C		6/1
animals	birds	Cacatuidae	*Cacatua sanguinea*	little corella		C		33
animals	birds	Cacatuidae	*Eolophus roseicapilla*	galah		C		108
animals	birds	Cacatuidae	*Nymphicus hollandicus*	cockatiel		C		2
animals	birds	Cacatuidae	*Cacatua galerita*	sulphur-crested cockatoo		C		64
animals	birds	Cacatuidae	*Cacatua tenuirostris*	long-billed corella	Y	C		3
animals	birds	Campephagidae	*Lalage tricolor*	white-winged triller		C		4
animals	birds	Campephagidae	*Coracina maxima*	ground cuckoo-shrike		C		2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Campephagidae	*Coracina tenuirostris*	cicadabird		C		21
animals	birds	Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike		C		138
animals	birds	Campephagidae	*Coracina papuensis*	white-bellied cuckoo-shrike		C		7
animals	birds	Campephagidae	*Lalage leucomela*	varied triller		C		1
animals	birds	Charadriidae	*Vanellus miles novaehollandiae*	masked lapwing (southern subspecies)		C		76
animals	birds	Charadriidae	*Vanellus miles*	masked lapwing		C		15
animals	birds	Charadriidae	*Erythrogonys cinctus*	red-kneed dotterel		C		4
animals	birds	Charadriidae	*Elseyornis melanops*	black-fronted dotterel		C		12
animals	birds	Ciconiidae	*Ephippiorhynchus asiaticus*	black-necked stork		C		6
animals	birds	Cisticolidae	*Cisticola exilis*	golden-headed cisticola		C		79
animals	birds	Climacteridae	*Cormobates leucophaea metastasis*	white-throated treecreeper (southern)		C		27
animals	birds	Columbidae	*Geopelia striata*	peaceful dove		C		42
animals	birds	Columbidae	*Ocyphaps lophotes*	crested pigeon		C		100
animals	birds	Columbidae	*Phaps chalcoptera*	common bronzewing		C		7
animals	birds	Columbidae	*Chalcophaps indica*	emerald dove		C		1
animals	birds	Columbidae	*Geopelia humeralis*	bar-shouldered dove		C		42
animals	birds	Columbidae	*Macropygia amboinensis*	brown cuckoo-dove		C		8
animals	birds	Columbidae	*Streptopelia chinensis*	spotted dove	Y			62
animals	birds	Columbidae	*Geopelia cuneata*	diamond dove		C		1
animals	birds	Columbidae	*Lopholaimus antarcticus*	topknot pigeon		C		6
animals	birds	Columbidae	*Leucosarcia melanoleuca*	wonga pigeon		C		1
animals	birds	Columbidae	*Columba livia*	rock dove	Y			27
animals	birds	Coraciidae	*Eurystomus orientalis*	dollarbird		C		59
animals	birds	Corcoracidae	*Struthidea cinerea*	apostlebird		C		2
animals	birds	Corvidae	*Corvus coronoides*	Australian raven		C		2
animals	birds	Corvidae	*Corvus orru*	Torresian crow		C		214
animals	birds	Cuculidae	*Cacomantis variolosus*	brush cuckoo		C		9
animals	birds	Cuculidae	*Eudynamys orientalis*	eastern koel		C		31
animals	birds	Cuculidae	*Cacomantis pallidus*	pallid cuckoo		C		7
animals	birds	Cuculidae	*Chalcites lucidus*	shining bronze-cuckoo		C		6
animals	birds	Cuculidae	*Chalcites basalis*	Horsfield's bronze-cuckoo		C		10
animals	birds	Cuculidae	*Cuculus optatus*	oriental cuckoo		SL		1
animals	birds	Cuculidae	*Chalcites minutillus barnardi*	little bronze-cuckoo		C		1
animals	birds	Cuculidae	*Scythrops novaehollandiae*	channel-billed cuckoo		C		31
animals	birds	Cuculidae	*Centropus phasianinus*	pheasant coucal		C		39
animals	birds	Cuculidae	*Cacomantis flabelliformis*	fan-tailed cuckoo		C		32
animals	birds	Dicruridae	*Dicrurus bracteatus bracteatus*	spangled drongo (eastern Australia)		C		1
animals	birds	Dicruridae	*Dicrurus bracteatus*	spangled drongo		C		33
animals	birds	Estrildidae	*Neochmia temporalis*	red-browed finch		C		28
animals	birds	Estrildidae	*Lonchura punctulata*	nutmeg mannikin	Y			4
animals	birds	Estrildidae	*Lonchura castaneothorax*	chestnut-breasted mannikin		C		32
animals	birds	Estrildidae	*Taeniopygia bichenovii*	double-barred finch		C		58
animals	birds	Eurostopodidae	*Eurostopodus mystacalis*	white-throated nightjar		C		8
animals	birds	Falconidae	*Falco berigora*	brown falcon		C		5
animals	birds	Falconidae	*Falco subniger*	black falcon		C		1
animals	birds	Falconidae	*Falco longipennis*	Australian hobby		C		3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Falconidae	*Falco cenchroides*	nankeen kestrel		C		22
animals	birds	Falconidae	*Falco peregrinus*	peregrine falcon		C		10
animals	birds	Halcyonidae	*Todiramphus macleayii*	forest kingfisher		C		19
animals	birds	Halcyonidae	*Todiramphus sanctus*	sacred kingfisher		C		59
animals	birds	Halcyonidae	*Dacelo novaeguineae*	laughing kookaburra		C		95
animals	birds	Hirundinidae	*Cheramoeca leucosterna*	white-backed swallow		C		9
animals	birds	Hirundinidae	*Petrochelidon ariel*	fairy martin		C		43
animals	birds	Hirundinidae	*Petrochelidon nigricans*	tree martin		C		28
animals	birds	Hirundinidae	*Hirundo neoxena*	welcome swallow		C		117
animals	birds	Jacanidae	*Irediparra gallinacea*	comb-crested jacana		C		7
animals	birds	Laridae	*Chlidonias hybrida*	whiskered tern		C		1
animals	birds	Laridae	*Chroicocephalus novaehollandiae*	silver gull		C		1
animals	birds	Laridae	*Sternula albifrons*	little tern		SL		1
animals	birds	Maluridae	*Malurus cyaneus*	superb fairy-wren		C		54
animals	birds	Maluridae	*Malurus lamberti*	variegated fairy-wren		C		34
animals	birds	Maluridae	*Malurus melanocephalus*	red-backed fairy-wren		C		103
animals	birds	Megaluridae	*Cincloramphus mathewsi*	rufous songlark		C		2
animals	birds	Megaluridae	*Cincloramphus cruralis*	brown songlark		C		5
animals	birds	Megaluridae	*Megalurus timoriensis*	tawny grassbird		C		26
animals	birds	Megaluridae	*Megalurus gramineus*	little grassbird		C		5
animals	birds	Megapodiidae	*Alectura lathami*	Australian brush-turkey		C		10
animals	birds	Meliphagidae	*Melithreptus albogularis*	white-throated honeyeater		C		56
animals	birds	Meliphagidae	*Plectorhyncha lanceolata*	striped honeyeater		C		7
animals	birds	Meliphagidae	*Acanthorhynchus tenuirostris*	eastern spinebill		C		3
animals	birds	Meliphagidae	*Anthochaera carunculata*	red wattlebird		C		1
animals	birds	Meliphagidae	*Anthochaera chrysoptera*	little wattlebird		C		2
animals	birds	Meliphagidae	*Manorina melanocephala*	noisy miner		C		135
animals	birds	Meliphagidae	*Myzomela sanguinolenta*	scarlet honeyeater		C		61
animals	birds	Meliphagidae	*Philemon citreogularis*	little friarbird		C		17
animals	birds	Meliphagidae	*Manorina melanophrys*	bell miner		C		1
animals	birds	Meliphagidae	*Lichmera indistincta*	brown honeyeater		C		100
animals	birds	Meliphagidae	*Entomyzon cyanotis*	blue-faced honeyeater		C		29
animals	birds	Meliphagidae	*Caligavis chrysops*	yellow-faced honeyeater		C		53
animals	birds	Meliphagidae	*Melithreptus gularis*	black-chinned honeyeater		C		10
animals	birds	Meliphagidae	*Melithreptus lunatus*	white-naped honeyeater		C		2
animals	birds	Meliphagidae	*Philemon corniculatus*	noisy friarbird		C		74
animals	birds	Meliphagidae	*Lichenostomus melanops*	yellow-tufted honeyeater		C		11
animals	birds	Meliphagidae	*Ptilotula fusca*	fuscous honeyeater		C		28
animals	birds	Meliphagidae	*Meliphaga lewinii*	Lewin's honeyeater		C		17
animals	birds	Meropidae	*Merops ornatus*	rainbow bee-eater		C		74
animals	birds	Monarchidae	*Myiagra rubecula*	leaden flycatcher		C		18
animals	birds	Monarchidae	*Myiagra inquieta*	restless flycatcher		C		2
animals	birds	Monarchidae	*Monarcha sp.*					1
animals	birds	Monarchidae	*Monarcha melanopsis*	black-faced monarch		SL		2
animals	birds	Monarchidae	*Grallina cyanoleuca*	magpie-lark		C		127
animals	birds	Monarchidae	*Myiagra cyanoleuca*	satin flycatcher		SL		3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Motacillidae	*Anthus novaeseelandiae*	Australasian pipit		C		20
animals	birds	Nectariniidae	*Dicaeum hirundinaceum*	mistletoebird		C		58
animals	birds	Neosittidae	*Daphoenositta chrysoptera*	varied sittella		C		26
animals	birds	Oriolidae	*Sphecotheres vieilloti*	Australasian figbird		C		66
animals	birds	Oriolidae	*Oriolus sagittatus*	olive-backed oriole		C		29
animals	birds	Pachycephalidae	*Falcunculus frontatus*	crested shrike-tit		C		1
animals	birds	Pachycephalidae	*Colluricincla megarhyncha*	little shrike-thrush		C		1
animals	birds	Pachycephalidae	*Pachycephala rufiventris*	rufous whistler		C		55
animals	birds	Pachycephalidae	*Pachycephala pectoralis*	golden whistler		C		33
animals	birds	Pachycephalidae	*Colluricincla harmonica*	grey shrike-thrush		C		45
animals	birds	Pardalotidae	*Pardalotus striatus*	striated pardalote		C		109
animals	birds	Pardalotidae	*Pardalotus punctatus*	spotted pardalote		C		16
animals	birds	Passeridae	*Passer domesticus*	house sparrow	Y			20
animals	birds	Pelecanidae	*Pelecanus conspicillatus*	Australian pelican		C		21
animals	birds	Petroicidae	*Petroica rosea*	rose robin		C		22
animals	birds	Petroicidae	*Microeca fascinans*	jacky winter		C		9
animals	birds	Petroicidae	*Eopsaltria australis*	eastern yellow robin		C		24
animals	birds	Phaethontidae	*Phaethon lepturus*	white-tailed tropicbird		SL		1/1
animals	birds	Phalacrocoracidae	*Phalacrocorax sulcirostris*	little black cormorant		C		26
animals	birds	Phalacrocoracidae	*Microcarbo melanoleucos*	little pied cormorant		C		35
animals	birds	Phalacrocoracidae	*Phalacrocorax varius*	pied cormorant		C		14
animals	birds	Phalacrocoracidae	*Phalacrocorax carbo*	great cormorant		C		7
animals	birds	Phasianidae	*Coturnix ypsilophora*	brown quail		C		15
animals	birds	Phasianidae	*Coturnix pectoralis*	stubble quail		C		2
animals	birds	Podargidae	*Podargus strigoides*	tawny frogmouth		C		32
animals	birds	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian grebe		C		24
animals	birds	Podicipedidae	*Podiceps cristatus*	great crested grebe		C		9
animals	birds	Pomatostomidae	*Pomatostomus temporalis*	grey-crowned babbler		C		6
animals	birds	Psittacidae	*Platycercus adscitus palliceps*	pale-headed rosella (southern form)		C		3
animals	birds	Psittacidae	*Trichoglossus haematodus moluccanus*	rainbow lorikeet		C		136
animals	birds	Psittacidae	*Lathamus discolor*	swift parrot		E	CE	1
animals	birds	Psittacidae	*Neophema pulchella*	turquoise parrot		C		1
animals	birds	Psittacidae	*Barnardius zonarius*	Australian ringneck		C		4
animals	birds	Psittacidae	*Parvipsitta pusilla*	little lorikeet		C		52
animals	birds	Psittacidae	*Platycercus elegans*	crimson rosella		C		4
animals	birds	Psittacidae	*Platycercus eximius*	eastern rosella		C		2
animals	birds	Psittacidae	*Alisterus scapularis*	Australian king-parrot		C		5
animals	birds	Psittacidae	*Platycercus adscitus*	pale-headed rosella		C		144
animals	birds	Psittacidae	*Melopsittacus undulatus*	budgerigar		C		2
animals	birds	Psittacidae	*Trichoglossus chlorolepidotus*	scaly-breasted lorikeet		C		150
animals	birds	Psophodidae	*Psophodes olivaceus*	eastern whipbird		C		38
animals	birds	Psophodidae	*Cinclosoma punctatum*	spotted quail-thrush		C		5
animals	birds	Rallidae	*Lewinia pectoralis*	Lewin's rail		C		4
animals	birds	Rallidae	*Gallirallus philippensis*	buff-banded rail		C		3
animals	birds	Rallidae	*Amaurornis moluccana*	pale-vented bush-hen		C		1
animals	birds	Rallidae	*Porphyrio melanotus*	purple swamphen		C		32

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Rallidae	*Gallinula tenebrosa*	dusky moorhen		C		46
animals	birds	Rallidae	*Porzana tabuensis*	spotless crake		C		6
animals	birds	Rallidae	*Porzana fluminea*	Australian spotted crake		C		6
animals	birds	Rallidae	*Porzana pusilla*	Baillon's crake		C		12
animals	birds	Rallidae	*Fulica atra*	Eurasian coot		C		18
animals	birds	Recurvirostridae	*Himantopus himantopus*	black-winged stilt		C		13
animals	birds	Rhipiduridae	*Rhipidura albiscapa*	grey fantail		C		63
animals	birds	Rhipiduridae	*Rhipidura leucophrys*	willie wagtail		C		132
animals	birds	Rhipiduridae	*Rhipidura rufifrons*	rufous fantail		SL		10
animals	birds	Rhipiduridae	*Rhipidura leucophrys leucophrys*	willie wagtail (southern)		C		1
animals	birds	Rostratulidae	*Rostratula australis*	Australian painted snipe		V	E	6
animals	birds	Scolopacidae	*Gallinago hardwickii*	Latham's snipe		SL		4
animals	birds	Scolopacidae	*Calidris acuminata*	sharp-tailed sandpiper		SL		1
animals	birds	Scolopacidae	*Tringa stagnatilis*	marsh sandpiper		SL		1
animals	birds	Scolopacidae	*Limosa limosa*	black-tailed godwit		SL		3
animals	birds	Scolopacidae	*Actitis hypoleucos*	common sandpiper		SL		8
animals	birds	Strigidae	*Ninox strenua*	powerful owl		V		2
animals	birds	Strigidae	*Ninox boobook*	southern boobook		C		24
animals	birds	Sturnidae	*Sturnus vulgaris*	common starling	Y			47
animals	birds	Sturnidae	*Acridotheres tristis*	common myna	Y			69
animals	birds	Threskiornithidae	*Threskiornis molucca*	Australian white ibis		C		20
animals	birds	Threskiornithidae	*Plegadis falcinellus*	glossy ibis		SL		1
animals	birds	Threskiornithidae	*Threskiornis spinicollis*	straw-necked ibis		C		38
animals	birds	Threskiornithidae	*Platalea flavipes*	yellow-billed spoonbill		C		9
animals	birds	Threskiornithidae	*Platalea regia*	royal spoonbill		C		11
animals	birds	Timaliidae	*Zosterops lateralis cornwalli*	silvereye (eastern)		C		1
animals	birds	Timaliidae	*Zosterops lateralis*	silvereye		C		126
animals	birds	Turnicidae	*Turnix maculosus*	red-backed button-quail		C		2
animals	birds	Turnicidae	*Turnix melanogaster*	black-breasted button-quail		V	V	2
animals	birds	Turnicidae	*Turnix varius*	painted button-quail		C		5
animals	birds	Tytonidae	*Tyto novaehollandiae*	masked owl		C		1
animals	birds	Tytonidae	*Tyto delicatula*	eastern barn owl		C		3
animals	birds	Tytonidae	*Tyto novaehollandiae novaehollandiae*	masked owl (southern subspecies)		C		1
animals	cartilaginous fishes	Dasyatidae	*Hemitrygon fluviorum*	estuary stingray		NT		1
animals	insects	Aeshnidae	*Adversaeschna brevistyla*	blue-spotted hawker				1
animals	insects	Aeshnidae	*Anax papuensis*	Australian Emperor				1
animals	insects	Coenagrionidae	*Ischnura heterosticta heterosticta*	common bluetail				1
animals	insects	Corduliidae	*Hemicordulia australiae*	Australian emerald				1
animals	insects	Corduliidae	*Hemicordulia continentalis*	fat-bellied emerald				1
animals	insects	Hesperiidae	*Suniana sunias rectivitta*	wide-brand grass-dart				1
animals	insects	Hesperiidae	*Toxidia peron*	dingy grass-skipper				1
animals	insects	Hesperiidae	*Ocybadistes walkeri sothis*	green grass-dart				1
animals	insects	Lestidae	*Austrolestes leda*	wandering ringtail				1
animals	insects	Libellulidae	*Diplacodes bipunctata*	wandering percher				1
animals	insects	Libellulidae	*Orthetrum villosovittatum*	fiery skimmer				1
animals	insects	Libellulidae	*Crocothemis nigrifrons*	black-headed skimmer				1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	insects	Libellulidae	*Orthetrum caledonicum*	blue skimmer				1
animals	insects	Libellulidae	*Diplacodes haematodes*	scarlet percher				1
animals	insects	Libellulidae	*Pantala flavescens*	wandering glider				1
animals	insects	Libellulidae	*Orthetrum sabina*	slender skimmer				1
animals	insects	Libellulidae	*Macrodiplax cora*	wandering pennant				1
animals	insects	Libellulidae	*Tramea loewii*	common glider				1
animals	insects	Lycaenidae	*Catopyrops florinda*					1
animals	insects	Lycaenidae	*Zizina otis labradus*	common grass-blue (Australian subspecies)				2
animals	insects	Lycaenidae	*Psychonotis caelius taygetus*	small green-banded blue				2
animals	insects	Lycaenidae	*Prosotas dubiosa dubiosa*	purple line-blue				1
animals	insects	Nymphalidae	*Charaxes sempronius sempronius*	tailed emperor				2
animals	insects	Nymphalidae	*Phaedyma shepherdi shepherdi*	white-banded plane (southern subspecies)				1
animals	insects	Nymphalidae	*Danaus sp.*					1
animals	insects	Nymphalidae	*Heteronympha merope merope*	common brown				1
animals	insects	Nymphalidae	*Acraea andromacha andromacha*	glasswing				8
animals	insects	Nymphalidae	*Danaus petilia*	lesser wanderer				7
animals	insects	Nymphalidae	*Euploea corinna*	common crow				9
animals	insects	Nymphalidae	*Vanessa kershawi*	Australian painted lady				1
animals	insects	Nymphalidae	*Melanitis leda bankia*	evening brown				7
animals	insects	Nymphalidae	*Tirumala hamata hamata*	blue tiger				3
animals	insects	Nymphalidae	*Junonia villida villida*	meadow argus				7
animals	insects	Nymphalidae	*Hypolimnas bolina nerina*	varied eggfly				2
animals	insects	Nymphalidae	*Hypocysta adiante adiante*	orange ringlet				1
animals	insects	Nymphalidae	*Danaus plexippus*	monarch	Y			11
animals	insects	Papilionidae	*Cressida cressida cressida*	clearwing swallowtail				2
animals	insects	Papilionidae	*Papilio demoleus sthenelus*	chequered swallowtail				3
animals	insects	Papilionidae	*Papilio aegeus*					1
animals	insects	Papilionidae	*Papilio anactus*	dainty swallowtail				1
animals	insects	Papilionidae	*Graphium choredon*	blue triangle				2
animals	insects	Papilionidae	*Papilio aegeus aegeus*	orchard swallowtail (Australian subspecies)				2
animals	insects	Papilionidae	*Graphium eurypylus lycaon*	pale triangle				1
animals	insects	Pieridae	*Catopsilia pyranthe crokera*	white migrant				2
animals	insects	Pieridae	*Delias nigrina*	black jezebel				2
animals	insects	Pieridae	*Cepora perimale scyllara*	caper gull (Australian subspecies)				1
animals	insects	Pieridae	*Delias argenthona argenthona*	scarlet jezebel				3
animals	insects	Pieridae	*Eurema brigitta australis*	no-brand grass-yellow				1
animals	insects	Pieridae	*Eurema hecabe*	large grass-yellow				6
animals	insects	Pieridae	*Pieris rapae*	cabbage white	Y			2
animals	insects	Pieridae	*Catopsilia pomona*	lemon migrant				5
animals	insects	Pieridae	*Belenois java teutonia*	caper white				4
animals	insects	Pieridae	*Eurema smilax*	small grass-yellow				3
animals	mammals	Canidae	*Canis lupus dingo*	dingo				1
animals	mammals	Canidae	*Canis lupus familiaris*	dog	Y			3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Canidae	*Vulpes vulpes*	red fox	Y			8
animals	mammals	Dasyuridae	*Antechinus flavipes flavipes*	yellow-footed antechinus (south-east Queensland)		C		5
animals	mammals	Dasyuridae	*Planigale maculata*	common planigale		C		1
animals	mammals	Dasyuridae	*Sminthopsis murina*	common dunnart		C		1
animals	mammals	Delphinidae	*Orcaella heinsohni*	Australian snubfin dolphin		V		1
animals	mammals	Emballonuridae	*Saccolaimus flaviventris*	yellow-bellied sheathtail bat		C		1
animals	mammals	Felidae	*Felis catus*	cat	Y			1
animals	mammals	Leporidae	*Lepus europaeus*	European brown hare	Y			13
animals	mammals	Macropodidae	*Macropus rufogriseus*	red-necked wallaby		C		29
animals	mammals	Macropodidae	*Wallabia bicolor*	swamp wallaby		C		6
animals	mammals	Macropodidae	*Macropus parryi*	whiptail wallaby		C		2
animals	mammals	Macropodidae	*Macropus giganteus*	eastern grey kangaroo		C		9
animals	mammals	Macropodidae	*Macropus sp.*					2
animals	mammals	Miniopteridae	*Miniopterus schreibersii oceanensis*	eastern bent-wing bat		C		2
animals	mammals	Molossidae	*Mormopterus ridei*	eastern free-tailed bat		C		1
animals	mammals	Molossidae	*Mormopterus norfolkensis*	east coast freetail bat		C		1
animals	mammals	Molossidae	*Mormopterus lumsdenae*	northern free-tailed bat		C		1
animals	mammals	Molossidae	*Tadarida australis*	white-striped freetail bat		C		19
animals	mammals	Molossidae	*Mormopterus sp.*					5
animals	mammals	Muridae	*Mus musculus*	house mouse	Y			15
animals	mammals	Muridae	*Rattus rattus*	black rat	Y			13
animals	mammals	Muridae	*Rattus tunneyi*	pale field-rat		C		3
animals	mammals	Muridae	*Rattus lutreolus*	swamp rat		C		3
animals	mammals	Muridae	*Hydromys chrysogaster*	water rat		C		1
animals	mammals	Muridae	*Pseudomys gracilicaudatus*	eastern chestnut mouse		C		1
animals	mammals	Muridae	*Rattus fuscipes*	bush rat		C		1
animals	mammals	Peramelidae	*Isoodon macrourus*	northern brown bandicoot		C		11
animals	mammals	Petauridae	*Petaurus norfolcensis*	squirrel glider		C		23
animals	mammals	Petauridae	*Petaurus australis australis*	yellow-bellied glider (southern subspecies)		C		1
animals	mammals	Petauridae	*Petaurus breviceps*	sugar glider		C		6
animals	mammals	Petauridae	*Petaurus sp.*					2
animals	mammals	Phalangeridae	*Trichosurus vulpecula*	common brushtail possum		C		51
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		V	V	171
animals	mammals	Pseudocheiridae	*Petauroides volans volans*	southern greater glider		V	V	11/1
animals	mammals	Pseudocheiridae	*Pseudocheirus peregrinus*	common ringtail possum		C		4
animals	mammals	Pteropodidae	*Pteropus poliocephalus*	grey-headed flying-fox		C	V	12
animals	mammals	Pteropodidae	*Pteropus scapulatus*	little red flying-fox		C		4
animals	mammals	Pteropodidae	*Pteropus sp.*					1
animals	mammals	Pteropodidae	*Pteropus alecto*	black flying-fox		C		11
animals	mammals	Suidae	*Sus scrofa*	pig	Y			1
animals	mammals	Tachyglossidae	*Tachyglossus aculeatus*	short-beaked echidna		SL		4
animals	mammals	Vespertilionidae	*Scotorepens sp. (Parnaby)*	central-eastern broad-nosed bat		C		1
animals	mammals	Vespertilionidae	*Vespadelus troughtoni*	eastern cave bat		C		1
animals	mammals	Vespertilionidae	*Nyctophilus geoffroyi*	lesser long-eared bat		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Vespertilionidae	*Myotis macropus*	large-footed myotis		C		1
animals	mammals	Vespertilionidae	*Scotorepens orion*	south-eastern broad-nosed bat		C		1
animals	mammals	Vespertilionidae	*Chalinolobus morio*	chocolate wattled bat		C		1
animals	mammals	Vespertilionidae	*Nyctophilus gouldi*	Gould's long-eared bat		C		1
animals	mammals	Vespertilionidae	*Scotorepens greyii*	little broad-nosed bat		C		9
animals	mammals	Vespertilionidae	*Scoteanax rueppellii*	greater broad-nosed bat		C		1
animals	mammals	Vespertilionidae	*Chalinolobus gouldii*	Gould's wattled bat		C		5
animals	ray-finned fishes	Ambassidae	*Ambassis agassizii*	Agassiz's glassfish				2
animals	ray-finned fishes	Anguillidae	*Anguilla reinhardtii*	longfin eel				15
animals	ray-finned fishes	Anguillidae	*Anguilla australis*	southern shortfin eel				6
animals	ray-finned fishes	Atherinidae	*Craterocephalus stercusmuscarum*	flyspecked hardyhead				3
animals	ray-finned fishes	Atherinidae	*Craterocephalus marjoriae*	silverstreak hardyhead				1
animals	ray-finned fishes	Cichlidae	*Oreochromis mossambica*	Mozambique mouthbrooder	Y			3
animals	ray-finned fishes	Clupeidae	*Nematalosa erebi*	bony bream				1
animals	ray-finned fishes	Eleotridae	*Gobiomorphus australis*	striped gudgeon				10
animals	ray-finned fishes	Eleotridae	*Hypseleotris klunzingeri*	western carp gudgeon				1
animals	ray-finned fishes	Eleotridae	*Hypseleotris sp.*					1
animals	ray-finned fishes	Eleotridae	*Hypseleotris galii*	firetail gudgeon				12
animals	ray-finned fishes	Eleotridae	*Hypseleotris compressa*	empire gudgeon				12
animals	ray-finned fishes	Melanotaeniidae	*Melanotaenia duboulayi*	crimsonspotted rainbowfish				5
animals	ray-finned fishes	Mugilidae	*Mugil cephalus*	sea mullet				6
animals	ray-finned fishes	Plotosidae	*Tandanus tandanus*	freshwater catfish				5
animals	ray-finned fishes	Poeciliidae	*Xiphophorus hellerii*	swordtail	Y			1
animals	ray-finned fishes	Poeciliidae	*Xiphophorus maculatus*	platy	Y			8
animals	ray-finned fishes	Poeciliidae	*Poecilia reticulata*	guppy	Y			1
animals	ray-finned fishes	Poeciliidae	*Gambusia holbrooki*	mosquitofish	Y			19
animals	ray-finned fishes	Pseudomugilidae	*Pseudomugil signifer*	Pacific blue eye				5
animals	ray-finned fishes	Retropinnidae	*Retropinna semoni*	Australian smelt				5
animals	ray-finned fishes	Scorpaenidae	*Notesthes robusta*	bullrout				3
animals	ray-finned fishes	Terapontidae	*Leiopotherapon unicolor*	spangled perch				8
animals	reptiles	Agamidae	*Diporiphora australis*	tommy roundhead		C		13
animals	reptiles	Agamidae	*Intellagama lesueurii*	eastern water dragon		C		18
animals	reptiles	Agamidae	*Pogona barbata*	bearded dragon		C		25
animals	reptiles	Agamidae	*Diporiphora nobbi*	nobbi		C		1
animals	reptiles	Boidae	*Antaresia maculosa*	spotted python		C		2
animals	reptiles	Boidae	*Morelia spilota*	carpet python		C		13
animals	reptiles	Chelidae	*Emydura macquarii macquarii*	Murray turtle		C		4/1
animals	reptiles	Colubridae	*Dendrelaphis punctulatus*	green tree snake		C		10
animals	reptiles	Colubridae	*Tropidonophis mairii*	freshwater snake		C		3
animals	reptiles	Colubridae	*Boiga irregularis*	brown tree snake		C		3
animals	reptiles	Diplodactylidae	*Nebulifera robusta*	robust velvet gecko		C		4
animals	reptiles	Diplodactylidae	*Diplodactylus vittatus*	wood gecko		C		5
animals	reptiles	Elapidae	*Pseudechis guttatus*	spotted black snake		C		2
animals	reptiles	Elapidae	*Pseudechis porphyriacus*	red-bellied black snake		C		7
animals	reptiles	Elapidae	*Furina diadema*	red-naped snake		C		7/1
animals	reptiles	Elapidae	*Cacophis harriettae*	white-crowned snake		C		2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	reptiles	Elapidae	*Demansia psammophis*	yellow-faced whipsnake		C		15
animals	reptiles	Elapidae	*Pseudonaja textilis*	eastern brown snake		C		12
animals	reptiles	Elapidae	*Vermicella annulata*	bandy-bandy		C		1
animals	reptiles	Elapidae	*Cryptophis nigrescens*	eastern small-eyed snake		C		2
animals	reptiles	Elapidae	*Brachyurophis australis*	coral snake		C		5/1
animals	reptiles	Gekkonidae	*Gehyra dubia*	dubious dtella		C		18
animals	reptiles	Gekkonidae	*Hemidactylus frenatus*	house gecko	Y			3
animals	reptiles	Pygopodidae	*Lialis burtonis*	Burton's legless lizard		C		5/2
animals	reptiles	Pygopodidae	*Delma plebeia*	common delma		C		1
animals	reptiles	Scincidae	*Ctenotus spaldingi*	straight-browed ctenotus		C		12
animals	reptiles	Scincidae	*Carlia pectoralis*	open-litter rainbow skink		C		2
animals	reptiles	Scincidae	*Lygisaurus foliorum*	tree-base litter-skink		C		4
animals	reptiles	Scincidae	*Ctenotus taeniolatus*	copper-tailed skink		C		2
animals	reptiles	Scincidae	*Anomalopus verreauxii*	three-clawed worm-skink		C		4
animals	reptiles	Scincidae	*Lampropholis delicata*	dark-flecked garden sunskink		C		17
animals	reptiles	Scincidae	*Morethia taeniopleura*	fire-tailed skink		C		6
animals	reptiles	Scincidae	*Calyptotis scutirostrum*	scute-snouted calyptotis		C		2
animals	reptiles	Scincidae	*Lampropholis guichenoti*	pale-flecked garden sunskink		C		1
animals	reptiles	Scincidae	*Carlia pectoralis sensu lato*			C		1
animals	reptiles	Scincidae	*Cryptoblepharus pulcher pulcher*	elegant snake-eyed skink		C		18
animals	reptiles	Scincidae	*Tiliqua scincoides*	eastern blue-tongued lizard		C		4
animals	reptiles	Scincidae	*Carlia vivax*	tussock rainbow-skink		C		11/2
animals	reptiles	Scincidae	*Karma murrayi*	Murray's skink		C		2/1
animals	reptiles	Typhlopidae	*Anilios sp.*					1
animals	reptiles	Varanidae	*Varanus varius*	lace monitor		C		9/1
animals	uncertain	Indeterminate	*Indeterminate*	Unknown or Code Pending		C		6
fungi	uncertain	Ascomycota	*Mycocalicium fulvofuscum*			C		1/1
fungi	uncertain	Ascomycota	*Ascobolus australis*			C		1/1
fungi		Basidiomycota	*Agrocybe*			C		1/1
fungi		Basidiomycota	*Conocybe*			C		1/1
fungi		Basidiomycota	*Coprinus*			C		3/3
fungi		Basidiomycota	*Tylopilus*			C		1/1
fungi		Basidiomycota	*Inocybe*			C		5/5
fungi		Basidiomycota	*Amanita flavella*			C		1/1
fungi		Basidiomycota	*Gloeophyllum striatum*			C		1/1
fungi		Basidiomycota	*Trichaptum byssogenum*			C		1/1
fungi		Basidiomycota	*Scleroderma verrucosum*			C		1/1
fungi		Basidiomycota	*Agaricus*			C		1/1
fungi		Basidiomycota	*Russula*			C		1/1
fungi		Basidiomycota	*Tricholoma*			C		1/1
plants	conifers	Araucariaceae	*Araucaria bidwillii*	bunya pine		C		1
plants	conifers	Cupressaceae	*Callitris baileyi*	Bailey's cypress		NT		1
plants	ferns	Aspleniaceae	*Asplenium attenuatum var. attenuatum*			C		1
plants	ferns	Blechnaceae	*Blechnum indicum*	swamp water fern		C		1
plants	ferns	Blechnaceae	*Doodia caudata*			C		1/1
plants	ferns	Blechnaceae	*Doodia australis*			C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	ferns	Cyatheaceae	*Cyathea cooperi*			C		1
plants	ferns	Dennstaedtiaceae	*Histiopteris incisa*	bats-wing fern		C		1
plants	ferns	Dennstaedtiaceae	*Pteridium esculentum*	common bracken		C		1
plants	ferns	Dicksoniaceae	*Calochlaena dubia*			C		1
plants	ferns	Gleicheniaceae	*Gleichenia dicarpa*	pouched coral fern		C		1
plants	ferns	Polypodiaceae	*Pyrrosia rupestris*	rock felt fern		C		1
plants	ferns	Polypodiaceae	*Drynaria rigidula*			C		1
plants	ferns	Pteridaceae	*Adiantum aethiopicum*			C		1
plants	ferns	Pteridaceae	*Adiantum hispidulum var. hispidulum*			C		1
plants	ferns	Pteridaceae	*Cheilanthes sieberi*			C		1
plants	ferns	Pteridaceae	*Pellaea paradoxa*	heart fern		C		1
plants	ferns	Pteridaceae	*Pteris vittata*	Chinese bracken		C		1/1
plants	ferns	Pteridaceae	*Acrostichum speciosum*	mangrove fern		C		2/1
plants	higher dicots	Acanthaceae	*Ruellia simplex*		Y			7/7
plants	higher dicots	Acanthaceae	*Thunbergia alata*	black-eyed Susan	Y			1
plants	higher dicots	Acanthaceae	*Brunoniella australis*	blue trumpet		C		3/2
plants	higher dicots	Acanthaceae	*Rostellularia adscendens*			C		1/1
plants	higher dicots	Acanthaceae	*Pseuderanthemum variabile*	pastel flower		C		2/1
plants	higher dicots	Adoxaceae	*Sambucus nigra*		Y			2/2
plants	higher dicots	Aizoaceae	*Aptenia cordifolia*		Y			1/1
plants	higher dicots	Amaranthaceae	*Alternanthera brasiliana*		Y			1/1
plants	higher dicots	Amaranthaceae	*Alternanthera pungens*	khaki weed	Y			2/2
plants	higher dicots	Amaranthaceae	*Alternanthera nana*	hairy joyweed		C		2/2
plants	higher dicots	Amaranthaceae	*Alternanthera denticulata*	lesser joyweed		C		3/3
plants	higher dicots	Anacardiaceae	*Schinus terebinthifolius*		Y			3/3
plants	higher dicots	Aphanopetalaceae	*Aphanopetalum resinosum*	gumvine		C		1
plants	higher dicots	Apiaceae	*Cyclospermum leptophyllum*		Y			2/2
plants	higher dicots	Apiaceae	*Lilaeopsis brisbanica*			E		1/1
plants	higher dicots	Apiaceae	*Platysace ericoides*	heath platysace		C		1/1
plants	higher dicots	Apiaceae	*Apium prostratum*			C		1
plants	higher dicots	Apiaceae	*Ammi majus*	bishop's weed	Y			3/3
plants	higher dicots	Apiaceae	*Daucus carota*	wild carrot	Y			2/2
plants	higher dicots	Araliaceae	*Polyscias elegans*	celery wood		C		1
plants	higher dicots	Araliaceae	*Astrotricha latifolia*			C		1
plants	higher dicots	Araliaceae	*Hydrocotyle laxiflora*	stinking pennywort		C		1/1
plants	higher dicots	Araliaceae	*Trachymene procumbens*	creeping wild parsnip		C		1
plants	higher dicots	Asteraceae	*Vittadinia sulcata*	native daisy		C		1/1
plants	higher dicots	Asteraceae	*Cassinia subtropica*			C		1
plants	higher dicots	Asteraceae	*Erigeron canadensis*		Y			1/1
plants	higher dicots	Asteraceae	*Glossocardia bidens*	native cobbler's pegs		C		1/1
plants	higher dicots	Asteraceae	*Arctotheca calendula*	Cape weed	Y			1/1
plants	higher dicots	Asteraceae	*Calyptocarpus vialis*	creeping cinderella weed	Y			3/3
plants	higher dicots	Asteraceae	*Hypochaeris radicata*	catsear	Y			1/1
plants	higher dicots	Asteraceae	*Vittadinia pustulata*			C		2/2
plants	higher dicots	Asteraceae	*Ageratum houstonianum*	blue billygoat weed	Y			3/2
plants	higher dicots	Asteraceae	*Brachyscome basaltica*			C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Asteraceae	*Carduus pycnocephalus*		Y			1/1
plants	higher dicots	Asteraceae	*Cyanthillium cinereum*			C		2/1
plants	higher dicots	Asteraceae	*Hypochaeris albiflora*		Y			1/1
plants	higher dicots	Asteraceae	*Leiocarpa brevicompta*			C		2/2
plants	higher dicots	Asteraceae	*Dimorphotheca ecklonis*		Y			2/2
plants	higher dicots	Asteraceae	*Sigesbeckia orientalis*	Indian weed		C		1
plants	higher dicots	Asteraceae	*Ambrosia artemisiifolia*	annual ragweed	Y			2/2
plants	higher dicots	Asteraceae	*Gamochaeta pensylvanica*		Y			1/1
plants	higher dicots	Asteraceae	*Ozothamnus diosmifolius*	white dogwood		C		1/1
plants	higher dicots	Asteraceae	*Sphagneticola trilobata*		Y			1/1
plants	higher dicots	Asteraceae	*Senecio madagascariensis*	fireweed	Y			2
plants	higher dicots	Asteraceae	*Lactuca serriola forma serriola*		Y			2/2
plants	higher dicots	Asteraceae	*Solidago altissima subsp. altissima*	goldenrod	Y			1/1
plants	higher dicots	Asteraceae	*Thymophylla tenuiloba var. tenuiloba*		Y			1/1
plants	higher dicots	Asteraceae	*Verbesina encelioides var. encelioides*		Y			1/1
plants	higher dicots	Asteraceae	*Olearia nernstii*	Ipswich daisy		C		3/2
plants	higher dicots	Asteraceae	*Bidens bipinnata*	bipinnate beggar's ticks	Y			1
plants	higher dicots	Asteraceae	*Cirsium vulgare*	spear thistle	Y			1/1
plants	higher dicots	Asteraceae	*Centaurea jacea*		Y			9/9
plants	higher dicots	Asteraceae	*Tagetes minuta*	stinking roger	Y			1/1
plants	higher dicots	Asteraceae	*Bidens pilosa*		Y			2/1
plants	higher dicots	Asteraceae	*Sonchus oleraceus*	common sowthistle	Y			2/2
plants	higher dicots	Asteraceae	*Cichorium intybus*	chicory	Y			2/2
plants	higher dicots	Asteraceae	*Zinnia peruviana*	wild zinnia	Y			1
plants	higher dicots	Asteraceae	*Ageratina riparia*	mistflower	Y			1/1
plants	higher dicots	Asteraceae	*Camptacra barbata*			C		1/1
plants	higher dicots	Basellaceae	*Anredera cordifolia*	Madeira vine	Y			2/2
plants	higher dicots	Bignoniaceae	*Campsis radicans*		Y			1/1
plants	higher dicots	Bignoniaceae	*Pyrostegia venusta*		Y			1/1
plants	higher dicots	Bignoniaceae	*Pandorea floribunda*			C		3/3
plants	higher dicots	Bignoniaceae	*Jacaranda mimosifolia*	jacaranda	Y			1
plants	higher dicots	Bignoniaceae	*Pandorea*			C		1
plants	higher dicots	Bignoniaceae	*Tecoma stans var. stans*		Y			1/1
plants	higher dicots	Brassicaceae	*Cardamine hirsuta*	common bittercress	Y			2/2
plants	higher dicots	Brassicaceae	*Brassica chinensis*	Chinese cabbage	Y			1/1
plants	higher dicots	Brassicaceae	*Raphanus raphanistrum*	wild radish	Y			2/2
plants	higher dicots	Brassicaceae	*Capsella bursapastoris*	shepherd's purse	Y			2/2
plants	higher dicots	Brassicaceae	*Lepidium didymum*		Y			1/1
plants	higher dicots	Cactaceae	*Opuntia aurantiaca*	tiger pear	Y			1/1
plants	higher dicots	Caesalpiniaceae	*Senna artemisioides subsp. filifolia*			C		1/1
plants	higher dicots	Caesalpiniaceae	*Senna pendula var. glabrata*	Easter cassia	Y			1
plants	higher dicots	Caesalpiniaceae	*Senna septemtrionalis*		Y			1/1
plants	higher dicots	Caesalpiniaceae	*Biancaea decapetala*		Y			1/1
plants	higher dicots	Campanulaceae	*Lobelia concolor*			C		1/1
plants	higher dicots	Campanulaceae	*Lobelia browniana*			C		1/1
plants	higher dicots	Campanulaceae	*Lobelia purpurascens*	white root		C		2/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Campanulaceae	*Wahlenbergia gracilis*	sprawling bluebell		C		4/4
plants	higher dicots	Campanulaceae	*Wahlenbergia capillaris*			C		1/1
plants	higher dicots	Campanulaceae	*Wahlenbergia littoricola*			C		1/1
plants	higher dicots	Campanulaceae	*Lobelia stenophylla*			C		1/1
plants	higher dicots	Capparaceae	*Capparis arborea*	brush caper berry		C		1
plants	higher dicots	Capparaceae	*Capparis sarmentosa*	scrambling caper		C		1
plants	higher dicots	Caryophyllaceae	*Sagina procumbens*	spreading pearlwort	Y			1/1
plants	higher dicots	Caryophyllaceae	*Polycarpaea corymbosa var. minor*			C		1/1
plants	higher dicots	Caryophyllaceae	*Drymaria cordata subsp. cordata*		Y			1/1
plants	higher dicots	Caryophyllaceae	*Stellaria media*	chickweed	Y			1/1
plants	higher dicots	Casuarinaceae	*Casuarina cunninghamiana subsp. cunninghamiana*			C		1/1
plants	higher dicots	Casuarinaceae	*Casuarina cunninghamiana*			C		1
plants	higher dicots	Casuarinaceae	*Allocasuarina torulosa*			C		1
plants	higher dicots	Casuarinaceae	*Allocasuarina littoralis*			C		1
plants	higher dicots	Celastraceae	*Denhamia celastroides*	broad-leaved boxwood		C		1
plants	higher dicots	Celastraceae	*Denhamia bilocularis*			C		1
plants	higher dicots	Celastraceae	*Elaeodendron australe var. australe*			C		1
plants	higher dicots	Celastraceae	*Denhamia cunninghamii*			C		2/2
plants	higher dicots	Celastraceae	*Denhamia silvestris*			C		1/1
plants	higher dicots	Chenopodiaceae	*Einadia nutans subsp. linifolia*			C		1/1
plants	higher dicots	Chenopodiaceae	*Einadia hastata*			C		1
plants	higher dicots	Clusiaceae	*Hypericum gramineum*			C		1/1
plants	higher dicots	Combretaceae	*Combretum paniculatum*		Y			1/1
plants	higher dicots	Crassulaceae	*Bryophyllum beauverdii*		Y			1/1
plants	higher dicots	Crassulaceae	*Bryophyllum delagoense*		Y			1
plants	higher dicots	Crassulaceae	*Bryophyllum daigremontianum*		Y			1/1
plants	higher dicots	Crassulaceae	*Bryophyllum fedtschenkoi*		Y			2/2
plants	higher dicots	Crassulaceae	*Crassula sieberiana*			C		1/1
plants	higher dicots	Cucurbitaceae	*Cucumis metuliferus*	prickly cucumber	Y			1/1
plants	higher dicots	Dilleniaceae	*Hibbertia diffusa*			C		1
plants	higher dicots	Dilleniaceae	*Hibbertia linearis var. obtusifolia*			C		1
plants	higher dicots	Dilleniaceae	*Hibbertia stricta*			C		1
plants	higher dicots	Ebenaceae	*Diospyros fasciculosa*	grey ebony		C		1
plants	higher dicots	Ebenaceae	*Diospyros geminata*	scaly ebony		C		1
plants	higher dicots	Elaeocarpaceae	*Elaeocarpus obovatus*	blueberry ash		C		1
plants	higher dicots	Ericaceae	*Brachyloma daphnoides subsp. daphnoides*			C		1/1
plants	higher dicots	Ericaceae	*Leucopogon juniperinus*	prickly heath		C		1
plants	higher dicots	Ericaceae	*Acrotriche aggregata*	red cluster heath		C		2/1
plants	higher dicots	Ericaceae	*Melichrus adpressus*			C		1
plants	higher dicots	Erythroxylaceae	*Erythroxylum sp. (Splityard Creek L.Pedley 5360)*			C		1
plants	higher dicots	Euphorbiaceae	*Mallotus philippensis*	red kamala		C		1
plants	higher dicots	Euphorbiaceae	*Euphorbia hyssopifolia*		Y			2/2
plants	higher dicots	Euphorbiaceae	*Mallotus claoxyloides*	green kamala		C		1
plants	higher dicots	Euphorbiaceae	*Euphorbia ophthalmica*		Y			2/2
plants	higher dicots	Euphorbiaceae	*Euphorbia dallachyana*			C		1/1
plants	higher dicots	Euphorbiaceae	*Euphorbia cyathophora*	dwarf poinsettia	Y			1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Euphorbiaceae	*Alchornea ilicifolia*	native holly		C		1
plants	higher dicots	Euphorbiaceae	*Euphorbia umbellata*		Y			1/1
plants	higher dicots	Euphorbiaceae	*Euphorbia peplus*	petty spurge	Y			1/1
plants	higher dicots	Euphorbiaceae	*Acalypha nemorum*	hairy acalypha		C		1
plants	higher dicots	Euphorbiaceae	*Ricinus communis*	castor oil bush	Y			1/1
plants	higher dicots	Fabaceae	*Galactia tenuiflora var. lucida*			C		1/1
plants	higher dicots	Fabaceae	*Neonotonia wightii var. wightii*		Y			3/3
plants	higher dicots	Fabaceae	*Sesbania cannabina var. cannabina*			C		1/1
plants	higher dicots	Fabaceae	*Vigna vexillata var. angustifolia*			C		1/1
plants	higher dicots	Fabaceae	*Indigofera australis subsp. australis*			C		1/1
plants	higher dicots	Fabaceae	*Erythrina vespertilio subsp. vespertilio*			C		1/1
plants	higher dicots	Fabaceae	*Glycine*			C		1/1
plants	higher dicots	Fabaceae	*Cullen tenax*	emu-foot		C		2/2
plants	higher dicots	Fabaceae	*Hovea lorata*			C		4/4
plants	higher dicots	Fabaceae	*Vigna luteola*	dalrymple vigna	Y			2/2
plants	higher dicots	Fabaceae	*Desmodium gunnii*			C		1/1
plants	higher dicots	Fabaceae	*Glycine tabacina*	glycine pea		C		1/1
plants	higher dicots	Fabaceae	*Hovea lanceolata*			C		1
plants	higher dicots	Fabaceae	*Hovea planifolia*			C		2/2
plants	higher dicots	Fabaceae	*Trifolium dubium*	yellow sucking clover	Y			1/1
plants	higher dicots	Fabaceae	*Desmodium varians*	slender tick trefoil		C		1/1
plants	higher dicots	Fabaceae	*Melilotus indicus*	hexham scent	Y			1/1
plants	higher dicots	Fabaceae	*Pultenaea euchila*	orange pultenaea		C		2/1
plants	higher dicots	Fabaceae	*Pultenaea spinosa*			C		1
plants	higher dicots	Fabaceae	*Pultenaea villosa*	hairy bush pea		C		1
plants	higher dicots	Fabaceae	*Daviesia villifera*	prickly daviesia		C		1
plants	higher dicots	Fabaceae	*Daviesia wyattiana*	long-leaved bitter pea		C		1
plants	higher dicots	Fabaceae	*Indigofera baileyi*			C		3/3
plants	higher dicots	Fabaceae	*Indigofera spicata*	creeping indigo	Y			2/2
plants	higher dicots	Fabaceae	*Jacksonia scoparia*			C		1
plants	higher dicots	Fabaceae	*Kennedia rubicunda*	red Kennedy pea		C		1
plants	higher dicots	Fabaceae	*Neonotonia wightii*		Y			1
plants	higher dicots	Fabaceae	*Sesbania cannabina*			C		1/1
plants	higher dicots	Fabaceae	*Daviesia ulicifolia*	native gorse		C		1
plants	higher dicots	Fabaceae	*Desmodium triflorum*		Y			1/1
plants	higher dicots	Fabaceae	*Glycine clandestina*			C		1
plants	higher dicots	Fabaceae	*Glycine microphylla*			C		1/1
plants	higher dicots	Fabaceae	*Medicago polymorpha*	burr medic	Y			1/1
plants	higher dicots	Fabaceae	*Stylosanthes scabra*		Y			1/1
plants	higher dicots	Fabaceae	*Pultenaea petiolaris*			C		1
plants	higher dicots	Fabaceae	*Chorizema parviflorum*	eastern flame pea		C		1/1
plants	higher dicots	Fabaceae	*Genista monspessulana*	Montpellier broom	Y			1/1
plants	higher dicots	Fabaceae	*Swainsona brachycarpa*			C		1/1
plants	higher dicots	Fabaceae	*Erythrina crista-galli*		Y			2/2
plants	higher dicots	Fabaceae	*Austrosteenisia blackii*	bloodvine		C		1
plants	higher dicots	Fabaceae	*Castanospermum australe*	black bean		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Fabaceae	*Swainsona queenslandica*			C		1/1
plants	higher dicots	Fabaceae	*Desmodium rhytidophyllum*			C		1/1
plants	higher dicots	Fabaceae	*Tephrosia glomeruliflora*	pink tephrosia	Y			1/1
plants	higher dicots	Fabaceae	*Vicia sativa subsp. nigra*		Y			1/1
plants	higher dicots	Fabaceae	*Macroptilium atropurpureum*	siratro	Y			1/1
plants	higher dicots	Geraniaceae	*Geranium homeanum*			C		1/1
plants	higher dicots	Geraniaceae	*Pelargonium*			C		2/2
plants	higher dicots	Geraniaceae	*Geranium solanderi var. solanderi*	native geranium		C		3/2
plants	higher dicots	Goodeniaceae	*Goodenia hederacea subsp. hederacea*			C		3/3
plants	higher dicots	Goodeniaceae	*Goodenia bellidifolia subsp. argentea*			C		1/1
plants	higher dicots	Goodeniaceae	*Goodenia rotundifolia*			C		1
plants	higher dicots	Loranthaceae	*Amyema pendula subsp. longifolia*			C		1/1
plants	higher dicots	Loranthaceae	*Amyema miquelii*			C		1/1
plants	higher dicots	Malvaceae	*Pavonia hastata*	pink pavonia	Y			2/1
plants	higher dicots	Malvaceae	*Abutilon oxycarpum var. oxycarpum*			C		1
plants	higher dicots	Malvaceae	*Hibiscus heterophyllus*			C		1
plants	higher dicots	Malvaceae	*Malvaviscus arboreus*		Y			1/1
plants	higher dicots	Malvaceae	*Gossypium hirsutum*		Y			1/1
plants	higher dicots	Malvaceae	*Sida rhombifolia*		Y			1
plants	higher dicots	Malvaceae	*Sida cordifolia*		Y			1
plants	higher dicots	Meliaceae	*Melia azedarach*	white cedar		C		1
plants	higher dicots	Mimosaceae	*Acacia hispidula*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia penninervis var. penninervis*			C		1
plants	higher dicots	Mimosaceae	*Acacia penninervis var. longiracemosa*			C		2/2
plants	higher dicots	Mimosaceae	*Acacia maidenii*	Maiden's wattle		C		1
plants	higher dicots	Mimosaceae	*Leucaena leucocephala subsp. leucocephala*		Y			2/2
plants	higher dicots	Mimosaceae	*Acacia falcata*	sickle wattle		C		2/1
plants	higher dicots	Mimosaceae	*Acacia fimbriata*	Brisbane golden wattle		C		2/1
plants	higher dicots	Mimosaceae	*Neptunia gracilis forma gracilis*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia julifera subsp. julifera*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia glaucocarpa*	hickory wattle		C		1/1
plants	higher dicots	Mimosaceae	*Acacia macradenia*	zig-zag wattle		C		1
plants	higher dicots	Mimosaceae	*Acacia juncifolia*			C		3/2
plants	higher dicots	Mimosaceae	*Acacia complanata*	flatstem wattle		C		4/3
plants	higher dicots	Mimosaceae	*Acacia leiocalyx subsp. leiocalyx*			C		1
plants	higher dicots	Mimosaceae	*Acacia disparrima subsp. disparrima*			C		1
plants	higher dicots	Moraceae	*Trophis scandens subsp. scandens*			C		1
plants	higher dicots	Moraceae	*Maclura cochinchinensis*	cockspur thorn		C		1
plants	higher dicots	Moraceae	*Streblus brunonianus*	whalebone tree		C		1
plants	higher dicots	Moraceae	*Ficus opposita*			C		1
plants	higher dicots	Moraceae	*Ficus coronata*	creek sandpaper fig		C		1
plants	higher dicots	Moraceae	*Morus alba*	white mulberry	Y			2/2
plants	higher dicots	Moraceae	*Ficus obliqua*			C		1
plants	higher dicots	Myrsinaceae	*Myrsine variabilis*			C		1
plants	higher dicots	Myrsinaceae	*Embelia australiana*	embelia		C		1
plants	higher dicots	Myrsinaceae	*Lysimachia arvensis*		Y			2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Myrtaceae	*Acmena smithii*	lillypilly satinash		C		1
plants	higher dicots	Myrtaceae	*Corymbia henryi*	large-leaved spotted gum		C		3/2
plants	higher dicots	Myrtaceae	*Eucalyptus dura*			C		5/4
plants	higher dicots	Myrtaceae	*Eucalyptus major*	mountain grey gum		C		1
plants	higher dicots	Myrtaceae	*Gossia bidwillii*			C		1
plants	higher dicots	Myrtaceae	*Eucalyptus carnea*			C		1
plants	higher dicots	Myrtaceae	*Sannantha collina*			C		1
plants	higher dicots	Myrtaceae	*Corymbia gummifera*	red bloodwood		C		1
plants	higher dicots	Myrtaceae	*Eucalyptus fibrosa*			C		1
plants	higher dicots	Myrtaceae	*Angophora leiocarpa*	rusty gum		C		1
plants	higher dicots	Myrtaceae	*Corymbia citriodora*	spotted gum		C		1
plants	higher dicots	Myrtaceae	*Corymbia intermedia*	pink bloodwood		C		1
plants	higher dicots	Myrtaceae	*Corymbia torelliana*	cadaghi		C		2/1
plants	higher dicots	Myrtaceae	*Eucalyptus curtisii*	Plunkett mallee		NT		12/11
plants	higher dicots	Myrtaceae	*Melaleuca bracteata*			C		1
plants	higher dicots	Myrtaceae	*Melaleuca viminalis*			C		2/1
plants	higher dicots	Myrtaceae	*Corymbia tessellaris*	Moreton Bay ash		C		1
plants	higher dicots	Myrtaceae	*Eucalyptus moluccana*	gum-topped box		C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus tindaliae*	Queensland white stringybark		C		1
plants	higher dicots	Myrtaceae	*Backhousia myrtifolia*	carrol		C		1
plants	higher dicots	Myrtaceae	*Eucalyptus acmenoides*			C		2/2
plants	higher dicots	Myrtaceae	*Lophostemon confertus*	brush box		C		1
plants	higher dicots	Myrtaceae	*Tristaniopsis laurina*			C		1
plants	higher dicots	Myrtaceae	*Leptospermum neglectum*			C		1/1
plants	higher dicots	Myrtaceae	*Lophostemon suaveolens*	swamp box		C		1
plants	higher dicots	Myrtaceae	*Rhodomyrtus psidioides*	native guava		C		1
plants	higher dicots	Myrtaceae	*Eucalyptus siderophloia*			C		1
plants	higher dicots	Myrtaceae	*Eucalyptus tereticornis*			C		1
plants	higher dicots	Myrtaceae	*Leptospermum trinervium*	woolly tea-tree		C		1
plants	higher dicots	Myrtaceae	*Leptospermum polygalifolium*	tantoon		C		1
plants	higher dicots	Myrtaceae	*Corymbia henryi x C.torelliana*			C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus fibrosa subsp. fibrosa*			C		5/5
plants	higher dicots	Myrtaceae	*Eucalyptus melanophloia subsp. melanophloia*			C		1/1
plants	higher dicots	Ochnaceae	*Ochna serrulata*	ochna	Y			2/1
plants	higher dicots	Oleaceae	*Notelaea lloydii*	Lloyd's native olive		V	V	10/10
plants	higher dicots	Oleaceae	*Jasminum didymum subsp. racemosum*			C		1
plants	higher dicots	Oleaceae	*Olea europaea subsp. cuspidata*		Y			2/2
plants	higher dicots	Oleaceae	*Notelaea*			C		3/3
plants	higher dicots	Oleaceae	*Olea europaea*	common olive	Y			1
plants	higher dicots	Oleaceae	*Notelaea ovata*	forest olive		C		3/2
plants	higher dicots	Oleaceae	*Jasminum simplicifolium subsp. australiense*			C		1
plants	higher dicots	Oleaceae	*Notelaea punctata*			C		1
plants	higher dicots	Oleaceae	*Notelaea microcarpa*			C		1/1
plants	higher dicots	Oleaceae	*Notelaea ipsviciensis*			E	CE	10/10
plants	higher dicots	Oleaceae	*Chionanthus ramiflorus*	northern olive		C		1/1
plants	higher dicots	Oleaceae	*Jasminum dianthifolium*			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Onagraceae	*Oenothera rosea*	rose evening primrose	Y			1/1
plants	higher dicots	Onagraceae	*Oenothera indecora subsp. bonariensis*		Y			1/1
plants	higher dicots	Onagraceae	*Oenothera stricta subsp. stricta*		Y			1/1
plants	higher dicots	Passifloraceae	*Passiflora foetida*		Y			1/1
plants	higher dicots	Passifloraceae	*Passiflora pallida*		Y			1/1
plants	higher dicots	Passifloraceae	*Passiflora suberosa*	corky passion flower	Y			1
plants	higher dicots	Passifloraceae	*Passiflora subpeltata*	white passion flower	Y			1
plants	higher dicots	Passifloraceae	*Passiflora suberosa subsp. litoralis*		Y			1/1
plants	higher dicots	Passifloraceae	*Passiflora herbertiana subsp. herbertiana*	native passionfruit		C		1
plants	higher dicots	Petiveriaceae	*Rivina humilis*		Y			1
plants	higher dicots	Phyllanthaceae	*Phyllanthus similis*			C		3/3
plants	higher dicots	Phyllanthaceae	*Phyllanthus simplex*			C		1/1
plants	higher dicots	Phyllanthaceae	*Breynia oblongifolia*			C		1
plants	higher dicots	Phyllanthaceae	*Phyllanthus virgatus*			C		1/1
plants	higher dicots	Phyllanthaceae	*Bridelia exaltata*			C		1
plants	higher dicots	Phyllanthaceae	*Phyllanthus hirtellus*			C		1/1
plants	higher dicots	Phyllanthaceae	*Glochidion ferdinandi*			C		1
plants	higher dicots	Pittosporaceae	*Bursaria spinosa subsp. spinosa*			C		1
plants	higher dicots	Pittosporaceae	*Auranticarpa rhombifolia*			C		1
plants	higher dicots	Pittosporaceae	*Pittosporum revolutum*	yellow pittosporum		C		1
plants	higher dicots	Plantaginaceae	*Plantago lanceolata*		Y			2/2
plants	higher dicots	Plantaginaceae	*Veronica plebeia*	trailing speedwell		C		1
plants	higher dicots	Polygonaceae	*Rumex hypogaeus*		Y			1/1
plants	higher dicots	Polygonaceae	*Persicaria decipiens*	slender knotweed		C		1/1
plants	higher dicots	Polygonaceae	*Persicaria attenuata*			C		1/1
plants	higher dicots	Polygonaceae	*Antigonon leptopus*		Y			2/2
plants	higher dicots	Polygonaceae	*Rumex crispus*	curled dock	Y			1/1
plants	higher dicots	Polygonaceae	*Acetosa vesicaria*		Y			2/2
plants	higher dicots	Portulacaceae	*Calandrinia pickeringii*			C		1/1
plants	higher dicots	Proteaceae	*Persoonia sericea*	silky geebung		C		1/1
plants	higher dicots	Proteaceae	*Grevillea robusta*			C		1
plants	higher dicots	Putranjivaceae	*Drypetes deplanchei*	grey boxwood		C		1
plants	higher dicots	Rhamnaceae	*Alphitonia excelsa*	soap tree		C		1
plants	higher dicots	Rhamnaceae	*Cryptandra longistaminea*			C		1/1
plants	higher dicots	Rhamnaceae	*Pomaderris lanigera*			C		1/1
plants	higher dicots	Rosaceae	*Malus pumila*		Y			1/1
plants	higher dicots	Rosaceae	*Eriobotrya japonica*	loquat	Y			1
plants	higher dicots	Rosaceae	*Rhaphiolepis indica*	Indian hawthorn	Y			1
plants	higher dicots	Rubiaceae	*Gynochthodes canthoides*			C		1
plants	higher dicots	Rubiaceae	*Hodgkinsonia ovatiflora*	golden ash		C		1
plants	higher dicots	Rubiaceae	*Cyclophyllum coprosmoides*			C		2
plants	higher dicots	Rubiaceae	*Psydrax odorata*			C		1
plants	higher dicots	Rubiaceae	*Everistia vacciniifolia*			C		1
plants	higher dicots	Rubiaceae	*Spermacoce multicaulis*			C		2/2
plants	higher dicots	Rubiaceae	*Opercularia diphylla*			C		1/1
plants	higher dicots	Rubiaceae	*Asperula geminifolia*			C		2/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Rubiaceae	*Richardia stellaris*		Y			4/4
plants	higher dicots	Rubiaceae	*Asperula conferta*			C		1/1
plants	higher dicots	Rubiaceae	*Pomax umbellata*			C		2/1
plants	higher dicots	Rutaceae	*Sarcomelicope simplicifolia subsp. simplicifolia*	yellow aspen		C		1
plants	higher dicots	Rutaceae	*Zieria smithii*			C		1
plants	higher dicots	Rutaceae	*Bergera koenigii*		Y			1/1
plants	higher dicots	Rutaceae	*Acronychia laevis*	glossy acronychia		C		1/1
plants	higher dicots	Rutaceae	*Boronia rosmarinifolia*	forest boronia		C		3/2
plants	higher dicots	Rutaceae	*Flindersia australis*	crow's ash		C		1
plants	higher dicots	Rutaceae	*Flindersia bennettii*			C		1
plants	higher dicots	Rutaceae	*Acronychia pauciflora*	soft acronychia		C		1
plants	higher dicots	Rutaceae	*Flindersia xanthoxyla*	yellow-wood		C		1
plants	higher dicots	Rutaceae	*Flindersia collina*	broad-leaved leopard tree		C		1
plants	higher dicots	Sapindaceae	*Mischocarpus pyriformis*			C		1
plants	higher dicots	Sapindaceae	*Cardiospermum grandiflorum*	heart seed vine	Y			6/5
plants	higher dicots	Sapindaceae	*Toechima tenax*	pitted-leaf steelwood		C		1
plants	higher dicots	Sapindaceae	*Harpullia hillii*			C		1
plants	higher dicots	Sapindaceae	*Jagera pseudorhus*			C		1
plants	higher dicots	Sapindaceae	*Alectryon connatus*	grey birds-eye		C		1
plants	higher dicots	Sapindaceae	*Mischocarpus anodontus*	veiny pearfruit		C		1
plants	higher dicots	Sapindaceae	*Alectryon tomentosus*			C		2/1
plants	higher dicots	Sapindaceae	*Alectryon subcinereus*			C		1
plants	higher dicots	Sapindaceae	*Dodonaea triangularis*			C		2/2
plants	higher dicots	Sapindaceae	*Elattostachys nervosa*	green tamarind		C		2/1
plants	higher dicots	Sapindaceae	*Cupaniopsis parvifolia*	small-leaved tuckeroo		C		1
plants	higher dicots	Sapindaceae	*Arytera divaricata*	coogera		C		1
plants	higher dicots	Sapotaceae	*Planchonella pohlmaniana*			C		1
plants	higher dicots	Sapotaceae	*Planchonella cotinifolia var. pubescens*			C		1
plants	higher dicots	Scrophulariaceae	*Eremophila debilis*	winter apple		C		1/1
plants	higher dicots	Scrophulariaceae	*Myoporum acuminatum*	coastal boobialla		C		1/1
plants	higher dicots	Simaroubaceae	*Ailanthus triphysa*	white siris		C		1
plants	higher dicots	Sparrmanniaceae	*Corchorus olitorius*	jute		C		1/1
plants	higher dicots	Stackhousiaceae	*Stackhousia muricata*			C		1/1
plants	higher dicots	Stylidiaceae	*Stylidium graminifolium*	grassy-leaved trigger-flower		C		1/1
plants	higher dicots	Stylidiaceae	*Stylidium debile*	frail trigger plant		C		1/1
plants	higher dicots	Thymelaeaceae	*Wikstroemia indica*	tie bush		C		1
plants	higher dicots	Thymelaeaceae	*Pimelea glauca*	smooth riceflower		C		3/3
plants	higher dicots	Thymelaeaceae	*Pimelea linifolia*			C		1
plants	higher dicots	Tropaeolaceae	*Tropaeolum majus*	garden nasturtium	Y			1/1
plants	higher dicots	Ulmaceae	*Aphananthe philippinensis*			C		1
plants	higher dicots	Ulmaceae	*Trema tomentosa var. aspera*			C		1
plants	higher dicots	Ulmaceae	*Celtis sinensis*	Chinese elm	Y			3/2
plants	higher dicots	Urticaceae	*Dendrocnide photinophylla*	shiny-leaved stinging tree		C		1
plants	higher dicots	Urticaceae	*Urtica incisa*	stinging nettle		C		1
plants	higher dicots	Violaceae	*Afrohybanthus stellarioides*			C		2/1
plants	higher dicots	Vitaceae	*Cayratia clematidea*	slender grape		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Vitaceae	*Clematicissus opaca*			C		1
plants	lower dicots	Annonaceae	*Polyalthia nitidissima*	polyalthia		C		1
plants	lower dicots	Apocynaceae	*Cascabela thevetia*	yellow oleander	Y			2/2
plants	lower dicots	Apocynaceae	*Marsdenia coronata*	slender milkvine		V		13/13
plants	lower dicots	Apocynaceae	*Secamone elliptica*			C		1
plants	lower dicots	Apocynaceae	*Alstonia constricta*	bitterbark		C		2/1
plants	lower dicots	Apocynaceae	*Parsonsia straminea*	monkey rope		C		1
plants	lower dicots	Apocynaceae	*Alyxia ruscifolia*			C		1
plants	lower dicots	Apocynaceae	*Gomphocarpus physocarpus*	balloon cottonbush	Y			1/1
plants	lower dicots	Apocynaceae	*Araujia sericifera*	white moth vine	Y			1/1
plants	lower dicots	Apocynaceae	*Parsonsia brisbanensis*	broad-leaved monkey vine		C		9/9
plants	lower dicots	Apocynaceae	*Marsdenia*			C		1
plants	lower dicots	Apocynaceae	*Carissa ovata*	currantbush		C		1
plants	lower dicots	Apocynaceae	*Nerium oleander*	oleander	Y			2/2
plants	lower dicots	Aristolochiaceae	*Aristolochia meridionalis subsp. meridionalis*			C		3/3
plants	lower dicots	Boraginaceae	*Cordia myxa*		Y			1/1
plants	lower dicots	Boraginaceae	*Echium plantagineum*	Paterson's curse	Y			1/1
plants	lower dicots	Convolvulaceae	*Ipomoea cairica*		Y			1/1
plants	lower dicots	Convolvulaceae	*Dichondra repens*	kidney weed		C		1
plants	lower dicots	Convolvulaceae	*Cuscuta campestris*	dodder	Y			1
plants	lower dicots	Convolvulaceae	*Polymeria calycina*	pink bindweed		C		1
plants	lower dicots	Hernandiaceae	*Hernandia bivalvis*	cudgerie		NT		1
plants	lower dicots	Lamiaceae	*Plectranthus amboinicus*	allspice	Y			1/1
plants	lower dicots	Lamiaceae	*Clerodendrum floribundum*			C		1
plants	lower dicots	Lamiaceae	*Plectranthus habrophyllus*			E	E	1/1
plants	lower dicots	Lamiaceae	*Westringia eremicola*	slender westringia		C		1/1
plants	lower dicots	Lamiaceae	*Leonotis nepetifolia*		Y			2/2
plants	lower dicots	Lamiaceae	*Mentha satureioides*	native pennyroyal		C		2/2
plants	lower dicots	Lamiaceae	*Lamium amplexicaule*	deadnettle	Y			1/1
plants	lower dicots	Lamiaceae	*Salvia coccinea*	red salvia	Y			1
plants	lower dicots	Lamiaceae	*Stachys arvensis*	stagger weed	Y			1/1
plants	lower dicots	Lamiaceae	*Plectranthus verticillatus*		Y			1/1
plants	lower dicots	Lauraceae	*Cryptocarya triplinervis var. triplinervis*			C		1/1
plants	lower dicots	Lauraceae	*Cryptocarya triplinervis*			C		1
plants	lower dicots	Lauraceae	*Cryptocarya sclerophylla*	totempole		C		1
plants	lower dicots	Lauraceae	*Cassytha filiformis*	dodder laurel		C		1/1
plants	lower dicots	Lauraceae	*Endiandra sieberi*	hard corkwood		C		1
plants	lower dicots	Menispermaceae	*Stephania japonica var. discolor*			C		1
plants	lower dicots	Menispermaceae	*Tinospora smilacina*	snakevine		C		1
plants	lower dicots	Menispermaceae	*Legnephora moorei*			C		1
plants	lower dicots	Menispermaceae	*Pleogyne australis*	wiry grape		C		1
plants	lower dicots	Papaveraceae	*Argemone ochroleuca subsp. ochroleuca*	Mexican poppy	Y			2/2
plants	lower dicots	Papaveraceae	*Fumaria officinalis subsp. officinalis*		Y			1/1
plants	lower dicots	Ranunculaceae	*Ranunculus sessiliflorus var. sessiliflorus*			C		1/1
plants	lower dicots	Ranunculaceae	*Ranunculus lappaceus*	common buttercup		C		1/1
plants	lower dicots	Ranunculaceae	*Ranunculus sceleratus subsp. sceleratus*		Y			3/3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	lower dicots	Solanaceae	*Solanum chrysotrichum*		Y			2/2
plants	lower dicots	Solanaceae	*Cestrum parqui*	green cestrum	Y			4/3
plants	lower dicots	Solanaceae	*Nicotiana glauca*	tree tobacco	Y			1/1
plants	lower dicots	Solanaceae	*Solanum nodiflorum*		Y			2/2
plants	lower dicots	Solanaceae	*Solanum pseudolulo*		Y			1/1
plants	lower dicots	Solanaceae	*Solanum mauritianum*	wild tobacco	Y			1/1
plants	lower dicots	Solanaceae	*Solanum stelligerum*	devil's needles		C		1
plants	lower dicots	Solanaceae	*Solanum elaeagnifolium*	silverleaf nightshade	Y			1/1
plants	lower dicots	Solanaceae	*Solanum seaforthianum*	Brazilian nightshade	Y			2/1
plants	lower dicots	Solanaceae	*Salpichroa origanifolia*	pampas lily of the valley	Y			1/1
plants	lower dicots	Solanaceae	*Datura ferox*	fierce thornapple	Y			1/1
plants	lower dicots	Verbenaceae	*Lantana camara*	lantana	Y			1
plants	lower dicots	Verbenaceae	*Lantana montevidensis*	creeping lantana	Y			3/2
plants	lower dicots	Verbenaceae	*Verbena bonariensis*	purpletop	Y			1
plants	monocots	Amaryllidaceae	*Crinum pedunculatum*	river lily		C		2/1
plants	monocots	Amaryllidaceae	*Zephyranthes carinata*		Y			1/1
plants	monocots	Araceae	*Pistia stratiotes*	water lettuce	Y			1/1
plants	monocots	Araceae	*Colocasia esculenta*	taro	Y			3/3
plants	monocots	Arecaceae	*Syagrus romanzoffiana*	Queen palm	Y			1
plants	monocots	Asparagaceae	*Asparagus virgatus*		Y			1/1
plants	monocots	Asparagaceae	*Asparagus africanus*	ornamental asparagus	Y			3/2
plants	monocots	Asparagaceae	*Asparagus plumosus*	feathered asparagus fern	Y			1
plants	monocots	Asphodelaceae	*Aloe maculata*		Y			2/2
plants	monocots	Asphodelaceae	*xGastrolea*			C		1/1
plants	monocots	Colchicaceae	*Iphigenia indica*			C		1/1
plants	monocots	Commelinaceae	*Commelina benghalensis*		Y			1/1
plants	monocots	Commelinaceae	*Aneilema acuminatum*			C		1
plants	monocots	Commelinaceae	*Commelina diffusa*	wandering jew		C		2/1
plants	monocots	Commelinaceae	*Callisia repens*		Y			1/1
plants	monocots	Commelinaceae	*Callisia fragrans*		Y			2/1
plants	monocots	Cyperaceae	*Fimbristylis microcarya*			C		1/1
plants	monocots	Cyperaceae	*Fimbristylis dichotoma*	common fringe-rush		C		1/1
plants	monocots	Cyperaceae	*Lepidosperma laterale*			C		1
plants	monocots	Cyperaceae	*Cyperus victoriensis*			C		1/1
plants	monocots	Cyperaceae	*Cyperus involucratus*		Y			1/1
plants	monocots	Cyperaceae	*Cyperus brevifolius*	Mullumbimby couch	Y			1/1
plants	monocots	Cyperaceae	*Abildgaardia ovata*			C		1/1
plants	monocots	Cyperaceae	*Gahnia aspera*			C		2/1
plants	monocots	Cyperaceae	*Cyperus fulvus*			C		1/1
plants	monocots	Cyperaceae	*Cyperus papyrus*	papyrus	Y			1/1
plants	monocots	Cyperaceae	*Caustis blakei*			C		1
plants	monocots	Dioscoreaceae	*Dioscorea transversa*	native yam		C		1
plants	monocots	Dracaenaceae	*Sansevieria trifasciata*	mother-in-law's tongue	Y			1
plants	monocots	Dracaenaceae	*Sansevieria trifasciata cv. Laurentii*		Y			1/1
plants	monocots	Hemerocallidaceae	*Dianella caerulea*			C		1
plants	monocots	Hemerocallidaceae	*Dianella longifolia*			C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Hemerocallidaceae	*Geitonoplesium cymosum*	scrambling lily		C		1
plants	monocots	Hemerocallidaceae	*Dianella brevipedunculata*			C		1/1
plants	monocots	Hemerocallidaceae	*Dianella longifolia var. stenophylla*			C		3/3
plants	monocots	Hypoxidaceae	*Hypoxis pratensis var. tuberculata*			C		2/2
plants	monocots	Iridaceae	*Patersonia sericea*			C		1
plants	monocots	Laxmanniaceae	*Lomandra filiformis subsp. filiformis*			C		1/1
plants	monocots	Laxmanniaceae	*Lomandra filiformis subsp. coriacea*			C		1/1
plants	monocots	Laxmanniaceae	*Eustrephus latifolius*	wombat berry		C		1
plants	monocots	Laxmanniaceae	*Lomandra multiflora*			C		1
plants	monocots	Laxmanniaceae	*Lomandra longifolia*			C		1
plants	monocots	Laxmanniaceae	*Laxmannia gracilis*	slender wire lily		C		2/2
plants	monocots	Laxmanniaceae	*Lomandra confertifolia subsp. pallida*			C		2/2
plants	monocots	Orchidaceae	*Chiloglottis*			C		1
plants	monocots	Orchidaceae	*Pterostylis nutans*			C		1
plants	monocots	Orchidaceae	*Microtis parviflora*	slender onion orchid		C		1
plants	monocots	Orchidaceae	*Chiloglottis diphylla*			C		2/2
plants	monocots	Orchidaceae	*Pterostylis ophioglossa*			C		1
plants	monocots	Orchidaceae	*Epidendrum x obrienianum*		Y			1/1
plants	monocots	Orchidaceae	*Acianthus*			C		1
plants	monocots	Poaceae	*Digitaria parviflora*			C		1
plants	monocots	Poaceae	*Dichanthium annulatum*	sheda grass	Y			1/1
plants	monocots	Poaceae	*Dichanthium aristatum*	angleton grass	Y			2/2
plants	monocots	Poaceae	*Dichelachne micrantha*	shorthair plumegrass		C		1
plants	monocots	Poaceae	*Eremochloa bimaculata*	poverty grass		C		2/2
plants	monocots	Poaceae	*Chrysopogon sylvaticus*			C		1/1
plants	monocots	Poaceae	*Dichanthium sericeum subsp. sericeum*			C		1/1
plants	monocots	Poaceae	*Anthosachne kingiana subsp. multiflora*			C		1/1
plants	monocots	Poaceae	*Enteropogon unispiceus*			C		1
plants	monocots	Poaceae	*Aristida leichhardtiana*			C		1/1
plants	monocots	Poaceae	*Eragrostis leptostachya*			C		1/1
plants	monocots	Poaceae	*Lachnagrostis filiformis*			C		1/1
plants	monocots	Poaceae	*Hyparrhenia rufa subsp. rufa*		Y			1/1
plants	monocots	Poaceae	*Cynodon dactylon var. dactylon*		Y			1/1
plants	monocots	Poaceae	*Echinopogon nutans var. nutans*			C		2/2
plants	monocots	Poaceae	*Austrostipa rudis subsp. nervosa*			C		1/1
plants	monocots	Poaceae	*Dinebra decipiens var. decipiens*			C		1/1
plants	monocots	Poaceae	*Megathyrsus maximus var. maximus*		Y			1
plants	monocots	Poaceae	*Panicum decompositum var. tenuius*			C		1/1
plants	monocots	Poaceae	*Bothriochloa bladhii subsp. bladhii*			C		1/1
plants	monocots	Poaceae	*Megathyrsus maximus var. pubiglumis*		Y			2/1
plants	monocots	Poaceae	*Microlaena stipoides var. stipoides*			C		1/1
plants	monocots	Poaceae	*Cynodon nlemfuensis var. nlemfuensis*		Y			1/1
plants	monocots	Poaceae	*Chloris gayana*	rhodes grass	Y			1/1
plants	monocots	Poaceae	*Melinis repens*	red natal grass	Y			2/1
plants	monocots	Poaceae	*Panicum simile*			C		1/1
plants	monocots	Poaceae	*Aristida vagans*			C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Poaceae	*Panicum effusum*			C		1/1
plants	monocots	Poaceae	*Urochloa mutica*		Y			1/1
plants	monocots	Poaceae	*Cynodon dactylon*		Y			1
plants	monocots	Poaceae	*Dichelachne rara*			C		1
plants	monocots	Poaceae	*Panicum pygmaeum*	dwarf panic		C		1
plants	monocots	Poaceae	*Sarga leiocladum*			C		1/1
plants	monocots	Poaceae	*Themeda triandra*	kangaroo grass		C		1/1
plants	monocots	Poaceae	*Urochloa foliosa*			C		1/1
plants	monocots	Poaceae	*Cenchrus setaceus*		Y			1/1
plants	monocots	Poaceae	*Entolasia stricta*	wiry panic		C		1
plants	monocots	Poaceae	*Urochloa whiteana*			C		1/1
plants	monocots	Poaceae	*Aristida personata*			C		1/1
plants	monocots	Poaceae	*Cenchrus purpureus*		Y			1
plants	monocots	Poaceae	*Eragrostis curvula*		Y			1/1
plants	monocots	Poaceae	*Oplismenus aemulus*	creeping shade grass		C		1
plants	monocots	Poaceae	*Urochloa decumbens*		Y			1/1
plants	monocots	Poaceae	*Digitaria ramularis*			C		1/1
plants	monocots	Poaceae	*Entolasia marginata*	bordered panic		C		1/1
plants	monocots	Poaceae	*Imperata cylindrica*	blady grass		C		2/1
plants	monocots	Poaceae	*Melinis minutiflora*	molasses grass	Y			1
plants	monocots	Poaceae	*Paspalidium distans*	shotgrass		C		1/1
plants	monocots	Poaceae	*Cymbopogon refractus*	barbed-wire grass		C		1
plants	monocots	Ripogonaceae	*Ripogonum album*	white supplejack		C		1
plants	monocots	Smilacaceae	*Smilax australis*	barbed-wire vine		C		1
plants	monocots	Xanthorrhoeaceae	*Xanthorrhoea latifolia subsp. latifolia*			C		1
plants	monocots	Xyridaceae	*Xyris complanata*	yellow-eye		C		1/1
plants	mosses	Bryophyte	*Bryophyte*			C		1/1
plants	mosses	Ptychomitriaceae	*Ptychomitrium australe*			C		1/1
plants		Rhodophyta	*Audouinella*			C		1/1
plants		Rhodophyta	*Caloglossa leprieurii var. angustata*			C		1/1
plants		Rhodophyta	*Caloglossa ogasawaraensis*			C		1/1
plants		Rhodophyta	*Compsopogon coeruleus*			C		1/1
protists	blue-green algae	Cyanophyceae	*Scytonema crispum*			C		1/1
protists	blue-green algae	Cyanophyceae	*Porphyrosiphon notarisii*			C		3/3
protists	blue-green algae	Cyanophyceae	*Aphanothece elabens*			C		1/1
protists	green algae	Chlorophyceae	*Cephaleuros parasiticus*			C		1/1
protists	green algae	Chlorophyceae	*Trentepohlia rigidula*			C		2/2
protists	green algae	Chlorophyceae	*Pithophora oedogonia var. oedogonia*			C		1/1
protists	uncertain	Algae	*Algae*			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 Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (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 V

VEGETATION MANAGEMENT REPORT AND PRE-CLEARING MAPPING

Department of Natural Resources, Mines and Energy



Vegetation management report

For Lot: 73 Plan: SP128662

Current as at 04/09/2018

Queensland Government

This publication has been compiled by Operations Support, Department of Natural Resources, Mines and Energy.

© State of Queensland, (2018)

The Queensland Government supports and encourages the dissemination and exchange of its information. The copyright in this publication is licensed under a Creative Commons - Attribution 4.0 International (CC BY) licence.

Under this licence you are free, without having to seek our permission, to use this publication in accordance with the licence terms.



You must keep intact the copyright notice and attribute the State of Queensland as the source of the publication.

Note: Some content in this publication may have different licence terms as indicated.

For more information on this licence, visit http://creativecommons.org/licenses/by/3.0/au/deed.en

The information contained herein is subject to change without notice. The Queensland Government shall not be liable for technical or other errors or omissions contained herein. The reader/user accepts all risks and responsibility for losses, damages, costs and other consequences resulting directly or indirectly from using this information.

Recent changes

New vegetation clearing laws

New vegetation management laws were passed by the Queensland Parliament on 3 May 2018 and may affect the clearing you can undertake on your property.

For more information, read about the new vegetation management laws (https://www.dnrme.qld.gov.au/land-water/initiatives/vegetation-management-laws/) or call 135VEG (13 58 34) between 8.30am and 4.30pm Monday to Friday.

Updated mapping

The Regulated Vegetation Management Map and Supporting Map was updated in March 2018 to reflect the most up to date information available in relation to regional ecosystems, essential habitat and wetland mapping (Version 10).

Overview

Based on the lot on plan details you have supplied, this report provides the following detailed information:

- *Vegetation management framework* - an explanation of the application of the framework.
- *Property details* - information about the specified Lot on Plan, lot size, local government area, bioregion(s), subregion(s), catchment(s), coastal or non coastal status, and any applicable area management plans associated with your property.
- *Vegetation management details for the specified Lot on Plan* - specific information about your property including vegetation categories, regional ecosystems, watercourses, wetlands, essential habitat, and protected plants.
- *Contact information.*
- *Maps* - a series of colour maps to assist in identifying regulated vegetation on your property.
- *Other legislation contact information.*

This information will assist you to determine your options for managing vegetation, which may include:

- exempt clearing work
- accepted development vegetation clearing code
- an area management plan
- a development approval.

Other laws

The clearing of native vegetation is regulated by both Queensland and Australian legislation, and some local governments also regulate native vegetation clearing. You may need to obtain an approval or permit under another Act, such as Queensland's Protected Plants framework or the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Section 6 of this guide provides contact details of other agencies you should confirm requirements with, before commencing vegetation clearing.

Table of Contents

1. Vegetation management framework . . . 5
1.1 Exempt clearing work . . . 5
1.2 Accepted development vegetation clearing codes . . . 5
1.3 Area management plans . . . 6
1.4 Development approvals . . . 6
2. Property details . . . 7
2.1 Tenure . . . 7
2.2 Property location . . . 7
3. Vegetation management details for Lot: 73 Plan: SP128662 . . . 8
3.1 Vegetation categories . . . 8
3.2 Regional ecosystems . . . 9
3.3 Watercourses . . . 9
3.4 Wetlands . . . 10
3.5 Essential habitat . . . 10
3.6 Protected plants (administered by the Department of Environment and Science (DES)) . . . 13
3.7 Emissions Reduction Fund (ERF) . . . 14
4. Contact information for DNRME . . . 14
5. Maps . . . 15
5.1 Regulated vegetation management map . . . 16
5.2 Vegetation management supporting map . . . 17
5.3 Coastal/non coastal map . . . 18
5.4 Protected plants map administered by DES . . . 19
6. Other relevant legislation contacts list . . . 20

1. Vegetation management framework

The *Vegetation Management Act 1999* (VMA), the Vegetation Management Regulation 2012, the *Planning Act 2016* and the Planning Regulation 2017, in conjunction with associated policies and codes, form the Vegetation Management Framework.

The VMA does not apply to all land tenures or vegetation types. State forests, national parks, forest reserves and some tenures under the *Forestry Act 1959* and *Nature Conservation Act 1992* are not regulated by the VMA. Managing or clearing vegetation on these tenures may require approvals under these laws.

The following native vegetation is not regulated under the VMA but may require permit(s) under other laws:

- grass or non-woody herbage;
- a plant within a grassland regional ecosystem prescribed under Schedule 5 of the Vegetation Management Regulation 2012; and
- a mangrove.

1.1 Exempt clearing work

Exempt clearing work is an activity for which you do not need to notify DNRME or obtain an approval. Exempt clearing work was previously known as exemptions.

In areas that are mapped as Category X (white in colour) on the regulated vegetation management map (see section 5.1), and where the land tenure is freehold, indigenous land and leasehold land for agriculture and grazing purposes, the clearing of vegetation is considered exempt clearing work and does not require notification or development approval. For all other land tenures, contact DNRME before commencing clearing to ensure that the proposed activity is exempt clearing work.

A range of routine property management activities are considered exempt clearing work. A list of exempt clearing work is available at
https://www.qld.gov.au/environment/land/vegetation/exemptions/.

Exempt clearing work may be affected if the proposed clearing area is subject to development approval conditions, a covenant, an environmental offset, an exchange area, a restoration notice, or an area mapped as Category A. Contact DNRME prior to clearing in any of these areas.

1.2 Accepted development vegetation clearing codes

Some clearing activities can be undertaken under an accepted development vegetation clearing code. The codes can be downloaded at
https://www.qld.gov.au/environment/land/vegetation/codes/

If you intend to clear vegetation under an accepted development vegetation clearing code, you must notify DNRME before commencing. The information in this report will assist you to complete the online notification form.

You can complete the online form at
https://apps.dnrm.qld.gov.au/vegetation/

1.3 Area management plans

Area Management Plans (AMP) provide an alternative approval system for vegetation clearing. They list the purposes and clearing conditions that have been approved for the areas covered by the plan. It is not necessary to use an AMP, even when an AMP applies to your property.

As a result of the new laws, AMPs for fodder harvesting, managing thickened vegetation and managing encroachment will continue for 2 years. New notifications cannot be made for these AMPs.

New notifications can be made for all other AMPs. These will continue to apply until their nominated end date.

If an area management plan applies to your property for which you can make a new notification, it will be listed in Section 2.2 of this report. Before clearing under one of these AMPs, you must first notify the DNRME and then follow the conditions and requirements listed in the AMP.
https://www.qld.gov.au/environment/land/vegetation/area-plans/

1.4 Development approvals

If your proposed clearing is not exempt clearing work, or is not permitted under an accepted development vegetation clearing code, or an AMP, you may be able to apply for a development approval. Information on how to apply for a development approval is available at
https://www.qld.gov.au/environment/land/vegetation/applying/

2. Property details

2.1 Tenure

All of the lot, plan and tenure information associated with property Lot: 73 Plan: SP128662, including links to relevant Smart Maps, are listed in Table 1. The tenure of the property (whether it is freehold, leasehold, or other) may be viewed by clicking on the Smart Map link(s) provided.

Table 1: Lot, plan and tenure information for the property

Lot	Plan	Tenure	Link to property on SmartMap
273	SP128662	State Land	https://apps.information.qld.gov.au/data/cadastre/GenerateSmartMap?q=273\SP128662
73	SP128662	Freehold	https://apps.information.qld.gov.au/data/cadastre/GenerateSmartMap?q=73\SP128662

The tenure of the land may affect whether clearing is considered exempt clearing work or may be carried out under an accepted development vegetation clearing code.

2.2 Property location

Table 2 provides a summary of the locations for property Lot: 73 Plan: SP128662, in relation to natural and administrative boundaries.

Table 2: Property location details

Local Government(s)
Ipswich City

Bioregion(s)	Subregion(s)
Southeast Queensland	Moreton Basin

Catchment(s)
Brisbane

For the purposes of the accepted development vegetation clearing codes and the State Development Assessment Provisions (SDAP), this property is regarded as*
Coastal

*See also Map 5.4

Area Management Plan(s): Nil

3. Vegetation management details for Lot: 73 Plan: SP128662

3.1 Vegetation categories

Vegetation categories are shown on the regulated vegetation management map in section 5.1 of this report. A summary of vegetation categories on the subject lot are listed in Table 3. Descriptions for these categories are shown in Table 4.

Table 3: Vegetation categories for subject property. Total area: 25.01ha

Vegetation category	Area (ha)
Category B	4.8
Category C	14.42
Category X	5.79

Table 4

Category	Colour on Map	Description	Requirements / options
A	red	Compliance areas, environmental offset areas and voluntary declaration areas	Special conditions apply to Category A areas. Before clearing, contact DNRME to confirm any requirements in a Category A area.
B	dark blue	Remnant vegetation areas	Exempt clearing work, or notification and compliance with accepted development vegetation clearing codes, area management plans or development approval.
C	light blue	High-value regrowth areas	Exempt clearing work, or notification and compliance with managing Category C regrowth vegetation accepted development vegetation clearing code.
R	yellow	Regrowth within 50m of a watercourse or drainage feature in the Great Barrier Reef catchment areas	Exempt clearing work, or notification and compliance with managing Category R regrowth accepted development vegetation clearing code or area management plans.
X	white	Clearing is considered accepted development on freehold land, indigenous land and leasehold land for agriculture and grazing purposes. Contact DNRME to clarify whether a development approval is required for other State land tenures.	No permit or notification required on freehold land, indigenous land and leasehold land for agriculture and grazing. A development approval may be required for some State land tenures.

Property Map of Assessable Vegetation (PMAV)

This report does not confirm if a Property Map of Assessable Vegetation (PMAV) exists on a lot. To confirm whether or not a PMAV exists on a lot, please check the PMAV layer on the Queensland Globe2, or contact DNRME on 135VEG (135 834).

3.2 Regional ecosystems

The endangered, of concern and least concern regional ecosystems on your property are shown on the vegetation management supporting map in section 5.2 and are listed in Table 5.

A description of regional ecosystems can be accessed online at
https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/descriptions/

Table 5: Regional ecosystems present on subject property

Regional Ecosystem	VMA Status	Category	Area (Ha)	Short Description	Structure Category
12.3.3	Endangered	B	0.52	Eucalyptus tereticornis woodland on Quaternary alluvium	Sparse
12.3.3	Endangered	C	3.72	Eucalyptus tereticornis woodland on Quaternary alluvium	Sparse
12.3.7	Least concern	B	0.03	Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca spp. fringing woodland	Sparse
12.3.7	Least concern	C	0.09	Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca spp. fringing woodland	Sparse
12.9-10.19	Least concern	C	1.59	Eucalyptus fibrosa subsp. fibrosa woodland on sedimentary rocks	Sparse
12.9-10.2	Least concern	B	4.13	Corymbia citriodora subsp. variegata +/- Eucalyptus crebra open forest on sedimentary rocks	Mid-dense
12.9-10.2	Least concern	C	6.89	Corymbia citriodora subsp. variegata +/- Eucalyptus crebra open forest on sedimentary rocks	Mid-dense
12.9-10.3	Of concern	B	0.03	Eucalyptus moluccana open forest on sedimentary rocks	Mid-dense
12.9-10.7	Of concern	B	0.09	Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp., E. melanophloia woodland on sedimentary rocks	Sparse
12.9-10.7	Of concern	C	2.12	Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp., E. melanophloia woodland on sedimentary rocks	Sparse
non-rem	None	X	5.79	None	None

Please note:

1. All area and area derived figures included in this table have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

2. If Table 5 contains a Category 'plant', please be aware that this refers to 'plantations' such as forestry, and these areas are considered non-remnant under the VMA.

The VMA status of the regional ecosystem (whether it is endangered, of concern or least concern) also determines if any of the following are applicable:

- exempt clearing work
- accepted development vegetation clearing codes
- performance outcomes in State Development Assessment Provisions (SDAP).

3.3 Watercourses

Vegetation management watercourses and drainage features for this property are shown on the vegetation management supporting map in section 5.2.

3.4 Wetlands

There are no vegetation management wetlands present on this property.

3.5 Essential habitat

Protected wildlife is native wildlife prescribed under the *Nature Conservation Act 1992* (NCA), and includes endangered, vulnerable or near-threatened wildlife.

Essential habitat for protected wildlife includes suitable habitat on the lot, or where a species has been known to occur up to 1.1 kilometres from a lot on which there is assessable vegetation. These important habitat areas are protected under the VMA.

Any essential habitat on this property will be shown as blue hatching on the vegetation supporting map in section 5.2.

If essential habitat is identified on the lot, information about the protected wildlife species is provided in Table 6 below. The numeric labels on the vegetation management supporting map can be cross referenced with Table 6 to outline the essential habitat factors for that particular species. There may be essential habitat for more than one species on each lot, and areas of Category A, Category B and Category C can be mapped as Essential Habitat.

Essential habitat is compiled from a combination of species habitat models and buffered species records. Regional ecosystem is a mandatory essential habitat factor, unless otherwise stated. Essential habitat, for protected wildlife, means an area of vegetation shown on the Regulated Vegetation Management Map as assessable vegetation -

1) that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database. Essential habitat factors are comprised of - regional ecosystem (mandatory for most species), vegetation community, altitude, soils, position in landscape; or
2) in which the protected wildlife, at any stage of its life cycle, is located.

If there is no essential habitat mapping shown on the vegetation management supporting map for this lot, and there is no table in the sections below, it confirms that there is no essential habitat on the lot.

Category A and/or Category B and/or Category C

Table 6: Essential habitat in Category A and/or Category B and/or Category C

Label	Scientific Name	Common Name	NCA Status	Vegetation Community	Altitude	Soils	Position in Landscape
860	Phascolarctos cinereus	koala	V	SEQ: Open eucalypt forest and woodland that has: a) multiple strata layers containing Eucalyptus, Corymbia, Angophora, Lophostemon or Melaleuca trees that-at 1.3 metres above the ground-have a diameter both greater and less than 30 centimetres; and b) at least 1 of the following species: Eucalyptus tereticornis, E. fibrosa, E. propinqua; E. umbra, E. grandis, E. microcorys, E. tindaliae, E. resinifera, E. populnea, E. robusta, E. nigra, E. racemosa, E. crebra, E. exserta, E. seeana, Lophostemon confertus, L. suaveolens, Melaleuca quinquenervia. Outside SEQ: Open eucalypt forest and woodland that contains Eucalyptus &/or Corymbia spp. Tree species used for food varies across State and can include Eucalyptus tereticornis, E. camaldulensis, E. coolabah; E. drepanophylla, E. platyphylla, E. orgadophilla, E. thozetiana, E. melanophloia, E. populnea, E. melliodora, E. dealbata, E. microtheca, E. crebra, E. exserta, E. blakelyi, E. papuana, Corymbia tessellaris, C. citriodora, Melaleuca quinquenervia, M. leucadendra.	Sea level to 1000m.	None	Riparian areas, plains and hill/escarpment slopes.
848	Petauroides volans	greater glider	V	Tall mature open wet and dry eucalypt forest (Eucalyptus &/or Corymbia spp.) to low open eucalypt woodland; presence of hollow-bearing trees.	Sea level to 1300m.	Usually on soils of relatively high fertility.	None
1107	Ninox strenua	powerful owl	V	Wet and dry tall open eucalypt forest (Eucalyptus pilularis, E. acmenoides, E. tereticornis, E. camaldulensis, E. crebra, E. melliodora, Corymbia citriodora & C. intermedia), including mountain forest gullies/gorges; forests aged 60+ years (large & old) on fertile soils with suitable hollows; roosting in dense foliage of closed forest (occasionally caves) and foraging in open forest and woodland including areas adjacent to urban/rural development. Nest in large hollows (45-75cm diameter, 50-180cm deep) 6-45m above ground, in large (>100cm dbh) old eucalypts on the side or at the head of heavily wooded gully.	Sea level to 1000m.	None	Gully.
2180	Notelaea ipsviciensis	Cooneana olive	E	dry sclerophyll eucalypt forest.; open forest of Eucalyptus fibrosa, Corymbia citriodora and C. henryii	0 to 300 m	shallow sandy to loam soil derived from sandstone substrates or stony clay soils	hill sides, gullies in hilly terrain

Label	Scientific Name	Common Name	NCA Status	Vegetation Community	Altitude	Soils	Position in Landscape
11205	Marsdenia coronata	slender milkvine	V	open forest of Eucalyptus pilularis, E. microcorys, Corymbia intermedia, or Eucalyptus propinqua, E. carnea with Themeda understorey, or Lophostemon confertus, Corymbia intermedia, Eucalyptus carnea, Allocasuarina littoralis, Banksia integrifolia, or Eucalyptus carnea, E. propinqua, or Eucalyptus carnea, E. propinqua, E. acmenoides, or Allocasuarina littoralis, Lophostemon confertus, Corymbia citriodora, Eucalyptus carnea, E. tindaliae; woodland to open forest of Eucalyptus fibrosa, Corymbia citriodora, or Eucalyptus fibrosa, C. henryi, or Corymbia citriodora, Eucalyptus dura, C. henryii, or Eucalyptus dura, Eucalyptus acmenoides; rocky heathland with Acacia blakei; wet sclerophyll forest dominated by Eucalyptus andrewsii, E. biturbinata	0 to 800 m	red brown loam to clay or sandy soil occasionally skeletal	mostly on steep ridge or hill slope sometimes on rock ledges along clifflines rarely on alluvial terrace

Label	Regional Ecosystem (mandatory unless otherwise specified)
860	SEQ: 11.3.2, 11.3.4, 11.3.25, 11.3.26, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.9, 12.2.5, 12.2.6, 12.2.7, 12.2.8, 12.2.10, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.6, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.14, 12.3.18, 12.3.19, 12.3.20, 12.5.1, 12.5.2, 12.5.3, 12.5.4, 12.5.6, 12.5.7, 12.5.10, 12.5.12, 12.8.1, 12.8.8, 12.8.9, 12.8.11, 12.8.12, 12.8.14, 12.8.16, 12.8.17, 12.8.20, 12.8.24, 12.8.25, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.7, 12.9-10.8, 12.9-10.11, 12.9-10.12, 12.9-10.14, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.21, 12.9-10.25, 12.9-10.26, 12.9-10.27, 12.9-10.28, 12.9-10.29, 12.11.2, 12.11.3, 12.11.5, 12.11.6, 12.11.7, 12.11.8, 12.11.9, 12.11.14, 12.11.16, 12.11.17, 12.11.18, 12.11.22, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.2, 12.12.3, 12.12.5, 12.12.6, 12.12.7, 12.12.8, 12.12.9, 12.12.11, 12.12.12, 12.12.14, 12.12.15, 12.12.23, 12.12.24, 12.12.25, 12.12.28. Outside SEQ: 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.3.8, 4.3.10, 4.3.11, 4.4.1, 4.5.3, 4.5.5, 4.5.6, 4.5.8, 4.5.9, 4.7.1, 4.7.7, 4.7.8, 4.9.6, 4.9.10, 4.9.12, 4.9.17, 6.3.1, 6.3.2, 6.3.3, 6.3.4, 6.3.5, 6.3.7, 6.3.8, 6.3.9, 6.3.11, 6.3.12, 6.3.17, 6.3.18, 6.3.22, 6.3.24, 6.3.25, 6.4.1, 6.4.2, 6.4.3, 6.4.4, 6.5.1, 6.5.2, 6.5.3, 6.5.5, 6.5.6, 6.5.7, 6.5.8, 6.5.9, 6.5.10, 6.5.11, 6.5.13, 6.5.14, 6.5.15, 6.5.16, 6.5.17, 6.5.18, 6.5.19, 6.6.2, 6.7.1, 6.7.2, 6.7.5, 6.7.6, 6.7.7, 6.7.9, 6.7.11, 6.7.12, 6.7.13, 6.7.14, 6.7.17, 6.9.3, 7.2.3, 7.2.4, 7.2.7, 7.2.11, 7.3.7, 7.3.8, 7.3.9, 7.3.12, 7.3.13, 7.3.14, 7.3.16, 7.3.19, 7.3.20, 7.3.21, 7.3.25, 7.3.26, 7.3.39, 7.3.40, 7.3.42, 7.3.43, 7.3.44, 7.3.45, 7.3.47, 7.3.48, 7.3.50, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.8.7, 7.8.8, 7.8.10, 7.8.15, 7.8.16, 7.8.17, 7.8.18, 7.8.19, 7.11.5, 7.11.6, 7.11.13, 7.11.14, 7.11.16, 7.11.18, 7.11.19, 7.11.20, 7.11.21, 7.11.31, 7.11.32, 7.11.33, 7.11.34, 7.11.35, 7.11.37, 7.11.41, 7.11.42, 7.11.43, 7.11.44, 7.11.45, 7.11.46, 7.11.47, 7.11.48, 7.11.49, 7.11.50, 7.11.51, 7.12.4, 7.12.5, 7.12.17, 7.12.21, 7.12.22, 7.12.23, 7.12.24, 7.12.25, 7.12.26, 7.12.27, 7.12.28, 7.12.29, 7.12.30, 7.12.33, 7.12.34, 7.12.35, 7.12.51, 7.12.52, 7.12.53, 7.12.54, 7.12.55, 7.12.56, 7.12.57, 7.12.58, 7.12.59, 7.12.60, 7.12.61, 7.12.62, 7.12.63, 7.12.65, 7.12.66, 7.12.69, 8.1.5, 8.2.3, 8.2.6, 8.2.7, 8.2.8, 8.2.11, 8.2.12, 8.2.13, 8.2.14, 8.3.1, 8.3.2, 8.3.3, 8.3.5, 8.3.6, 8.3.8, 8.3.10, 8.3.11, 8.3.13, 8.5.1, 8.5.2, 8.5.3, 8.5.5, 8.5.6, 8.5.7, 8.9.1, 8.10.1, 8.11.1, 8.11.3, 8.11.4, 8.11.5, 8.11.6, 8.11.8, 8.11.10, 8.11.12, 8.12.4, 8.12.5, 8.12.6, 8.12.7, 8.12.8, 8.12.9, 8.12.12, 8.12.14, 8.12.20, 8.12.22, 8.12.23, 8.12.25, 8.12.26, 8.12.27, 8.12.29, 8.12.31, 8.12.32, 9.3.1, 9.3.2, 9.3.3, 9.3.4, 9.3.5, 9.3.6, 9.3.7, 9.3.8, 9.3.10, 9.3.11, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.27, 9.4.1, 9.4.2, 9.4.3, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.15, 9.5.16, 9.5.17, 9.7.1, 9.7.2, 9.7.3, 9.7.4, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.3, 9.8.4, 9.8.5, 9.8.9, 9.8.10, 9.8.11, 9.8.13, 9.10.1, 9.10.3, 9.10.4, 9.10.5, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.10, 9.11.12, 9.11.13, 9.11.14, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.21, 9.11.22, 9.11.23, 9.11.24, 9.11.25, 9.11.26, 9.11.28, 9.11.29, 9.11.30, 9.11.31, 9.11.32, 9.12.1, 9.12.2, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.14, 9.12.15, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.25, 9.12.26, 9.12.27, 9.12.28, 9.12.29, 9.12.30, 9.12.31, 9.12.32, 9.12.33, 9.12.35, 9.12.36, 9.12.37, 9.12.38, 9.12.39, 9.12.44, 10.3.2, 10.3.3, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.17, 10.3.20, 10.3.27, 10.3.28, 10.4.3, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.2, 10.9.3, 10.9.5, 10.10.1, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.21, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.11, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.19, 11.12.20, 13.3.1, 13.3.2, 13.3.3, 13.3.4, 13.3.5, 13.3.7, 13.9.2, 13.11.1, 13.11.2, 13.11.3, 13.11.4, 13.11.5, 13.11.6, 13.11.8, 13.11.9, 13.12.1, 13.12.2, 13.12.3, 13.12.4, 13.12.5, 13.12.6, 13.12.8, 13.12.9, 13.12.10.

Label	Regional Ecosystem (mandatory unless otherwise specified)
848	7.3.7, 7.3.8, 7.3.9, 7.3.12, 7.3.13, 7.3.14, 7.3.16, 7.3.19, 7.3.20, 7.3.21, 7.3.25, 7.3.26, 7.3.39, 7.3.40, 7.3.42, 7.3.43, 7.3.44, 7.3.45, 7.3.47, 7.3.48, 7.3.50, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.8.7, 7.8.8, 7.8.10, 7.8.15, 7.8.16, 7.8.17, 7.8.18, 7.8.19, 7.11.5, 7.11.6, 7.11.13, 7.11.14, 7.11.16, 7.11.18, 7.11.19, 7.11.20, 7.11.21, 7.11.31, 7.11.32, 7.11.33, 7.11.34, 7.11.35, 7.11.37, 7.11.38, 7.11.41, 7.11.42, 7.11.43, 7.11.44, 7.11.45, 7.11.46, 7.11.47, 7.11.48, 7.11.49, 7.11.50, 7.11.51, 7.12.4, 7.12.5, 7.12.17, 7.12.21, 7.12.22, 7.12.23, 7.12.24, 7.12.25, 7.12.26, 7.12.27, 7.12.28, 7.12.29, 7.12.30, 7.12.33, 7.12.34, 7.12.35, 7.12.51, 7.12.52, 7.12.53, 7.12.54, 7.12.55, 7.12.56, 7.12.58, 7.12.59, 7.12.60, 7.12.61, 7.12.62, 7.12.63, 7.12.65, 7.12.66, 7.12.69, 9.3.1, 9.3.2, 9.3.3, 9.3.5, 9.3.6, 9.3.8, 9.3.10, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.24, 9.4.1, 9.4.2, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.13, 9.5.14, 9.5.15, 9.5.16, 9.5.17, 9.7.1, 9.7.2, 9.7.3, 9.7.4, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.4, 9.8.5, 9.8.9, 9.8.10, 9.8.11, 9.10.1, 9.10.3, 9.10.4, 9.10.5, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.10, 9.11.12, 9.11.13, 9.11.14, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.21, 9.11.22, 9.11.23, 9.11.24, 9.11.25, 9.11.26, 9.11.28, 9.11.29, 9.11.30, 9.11.31, 9.11.32, 9.12.1, 9.12.2, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.14, 9.12.15, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.25, 9.12.26, 9.12.27, 9.12.28, 9.12.29, 9.12.30, 9.12.31, 9.12.32, 9.12.33, 9.12.35, 9.12.36, 9.12.37, 9.12.38, 9.12.39, 9.12.40, 9.12.44, 10.3.2, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.7, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.7, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.7.1, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.10.1, 11.10.2, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.16, 11.12.17, 11.12.19, 11.12.20; 12.2.5, 12.2.6, 12.2.7, 12.2.8, 12.2.10, 12.2.11, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.6, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.12, 12.3.14, 12.3.15, 12.3.18, 12.3.19, 12.3.20, 12.5.1, 12.5.2, 12.5.3, 12.5.4, 12.5.5, 12.5.6, 12.5.7, 12.5.8, 12.5.10, 12.5.11, 12.5.12, 12.7.1, 12.7.2, 12.8.1, 12.8.2, 12.8.8, 12.8.10, 12.8.11, 12.8.12, 12.8.14, 12.8.16, 12.8.17, 12.8.20, 12.8.23, 12.8.24, 12.8.25, 12.8.26, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.7, 12.9-10.8, 12.9-10.11, 12.9-10.12, 12.9-10.13, 12.9-10.14, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.20, 12.9-10.21, 12.9-10.23, 12.9-10.24, 12.9-10.25, 12.9-10.26, 12.9-10.27, 12.9-10.28, 12.9-10.29, 12.11.2, 12.11.3, 12.11.5, 12.11.6, 12.11.7, 12.11.8, 12.11.9, 12.11.14, 12.11.15, 12.11.16, 12.11.17, 12.11.18, 12.11.19, 12.11.20, 12.11.21, 12.11.22, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.2, 12.12.3, 12.12.4, 12.12.5, 12.12.6, 12.12.7, 12.12.8, 12.12.9, 12.12.11, 12.12.12, 12.12.14, 12.12.15, 12.12.20, 12.12.21, 12.12.22, 12.12.23, 12.12.24, 12.12.25, 12.12.26, 12.12.27, 12.12.28, 13.3.1, 13.3.2, 13.3.3, 13.3.4, 13.3.5, 13.3.7, 13.9.2, 13.11.1, 13.11.2, 13.11.3, 13.11.4, 13.11.5, 13.11.6, 13.11.8, 13.11.9, 13.12.1, 13.12.2, 13.12.3, 13.12.4, 13.12.5, 13.12.6, 13.12.8, 13.12.9, 13.12.10
1107	8.2.2, 8.2.3, 8.2.4, 8.2.5, 8.2.6, 8.2.7, 8.2.8, 8.2.11, 8.2.13, 8.2.14, 8.3.1, 8.3.3, 8.3.6, 8.3.8, 8.3.9, 8.3.10, 8.3.11, 8.5.1, 8.8.1, 8.10.1, 8.11.2, 8.11.3, 8.11.5, 8.12.1, 8.12.2, 8.12.3, 8.12.4, 8.12.5, 8.12.7, 8.12.8, 8.12.11, 8.12.12, 8.12.14, 8.12.16, 8.12.17, 8.12.18, 8.12.19, 8.12.26, 8.12.27, 8.12.28, 8.12.29, 8.12.30, 8.12.31, 8.12.32, 11.2.2, 11.2.3, 11.3.1, 11.3.11, 11.3.12, 11.3.25, 11.3.26, 11.3.40, 11.4.1, 11.4.3, 11.4.7, 11.4.9, 11.5.7, 11.5.16, 11.8.1, 11.8.13, 11.9.1, 11.9.4, 11.9.5, 11.9.6, 11.9.10, 11.9.13, 11.10.1, 11.10.2, 11.10.5, 11.10.8, 11.10.9, 11.10.13, 11.11.3, 11.11.5, 11.11.13, 11.11.14, 11.11.18, 11.12.4, 11.12.13, 11.12.19, 11.12.21, 12.2.1, 12.2.2, 12.2.3, 12.2.4, 12.2.5, 12.2.7, 12.2.8, 12.3.1, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.15, 12.3.16, 12.3.17, 12.3.18, 12.3.19, 12.3.20, 12.3.21, 12.5.1, 12.5.3, 12.5.6, 12.5.7, 12.5.13, 12.8.1, 12.8.2, 12.8.3, 12.8.4, 12.8.5, 12.8.6, 12.8.7, 12.8.8, 12.8.9, 12.8.10, 12.8.11, 12.8.12, 12.8.13, 12.8.14, 12.8.18, 12.8.21, 12.8.22, 12.8.23, 12.8.24, 12.8.25, 12.8.26, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.6, 12.9-10.14, 12.9-10.16, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.20, 12.9-10.21, 12.9-10.23, 12.9-10.24, 12.9-10.25, 12.9-10.26, 12.9-10.29, 12.11.1, 12.11.2, 12.11.3, 12.11.4, 12.11.5, 12.11.6, 12.11.9, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.11.16, 12.11.17, 12.11.18, 12.11.19, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.1, 12.12.2, 12.12.3, 12.12.4, 12.12.5, 12.12.6, 12.12.11, 12.12.13, 12.12.15, 12.12.16, 12.12.17, 12.12.18, 12.12.20, 12.12.26, 12.12.28, 13.3.2, 13.3.3, 13.3.5, 13.9.2, 13.11.2, 13.11.5, 13.11.6, 13.11.7, 13.12.1, 13.12.4, 13.12.11
2180	12.9-10.19
11205	12.3.11, 12.8.19, 12.8.20, 12.9-10.17, 12.9-10.19, 12.11.3, 12.11.5, 12.11.6

3.6 Protected plants (administered by the Department of Environment and Science (DES))

In Queensland, all plants that are native to Australia are protected plants under the *Nature Conservation Act 1992* (NCA), with clearing of protected plants in the wild regulated by the Nature Conservation (Wildlife Management) Regulation 2006. These requirements apply irrespective of the classification of the vegetation under the *Vegetation Management Act 1999*.

Prior to clearing, if the plants proposed to be cleared are in the wild (see Operational policy: When a protected plant in Queensland is considered to be 'in the wild') and the exemptions under the Nature Conservation (Wildlife Management) Regulation 2006 are not applicable to the proposed clearing, you must check the flora survey trigger map to determine if any part of the area to be cleared is within a high risk area. The trigger map for this property is provided in section 5.5. The exemptions relate to:

- imminent risk of death or serious injury (refer s261A)
- imminent risk of serious damage to a building or other structure on land, or to personal property (refer s261B)
- *Fire and Emergency Service Act 1990* (refer 261C)
- previously cleared areas (refer s261ZB)
- maintenance activities (refer s261ZC)
- firebreak or fire management line (refer s261ZD)

- accepted development vegetation clearing code (refer s261ZE)
- conservation purposes (refer s261ZG)
- authorised in particular circumstances (refer s385).

Some exemptions under the NCA are the same as exempt clearing work (formerly known as exemptions) from the *Vegetation Management Act 1999* (i.e. listed in the Planning Regulations 2017) while some are different.

If the proposed area to be cleared is shown as blue (i.e. high risk) on the flora survey trigger map, a flora survey of the clearing impact area must be undertaken in accordance with the flora survey guidelines. The main objective of a flora survey is to locate any endangered, vulnerable or near threatened plants (EVNT plants) that may be present in the clearing impact area.

If a flora survey identifies that EVNT plants are not present within the clearing impact area or clearing within 100m of EVNT plants can be avoided, the clearing activity is exempt from a permit. An exempt clearing notification form must be submitted to the Department of Environment and Science, with a copy of the flora survey report, at least one week prior to clearing. The clearing must be conducted within two years after the flora survey report was submitted.

If a flora survey identifies that EVNT plants are present in, or within 100m of, the area to be cleared, a clearing permit is required before any clearing is undertaken. The flora survey report, as well as an impact management report, must be submitted with the application form clearing permit.

In an area other than a high risk area, a clearing permit is only required where a person is, or becomes aware that EVNT plants are present in, or within 100m of, the area to be cleared. You must keep a copy of the flora survey trigger map for the area subject to clearing for five years from the day the clearing starts. If you do not clear within the 12 month period that the flora survey trigger map was printed, you need to print and check a new flora survey trigger map.

Further information on protected plants is available at
http://www.ehp.qld.gov.au/licences-permits/plants-animals/protected-plants/

For assistance on the protected plants flora survey trigger map for this property, please contact the Department of Environment and Science at palm@des.qld.gov.au.

3.7 Emissions Reduction Fund (ERF)

The ERF is an Australian Government scheme which offers incentives for businesses and communities across the economy to reduce emissions.

Under the ERF, landholders can earn money from activities such as planting (and keeping) trees, managing regrowth vegetation and adopting more sustainable agricultural practices.

The purpose of a project is to remove greenhouse gases from the atmosphere. Each project will provide new economic opportunities for farmers, forest growers and land managers.

Further information on ERF is available at https://www.qld.gov.au/environment/land/state/use/carbon-rights/.

4. Contact information for DNRME

For further information on vegetation management:
Phone 135VEG (135 834)
Email vegetation@dnrme.qld.gov.au
Visit www.dnrme.qld.gov.au/our-department/contact-us/vegetation-contacts to submit an online enquiry.

For contact details for other State and Commonwealth agencies, please see Section 6.

5. Maps

The maps included in this report may also be requested individually at:

https://www.dnrme.qld.gov.au/qld/environment/land/vegetation/vegetation-map-request-form

and

http://www.ehp.qld.gov.au/licences-permits/plants-animals/protected-plants/map-request.php

Regulated vegetation management map

The regulated vegetation management map shows vegetation categories needed to determine clearing requirements. These maps are updated monthly to show new property maps of assessable vegetation (PMAV).

Vegetation management supporting map

The vegetation management supporting map provides information on regional ecosystems, wetlands, watercourses and essential habitat.

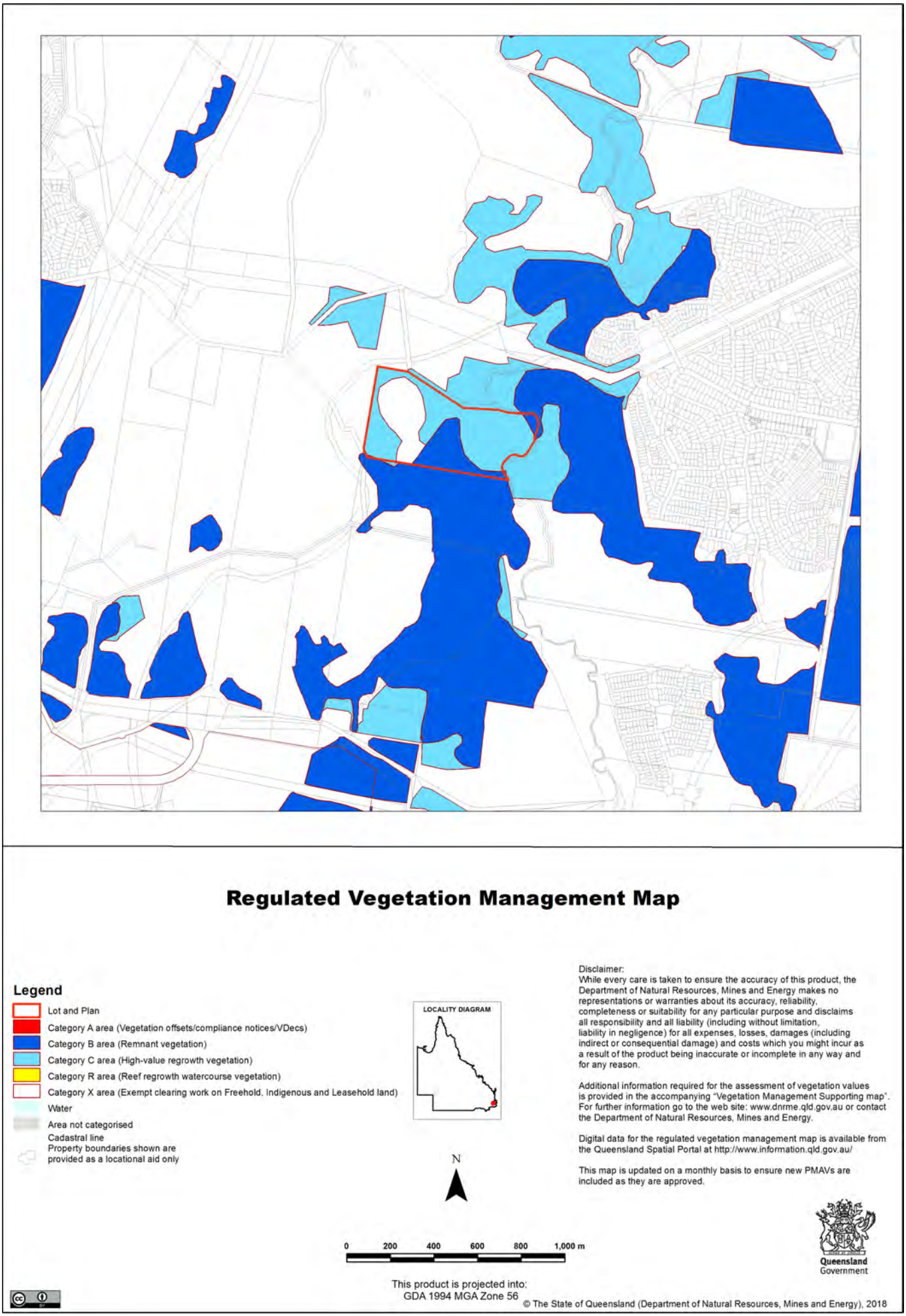
Coastal/non coastal map

The coastal/non-coastal map confirms whether the lot, or which parts of the lot, are considered coastal or non-coastal for the purposes of the accepted development vegetation clearing codes and the State Development Assessment Provisions (SDAP).

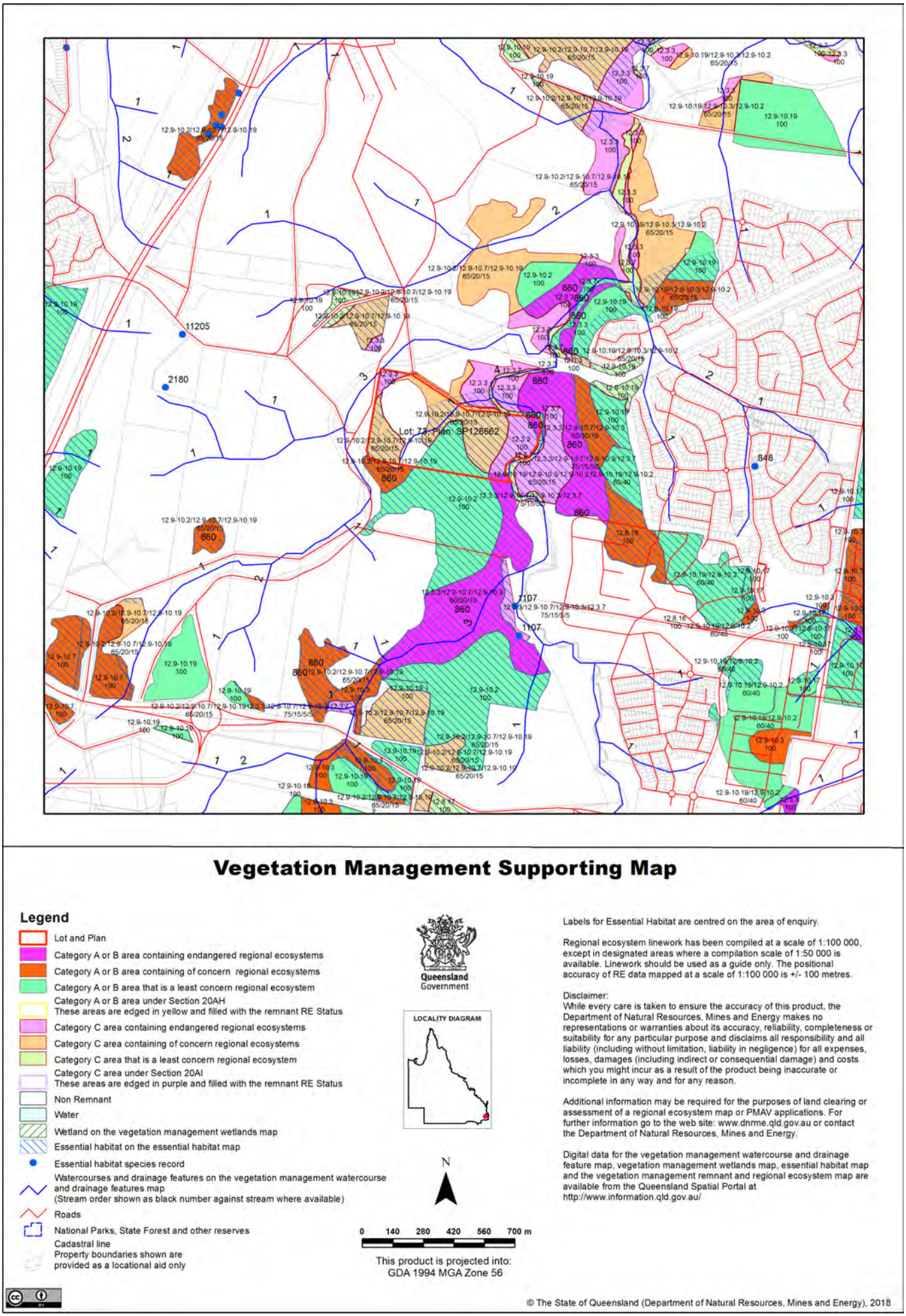
Protected plants map

The protected plants map shows areas where particular provisions of the *Nature Conservation Act 1992* apply to the clearing of protected plants.

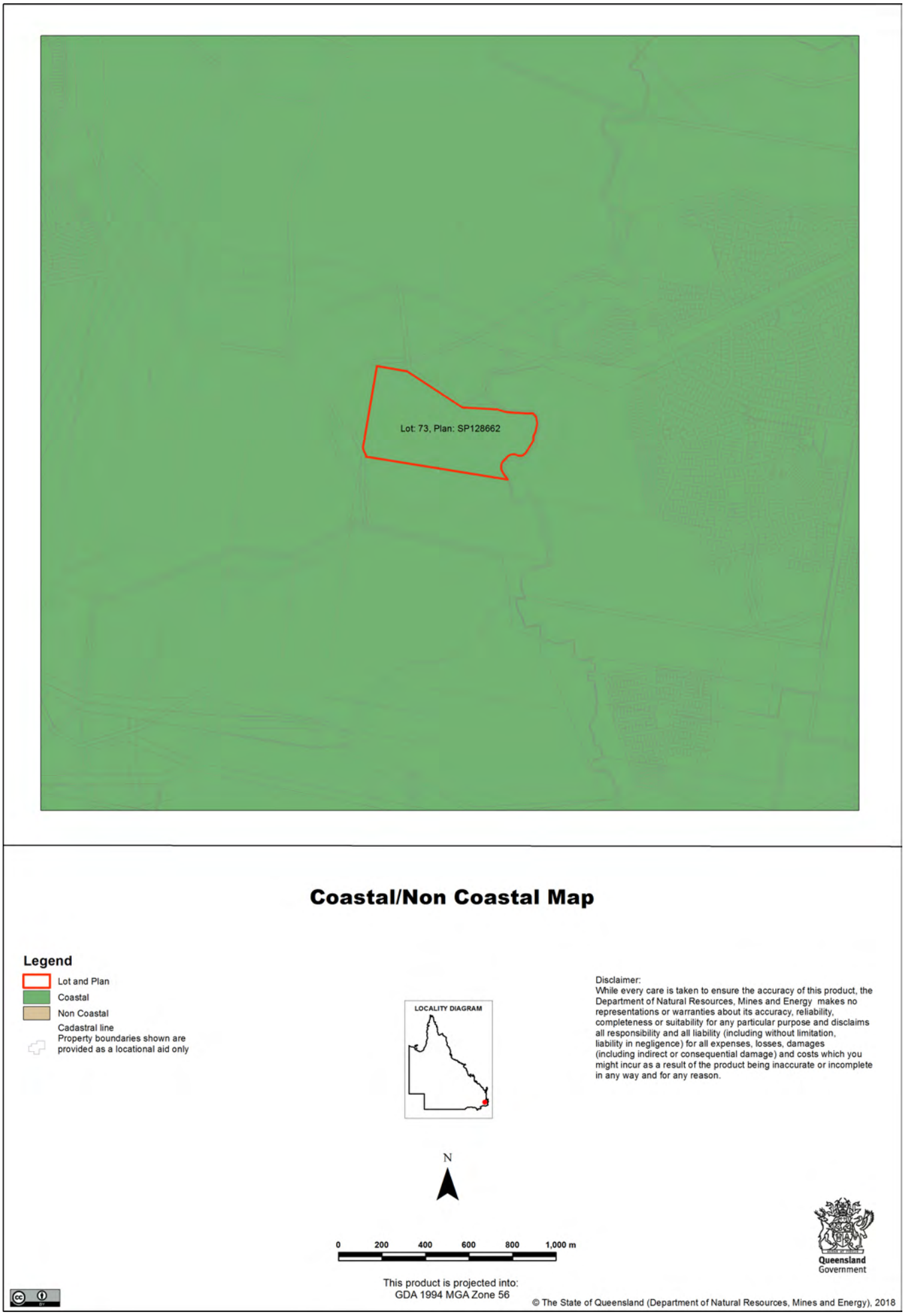
5.1 Regulated vegetation management map



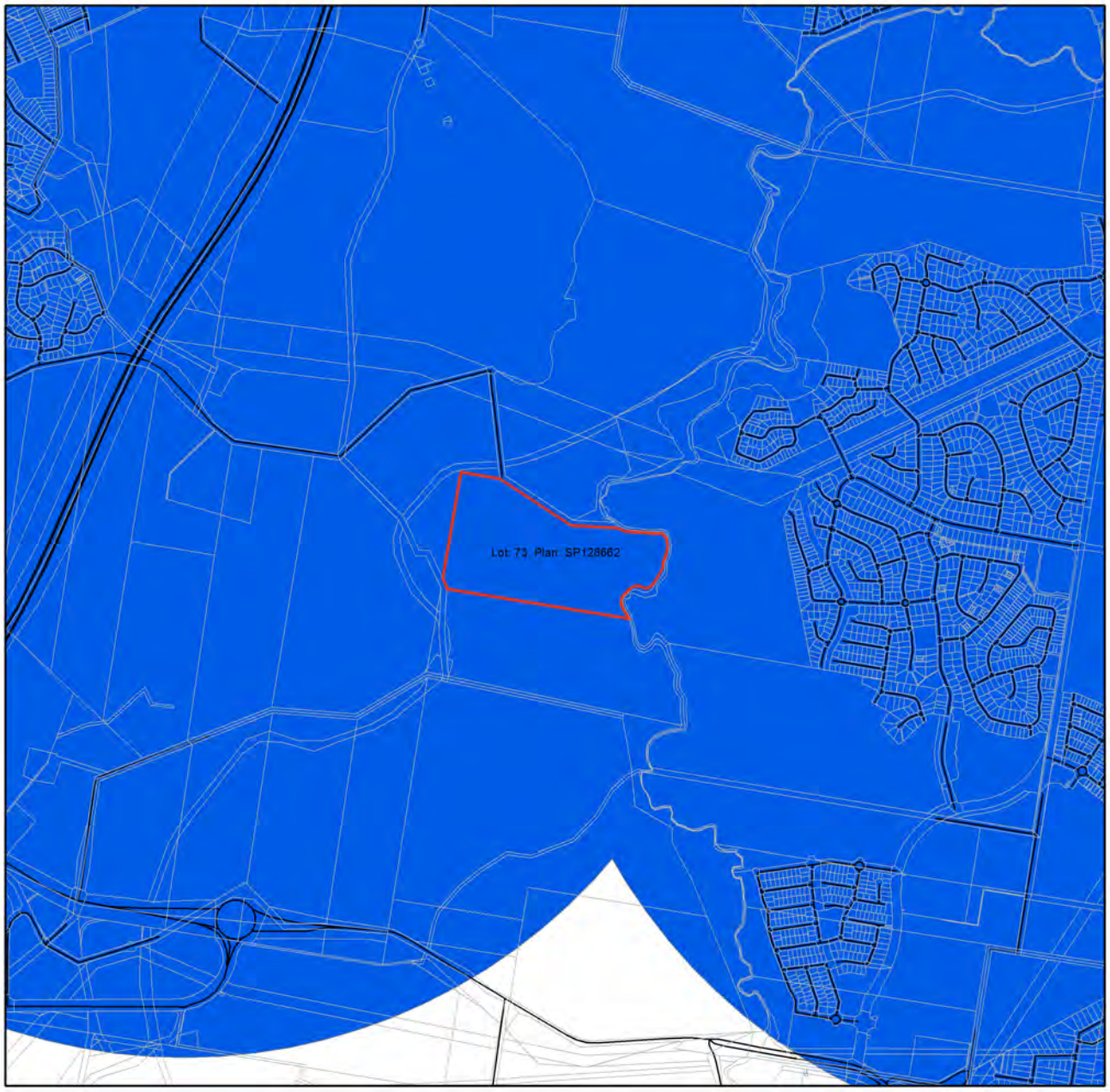
5.2 Vegetation management supporting map



5.3 Coastal/non coastal map



5.4 Protected plants map administered by DES



Protected Plants Flora Survey Trigger Map

Legend

- Lot and Plan
- High risk area
- Cadastral line
  Property boundaries shown are provided as a locational aid only
- Freeways / motorways / highways
- Secondary roads / streets

LOCALITY DIAGRAM



This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Science at palm@ehp.qld.gov.au

N

0 140 280 420 560 700 m

This product is projected into:
GDA 1994 MGA Zone 56

Disclaimer:
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

© The State of Queensland (Department of Environment and Science), 2018

6. Other relevant legislation contacts list

Activity	Legislation	Agency	Contact details
Interference with overland flow Earthworks, significant disturbance	*Water Act 2000* *Soil Conservation Act 1986*	Department of Natural Resources, Mines and Energy (Queensland Government)	Ph: 13 QGOV (13 74 68) www.dnrme.qld.gov.au
Indigenous Cultural Heritage	*Aboriginal Cultural Heritage Act 2003* *Torres Strait Islander Cultural Heritage Act 2003*	Department of Aboriginal and Torres Strait Islander Partnerships (Queensland Government)	Ph: 13 QGOV (13 74 68) www.datsip.qld.gov.au
Mining and environmentally relevant activities Infrastructure development (coastal) Heritage issues Protected plants and protected areas[1]	*Environmental Protection Act 1994* *Coastal Protection and Management Act 1995* *Queensland Heritage Act 1992* *Nature Conservation Act 1992*	Department of Environment and Science (Queensland Government)	Ph: 13 QGOV (13 74 68) www.des.qld.gov.au
Interference with fish passage in a watercourse, mangroves Forestry activities[2]	*Fisheries Act 1994* *Forestry Act 1959*	Department of Agriculture and Fisheries (Queensland Government)	Ph: 13 QGOV (13 74 68) www.daf.qld.gov.au
Matters of National Environmental Significance including listed threatened species and ecological communities	*Environment Protection and Biodiversity Conservation Act 1999*	Department of the Environment (Australian Government)	Ph: 1800 803 772 www.environment.gov.au
Development and planning processes	*Planning Act 2016* *State Development and Public Works Organisation Act 1971*	Department of State Development, Manufacturing, Infrastructure and Planning (Queensland Government)	Ph: 13 QGOV (13 74 68) www.dsdmip.qld.gov.au
Local government requirements	*Local Government Act 2009*	Department of Local Government, Racing and Multicultural Affairs (Queensland Government)	Ph: 13 QGOV (13 74 68) Your relevant local government office

1. In Queensland, all plants that are native to Australia are protected plants under the *Nature Conservation Act 1992*, which endeavours to ensure that protected plants (whether whole plants or protected plants parts) are not illegally removed from the wild, or illegally traded. Prior to clearing, you should check the flora survey trigger map to determine if the clearing is within a high-risk area by visiting www.des.qld.gov.au. For further information or assistance on the protected plants flora survey trigger map for your property, please contact the Department of Environment and Science on 13QGOV (13 74 68) or email palm@des.qld.gov.au.

2. Contact the Department of Agriculture and Fisheries before clearing:

- Any sandalwood on state-owned land (including leasehold land)
- On freehold land in a 'forest consent area'
- More than five hectares on state-owned land (including leasehold land) containing commercial timber species listed in parts 2 or 3 of Schedule 6 of the Vegetation Management Regulation 2012 and located within any of the following local government management areas-Banana, Bundaberg Regional, Fraser Coast Regional, Gladstone Regional, Isaac Regional, North Burnett Regional, Somerset Regional, South Burnett Regional, Southern Downs Regional, Tablelands Regional, Toowoomba Regional, Western Downs Regional.

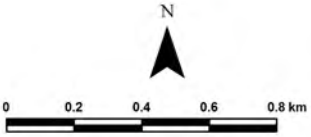


Pre-clearing Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups
BVG5M Description (BVG1M codes)

- Lot and Plan
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Water
- Cadastral Boundaries





This product is projected into GDA 1994 MGA Zone 56

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

© The State of Queensland, 2018

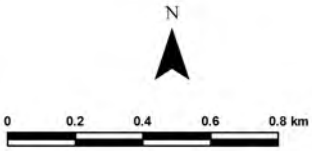


Remnant 2015 Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups
BVG5M Description (BVG1M codes)

- Lot and Plan
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Non-remnant vegetation, cultivated or built environment
- Water
- Cadastral Boundaries





This product is projected into GDA 1994 MGA Zone 56

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

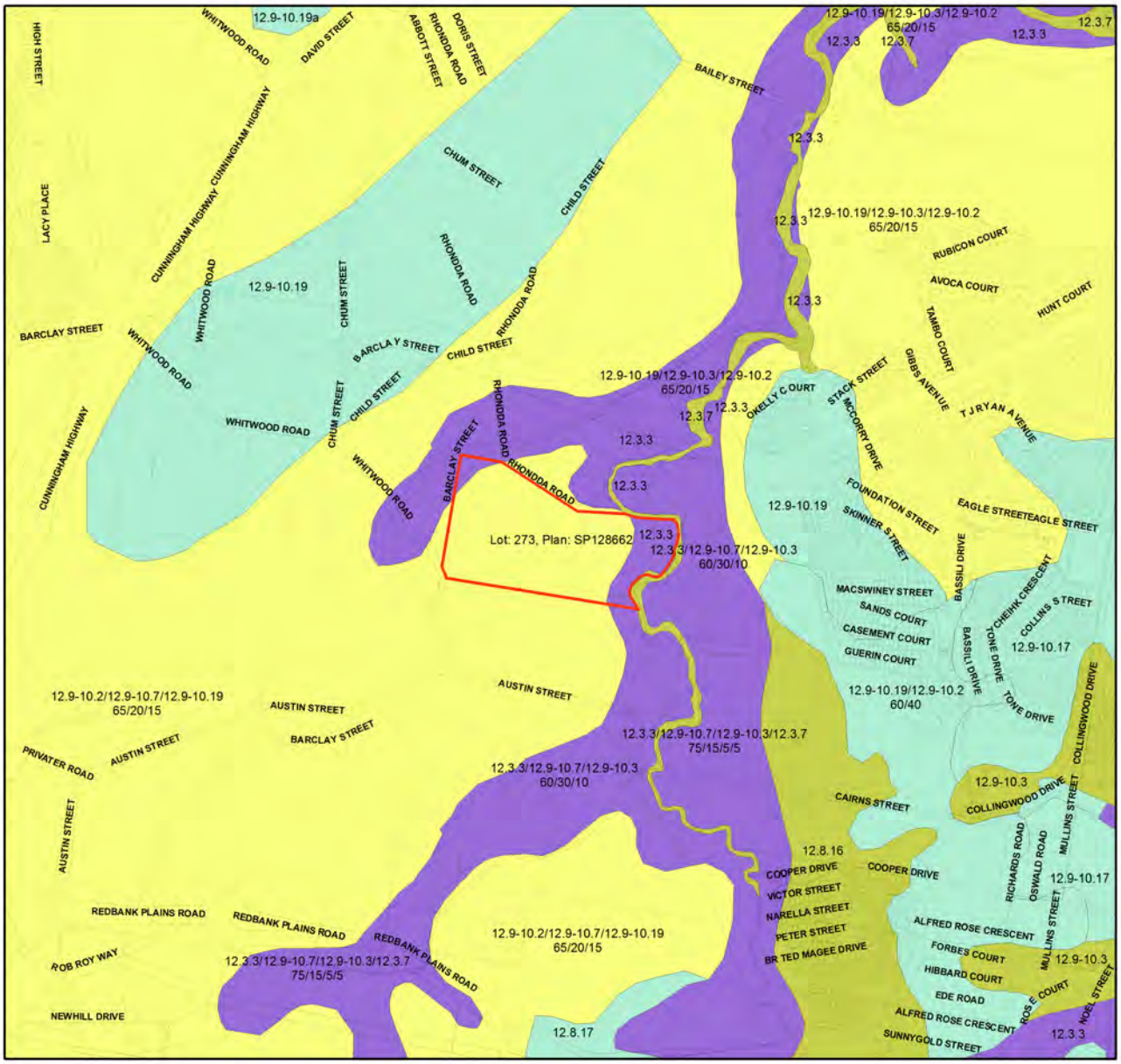
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

Non-remnant vegetation includes regrowth and disturbed native vegetation.

© The State of Queensland, 2018

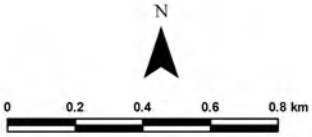


Pre-clearing Regional Ecosystems

Biodiversity Status

- Lot and Plan
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Water
- Cadastral Boundaries





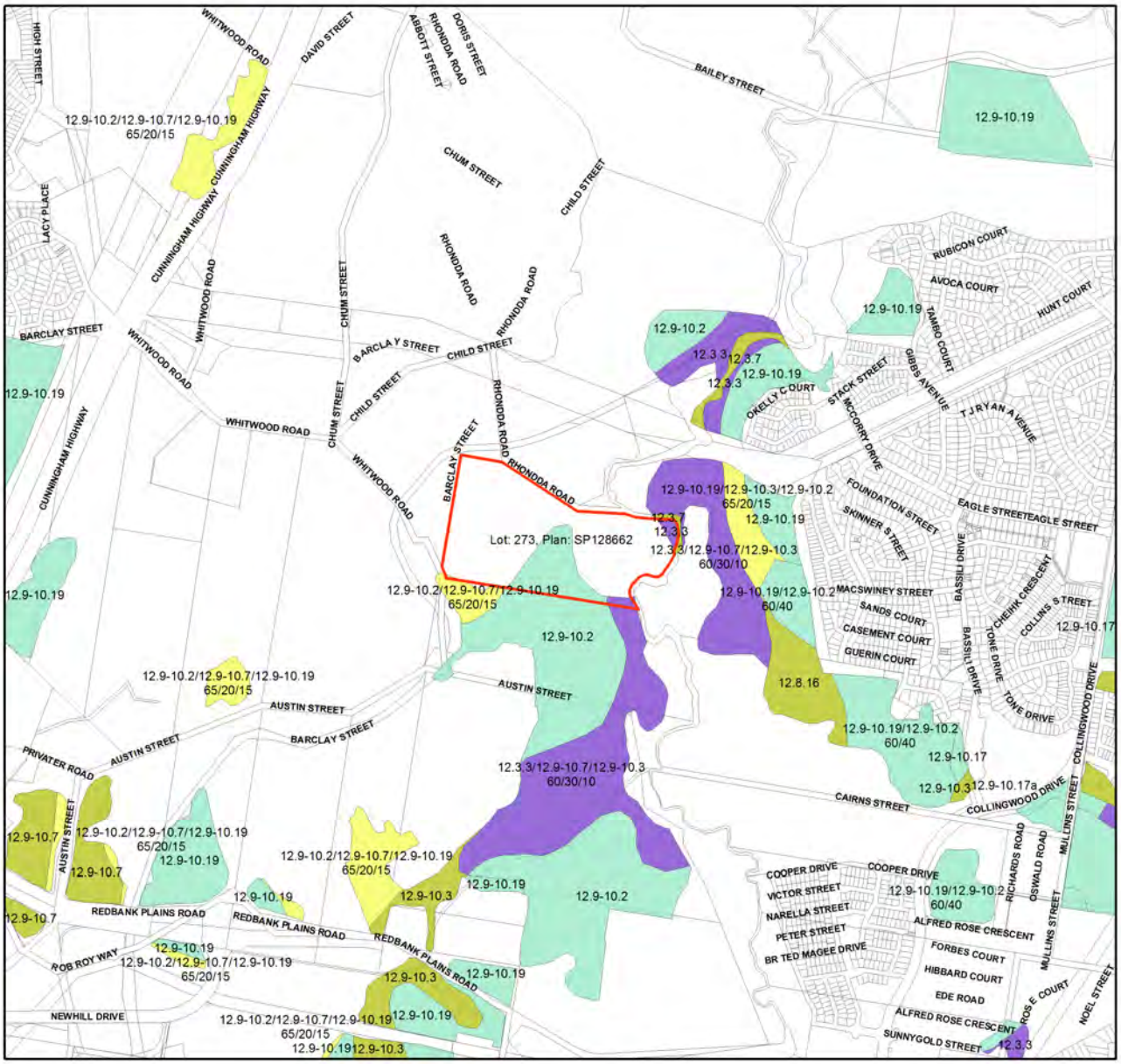
This product is projected into GDA 1994 MGA Zone 56

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

© The State of Queensland, 2018



Remnant 2015 Regional Ecosystems

Biodiversity Status

- Lot and Plan
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Non-remnant vegetation, cultivated or built environment
- Plantation
- Water
- Cadastral Boundaries

LOCALITY DIAGRAM



Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.

The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

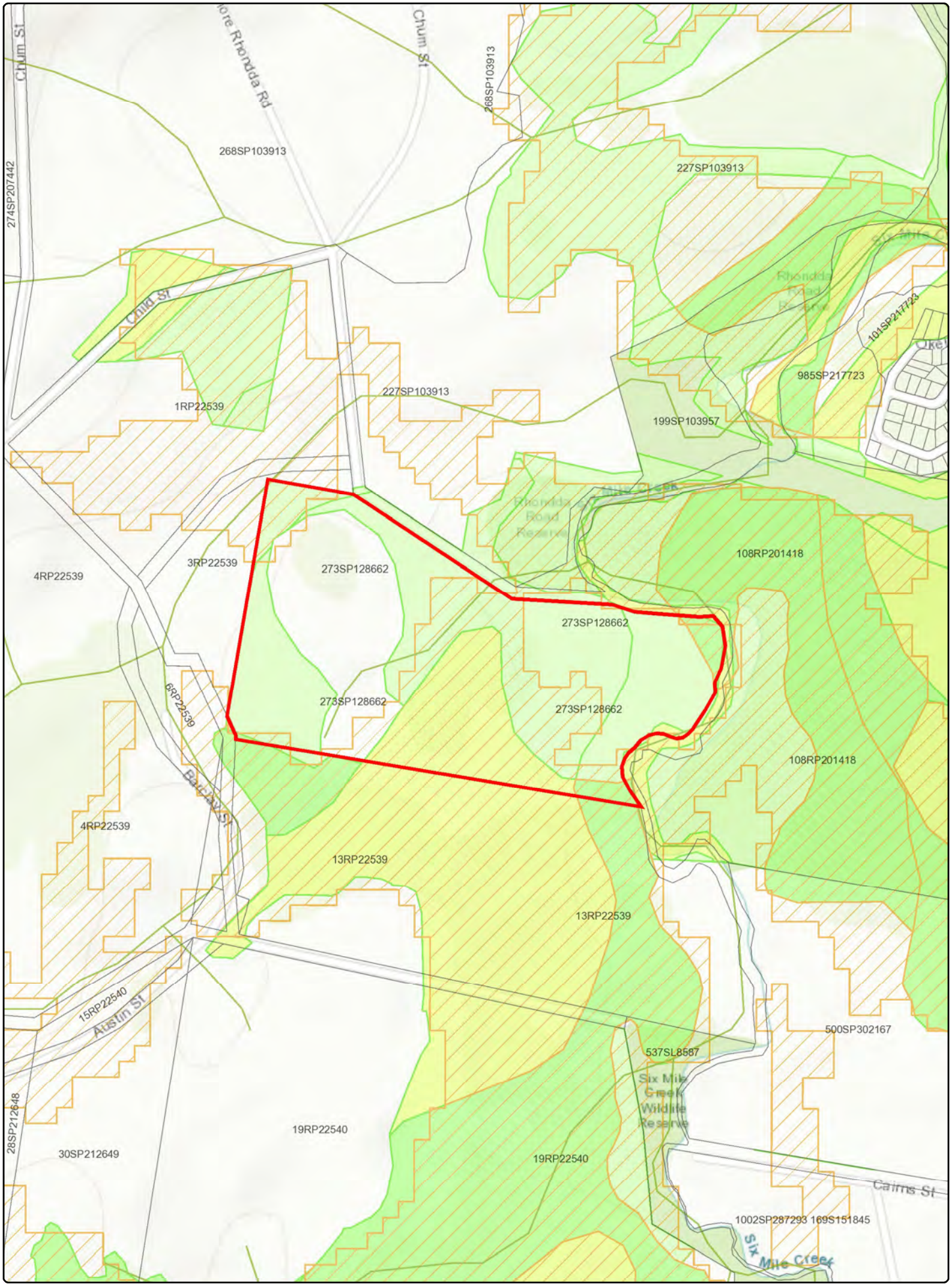
Non-remnant vegetation includes regrowth and disturbed native vegetation.

This product is projected into GDA 1994 MGA Zone 56

© The State of Queensland, 2018

APPENDIX VI

STATE PLANNING POLICY AND DEVELOPMENT ASSESSMENT MAPPING



State Planning Policy

Making or amending a local planning instrument and designating land for community infrastructure

Date: 28/09/2018

Department of State

0 140 280 420 560

Legend

Drawn Polygon Layer

Override 1

Cadastre (10k)



Cadastre (10k)

MSES - Regulated vegetation (intersecting a watercourse)

MSES - Regulated vegetation (intersecting a watercourse)

MSES - High ecological value waters (watercourse)

MSES - High ecological value waters (watercourse)

MSES - Wildlife habitat



MSES - Wildlife habitat

MSES - Strategic environmental areas (designated precinct)



MSES - Strategic environmental areas (designated precinct)

MSES - High ecological significance wetlands

MSES - High ecological significance wetlands

MSES - High ecological value waters (wetland)



MSES - High ecological value waters (wetland)

MSES - Legally secured offset area (offset register)



MSES - Legally secured offset area (offset register)

MSES - Legally secured offset area (regulated vegetation offsets)



MSES - Legally secured offset area (regulated vegetation offsets)

MSES - Protected areas (estate)



MSES - Protected areas (estate)

MSES - Protected areas (nature refuge)



MSES - Protected areas (nature refuge)

MSES - Marine park



MSES - Marine park

MSES - Declared fish habitat area



MSES - Declared fish habitat area

MSES - Regulated vegetation (category B)



MSES - Regulated vegetation (category B)

MSES - Regulated vegetation (category C)



MSES - Regulated vegetation (category C)

MSES - Regulated vegetation (category R)



MSES - Regulated vegetation (category R)

MSES - Regulated vegetation (essential habitat)



MSES - Regulated vegetation (essential habitat)

MSES - Regulated vegetation (wetland)



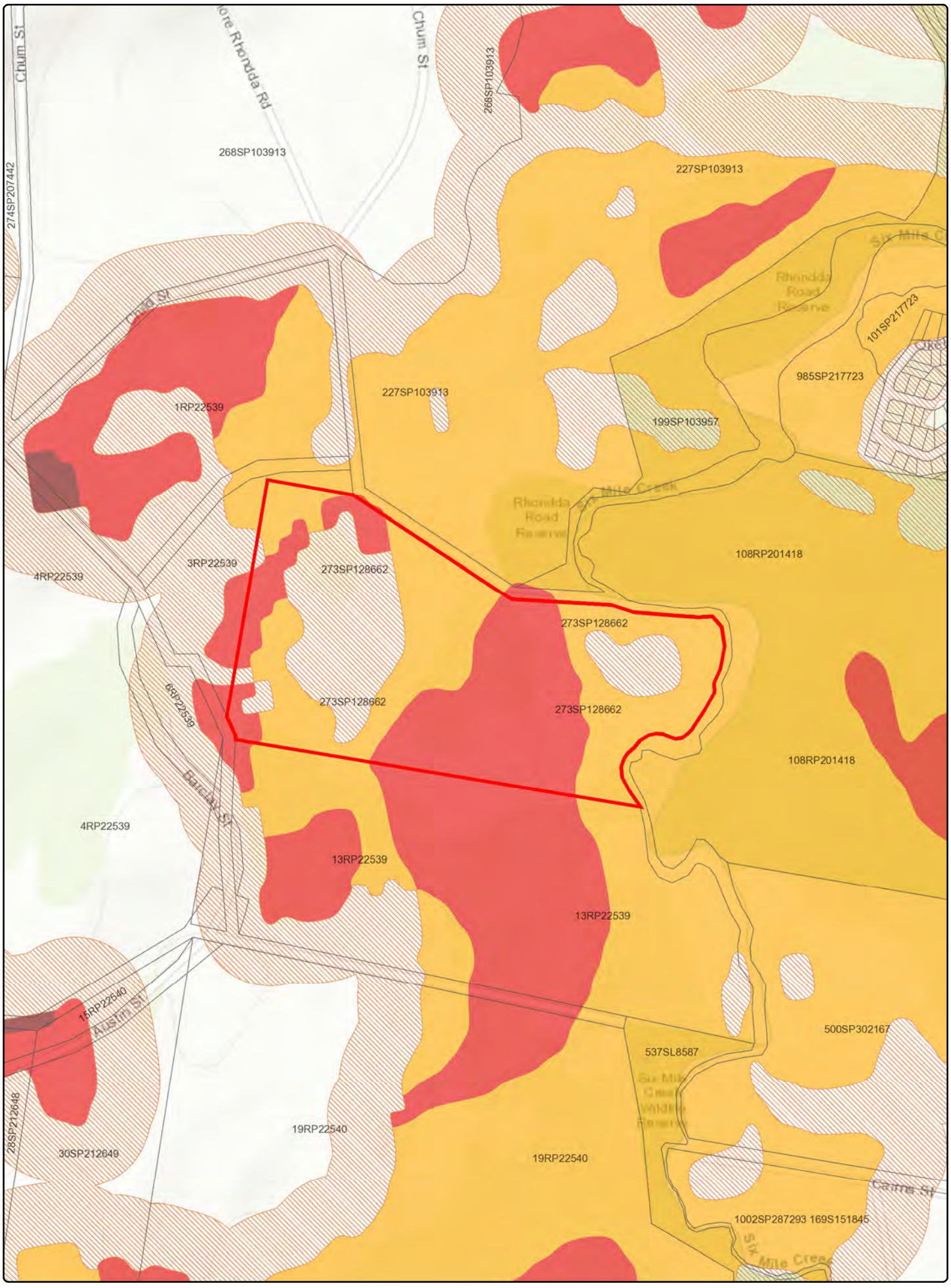
MSES - Regulated vegetation (wetland)

Date: 28/09/2018

State Planning Policy

Making or amending a local planning instrument and designating land for community infrastructure

Department of State



State Planning Policy

Making or amending a local planning instrument and designating land for community infrastructure

Date: 28/09/2018

Department of State

0 140 280 420 560

Legend

Drawn Polygon Layer

Override 1

Cadastre (10k)

Cadastre (10k)

High pressure gas pipeline

High pressure gas pipeline

Bushfire prone area

Very High Potential Bushfire Intensity

High Potential Bushfire Intensity

Medium Potential Bushfire Intensity

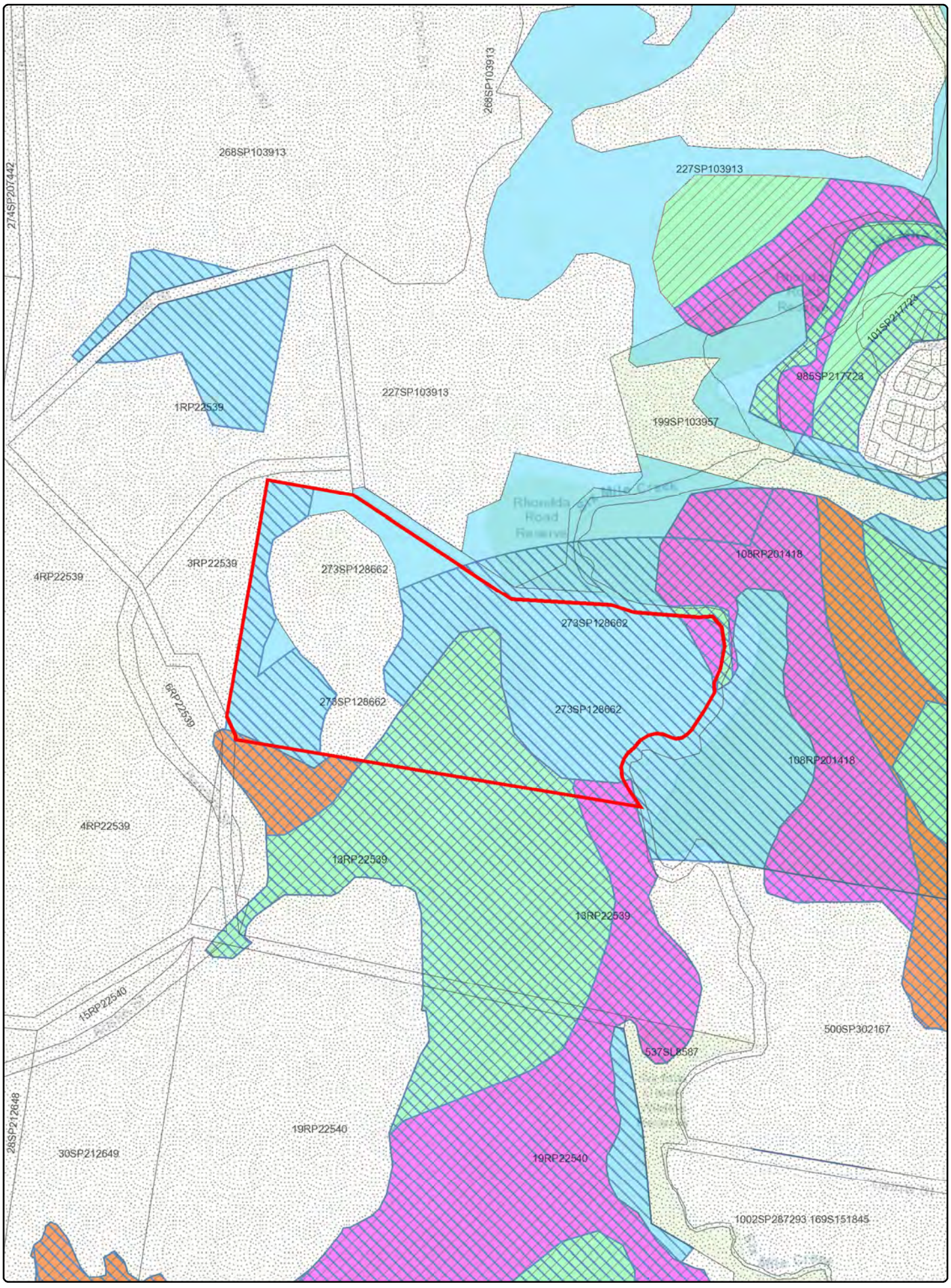
Potential Impact Buffer

Date: 28/09/2018

State Planning Policy

Making or amending a local planning instrument and designating land for community infrastructure

Department of State



DA Mapping System – Print Screen

Date: 28/09/2018

0 140 280 420 560

Metres

Department of State

Legend

Drawn Polygon Layer

Override 1

Cadastre (10k)

Cadastre (10k)

Regulated vegetation management map (Category A and B extract)

Category A on the regulated vegetation management map

Category B on the regulated vegetation management map

Essential habitat

Essential habitat

Regulated vegetation management map (other vegetation categories)

Category C on the regulated vegetation managment map

Category R on the regulated vegetation management map

Category X on the regulated vegetation management map

Vegetation management regional ecosystem map

Category A or B area containing endangered regional ecosystems

Category A or B area containing of concern regional ecosystems

Category A or B area that is a least concern regional ecosystem

Non remnant

Water

Vegetation management coastal and non-coastal bioregions and sub-regions

Coastal bioregions and sub-regions

Non coastal bioregions and sub-regions

DA Mapping System – Print Screen

Date: 28/09/2018

Department of State

APPENDIX VII

RED IMPORTED FIRE ANT MAPPING

National Red Imported Fire Ant Eradication Program: Fire ant biosecurity zones



Fire ant biosecurity zone 1

Acacia Ridge
Algester
Amberley
Archerfield
Augustine Heights
Basin Pocket
Bellbird Park
Berrinba
Bethania
Blackstone
Booval
Boronia Heights
Brookwater
Browns Plains
Buccan
Bundamba
Calamvale
Camira
Carole Park
Churchill
Coalfalls
Collingwood Park
Coopers Plains
Crestmead
Darra
Deebing Heights
Dinmore
Doolandella
Drewvale
Durack
East Ipswich
Eastern Heights
Ebbw Vale
Eight Mile Plains
Ellen Grove
Flinders View
Forest Lake
Forestdale
Gailes
Goodna
Greenbank
Heathwood
Heritage Park
Hillcrest
Holmview
Inala
Ipswich
Karawatha
Kingston
Kuraby
Larapinta
Leichhardt
Logan Central
Logan Reserve
Loganlea
Mackenzie
Mansfield
Marsden
Meadowbrook
Moggill
Moores Pocket
Munruben
New Chum
Newtown
North Booval
North Maclean
North Tivoli
One Mile
Oxley
Pallara
Park Ridge
Park Ridge South
Parkinson
Purga
Raceview
Redbank
Redbank Plains
Regents Park
Richlands
Ripley
Riverview
Rochedale
Rocklea
Runcorn
Sadliers Crossing
Silkstone
Slacks Creek
South Ripley
Spring Mountain
Springfield
Springfield Central
Springfield Lakes
Stretton
Sumner
Sunnybank
Sunnybank Hills
Swanbank
Tivoli
Underwood
Wacol
Waterford
Waterford West
West Ipswich
White Rock
Willawong
Willowbank
Wishart
Woodend
Woodridge
Wulkuraka
Yamanto

Fire ant biosecurity zone 2

Alberton
Alexandra Hills
Allenview
Anstead
Ashwell
Bahrs Scrub
Bannockburn
Barellan Point
Beenleigh
Belivah
Bellbowrie
Belmont
Blacksoil
Blenheim
Brassall
Burbank
Calvert
Camp Hill
Capalaba
Carbrook
Carina
Carina Heights
Carindale
Cedar Creek
Cedar Grove
Cedar Vale
Chambers Flat
Chandler
Chapel Hill
Chelmer
Chuwar
Cleveland
Coleyville
College View
Coomera
Coorparoo
Corinda
Cornubia
Crowley Vale
Daisy Hill
Eagleby
Ebenezer
Edens Landing
Fig Tree Pocket
Flagstone
Flinders Lakes
Forest Hill
Gilberton
Glen Cairn
Gleneagle Grove
Goolman
Graceville
Grandchester
Gumdale
Haigslea
Harrisville
Holland Park
Indooroopilly
Jacobs Well
Jamboree Heights
Jeebropilly
Jimboomba
Jindalee
Kagaru
Kairabah
Karalee
Karana Downs
Karrabin
Kenmore
Kents Lagoon
Kingsholme
Laidley
Laidley Heights
Laidley North
Laidley South
Lanefield
Lawes
Limestone Ridges
Logan Village
Loganholme
Lower Mount Walker
Luscombe
Lyons
Macgregor
Marburg
Merrivale
Middle Park
Milbong
Milora
Minden
Monarch Glen
Moorooka
Mount Cotton
Mount Crosby
Mount Forbes
Mount Gravatt East
Mount Marrow
Mount Mort
Mount Ommaney
Mount Walker
Mount Walker West
Mount Warren Park
Muirlea
Mundoolun
Mutdapilly
Nathan
New Beith
Norman Park
North Ipswich
Norwell
Ormeau
Ormeau Hills
Peak Crossing
Pimpama
Pinjarra Hills
Plainland
Priestdale
Radford
Redland Bay
Riverhills
Robertson
Rochedale South
Rosevale
Rosewood
Salisbury
Seventeen Mile Rocks
Shailer Park
Sheldon
Sherwood
Silverbark Ridge
Silverdale
Sinnamon Park
South Maclean
Springwood
Stapylton
Steiglitz
Stockleigh
Summerholm
Tallegalla
Tamborine
Tanah Merah
Tennyson
Thagoona
The Bluff
Thornlands
Tingalpa
Undullah
Upper Coomera
Upper Mount Gravatt
Victoria Point
Walloon
Warrill View
Westlake
Willow Vale
Wilsons Plains
Windaroo
Wolffdene
Woodhill
Woodlands
Wyaralong
Woongoolba
Yarrabilba
Yatala
Yeerongpilly
Yeronga

Fire ant biosecurity zone 3

Brisbane Airport
Eagle Farm
Lytton
Nudgee
Nudgee Beach
Pinkenba
Port Of Brisbane

Fire ant carrier movement restrictions

Fire ant biosecurity zone 1	Fire ant biosecurity zone 2	Fire ant biosecurity zone 3
Moving soil*? To move soil from a property within biosecurity zone 1 you must have a biosecurity instrument permit unless: - the soil remains within zone 1; or - the soil is moved to a waste facility within zone 1 or zone 2.	**Moving soil*?** To move soil from a property within biosecurity zone 2 you must have a biosecurity instrument permit unless: - the soil remains within zone 2 or is moved to zone 1; or - the soil is moved to a waste facility within zone 1 or 2.	**Moving soil*?** To move soil from a property within biosecurity zone 3 you must have a biosecurity instrument permit unless: - the soil remains within zone 3; or - the soil is moved to a waste facility within zone 3.
Moving mulch, manure, baled hay or straw, potted plants or turf? To move these fire ant carriers from a property within biosecurity zone 1 you must either : - follow procedures outlined in the Biosecurity Regulation 2016; or - move the material to a waste facility within zone 1 or 2; or - move the material within 24 hours of being on the property. If you are unable to fulfil the above conditions then you must request a biosecurity instrument permit from an inspector.	**Moving mulch, manure, baled hay or straw, potted plants or turf?** To move these fire ant carriers from a property within biosecurity zone 2 you must either : - follow procedures outlined in the Biosecurity Regulation 2016; or - move the material to a waste facility within zone 1 or 2; or - move the material within 24 hours of being on the property. If you are unable to fulfil the above conditions then you must request a biosecurity instrument permit from an inspector.	**Moving mulch, manure, baled hay or straw, potted plants or turf?** To move these fire ant carriers from a property within biosecurity zone 3 you must either : - follow procedures outlined in the Biosecurity Regulation 2016; or - move the material to a waste facility within zone 3; or - move the material within 24 hours of being on the property. If you are unable to fulfil the above conditions then you must request a biosecurity instrument permit from an inspector.
Moving other fire ant carriers i.e. mining/quarrying products or by-products; compost? To move these fire ant carriers from a property within biosecurity zone 1 you must either: - move the material to a waste facility within zone 1 or 2; or - move the material within 24 hours of being on the property; or - obtain a biosecurity instrument permit from an inspector.	**Moving other fire ant carriers** i.e. mining/quarrying products or by-products; compost? To move these fire ant carriers from a property within biosecurity zone 2 you must either: - move the material to a waste facility within zone 1 or 2; or - move the material within 24 hours of being on the property; or - obtain a biosecurity instrument permit from an inspector.	**Moving other fire ant carriers** i.e. mining/quarrying products or by-products; compost? To move these fire ant carriers from a property within biosecurity zone 3 you must either: - move the material to a waste facility within zone 3; or - move the material within 24 hours of being on the property; or - obtain a biosecurity instrument permit from an inspector.

For soil* movement within the zones you must meet the General Biosecurity Obligation, see www.daf.qld.gov.au/fireants for more information.
*soil includes fill, clay, scrapings and any material removed from the ground at a site where earthworks are being carried out

The State of Queensland does not warrant the accuracy of this map and disclaims any liability for loss arising from the use of this map beyond its intended purpose. Acknowledgements © State of Queensland (Department of Agriculture and Fisheries) 2018. © State of Queensland (Department of Natural Resources and Mines) 2018.

Fire Ant Biosecurity Zone Map – RIFA02
15 June 2018

- Fire ant biosecurity zone 1
- Fire ant biosecurity zone 2
- Fire ant biosecurity zone 3
- Suburb
- Local Government Area

Contact the Department of Agriculture and Fisheries for more information or request a biosecurity instrument permit at www.daf.qld.gov.au/fireants or call 13 25 23

Queensland Government

BAAM
ECOLOGICAL CONSULTANTS

specialised ecological knowledge
that reduces your risk

13 August 2021

Conservation and Biodiversity Policy Unit
Department of Environment and Science

To whom it may concern,

RE: Certification by suitably qualified person, Protected Flora Survey

I, Dr Jarrah Wills, Senior Ecologist at Biodiversity Assessment and Management Pty Ltd (BAAM), completed a targeted flora survey within areas of vegetation proposed to be cleared at the 'Jackal Renewables' facility located at 149 Rhondda Road, New Chum (Lot 273 on SP128662)

In accordance with the Queensland *Flora Survey Guidelines – Protected Plants* (Version 2.01, 2020), I hereby certify that:

a). I have adhered to all statutory requirements and flora survey guideline requirements; and
b) In the area surveyed I have not found any plants (as detailed in this report) that are currently listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable or near threatened in the *Nature Conservation (Plants) Regulation 2020*; and
c). The ecological assessment report provides an accurate and full account of the flora survey.

A copy of my CV that demonstrates I have the necessary qualifications and experience to undertake flora surveys in accordance with the Queensland *Flora Survey Guidelines – Protected Plants* (Version 2.01, 2020) is included in the attached report.



Dr Jarrah Wills
Senior Ecologist
Biodiversity Assessment and Management Pty Ltd

Document Control Sheet

File Number: 0410-005

Project Manager: Dr Jarrah Wills

Client: Ardent Group Pty Ltd

Project Title: Protected Flora Survey Report – Jackal Renewables

Project Author/s: Shelley Trevaskis

Project Summary: This report presents the results of a flora survey for protected plant species, undertaken in accordance with the Queensland *Flora Survey Guidelines – Protected Plants*, for a proposed clearing impact area at 149 Rhondda Road, New Chum (Lot 273 on SP128662), to accompany an application for a protected plant clearing permit or activity exemption under the Queensland *Nature Conservation Act 1992*.

Draft Preparation History

Draft	Date Issued	Checked By	Issued By
0410-005 Draft A	20/08/2021	Jedd Appleton	Shelley Trevaskis

Revision/Checking History Track

Version	Date Issued	Checked By	Issued By
0410-005 Version 0	8/09/2021	Jedd Appleton	Jarrah Wills

Destination	Revision					
		Date Dispatched		Date Dispatched		Date Dispatched
Client Copy 1 – digital	A	20/08/2021	0	8/09/2021		
Client Copy 1 – hard copy						
PDF server	A	20/08/2021	0	8/09/2021		
PDF backup – archived	A	20/08/2021	0	8/09/2021		
Hard copy – BAAM library						

NOTICE TO USERS OF THIS REPORT

Purpose of Report

Biodiversity Assessment and Management Pty Ltd has produced this report in its capacity as {consultants} for and on the request of Ardent Group Pty Ltd (the "Client") for the sole purpose of documenting the results of a flora survey for protected plant species, undertaken in accordance with the Queensland *Flora Survey Guidelines – Protected Plants*, for a proposed clearing impact area at 149 Rhondda Road, New Chum (Lot 273 on SP128662), to accompany an application for a protected plant clearing permit or activity exemption under the Queensland *Nature Conservation Act 1992* (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.

This report has been produced solely for the benefit of the Client. Biodiversity Assessment and Management Pty Ltd does not accept that a duty of care is owed to any party other than the Client. This report is not to be used by any third party other than as authorised in writing by Biodiversity Assessment and Management Pty Ltd and any such use shall continue to be limited to the Specified Purpose. Further, Biodiversity Assessment and Management Pty Ltd does not make any warranty, express or implied, or assume any legal liability or responsibility for any third party's use in whole or in part of the report or application or use of any other information or process disclosed in this report and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by any person or body corporate arising from or in connection with the supply or use of the whole part of the report through any cause whatsoever.

Biodiversity Assessment and Management Pty Ltd has used information provided to it by the Client and governmental registers, databases, departments and agencies in the preparation of this report. Biodiversity Assessment and Management Pty Ltd does not know, nor does it have any reason to suspect, that the information provided to it was false, inaccurate, incomplete or misleading at the time of its receipt. This report is supplied on the basis that while Biodiversity Assessment and Management Pty Ltd believes all the information in it is deemed reliable at the time of publication, it does not warrant its accuracy or completeness and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by any person or body corporate arising from or in connection with the supply or use of the whole or any part of the information in this report through any cause whatsoever.

Copyright and reproduction

This report and all indexes, schedules, annexures or appendices are subject to copyright pursuant to the Copyright Act 1968 (Cth). Subject to statutory defences, no third party may reproduce, publish, adapt or communicate to the public, in whole or in part, the content of this report without the express written consent of Biodiversity Assessment and Management Pty Ltd.

Signed on behalf of
Biodiversity Assessment and Management Pty Ltd

Date: 8/09/2021



Director

PROTECTED FLORA SURVEY REPORT 'JACKAL RENEWABLES' - 149 RHONDDA ROAD, NEW CHUM

Table of Contents

1.0 INTRODUCTION 1
1.1. BACKGROUND AND PURPOSE 1
1.2. REPORT CONTENT 1
1.3. PROPOSED CLEARING AREA 1
2.0 METHODOLOGY 1
2.1. INITIAL DESKTOP REVIEW 1
2.2. FIELD SURVEY APPROACH 1
2.3. QUALIFICATIONS OF FIELD TEAM 4
2.4. SURVEY TIMING 4
3.0 RESULTS 4
3.1. DESKTOP ASSESSMENT 4
3.2. FIELD ASSESSMENT 4
4.0 POTENTIAL IMPACTS 8
5.0 CONFIRMATION OF EXEMPT CLEARING NOTIFICATION AND SUBMISSION REQUIREMENTS 8
6.0 REFERENCES 9

List of Figures

Figure 1.1 Site Location
Figure 2.1 Survey Effort

List of Appendices

Appendix 1 Flora Survey Trigger Map of the Site
Appendix 2 Wildlife Online Database Search Results
Appendix 3 DNRM Regulated Vegetation and Essential Habitat Mapping
Appendix 4 Survey Personnel Curriculum vitae

List of Abbreviations

BAAM	Biodiversity Assessment and Management Pty Ltd
DES	Queensland Department of Environment and Science
EVNT	Endangered, Vulnerable or Near Threatened
NC Act	Queensland *Nature Conservation Act 1992*
RE	Regional Ecosystem

1.0 INTRODUCTION

1.1. BACKGROUND AND PURPOSE

Biodiversity Assessment and Management Pty Ltd (BAAM) has prepared this report for Ardent Group Pty Ltd to document the results of a survey undertaken in accordance with the Queensland *Flora Survey Guidelines - Protected Plants* (DES, 2020) for the clearing of vegetation at the 'Jackal Renewables Pty Ltd' facility located at 149 Rhondda Road, New Chum (Lot 273 on SP128662) (**Figure 1.1**).

As the vegetation proposed to be cleared is identified as occurring within a high risk area on the Queensland Department of Environment and Science (DES) flora survey trigger map (**Appendix 1**), targeted searches for flora species listed as Endangered, Vulnerable or Near Threatened (EVNT) under the Queensland *Nature Conservation Act 1992* (NC Act) are required to be undertaken in accordance with the Queensland *Flora Survey Guidelines - Protected Plants* (DES, 2020) before a clearing permit or exemption can be applied for under the NC Act.

1.2. REPORT CONTENT

In accordance with the Queensland *Flora Survey Guidelines - Protected Plants* (DES, 2020), the following information is provided in the subsequent sections of this report:

- A description of the location and map of the area to be cleared.
- A description of the survey methodology, including:
  - survey techniques;
  - a statement to justify the suitability and qualifications of the person undertaking the flora survey; and
  - justification of the timing of the flora survey (with details of any limitations associated with the timing).
- A description of the habitat types identified for the clearing impact area and a map of the GPS data showing the on-ground surveys undertaken and extent of the clearing impact area.

1.3. PROPOSED CLEARING AREA

The proposed works areas include three separate locations within the Jackal Renewables facility (Study Area) (**Figure 1.1**). The vegetation in these locations was generally disturbed and featured eucalypt open forest regrowth with a partially weed infested understorey.

The surrounding landscape includes cleared and highly disturbed lands, water bodies, minor roadways and bushland.

2.0 METHODOLOGY

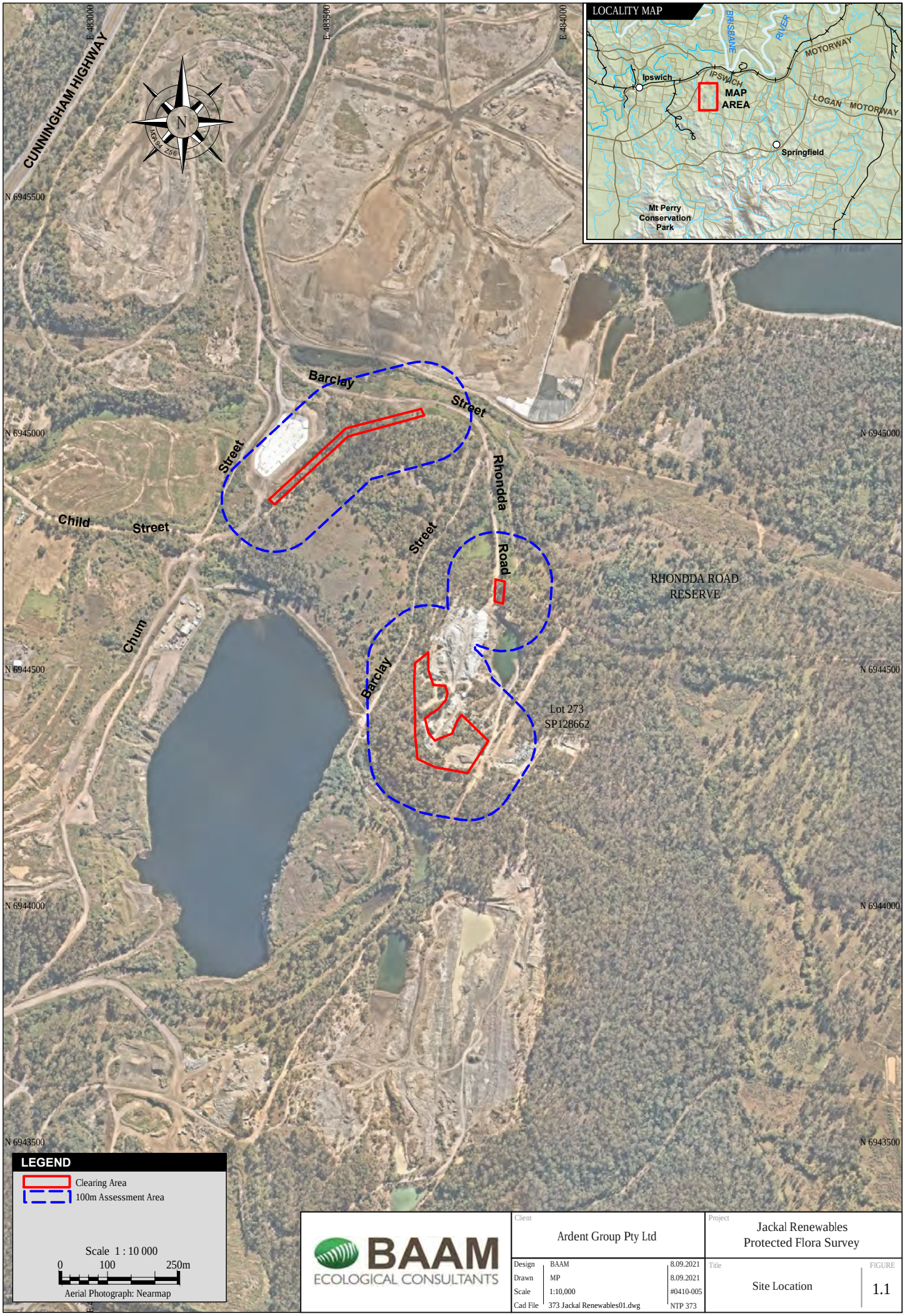
2.1. INITIAL DESKTOP REVIEW

A review of available information was undertaken to determine which EVNT flora species may occur within the proposed clearing area and immediate surrounds, such that survey effort could be targeted towards confirming the presence or absence of these species. Specifically, this involved accessing and reviewing:

- DES's Wildlife Online Database (**Appendix 2**) and the Atlas of Living Australia online database, to determine whether any EVNT species listed under the NC Act have been previously recorded within the vicinity.
- State mapping of regulated vegetation and associated Essential Habitat (**Appendix 3**), to determine whether preferred habitats for potentially occurring EVNT flora species may occur; and
- Reference material on the target species (species profiles, etc.) to confirm habitat requirements and distinguishing features to assist field identification.

2.2. FIELD SURVEY APPROACH

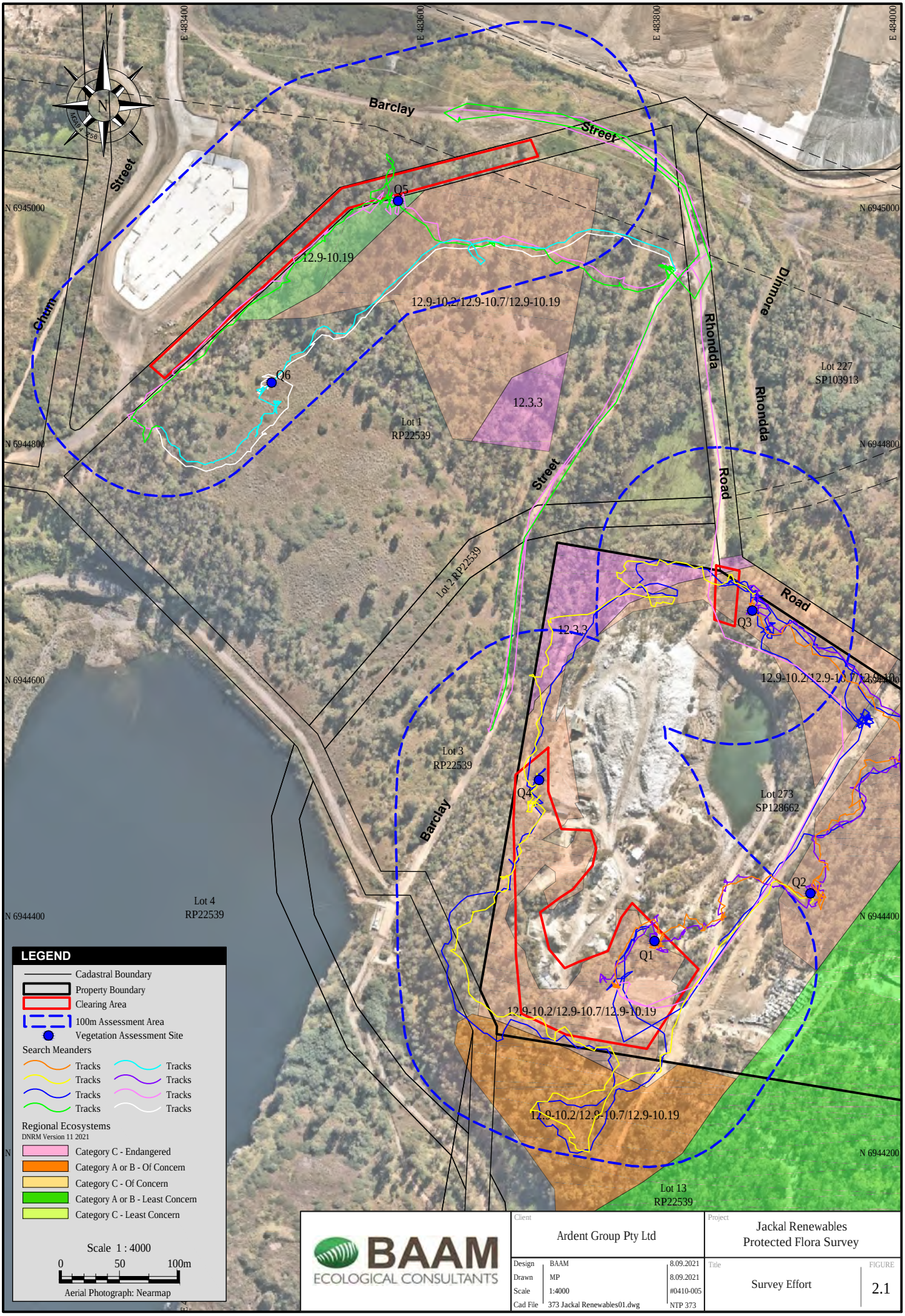
The flora survey covered the areas to be cleared as well as a 100m buffer around each proposed clearing area. This combined area is hereafter referred to as the 'clearing impact area' (refer **Figure 2.1**).



BAAM ECOLOGICAL CONSULTANTS

Client	Ardent Group Pty Ltd	Project	Jackal Renewables Protected Flora Survey
Design	BAAM	8.09.2021	
Drawn	MP	8.09.2021	
Scale	1:10,000	#0410-005	
Cad File	373 Jackal Renewables01.dwg	NTP 373	
Title	Site Location	FIGURE	1.1

©Biodiversity Assessment and Management Pty Ltd. While every care is taken to ensure the accuracy of this data, Biodiversity Assessment and Management makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.



BAAM ECOLOGICAL CONSULTANTS

Client	Ardent Group Pty Ltd		
Project	Jackal Renewables Protected Flora Survey		
Design	BAAM	8.09.2021	
Drawn	MP	8.09.2021	
Scale	1:4000	#0410-005	
Cad File	373 Jackal Renewables01.dwg	NTP 373	
Title	Survey Effort	FIGURE	2.1

©Biodiversity Assessment and Management Pty Ltd. While every care is taken to ensure the accuracy of this data, Biodiversity Assessment and Management makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.

In accordance with the *Flora Survey Guidelines - Protected Plants* (DES, 2020), the survey involved timed, random meander surveys of each habitat type within the clearing impact area.

The clearing impact area was dominated by one habitat type, this being eucalypt open forest/woodland. This community featured remnant, regrowth and non-remnant areas in a patchy mosaic – all of which were included in survey meanders.

All three clearing sites are located in regrowth vegetation mapped as a heterogeneous community of regional ecosystem (RE) 12.9-10.2/ RE12.9-10.7/RE12.9-10.19. For the southernmost clearing area, the clearing impact area (within the 100 metre buffer) also included one smaller area of remnant RE12.9-10.19.

For each clearing area, portions of the 100m buffer were completely cleared, highly disturbed land (highly modified environments) (refer **Figure 1.1**), which were not included in meanders.

Overall, eight meanders were completed in the clearing impact areas, as shown in **Figure 2.1**.

For the random meanders, a starting point was selected, and the starting time noted. The area of interest was then traversed as a random meander, searching carefully for EVNT plant species. Whenever the survey was interrupted, the survey time was paused until the survey started again. The random meander was terminated once no new species had been recorded for 30 minutes of active survey or when the entire area of the habitat type had been surveyed, whichever happened sooner.

2.3. QUALIFICATIONS OF FIELD TEAM

The targeted flora survey was led by Dr Jarrah Wills (Senior Ecologist) on 13th August 2021. Jarrah is suitably qualified to undertake protected plants assessments as prescribed under the Queensland *Flora Survey Guidelines – Protected Plants* (DES, 2020) – his certification statement is provided as a front cover to this report and his curriculum vitae is provided in **Appendix 4**.

2.4. SURVEY TIMING

The protected plant survey was commissioned to be undertaken in August 2021 to achieve operational timeframes. Rainfall during the months leading up to the survey was average. Conditions during the survey were mild and fine.

The protected plants survey methodology is designed to confirm the presence or absence of potentially occurring EVNT flora species, preferably at an optimal time for detection of species being targeted. All targeted species in this survey were expected to have identifiable foliage and bark characteristics present at the time of survey.

3.0 RESULTS

3.1. DESKTOP ASSESSMENT

A search of the DES Wildlife Online database (**Appendix 2**) and the ALA database found that nine EVNT flora species listed under the NC Act have been previously recorded within 5 km of the clearing impact area since 1980. The results of these searches, together with the preferred habitat and likelihood of occurrence of each species on this site, are presented in **Table 3.1**.

The State regulated vegetation mapping (**Appendix 3**) shows the clearing impact area predominantly occurs within non-remnant and regrowth vegetation, and one small area of remnant vegetation in the 100m buffer of the southernmost clearing area. No Essential Habitat mapping for flora species is associated with this RE.

3.2. FIELD ASSESSMENT

The habitat types recorded in the clearing impact area are described in **Table 3.2**. The location of vegetation assessment sites Q1 to Q6 are indicated in **Figure 2.1**.

Of the EVNT flora species recorded within 5km of the impact area, preferred habitat was present for *Eucalyptus curtissii, Marsdenia coronata* and *Notelaea ipsviciensis* (all of which occur in dry sclerophyll forest) (**Table 3.1**). However, no EVNT flora species were detected during the survey, despite thorough searching of the clearing area and adjacent vegetation.

Table 3.1. EVNT flora species recorded within 5km of the site and likelihood of occurrence

Species	Status (NCA)	Preferred Habitat	Likelihood of occurrence
Callitris baileyi	Near Threatened	Rocky slopes, hilly or mountainous areas, in shallow and often clay soils. It is found in eucalypt woodland, commonly associated with ironbark, blue gum and spotted gum (DES, 2019b).	**Unlikely**. Whilst marginal habitat for the species is present on site, extensive searches did not record the species. It is also noted that much of the Study Area displays landforms that have been historically disturbed.
Coleus habrophyllus	Endangered	Known only from near Ipswich and near Ormeau in south-east Queensland where it is associated with shaded gullies on rocky sediment substrates, often adjacent to dry rainforest (DoE, 2021a).	**Unlikely**. Dry rainforest was not recorded on site. Marginal habitat occurs in the form of gullies; however extensive searches in gully habitat did not record the species.
Eucalyptus curtisii	Near Threatened	The larger growth form occurs as scattered individuals on better drained soils in the more open areas of mixed eucalypt forests (DES, 2019d).	**Unlikely**. Whilst preferred habitat for the species is present on site, extensive searches did not record the species. It is also noted that much of the Study Area displays landforms that have been historically disturbed.
Hernandia bivalvis	Near Threatened	Mainly grows in rainforest on rock pavements and outcrops with shallow soils. Most Queensland Herbarium records are from either vine thicket or microphyll vine forest (DES, 2019c).	**Unlikely**. No suitable habitat occurs in the Study Area.
Lilaeopsis brisbanica	Endangered	Grows along tidal riverbanks in grey saline mud, in association with mangrove trees. Although occurring naturally in areas near saline waters, fresh water is satisfactory (DES, 2019).	**Unlikely**. Specimens have bee recorded on the Bremer and Brisbane Rivers well north of the Study Area. No suitable habitat occurs in the Study Area.
Marsdenia coronata	Vulnerable	Commonly found in open eucalypt forest/woodland communities on hillslopes and ridge tops at altitudes of 40–780 m above sea level. Also known from rocky outcrops along cliff lines. Most commonly recorded with *E. carnea, Corymbia citriodora, C. henryi, E. acmenoides* and *E. propinqua*. (DoE, 2021b)	**Unlikely** Potentially suitable habitat occurs in the Study Area. However extensive searches of representative habitats did not record the species. It is also noted that much of the Study Area displays landforms that have been historically disturbed.
Notelaea ipsviciensis	Critically Endangered	Known from three closely clustered sub-populations in the Ipswich area. Occurs as an understorey plant in degraded, eucalypt dominated, dry sclerophyll vegetation communities (DoE, 2021c).	**Unlikely**. Whilst preferred habitat for the species is present on site, extensive searches did not record the species. It is also noted that much of the Study Area displays landforms that have been historically disturbed.
Notelaea lloydii	Vulnerable	Found in the ecotone between eucalypt open forests and vine thicket on undulating to hilly terrain either in moist gullies or on dry slopes, rarely on rocky outcrops. (DoE. 2021d).	**Unlikely**. Vine thicket is not present on site. No suitable habitat occurs in the Study Area.
Rhodomyrtus psidioides	Critically Endangered	Grows in warmer rainforest and on rainforest margins; coastal districts (PlantNet, 2021).	**Unlikely**. No suitable habitat occurs in the Study Area.

Table 3.2. Description of vegetation within the clearing impact area (* exotic species)

Site	Habitat description	Representative photo
Q1	**Brief description:** Disturbed regrowth and non-remnant vegetation on highly disturbed landform. **Canopy (T1):** Sparse. Height range 7-14m; median height 12m. *Eucalyptus tereticornis, Acacia disparrima, Eucalyptus fibrosa.* **Sub-canopy (T2):** Sparse. Height range 3-6m; median height 4m: *Acacia leiocalyx.* **Shrub (S1)** nil **Groundcover:** Very sparse. Height range 0.0-0.5m; median height 0.3m. *Entolasia stricta.*	
Q2	**Brief description:** Eucalypt open forest - mapped regrowth but has achieved remnant status. **Canopy (T1):** Mid-dense. Height range 16-21m; median height 19m. *Eucalyptus fibrosa, Corymbia citriodora.* **Sub-canopy (T2):** Dense. Height range 2-5m; median height 3m: *Acacia leiocalyx*, *Alphitonia excelsa, Hovea acutifolia, Dodonaea triangularis, Acacia* sp. **Shrub (S1)** Dense: Height range 1-2m; median height 1.5m. *Acacia* sp. **Groundcover:** Sparse. Height range 0.0-1.0m; median height 0.3m. *Entolasia stricta*, *Aristida sp., Lomandra multiflora, Eragrostis corrollii.*	
Q3	**Brief description:** Eucalypt open forest - mapped regrowth but has achieved remnant status. Disturbed understorey. **Canopy (T1):** Mid-dense. Height range 18-21m; median height 20m. *Corymbia citriodora.* **Sub-canopy (T2):** Dense. Height range 2-4m; median height 3m: *Acacia leiocalyx.* **Shrub (S1)** Mid-dense: Height range 1-2m; median height 1.2m. *Alphitonia excelsa, Lantana camara** **Groundcover:** Sparse. Height range 0.0-1.0m; median height 0.5m. *Entolasia stricta*.	

Site	Habitat description	Representative photo
Q4	**Brief description:** non-remnant Acacia regrowth. **Canopy (T1):** Sparse. Height range 2.5-6m; median height 4m. *Acacia leiocalyx, Alphitonia excelsa, Eucalyptus tereticornis.* **Sub-canopy (T2):** nil **Shrub (S1)** nil **Groundcover:** Mid-dense. Height range 0.0-1.0m; median height 0.8m. *Melinis repens*; Pennisetum alopecuroides*, Senecio madagascariensis*, Cyanthillium cinereum**	
Q5	**Brief description:** Eucalypt open forest – mapped regrowth but has achieved remnant status. **Canopy (T1):** Sparse. Height range 17-22m; median height 20m. *Eucalyptus fibrosa, Corymbia citriodora.* **Sub-canopy (T2):** Mid-dense**.** Height range 2-4m; median height 3m: *Acacia fimbriata*. **Shrub (S1)** nil **Groundcover**: Sparse. Height range 0.0-1.0m; median height 0.5m. *Entolasia stricta*.	
Q6	**Brief description:** non-remnant rank grassland **Canopy (T1):** *nil* **Sub-canopy (T2):** nil **Shrub (S1):** nil **Groundcover:** Dense. Height range 0.0-1.0m; median height 0.8m. *Andropogon virginicus**	

4.0 POTENTIAL IMPACTS

As no EVNT species were detected within the clearing impact area, no direct or indirect impacts on EVNT plants are expected.

5.0 CONFIRMATION OF EXEMPT CLEARING NOTIFICATION AND SUBMISSION REQUIREMENTS

The *Flora Survey Guidelines – Protected Plants* (DES, 2020) stipulate that, where no EVNT species are identified within the clearing "impact" area (which includes the 100m buffer), an exempt clearing notification is required to be submitted to DES. This Protected Flora Survey Report should accompany the notification as an attachment.

Section 261ZA requires that the exemption and supporting report are submitted at least one week before clearing commences, but no later than one year after the completion of the flora survey that was undertaken for the report (i.e. by 13th August, 2022). Following submission of the exemption, the applicant will receive a receipt of the submission providing approval for the clearing to commence. Clearing under this exemption may be conducted within two years after the flora survey report is submitted.

6.0 REFERENCES

Atlas of Living Australia (2021). https://www.ala.org.au/

Department of the Environment (2021a). *Approved Conservation Advice: Plectranthus habrophyllus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/sprat

Department of the Environment (2021b). *Approved Conservation Advice: Marsdenia coronata* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/cgi-in/sprat/public/publicspecies.pl?taxon_id=20632

Department of the Environment (2021c). *Notelaea ipsviciensis* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/cgi-in/sprat/public/publicspecies.pl?taxon_id=81858

Department of the Environment (2021d). *Notelaea lloydii* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=15002

Department of Environment and Science (2019) *Lilaeopsis brisbanica* https://apps.des.qld.gov.au/species-search/details/?id=18503

Department of Environment and Science (2019b) *Callitris baileyi* https://apps.des.qld.gov.au/species-search/details/?id=14766

Department of Environment and Science (2019c) *Hernandia bivalvis.* https://apps.des.qld.gov.au/species-search/details/?id=14766

Department of Environment and Science (2019d) *Eucalyptus curtisii.* https://apps.des.qld.gov.au/species-search/details/?id=17256

Department of Environment and Science (DES) (2020). *Flora Survey Guidelines – Protected Plants* (Version 2.01). Department of Environment and Heritage Protection Queensland Government, Brisbane.

Leiper et al (2008). *Mountain to Mangroves* revised edition. Society for Growing Australian Plants. Logan Branch.

PlantNet (2021) *Rhodomyrtus psidioides.* Found at: https://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Rhodomyrtus~psidioides

APPENDIX 1
FLORA SURVEY TRIGGER MAP FOR THE SITE

09/07/2020 12:32:16
Lot: 73 Plan: SP128662



Protected Plants Flora Survey Trigger Map

Legend

- Selected Lot and Plan
- High risk area
- Other land parcel boundaries
- Freeways / motorways / highways
- Secondary roads / streets

LOCALITY DIAGRAM



N

0 140 280 420 560 700 m

This product is projected into:
GDA 1994 Queensland Albers

This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

Land parcel boundaries are provided as locational aid only.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Science at palm@ehp.qld.gov.au

Disclaimer:
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

© The State of Queensland (Department of Environment and Science), 2020

Queensland Government

Protected plants flora survey trigger map

The protected plants flora survey trigger map identifies 'high risk areas' where endangered, vulnerable or near threatened plants are known to exist or are likely to exist. Under the *Nature Conservation Act 1992* (the Act) it is an offence to clear protected plants that are 'in the wild' unless you are authorised or the clearing is exempt, for more information see section 89 of the Act.

Please see the Department of Environment and Science webpage on the clearing of protected plants for information on what exemptions may apply in your circumstances, whether you may need to undertake a flora survey, and whether you may need a protected plants clearing permit.

Updates to the data informing the flora survey trigger map

The flora survey trigger map will be reviewed, and updated if necessary, at least every 12 months to ensure the map reflects the most up-to-date and accurate data available.

Species information

Please note that flora survey trigger maps do not identify species associated with 'high risk areas'. While some species information may be publicly available, for example via the Queensland Spatial Catalogue, the Department of Environment and Science does not provide species information on request. Regardless of whether species information is available for a particular high risk area, clearing plants in a high risk area may require a flora survey and/or clearing permit. Please see the Department of Environment and Science webpage on the clearing of protected plants for more information.

Queensland Government

APPENDIX 2
WILDLIFE ONLINE DATABASE SEARCH RESULTS

Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: Plants (including other non-animals such as fungi and protists)
Type: Native
Status: Rare and threatened species
Records: Confirmed
Date: Since 1980
Latitude: -27.621
Longitude: 152.831
Distance: 5
Email: jarrah@baamecology.com
Date submitted: Wednesday 13 Jan 2021 13:32:35
Date extracted: Wednesday 13 Jan 2021 13:40:02

The number of records retrieved = 9

Disclaimer

As the DSITIA 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
plants	land plants	Apiaceae	*Lilaeopsis brisbanica*			E		3/3
plants	land plants	Apocynaceae	*Marsdenia coronata*	slender milkvine		V		13/13
plants	land plants	Cupressaceae	*Callitris baileyi*	Bailey's cypress		NT		1
plants	land plants	Hernandiaceae	*Hernandia bivalvis*	cudgerie		NT		1
plants	land plants	Lamiaceae	*Coleus habrophyllus*			E	E	1/1
plants	land plants	Myrtaceae	*Rhodomyrtus psidioides*	native guava		CR	CE	1
plants	land plants	Myrtaceae	*Eucalyptus curtisii*	Plunkett mallee		NT		6/5
plants	land plants	Oleaceae	*Notelaea lloydii*	Lloyd's native olive		V	V	13/13
plants	land plants	Oleaceae	*Notelaea ipsviciensis*	Cooneana olive		CR	CE	15/15

CODES

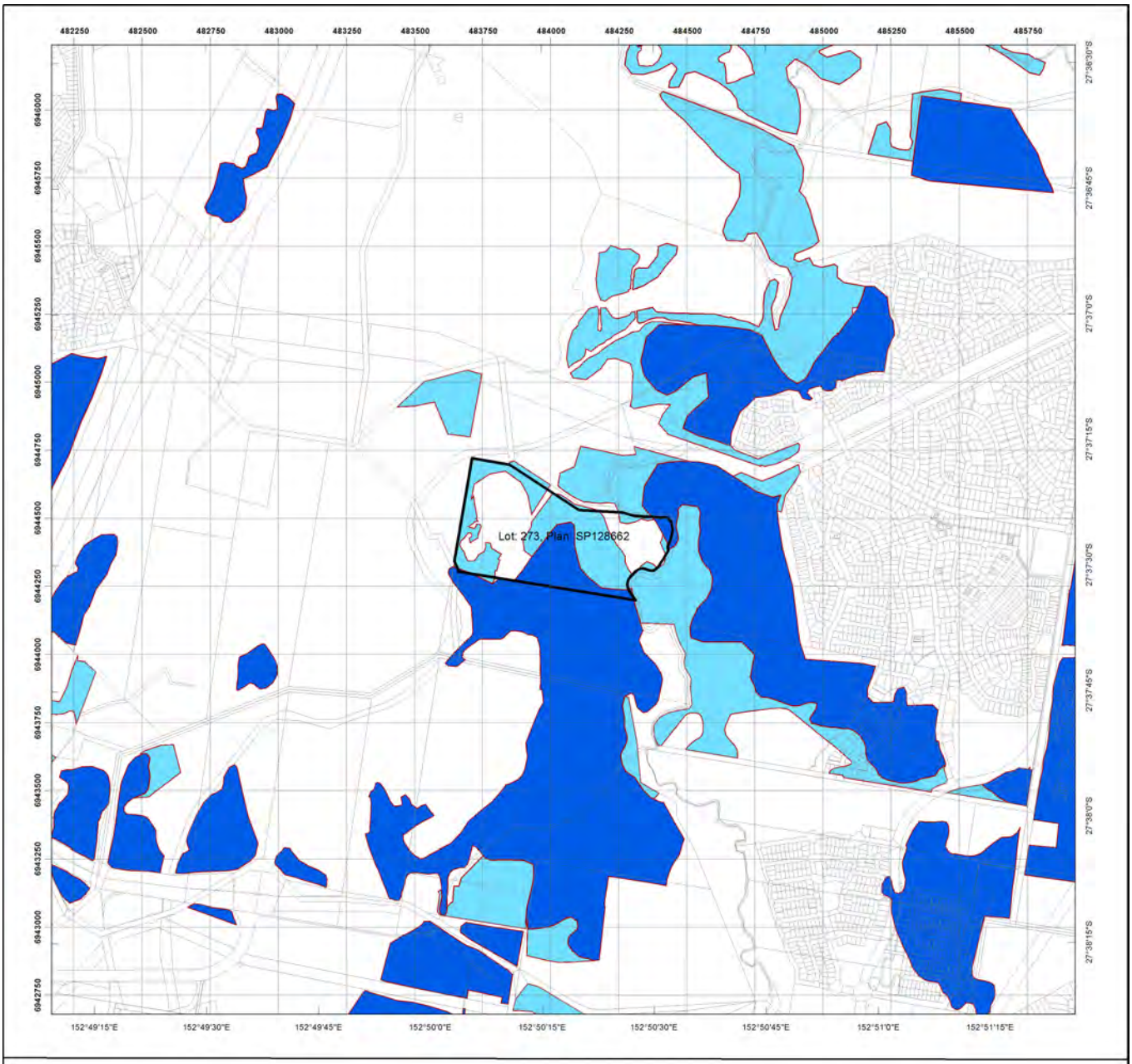
I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.* The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (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 3
DNRM REGULATED VEGETATION AND ESSENTIAL HABITAT MAPPING



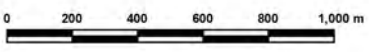
Regulated Vegetation Management Map

Legend

- Selected Lot and Plan
- Category A area (Vegetation offsets/compliance notices/VDecs)
- Category B area (Remnant vegetation)
- Category C area (High-value regrowth vegetation)
- Category R area (Reef regrowth watercourse vegetation)
- Category X area (Exempt clearing work on Freehold, Indigenous and Leasehold land)
- Water
- Area not categorised
- Other land parcel boundaries







This product is projected into:
GDA 1994 MGA Zone 56

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Resources makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

Additional information required for the assessment of vegetation values is provided in the accompanying "Vegetation Management Supporting map". For further information go to the web site: www.resources.qld.gov.au or contact the Department of Resources.

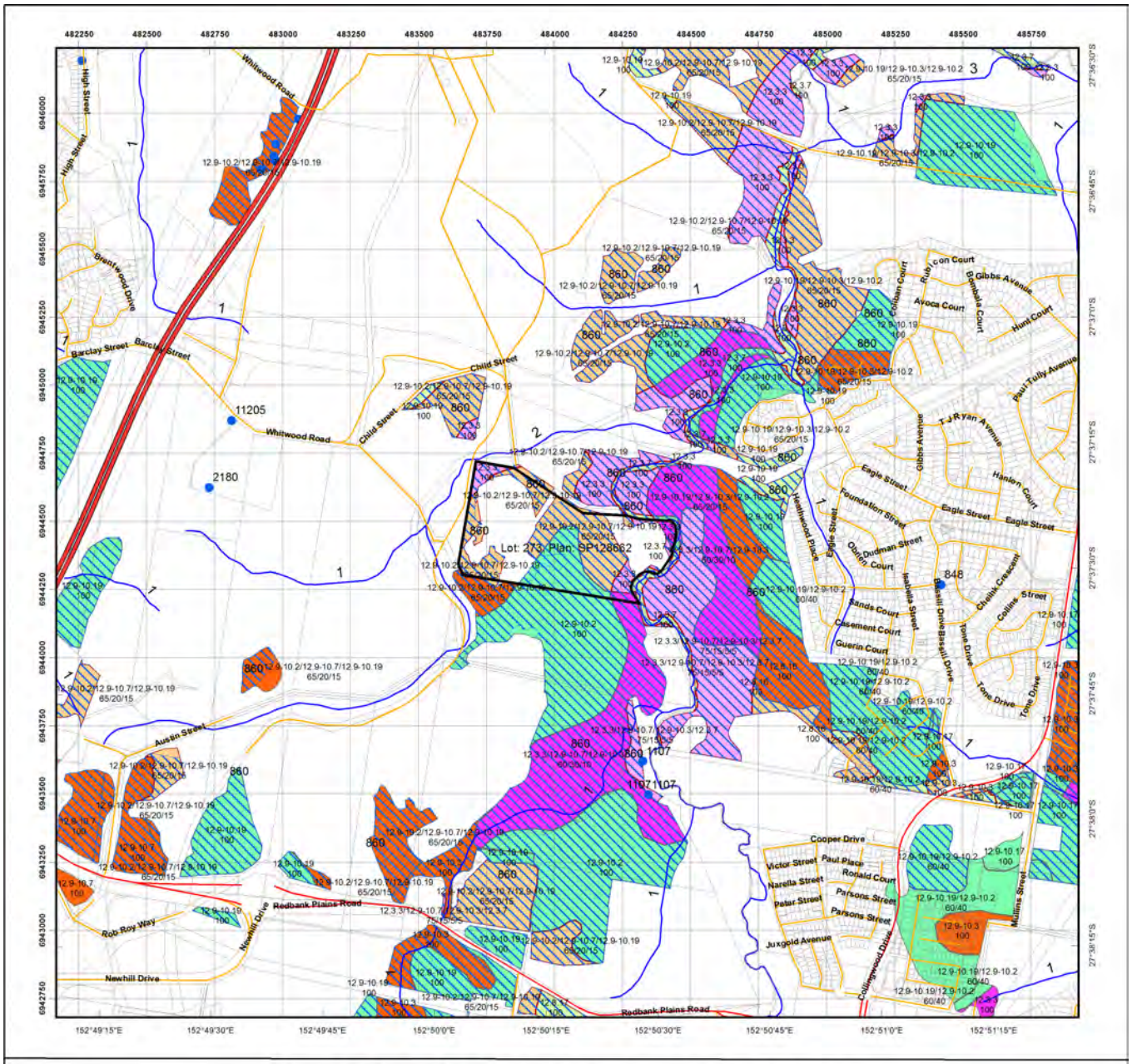
Digital data for the regulated vegetation management map is available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries are provided as locational aid only.

This map is updated on a monthly basis to ensure new PMAVs are included as they are approved.

Queensland Government

© The State of Queensland (Department of Resources), 2021



Vegetation Management Supporting Map

Legend

- Selected Lot and Plan
- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystem
- Category A or B area under Section 20AH
  These areas are edged in yellow and filled with the remnant RE Status
- Category C or R area containing endangered regional ecosystems
- Category C or R area containing of concern regional ecosystems
- Category C or R area that is a least concern regional ecosystem
- Category C area under Section 20AI
  These areas are edged in purple and filled with the remnant RE Status
- Category X area
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourses and drainage features on the vegetation management watercourse and drainage features map
  (Stream order shown as black number against stream where available)
- Highway
- Connector
- Street/Local Road
- National Parks, State Forest and other reserves
- Other land parcel boundaries

Queensland Government

LOCALITY DIAGRAM



N

0 140 280 420 560 700 m

This product is projected into:
GDA 1994 MGA Zone 56

Labels for Essential Habitat are centred on the area of enquiry.

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.

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Resources makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

Additional information may be 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.resources.qld.gov.au or contact the Department of Resources.

Digital data for the vegetation management watercourse and drainage feature map, vegetation management wetlands map, essential habitat map and the vegetation management remnant and regional ecosystem map are available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries are provided as locational aid only.

© The State of Queensland (Department of Resources), 2021

Vegetation Management Act 1999 - Extract from the essential habitat database

Essential habitat is required for assessment under the:

- State Development Assessment Provisions - State Code 16: Native vegetation clearing which sets out the matters of interest to the state for development assessment under the *Planning Act 2016*; and
- Accepted development vegetation clearing codes made under the *Vegetation Management Act 1999*

Essential habitat for one or more of the following species is found on and within 1.1 km of the identified subject lot/s on the accompanying essential habitat map.

This report identifies essential habitat in Category A, B and Category C areas.

The numeric labels on the essential habitat map can be cross referenced with the database below to determine which essential habitat factors might exist for a particular species.

Essential habitat is compiled from a combination of species habitat models and buffered species records.

The Department of Resources website (http://www.dnrme.qld.gov.au) has more information on how the layer is applied under the State Development Assessment Provisions - State Code 16: Native vegetation clearing and the *Vegetation Management Act 1999*.

Regional ecosystem is a mandatory essential habitat factor, unless otherwise stated.

Essential habitat, for protected wildlife, means a category A area, a category B area or category C area shown on the regulated vegetation management map-

1) that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or

2) in which the protected wildlife, at any stage of its life cycle, is located.

Protected wildlife includes critically endangered, endangered, vulnerable or near-threatened native wildlife prescribed under the *Nature Conservation Act 1992*.

Essential habitat in Category A and/or Category B and/or Category C

Label	Scientific Name	Common Name	NCA Status	Vegetation Community	Altitude	Soils	Position in Landscape
860	Phascolarctos cinereus	koala	V	SEQ: Open eucalypt forest and woodland that has: a) multiple strata layers containing Eucalyptus, Corymbia, Angophora, Lophostemon or Melaleuca trees that-at 1.3 metres above the ground-have a diameter both greater and less than 30 centimetres; and b) at least 1 of the following species: Eucalyptus tereticornis, E. fibrosa, E. propinqua; E. umbra, E. grandis, E. microcorys, E. tindaliae, E. resinifera, E. populnea, E. robusta, E. nigra, E. racemosa, E. crebra, E. exserta, E. seeana, Lophostemon confertus, L. suaveolens, Melaleuca quinquenervia. Outside SEQ: Open eucalypt forest and woodland that contains Eucalyptus &/or Corymbia spp. Tree species used for food varies across State and can include Eucalyptus tereticornis, E. camaldulensis, E. coolabah; E. drepanophylla, E. platyphylla, E. orgadophilla, E. thozetiana, E. melanophloia, E. populnea, E. melliodora, E. dealbata, E. microtheca, E. crebra, E. exserta, E. blakelyi, E. papuana, Corymbia tessellaris, C. citriodora, Melaleuca quinquenervia, M. leucadendra.	Sea level to 1000m.	None	Riparian areas, plains and hill/escarpment slopes.
848	Petauroides volans	greater glider	V	Tall mature open wet and dry eucalypt forest (Eucalyptus &/or Corymbia spp.) to low open eucalypt woodland; presence of hollow-bearing trees.	Sea level to 1300m.	Usually on soils of relatively high fertility.	None
1107	Ninox strenua	powerful owl	V	Wet and dry tall open eucalypt forest (Eucalyptus pilularis, E. acmenoides, E. tereticornis, E. camaldulensis, E. crebra, E. melliodora, Corymbia citriodora & C. intermedia), including mountain forest gullies/gorges; forests aged 60+ years (large & old) on fertile soils with suitable hollows; roosting in dense foliage of closed forest (occasionally caves) and foraging in open forest and woodland including areas adjacent to urban/rural development. Nest in large hollows (45-75cm diameter, 50-180cm deep) 6-45m above ground, in large (>100cm dbh) old eucalypts on the side or at the head of heavily wooded gully.	Sea level to 1000m.	None	Gully.
2180	Notelaea ipsviciensis	Cooneana olive	E	dry sclerophyll eucalypt forest.; open forest of Eucalyptus fibrosa, Corymbia citriodora and C. henryii	0 to 300 m	shallow sandy to loam soil derived from sandstone substrates or stony clay soils	hill sides, gullies in hilly terrain
11205	Marsdenia coronata	slender milkvine	V	open forest of Eucalyptus pilularis, E. microcorys, Corymbia intermedia, or Eucalyptus propinqua, E. carnea with Themeda understorey, or Lophostemon confertus, Corymbia intermedia, Eucalyptus carnea, Allocasuarina littoralis, Banksia integrifolia, or Eucalyptus carnea, E. propinqua, or Eucalyptus carnea, E. propinqua, E. acmenoides, or Allocasuarina littoralis, Lophostemon confertus, Corymbia citriodora, Eucalyptus carnea, E. tindaliae; woodland to open forest of Eucalyptus fibrosa, Corymbia citriodora, or Eucalyptus fibrosa, C. henryi, or Corymbia citriodora, Eucalyptus dura, C. henryii, or Eucalyptus dura, Eucalyptus acmenoides; rocky heathland with Acacia blakei; wet sclerophyll forest dominated by Eucalyptus andrewsii, E. biturbinata	0 to 800 m	red brown loam to clay or sandy soil occasionally skeletal	mostly on steep ridge or hill slope sometimes on rock ledges along cliftlines rarely on alluvial terrace

Label	Regional Ecosystem (mandatory unless otherwise specified)
860	SEQ: 11.3.2, 11.3.4, 11.3.25, 11.3.26, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.9, 12.2.5, 12.2.6, 12.2.7, 12.2.8, 12.2.10, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.6, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.14, 12.3.18, 12.3.19, 12.3.20, 12.5.1, 12.5.2, 12.5.3, 12.5.4, 12.5.6, 12.5.7, 12.5.10, 12.5.12, 12.8.1, 12.8.8, 12.8.9, 12.8.11, 12.8.12, 12.8.14, 12.8.16, 12.8.17, 12.8.20, 12.8.24, 12.8.25, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.7, 12.9-10.8, 12.9-10.11, 12.9-10.12, 12.9-10.14, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.21, 12.9-10.25, 12.9-10.26, 12.9-10.27, 12.9-10.28, 12.9-10.29, 12.11.2, 12.11.3, 12.11.5, 12.11.6, 12.11.7, 12.11.8, 12.11.9, 12.11.14, 12.11.15, 12.11.16, 12.11.17, 12.11.18, 12.11.22, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.2, 12.12.3, 12.12.5, 12.12.6, 12.12.7, 12.12.8, 12.12.9, 12.12.11, 12.12.12, 12.12.14, 12.12.15, 12.12.23, 12.12.24, 12.12.25, 12.12.28. Outside SEQ: 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.3.8, 4.3.10, 4.3.11, 4.4.1, 4.5.3, 4.5.5, 4.5.6, 4.5.8, 4.5.9, 4.7.1, 4.7.7, 4.7.8, 4.9.6, 4.9.10, 4.9.12, 4.9.17, 6.3.1, 6.3.2, 6.3.3, 6.3.4, 6.3.5, 6.3.7, 6.3.8, 6.3.9, 6.3.11, 6.3.12, 6.3.17, 6.3.18, 6.3.22, 6.3.24, 6.3.25, 6.4.1, 6.4.2, 6.4.3, 6.4.4, 6.5.1, 6.5.2, 6.5.3, 6.5.5, 6.5.6, 6.5.7, 6.5.8, 6.5.9, 6.5.10, 6.5.11, 6.5.13, 6.5.14, 6.5.15, 6.5.16, 6.5.17, 6.5.18, 6.5.19, 6.6.2, 6.7.1, 6.7.2, 6.7.5, 6.7.6, 6.7.7, 6.7.9, 6.7.11, 6.7.12, 6.7.13, 6.7.14, 6.7.17, 6.9.3, 7.2.3, 7.2.4, 7.2.7, 7.2.11, 7.3.7, 7.3.8, 7.3.9, 7.3.12, 7.3.13, 7.3.14, 7.3.16, 7.3.19, 7.3.20, 7.3.21, 7.3.25, 7.3.26, 7.3.39, 7.3.40, 7.3.42, 7.3.43, 7.3.44, 7.3.45, 7.3.47, 7.3.48, 7.3.50, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.8.7, 7.8.8, 7.8.10, 7.8.15, 7.8.16, 7.8.17, 7.8.18, 7.8.19, 7.11.5, 7.11.6, 7.11.13, 7.11.14, 7.11.16, 7.11.18, 7.11.19, 7.11.20, 7.11.21, 7.11.31, 7.11.32, 7.11.33, 7.11.34, 7.11.35, 7.11.37, 7.11.41, 7.11.42, 7.11.43, 7.11.44, 7.11.45, 7.11.46, 7.11.47, 7.11.48, 7.11.49, 7.11.50, 7.11.51, 7.12.4, 7.12.5, 7.12.17, 7.12.21, 7.12.22, 7.12.23, 7.12.24, 7.12.25, 7.12.26, 7.12.27, 7.12.28, 7.12.29, 7.12.30, 7.12.33, 7.12.34, 7.12.35, 7.12.51, 7.12.52, 7.12.53, 7.12.54, 7.12.55, 7.12.56, 7.12.57, 7.12.58, 7.12.59, 7.12.60, 7.12.61, 7.12.62, 7.12.63, 7.12.65, 7.12.66, 7.12.69, 8.1.5, 8.2.3, 8.2.6, 8.2.7, 8.2.8, 8.2.11, 8.2.12, 8.2.13, 8.2.14, 8.3.1, 8.3.2, 8.3.3, 8.3.5, 8.3.6, 8.3.8, 8.3.10, 8.3.11, 8.3.13, 8.5.1, 8.5.2, 8.5.3, 8.5.5, 8.5.6, 8.5.7, 8.9.1, 8.10.1, 8.11.1, 8.11.3, 8.11.4, 8.11.5, 8.11.6, 8.11.8, 8.11.10, 8.11.12, 8.12.4, 8.12.5, 8.12.6, 8.12.7, 8.12.8, 8.12.9, 8.12.12, 8.12.14, 8.12.20, 8.12.22, 8.12.23, 8.12.25, 8.12.26, 8.12.27, 8.12.29, 8.12.31, 8.12.32, 9.3.1, 9.3.2, 9.3.3, 9.3.4, 9.3.5, 9.3.6, 9.3.7, 9.3.8, 9.3.10, 9.3.11, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.27, 9.4.1, 9.4.2, 9.4.3, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.13, 9.5.14, 9.5.15, 9.5.16, 9.5.17, 9.7.1, 9.7.2, 9.7.3, 9.7.4, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.4, 9.8.5, 9.8.9, 9.8.10, 9.8.11, 9.10.1, 9.10.3, 9.10.4, 9.10.5, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.8, 9.11.9, 9.11.10, 9.11.11, 9.11.12, 9.11.13, 9.11.14, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.21, 9.11.22, 9.11.23, 9.11.24, 9.11.25, 9.11.26, 9.11.28, 9.11.29, 9.11.30, 9.11.31, 9.11.32, 9.12.1, 9.12.2, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.8, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.14, 9.12.15, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.25, 9.12.26, 9.12.27, 9.12.28, 9.12.29, 9.12.30, 9.12.31, 9.12.32, 9.12.33, 9.12.35, 9.12.36, 9.12.37, 9.12.38, 9.12.39, 9.12.44, 10.3.2, 10.3.3, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.17, 10.3.20, 10.3.27, 10.3.28, 10.4.3, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.2, 10.9.3, 10.9.5, 10.10.1, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.21, 11.3.22, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.7, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.11, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.12, 11.10.13, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.4, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.19, 11.12.20, 13.3.1, 13.3.2, 13.3.3, 13.3.4, 13.3.5, 13.3.7, 13.9.2, 13.11.1, 13.11.2, 13.11.3, 13.11.4, 13.11.5, 13.11.6, 13.11.8, 13.11.9, 13.12.1, 13.12.2, 13.12.3, 13.12.4, 13.12.5, 13.12.6, 13.12.8, 13.12.9, 13.12.10.
848	7.3.7, 7.3.8, 7.3.9, 7.3.12, 7.3.13, 7.3.14, 7.3.16, 7.3.19, 7.3.20, 7.3.21, 7.3.25, 7.3.26, 7.3.39, 7.3.40, 7.3.42, 7.3.43, 7.3.44, 7.3.45, 7.3.47, 7.3.48, 7.3.50, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.8.7, 7.8.8, 7.8.10, 7.8.15, 7.8.16, 7.8.17, 7.8.18, 7.8.19, 7.11.5, 7.11.6, 7.11.13, 7.11.14, 7.11.16, 7.11.18, 7.11.19, 7.11.20, 7.11.21, 7.11.31, 7.11.32, 7.11.33, 7.11.34, 7.11.35, 7.11.37, 7.11.41, 7.11.42, 7.11.43, 7.11.44, 7.11.45, 7.11.46, 7.11.47, 7.11.48, 7.11.49, 7.11.50, 7.11.51, 7.12.4, 7.12.5, 7.12.17, 7.12.21, 7.12.22, 7.12.23, 7.12.24, 7.12.25, 7.12.26, 7.12.27, 7.12.28, 7.12.29, 7.12.30, 7.12.33, 7.12.34, 7.12.35, 7.12.51, 7.12.52, 7.12.53, 7.12.54, 7.12.55, 7.12.56, 7.12.58, 7.12.59, 7.12.60, 7.12.61, 7.12.62, 7.12.63, 7.12.65, 7.12.66, 7.12.69, 9.3.1, 9.3.2, 9.3.3, 9.3.5, 9.3.6, 9.3.8, 9.3.10, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.24, 9.4.1, 9.4.2, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.13, 9.5.14, 9.5.15, 9.5.16, 9.5.17, 9.7.1, 9.7.2, 9.7.3, 9.7.4, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.4, 9.8.5, 9.8.9, 9.8.10, 9.8.11, 9.10.1, 9.10.3, 9.10.4, 9.10.5, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.10, 9.11.12, 9.11.13, 9.11.14, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.21, 9.11.22, 9.11.23, 9.11.24, 9.11.25, 9.11.26, 9.11.28, 9.11.29, 9.11.30, 9.11.31, 9.11.32, 9.12.1, 9.12.2, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.14, 9.12.15, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.25, 9.12.26, 9.12.27, 9.12.28, 9.12.29, 9.12.30, 9.12.31, 9.12.32, 9.12.33, 9.12.35, 9.12.36, 9.12.37, 9.12.38, 9.12.39, 9.12.40, 9.12.44, 10.3.2, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.7, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.7, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.10.1, 11.10.2, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.16, 11.12.17, 11.12.19, 11.12.20; 12.2.5, 12.2.6, 12.2.7, 12.2.8, 12.2.10, 12.2.11, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.6, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.12, 12.3.14, 12.3.15, 12.3.18, 12.3.19, 12.3.20, 12.5.1, 12.5.2, 12.5.3, 12.5.4, 12.5.5, 12.5.6, 12.5.7, 12.5.8, 12.5.10, 12.5.11, 12.5.12, 12.7.1, 12.7.2, 12.8.1, 12.8.2, 12.8.8, 12.8.10, 12.8.11, 12.8.12, 12.8.14, 12.8.16, 12.8.17, 12.8.20, 12.8.23, 12.8.24, 12.8.25, 12.8.26, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.7, 12.9-10.8, 12.9-10.11, 12.9-10.12, 12.9-10.13, 12.9-10.14, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.20, 12.9-10.21, 12.9-10.23, 12.9-10.24, 12.9-10.25, 12.9-10.26, 12.9-10.27, 12.9-10.28, 12.9-10.29, 12.11.2, 12.11.3, 12.11.5, 12.11.6, 12.11.7, 12.11.8, 12.11.9, 12.11.14, 12.11.15, 12.11.16, 12.11.17, 12.11.18, 12.11.19, 12.11.20, 12.11.21, 12.11.22, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.2, 12.12.3, 12.12.4, 12.12.5, 12.12.6, 12.12.7, 12.12.8, 12.12.9, 12.12.11, 12.12.12, 12.12.14, 12.12.15, 12.12.20, 12.12.21, 12.12.22, 12.12.23, 12.12.24, 12.12.25, 12.12.26, 12.12.27, 12.12.28, 13.3.1, 13.3.2, 13.3.3, 13.3.4, 13.3.5, 13.3.7, 13.9.2, 13.11.1, 13.11.2, 13.11.3, 13.11.4, 13.11.5, 13.11.6, 13.11.8, 13.11.9, 13.12.1, 13.12.2, 13.12.3, 13.12.4, 13.12.5, 13.12.6, 13.12.8, 13.12.9, 13.12.10
1107	8.2.2, 8.2.3, 8.2.4, 8.2.5, 8.2.6, 8.2.7, 8.2.8, 8.2.11, 8.2.13, 8.2.14, 8.3.1, 8.3.3, 8.3.6, 8.3.8, 8.3.9, 8.3.10, 8.3.11, 8.5.1, 8.8.1, 8.10.1, 8.11.2, 8.11.3, 8.11.5, 8.12.1, 8.12.2, 8.12.3, 8.12.4, 8.12.5, 8.12.7, 8.12.8, 8.12.11, 8.12.12, 8.12.14, 8.12.16, 8.12.17, 8.12.18, 8.12.19, 8.12.26, 8.12.27, 8.12.28, 8.12.29, 8.12.30, 8.12.31, 8.12.32, 11.2.2, 11.2.3, 11.3.1, 11.3.11, 11.3.12, 11.3.25, 11.3.26, 11.3.40, 11.4.1, 11.4.3, 11.4.7, 11.4.9, 11.5.7, 11.5.16, 11.8.1, 11.8.13, 11.9.1, 11.9.4, 11.9.5, 11.9.6, 11.9.10, 11.9.13, 11.10.1, 11.10.2, 11.10.5, 11.10.8, 11.10.9, 11.10.13, 11.11.3, 11.11.5, 11.11.13, 11.11.14, 11.11.18, 11.12.4, 11.12.13, 11.12.19, 11.12.21, 12.2.1, 12.2.2, 12.2.3, 12.2.4, 12.2.5, 12.2.7, 12.2.8, 12.3.1, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.15, 12.3.16, 12.3.17, 12.3.18, 12.3.19, 12.3.20, 12.3.21, 12.5.1, 12.5.3, 12.5.6, 12.5.7, 12.5.13, 12.8.1, 12.8.2, 12.8.3, 12.8.4, 12.8.5, 12.8.6, 12.8.7, 12.8.8, 12.8.9, 12.8.10, 12.8.11, 12.8.12, 12.8.13, 12.8.14, 12.8.18, 12.8.21, 12.8.22, 12.8.23, 12.8.24, 12.8.25, 12.8.26, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.6, 12.9-10.14, 12.9-10.16, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.20, 12.9-10.21, 12.9-10.23, 12.9-10.24, 12.9-10.25, 12.9-10.26, 12.9-10.29, 12.11.1, 12.11.2, 12.11.3, 12.11.4, 12.11.5, 12.11.6, 12.11.9, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.11.16, 12.11.17, 12.11.18, 12.11.19, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.1, 12.12.2, 12.12.3, 12.12.4, 12.12.5, 12.12.6, 12.12.11, 12.12.13, 12.12.15, 12.12.16, 12.12.17, 12.12.18, 12.12.20, 12.12.26, 12.12.28, 13.3.2, 13.3.3, 13.3.5, 13.9.2, 13.11.2, 13.11.5, 13.11.6, 13.11.7, 13.12.1, 13.12.4, 13.12.11
2180	12.9-10.19
11205	12.3.11, 12.8.19, 12.8.20, 12.9-10.17, 12.9-10.19, 12.11.3, 12.11.5, 12.11.6

APPENDIX 4
CURRICULA VITA OF FIELD PERSONNEL

DR JARRAH WILLS

SENIOR ECOLOGIST

SPECIALISATION

- Ecological Survey
- Protected Plant Survey
- Vegetation and Rehabilitation Management Plans
- Biocondition Assessment
- Plant Identification
- Bush Regeneration
- Project Management



EDUCATION & PROFESSIONAL QUALIFICATIONS

PhD Plant Ecology, University of Queensland (2017)

BSc Ecology, Queensland University of Technology (2012)

Chemical Application Licence, Axiom College (2008)

Chainsaw Operations, In Training Systems (2008)

KEY EXPERIENCE

Jarrah Wills is a Senior Ecologist at BAAM Pty Ltd. His areas of expertise are botanical and ecological surveys, ecological restoration and how they relate to ecosystem functioning and subsequent services. Jarrah has over 10 years' experience in vegetation management, and 6 years' experience in undertaking vegetation surveys within Australia and Internationally.

RECENT PROJECT EXPERIENCE

- Comprehensive baseline ecological surveys for Saraji and Saraji South Mines for BHP, including vegetation assessment and ground-truthed mapping, biocondition assessment and habitat assessment.
- Ground-verification of ecological values for the Cooloola Great Walk project.
- Large scale tree surveys, Vegetation Mapping, Vegetation Condition Assessments and Comparisons, Food Web Analysis for the Terrestrial Ecology, and on-going technical advice for the rehabilitation of the Old Petrie Mill site.
- Planning, direction and monitoring of weeding and rehabilitation works at Hilliards Creek for Department of Agriculture and Fisheries.
- Protected Flora Surveys undertaken in accordance with state guidelines – various locations throughout south-east Queensland.
- National assessment of the impact of myrtle rust – Threatened Species Recovery Hub (NESP)
- Vegetation survey – Gulkula Mining vegetation assessment and comparative analysis, Gove
- Forest Resource Survey – Rio Tinto mining lease pre-clearing forest resource assessment, Gove and Weipa

PROFESSIONAL HISTORY

2019-present	**BAAM Pty Ltd** Senior Ecologist
2017-2018	**University of Queensland Queensland Herbarium** Post-doctoral research fellow
2016-2017	**University of the Sunshine Coast** Researcher
2013-2017	**University of Queensland** PhD Researcher
2006-2018	**Mt Nebo and Mt Glorious Environmental Protection Agency Inc** Ecologist/Bush Regenerator
2012-2013	**Davanco Environmental Pty Ltd** Bush Regenerator
2006-2010	**Brisbane Bush Care Pty Ltd** Bush Regenerator

SELECTED PUBLICATIONS

Fensham, R.J.et al. and **Wills, J** (2020) Imminent Extinction of Australian Myrtaceae by Fungal Disease. Trends in Ecology and Evolution.

Wills, J. et al (2018) Leaf economic trade-offs are stronger for sub-canopy trees: leaf traits reveal little about growth rates in canopy trees. Ecological Applications, 28: 1116-1125

Wills, J., (2018) Myrtle Rust Is Here. Science for Saving species, Threatened Species Recovery Hub.

Wills, J., et al. (2017) Next-generation tropical forests: reforestation type affects recruitment of species and functional diversity in a human-dominated landscape. Journal of Applied Ecology, 54: 772-783

Ecological Report for Lot 73 on SP128662, 149 Rhondda Road, New Chum

Ardent Group Pty Ltd

31st October 2018

Sticks & Stones Environmental
ABN 69108 199 254

DOCUMENT CONTROL SHEET

Street Address:	323 Candle Mountain Drive Peachester 4519
Postal Address:	PO Box 458 Beerwah Queensland 4519
Phone:	0412 936 361
Email:	sticksandstonesenv@bigpond.com
Web:	http://www.sticksandstonesenv.com.au/

Project:	Material Change of Use - Special Industry (Waste recycling and reprocessing – waste transfer station, crushing, milling or grinding), Minor Utility, Caretakers Residence and Environmentally Relevant Activities (ERA33, ERA61 (B) and ERA62)	**Issue Date:**	16/10/2018
Title:	Ecological Report for Lot 73 on SP128662, 149 Rhondda Road, New Chum		
Project Manager:	Michele Deveze		
Author:	Michele Deveze		
Client:	Ardent Group Pty Ltd		
Client Contact:	Richard Davis, 07 3368 1033		

Revision Number	Date	Description	To	Prepared by	Approved by
Rev A	28/09/2018	Draft	Internal	MD	MD
Rev B	03/10/2018	Draft for Client	Client - Ardent	MD	MD
Rev C	08/10/2018	Draft for Client	Client - Jackal	MD	MD
00	19/10/2018	Draft for Client	Client - Jackal	MD	MD
01	31/10/2018	Final	Client - Jackal	MD	MD
02					
03					
04					

ECOLOGICAL REPORT FOR LOT 73 ON SP128662, 149 RHONDDA ROAD, NEW CHUM

EXECUTIVE SUMMARY

Sticks & Stones Environmental was commissioned by Ardent Group Pty. Ltd., to undertake a vegetation, fauna and flora survey of the location of a proposed development site at Lot 73 on SP128662 (149 Rhondda Road, New Chum). The survey was conducted on September 27th 2018 and found that no conservation significant plants or animals were observed during the survey; and that no Endangered Regional Ecosystems or Threatened Ecological Communities were observed during the survey. It was considered that in general the Lot provides some habitat opportunity for animals, birds and reptiles; however, within the Lot the proposed development site has limited habitat opportunity available, and that it is unlikely that the proposed development will have an adverse impact on any protected plant or animal species or vegetation associations.

Statement of Limitations

This report has been prepared in accordance with the agreement between Ardent Group Pty. Ltd. and Sticks & Stones Environmental.

Within the limitations of the agreed upon scope of services, this work has been undertaken and performed in a professional manner, in accordance with generally accepted practices, using a degree of skill and care ordinarily exercised by members of its profession and consulting practice. No other warranty, expressed or implied, is made.

This report is solely for the use of Ardent Group Pty. Ltd. and Jackal Renewables Pty Ltd and any reliance on this report by third parties shall be at such parties' sole risk and may not contain sufficient information for the purposes of other parties or for other uses. This report shall only be presented in full and may not be used to support any other objective than those set out in the report, except where written approval with comments are provided by Sticks & Stones Environmental.

Table of Contents

DOCUMENT CONTROL SHEET ii

Executive Summary iii

1 Introduction 1

1.1 Objectives and Scope 1

1.2 Proposed Disturbance 2

1.3 Description of the Development Site 2

2 Legislation and Planning 7

2.1 International Agreements 7

2.1.1 Ramsar Convention on Wetlands 1971 7

2.2 Commonwealth Legislation 7

2.2.1 Environment Protection and Biodiversity Conservation Act 1999 7

2.2.2 Red Imported Fire Ant 8

2.3 State Legislation 8

2.3.1 Vegetation Management Act 1999 8

2.3.2 Referable Wetlands 9

2.3.3 Nature Conservation Act 1992 9

2.3.4 South-East Queensland Koala Conservation State Planning Regulatory Provisions 10

2.3.5 Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016 11

2.3.6 The *Environmental Offsets Act 2014* and subordinate Legislation 11

2.3.7 Biosecurity Act 2014 12

2.3.8 Red Imported Fire Ants 13

2.4 Ipswich City Council Planning Scheme 13

2.4.1 Desired Environmental Outcomes and Performance Indicators 13

2.4.2 Implementation Guideline No. 19 Vegetation Retention 14

2.4.3 Fact Sheet No 4 Vegetation Management 14

3 Method 15
3.1 Desktop Study 15
3.2 Field Survey 16
3.2.1 Vegetation Survey 16
3.2.2 Protected Plant Survey 16
3.2.3 Fauna Survey 16
3.2.4 Spot Assessment Technique Survey 17
3.2.5 Weed and Pest Survey 17
3.3 Survey Limitations 17
3.3.1 Flora and Vegetation 17
3.3.2 Fauna 17
4 Results 18
4.1 Desktop Study 18
4.2 Desktop Study – Flora and Vegetation Associations 18
4.3 Desktop Study – Fauna 27
4.4 Desktop Study – Other State Government Matters 45
4.4.1 Vegetation Management Property Report – Essential Habitat 45
4.4.2 SPP Biodiversity. 45
4.4.3 DA Vegetation Mapping 45
4.4.4 SPP Bushfire Hazard. 45
4.4.5 Red Imported Fire Ants 45
4.5 Desktop Study – Ipswich City Council Planning Scheme 46
4.6 Desktop Study Discussion 46
5 Results – Field Study 47
5.1 Field Survey – Vegetation Associations 47
5.2 Field Survey – Protected Plants 53
5.3 Field Survey – Weeds 53
5.4 Field Survey – Fauna 53

5.5 Koala Survey.....59
5.6 Habitat and Connectivity.....59
6 Discussion 67
6.1 Vegetation, Vegetation Associations and Habitat 67
6.2 Protected Flora 68
6.3 Protected Fauna 68
6.4 Weeds and Pest Animals.....68
7 Ipswich City Council Assessment Requirements 70
7.1 Vegetation Management Code.....70
7.2 Ipswich Planning Scheme.....70
8 Potential Impacts 72
9 Recommendations 73
References 74

Figures..... 75
Figure 1 The Location of the Proposed Development at 149 Rhondda Road, New Chum 75
Figure 2 Surrounding Landuse of the Proposed Development Site.....75
Figure 3 Landscape Context of the Proposed Development Site.....75
Figure 4 Field Survey Traverse.....75

Appendix I..... 76
IPSWICH CITY COUNCIL CITY PLAN REPORT AND MAPS 76
APPENDIX II 77
SITE LAYOUT PLAN FOR 149 RHONDDA ROAD, NEW CHUM, DRAWING NUMBER C1 DEVELOPMENT PLAN.....77

APPENDIX III 78
MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE UNDER THE EPBC ACT .78
APPENDIX IV 79
WILDNET ONLINE REPORT 79
APPENDIX V 80
VEGETATION MANAGEMENT REPORT AND PRE-CLEARING MAPPING 80
APPENDIX VI 81
STATE PLANNING POLICY AND DEVELOPMENT ASSESSMENT MAPPING 81
APPENDIX VII 82
RED IMPORTED FIRE ANT MAPPING 82

Table 1 EVNT Plant Species Listed in On-Line Data-Searches as Potentially Present on Site and Preferred Habitat 21
Table 2 EVNT Animal Species Listed in On-Line Data-Searches as Potentially Present on Site and their Preferred Habitat 28
Table 3 Migratory Species Protected Under International Agreements Potentially Present on Site 44
Table 4 Terrestrial Plants Recorded during the Survey 50
Table 5 Bird Species Observed During the Survey 53

1 INTRODUCTION

1.1 OBJECTIVES AND SCOPE

Sticks & Stones Environmental was commissioned by Ardent Group Pty. Ltd., to undertake a vegetation, fauna and flora survey of the location of a proposed development site at Lot 73 on SP128662 (149 Rhondda Road, New Chum (the Lot)) (the proposed development site) (**Figure 1**). The Lot is zoned RBIA02 - Regional Bus & Industry Investigation (New Chum) and REC - Recreation (**Appendix I**) under the 2006 Consolidated Ipswich City Council Planning Scheme. The Lot largely is co-incident with Mining Lease ML 50070, also held by the land owner and project proponent, Jackal Renewables Pty Ltd.

The scope of this report is as follows:

- Describe the methods used to survey the vegetation associations, flora, fauna and habitat present on site;
- On the basis of desktop and field ecological surveys of the site -
    - Describe the vegetation associations, flora, fauna and habitat present on site, and potentially present on site – with particular reference to vegetation associations, fauna, and flora protected by Commonwealth, State or Local legislation, and demonstrating the presence or absence of Koala on the site;
    - Identify the biodiversity values on and neighbouring the site including important linkages;
    - Describe ecological functionality and habitat values such as hollows, fire scars, nests, canopy size, foraging resources, stags, or fallen timber;
- Analyse the results of the surveys and present the findings;
- Discuss the potential impacts on identified site ecological values, that may be caused by the proposed development;
- Recommend measures to conserve and link important habitat for significant species with potential habitat on the site; and
- Provide a summary of the findings and recommendations for ecological management of the site before, during, and after development activities occur.

1.1.1 The Need for this Survey

The need for this survey has come from the Council information request dated 26 April 2018. The request included;

> 6. Ecological Report
>
> Arial photography of the site indicates that approximately 1 hectare of native vegetation along the western property boundary has already been cleared to

accommodate the footprint of this development. This vegetation borders onto a Stream Order 2. Further, Ipswich City Council (ICC) has several koala siting records from nearby locations.

(a) Therefore, in accordance with the TLPI No.1/2018 (Waste Activity Regulation) and the Specific Outcome 1 in Table 12.4.1 of the Ipswich City Council Vegetation Management Code, the applicant is requested to demonstrate how "clearing of vegetation does not cause or exacerbate land degradation within environmentally sensitive areas including steeply sloping land, areas prone to erosion or salinity, riparian corridors, wetlands or water catchment areas". The applicant is therefore requested to submit a vegetation survey in order to demonstrate compliance with sections 4.3.3 (4)(f); 4.3.3(4)(g) of the Urban Areas Code. (note this reference was subsequently corrected to section 6.7 (j) (a)(d) by ICC.)

1.2 Proposed Disturbance

The proposed disturbance is a Material Change of Use - Special Industry (Waste recycling and reprocessing – waste transfer station, crushing, milling or grinding), Minor Utility, Caretakers Residence and Environmentally Relevant Activities (ERA33, ERA61 (B) and ERA62), and involves battering and levelling the existing fibre cement sheet stockpile area and part of the relict mine overburden and topsoil storage area, constructing a ring road, and constructing ancillary infrastructure. The development proposal is shown in **Appendix II**. As far as practical it is intended to use existing roads, tracks and other cleared areas for infrastructure development.

1.3 Description of the Development Site

The Site

The Lot covers 25.38ha with access frontage on Rhondda Road and frontage to Six Mile Creek to the to the east (**Figure 1**). The Lot is in the New Chum mining area and generally is heavily disturbed with relict open cut pits, excavations, trenches and piles of mine overburden and topsoil (**Plates 1** and **2**). The proposed development will be largely located on an area of reject fibre cement-sheet and fibre cement-sheet by-product (**Plate 3**), and on levelled and battered relict mine overburden stockpiles (**Plates 2** and **10**). The Lot is unequally divided by a power line right of way which also provides a north-south access synonymous with the east part of the proposed ring road (**Figure 1**). The open cut pit and land-fill area is to the west of the power easement – this area generally is the area proposed for development. To the east of the power line right of way, and outside the proposed development footprint, is an active clay pit (**Figure 1**, **Plate 4**).

Historical aerial photography shows that, although surrounded by active mining, the Lot was largely undeveloped until the early 1980s. Since that time the pit has remained active, unfilled, or otherwise unrehabilitated (**Plates 5**, **6** and **7**) [For note, because the 'QImagery' rectification process is predominantly automated, the location of the Lot on the aerial photography, as provided by the Queensland Department of State Development, is not precise]. However, it appears that parts of the eastern portion of the Lot were cleared in 1971, but over intervening decades it has started to regenerate. Although aerial photography does not indicate disturbance

on the site until the early 1980s, there is evidence of extensive minor disturbance across the entire site, including excavations, drill holes, temporary camp/accommodation infrastructure, and limited fly tipping.



Plate 1 The Clay-Shale Mine Pit



Plate 2 Acacia and Eucalypt Natural Regeneration on Topsoil Stockpile



Plate 3 Fibre Cement Sheet Stockpile Adjacent to the Clay-Shale Mine Pit



Plate 4 Clay Pit Outside the Proposed Development Area

Adjoining Properties

The Lot is surrounded by mine sites, some of which are still active, some of which are being used for other industrial purposes such as landfill or broadscale industrial activities such as compost preparation, or clay extraction and masonry production; other areas are holding water or are actively or naturally regenerating (**Figure 2**).

A small wetland, assumed to be an inundated mine pit, adjoins the Lot to the north-west, and a larger wetland, also assumed to be a relict mine pit, runs parallel to the southern and western boundaries of the Lot (**Figure 1**). Six Mile Creek, which forms the eastern boundary of the Lot is in the northernmost part of a relatively contiguous corridor that runs from slightly south of Ipswich Motorway to an extensive area of native vegetation south of Centenary Highway (**Figure 3**). However, urban development surrounds the corridor to the east and west, consequently, although of local significance, the corridor along Six Mile Creek has limited regional importance.



Plate 5 QAP 2258 Frame 24 May 1971



Plate 6 QAP 4019 Frame 128 May 1982

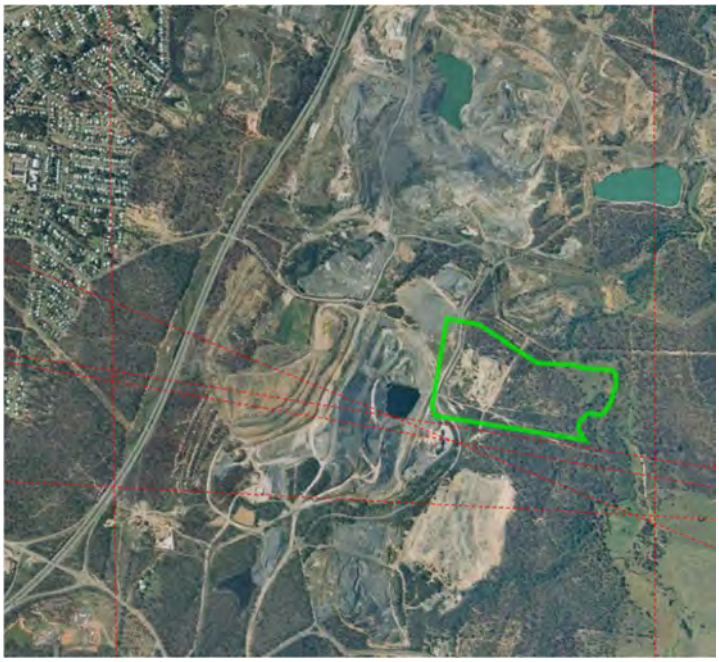


Plate 7 QAP 5588 Frame 28 October 1997

2 LEGISLATION AND PLANNING

This Section provides an overview of legislation and agreements that generally apply to development where vegetation needs to be cleared in the Brisbane Region. Reference to any piece of legislation or policy does not infer that that piece of legislation or policy is triggered by the proposed development. The findings of the desktop and field survey will be assessed against the following legislative requirements.

2.1 INTERNATIONAL AGREEMENTS

2.1.1 RAMSAR CONVENTION ON WETLANDS 1971

The aims of the Ramsar Convention on Wetlands 1971 are to halt the worldwide loss of wetlands and to conserve those that remain. The Ramsar Convention encourages the designation of sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity. Once designated, these sites are added to the Convention's List of Wetlands of International Importance and become known as Ramsar sites. In designating a wetland as a Ramsar site, countries agree to establish and oversee a management framework aimed at conserving the wetland and ensuring its wise use. Australia currently has 65 Wetlands of International Importance listed under the Ramsar Convention.

In Australia, primary responsibility for managing wetlands and their associated flora and fauna is vested in the appropriate landholders or land managers. National Guidelines for Ramsar Wetlands are being developed by the Commonwealth Department of the Environment to facilitate improved management of Ramsar sites in line with Australia's commitments under the Ramsar Convention and responsibilities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

2.2 COMMONWEALTH LEGISLATION

2.2.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places as defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The nine Matters of National Environmental Significance which the EPBC Act applies to are:

- World heritage properties,
- National heritage places,
- Wetlands of international importance (called 'Ramsar' wetlands),
- Nationally threatened species and ecological communities,
- Migratory species,
- Commonwealth marine areas,

- The Great Barrier Reef marine park,
- Nuclear actions (including uranium mining), and
- A water resource in relation to coal seam gas development and large coal mining development.

An on-line database, 'EPBC Act Protected Matters Report', provides geospatial information of the sightings or locations of MNES. If MNES are, or are likely, to be affected by a proposed development, the matter must be referred to the Commonwealth Department of the Environment (DotE). On the basis of the Referral, the Commonwealth Minister for the Environment will determine if the project is a 'Controlled Action'. The Referral includes an assessment of the Significance of the Impact on any MNES present, or likely to be present, in the impact area. If an action is considered to be a Controlled Action there may be a requirement to provide offsets under the *EPBC Act Environmental Offsets Policy 2012*.

2.2.2 Red Imported Fire Ant

Under the EPBC Act the Australian Government, in consultation with the States and Territories and other key stakeholders, has developed a threat abatement plan to provide a national framework to mitigate the potential impact of the group of ants known as tramp ants, including the Red Imported Fire Ant. The National Red Imported Fire Ant Eradication Program is administered in Queensland by Biosecurity Queensland, Department of Agriculture and Fisheries (**Section 2.3.8**).

2.3 State Legislation

2.3.1 Vegetation Management Act 1999

Clearing native vegetation in Queensland is regulated by the *Vegetation Management Act 1999* (VM Act), and subordinate legislation, Policies and Codes. The purpose of the VM Act is to regulate the clearing of Endangered, Of Concern and Least Concern Regional Ecosystems (REs), to manage the environmental effects of clearing, to prevent land degradation and loss of biodiversity, and to maintain ecological processes. This is achieved by developing a decision-making framework, preparing Codes which relate to the assessment of vegetation clearing, and protecting some regrowth vegetation in certain circumstances.

Many routine clearing activities can be undertaken under an exemption or by simply notifying the Department of Natural Resources and Mines (DNRM). Whether or not a permit will be needed depends on the type of vegetation, the land tenure of the land, and the location, extent and purpose of the proposed clearing. Self-assessable Codes apply to a range of activities such as fodder harvesting and weed control; the practices listed in the Code must be followed and DNRM must be notified before clearing starts. Area Management Plans which apply to certain clearing activities can be prepared by groups of landholders or rural organisations.

Development approvals may be required if the clearing cannot be conducted under an exemption, self-assessable Code, or Area Management Plan. Any Remnant Vegetation on freehold or leasehold land tenure, and any High Value Regrowth vegetation on leasehold land, may only be cleared under a Development Authority (DA) for Operational Works – Vegetation

Clearing. The application for a DA is assessed against State Development Assessment Provisions (SDAP) Module 8 under the *Sustainable Planning Act 2009* (SP Act).

Geospatially referenced mapping of Remnant Vegetation and Regional Ecosystems is available on-line. The mapping indicates areas of Endangered, Of Concern and Least Concern vegetation under the VM Act; it also indicates areas of High Value Regrowth and of known Essential Habitat.

It is noted that clearing vegetation for a resource activity under the Environmental Protection Act is exempt under Schedule 21, Part 1 (6) of the *Planning Regulation 2017*. Jackal Renewables has advised that the proposed development the subject of the MCU application will be located in an area cleared during the mining activities on ML 50070.

2.3.2 Referable Wetlands

The map of Referable Wetlands identifies the location of wetland protection areas (WPA) in Great Barrier Reef catchments. The Queensland wetland mapping was produced using existing information including water body mapping derived from Landsat satellite imagery, regional ecosystem mapping, topographic data, and a springs database. The result is a consistent wetland map for the whole of Queensland.

High impact earthworks within WPAs indicated on the map of referable wetlands are regulated under the SP Act. SDAP Module 11 regulates development in and near wetlands in a WPA. Development applications for Material Change of Use, Reconfiguring a Lot or Operational Works involving high impact earthworks either wholly or partly within a WPA are assessed by Local Government or the Department of State Development (DSD) as an assessment manager or referral agency. High impact earthworks include the construction of new drains, placing fill, or constructing levies that will significantly alter the hydrology of a WPA wetland.

2.3.3 Nature Conservation Act 1992

Much of Queensland's native wildlife is protected under the *Nature Conservation Act 1992* (NC Act) to ensure its survival and to protect biodiversity. All native birds, reptiles, mammals and amphibians are protected in Queensland, as well as a limited range of invertebrates, freshwater fish, and the grey nurse shark. All plants that are indigenous to Australia are protected. A licensing system helps protect native wildlife from over-exploitation and from the impacts of exotic species. These controls ensure that viable wild populations of plants and animals are maintained and that taking, keeping, using or moving wildlife for commercial, recreational or other purposes is monitored.

In Queensland, all plants that are native to Australia are protected plants under the NC Act. The *Nature Conservation (Wildlife) Regulation 2006* schedules plants and animals that are protected under statutory provisions in Queensland. These include Extinct in the Wild, Endangered, Near Threatened, Vulnerable, Special Least Concern, and Least Concern (EVNT, SLC and LC)

The NC Act endeavours to ensure that protected plants (whole plants or protected plant parts) and protected animals are not illegally removed from the wild, or illegally traded. The *Nature Conservation (Wildlife Management) Regulation 2006* regulates the clearing, growing, harvesting and trade of protected plants in Queensland. In most instances, commonly occurring native plants can be taken and used for a range of commercial, operational and recreational purposes in Queensland without a license or permit. However, a license, permit or authority

may be required to take and use native plants or animals listed as Special Least Concern (SLC), Endangered, Vulnerable or Near Threatened (EVNT) under the *Nature Conservation Act 1992*.

An on-line database, 'Wildlife On-line', provides geospatial information of the sightings of plants and animals. Geospatially referenced mapping of Remnant Vegetation and Regional Ecosystems also indicates areas of known Essential Habitat. The 'Protected Plants Flora Survey Trigger Map' indicates areas of known protected plant habitat. If a proposed impact site falls within the 'Protected Plants Flora Survey Trigger Map' a survey of the site must be done to determine if any EVNT plants are present on that site. (*HTTP://WWW.EHP.QLD.GOV.AU/LICENCES-PERMITS/PLANTS-ANIMALS/PROTECTED-PLANTS/FRAMEWORK-GUIDE.HTML*).

2.3.4 South-East Queensland Koala Conservation State Planning Regulatory Provisions

The South-East Queensland Koala Conservation State Planning Regulatory Provisions (SPRP) is an overarching state planning instrument that regulates new development at the development assessment stage. The SPRP covers areas of the highest priority for koala conservation action. This incorporates Priority Koala Assessable Development Areas which are made up of the Koala Coast and Pine Rivers areas, and Koala Assessable Development Areas which are made up of areas managed under previous State Koala conservation initiatives.

The SPRP prohibits clearing bushland habitat in the priority areas of Koala Coast and Pine Rivers, and in areas outside the urban footprint. Urban development is also prohibited in conservation, open space, rural and rural-residential zones within the Koala Coast and Pine Rivers areas. This approach aims to support habitat for the koala populations at risk. The SPRP provides requirements for all development activity to minimise its impact on koalas. Depending on the development type and koala habitat type, requirements may include:

- Avoiding, minimising or offsetting clearing non-juvenile koala habitat trees,
- Site design that provides safe koala movement opportunities appropriate to the development type and habitat connectivity values of the site,
- Construction phases that do not increase the risk of death or injury to koalas,
- Clearing native vegetation sequentially, and
- Clearing koala habitat trees in the presence of a koala spotter.

Koala Habitat for South-East Queensland Local Government Authorities includes:

Non-juvenile koala habitat tree means a tree of any of the following genera:

- Angophora,
- Corymbia,
- Eucalyptus,
- Lophostemon,
- Melaleuca,

which is more than 4m high; or has a trunk with a circumference of more than 31.5cm at 1.3m above the ground (*Nature Conservation (Koala) Conservation Plan 2006*).

Essential habitat is an area of essential habitat on the essential habitat map for an animal that is endangered wildlife or vulnerable wildlife or a plant that is endangered wildlife or vulnerable wildlife.

Habitat for koalas as a Matter of State Environmental Significance (MSES).

2.3.5 Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016

The Koala Plan, in relation to planning and development assessment, has now been replaced by the SPRP. Other elements of the Koala Plan, such as policies relating to sequential clearing, use of a koala spotter, the rehabilitation of injured or sick koalas and translocation remain in place. The Koala Conservation Plan established three Koala Districts (A, B and C) (**Plate 8**). The boundaries of the districts have been determined on the basis of the conservation status of the species and the significance of threatening processes affecting the species. Sequential clearing requirements of Koala Habitat Trees defined under the NC Act is in place in Koala Districts A and B, and koala spotters are required in Koala Habitat Areas in district A.

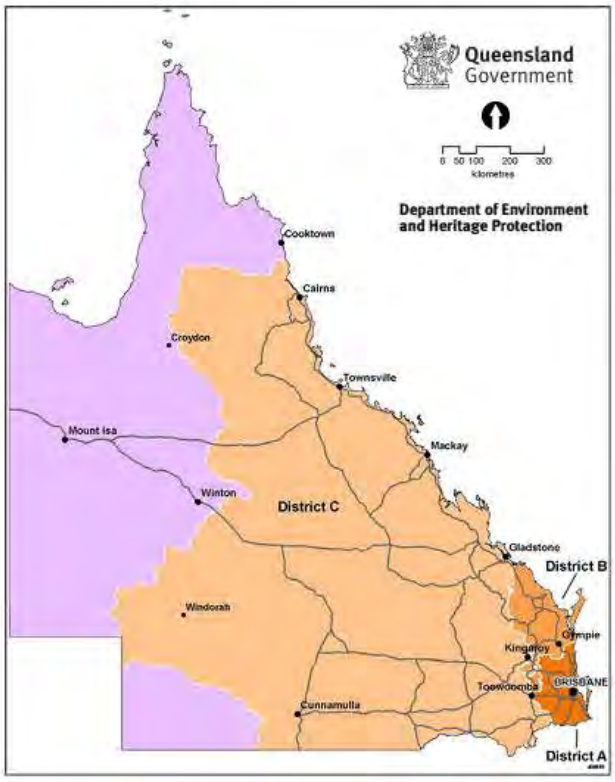


Plate 8 Koala Districts A, B and C (Koala Conservation Plan)

2.3.6 The *Environmental Offsets Act 2014* and subordinate Legislation

Under a number of existing Queensland laws, if there is an unavoidable impact on significant environmental values, offsets may be required for certain developments. Offset actions, which can include improvement and protection of alternative sites and/or actions that improve environmental viability, can provide a conservation outcome that is equivalent to the environmental value being lost. The *Environmental Offsets Act 2014* (EO Act) is the overarching legislative instrument that administers Environmental Offsets for matters which require offsetting under some Queensland legislation.

The EO Act has provision for Offsets to be provided under the VM Act, the NC Act, the SPRP and the *Fisheries Act 1994*. Section 2.3.1.6 of the Queensland Environmental Offsets Policy (Version 1.1) December 2014 details requirements for offsetting Koala habitat. The EO Act also makes provision for Local Government to nominate Matters of Local Environmental Significance (MLES) and gives Local Governments the authority to require offset arrangements for MLES that may be affected by development or disturbance.

2.3.7 BIOSECURITY ACT 2014

The Queensland *Biosecurity Act 2014* (Biosecurity Act) which commenced in July 2016, refers to 'Designated Biosecurity Matter' which includes pest plants and animals. These are further classified as either 'Prohibited' or 'Restricted':

- Prohibited Matter is biosecurity matter not currently present or known to be present in Queensland. It is prohibited because it may have a significant adverse effect on a biosecurity consideration if it did enter Queensland, and
- Restricted Matter is biosecurity matter found in Queensland that may have adverse effects on a biosecurity consideration if conditions or restrictions under the Act were not imposed.

Prohibited Plants are listed in Schedule 1 Part 3 of the Biosecurity Act, and Prohibited Animals are listed in Schedule 1 Part 4 of the Biosecurity Act. Restricted Plants and Restricted Animals are listed in Schedule 2 Part 2 of the Biosecurity Act.

Restricted Plants and Animals may be allocated one or more 'Categories':

> **Category 1** includes red imported fire ants, electric ants, Asian honey bees, and certain animal diseases, aquatic diseases and pathogens. Category 1 restricted matter must be reported to an inspector within 24 hours.
>
> **Category 2** restricted matter includes certain noxious fish, weeds and pest animals such as spotted gar and red-eared slider turtle. Category 2 restricted matter must be reported to an inspector or authorised person within 24 hours.
>
> **Category 3** includes weeds, pest animals and noxious such as: gambusia, dingoes, or yellow crazy ants. This restricted matter must not be distributed: it must not be given as a gift, sold, traded or released into the environment unless the distribution or disposal is authorised in a regulation or under a permit. Deliberate human distribution or disposal contrary to the legislation is a key source of spread into other areas of the state.
>
> **Category 4** includes specific weeds, pest animals and noxious fish such as: the bitou bush, feral pig or giant cichlid. To ensure that it does not spread into other areas of the state this restricted matter must not be moved.
>
> **Category 5** includes weeds, pest animals and noxious fish such as: Mexican feather grass, rabbits and carp. This restricted matter cannot be possessed or kept under your control. These pests have a high risk of having a negative impact on the environment.

This restricted matter may only be kept under a permit of the *Biosecurity Act 2014* or another Act.

Category 6 includes invasive animals such as: feral deer, foxes, rabbits and wild dogs and noxious fish such as carp, gambusia and tilapia. This category of restricted matter cannot be purposefully or intentionally fed. Feeding this restricted matter may cause their numbers to increase and have a negative impact the economy or the environment. Feeding for the purpose of preparing for or undertaking a control program is exempted.

Category 7 includes noxious fish such as: carp, weatherloach, climbing perch, gambusia and tilapia. These animals may not be kept. They must be killed and the carcass disposed of by burying the whole carcass, with no parts removed, in the ground above the high tide water mark, or by placing it in a waste disposal receptacle.

2.3.8 Red Imported Fire Ants

The National Red Imported Fire Ant Eradication Program (NRIFAEP) is a nationally funded program which aims to eradicate this exotic pest (**Section 2.2.2**). In Queensland the NRIFAEP is administered under provisions in the *Plant Protection Act 1989*, and subordinate legislation. Within a High Risk Restricted Area for Red Imported Fire Ants, movement of restricted items is controlled, and an Approved Risk Management Plan or an Inspector's Approval is required to move restricted items from the site. The National Red Imported Fire Ant Eradication Program is administered in Queensland by Biosecurity Queensland, Department of Agriculture and Fisheries.

2.4 Ipswich City Council Planning Scheme

2.4.1 Desired Environmental Outcomes and Performance Indicators

The Ipswich City Councils Desired Environmental Outcomes and Performance Indicators under the Ipswich Planning Scheme requires:

> The desired environmental outcomes for the Local Government area are as follows—
>
> (a) the values of significant natural features, including the principal conservation areas are not compromised;
>
> (b) adverse effects on the natural environment are minimised or prevented with respect to the loss of natural vegetation and associated habitat, soil degradation, air pollution and water pollution owing to erosion, chemical contamination, acidification, salinity, sewage and wastewater treatment, management and effluent disposal and the like...

Performance Indicators listed are:

> Where development has occurred, has it—
>
> (a) adversely affected the significant natural features in the local government area;
>
> (b) resulted in soil degradation, water pollution, air pollution or inappropriate clearing of natural vegetation.

2.4.2 Implementation Guideline No. 19 Vegetation Retention

The Ipswich City Councils Implementation Guideline No.19 Vegetation, under the Ipswich Planning Scheme states:

> The purpose of this guideline is to create opportunities and provide solutions to retain vegetation on land identified as suitable for development. Where Council accepts that the retention of vegetation is not appropriate or feasible (e.g. on part or all of the site), the development should provide for nil net loss of vegetation in the general locality.

However, the Guideline further states:

> The guideline does not apply in respect to land which is zoned for dense forms of development, such as Residential Medium and High Density, Commercial, Retail, Business and Industry and similar zoned areas except where vegetation clearing is proposed within greenfield locations.

Therefore this guideline does not apply to the proposed development (as it is zoned Regional Business and Industry Investigation) and has not been addressed in this report.

Ipswich Planning Scheme – Part 12 Division 4 Vegetation Management Code

The specific outcomes for the management of vegetation are set out in Table 12.4.1 of this Code. Council has advised in the information request that consideration needs to be given to achieving specific outcome 1 of Table 12.4.1, namely "*the clearing of vegetation does not cause or exacerbate land degradation within environmentally sensitive areas including steeply sloping land, areas prone to erosion or salinity, riparian corridors, wetlands or water catchment areas*".

2.4.3 Fact Sheet No 4 Vegetation Management

The Ipswich City Councils Fact Sheet No 4 Vegetation Management, under the Ipswich Planning Scheme summarises Commonwealth and State Government legislation relevant to vegetation clearing, and details Ipswich City Councils vegetation management arrangements. Table 5.1 of the Fact Sheet states that for Regional Business and Industry Investigation zoning, if the clearing is less than 0.5ha in a five year period it is Self-Assessable, however if more than 0.5ha are to be cleared the clearing is Code Assessable and planning approval is required.

3 METHOD

3.1 DESKTOP STUDY

The desktop study drew from information derived from publicly available datasets. The information was collected and collated to provide a detailed overview of Commonwealth, State and Local environmentally significant matters potentially present on site.

A desktop study of Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and potentially present on site, was downloaded from:
HTTP://WWW.ENVIRONMENT.GOV.AU/WEBGIS-FRAMEWORK/APPS/PMST/PMST-COORDINATE.JSF (27/09/2018) (**Appendix III**);

A desktop study of Protected Plants and Animals under the NC Act, and potentially present in the proposed disturbance area was downloaded from:
HTTPS://ENVIRONMENT.EHP.QLD.GOV.AU/REPORT-REQUEST/SPECIES-LIST/ (29/09/2018) (**Appendix IV**);

Vegetation Management maps and data and the Protected Plants Flora Survey Trigger Map were downloaded from:
HTTPS://WWW.DNRM.QLD.GOV.AU/QLD/ENVIRONMENT/LAND/VEGETATION/VEGETATION-MAP-REQUEST-FORM (04/09/2018) and *HTTPS://ENVIRONMENT.EHP.QLD.GOV.AU/MAP-REQUEST/RE-BROAD-VEG-GROUP/* (29/09/2018) (**Appendix V**);

State Planning Policy and Development Assessment mapping were viewed on-line, and relevant maps were downloaded from:
HTTPS://PLANNING.DSDMIP.QLD.GOV.AU/MAPS (28/09/2018) (**Appendix VI**);

Archival Aerial Photography was downloaded from:
HTTPS://QIMAGERY.INFORMATION.QLD.GOV.AU/ (28/09/2018) (**Figures 5, 6** and **7**);

Red Imported Fire Ant Mapping was downloaded from:
HTTPS://WWW.DAF.QLD.GOV.AU/__DATA/ASSETS/PDF_FILE/0006/1384476/FIRE_ANT_BIOSECURITY_ZONE_MAP.PDF (**Appendix VII**), and

Ipswich City Council City Plan 2014 mapping – overlays were viewed on-line, and relevant maps were downloaded from:
HTTP://PDONLINE.IPSWICH.QLD.GOV.AU/PDONLINE/USER/HOME/DEFAULT.ASPX?PAGE=WELCOME (28/09/2018) (**Appendix I**).

Information on the distribution, ecology, and preferred habitat of EVNT plant species and protected vegetation potentially present on site, was collated, reviewed, and used to determine the field survey methods.

The information collated is summarised in **Section 4.2**, **Section 4.3**, **Section 4.4** and **Section 4.5**, and discussed in **Section 4.6**. The results of the desk-top study were used to focus the ecology field surveys.

3.2 Field Survey

An ecology, and protected plant survey in accordance with Queensland State Guidelines, and to meet requirements under Ipswich City Council's guidelines, was conducted of the site on the 27th of September 2018 by Sticks & Stones Environmentals' Principal Ecologist Michele Deveze.

Michele Deveze has over 25 years' experience in ecological management and assessment. Her area of expertise includes: fauna and flora survey and identification, Regional Ecosystem verification, Biocondition Assessment, and vegetation management planning.

The weather on the day of the survey was warm and generally overcast with a maximum temperature of 27°C and a very light breeze. There had been consistently light and irregular rainfall during the six months preceding the survey, consequently, although the waterbodies surrounding the Lot were well filled, the groundcover and shrubs were generally desiccated, grasses had no inflorescence or seed, and in many instances shrubs were completely or partially defoliated.

3.2.1 Vegetation Survey

The details of all observed shrub and tree species within the proposed development site were recorded during the survey. Collections were made of unfamiliar plants for later identification.

Details including: component species, structure, density, and the predominant height of strata were recorded for all vegetation associations on the proposed development site, and in accordance with Neldner *et al* (2012). The information recorded was used to determine the accuracy of existing vegetation mapping.

3.2.2 Protected Plant Survey

The method employed for the survey followed the preferred method in 'Flora Survey Guidelines - Protected Plants *Nature Conservation Act 1992*' (2014), based on the 'Timed Random Meander' survey method designed by Cropper (1993), and Goff *et al*. (1982).

The ecology of the EVNTs listed as potentially present on site was reviewed (**Table 1**) and descriptions were obtained of each of the species potentially present in the proposed impact area. A record was made of each species observed during the survey (**Table 4**). Any species not able to be identified in the field and any potential threatened species found during the survey were collected for positive identification. The survey ceased when either no new species was recorded for 30 minutes or when the entire area of habitat type was surveyed.

The timed meander method has been demonstrated as a means of discovering threatened and endangered species that have low incidence or an uneven distribution across a site, and as a means of documenting a low probability of occurrence of such species if they have not been found during the procedure (Goff *et al.*, 1982).

3.2.3 Fauna Survey

Information was also collected on fauna observed on site, and signs and indicators of fauna – including scratch marks and faeces, hollows and nests, and other indicators of the presence or use of fauna on site, such as trails, and diggings. The quality of potential terrestrial habitat and connectivity was assessed.

3.2.4 Spot Assessment Technique Survey

The Spot Assessment Technique (SAT) survey method of indirect survey was used to assess the probability and intensity of Koala use of the site. The method quickly establishes presence of Koalas and activity levels within a survey area (Phillips and Callaghan, 2011). The method requires a centre tree to be selected, and a one metre radius around it to be searched for two person minutes for Koala pellets.

3.2.5 Weed and Pest Survey

Other information collected during the survey included the presence, distribution and abundance of weeds and pest plants, and any indication of the presence of feral animals. To complete the vegetation survey, the natural and physical environment, the topography, and soils and geology of the site and the surrounding area was described.

3.3 Survey Limitations

3.3.1 Flora and Vegetation

The Lot is generally heavily disturbed and some parts are inaccessible by foot or vehicle. Much of the generally undeveloped area is scattered with relict earthworks and excavations which provide access hazards. Some parts of the site have a dense and impenetrable Lantana (*Lantana camara**) cover, or are covered with tall rank grasses. Given the access restrictions, a complete survey of the site was not possible.

Generally, the site was very dry. It is possible that cryptic or ground dwelling plant species present may not have been recorded because they were not evident under the weather conditions, or were concealed by dense Lantana or grass growth. Repeat assessments to address seasonality were not included in the survey.

3.3.2 Fauna

The fauna survey was dependent on direct observation, and observation of tracks, scats or signs and did not employ quantitative ecological assessment techniques, such as fauna trapping. Also, repeat assessments to address seasonality were not included in the survey.

4 RESULTS

4.1 DESKTOP STUDY

The results of the searches described in **Section 3.1** are summarised in **Section 4.2**, **Section 4.3**, **Section 4.4** and **Section 4.5**, and are discussed in **Section 4.6** .

4.2 DESKTOP STUDY – FLORA AND VEGETATION ASSOCIATIONS

The desktop study for flora and vegetation associations is based on the Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (**Appendix III**), the 'Wildlife On-Line Report' (**Appendix IV**), and the Vegetation Management Property Report (**Appendix V**).

Three Threatened Ecological Communities (TEC) listed under the EPBC Act were indicated as potentially present on the site (**Appendix III**):

- Lowland Rainforest of Subtropical Australia Critically Endangered Community may occur within the area
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community Endangered community likely to occur within area
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Community may occur within the area

A small area of mapped Category C Regional Ecosystem (RE) 12.3.3 is mapped in the north-western corner of the Lot, and the proposed development site is generally surrounded by Category C RE 12.9-10.2, 12.9-10.7, and 12.9-10.19. A small area of RE 12.9-10.2 is mapped on the south-eastern part of the proposed development site and extends into the eastern part of the Lot, as does the RE 12.9-10.2, 12.9-10.7 mixed polygon. the mapping for Six Mile Creek and the adjacent creek flats shows Category C Regional Ecosystem (RE) 12.3.3 (**Appendix V**).

RE 12.3.3 (Endangered) is described as:

> *Eucalyptus tereticornis* woodland on Quaternary alluvium
>
> *Eucalyptus tereticornis* woodland. *Eucalyptus crebra* and *E. moluccana* are sometimes present and may be relatively abundant in places, especially on edges of plains and higher level alluvium. Other species that may be present as scattered individuals or clumps include *Angophora subvelutina* or *A. floribunda, Corymbia clarksoniana, C. intermedia, C. tessellaris, Lophostemon suaveolens* and *E. melanophloia*. Occurs on Quaternary alluvial plains, terraces and fans where rainfall is usually less than 1000mm/y. (BVG1M: 16c)
>
> Vegetation communities in this regional ecosystem include:
>
> 12.3.3a: *Eucalyptus crebra, C. tessellaris* woodland to open forest. Other species that may be present as scattered individuals or clumps include *Corymbia clarksoniana, Eucalyptus melanophloia, E. tereticornis* and *C. citriodora* subsp. *variegata*. Occurs on

high level alluvial plains often of Pleistocene age, terraces and fans where rainfall is usually less than 1000mm/y. Floodplain (other than floodplain wetlands). (BVG1M: 18b)

12.3.3b: [Not in RE version 10.1][2]: Open forest to woodland of *Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra*, with a sparse to mid-dense understorey of *Melaleuca irbyana*. Occurs on margins of Quaternary alluvial plains. Floodplain (other than floodplain wetlands). (BVG1M: 13d)

12.3.3c: [Not in RE version 10.1][2]: *Melaleuca irbyana* low open forest or thicket. Emergent *Eucalyptus moluccana, E. crebra, E. tereticornis* or *Corymbia citriodora* subsp. *variegata* may be present. Occurs on Quaternary alluvial plains where drainage of soils is impeded. Palustrine wetland (e.g. vegetated swamp). (BVG1M: 21b)

12.3.3d: *Eucalyptus moluccana* woodland. Other frequently occurring species include *Eucalyptus tereticornis, E. crebra, E. siderophloia, Corymbia citriodora* subsp. *variegata, Angophora leiocarpa* and *C. intermedia*. Occurs on margins of Quaternary alluvial plains often adjacent sedimentary geologies. May also occur on stranded Pleistocene river terraces. Floodplain (other than floodplain wetlands). (BVG1M: 13d)

[2] Superseded: Revision of the regional ecosystem classification removed this regional ecosystem code from use in version 10 RE mapping. It is included in the regional ecosystem description database because the RE code may appear in older versions of RE mapping and regulation.

12.9-10.2 (Least Concern) is described as:

Corymbia citriodora subsp. *variegata* +/- *Eucalyptus crebra* open forest on sedimentary rocks

Corymbia citriodora subsp. *variegata* open forest or woodland usually with *Eucalyptus crebra*. Other species such as *Eucalyptus tereticornis, E. moluccana, E. acmenoides* and *E. siderophloia* may be present in scattered patches or in low densities. Understorey can be grassy or shrubby. Shrubby understorey of *Lophostemon confertus* (whipstick form) often present in northern parts of bioregion. Occurs on Cainozoic and Mesozoic sediments. (BVG1M: 10b)

12.9-10.7 (Of Concern) is described as:

Eucalyptus crebra +/- *E. tereticornis, Corymbia tessellaris, Angophora* spp., *E. melanophloia* woodland on sedimentary rocks

Eucalyptus crebra +/- *E. tereticornis, Corymbia tessellaris, Angophora leiocarpa, E. melanophloia* woodland. Occurs on Cainozoic and Mesozoic sediments. (BVG1M: 13c)

Vegetation communities in this regional ecosystem include:

12.9-10.7a: *Eucalyptus siderophloia, Corymbia intermedia* +/- *E. tereticornis* and *Lophostemon confertus* open forest. Occurs on Cainozoic and Mesozoic sediments in near coastal areas. (BVG1M: 12a)

12.9-10.19 (Least Concern) is described as:

Eucalyptus fibrosa subsp. *fibrosa* woodland on sedimentary rocks

Eucalyptus fibrosa subsp. *fibrosa* woodland +/- *Corymbia citriodora* subsp. *variegata*, *E. acmenoides* or *E. portuensis, Angophora leiocarpa, E. major*. Understorey often sparse. Localised occurrences of *Eucalyptus sideroxylon*. Occurs on Cainozoic and Mesozoic sediments. (BVG1M: 12a)

Vegetation communities in this regional ecosystem include:

12.9-10.19a: *Corymbia henryi* and/or *Eucalyptus fibrosa* subsp. *fibrosa* open forest. Other commonly associated species include, *Corymbia citriodora* subsp. *variegata, E. carnea, E. siderophloia, E. crebra* and *E. major*. Occurs in coastal areas on Cainozoic and Mesozoic sediments. (BVG1M: 10b)

Pre-clearing Regional ecosystems mapped for the site include 12.3.3, 12.9-10.2, 12.9-10.7, and 12.9-10.19. (**Appendix V**).

The Vegetation Management Report also indicated that the proposed development site is mapped as a High Risk Area on the Protected Plants Flora Survey Trigger Map (**Appendix V**). Consequently, a Protected Plant survey was conducted in accordance with the Flora Survey Guidelines - Protected Plants prepared under the *Nature Conservation Act 1992*.

EVNT plants listed in the two on-line reports (**Appendix III** and **Appendix IV**) are presented in **Table 1**.

Table 1 EVNT Plant Species Listed in On-Line Data-Searches as Potentially Present on Site and Preferred Habitat

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
Bosistoa transversa	Three-leaved Bosistoa, Yellow Satinheart	small tree		Vulnerable	Species or species habitat likely to occur within area	*Bosistoa transversa* grows in wet sclerophyll forest, dry sclerophyll forest and rainforest up to 300 m in altitude. Associated vegetation includes *Argyrodendron trifoliolatum, Syzygium hodgkinsoniae, Endiandra pubens, Dendrocnide photinophylla, Acmena ingens, Diploglottis australis* and *Diospyros mabacea*. *HTTP://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?BOSISTOA-TRANSVERSA*
Callitris baileyi	Bailey's cypress		Near Threatened			*Callitris baileyi* grows on rocky slopes, hilly or mountainous areas, in shallow and often clay soils. It is found in eucalypt woodland, commonly associated with ironbark, blue gum and spotted gum. *HTTPS://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?CALLITRIS-BAILEYI*
Cycas ophiolitica				Endangered	Species or habitat likely to occur within area	*Cycas ophiolitica* grows on hills and slopes in sparse, grassy open forest at altitude ranges from 80–400 m above sea level. Although this species reaches its best development on red clay soils near Marlborough, it is more frequently found on shallow, stony, infertile soils, which are developed on sandstone and serpentinite, and is associated with species such as *Corymbia dallachiana, C. erythrophloia, C. xanthope* and *Eucalyptus fibrosa*. *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=55797*
Dichanthium setosum	Bluegrass			Vulnerable	Species or species habitat likely to occur within area	*Dichanthium setosum i*s associated with heavy basaltic black soils and red-brown loams with clay subsoil (NSW OEH 2013a). Associated species include White Box *(Eucalyptus albens),* Silver-

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
						leaved Ironbark *(Eucalyptus melanophloia),* Yellow Box *(Eucalyptus melliodora),* Manna Gum *(Eucalyptus viminalis),* Amulla *(Myoporum debile),* Purple Wire-grass *(Aristida ramosa),* Kangaroo Grass *(Themeda triandra),* Fine-leaved Tussock-grass *(Poa sieberiana),* Red-leg Grass *(Bothriochloa ambigua),* Pitted Blue-grass *(Bothriochloa decipiens), Macrozamia stenomera,* Small Woolly Burr-medic *(Medicago minima),* Scaly Buttons *(Leptorhynchos squamatus), Lomandra* aff. *longifolia,* Australian Bugle *(Ajuga australis),* Bogan-flea *(Calotis hispidula)* and *Austrodanthonia* spp., *Dichopogon spp., Brachyscome* spp., *Vittadinia* spp., *Wahlenbergia* spp. and *Psoralea* spp. (Ayers *et al.* 1996; NSW OEH 2013a). *Dichanthium setosum* is often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. It is often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched. The species may tolerate or benefit from disturbance, otherwise, disturbance is indicative of threatening processes in its habitat (NSW OEH 2013a). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=14159*

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
Eucalyptus curtisii	Plunkett Mallee		Near Threatened			*Eucalyptus curtisii* has two growth forms that occur in different habitats. The shorter mallee form is more likely to occur as the only eucalypt species on poorly drained lowland sites in shrubland dominated by banksia, with an understorey of heath plants, and sometimes *E. conglomerata* may also be present. The larger growth form occurs as scattered individuals on better drained soils in the more open areas of mixed eucalypt forests. Commonly associated species include *Corymbia citriodora* subsp. *variegata*, *C. trachyphloia* and *Callitris endlicheri*, less commonly associated with *E. fibrosa*, *E. planchoniana* and *E. acmenoides*. *E. curtisii* occurs on sandy podsoils with impeded drainage, shallow stony soils, clay loams and stony clays with a surface layer of loose stones. *HTTPS://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?EUCALYPTUS-CURTISII*
Hernandia bivalvis	Cudgerie		Near Threatened			*Hernandia bivalvis* mainly grows in rainforest on rock pavements and outcrops with shallow soils. Most Queensland Herbarium records are from either vine thicket or microphyll vine forest. It occurs up to 620 m altitude. *HTTPS://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?HERNANDIA-BIVALVIS*
Lilaeopsis brisbanica			Endangered			*Lilaeopsis brisbanica* grows along tidal riverbanks in grey saline mud, in association with mangrove trees. Although occurring naturally in areas near saline waters, fresh water is satisfactory for the growth of *Lilaeopsis brisbanica*. *HTTPS://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?LILAEOPSIS-BRISBANICA*

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
Marsdenia coronata	Slender Milkvine		Vulnerable			*Marsdenia coronata* is restricted to south-east Queensland where it commonly grows in rainforest or moist areas of open forest, especially in eucalypt forest. It has been observed on rainforest margins. Also recorded from an area of natural grassland on the top of Mt Kandanga, Imbil State Forest. The vine has been found between 40 and 780 m asl, and usually occurs on sandstone or stony soils. Associated vegetation includes: eucalypt open forest with *Corymbia maculata* and *Eucalyptus crebra*; tall open forest of *E. propinqua* and *E. siderophloia* with developing shrubby vineforest understorey; open forest of *E. pilularis*, *E. microcorys*, *Corymbia intermedia*; grassy open forest of *E. propinqua*, *E. carnea*, and *Themeda*; Open, grassy forest 25-30m high of *Lophostemon confertus*, *C. intermedia*, *E. acmenoides*, *Casuarina littoralis*, *Banksia integrifolia*; in open forest with *E. carnea* and *E. propinqua*; open forest of *Eucalyptus siderophloia*, *E. propinqua*, *Lophostemon confertus*; woodland of *E. tindaliae* with *Corymbia* and *E. carnea* with shrubby understorey dominated by *Pultenaea euchila*. *HTTPS://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?MARSDENIA-CORONATA*
Notelaea ipsviciensis	Cooneana Olive		Endangered	Critically Endangered	Species or species habitat likely to occur within area	The Cooneana Olive survives as an understorey plant in degraded, eucalypt dominated dry sclerophyll vegetation communities. Soils in the area are of low fertility, depauperate and sandstone-based. This species prefers open woodland communities with open canopies. The known population is adjacent to subdivided, modified and developed land. *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=81858*

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
Notelaea lloydii	Lloyd's Olive		Vulnerable	Vulnerable	Species or species habitat likely to occur within area	The species occurs on undulating to hilly terrain either in moist gullies or on gentle to steep dry slopes, but is rarely found on rocky outcrops. Soil types are mostly shallow, well drained and stony to very rocky in texture. Lloyd's Olive is found in the ecotone between eucalypt open forests and vine thickets at 80-480 m above sea level (asl). The more frequent tree species recorded with this species are Narrow-leaved Ironbark (*Eucalyptus crebra*), Spotted Gum (*Corymbia maculata*), White Mahogany (*E. acmenoides*), Lemon-scented gum (*C. citriodora*) and Curracabah (*Acacia concurrens*) with associated trees and shrubs of Kurrajong (*Brachychiton populneus*), Red Ash (*Alphitonia excelsa*), Brown Salwood (*A.aulacocarpa*), Burra (*A. falcata*) and Ebony (*Diospyros ferrea* var. *geminata*). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=15002*
Phaius australis	Lesser Swamp-orchid	ground orchid		Endangered	Species or species habitat may occur within area	*Phaius australis* grows in areas where soils are almost always damp, but not flooded for lengthy periods. Sands are generally the underlying soil type. *P. australis* are usually found in coastal habitats between swamps and forests or in suitable areas further inland. This includes swampy sclerophyll forest dominated by melaleucas, swampy forest that often have scleorphyll emergents, or fringing open forest and melaleuca swamp forest associated with rainforest species. *P. australis* has also been recorded in wallum, sedgeland, rainforest and closed forest. They often grow in deep shade, but can also occur in full sun. This species occurs at higher altitudes in northern Queensland. *HTTP://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?PHAIUS-AUSTRALIS*

Scientific Name	Common Name	Habit	NCA Status	EPBC Status	EPBC Comment	Preferred Habitat
Plectranthus habrophyllus			Endangered	Endangered		Plants have been recorded growing on chert or sandstone outcrops, in open woodlands often in shaded situations near vine forest. *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=64589*
Samadera bidwillii	Quassia	small shrub or tree		Vulnerable	Species or species habitat likely to occur within area	Lowland rainforest or on rainforest margins, but it can also be found in other forest types, such as open forest and woodland. Quassia is commonly found in areas adjacent to both temporary and permanent watercourses in locations up to 510 m altitude. The species occurs on lithosols, skeletal soils, loam soils, sands, silts and sands with clay subsoils. *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=29708*
Thesium australe	Austral Toadflax, Toadflax	erect herb		Vulnerable	Species or species habitat may occur within area	*Thesium australe* grows in grassland or woodland, often in damp sites. Examples of associated vegetation includes: open woodland with *Eucalyptus tereticornis* and *E. tindaliae* on skeletal soils; on heavy alluvium soil in grassy *E. populnea* woodland; on black cracking clay in grassland of *Dichanthium sericeum*; and grassland dominated by *Themeda triandra* and *Heteropogon contortus* on basaltic, rocky soils. *HTTP://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?THESIUM-AUSTRALE*

4.3 DESKTOP STUDY – FAUNA

EVNT fauna listed in the two on-line reports (**Appendix III** and **Appendix IV**) for the proposed development site are presented in **Table 2**. Migratory species protected under international agreements are presented in **Table 3**.

Table 2 EVNT Animal Species Listed in On-Line Data-Searches as Potentially Present on Site and their Preferred Habitat

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
Birds					
Actitis hypoleucos	Common Sandpiper	Special Least Concern			**Salt-water and fresh-water ecosystems** The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags (Geering et al. 2007; Higgins & Davies 1996). **Foraging environments** Generally the species forages in shallow water and on bare soft mud at the edges of wetlands; often where obstacles project from substrate, e.g. rocks or mangrove roots. Birds sometimes venture into grassy areas adjoining wetlands (Higgins & Davies 1996). **Roost sites** Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks (Higgins & Davies 1996).

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=59309
Anthochaera phrygia	Regent Honeyeater		Critically Endangered	Foraging, feeding or related behavior likely to occur within area	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. *HTTP://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10841*
Botaurus poiciloptilus	Australasian Bittern		Endangered	Species or species habitat likely to occur within area	The Australasian Bittern inhabits shallow (less than 30cm deep), permanent freshwater and brackish swamps or lagoons that are densely vegetated (e.g. tall reeds, sedges, lignum). They also inhabit bore drains with tussocky vegetation and occasionally saltmarsh. They use temporary pools when population densities are high and deep swamps when breeding. *HTTP://WETLANDINFO.EHP.QLD.GOV.AU/WETLANDS/ECOLOGY/COMPONENTS/SPECIES/?BOTAURUS-POICILOPTILUS*
Calidris acuminata	Sharp-tailed Sandpiper	Special Least Concern			In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. They may be attracted to mats of algae and water weed either floating or washed up around terrestrial wetlands, and coastal areas with much beachcast seaweed. Sometimes they occur on rocky shores and rarely on exposed reefs (Higgins & Davies 1996). **Foraging** They forage at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water. They also forage among inundated vegetation of saltmarsh, grass or sedges. They forage in sewage ponds, and often in hypersaline environments. After rain, they may forage in paddocks of short grass, well away from water. They may forage on coastal mudflats at low tide, and move to freshwater wetlands near the coast to feed at high tide. Occasionally they forage on wet or dry mats of algae and among rotting beachcast seagrass or seaweed, and sometimes they are recorded foraging around the edges of stony wetlands or among rocks in water, and rarely on exposed reef (Higgins & Davies 1996). **Roosting** Roosting occurs at the edges of wetlands, on wet open mud or sand, in shallow water, or in short sparse vegetation, such as grass or saltmarsh. Occasionally, they roost on sandy beaches, stony shores or on rocks in water (Higgins & Davies 1996). They have also been recorded roosting in mangroves (Minton & Whitelaw 2000). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=874*

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
Calidris ferruginea	Curlew Sandpiper		Critically Endangered	Species or species habitat known to occur within area	Intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. *HTTP://WWW.ENVIRONMENT.GOV.AU/BIODIVERSITY/THREATENED/SPECIES/PUBS/856-CONSERVATION-ADVICE.PDF*
Cuculus optatus	Oriental Cuckoo	Special Least Concern			It mainly inhabits forests, occurring in coniferous, deciduous and mixed forest. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground. It is usually secretive and hard to see. *HTTPS://EN.WIKIPEDIA.ORG/WIKI/ORIENTAL_CUCKOO*
Dasyornis brachypterus	Eastern Bristlebird		Endangered	Species or species habitat may occur within area	Habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone. *HTTP://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10206*
Erythrotriorchis radiatus	Red Goshawk	Endangered	Vulnerable	Species or species habitat likely to occur within area	Found in coastal and sub-coastal areas with tall open forest, woodland, lightly treed savannah and at the edge of rainforest. However, the breeding habitat is much more specific, with nesting only occurring in very tall trees, close to water. *HTTP://WWW.ARKIVE.ORG/RED-GOSHAWK/ERYTHROTRIORCHIS-RADIATUS/*
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Special Least Concern			In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level (Chapman 1969; Naarding 1981). They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands,

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					around bogs and other water bodies) (Frith et. al. 1977; Naarding 1983; Weston 2006, pers. comm.). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity (Frith et al. 1977; Naarding 1983). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=863*
Geophaps scripta scripta	Squatter Pigeon (southern)		Vulnerable	Species or species habitat may occur within area	Their habitat is dominated by a canopy of Eucalyptus, Corymbia, Acacia or Callitris species. They can also be found in regrowth or partially modified vegetation. Squatter pigeons are only found within 3 km of a water body or water course, and when breeding must be within 1 km. Their breeding habitat is in well-drained gravelly, sandy or loamy soil, where they nest in a shallow depression lined with grass and leaves. *HTTP://REEFCATCHMENTS.COM.AU/SPECIES_ECOSYSTEMS/SQUATTER-PIGEON-SOUTHERN/*
Grantiella picta	Painted Honeyeater		Vulnerable	Species or species habitat may occur within area	Inhabits Boree/ Weeping Myall (Acacia pendula), Brigalow (A. harpophylla) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema. Insects and nectar from mistletoe or eucalypts are occasionally eaten. *HTTPS://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10357*
Hirundapus caudacutus	White Throated Needletail	Special Least Concern			In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground (Coventry 1989; Tarburton 1993; Watson 1955). Because

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					they are aerial, it has been stated that conventional habitat descriptions are inapplicable (Cramp 1985), but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland (Higgins 1999). They also commonly occur over heathland (Cooper 1971; Learmonth 1951; McFarland 1988), but less often over treeless areas, such as grassland or swamps (Cooper 1971; Gosper 1981; Learmonth 1951). When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks (Emison & Porter 1978; Friend 1982; Tarburton 1993). In coastal areas, they are sometimes seen flying over sandy beaches or mudflats (Cooper 1971; Crompton 1936; Davis 1965), and often around coastal cliffs and other areas with prominent updraughts, such as ridges and sand-dunes (Cooper 1971; Dawson et al. 1991; Loyn 1980; Mitchell et al. 1996; Schulz & Kristensen 1994). They are sometimes recorded above islands well out to sea (Brandis et al. 1992; Cooper 1971; Warham 1957). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=682*
Lathamus discolor	Swift Parrot	Endangered	Critically Endangered	Species or species habitat may occur within area	On the mainland, it lives in eucalypt forest and woodlands, mainly box-ironbark habitats on the inland slopes of the Great Dividing Range. In some years, urban landscapes containing indigenous or non-local flowering eucalypts are also readily used. The importance of larger trees as a food source has been shown in this species' breeding range and wintering range, as such trees tend to offer a more reliable

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					and abundant source of nectar. HTTP://WWW.BIRDLIFE.ORG/DATAZONE/SPECIESFACTSHEET.PHP?ID=1488
Limosa limosa	Black Tailed Godwit	Special Least Concern			In Australia the Black-tailed Godwit has a primarily coastal habitat environment. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets. The use of habitat often depends on the stage of the tide. It is also found in shallow and sparsely vegetated, near-coastal, wetlands; such as saltmarsh, saltflats, river pools, swamps, lagoons and floodplains. There are a few inland records, around shallow, freshwater and saline lakes, swamps, dams and bore-overflows. They also use lagoons in sewage farms and saltworks (Higgins & Davies 1996). HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=845
Monarcha melanopsis	Black-faced Monarch	Special Least Concern			The Black-faced Monarch is found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. HTTP://WWW.BIRDSINBACKYARDS.NET/SPECIES/MONARCHA-MELANOPSIS
Myiagra cyanoleuca	Satin Flycatcher	Special Least Concern			Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests (Blakers et al. 1984; Emison et al. 1987; Officer 1969). HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=612
Ninox strenua	Powerful Owl	Vulnerable			The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him. *HTTPS://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10562*
Numenius madagascariensis	Eastern Curlew	Vulnerable	Critically Endangered		During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Zosteraceae). Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes within the mangroves. The birds are also found in coastal salt works and sewage farms. *HTTP://WWW.ENVIRONMENT.GOV.AU/BIODIVERSITY/THREATENED/SPECIES/PUBS/847-CONSERVATION-ADVICE.PDF*

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
Phaethon lepturus	White-Tailed Tropicbird	Special Least Concern			At the species level, the White-tailed Tropicbird occupies marine habitats in tropical waters with sea-surface temperatures of more than 22°C. The tropicbird breeds on islands and atolls, where it nests in a variety of habitats including on bare sandy ground, in closed-canopy rainforest, on rocky cliffs and in quarries. In Australia, the White-tailed Tropicbird (Indian Ocean) nests in Pisonia trees amongst Pisonia-coconut vegetation, and on sandy ground. *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=66986*
Plegadis falcinellus	Glossy Ibis	Special least Concern			The Glossy Ibis' preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons (del Hoyo et al. 1992; Hancock et al. 1992; Marchant & Higgins 1990). Within Australia, the largest contiguous areas of prime habitat is inland and northern floodplains. The Glossy Ibis is commonly in largest numbers in drying Top End grass/sedge swamps and Channel Country grass/forb meadows. The species is sometimes recorded in wooded swamps, artificial wetlands (such as irrigated fields), and in mangroves for breeding (Chatto 2000; Marchant & Higgins 1990). The species may retreat to permanent wetlands and/or coastal areas (including tidal wetlands) during drought (Marchant & Higgins 1990). Glossy Ibis roost in trees or shrubs usually near, but sometimes far, from water bodies (Brown et al. 1982; Marchant & Higgins 1990). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=991*

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
Poephila cincta cincta	Southern Black-throated Finch		Endangered	Species or species habitat may occur within area	The Black-throated Finch (southern) occurs mainly in grassy, open woodlands and forests, typically dominated by *Eucalyptus*, *Corymbia* and *Melaleuca*, and occasionally in tussock grasslands or other habitats (for example freshwater wetlands), often along or near watercourses, or in the vicinity of water (Baldwin 1976; Britton & Britton 2000; BTF Recovery Team 2004; Ley & Cook 2001; NRA 2005; Wieneke 1989). Almost all recent records of the finch from south of the tropics have been in riparian habitat (Baldwin 1976; BTF Recovery Team 2004; Ley & Cook 2001). The subspecies is thought to require a mosaic of different habitats in which it can find seed during the wet season (Mitchell 1996). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=64447*
Rhipidura rufifrons	Rufous Fantail	Special Least Concern			In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (*Eucalyptus microcorys*), Mountain Grey Gum (*E. cypellocarpa*), Narrow-leaved Peppermint (*E. radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); usually with a dense shrubby understorey often including ferns. They also occur in subtropical and temperate rainforests; for example near Bega in south-east NSW, where they are recorded in temperate Lilly Pilly (*Acmena smithi*) rainforest, with Grey Myrtle (*Backhousia myrtifolia*), Sassafras (*Doryphora sassafras*) and Sweet Pittosporum (*Pittosporum undulatum*) subdominants. They occasionally occur in secondary regrowth, following logging or disturbance in forests or rainforests. When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands, including Spotted Gum (*Eucalyptus maculata*), Yellow Box (*E. melliodora*), ironbarks or stringybarks,

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					often with a shrubby or heath understorey. They are also recorded from parks and gardens when on passage. In north and north-east Australia, they often occur in tropical rainforest and monsoon rainforests, including semi-evergreen mesophyll vine forests, semi-deciduous vine thickets or thickets of Paperbarks (*Melaleuca* spp.) (Higgins et al. 2006). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=592*
Rostratula australis	Australian Painted Snipe	Vulnerable	Endangered	Species or species habitat likely to occur within area	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. *HTTP://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10734*
Sternula albifrons	Little Tern	Special Least Concern			In Australia, Little Terns inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches. Little Terns are widespread on islands off the Northern Territory coast but appear to be less often on offshore continental islands or coral cays off Queensland (Chatto 2001; Higgins & Davies 1996; Hill et al. 1988; Johnstone & Storr 1996; NSW National Parks and Wildlife Service 2003). In the Northern Territory, Little Terns are commonly seen in sandy coastal habitats and in mangrove-mudflat habitats along the coast or in bays and estuaries, but not recorded on wetlands more than 1 km from the coast (Chatto 2001). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=813*
Tringa nebularia	Common Greenshank, Greenshank	Special Least Concern			The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. The edges of the wetlands used are generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees. It was once recorded with Black-winged Stilts (*Himantopus himantopus*) in pasture, but are generally not found in dry grassland (Higgins & Davies 1996). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=832*
Turnix melanogaster	Black-breasted Button-quail	Vulnerable	Vulnerable	Species or species habitat likely to occur within area	The Black-Breasted Buttonquail inhabits rainforests and forests. They prefer forest with an annual rainfall of 770 – 1,200 mm, a largely closed canopy and a deep layer of leaf litter. However, they can also be found in low, dense thickets, of the flowering plant Lantana, and in vegetation behind sand dunes. *HTTP://WWW.ARKIVE.ORG/BLACK-BREASTED-BUTTONQUAIL/TURNIX-MELANOGASTER/*
Mammals					
Chalinolobus dwyeri	Large-eared Pied Bat		Vulnerable	Species or species habitat likely to occur within area	Sandstone cliffs and fertile woodland valley habitat within close proximity of each other is habitat of importance to the Large-eared Pied Bat. Rainforest and moist eucalypt forest habitats on other geological substrates (rhyolite, trachyte and basalt) at high elevation are of similar importance to the species.

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=183
Dasyurus hallucatus	Northern Quoll		EWndangered	Species or species habitat may occur within area	This quoll species is most abundant in rocky ranges and open eucalypt forest.
Dasyurus maculatus maculatus	Spotted-tail Quoll		Endangered	Species or species habitat likely to occur within area	The Spot-tailed Quoll has a preference for mature wet forest habitat, especially in areas with rainfall 600 mm/year. Unlogged forest or forest that has been less disturbed by timber harvesting is also preferable. This subspecies has been recorded from a wide range of habitats, including: temperate and subtropical rainforests in mountain areas, wet schlerophyll forest, lowland forests, open and closed eucalypt woodlands, inland riparian and River Red Gum (*Eucalyptus camaldulensis*) forests, dry 'rainshadow' woodland, sub-alpine woodlands, and coastal heathlands. HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=75184
Petauroides volans	Greater Glider	Vulnerable	Vulnerable	Species or species habitat likely to occur within area	It is a strictly nocturnal, and largely solitary, arboreal species of various undisturbed eucalypt-dominated woodland and forest habitat types. It does not inhabit rainforest or pine plantations. It requires large tree hollows so it is therefore dependent on mature forest. HTTP://WWW.IUCNREDLIST.ORG/DETAILS/40579/0
Petrogale penicillata	Brush-tailed Rock-wallaby		Vulnerable	Species or species habitat may occur within area	This species prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks (Murray et al. 2008; Short 1982). It also utilises tree limbs (Maxwell et al. 1996; Sharman & Maynes 1983). While it appears that most Brush-tailed Rock-wallaby colonies are on north-facing slopes and cliff lines (Short 1982), colonies have been found on south-facing

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					cliffs in Kangaroo Valley (Kutzner & Dodd 1996; Wong 1997), in the Macleay River Gorge (Bayne 1994), in the Warrumbungles and at Mt Kaputar (Soderquist undated, pers. comm., cited in NSW NPWS 2003a), although usually in lower densities. Rocky outcrops appear crucial to current habitat selection by rock-wallabies, however, vegetation structure and composition is also considered to be an important factor (Bugg 1995; Lim & Giles 1987; Pearson 1992). In many parts of their range, including at the Warrumbungles, rock-wallabies are closely associated with dense arboreal cover, especially fig trees (NSW NPWS 2003a). The vegetation on and below the cliff appear to be important to this species as a source of food and shelter and in some cases may provide some protection from predation (Wong 1993; 1997). A range of vegetation types are associated with Brush-tailed Rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest (Murray et al. 2008). *HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=225*
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	Koala (combined populations of Queensland, New South Wales and the Australian	Vulnerable	Vulnerable	Species or species habitat known to occur within area	Koalas occupy forests and woodlands where there are acceptable food trees. They are largely nocturnal and feed almost exclusively on eucalypts, but preferred food tree species vary with locality and there are quite distinct regional preferences. They are able to persist in fragmented habitats, and even survive in isolated trees across a predominantly agricultural landscape. *HTTP://WWW.IUCNREDLIST.ORG/DETAILS/16892/0*

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
	Capital Territory)				
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)		Vulnerable	Species or species habitat may occur within area	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. *HTTP://WWW.ENVIRONMENT.NSW.GOV.AU/THREATENEDSPECIESAPP/PROFILE.ASPX?ID=10662*
Pteropus poliocephalus	Grey-headed Flying-fox		Vulnerable	Foraging, feeding or related behaviour known to occur within area	Urban areas, forests and woodlands, intertidal mangroves. *HTTP://AUSTRALIANMUSEUM.NET.AU/GREY-HEADED-FLYING-FOX* Occurs in "subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species. *HTTP://WWW.ENVIRONMENT.NSW.GOV.AU/RESOURCES/NATURE/TSPROFILEGREYHEADEDFLYINGFOX.PDF*
Tachyglossus aculeatus	Short Beaked Echidna	Special Least Concern			In Australia, they are most common in forested areas with abundant, termite-filled, fallen logs. In agricultural areas, they are most likely to be found in uncleared scrub; they may be found in grassland, arid areas, and in the outer suburbs of the capital cities. *HTTPS://EN.WIKIPEDIA.ORG/WIKI/SHORT-BEAKED_ECHIDNA*
Amphibians					
Adelotus brevis	Tusked Frog	Vulnerable			Inhabits wet eucalypt forest, rainforest, and sometimes dry eucalypt forest, where it can be found in close proximity to suitable breeding habitat such as ponds and slow-moving sections of streams (Cogger 2000; Meyer et al. 2001; Hines 2012)

Scientific Name	Common Name	NCA Status	EPBC Status	EPBC Comments	Preferred Habitat
					HTTPS://WWW.QLD.GOV.AU/ENVIRONMENT/ASSETS/DOCUMENTS/PLANTS-ANIMALS/BIODIVERSITY/TUSKED-FROG.PDF
Insects					
Argynnis hyperbius inconstans	Australian Fritillary		Critically Endangered	Species or species habitat may occur within area	The Australian fritillary usually occurs around river estuaries or open, swampy coastal regions. While the Australian fritillary has been successfully reared on *Viola hederaceae* in captivity, the subspecies is believed to be host-plant specific in the wild and therefore only occurs in areas where its larval food plant, the arrowhead violet, occurs. The arrowhead violet is a small perennial herb which usually grows in damp niches in open habitats. It often grows beneath grasses and other plants, often in association with *Lomandra longifolia* (long leaved matrush) and *Imperata cylindrica* (bladey grass). HTTP://WWW.ENVIRONMENT.GOV.AU/BIODIVERSITY/THREATENED/SPECIES/PUBS/88056-CONSERVATION-ADVICE-15082017.PDF
Reptiles					
Delma torquata	Collared Delma		Vulnerable	Species or species habitat may occur within area	This species occurs on rocky outcroppings in dry, open eucalyptus-acacia woodlands with an under-storey of grass and shrubs. It is known to inhabit leaf litter and has also been found under logs and stones. HTTP://WWW.IUCNREDLIST.ORG/DETAILS/6317/0
Furina dunmalli	Dunmall's Snake		Vulnerable	Species or species habitat may occur within area	A broad range of habitats, including: Forests and woodlands on black alluvial cracking clay and clay loams dominated by Brigalow (*Acacia harpophylla*), other Wattles (*A. burowii, A. deanii, A. leioclyx*), native Cypress (*Callitris* spp.) or Bull-oak (*Allocasuarina luehmannii*); and various Blue Spotted Gum (*Corymbia citriodora*), Ironbark (*Eucalyptus crebra* and *E. melanophloia*), White Cypress Pine (*Callitris glaucophylla*) and Bulloak open forest and woodland associations on sandstone derived soils. HTTP://WWW.ENVIRONMENT.GOV.AU/CGI-BIN/SPRAT/PUBLIC/PUBLICSPECIES.PL?TAXON_ID=59254

Table 3 Migratory Species Protected Under International Agreements Potentially Present on Site

Scientific Name	Common Name	EPBC Status	Comments
Migratory Marine Birds			
Apus pacificus	Fork-tailed Swift	Vulnerable	Species or species habitat likely to occur within area
Migratory Terrestrial Species			
Cuculus optatus	Oriental Cuckoo, Horsfield's Cuckoo		Species or species habitat may occur within area
Hirundapus caudacutus	White-throated Needletail		Species or species habitat known to occur within area
Monarcha melanopsis	Black-faced Monarch		Species or species habitat known to occur within area
Monarcha trivirgatus	Spectacled Monarch		Species or species habitat known to occur within area
Myiagra cyanoleuca	Satin Flycatcher		Species or species habitat known to occur within area
Rhipidura rufifrons	Rufous Fantail		Species or species habitat known to occur within area
Migratory Wetlands Species			
Actitis hypoleucos	Common Sandpiper		Species or species habitat may occur within area
Calidris acuminata	Sharp-tailed Sandpiper		Species or species habitat may occur within area
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos	Pectoral Sandpiper		Species or species habitat may occur within area
Gallinago hardwickii	Latham's Snipe, Japanese Snipe		Species or species habitat may occur within area
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus	Osprey		Species or species habitat known to occur within area

Scientific Name	Common Name	EPBC Status	Comments
Tringa nebularia	Common Greenshank, Greenshank		Species or species habitat likely to occur within area

4.4 Desktop Study – Other State Government Matters

4.4.1 Vegetation Management Property Report – Essential Habitat

The Vegetation Management Property Report (**Appendix V**) shows almost all of the Lot and most of the vegetated area in the proposed development site as Essential Habitat. Species listed in the Report are: *Phascolarctos cinereus* (Koala), *Petauroides Volans* (Greater Glider), *Ninox strenua* (Powerful Owl), *Notelaea ipsviciensis* (Cooneana Olive), and *Marsdenia coronata* (Slender Milkvine).

4.4.2 SPP Biodiversity.

The SPP Biodiversity mapping (**Appendix VI**) indicated that there is wildlife habitat, regulated vegetation (Category C), and regulated vegetation intersecting a watercourse on the proposed development site. The area of regulated vegetation is synonymous with that marked in the Vegetation Management Property Report (**Section 4.2**). A part of the Category B area to the east of the power-line easement is mapped as Essential Habitat; this area is not consistent with the area mapped as Essential Habitat in the Vegetation Management Property Report.

4.4.3 DA Vegetation Mapping

The DA Vegetation mapping (**Appendix VI**) shows Category C Regulated Vegetation and Essential Habitat on the proposed development site. The area of regulated vegetation is synonymous with that marked in the Vegetation Management Property Report (**Section 4.2**). The Essential Habitat area is inconsistent with the wildlife habitat area mapped in the SPP Biodiversity mapping but is consistent with that marked in the Vegetation Management Property Report.

4.4.4 SPP Bushfire Hazard.

The SPP Natural Hazard mapping (**Appendix VI**) indicates that there is Medium and High Potential Bushfire Intensity Hazard and Potential Impact Buffer mapped on or adjacent to the proposed development site. The Bushfire Hazard area is associated with the mapped native vegetation cover, generally with High Potential Bushfire Intensity Hazard in the Category A or B Regulated Vegetation areas, and the Medium Potential Bushfire Intensity Hazard correlates with the Category C Regulated Vegetation.

4.4.5 Red Imported Fire Ants.

The site is in Fire Ant Biosecurity Zone 1 (**Appendix VII**). To move soil from a property within Biosecurity Zone 1 you must have a Biosecurity Instrument Permit unless the soil remains within Zone 1 or the soil is moved to a waste facility within Zone 1 or Zone 2. To move mulch, manure, baled hay or straw, potted plants or turf or other fire ant carriers such as mining or quarrying products or compost, from a property within biosecurity Zone 1 you must either follow procedures outlined in the *Biosecurity Regulation 2016*; or move the material to a waste facility within Zone 1 or 2; or move the material within 24 hours of being

on the property. If you are unable to fulfil the above conditions then you must request a Biosecurity Instrument Permit from an inspector.

4.5 Desktop Study – Ipswich City Council Planning Scheme

The Planning Scheme Property Report (**Appendix I**) shows the subject Lot as RBIA02 - Regional Bus & Industry Investigation (New Chum) and REC - Recreation. The Property Report and mapping did not show any ecological attributes or bushfire hazard for the proposed development site and surrounding areas.

4.6 Desktop Study Discussion

Fourteen plant species listed as Endangered, Vulnerable or Near Threatened under State and/or Commonwealth Legislation were indicated for the site (**Table 1**), and 26 bird species, ten mammal species, one amphibian, one insect and two reptile species listed in State and/or Commonwealth legislation as Endangered, Vulnerable, Near Threatened or Special Least Concern conservation status, were indicated as potentially present on site (**Table 2**). Another 15 migratory bird species, protected under international conventions, were also indicated as potentially present on site.

With the exception of the existing excavation and fill sites, the Lot is generally covered with *Vegetation Management Act 1999* regulated remnant vegetation, however, with the exception of the north-east corner the Lot is vegetated with Category C vegetation. The majority of the mapped vegetation on the proposed development site is vegetated with Category C Of Concern vegetation, however the north-west corner is mapped as Category C Endangered vegetation. The entire Lot is mapped as a Protected Plant Survey Trigger Area.

The State Planning Policy mapping shows a Matter of State Environmental Significance – 'regulated vegetation intersecting a watercourse' generally in the location of the power-line easement and associated track, however the Property Vegetation Management Report describes this only as 'watercourse and drainage features on the vegetation management watercourse and drainage features map'.

The Vegetation Mapping and the DA mapping indicate almost all of the Lot and most of the vegetated area in the proposed development site as Essential Habitat, while the SPP Biodiversity Mapping only indicates the north-west corner and the Category B area to the east of the power-line easement, part of which is also mapped on the SPP Biodiversity Mapping, as Essential Habitat.

The State Planning Policy mapping show the Lot and adjoining areas to be Medium and High Potential Bushfire Intensity Hazard and Potential Impact Buffer however the Ipswich City Council mapping shows no Bushfire Hazard in or near the proposed development site (**Appendix VI**).

5 RESULTS – FIELD STUDY

5.1 FIELD SURVEY – VEGETATION ASSOCIATIONS

The field survey traverse is illustrated in **Figure 4** and a list of all plant species recorded during the survey is presented in **Table 4.** There are numerous mature trees on the Lot; however, the majority are to the east of the power-line right of way and are outside the proposed development area. Historic aerial imagery indicates that the proposed development site remained generally vegetated until the 1980s, when the existing mine was established on the site, however the eastern creek flats were cleared in the 1970s and have gradually regenerated over the intervening years (Habitat Area 5 on **Figure 4**).

The proposed development site is very degraded and heavily disturbed. A large portion of the site has been raised by stockpiling of fibre cement sheet (**Plate 3**), and the area immediately adjacent and to the east of this is an existing open cut mine (**Plate 1**). The area under the power lines is clear of woody vegetation and is used as a road (**Plate 9**). The area to the south-west of the existing disturbance appears to comprise stockpiled topsoil (**Plate 2**) and mine overburden (**Plate 10**), and is supporting naturally regenerated vegetation comprising almost entirely of *Acacia disparrima* with a few scattered juvenile *Eucalyptus fibrosa* (Habitat Area 3 on **Figure 4**).



Plate 9 Cleared Road Under Power-Line Easement



Plate 10 Acacia Growing on Relict Mine Spoil

The area to the north-west and to the north-east of the proposed development site is supporting better developed and more intact native vegetation (Habitat Area 1 and 2 on **Figure 4**), however the site is evidently very disturbed with indications of minor excavations through the vegetation, and areas of domestic and industrial fly tipping. There is a small amount of dead timber on the ground, sufficient to provide habitat for small reptiles.

Dominant and structural species recorded in this area include:

Corymbia citriodora subsp. *variegata*
Corymbia intermedia
Corymbia tessellaris
Eucalyptus acmenoides
Eucalyptus crebra
Eucalyptus fibrosa
Eucalyptus major
Eucalyptus moluccana
Eucalyptus tereticornis
Lophostemon confertus
Lophostemon suaveolens

The area to the north-east of the proposed development site mapped as supporting the Endangered Regional Ecosystem 12.3.3 has been inundated and the Eucalypts are all dead although most are still

standing (Habitat Area 1a on **Figure 4**). The inundation appears to have occurred many years ago, possibly as a result of change to flow regimes during historical mining activities.

Within the constraints of allocating regenerating heavily disturbed vegetation to a Regional Ecosystem, the vegetation to the north and east of the proposed development site best meets the description of 12.9-10.19 (Least Concern) and 12.9-10.2 (Least Concern).

Approximately 87 Eucalypt, Corymbia and Lophostomen trees with a diameter over bark at breast height (DBHOB) of 20cm or greater were recorded in the vicinity of the development site. Because of access constraints, the tree count is not precise and trees were not marked. It is understood that the majority of the clearing for the proposed development will occur in the area immediately to the south and west of the existing disturbance. This area generally comprises relict spoil heap from earlier mining operations, and is predominantly vegetated with regrowth Acacia (Habitat Area 3 on **Figure 4**).

It is not anticipated that 87 trees will be cleared for the proposed development – the only clearing that is planned for the area to the north and east of the existing disturbance, where the trees are larger, is widening and forming the existing road around the proposed disturbance site. When a final site layout is confirmed, an accurate survey of all Eucalypt, Corymbia, Lophostomen and Angophora trees larger than 20cm DBHOB in the disturbance footprint will be conducted, and subsequently this report will be updated.

Table 4 Terrestrial Plants Recorded during the Survey

Species	Common Name	Exotic	Biosecurity Act Listing	WONs
Acacia amblygona				
Acacia complanata	Flat Stemmed Wattle			
Acacia disparrima	Hickory Wattle			
Acacia fimbriata	Brisbane Wattle			
Acacia spectablis	Glory Wattle			
*Ageratum houstonianum**	Billy goat weed	*		
Allocasuarina torulosa	Forest Oak			
Alphitonia excelsa	Pink Ash			
*Asparagus aethiopicus**	Sprengeri Fern	*	Restricted Invasive 3	WoNS
*Baccharis halimifolia**	Groundsel	*	Restricted Invasive 3	
Breynia oblongifolia				
Bryophyllum delagoense syn. Bryophyllum tubiflorum, (Kalanchoe delagoensis)	Mother Of Millions	*	Restricted Invasive 3	
Casuarina glauca	Swamp She Oak			
*Celtis sinensis**	Chinese Celtis	*	Restricted Invasive 3	
*Cestrum parqui**	Green Cestrum	*	Invasive	
Chloris sp.*		*		
*Cirsium vulgare**	Spear Thistle	*		
Clerodendrum floribundum	Lolly Bush			
Corymbia citriodora subsp. *variegata*	Spotted Gum			
Corymbia intermedia	Pink Bloodwood			
Corymbia tessellaris	Moreton Bay Ash			
Corymbia torelliana	Cadaghi			
Daviesia sp.				

Species	Common Name	Exotic	Biosecurity Act Listing	WONs
Dianella sp.	Flax Lilly			
Dodonaea viscosa ssp. *cuneata*				
Duboisia myoporoides	Dubosia			
*Duranta repens**	Duranta	*	Invasive	
Eucalyptus acmenoides	White Mahogany			
Eucalyptus crebra	Narrow Leaved Ironbark			
Eucalyptus fibrosa	Broad-Leaved Red Ironbark			
Eucalyptus major	Grey Gum			
Eucalyptus moluccana	Gum Topped Box			
Eucalyptus tereticornis	Forest Red Gum			
Eustrephus latifolius	Wombat Vine			
Flindersia collina	Leopard Ash			
*Heliotropium amplexicaule**	Buke Heliotrope	*		
Heteropogon contortus	Black Spear Grass			
*Imperata cylindrica**	Blady Grass	*		
Indigofera sp.	Native Indigo			
*Ipomoea cairica**	Mile a Minute	*	Invasive	
*Lantana camara**	Lantana	*	Restricted Invasive 3	WoNS
*Lantana montevidensis **	Creeping Lantana	*	Restricted Invasive 3	
*Leucaena leucocephala **	Leucaena	*	Invasive	
Lomandra sp.	Lomandra			
Lophostemon confertus	Brush Box			
Lophostemon suaveolens	Swamp Box			
*Ludwigia peploides**		*		
Maclura cochinchinensis	Cockspur			

Species	Common Name	Exotic	Biosecurity Act Listing	WONs
Melaleuca salicina syn *Callistemon salignus*	White Bottlebrush			
Melaleuca viminalis syn. *Callistemon viminalis*	Weeping Red Bottlebrush			
*Neontonia wightii**	Glycine	*	Invasive	
Nymphea caerulea	Blue Water Lilly			
*Opuntia stricta**	Prickly Pear	*	Restricted Invasive 3	WoNS
Panicum decompositum	Native Millet			
Parsonsia straminea	Monkey Rope			
*Passiflora foetida**	Stinking Passionfruit	*	Invasive	
Petalostigma triloculare	Quinine			
Phragmites australis	Common Reed			
Pimelea sp.*	Pimelea			
Pinus sp.*		*		
Pteridium sp.	Bracken			
Rumex sp.*	Dock Weed	*		
*Schinus terebinthifolius**	Broad Leafed Pepper Tree	*	Restricted Invasive 3	
*Senecio madagascariensis**	Fireweed	*	Restricted Invasive 3	
*Sida cordifolia**	Flannel Weed	*		
Themeda australis	Kangaroo Grass			
*Tipuana tipu**	Pride Of Bolivia	*		
Typha sp.	Bullrush. Cumbungi			
*Verbena bonariensis**		*		
Westringia eremicola				
Xanthorrhoea sp.	Grass tree			

5.2 Field Survey – Protected Plants

A review of the preferred habitats of EVNT Plant Species potentially present on site (**Table 1**) suggests that of the 14 plants listed as potentially present, only two species – *Notelaea ipsviciensis* and *Thesium australe* were considered to potentially be present. No EVNT plant species were recorded during the survey.

5.3 Field Survey – Weeds

The survey recorded 26 exotic plant species (**Table 4**). Of those, 15 are listed as either Restricted or Invasive plants under the *Biosecurity Act 2014*, and three are listed as Weeds of National Significance (WoNS). The remainder of the exotic species recorded during the survey are either low risk weeds or garden escapees.

5.4 Field Survey – Fauna

A review of the preferred habitats of Conservation Significant Animal Species potentially present on site (**Table 2**) suggests that of the listed birds only *Anthochaera phrygia, Botaurus poiciloptilus, Calidris acuminate, Erythrotriorchis radiatus, Gallinago hardwickii, Poephila cincta cincta, Rostratula australis* and *Tringa nebularia* could potentially be present. Of the animals it was considered possible that *Adelotus brevis, Delma torquata, Phascolarctos cinereus,* and *Tachyglossus aculeatus* could be present.

Bird species observed during the survey are listed in **Table 5**. It should be noted that the weather at the time of the survey was warm to hot and overcast, consequently the full range of bird species using the site may not have been active and readily observed at the time of the survey. The majority of birds recorded were seen on or near the two waterbodies, with the Darter, Great Egret, Dusky Moor Hen, Little Pied Cormorant, Royal Spoonbill and Purple Swamp Hen (**Plates 12** to **17**) all found in the wetland to the north-west of the Lot.

Table 5 Bird Species Observed During the Survey

Species	Common Name
Anas supersciliosa	Pacific Black Duck
Anhinga melanogaster	Darter
Ardea alba	Great Egret
Corvus orru	Torresian Crow
Coturnix ypsilophora	Brown Quail
Dacelo novaeguineae	Kookaburra

Species	Common Name
Gallinula tenebrosa	Dusky Moor Hen
Malurus sp.	Fairy Wren
Phalacrocorax melanoleucos	Little Pied Cormorant
Platalea regia	Royal Spoonbill
Porphyrio porphyrio	Purple Swamp Hen
Rhipidura leucophrys	Willy Wagtail



Plate 12 Darter *Anhinga melanogaster*



Plate 13 Great Egret *Ardea alba*



Plate 14 Dusky Moor Hen *Gallinula tenebrosa*



Plate 15 Little Pied Cormorant *Phalacrocorax melanoleucos*



Plate 16 Royal Spoonbill *Platalea regia*



Plate 17 Purple Swamp Hen *Porphyrio porphyrio*

Two Eastern Grey Kangaroos (*Macropus giganteus*) were observed during the survey. There were several sightings of two animals, but it is believed that the sightings were of the same animals. They were observed on the flats adjacent to Six Mile Creek (Habitat Area 5 on **Figure 4**), and in the native forest adjacent to the flats (Habitat Area 4 on **Figure 4**).

Only one tree, a *Eucalyptus major*, was observed to have scratch marks on it (**Plate 18**); the scratch marks were inconsistent with those normally made by Koala, and were probably made by possums (*Trichosurus vulpecula* (Brushtail Possum) or *Pseudocheirus peregrinus* (Ringtail Possum)). No other mammals were observed during the survey, and with the exception of scattered macropod scats, no other signs of mammals were observed during the survey.

Some old diggings were observed, potentially made by either *Tachyglossus aculeatus* (Echidna) or *Varanus* sp. (Monitor Lizard). No fresh diggings were observed. A Water Dragon (*Intellagama lesueurii*) was observed in the waterhole to the south-west of the Lot (**Plate 19**), and the Skink *Lampropholis guichenoti* was observed on trees in the mapped vegetation to the east of the power-line easement.

No animals listed as Conservation Significant were observed during the survey, and there was no evidence of the presence of Conservation Significant animals on the site.



Plate 18 Scratch Marks on *Eucalyptus major*



Plate 19 Water Dragon *Intellagama lesueurii*

5.5 KOALA SURVEY

The SAT survey method was used to determine the presence and abundance of Koala in and around the proposed disturbance area. Six Koala Habitat Trees (KHTs), including a *Eucalyptus major* with extensive scratch marks on the trunk (**Plate 18**), were selected at random locations within the proposed disturbance area for Spot Assessment. No Koala pellets were found in the vicinity of any of the trees, and no Koala pellets or other evidence of Koala presence was observed during the survey. Although absence of evidence does not constitute evidence of absence, it is considered highly unlikely that Koala recently or regularly uses the site.

5.6 HABITAT AND CONNECTIVITY

The areas on the Lot supporting the heaviest vegetation are:

- The area to the north-west of the current disturbance area (Habitat Area 1a and 1b on **Figure 4**),
- The area to the north and north-east of the current disturbance area (Habitat Area 2 on **Figure 4**), and
- The area east of the power-line right of way, which is not in the proposed development site (Habitat Area 4 on **Figure 4**).

<u>The area to the north-west of the current disturbance area</u>

Within the Lot the habitat in area to the north-west of the current disturbance area is limited in extent, however, it borders the wetland to the north of the site, where the majority of the water birds were observed (**Plate 20**). The wetland appears to be an important resource for native and feral birds and terrestrial animals in the area.



Plate 20 Wetland to the North of the Lot

To the west of this area is a track formed on a gazetted road and bordered on both sides by dense exotic and native vegetation. The thick grass had evidence of extensive use by animals, however, no scats, nests or other evidence of species using the area were observed. The tracks may have been made by the local population of Eastern Grey Kangaroo, or by feral animals such a Pig (*Sus scrofa*) or Dog (*Canis lupus*) (**Plate 21**).

There is light fallen timber throughout this area, sufficient to provide habitat to small reptiles and mammals, and an excavation to the west, and draining into the wetland, has been filled with large rocks, which may also provide habitat to reptiles (**Plate 22**).



Plate 21 Animal tracks through long grass



Plate 22 Excavation filled with large rocks

The area to the north and north-east of the current and proposed disturbance area

The habitat in this area is well developed and complex with light fallen timber cover on the ground (**Plate 23**), however, being bordered to the north and east by a road and powerline and with adjoining lands to the north being generally cleared, its habitat value is limited by its extent and it is considered to only have habitat value to small birds, reptiles and mammals, with larger animals only using the area from time to time for foraging or access to the wetland to the north of the site.



Plate 23 Well Developed and Complex Habitat in the Area to the North and North-East of the Current and Proposed Disturbance Area

The area east of the power-line right of way

The area east of the power-line right of way is not in the proposed development site, however it has linkages to the area to the north-east of the current and proposed disturbance area and consequently to the wetland to the north of the site; and it connects these areas to Six Mile Creek and associated creek flats. The vegetation in this area is generally well developed and complex, with evidence of timber harvesting activities, large fallen logs and standing trees with extensive hollow development (**Plate 24**) consequently offering habitat opportunity to a wide range of terrestrial reptile, mammal and bird species. The creek flats are generally open with a dense grass layer, while the slopes, although disturbed provides open forest habitat, and open forest with a dense shrub layer of Acacia, Lantana or Dodonaea (**Plate 25** and **26**).



Plate 24 Spotted Gum (*Corymbia citriodora* subsp. *variegata*) with Hollow Development in the Area Outside the Proposed Development Footprint

Six Mile Creek provides continuous habitat corridor that runs from slightly south of Ipswich Motorway to an extensive area of native vegetation south of Centenary Highway (**Figure 3**) (**Section 1.3**). The vegetation and adjacent to Six Mile Creek comprises predominantly *Melaleuca viminalis, Eucalyptus tereticornis* and *Celtis sinensis* (**Plate 27**). Because of urban encroachment, although of local significance, the corridor along Six Mile Creek has limited regional importance.



Plate 25 Open Forest with a Dense Shrub Layer of Acacia and Lantana in the Area East of the Power-Line Easement



Plate 26 Open Forest with a Dense Shrub Layer of Acacia and Dodonaea in the Area East of the Power-Line Easement



Plate 27 Vegetation on Six Mile Creek

The area to the south-west of the Lot

To the south-west of the proposed development site is an extensive area of excavation and rehabilitated mines (**Plate 28**). An elongated wetland, understood to be an inundated relict mine open pit, runs along the boundary and outside of the subject Lot (**Plate 29**). The wetland supported a large number of water birds, however, at the time of the survey the diversity of water birds was greater on the wetland to the north-east of the Lot. Nevertheless, it is apparent that this wetland is an important resource for native and feral animals in the area.



Plate 28 Naturally Regenerated Acacia and Eucalypt on Mine Spoil to the South of the Proposed Disturbance Area



Plate 29 Wetland to the South of the Lot

Overall, with the exception of the vegetation between the proposed development site and the waterbody to the north, and the waterbody itself – which is not in the development footprint, the vegetation in and near the proposed development site offered little fauna habitat opportunity and limited connectivity to other areas of habitat. However, the area to the east of the powerline, and not in the development footprint, provides complex fauna habitat and connectivity to the Six Mile Creek corridor.

6 DISCUSSION

6.1 VEGETATION, VEGETATION ASSOCIATIONS AND HABITAT

During the survey 71 plant species were recorded, of which 26 were exotic species and 1 native species (*Corymbia torelliana*) was thought to be an off-site native species. Of the exotic species, 15 are 'Invasive' or 'Restricted Invasive 3' plants under the *Biosecurity Act 2014*, and three species are WoNS. Forty-four native and endemic plant species were recorded across the site. Generally, the native species recorded during the survey were consistent with the current and pre-clearing Regional Ecosystems mapped for the location (**Section 4.2**, **Appendix V**).

None of the Threatened Ecological Communities identified in the EPBC Protected Matters Report (**Appendix III**) were observed in the proposed development area and the observed ecological characteristics of the site are unlikely to support those communities. The existing vegetation does not consist of regionally or locally significant species, protected species or ecosystems, plants and plant communities that have heritage or landscape significance.

The proposed development will remove a small area of the regenerating Acacia dominated vegetation to the south-west of the current disturbance area, and a small area of the structurally more complex vegetation to the north of the existing disturbance (**Figure 1**). It is considered that the proposed vegetation clearing will not have a significant impact on the habitat and connectivity values of the Lot or surrounding areas, however, it is recommended that the habitat values associated with the two wetlands adjoining the proposed development site are protected. With appropriate weed control and rehabilitation management the habitat values of the vegetation on the remainder of the Lot would be enhanced.

The proposed disturbance site does not have important habitat or biodiversity values, however the two waterbodies adjacent to the Lot provide habitat to water birds and terrestrial reptiles and mammals. The proposed disturbance site does not have old or dead trees with hollows or nests that potentially could be used by hollow dwelling fauna, however old hollow-bearing trees were observed in the vegetation to be retained to the east of the development site (**Plate 24**). Generally, the existing vegetation does enhance the landscape amenity of the site although it does not comprise visually prominent hillsides, or ridgelines. However, the vegetation proposed to be cleared is Acacia regrowth on the relict mine spoil heaps to the south of the current disturbance, which do not provide visual amenity.

In places the landform underlying vegetation proposed to be cleared, is over 15% slope. However, this is local and artificial landform, largely comprising relict mine spoil heaps, and will be levelled and stabilised for the proposed development. The existing vegetation proposed to be cleared does not assist in the stabilisation of creeks and natural drainage paths. The catchment of the proposed development is draining into the two artificial waterbodies thought to be inundated mine excavations, those waterbodies are isolated from the local drainage system, consequently the vegetation proposed to be cleared does not contribute to water quality management and the natural behaviour of the catchment. Rainfall falling on the eastern portion of the site drains into the Six Mile Creek catchment, however, this area is not proposed to be cleared for this development.

6.2 PROTECTED FLORA

No EVNT plant species were recorded during the survey.

6.3 PROTECTED FAUNA

The preferred habitat for protected fauna potentially present on site was researched and is tabulated in **Table 2**. Analysis of the animals' preferred habitat and the degree of disturbance that the site has been subjected to, suggests that:

- It is unlikely that any of the pelagic or coastal birds listed in **Table 2** would be present on site;
- It would be possible although not probable for most of the other indicated birds to be occasionally on site, for example, when travelling through or over the site;
- It would be unlikely for many of the protected terrestrial animal species to be present on site.

A SAT survey was conducted for Koala in and adjacent to the proposed development site. No signs or indications of Koala presence or use were recorded during the survey.

No protected animals or their signs were observed or recorded during the survey.

6.4 WEEDS AND PEST ANIMALS

The survey recorded 26 exotic species of which, 15 are 'Invasive' or 'Restricted Invasive 3' plants under the Biosecurity Act 2014, and three species are Weeds of National Significance. Under the *Biosecurity Act 2014* Restricted Invasive Plants and Animals must not be kept, moved, fed, given away, sold, or released into the environment, without a permit, and everyone must take all reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control.

It is recommended that a pest control program is undertaken to manage and control:

*Asparagus aethiopicus**	Sprengeri Fern
Baccharis halimifolia	Groundsel
Bryophyllum delagoense syn. Bryophyllum tubiflorum	Mother Of Millions
Celtis sinensis	Chinese Celtis
*Lantana camara**	Lantana
Lantana montevidensis	Creeping Lantana
*Opuntia stricta**	Prickly Pear
Schinus terebinthifolius	Broad Leafed Pepper Tree
Senecio madagascariensis	Fireweed

All of the above species are Restricted Invasive Plants under the *Biosecurity Act 2014*. Those marked with an asterix (*) are also WoNS.

No Restricted Invasive Animals were observed or recorded during the survey, although it is likely that feral cats (*Felis catus*) and possibly foxes (*Vulpes vulpes*), feral pigs and wild dogs are present. It is not

considered appropriate to undertake a targeted control program for feral cat, dog, pig or fox on this site, nevertheless, it should be noted that during and after construction, feral animals should not be encouraged, kept or fed by employees, contractors or occupants.

The site is in Fire Ant Biosecurity Zone 1. Consequently, the movement of biosecurity matter off the property must be in accordance with the *Biosecurity Regulation 2016* or under a Biosecurity Instrument Permit from an inspector.

7 IPSWICH CITY COUNCIL ASSESSMENT REQUIREMENTS

7.1 VEGETATION MANAGEMENT CODE

Assessment of the proposed development against Specific Outcome 1 of Table 12.4.1 of the Vegetation Management Code is outlined below.

Specific Outcomes	Acceptable / Probable Solutions	How the Proposed Development Meets the Code Provisions
Environmentally Sensitive Areas **(1) The clearing of vegetation does not cause or exacerbate land degradation within environmentally sensitive areas including steeply sloping land, areas prone to erosion or salinity, riparian corridors, wetlands or water catchment areas.**	Environmentally Sensitive Areas (1) The clearing does not involve the removal of native vegetation from— (a) land with a slope of 15% or more; or (b) land within a Designated Watercourse or land within 30m of a Designated Watercourse or within 10 metres of the top of the bank of a Designated Watercourse where the slope of the bank exceeds 15%.	With the exception of the removal of vegetation from relict spoil heaps, which will be subsequently levelled and stabilised for the development, the clearing will not involve the removal of native vegetation from land with a slope of 15% or more; or land within a Designated Watercourse or land within 30m of a Designated Watercourse or within 10 metres of the top of the bank of a Designated Watercourse where the slope of the bank exceeds 15%

7.2 IPSWICH PLANNING SCHEME

Part 6(a) of the Information Request issued by Ipswich City Council on 26 April 2018 required that:

'…the applicant is requested to demonstrate how "clearing of vegetation does not cause or exacerbate land degradation within environmentally sensitive areas including steeply sloping land, areas prone to erosion or salinity, riparian corridors, wetlands or water catchment areas". The applicant is therefore requested to submit a vegetation survey in order to demonstrate compliance with sections 4.3.3 (4)(f); 4.3.3(4)(g) of the Urban Areas Code.'(note this reference was subsequently corrected to section 6.7 (j)(a)(d) by ICC).

The only steeply sloping land that will be cleared is relict mine spoil heaps, which are only locally steep as an artifact of their construction. This area will be levelled and stabilised to provide building pads and operational areas for the proposed activities.

No riparian areas or wetlands will be cleared for the proposed development; however, it is recommended that erosion and sedimentation controls are erected to protect the identified waterbodies on adjoining

properties from siltation during construction. The road that passes close to the waterbody to the north of the proposed development site should be formed, battered and drained to protect the waterbody from siltation.

No historic buildings, large mature trees, significant stands of vegetation, skyline elements, vegetated ridgelines or significant views will be affected by the proposed development.

The waterbodies on adjoining Lots will not be directly affected by the proposed activities, and will be protected from siltation and sedimentation during construction and operation of the proposed development.

8 POTENTIAL IMPACTS

No conservation significant plants or animals were observed during the survey. No Endangered Regional Ecosystems or Threatened Ecological Communities were observed during the survey. Generally, the proposed development site provides little habitat opportunity for animals other than small mammals and reptiles, and opportunistic arboreal mammals and scavenger birds.

However, the wetlands adjoining the Lot, and the vegetation on the Lot between the power-line right of way and Six Mile Creek offer habitat and connectivity to a range of terrestrial, arboreal and aquatic animals.

These areas will not be affected by the proposed development. It is unlikely that the proposed development will have an impact on any protected plant or animal species or vegetation association; and it is considered that appropriate management of the undisturbed portion of the site will enhance habitat opportunities for aquatic, terrestrial and arboreal animal species.

9 RECOMMENDATIONS

It is not considered likely that the proposed development will have a significant impact on the ecological values of the site, and will not have an adverse impact on any important local or regional habitat linkages. However, to improve the ecological values on the undeveloped portions of the site it is recommended that:

- Water quality and aquatic habitat values of the dam are protected and maintained through erosion and sediment control measures, and by managing surface runoff contamination and other potential water contamination sources;
- Retained vegetation on the batter and foot slopes of the existing development fill, and within and adjacent to the development site, is protected during construction and development works by a temporary fence and 'no-go' zone;
- A weed control program is implemented to manage State Government listed species on the site, in particular in the vegetation adjacent to the proposed development.

REFERENCES

Clayton P.D., Fielder D.P., Howel, S. and Hill C.J. (2006*). Aquatic Biodiversity Assessment and Mapping Method (AquaBAMM): a conservation values assessment tool for wetlands with trial application in the Burnett River catchment*. Published by the Environmental Protection Agency, Brisbane.

Cropper, S.C. (1993), *Management of Endangered Plants*. CSIRO, East Melbourne.

Department of the Environment, Water, Heritage and the Arts, 2010, Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*

Department of the Environment, Water, Heritage and the Arts, 2010 Survey guidelines for Australia's threatened reptiles: Guidelines for detecting bats listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*

Department of the Environment, Water, Heritage and the Arts, 2010, Survey guidelines for Australia's threatened reptiles: Guidelines for detecting frogs listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*

Department of the Environment, Water, Heritage and the Arts, 2011, Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*

Department of the Environment, Water, Heritage and the Arts, 2011, Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*

Eyre TJ, Ferguson DJ, Hourigan CL, Smith GC, Mathieson MT, Kelly, AL, Venz MF & Hogan, LD. (2012). *Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland*. Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J., 2015, *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2*. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane.

Goff, F.G., Dawson, G.A. and Rochow, J.J. (1982), *Site examination for threatened and endangered plant species*. Environmental Management 6: 307-316.

Neldner, V.J, Wilson, B.A, Thompson, E.J Dillewaard, H.A (2012), *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland,* Department of Science, Information Technology, Innovation and the Arts, Brisbane

Neldner, V.J., Wilson, B.A., Thompson, E.J. and Dillewaard, H.A. (2012) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland. Version 3.2*. Updated August 2012. Queensland Herbarium, Queensland Department of Science, Information Technology, Innovation and the Arts, Brisbane.

Phillips, S, and Callaghan, J, (2011), *The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus*. Zoologist, Vol35 (3) pp 774 – 780.

Slater, P, Slater, P, and Slater, R, 2012 *The Slater Field Guide to Australian Birds, Second Edition*. New Holland Publishers (Australia) Pty. Ltd., Sydney, Australia.

FIGURES

FIGURE 1 THE LOCATION OF THE PROPOSED DEVELOPMENT AT 149 RHONDDA ROAD, NEW CHUM

FIGURE 2 SURROUNDING LANDUSE OF THE PROPOSED DEVELOPMENT SITE

FIGURE 3 LANDSCAPE CONTEXT OF THE PROPOSED DEVELOPMENT SITE

FIGURE 4 FIELD SURVEY TRAVERSE

149 Rhondda Road Lot 273 on SP 128662

Site Details

27°37'14"S 152°50'1"E

27°37'14"S 152°50'35"E



27°37'38"S 152°50'1"E

27°37'38"S 152°50'35"E

A product of Queensland Globe



N

100 metres

Print Date: 29/9/2018
Paper Size: A4

Imagery

includes material © CNES reproduced under licence from Airbus DS, all rights reserved, © 21AT © Earth-i, all rights reserved, 2018

Queensland Government

© State of Queensland 2018
You are responsible for ensuring that the map is suitable for your purposes.
The State of Queensland makes no representation or warranties in relation to the map contents and disclaims all liability.

149 Rhondda Road Lot 273 on SP 128662

Site Details

Legend

Road crossing
- Bridge
- Tunnel

Road
- Highway
- Main
- Local
- Private

Railway

Coastline

Lake

Reservoir

Canal line

Canal area

Watercourse line
- Minor Watercourse
- Major Watercourse
- Minor Culvert
- Major Culvert

Watercourse area
- Perennial
- Non Perennial

Water area edge

Land parcel
- Parcel

Land parcel label

Attribution

DigitalGlobe

includes material © CNES reproduced under licence from Airbus DS, all rights reserved, © 21AT © Earth-i, all rights reserved, 2018

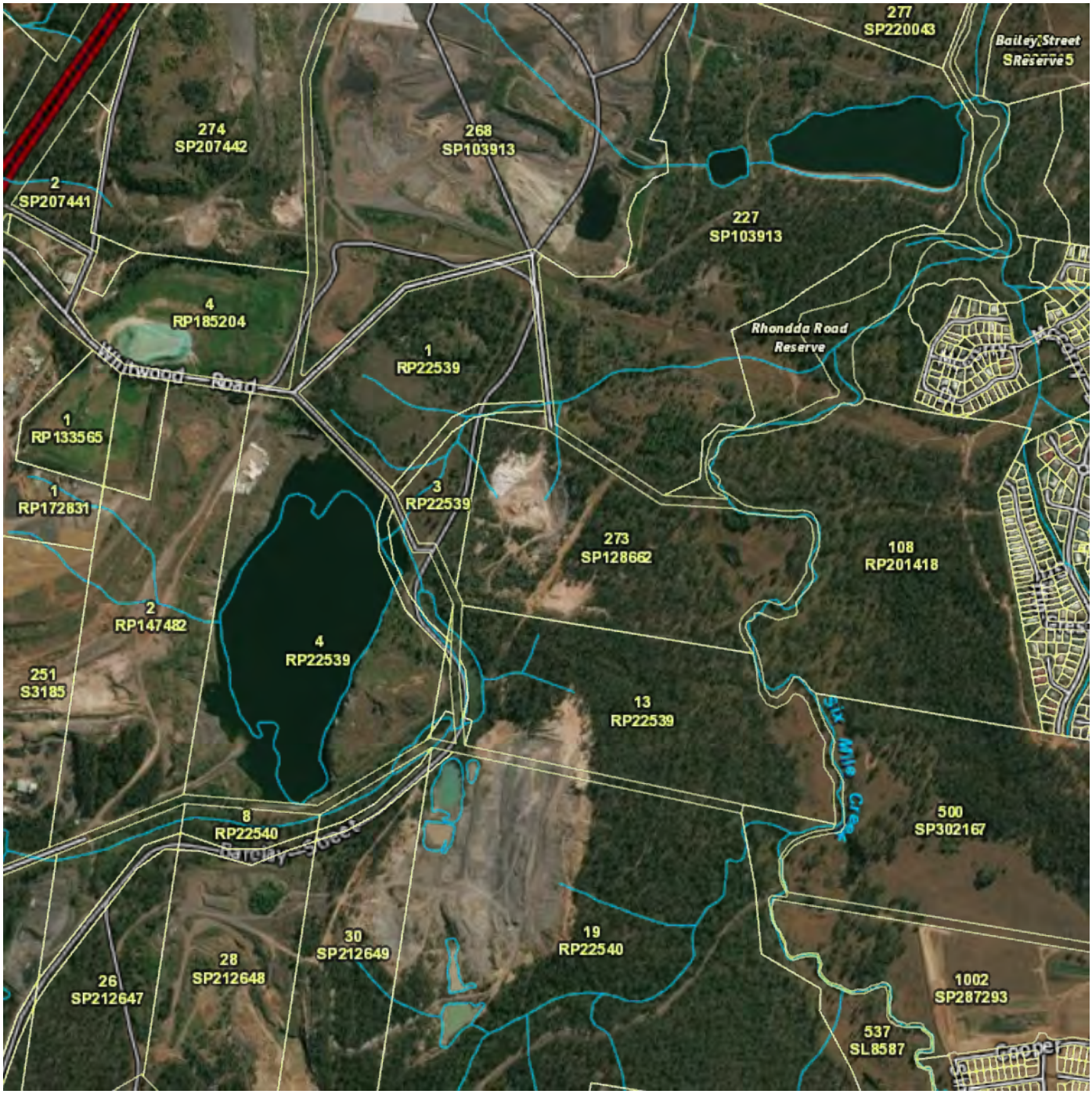
© State of Queensland (Department of Natural Resources, Mines and Energy) 2018

© State of Queensland (Department of Natural Resources and Mines), 2016

149 Rhondda Road

Surrounding Landuse Lot 273 on SP128662

27°36'47"S 152°49'26"E 27°36'47"S 152°50'54"E



27°38'5"S 152°49'26"E 27°38'5"S 152°50'54"E

A product of Queensland Globe



N

250 metres

Print Date: 29/9/2018
Paper Size: A4

Imagery

includes material © CNES reproduced under licence from Airbus DS, all rights reserved, © 21AT © Earth-i, all rights reserved, 2018

Queensland Government

© State of Queensland 2018
You are responsible for ensuring that the map is suitable for your purposes.
The State of Queensland makes no representation or warranties in relation to the map contents and disclaims all liability.

149 Rhondda Road

Surrounding Landuse Lot 273 on SP128662

Legend

Road

- Highway
- Main
- Local
- Private

Coastline

Lake

Reservoir

Canal line

Canal area

Watercourse line

- Minor Watercourse
- Major Watercourse
- Minor Culvert
- Major Culvert

Water area edge

Watercourse area

- Perennial
- Non Perennial

Railway

Land parcel

- Parcel

Land parcel label

Cities and Towns

Attribution

DigitalGlobe

© State of Queensland (Department of Natural Resources, Mines and Energy) 2018

© State of Queensland (Department of Natural Resources and Mines), 2016

149 Rhondda Road

Broad Environmental Context

27°35'47"S 152°47'58"E 27°35'47"S 152°55'17"E



27°42'16"S 152°47'58"E 27°42'16"S 152°55'17"E

A product of Queensland Globe



N

1 km

Print Date: 29/9/2018
Paper Size: A4

Imagery

includes material © CNES reproduced under licence from Airbus DS, all rights reserved, © 21AT © Earth-i, all rights reserved, 2018

Queensland Government

© State of Queensland 2018
You are responsible for ensuring that the map is suitable for your purposes.
The State of Queensland makes no representation or warranties in relation to the map contents and disclaims all liability.

149 Rhondda Road

Broad Environmental Context

Legend

Road

- Highway
- Main
- Local
- Private

Coastline

Lake

Reservoir

Canal area

Watercourse line

- Minor Watercourse
- Major Watercourse
- Minor Culvert
- Major Culvert

Watercourse area

- Perennial
- Non Perennial

Land parcel label - gt 1 ha

Water area edge

Railway

Land parcel - gt 1 ha

- Parcel

Cities and Towns

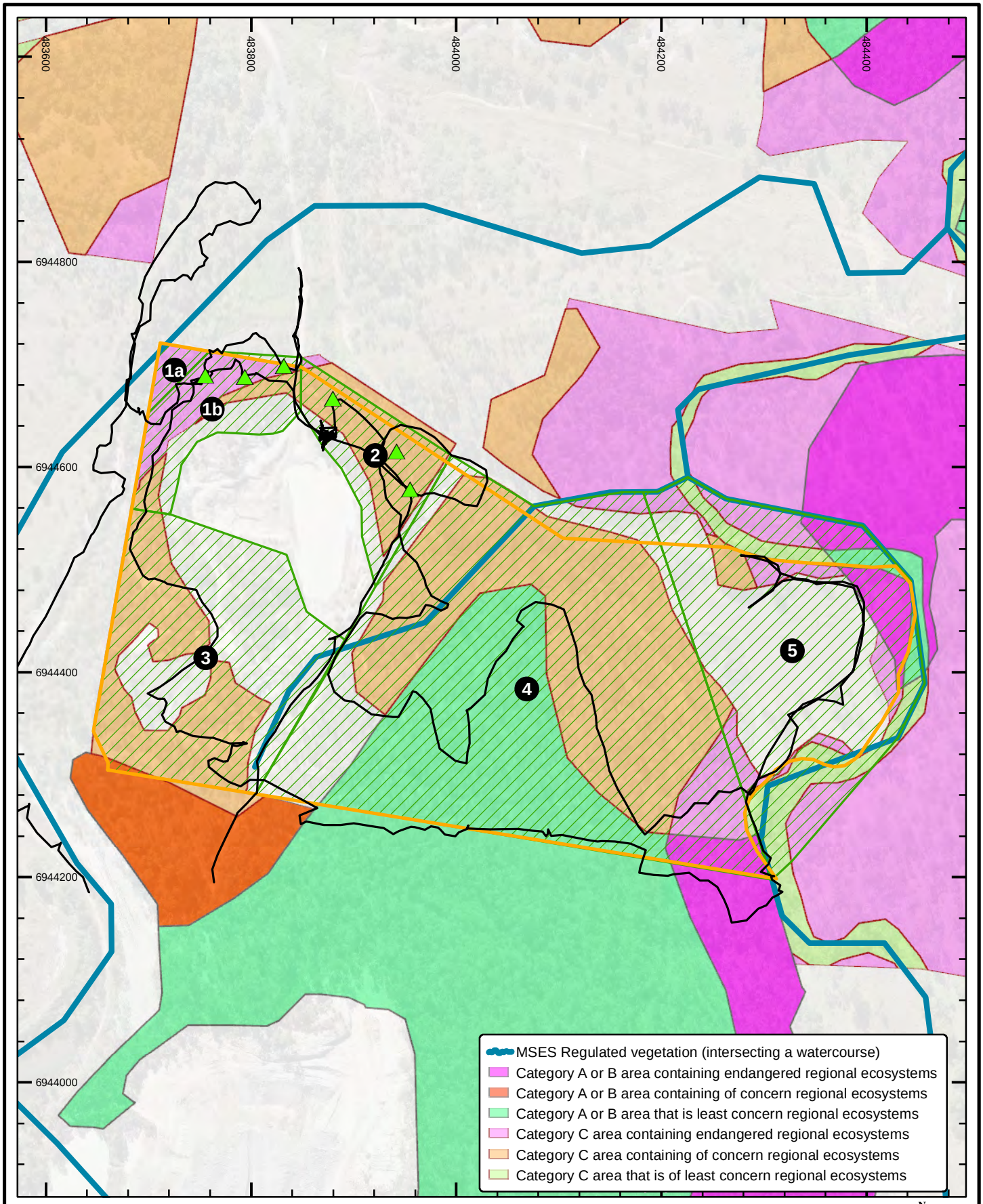
Attribution

Earthstar Geographics

includes material © CNES reproduced under licence from Airbus DS, all rights reserved, © 21AT © Earth-i, all rights reserved, 2018

© State of Queensland (Department of Natural Resources, Mines and Energy) 2018

© State of Queensland (Department of Natural Resources and Mines), 2016



JACKAL RENEWABLES PTY LTD

Lot 73 on SP 128662

GDA94, MGA Zone 56

ARDENT GROUP PTY LTD

Field and Habitat Assessment

Figure 4

Sheet No. ADMG_ARD_JKRGEN_MAP_0015_B

Drawn By: Chris Schlebusch

Requested by: Richard Davis

Date: 18/10/2018

Legend

- 73 SP128662
- Property boundary
- GPS Tracklog (2018-09-28)
- Habitat Area (boundaries approximate)
- SAT Survey Site

Data sources:
Qld Department of Natural Resources, Mines & Energy, Geoscience Australia

Path: S:\Plans\Project_Specific\Ardent\JKRGEN\ADMG_ARD_JKRGEN_MAP_0015_B Field and Habitat Assessment.mxd

APPENDIX I

IPSWICH CITY COUNCIL CITY PLAN REPORT AND MAPS

Property Details

149 Rhondda Road NEW CHUM QLD 4303

Details

Property Number: 245135
Lot RPD: Lot 273 SP 128662
Land Number(s): **123721**
Division 3

Valuations

Land Valuation:

Dimension

Area: 25.38 Ha

Zoning

RBIA02 - Regional Bus & Industry Investigation (New Chum)
REC - Recreation

Applications

No applications recorded against this property.

Constraints

Constraints applied against a property or land.
Parcel Conditions
OV2-Key Resource Area Overlay - 18/10/2006
OV2-Known Resources Overlay - 18/10/2006
OV2-Mining Leases - 20/11/2013
OV3-Mining Influence Area Overlay - 05/04/2004
OV4-Difficult Topography Overlay - 05/04/2004
OV5-Adopted Flood Regulation Line - 29/09/2014
OV5-Flood Development Line 1 in 20 - 29/09/2014
OV5-Urban Catchment Flow Path - 29/09/2014
OV7A-90m Building Height Restriction Overlay - 05/04/2004

Map

Select map layers from the drop-down list below:

1 - Base Map



To Print: Right click on map image and select "Print Picture..."

To obtain a property certificate for this property, click the link below:

Property Certificate

Contact us

APPENDIX II

SITE LAYOUT PLAN FOR 149 RHONDDA ROAD, NEW CHUM, DRAWING NUMBER C1 DEVELOPMENT PLAN

20m BUFFER

PROPOSED SITE ENTRANCE.
(CURRENT ENTRANCE).

RHONDDA ROAD

20m BUFFER TO SITE BOUNDARY TYP UNO.

CENTRELINE OF INTERNAL ROADWAY IS LOCATED 25m FROM BOUNDARIES TYP

25.0m

TOP OF PROPOSED BANK

TOP OF PROPOSED BANK

EXISTING CLAY PIT

PROPOSED PROCESSING PAD.
7100m2 OPEN HARDSTAND.

INTERNAL TRAFFIC FLOW

20m BUFFER

WEIGHBRIDGE (OUT)

COGENERATION AREA 60mX30mX6m HIGH COVERED ROOF

WORKSHOP SHED 20mX20m x 6m HIGH

PROPOSED INTERNAL ROADWAY 5.0m GRAVEL PAVEMENT

LOT 73 on SP128662

EXISTING CONTOURS (LIDAR 2014).

PROCESSING AREA 36m X 18m OPEN HARDSTAND

RESOURCE RECOVERY STATION 36m X 18m SHED 10m HIGH

DEPRESSION

CARETAKERS RESIDENCE 13x7m.

OFFICE

W/R

47 CARPARKS

WEIGHBRIDGE (IN)

20m BUFFER

20m BUFFER TO MINE LEASE BOUNDARY.

MINING LEASE EASTERN BOUNDARY (ML50070)

EASTERN BOUNDARY OF OF SITE (SIX MILE CREEK).

N

LEGEND

34.0 EXISTING SURFACE CONTOURS

PROCESSING PAD 7100m2
UNCOVERED HARDSTAND AREA.

COGEN PLANT AREA
COVERED ROOF 60mX30mX6m HIGH
OPEN WALLS. BUNDED CONCRETE
SLAB UNDER 60mX30m.

RESOURCE RECOVERY STATION
COVERED ROOF 36mX18mX10m HIGH WITH
WALL TO SOUTH–WEST WALL – OTHER WALLS
WITH 3m SKIRTS. SLAB UNDER 36mX18m.

PROCESSING AREA
UNCOVERED HARDSTAND AREA 36mX18m.

WORKSHOP
ENCLOSED COVERED SHEETMETAL BUILDING
20mX20mX6m HIGH. CONCRETE FLOOR SLAB.

WEIGHBRIDGES
2 WEIGHBRIDGES EACH 30mX4m.

FACILITIES
DEMOUNTABLE TYPE BUILDINGS:
OFFICE: 12mX3mX3m HIGH
LUNCH ROOM: 7mX3mX3m HIGH
TOILETS: 6mX3mX3m HIGH

CARETAKERS RESIDENCE
DEMOUNTABLE TYPE BUILDING:
12mX7mX3m HIGH

DEVELOPMENT PLAN

SCALE 1:1000 0 20 40 60 80 100m

HUNT MICHEL & PARTNERS
24 DARLING STREET IPSWICH Q 4305
CONSULTING CHARTERED ENGINEERS
CIVIL AND STRUCTURAL
A.B.N. 75 074 746 599
PH 3812 2399
FAX 3812 1900

CLIENT
JACKAL RENEWABLES PTY LTD

PROJECT
PROPOSED DEVELOPMENT
149 RHONDDA ST NEW CHUM

DRAWING TITLE
DEVELOPMENT PLAN
SITE LAYOUT PLAN

REV		DATE	REV		DATE

APPROVED: RPEQ 3766
DIRECTOR HUNT MICHEL & PARTNERS

DESIGNED:	D.A.	JOB No.	218010
DRAWN:	D.A.		
CHECKED:	D.M.	DWG No.	C1
SCALE:	1:1000 AT A1		
DATE:			

APPENDIX III

MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE UNDER THE EPBC ACT

Australian Government
Department of the Environment and Energy

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.

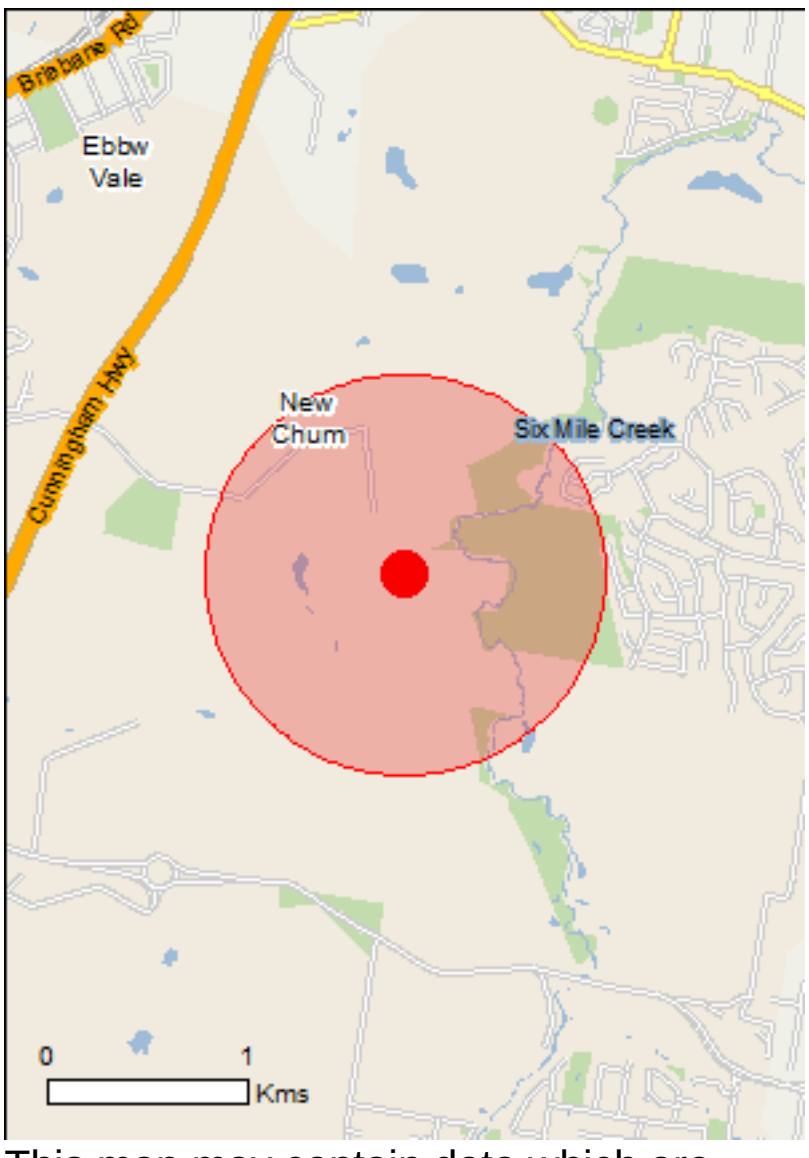
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 27/09/18 08:36:18

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

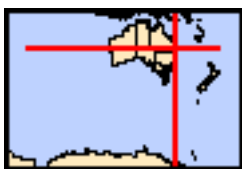
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 1.0Km



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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	31
Listed Migratory Species:	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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

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.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	22
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	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:	None
Regional Forest Agreements:	None
Invasive Species:	33
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

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.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Insects		
Argynnis hyperbius inconstans Australian Fritillary [88056]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Bosistoa transversa Three-leaved Bosistoa, Yellow Satinheart [16091]	Vulnerable	Species or species habitat likely to occur within area
Cycas ophiolitica [55797]	Endangered	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Notelaea ipsviciensis Cooneana Olive [81858]	Critically Endangered	Species or species habitat likely to occur within area
Notelaea lloydii Lloyd's Olive [15002]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Samadera bidwillii		
Quassia [29708]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Delma torquata		
Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat likely to occur within area
Furina dunmalli		
Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata		
Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		

Name	Status	Type of Presence
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat may occur within area

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 and National Heritage properties, Wetlands of International and National 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.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

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.

Coordinates

-27.624 152.8378

Acknowledgements

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

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-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, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

© Commonwealth of Australia
Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

APPENDIX IV

WILDNET ONLINE REPORT

Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Status: All
Records: All
Date: All
Latitude: -27.624
Longitude: 152.8378
Distance: 5
Email: sticksandstonesenv@bigpond.com
Date submitted: Saturday 29 Sep 2018 11:53:00
Date extracted: Saturday 29 Sep 2018 12:00:02

The number of records retrieved = 1000

Disclaimer

As the DSITIA 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	Bufonidae	*Rhinella marina*	cane toad	Y			51/1
animals	amphibians	Hylidae	*Litoria nasuta*	striped rocketfrog		C		8
animals	amphibians	Hylidae	*Litoria dentata*	bleating treefrog		C		9
animals	amphibians	Hylidae	*Litoria peronii*	emerald spotted treefrog		C		3
animals	amphibians	Hylidae	*Litoria rubella*	ruddy treefrog		C		17
animals	amphibians	Hylidae	*Litoria wilcoxii*	eastern stony creek frog		C		1
animals	amphibians	Hylidae	*Litoria gracilenta*	graceful treefrog		C		23
animals	amphibians	Hylidae	*Litoria latopalmata*	broad palmed rocketfrog		C		7
animals	amphibians	Hylidae	*Litoria brevipalmata*	green thighed frog		C		3
animals	amphibians	Hylidae	*Cyclorana alboguttata*	greenstripe frog		C		1
animals	amphibians	Hylidae	*Litoria fallax*	eastern sedgefrog		C		40
animals	amphibians	Hylidae	*Litoria caerulea*	common green treefrog		C		48
animals	amphibians	Limnodynastidae	*Limnodynastes tasmaniensis*	spotted grassfrog		C		4
animals	amphibians	Limnodynastidae	*Limnodynastes terraereginae*	scarlet sided pobblebonk		C		15
animals	amphibians	Limnodynastidae	*Platyplectrum ornatum*	ornate burrowing frog		C		23
animals	amphibians	Limnodynastidae	*Limnodynastes peronii*	striped marshfrog		C		27
animals	amphibians	Limnodynastidae	*Adelotus brevis*	tusked frog		V		6
animals	amphibians	Myobatrachidae	*Pseudophryne raveni*	copper backed broodfrog		C		4/1
animals	amphibians	Myobatrachidae	*Crinia parinsignifera*	beeping froglet		C		11
animals	amphibians	Myobatrachidae	*Mixophyes fasciolatus*	great barred frog		C		5
animals	amphibians	Myobatrachidae	*Pseudophryne coriacea*	red backed broodfrog		C		2
animals	amphibians	Myobatrachidae	*Uperoleia sp.*					1
animals	amphibians	Myobatrachidae	*Uperoleia rugosa*	chubby gungan		C		2
animals	amphibians	Myobatrachidae	*Crinia signifera*	clicking froglet		C		2
animals	amphibians	Myobatrachidae	*Uperoleia fusca*	dusky gungan		C		2
animals	amphibians	Myobatrachidae	*Pseudophryne major*	great brown broodfrog		C		1
animals	birds	Acanthizidae	*Smicrornis brevirostris*	weebill		C		30
animals	birds	Acanthizidae	*Chthonicola sagittata*	speckled warbler		C		15
animals	birds	Acanthizidae	*Acanthiza nana*	yellow thornbill		C		2
animals	birds	Acanthizidae	*Gerygone mouki*	brown gerygone		C		3
animals	birds	Acanthizidae	*Acanthiza chrysorrhoa*	yellow-rumped thornbill		C		9
animals	birds	Acanthizidae	*Acanthiza pusilla*	brown thornbill		C		5
animals	birds	Acanthizidae	*Gerygone olivacea*	white-throated gerygone		C		46
animals	birds	Acanthizidae	*Acanthiza reguloides*	buff-rumped thornbill		C		8
animals	birds	Acanthizidae	*Sericornis frontalis*	white-browed scrubwren		C		21
animals	birds	Acanthizidae	*Acanthiza lineata*	striated thornbill		C		2
animals	birds	Accipitridae	*Milvus migrans*	black kite		C		6
animals	birds	Accipitridae	*Erythrotriorchis radiatus*	red goshawk		E	V	1
animals	birds	Accipitridae	*Accipiter novaehollandiae*	grey goshawk		C		4
animals	birds	Accipitridae	*Aquila audax*	wedge-tailed eagle		C		26
animals	birds	Accipitridae	*Haliastur indus*	brahminy kite		C		12
animals	birds	Accipitridae	*Circus assimilis*	spotted harrier		C		1
animals	birds	Accipitridae	*Elanus axillaris*	black-shouldered kite		C		20
animals	birds	Accipitridae	*Circus approximans*	swamp harrier		C		3
animals	birds	Accipitridae	*Lophoictinia isura*	square-tailed kite		C		2
animals	birds	Accipitridae	*Accipiter fasciatus*	brown goshawk		C		12

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Accipitridae	*Aviceda subcristata*	Pacific baza		C		10
animals	birds	Accipitridae	*Haliastur sphenurus*	whistling kite		C		17
animals	birds	Accipitridae	*Haliaeetus leucogaster*	white-bellied sea-eagle		C		13
animals	birds	Accipitridae	*Hieraaetus morphnoides*	little eagle		C		1
animals	birds	Accipitridae	*Accipiter cirrocephalus*	collared sparrowhawk		C		4
animals	birds	Acrocephalidae	*Acrocephalus australis*	Australian reed-warbler		C		25
animals	birds	Aegothelidae	*Aegotheles cristatus*	Australian owlet-nightjar		C		12
animals	birds	Alcedinidae	*Ceyx azureus*	azure kingfisher		C		16
animals	birds	Anatidae	*Anas sp.*					2
animals	birds	Anatidae	*Anas castanea*	chestnut teal		C		4
animals	birds	Anatidae	*Anas gracilis*	grey teal		C		13
animals	birds	Anatidae	*Cygnus atratus*	black swan		C		10
animals	birds	Anatidae	*Anas rhynchotis*	Australasian shoveler		C		1
animals	birds	Anatidae	*Aythya australis*	hardhead		C		16
animals	birds	Anatidae	*Anas superciliosa*	Pacific black duck		C		67
animals	birds	Anatidae	*Chenonetta jubata*	Australian wood duck		C		78
animals	birds	Anatidae	*Anas platyrhynchos*	northern mallard	Y			1
animals	birds	Anatidae	*Dendrocygna eytoni*	plumed whistling-duck		C		3
animals	birds	Anatidae	*Dendrocygna arcuata*	wandering whistling-duck		C		2
animals	birds	Anatidae	*Stictonetta naevosa*	freckled duck		C		1
animals	birds	Anhingidae	*Anhinga novaehollandiae*	Australasian darter		C		25
animals	birds	Anseranatidae	*Anseranas semipalmata*	magpie goose		C		6
animals	birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail		SL		4
animals	birds	Ardeidae	*Egretta garzetta*	little egret		C		4
animals	birds	Ardeidae	*Butorides striata*	striated heron		C		2
animals	birds	Ardeidae	*Ardea intermedia*	intermediate egret		C		13
animals	birds	Ardeidae	*Ardea pacifica*	white-necked heron		C		13
animals	birds	Ardeidae	*Bubulcus ibis*	cattle egret		C		48
animals	birds	Ardeidae	*Ardea alba modesta*	eastern great egret		C		7
animals	birds	Ardeidae	*Egretta novaehollandiae*	white-faced heron		C		38
animals	birds	Ardeidae	*Nycticorax caledonicus*	nankeen night-heron		C		5
animals	birds	Artamidae	*Cracticus tibicen*	Australian magpie		C		147
animals	birds	Artamidae	*Strepera graculina*	pied currawong		C		17
animals	birds	Artamidae	*Artamus cyanopterus*	dusky woodswallow		C		6
animals	birds	Artamidae	*Cracticus torquatus*	grey butcherbird		C		61
animals	birds	Artamidae	*Artamus superciliosus*	white-browed woodswallow		C		2
animals	birds	Artamidae	*Artamus leucorynchus*	white-breasted woodswallow		C		9
animals	birds	Artamidae	*Cracticus nigrogularis*	pied butcherbird		C		95
animals	birds	Burhinidae	*Burhinus grallarius*	bush stone-curlew		C		6/1
animals	birds	Cacatuidae	*Cacatua sanguinea*	little corella		C		33
animals	birds	Cacatuidae	*Eolophus roseicapilla*	galah		C		108
animals	birds	Cacatuidae	*Nymphicus hollandicus*	cockatiel		C		2
animals	birds	Cacatuidae	*Cacatua galerita*	sulphur-crested cockatoo		C		64
animals	birds	Cacatuidae	*Cacatua tenuirostris*	long-billed corella	Y	C		3
animals	birds	Campephagidae	*Lalage tricolor*	white-winged triller		C		4
animals	birds	Campephagidae	*Coracina maxima*	ground cuckoo-shrike		C		2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Campephagidae	*Coracina tenuirostris*	cicadabird		C		21
animals	birds	Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike		C		138
animals	birds	Campephagidae	*Coracina papuensis*	white-bellied cuckoo-shrike		C		7
animals	birds	Campephagidae	*Lalage leucomela*	varied triller		C		1
animals	birds	Charadriidae	*Vanellus miles novaehollandiae*	masked lapwing (southern subspecies)		C		76
animals	birds	Charadriidae	*Vanellus miles*	masked lapwing		C		15
animals	birds	Charadriidae	*Erythrogonys cinctus*	red-kneed dotterel		C		4
animals	birds	Charadriidae	*Elseyornis melanops*	black-fronted dotterel		C		12
animals	birds	Ciconiidae	*Ephippiorhynchus asiaticus*	black-necked stork		C		6
animals	birds	Cisticolidae	*Cisticola exilis*	golden-headed cisticola		C		79
animals	birds	Climacteridae	*Cormobates leucophaea metastasis*	white-throated treecreeper (southern)		C		27
animals	birds	Columbidae	*Geopelia striata*	peaceful dove		C		42
animals	birds	Columbidae	*Ocyphaps lophotes*	crested pigeon		C		100
animals	birds	Columbidae	*Phaps chalcoptera*	common bronzewing		C		7
animals	birds	Columbidae	*Chalcophaps indica*	emerald dove		C		1
animals	birds	Columbidae	*Geopelia humeralis*	bar-shouldered dove		C		42
animals	birds	Columbidae	*Macropygia amboinensis*	brown cuckoo-dove		C		8
animals	birds	Columbidae	*Streptopelia chinensis*	spotted dove	Y			62
animals	birds	Columbidae	*Geopelia cuneata*	diamond dove		C		1
animals	birds	Columbidae	*Lopholaimus antarcticus*	topknot pigeon		C		6
animals	birds	Columbidae	*Leucosarcia melanoleuca*	wonga pigeon		C		1
animals	birds	Columbidae	*Columba livia*	rock dove	Y			27
animals	birds	Coraciidae	*Eurystomus orientalis*	dollarbird		C		59
animals	birds	Corcoracidae	*Struthidea cinerea*	apostlebird		C		2
animals	birds	Corvidae	*Corvus coronoides*	Australian raven		C		2
animals	birds	Corvidae	*Corvus orru*	Torresian crow		C		214
animals	birds	Cuculidae	*Cacomantis variolosus*	brush cuckoo		C		9
animals	birds	Cuculidae	*Eudynamys orientalis*	eastern koel		C		31
animals	birds	Cuculidae	*Cacomantis pallidus*	pallid cuckoo		C		7
animals	birds	Cuculidae	*Chalcites lucidus*	shining bronze-cuckoo		C		6
animals	birds	Cuculidae	*Chalcites basalis*	Horsfield's bronze-cuckoo		C		10
animals	birds	Cuculidae	*Cuculus optatus*	oriental cuckoo		SL		1
animals	birds	Cuculidae	*Chalcites minutillus barnardi*	little bronze-cuckoo		C		1
animals	birds	Cuculidae	*Scythrops novaehollandiae*	channel-billed cuckoo		C		31
animals	birds	Cuculidae	*Centropus phasianinus*	pheasant coucal		C		39
animals	birds	Cuculidae	*Cacomantis flabelliformis*	fan-tailed cuckoo		C		32
animals	birds	Dicruridae	*Dicrurus bracteatus bracteatus*	spangled drongo (eastern Australia)		C		1
animals	birds	Dicruridae	*Dicrurus bracteatus*	spangled drongo		C		33
animals	birds	Estrildidae	*Neochmia temporalis*	red-browed finch		C		28
animals	birds	Estrildidae	*Lonchura punctulata*	nutmeg mannikin	Y			4
animals	birds	Estrildidae	*Lonchura castaneothorax*	chestnut-breasted mannikin		C		32
animals	birds	Estrildidae	*Taeniopygia bichenovii*	double-barred finch		C		58
animals	birds	Eurostopodidae	*Eurostopodus mystacalis*	white-throated nightjar		C		8
animals	birds	Falconidae	*Falco berigora*	brown falcon		C		5
animals	birds	Falconidae	*Falco subniger*	black falcon		C		1
animals	birds	Falconidae	*Falco longipennis*	Australian hobby		C		3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Falconidae	*Falco cenchroides*	nankeen kestrel		C		22
animals	birds	Falconidae	*Falco peregrinus*	peregrine falcon		C		10
animals	birds	Halcyonidae	*Todiramphus macleayii*	forest kingfisher		C		19
animals	birds	Halcyonidae	*Todiramphus sanctus*	sacred kingfisher		C		59
animals	birds	Halcyonidae	*Dacelo novaeguineae*	laughing kookaburra		C		95
animals	birds	Hirundinidae	*Cheramoeca leucosterna*	white-backed swallow		C		9
animals	birds	Hirundinidae	*Petrochelidon ariel*	fairy martin		C		43
animals	birds	Hirundinidae	*Petrochelidon nigricans*	tree martin		C		28
animals	birds	Hirundinidae	*Hirundo neoxena*	welcome swallow		C		117
animals	birds	Jacanidae	*Irediparra gallinacea*	comb-crested jacana		C		7
animals	birds	Laridae	*Chlidonias hybrida*	whiskered tern		C		1
animals	birds	Laridae	*Chroicocephalus novaehollandiae*	silver gull		C		1
animals	birds	Laridae	*Sternula albifrons*	little tern		SL		1
animals	birds	Maluridae	*Malurus cyaneus*	superb fairy-wren		C		54
animals	birds	Maluridae	*Malurus lamberti*	variegated fairy-wren		C		34
animals	birds	Maluridae	*Malurus melanocephalus*	red-backed fairy-wren		C		103
animals	birds	Megaluridae	*Cincloramphus mathewsi*	rufous songlark		C		2
animals	birds	Megaluridae	*Cincloramphus cruralis*	brown songlark		C		5
animals	birds	Megaluridae	*Megalurus timoriensis*	tawny grassbird		C		26
animals	birds	Megaluridae	*Megalurus gramineus*	little grassbird		C		5
animals	birds	Megapodiidae	*Alectura lathami*	Australian brush-turkey		C		10
animals	birds	Meliphagidae	*Melithreptus albogularis*	white-throated honeyeater		C		56
animals	birds	Meliphagidae	*Plectorhyncha lanceolata*	striped honeyeater		C		7
animals	birds	Meliphagidae	*Acanthorhynchus tenuirostris*	eastern spinebill		C		3
animals	birds	Meliphagidae	*Anthochaera carunculata*	red wattlebird		C		1
animals	birds	Meliphagidae	*Anthochaera chrysoptera*	little wattlebird		C		2
animals	birds	Meliphagidae	*Manorina melanocephala*	noisy miner		C		135
animals	birds	Meliphagidae	*Myzomela sanguinolenta*	scarlet honeyeater		C		61
animals	birds	Meliphagidae	*Philemon citreogularis*	little friarbird		C		17
animals	birds	Meliphagidae	*Manorina melanophrys*	bell miner		C		1
animals	birds	Meliphagidae	*Lichmera indistincta*	brown honeyeater		C		100
animals	birds	Meliphagidae	*Entomyzon cyanotis*	blue-faced honeyeater		C		29
animals	birds	Meliphagidae	*Caligavis chrysops*	yellow-faced honeyeater		C		53
animals	birds	Meliphagidae	*Melithreptus gularis*	black-chinned honeyeater		C		10
animals	birds	Meliphagidae	*Melithreptus lunatus*	white-naped honeyeater		C		2
animals	birds	Meliphagidae	*Philemon corniculatus*	noisy friarbird		C		74
animals	birds	Meliphagidae	*Lichenostomus melanops*	yellow-tufted honeyeater		C		11
animals	birds	Meliphagidae	*Ptilotula fusca*	fuscous honeyeater		C		28
animals	birds	Meliphagidae	*Meliphaga lewinii*	Lewin's honeyeater		C		17
animals	birds	Meropidae	*Merops ornatus*	rainbow bee-eater		C		74
animals	birds	Monarchidae	*Myiagra rubecula*	leaden flycatcher		C		18
animals	birds	Monarchidae	*Myiagra inquieta*	restless flycatcher		C		2
animals	birds	Monarchidae	*Monarcha sp.*					1
animals	birds	Monarchidae	*Monarcha melanopsis*	black-faced monarch		SL		2
animals	birds	Monarchidae	*Grallina cyanoleuca*	magpie-lark		C		127
animals	birds	Monarchidae	*Myiagra cyanoleuca*	satin flycatcher		SL		3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Motacillidae	*Anthus novaeseelandiae*	Australasian pipit		C		20
animals	birds	Nectariniidae	*Dicaeum hirundinaceum*	mistletoebird		C		58
animals	birds	Neosittidae	*Daphoenositta chrysoptera*	varied sittella		C		26
animals	birds	Oriolidae	*Sphecotheres vieilloti*	Australasian figbird		C		66
animals	birds	Oriolidae	*Oriolus sagittatus*	olive-backed oriole		C		29
animals	birds	Pachycephalidae	*Falcunculus frontatus*	crested shrike-tit		C		1
animals	birds	Pachycephalidae	*Colluricincla megarhyncha*	little shrike-thrush		C		1
animals	birds	Pachycephalidae	*Pachycephala rufiventris*	rufous whistler		C		55
animals	birds	Pachycephalidae	*Pachycephala pectoralis*	golden whistler		C		33
animals	birds	Pachycephalidae	*Colluricincla harmonica*	grey shrike-thrush		C		45
animals	birds	Pardalotidae	*Pardalotus striatus*	striated pardalote		C		109
animals	birds	Pardalotidae	*Pardalotus punctatus*	spotted pardalote		C		16
animals	birds	Passeridae	*Passer domesticus*	house sparrow	Y			20
animals	birds	Pelecanidae	*Pelecanus conspicillatus*	Australian pelican		C		21
animals	birds	Petroicidae	*Petroica rosea*	rose robin		C		22
animals	birds	Petroicidae	*Microeca fascinans*	jacky winter		C		9
animals	birds	Petroicidae	*Eopsaltria australis*	eastern yellow robin		C		24
animals	birds	Phaethontidae	*Phaethon lepturus*	white-tailed tropicbird		SL		1/1
animals	birds	Phalacrocoracidae	*Phalacrocorax sulcirostris*	little black cormorant		C		26
animals	birds	Phalacrocoracidae	*Microcarbo melanoleucos*	little pied cormorant		C		35
animals	birds	Phalacrocoracidae	*Phalacrocorax varius*	pied cormorant		C		14
animals	birds	Phalacrocoracidae	*Phalacrocorax carbo*	great cormorant		C		7
animals	birds	Phasianidae	*Coturnix ypsilophora*	brown quail		C		15
animals	birds	Phasianidae	*Coturnix pectoralis*	stubble quail		C		2
animals	birds	Podargidae	*Podargus strigoides*	tawny frogmouth		C		32
animals	birds	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian grebe		C		24
animals	birds	Podicipedidae	*Podiceps cristatus*	great crested grebe		C		9
animals	birds	Pomatostomidae	*Pomatostomus temporalis*	grey-crowned babbler		C		6
animals	birds	Psittacidae	*Platycercus adscitus palliceps*	pale-headed rosella (southern form)		C		3
animals	birds	Psittacidae	*Trichoglossus haematodus moluccanus*	rainbow lorikeet		C		136
animals	birds	Psittacidae	*Lathamus discolor*	swift parrot		E	CE	1
animals	birds	Psittacidae	*Neophema pulchella*	turquoise parrot		C		1
animals	birds	Psittacidae	*Barnardius zonarius*	Australian ringneck		C		4
animals	birds	Psittacidae	*Parvipsitta pusilla*	little lorikeet		C		52
animals	birds	Psittacidae	*Platycercus elegans*	crimson rosella		C		4
animals	birds	Psittacidae	*Platycercus eximius*	eastern rosella		C		2
animals	birds	Psittacidae	*Alisterus scapularis*	Australian king-parrot		C		5
animals	birds	Psittacidae	*Platycercus adscitus*	pale-headed rosella		C		144
animals	birds	Psittacidae	*Melopsittacus undulatus*	budgerigar		C		2
animals	birds	Psittacidae	*Trichoglossus chlorolepidotus*	scaly-breasted lorikeet		C		150
animals	birds	Psophodidae	*Psophodes olivaceus*	eastern whipbird		C		38
animals	birds	Psophodidae	*Cinclosoma punctatum*	spotted quail-thrush		C		5
animals	birds	Rallidae	*Lewinia pectoralis*	Lewin's rail		C		4
animals	birds	Rallidae	*Gallirallus philippensis*	buff-banded rail		C		3
animals	birds	Rallidae	*Amaurornis moluccana*	pale-vented bush-hen		C		1
animals	birds	Rallidae	*Porphyrio melanotus*	purple swamphen		C		32

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Rallidae	*Gallinula tenebrosa*	dusky moorhen		C		46
animals	birds	Rallidae	*Porzana tabuensis*	spotless crake		C		6
animals	birds	Rallidae	*Porzana fluminea*	Australian spotted crake		C		6
animals	birds	Rallidae	*Porzana pusilla*	Baillon's crake		C		12
animals	birds	Rallidae	*Fulica atra*	Eurasian coot		C		18
animals	birds	Recurvirostridae	*Himantopus himantopus*	black-winged stilt		C		13
animals	birds	Rhipiduridae	*Rhipidura albiscapa*	grey fantail		C		63
animals	birds	Rhipiduridae	*Rhipidura leucophrys*	willie wagtail		C		132
animals	birds	Rhipiduridae	*Rhipidura rufifrons*	rufous fantail		SL		10
animals	birds	Rhipiduridae	*Rhipidura leucophrys leucophrys*	willie wagtail (southern)		C		1
animals	birds	Rostratulidae	*Rostratula australis*	Australian painted snipe		V	E	6
animals	birds	Scolopacidae	*Gallinago hardwickii*	Latham's snipe		SL		4
animals	birds	Scolopacidae	*Calidris acuminata*	sharp-tailed sandpiper		SL		1
animals	birds	Scolopacidae	*Tringa stagnatilis*	marsh sandpiper		SL		1
animals	birds	Scolopacidae	*Limosa limosa*	black-tailed godwit		SL		3
animals	birds	Scolopacidae	*Actitis hypoleucos*	common sandpiper		SL		8
animals	birds	Strigidae	*Ninox strenua*	powerful owl		V		2
animals	birds	Strigidae	*Ninox boobook*	southern boobook		C		24
animals	birds	Sturnidae	*Sturnus vulgaris*	common starling	Y			47
animals	birds	Sturnidae	*Acridotheres tristis*	common myna	Y			69
animals	birds	Threskiornithidae	*Threskiornis molucca*	Australian white ibis		C		20
animals	birds	Threskiornithidae	*Plegadis falcinellus*	glossy ibis		SL		1
animals	birds	Threskiornithidae	*Threskiornis spinicollis*	straw-necked ibis		C		38
animals	birds	Threskiornithidae	*Platalea flavipes*	yellow-billed spoonbill		C		9
animals	birds	Threskiornithidae	*Platalea regia*	royal spoonbill		C		11
animals	birds	Timaliidae	*Zosterops lateralis cornwalli*	silvereye (eastern)		C		1
animals	birds	Timaliidae	*Zosterops lateralis*	silvereye		C		126
animals	birds	Turnicidae	*Turnix maculosus*	red-backed button-quail		C		2
animals	birds	Turnicidae	*Turnix melanogaster*	black-breasted button-quail		V	V	2
animals	birds	Turnicidae	*Turnix varius*	painted button-quail		C		5
animals	birds	Tytonidae	*Tyto novaehollandiae*	masked owl		C		1
animals	birds	Tytonidae	*Tyto delicatula*	eastern barn owl		C		3
animals	birds	Tytonidae	*Tyto novaehollandiae novaehollandiae*	masked owl (southern subspecies)		C		1
animals	cartilaginous fishes	Dasyatidae	*Hemitrygon fluviorum*	estuary stingray		NT		1
animals	insects	Aeshnidae	*Adversaeschna brevistyla*	blue-spotted hawker				1
animals	insects	Aeshnidae	*Anax papuensis*	Australian Emperor				1
animals	insects	Coenagrionidae	*Ischnura heterosticta heterosticta*	common bluetail				1
animals	insects	Corduliidae	*Hemicordulia australiae*	Australian emerald				1
animals	insects	Corduliidae	*Hemicordulia continentalis*	fat-bellied emerald				1
animals	insects	Hesperiidae	*Suniana sunias rectivitta*	wide-brand grass-dart				1
animals	insects	Hesperiidae	*Toxidia peron*	dingy grass-skipper				1
animals	insects	Hesperiidae	*Ocybadistes walkeri sothis*	green grass-dart				1
animals	insects	Lestidae	*Austrolestes leda*	wandering ringtail				1
animals	insects	Libellulidae	*Diplacodes bipunctata*	wandering percher				1
animals	insects	Libellulidae	*Orthetrum villosovittatum*	fiery skimmer				1
animals	insects	Libellulidae	*Crocothemis nigrifrons*	black-headed skimmer				1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	insects	Libellulidae	*Orthetrum caledonicum*	blue skimmer				1
animals	insects	Libellulidae	*Diplacodes haematodes*	scarlet percher				1
animals	insects	Libellulidae	*Pantala flavescens*	wandering glider				1
animals	insects	Libellulidae	*Orthetrum sabina*	slender skimmer				1
animals	insects	Libellulidae	*Macrodiplax cora*	wandering pennant				1
animals	insects	Libellulidae	*Tramea loewii*	common glider				1
animals	insects	Lycaenidae	*Catopyrops florinda*					1
animals	insects	Lycaenidae	*Zizina otis labradus*	common grass-blue (Australian subspecies)				2
animals	insects	Lycaenidae	*Psychonotis caelius taygetus*	small green-banded blue				2
animals	insects	Lycaenidae	*Prosotas dubiosa dubiosa*	purple line-blue				1
animals	insects	Nymphalidae	*Charaxes sempronius sempronius*	tailed emperor				2
animals	insects	Nymphalidae	*Phaedyma shepherdi shepherdi*	white-banded plane (southern subspecies)				1
animals	insects	Nymphalidae	*Danaus sp.*					1
animals	insects	Nymphalidae	*Heteronympha merope merope*	common brown				1
animals	insects	Nymphalidae	*Acraea andromacha andromacha*	glasswing				8
animals	insects	Nymphalidae	*Danaus petilia*	lesser wanderer				7
animals	insects	Nymphalidae	*Euploea corinna*	common crow				9
animals	insects	Nymphalidae	*Vanessa kershawi*	Australian painted lady				1
animals	insects	Nymphalidae	*Melanitis leda bankia*	evening brown				7
animals	insects	Nymphalidae	*Tirumala hamata hamata*	blue tiger				3
animals	insects	Nymphalidae	*Junonia villida villida*	meadow argus				7
animals	insects	Nymphalidae	*Hypolimnas bolina nerina*	varied eggfly				2
animals	insects	Nymphalidae	*Hypocysta adiante adiante*	orange ringlet				1
animals	insects	Nymphalidae	*Danaus plexippus*	monarch	Y			11
animals	insects	Papilionidae	*Cressida cressida cressida*	clearwing swallowtail				2
animals	insects	Papilionidae	*Papilio demoleus sthenelus*	chequered swallowtail				3
animals	insects	Papilionidae	*Papilio aegeus*					1
animals	insects	Papilionidae	*Papilio anactus*	dainty swallowtail				1
animals	insects	Papilionidae	*Graphium choredon*	blue triangle				2
animals	insects	Papilionidae	*Papilio aegeus aegeus*	orchard swallowtail (Australian subspecies)				2
animals	insects	Papilionidae	*Graphium eurypylus lycaon*	pale triangle				1
animals	insects	Pieridae	*Catopsilia pyranthe crokera*	white migrant				2
animals	insects	Pieridae	*Delias nigrina*	black jezebel				2
animals	insects	Pieridae	*Cepora perimale scyllara*	caper gull (Australian subspecies)				1
animals	insects	Pieridae	*Delias argenthona argenthona*	scarlet jezebel				3
animals	insects	Pieridae	*Eurema brigitta australis*	no-brand grass-yellow				1
animals	insects	Pieridae	*Eurema hecabe*	large grass-yellow				6
animals	insects	Pieridae	*Pieris rapae*	cabbage white	Y			2
animals	insects	Pieridae	*Catopsilia pomona*	lemon migrant				5
animals	insects	Pieridae	*Belenois java teutonia*	caper white				4
animals	insects	Pieridae	*Eurema smilax*	small grass-yellow				3
animals	mammals	Canidae	*Canis lupus dingo*	dingo				1
animals	mammals	Canidae	*Canis lupus familiaris*	dog	Y			3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Canidae	*Vulpes vulpes*	red fox	Y			8
animals	mammals	Dasyuridae	*Antechinus flavipes flavipes*	yellow-footed antechinus (south-east Queensland)		C		5
animals	mammals	Dasyuridae	*Planigale maculata*	common planigale		C		1
animals	mammals	Dasyuridae	*Sminthopsis murina*	common dunnart		C		1
animals	mammals	Delphinidae	*Orcaella heinsohni*	Australian snubfin dolphin		V		1
animals	mammals	Emballonuridae	*Saccolaimus flaviventris*	yellow-bellied sheathtail bat		C		1
animals	mammals	Felidae	*Felis catus*	cat	Y			1
animals	mammals	Leporidae	*Lepus europaeus*	European brown hare	Y			13
animals	mammals	Macropodidae	*Macropus rufogriseus*	red-necked wallaby		C		29
animals	mammals	Macropodidae	*Wallabia bicolor*	swamp wallaby		C		6
animals	mammals	Macropodidae	*Macropus parryi*	whiptail wallaby		C		2
animals	mammals	Macropodidae	*Macropus giganteus*	eastern grey kangaroo		C		9
animals	mammals	Macropodidae	*Macropus sp.*					2
animals	mammals	Miniopteridae	*Miniopterus schreibersii oceanensis*	eastern bent-wing bat		C		2
animals	mammals	Molossidae	*Mormopterus ridei*	eastern free-tailed bat		C		1
animals	mammals	Molossidae	*Mormopterus norfolkensis*	east coast freetail bat		C		1
animals	mammals	Molossidae	*Mormopterus lumsdenae*	northern free-tailed bat		C		1
animals	mammals	Molossidae	*Tadarida australis*	white-striped freetail bat		C		19
animals	mammals	Molossidae	*Mormopterus sp.*					5
animals	mammals	Muridae	*Mus musculus*	house mouse	Y			15
animals	mammals	Muridae	*Rattus rattus*	black rat	Y			13
animals	mammals	Muridae	*Rattus tunneyi*	pale field-rat		C		3
animals	mammals	Muridae	*Rattus lutreolus*	swamp rat		C		3
animals	mammals	Muridae	*Hydromys chrysogaster*	water rat		C		1
animals	mammals	Muridae	*Pseudomys gracilicaudatus*	eastern chestnut mouse		C		1
animals	mammals	Muridae	*Rattus fuscipes*	bush rat		C		1
animals	mammals	Peramelidae	*Isoodon macrourus*	northern brown bandicoot		C		11
animals	mammals	Petauridae	*Petaurus norfolcensis*	squirrel glider		C		23
animals	mammals	Petauridae	*Petaurus australis australis*	yellow-bellied glider (southern subspecies)		C		1
animals	mammals	Petauridae	*Petaurus breviceps*	sugar glider		C		6
animals	mammals	Petauridae	*Petaurus sp.*					2
animals	mammals	Phalangeridae	*Trichosurus vulpecula*	common brushtail possum		C		51
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		V	V	171
animals	mammals	Pseudocheiridae	*Petauroides volans volans*	southern greater glider		V	V	11/1
animals	mammals	Pseudocheiridae	*Pseudocheirus peregrinus*	common ringtail possum		C		4
animals	mammals	Pteropodidae	*Pteropus poliocephalus*	grey-headed flying-fox		C	V	12
animals	mammals	Pteropodidae	*Pteropus scapulatus*	little red flying-fox		C		4
animals	mammals	Pteropodidae	*Pteropus sp.*					1
animals	mammals	Pteropodidae	*Pteropus alecto*	black flying-fox		C		11
animals	mammals	Suidae	*Sus scrofa*	pig	Y			1
animals	mammals	Tachyglossidae	*Tachyglossus aculeatus*	short-beaked echidna		SL		4
animals	mammals	Vespertilionidae	*Scotorepens sp. (Parnaby)*	central-eastern broad-nosed bat		C		1
animals	mammals	Vespertilionidae	*Vespadelus troughtoni*	eastern cave bat		C		1
animals	mammals	Vespertilionidae	*Nyctophilus geoffroyi*	lesser long-eared bat		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Vespertilionidae	*Myotis macropus*	large-footed myotis		C		1
animals	mammals	Vespertilionidae	*Scotorepens orion*	south-eastern broad-nosed bat		C		1
animals	mammals	Vespertilionidae	*Chalinolobus morio*	chocolate wattled bat		C		1
animals	mammals	Vespertilionidae	*Nyctophilus gouldi*	Gould's long-eared bat		C		1
animals	mammals	Vespertilionidae	*Scotorepens greyii*	little broad-nosed bat		C		9
animals	mammals	Vespertilionidae	*Scoteanax rueppellii*	greater broad-nosed bat		C		1
animals	mammals	Vespertilionidae	*Chalinolobus gouldii*	Gould's wattled bat		C		5
animals	ray-finned fishes	Ambassidae	*Ambassis agassizii*	Agassiz's glassfish				2
animals	ray-finned fishes	Anguillidae	*Anguilla reinhardtii*	longfin eel				15
animals	ray-finned fishes	Anguillidae	*Anguilla australis*	southern shortfin eel				6
animals	ray-finned fishes	Atherinidae	*Craterocephalus stercusmuscarum*	flyspecked hardyhead				3
animals	ray-finned fishes	Atherinidae	*Craterocephalus marjoriae*	silverstreak hardyhead				1
animals	ray-finned fishes	Cichlidae	*Oreochromis mossambica*	Mozambique mouthbrooder	Y			3
animals	ray-finned fishes	Clupeidae	*Nematalosa erebi*	bony bream				1
animals	ray-finned fishes	Eleotridae	*Gobiomorphus australis*	striped gudgeon				10
animals	ray-finned fishes	Eleotridae	*Hypseleotris klunzingeri*	western carp gudgeon				1
animals	ray-finned fishes	Eleotridae	*Hypseleotris sp.*					1
animals	ray-finned fishes	Eleotridae	*Hypseleotris galii*	firetail gudgeon				12
animals	ray-finned fishes	Eleotridae	*Hypseleotris compressa*	empire gudgeon				12
animals	ray-finned fishes	Melanotaeniidae	*Melanotaenia duboulayi*	crimsonspotted rainbowfish				5
animals	ray-finned fishes	Mugilidae	*Mugil cephalus*	sea mullet				6
animals	ray-finned fishes	Plotosidae	*Tandanus tandanus*	freshwater catfish				5
animals	ray-finned fishes	Poeciliidae	*Xiphophorus hellerii*	swordtail	Y			1
animals	ray-finned fishes	Poeciliidae	*Xiphophorus maculatus*	platy	Y			8
animals	ray-finned fishes	Poeciliidae	*Poecilia reticulata*	guppy	Y			1
animals	ray-finned fishes	Poeciliidae	*Gambusia holbrooki*	mosquitofish	Y			19
animals	ray-finned fishes	Pseudomugilidae	*Pseudomugil signifer*	Pacific blue eye				5
animals	ray-finned fishes	Retropinnidae	*Retropinna semoni*	Australian smelt				5
animals	ray-finned fishes	Scorpaenidae	*Notesthes robusta*	bullrout				3
animals	ray-finned fishes	Terapontidae	*Leiopotherapon unicolor*	spangled perch				8
animals	reptiles	Agamidae	*Diporiphora australis*	tommy roundhead		C		13
animals	reptiles	Agamidae	*Intellagama lesueurii*	eastern water dragon		C		18
animals	reptiles	Agamidae	*Pogona barbata*	bearded dragon		C		25
animals	reptiles	Agamidae	*Diporiphora nobbi*	nobbi		C		1
animals	reptiles	Boidae	*Antaresia maculosa*	spotted python		C		2
animals	reptiles	Boidae	*Morelia spilota*	carpet python		C		13
animals	reptiles	Chelidae	*Emydura macquarii macquarii*	Murray turtle		C		4/1
animals	reptiles	Colubridae	*Dendrelaphis punctulatus*	green tree snake		C		10
animals	reptiles	Colubridae	*Tropidonophis mairii*	freshwater snake		C		3
animals	reptiles	Colubridae	*Boiga irregularis*	brown tree snake		C		3
animals	reptiles	Diplodactylidae	*Nebulifera robusta*	robust velvet gecko		C		4
animals	reptiles	Diplodactylidae	*Diplodactylus vittatus*	wood gecko		C		5
animals	reptiles	Elapidae	*Pseudechis guttatus*	spotted black snake		C		2
animals	reptiles	Elapidae	*Pseudechis porphyriacus*	red-bellied black snake		C		7
animals	reptiles	Elapidae	*Furina diadema*	red-naped snake		C		7/1
animals	reptiles	Elapidae	*Cacophis harriettae*	white-crowned snake		C		2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	reptiles	Elapidae	*Demansia psammophis*	yellow-faced whipsnake		C		15
animals	reptiles	Elapidae	*Pseudonaja textilis*	eastern brown snake		C		12
animals	reptiles	Elapidae	*Vermicella annulata*	bandy-bandy		C		1
animals	reptiles	Elapidae	*Cryptophis nigrescens*	eastern small-eyed snake		C		2
animals	reptiles	Elapidae	*Brachyurophis australis*	coral snake		C		5/1
animals	reptiles	Gekkonidae	*Gehyra dubia*	dubious dtella		C		18
animals	reptiles	Gekkonidae	*Hemidactylus frenatus*	house gecko	Y			3
animals	reptiles	Pygopodidae	*Lialis burtonis*	Burton's legless lizard		C		5/2
animals	reptiles	Pygopodidae	*Delma plebeia*	common delma		C		1
animals	reptiles	Scincidae	*Ctenotus spaldingi*	straight-browed ctenotus		C		12
animals	reptiles	Scincidae	*Carlia pectoralis*	open-litter rainbow skink		C		2
animals	reptiles	Scincidae	*Lygisaurus foliorum*	tree-base litter-skink		C		4
animals	reptiles	Scincidae	*Ctenotus taeniolatus*	copper-tailed skink		C		2
animals	reptiles	Scincidae	*Anomalopus verreauxii*	three-clawed worm-skink		C		4
animals	reptiles	Scincidae	*Lampropholis delicata*	dark-flecked garden sunskink		C		17
animals	reptiles	Scincidae	*Morethia taeniopleura*	fire-tailed skink		C		6
animals	reptiles	Scincidae	*Calyptotis scutirostrum*	scute-snouted calyptotis		C		2
animals	reptiles	Scincidae	*Lampropholis guichenoti*	pale-flecked garden sunskink		C		1
animals	reptiles	Scincidae	*Carlia pectoralis sensu lato*			C		1
animals	reptiles	Scincidae	*Cryptoblepharus pulcher pulcher*	elegant snake-eyed skink		C		18
animals	reptiles	Scincidae	*Tiliqua scincoides*	eastern blue-tongued lizard		C		4
animals	reptiles	Scincidae	*Carlia vivax*	tussock rainbow-skink		C		11/2
animals	reptiles	Scincidae	*Karma murrayi*	Murray's skink		C		2/1
animals	reptiles	Typhlopidae	*Anilios sp.*					1
animals	reptiles	Varanidae	*Varanus varius*	lace monitor		C		9/1
animals	uncertain	Indeterminate	*Indeterminate*	Unknown or Code Pending		C		6
fungi	uncertain	Ascomycota	*Mycocalicium fulvofuscum*			C		1/1
fungi	uncertain	Ascomycota	*Ascobolus australis*			C		1/1
fungi		Basidiomycota	*Agrocybe*			C		1/1
fungi		Basidiomycota	*Conocybe*			C		1/1
fungi		Basidiomycota	*Coprinus*			C		3/3
fungi		Basidiomycota	*Tylopilus*			C		1/1
fungi		Basidiomycota	*Inocybe*			C		5/5
fungi		Basidiomycota	*Amanita flavella*			C		1/1
fungi		Basidiomycota	*Gloeophyllum striatum*			C		1/1
fungi		Basidiomycota	*Trichaptum byssogenum*			C		1/1
fungi		Basidiomycota	*Scleroderma verrucosum*			C		1/1
fungi		Basidiomycota	*Agaricus*			C		1/1
fungi		Basidiomycota	*Russula*			C		1/1
fungi		Basidiomycota	*Tricholoma*			C		1/1
plants	conifers	Araucariaceae	*Araucaria bidwillii*	bunya pine		C		1
plants	conifers	Cupressaceae	*Callitris baileyi*	Bailey's cypress		NT		1
plants	ferns	Aspleniaceae	*Asplenium attenuatum var. attenuatum*			C		1
plants	ferns	Blechnaceae	*Blechnum indicum*	swamp water fern		C		1
plants	ferns	Blechnaceae	*Doodia caudata*			C		1/1
plants	ferns	Blechnaceae	*Doodia australis*			C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	ferns	Cyatheaceae	*Cyathea cooperi*			C		1
plants	ferns	Dennstaedtiaceae	*Histiopteris incisa*	bats-wing fern		C		1
plants	ferns	Dennstaedtiaceae	*Pteridium esculentum*	common bracken		C		1
plants	ferns	Dicksoniaceae	*Calochlaena dubia*			C		1
plants	ferns	Gleicheniaceae	*Gleichenia dicarpa*	pouched coral fern		C		1
plants	ferns	Polypodiaceae	*Pyrrosia rupestris*	rock felt fern		C		1
plants	ferns	Polypodiaceae	*Drynaria rigidula*			C		1
plants	ferns	Pteridaceae	*Adiantum aethiopicum*			C		1
plants	ferns	Pteridaceae	*Adiantum hispidulum var. hispidulum*			C		1
plants	ferns	Pteridaceae	*Cheilanthes sieberi*			C		1
plants	ferns	Pteridaceae	*Pellaea paradoxa*	heart fern		C		1
plants	ferns	Pteridaceae	*Pteris vittata*	Chinese bracken		C		1/1
plants	ferns	Pteridaceae	*Acrostichum speciosum*	mangrove fern		C		2/1
plants	higher dicots	Acanthaceae	*Ruellia simplex*		Y			7/7
plants	higher dicots	Acanthaceae	*Thunbergia alata*	black-eyed Susan	Y			1
plants	higher dicots	Acanthaceae	*Brunoniella australis*	blue trumpet		C		3/2
plants	higher dicots	Acanthaceae	*Rostellularia adscendens*			C		1/1
plants	higher dicots	Acanthaceae	*Pseuderanthemum variabile*	pastel flower		C		2/1
plants	higher dicots	Adoxaceae	*Sambucus nigra*		Y			2/2
plants	higher dicots	Aizoaceae	*Aptenia cordifolia*		Y			1/1
plants	higher dicots	Amaranthaceae	*Alternanthera brasiliana*		Y			1/1
plants	higher dicots	Amaranthaceae	*Alternanthera pungens*	khaki weed	Y			2/2
plants	higher dicots	Amaranthaceae	*Alternanthera nana*	hairy joyweed		C		2/2
plants	higher dicots	Amaranthaceae	*Alternanthera denticulata*	lesser joyweed		C		3/3
plants	higher dicots	Anacardiaceae	*Schinus terebinthifolius*		Y			3/3
plants	higher dicots	Aphanopetalaceae	*Aphanopetalum resinosum*	gumvine		C		1
plants	higher dicots	Apiaceae	*Cyclospermum leptophyllum*		Y			2/2
plants	higher dicots	Apiaceae	*Lilaeopsis brisbanica*			E		1/1
plants	higher dicots	Apiaceae	*Platysace ericoides*	heath platysace		C		1/1
plants	higher dicots	Apiaceae	*Apium prostratum*			C		1
plants	higher dicots	Apiaceae	*Ammi majus*	bishop's weed	Y			3/3
plants	higher dicots	Apiaceae	*Daucus carota*	wild carrot	Y			2/2
plants	higher dicots	Araliaceae	*Polyscias elegans*	celery wood		C		1
plants	higher dicots	Araliaceae	*Astrotricha latifolia*			C		1
plants	higher dicots	Araliaceae	*Hydrocotyle laxiflora*	stinking pennywort		C		1/1
plants	higher dicots	Araliaceae	*Trachymene procumbens*	creeping wild parsnip		C		1
plants	higher dicots	Asteraceae	*Vittadinia sulcata*	native daisy		C		1/1
plants	higher dicots	Asteraceae	*Cassinia subtropica*			C		1
plants	higher dicots	Asteraceae	*Erigeron canadensis*		Y			1/1
plants	higher dicots	Asteraceae	*Glossocardia bidens*	native cobbler's pegs		C		1/1
plants	higher dicots	Asteraceae	*Arctotheca calendula*	Cape weed	Y			1/1
plants	higher dicots	Asteraceae	*Calyptocarpus vialis*	creeping cinderella weed	Y			3/3
plants	higher dicots	Asteraceae	*Hypochaeris radicata*	catsear	Y			1/1
plants	higher dicots	Asteraceae	*Vittadinia pustulata*			C		2/2
plants	higher dicots	Asteraceae	*Ageratum houstonianum*	blue billygoat weed	Y			3/2
plants	higher dicots	Asteraceae	*Brachyscome basaltica*			C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Asteraceae	*Carduus pycnocephalus*		Y			1/1
plants	higher dicots	Asteraceae	*Cyanthillium cinereum*			C		2/1
plants	higher dicots	Asteraceae	*Hypochaeris albiflora*		Y			1/1
plants	higher dicots	Asteraceae	*Leiocarpa brevicompta*			C		2/2
plants	higher dicots	Asteraceae	*Dimorphotheca ecklonis*		Y			2/2
plants	higher dicots	Asteraceae	*Sigesbeckia orientalis*	Indian weed		C		1
plants	higher dicots	Asteraceae	*Ambrosia artemisiifolia*	annual ragweed	Y			2/2
plants	higher dicots	Asteraceae	*Gamochaeta pensylvanica*		Y			1/1
plants	higher dicots	Asteraceae	*Ozothamnus diosmifolius*	white dogwood		C		1/1
plants	higher dicots	Asteraceae	*Sphagneticola trilobata*		Y			1/1
plants	higher dicots	Asteraceae	*Senecio madagascariensis*	fireweed	Y			2
plants	higher dicots	Asteraceae	*Lactuca serriola forma serriola*		Y			2/2
plants	higher dicots	Asteraceae	*Solidago altissima subsp. altissima*	goldenrod	Y			1/1
plants	higher dicots	Asteraceae	*Thymophylla tenuiloba var. tenuiloba*		Y			1/1
plants	higher dicots	Asteraceae	*Verbesina encelioides var. encelioides*		Y			1/1
plants	higher dicots	Asteraceae	*Olearia nernstii*	Ipswich daisy		C		3/2
plants	higher dicots	Asteraceae	*Bidens bipinnata*	bipinnate beggar's ticks	Y			1
plants	higher dicots	Asteraceae	*Cirsium vulgare*	spear thistle	Y			1/1
plants	higher dicots	Asteraceae	*Centaurea jacea*		Y			9/9
plants	higher dicots	Asteraceae	*Tagetes minuta*	stinking roger	Y			1/1
plants	higher dicots	Asteraceae	*Bidens pilosa*		Y			2/1
plants	higher dicots	Asteraceae	*Sonchus oleraceus*	common sowthistle	Y			2/2
plants	higher dicots	Asteraceae	*Cichorium intybus*	chicory	Y			2/2
plants	higher dicots	Asteraceae	*Zinnia peruviana*	wild zinnia	Y			1
plants	higher dicots	Asteraceae	*Ageratina riparia*	mistflower	Y			1/1
plants	higher dicots	Asteraceae	*Camptacra barbata*			C		1/1
plants	higher dicots	Basellaceae	*Anredera cordifolia*	Madeira vine	Y			2/2
plants	higher dicots	Bignoniaceae	*Campsis radicans*		Y			1/1
plants	higher dicots	Bignoniaceae	*Pyrostegia venusta*		Y			1/1
plants	higher dicots	Bignoniaceae	*Pandorea floribunda*			C		3/3
plants	higher dicots	Bignoniaceae	*Jacaranda mimosifolia*	jacaranda	Y			1
plants	higher dicots	Bignoniaceae	*Pandorea*			C		1
plants	higher dicots	Bignoniaceae	*Tecoma stans var. stans*		Y			1/1
plants	higher dicots	Brassicaceae	*Cardamine hirsuta*	common bittercress	Y			2/2
plants	higher dicots	Brassicaceae	*Brassica chinensis*	Chinese cabbage	Y			1/1
plants	higher dicots	Brassicaceae	*Raphanus raphanistrum*	wild radish	Y			2/2
plants	higher dicots	Brassicaceae	*Capsella bursapastoris*	shepherd's purse	Y			2/2
plants	higher dicots	Brassicaceae	*Lepidium didymum*		Y			1/1
plants	higher dicots	Cactaceae	*Opuntia aurantiaca*	tiger pear	Y			1/1
plants	higher dicots	Caesalpiniaceae	*Senna artemisioides subsp. filifolia*			C		1/1
plants	higher dicots	Caesalpiniaceae	*Senna pendula var. glabrata*	Easter cassia	Y			1
plants	higher dicots	Caesalpiniaceae	*Senna septemtrionalis*		Y			1/1
plants	higher dicots	Caesalpiniaceae	*Biancaea decapetala*		Y			1/1
plants	higher dicots	Campanulaceae	*Lobelia concolor*			C		1/1
plants	higher dicots	Campanulaceae	*Lobelia browniana*			C		1/1
plants	higher dicots	Campanulaceae	*Lobelia purpurascens*	white root		C		2/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Campanulaceae	*Wahlenbergia gracilis*	sprawling bluebell		C		4/4
plants	higher dicots	Campanulaceae	*Wahlenbergia capillaris*			C		1/1
plants	higher dicots	Campanulaceae	*Wahlenbergia littoricola*			C		1/1
plants	higher dicots	Campanulaceae	*Lobelia stenophylla*			C		1/1
plants	higher dicots	Capparaceae	*Capparis arborea*	brush caper berry		C		1
plants	higher dicots	Capparaceae	*Capparis sarmentosa*	scrambling caper		C		1
plants	higher dicots	Caryophyllaceae	*Sagina procumbens*	spreading pearlwort	Y			1/1
plants	higher dicots	Caryophyllaceae	*Polycarpaea corymbosa var. minor*			C		1/1
plants	higher dicots	Caryophyllaceae	*Drymaria cordata subsp. cordata*		Y			1/1
plants	higher dicots	Caryophyllaceae	*Stellaria media*	chickweed	Y			1/1
plants	higher dicots	Casuarinaceae	*Casuarina cunninghamiana subsp. cunninghamiana*			C		1/1
plants	higher dicots	Casuarinaceae	*Casuarina cunninghamiana*			C		1
plants	higher dicots	Casuarinaceae	*Allocasuarina torulosa*			C		1
plants	higher dicots	Casuarinaceae	*Allocasuarina littoralis*			C		1
plants	higher dicots	Celastraceae	*Denhamia celastroides*	broad-leaved boxwood		C		1
plants	higher dicots	Celastraceae	*Denhamia bilocularis*			C		1
plants	higher dicots	Celastraceae	*Elaeodendron australe var. australe*			C		1
plants	higher dicots	Celastraceae	*Denhamia cunninghamii*			C		2/2
plants	higher dicots	Celastraceae	*Denhamia silvestris*			C		1/1
plants	higher dicots	Chenopodiaceae	*Einadia nutans subsp. linifolia*			C		1/1
plants	higher dicots	Chenopodiaceae	*Einadia hastata*			C		1
plants	higher dicots	Clusiaceae	*Hypericum gramineum*			C		1/1
plants	higher dicots	Combretaceae	*Combretum paniculatum*		Y			1/1
plants	higher dicots	Crassulaceae	*Bryophyllum beauverdii*		Y			1/1
plants	higher dicots	Crassulaceae	*Bryophyllum delagoense*		Y			1
plants	higher dicots	Crassulaceae	*Bryophyllum daigremontianum*		Y			1/1
plants	higher dicots	Crassulaceae	*Bryophyllum fedtschenkoi*		Y			2/2
plants	higher dicots	Crassulaceae	*Crassula sieberiana*			C		1/1
plants	higher dicots	Cucurbitaceae	*Cucumis metuliferus*	prickly cucumber	Y			1/1
plants	higher dicots	Dilleniaceae	*Hibbertia diffusa*			C		1
plants	higher dicots	Dilleniaceae	*Hibbertia linearis var. obtusifolia*			C		1
plants	higher dicots	Dilleniaceae	*Hibbertia stricta*			C		1
plants	higher dicots	Ebenaceae	*Diospyros fasciculosa*	grey ebony		C		1
plants	higher dicots	Ebenaceae	*Diospyros geminata*	scaly ebony		C		1
plants	higher dicots	Elaeocarpaceae	*Elaeocarpus obovatus*	blueberry ash		C		1
plants	higher dicots	Ericaceae	*Brachyloma daphnoides subsp. daphnoides*			C		1/1
plants	higher dicots	Ericaceae	*Leucopogon juniperinus*	prickly heath		C		1
plants	higher dicots	Ericaceae	*Acrotriche aggregata*	red cluster heath		C		2/1
plants	higher dicots	Ericaceae	*Melichrus adpressus*			C		1
plants	higher dicots	Erythroxylaceae	*Erythroxylum sp. (Splityard Creek L.Pedley 5360)*			C		1
plants	higher dicots	Euphorbiaceae	*Mallotus philippensis*	red kamala		C		1
plants	higher dicots	Euphorbiaceae	*Euphorbia hyssopifolia*		Y			2/2
plants	higher dicots	Euphorbiaceae	*Mallotus claoxyloides*	green kamala		C		1
plants	higher dicots	Euphorbiaceae	*Euphorbia ophthalmica*		Y			2/2
plants	higher dicots	Euphorbiaceae	*Euphorbia dallachyana*			C		1/1
plants	higher dicots	Euphorbiaceae	*Euphorbia cyathophora*	dwarf poinsettia	Y			1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Euphorbiaceae	*Alchornea ilicifolia*	native holly		C		1
plants	higher dicots	Euphorbiaceae	*Euphorbia umbellata*		Y			1/1
plants	higher dicots	Euphorbiaceae	*Euphorbia peplus*	petty spurge	Y			1/1
plants	higher dicots	Euphorbiaceae	*Acalypha nemorum*	hairy acalypha		C		1
plants	higher dicots	Euphorbiaceae	*Ricinus communis*	castor oil bush	Y			1/1
plants	higher dicots	Fabaceae	*Galactia tenuiflora var. lucida*			C		1/1
plants	higher dicots	Fabaceae	*Neonotonia wightii var. wightii*		Y			3/3
plants	higher dicots	Fabaceae	*Sesbania cannabina var. cannabina*			C		1/1
plants	higher dicots	Fabaceae	*Vigna vexillata var. angustifolia*			C		1/1
plants	higher dicots	Fabaceae	*Indigofera australis subsp. australis*			C		1/1
plants	higher dicots	Fabaceae	*Erythrina vespertilio subsp. vespertilio*			C		1/1
plants	higher dicots	Fabaceae	*Glycine*			C		1/1
plants	higher dicots	Fabaceae	*Cullen tenax*	emu-foot		C		2/2
plants	higher dicots	Fabaceae	*Hovea lorata*			C		4/4
plants	higher dicots	Fabaceae	*Vigna luteola*	dalrymple vigna	Y			2/2
plants	higher dicots	Fabaceae	*Desmodium gunnii*			C		1/1
plants	higher dicots	Fabaceae	*Glycine tabacina*	glycine pea		C		1/1
plants	higher dicots	Fabaceae	*Hovea lanceolata*			C		1
plants	higher dicots	Fabaceae	*Hovea planifolia*			C		2/2
plants	higher dicots	Fabaceae	*Trifolium dubium*	yellow sucking clover	Y			1/1
plants	higher dicots	Fabaceae	*Desmodium varians*	slender tick trefoil		C		1/1
plants	higher dicots	Fabaceae	*Melilotus indicus*	hexham scent	Y			1/1
plants	higher dicots	Fabaceae	*Pultenaea euchila*	orange pultenaea		C		2/1
plants	higher dicots	Fabaceae	*Pultenaea spinosa*			C		1
plants	higher dicots	Fabaceae	*Pultenaea villosa*	hairy bush pea		C		1
plants	higher dicots	Fabaceae	*Daviesia villifera*	prickly daviesia		C		1
plants	higher dicots	Fabaceae	*Daviesia wyattiana*	long-leaved bitter pea		C		1
plants	higher dicots	Fabaceae	*Indigofera baileyi*			C		3/3
plants	higher dicots	Fabaceae	*Indigofera spicata*	creeping indigo	Y			2/2
plants	higher dicots	Fabaceae	*Jacksonia scoparia*			C		1
plants	higher dicots	Fabaceae	*Kennedia rubicunda*	red Kennedy pea		C		1
plants	higher dicots	Fabaceae	*Neonotonia wightii*		Y			1
plants	higher dicots	Fabaceae	*Sesbania cannabina*			C		1/1
plants	higher dicots	Fabaceae	*Daviesia ulicifolia*	native gorse		C		1
plants	higher dicots	Fabaceae	*Desmodium triflorum*		Y			1/1
plants	higher dicots	Fabaceae	*Glycine clandestina*			C		1
plants	higher dicots	Fabaceae	*Glycine microphylla*			C		1/1
plants	higher dicots	Fabaceae	*Medicago polymorpha*	burr medic	Y			1/1
plants	higher dicots	Fabaceae	*Stylosanthes scabra*		Y			1/1
plants	higher dicots	Fabaceae	*Pultenaea petiolaris*			C		1
plants	higher dicots	Fabaceae	*Chorizema parviflorum*	eastern flame pea		C		1/1
plants	higher dicots	Fabaceae	*Genista monspessulana*	Montpellier broom	Y			1/1
plants	higher dicots	Fabaceae	*Swainsona brachycarpa*			C		1/1
plants	higher dicots	Fabaceae	*Erythrina crista-galli*		Y			2/2
plants	higher dicots	Fabaceae	*Austrosteenisia blackii*	bloodvine		C		1
plants	higher dicots	Fabaceae	*Castanospermum australe*	black bean		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Fabaceae	*Swainsona queenslandica*			C		1/1
plants	higher dicots	Fabaceae	*Desmodium rhytidophyllum*			C		1/1
plants	higher dicots	Fabaceae	*Tephrosia glomeruliflora*	pink tephrosia	Y			1/1
plants	higher dicots	Fabaceae	*Vicia sativa subsp. nigra*		Y			1/1
plants	higher dicots	Fabaceae	*Macroptilium atropurpureum*	siratro	Y			1/1
plants	higher dicots	Geraniaceae	*Geranium homeanum*			C		1/1
plants	higher dicots	Geraniaceae	*Pelargonium*			C		2/2
plants	higher dicots	Geraniaceae	*Geranium solanderi var. solanderi*	native geranium		C		3/2
plants	higher dicots	Goodeniaceae	*Goodenia hederacea subsp. hederacea*			C		3/3
plants	higher dicots	Goodeniaceae	*Goodenia bellidifolia subsp. argentea*			C		1/1
plants	higher dicots	Goodeniaceae	*Goodenia rotundifolia*			C		1
plants	higher dicots	Loranthaceae	*Amyema pendula subsp. longifolia*			C		1/1
plants	higher dicots	Loranthaceae	*Amyema miquelii*			C		1/1
plants	higher dicots	Malvaceae	*Pavonia hastata*	pink pavonia	Y			2/1
plants	higher dicots	Malvaceae	*Abutilon oxycarpum var. oxycarpum*			C		1
plants	higher dicots	Malvaceae	*Hibiscus heterophyllus*			C		1
plants	higher dicots	Malvaceae	*Malvaviscus arboreus*		Y			1/1
plants	higher dicots	Malvaceae	*Gossypium hirsutum*		Y			1/1
plants	higher dicots	Malvaceae	*Sida rhombifolia*		Y			1
plants	higher dicots	Malvaceae	*Sida cordifolia*		Y			1
plants	higher dicots	Meliaceae	*Melia azedarach*	white cedar		C		1
plants	higher dicots	Mimosaceae	*Acacia hispidula*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia penninervis var. penninervis*			C		1
plants	higher dicots	Mimosaceae	*Acacia penninervis var. longiracemosa*			C		2/2
plants	higher dicots	Mimosaceae	*Acacia maidenii*	Maiden's wattle		C		1
plants	higher dicots	Mimosaceae	*Leucaena leucocephala subsp. leucocephala*		Y			2/2
plants	higher dicots	Mimosaceae	*Acacia falcata*	sickle wattle		C		2/1
plants	higher dicots	Mimosaceae	*Acacia fimbriata*	Brisbane golden wattle		C		2/1
plants	higher dicots	Mimosaceae	*Neptunia gracilis forma gracilis*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia julifera subsp. julifera*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia glaucocarpa*	hickory wattle		C		1/1
plants	higher dicots	Mimosaceae	*Acacia macradenia*	zig-zag wattle		C		1
plants	higher dicots	Mimosaceae	*Acacia juncifolia*			C		3/2
plants	higher dicots	Mimosaceae	*Acacia complanata*	flatstem wattle		C		4/3
plants	higher dicots	Mimosaceae	*Acacia leiocalyx subsp. leiocalyx*			C		1
plants	higher dicots	Mimosaceae	*Acacia disparrima subsp. disparrima*			C		1
plants	higher dicots	Moraceae	*Trophis scandens subsp. scandens*			C		1
plants	higher dicots	Moraceae	*Maclura cochinchinensis*	cockspur thorn		C		1
plants	higher dicots	Moraceae	*Streblus brunonianus*	whalebone tree		C		1
plants	higher dicots	Moraceae	*Ficus opposita*			C		1
plants	higher dicots	Moraceae	*Ficus coronata*	creek sandpaper fig		C		1
plants	higher dicots	Moraceae	*Morus alba*	white mulberry	Y			2/2
plants	higher dicots	Moraceae	*Ficus obliqua*			C		1
plants	higher dicots	Myrsinaceae	*Myrsine variabilis*			C		1
plants	higher dicots	Myrsinaceae	*Embelia australiana*	embelia		C		1
plants	higher dicots	Myrsinaceae	*Lysimachia arvensis*		Y			2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Myrtaceae	*Acmena smithii*	lillypilly satinash		C		1
plants	higher dicots	Myrtaceae	*Corymbia henryi*	large-leaved spotted gum		C		3/2
plants	higher dicots	Myrtaceae	*Eucalyptus dura*			C		5/4
plants	higher dicots	Myrtaceae	*Eucalyptus major*	mountain grey gum		C		1
plants	higher dicots	Myrtaceae	*Gossia bidwillii*			C		1
plants	higher dicots	Myrtaceae	*Eucalyptus carnea*			C		1
plants	higher dicots	Myrtaceae	*Sannantha collina*			C		1
plants	higher dicots	Myrtaceae	*Corymbia gummifera*	red bloodwood		C		1
plants	higher dicots	Myrtaceae	*Eucalyptus fibrosa*			C		1
plants	higher dicots	Myrtaceae	*Angophora leiocarpa*	rusty gum		C		1
plants	higher dicots	Myrtaceae	*Corymbia citriodora*	spotted gum		C		1
plants	higher dicots	Myrtaceae	*Corymbia intermedia*	pink bloodwood		C		1
plants	higher dicots	Myrtaceae	*Corymbia torelliana*	cadaghi		C		2/1
plants	higher dicots	Myrtaceae	*Eucalyptus curtisii*	Plunkett mallee		NT		12/11
plants	higher dicots	Myrtaceae	*Melaleuca bracteata*			C		1
plants	higher dicots	Myrtaceae	*Melaleuca viminalis*			C		2/1
plants	higher dicots	Myrtaceae	*Corymbia tessellaris*	Moreton Bay ash		C		1
plants	higher dicots	Myrtaceae	*Eucalyptus moluccana*	gum-topped box		C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus tindaliae*	Queensland white stringybark		C		1
plants	higher dicots	Myrtaceae	*Backhousia myrtifolia*	carrol		C		1
plants	higher dicots	Myrtaceae	*Eucalyptus acmenoides*			C		2/2
plants	higher dicots	Myrtaceae	*Lophostemon confertus*	brush box		C		1
plants	higher dicots	Myrtaceae	*Tristaniopsis laurina*			C		1
plants	higher dicots	Myrtaceae	*Leptospermum neglectum*			C		1/1
plants	higher dicots	Myrtaceae	*Lophostemon suaveolens*	swamp box		C		1
plants	higher dicots	Myrtaceae	*Rhodomyrtus psidioides*	native guava		C		1
plants	higher dicots	Myrtaceae	*Eucalyptus siderophloia*			C		1
plants	higher dicots	Myrtaceae	*Eucalyptus tereticornis*			C		1
plants	higher dicots	Myrtaceae	*Leptospermum trinervium*	woolly tea-tree		C		1
plants	higher dicots	Myrtaceae	*Leptospermum polygalifolium*	tantoon		C		1
plants	higher dicots	Myrtaceae	*Corymbia henryi x C.torelliana*			C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus fibrosa subsp. fibrosa*			C		5/5
plants	higher dicots	Myrtaceae	*Eucalyptus melanophloia subsp. melanophloia*			C		1/1
plants	higher dicots	Ochnaceae	*Ochna serrulata*	ochna	Y			2/1
plants	higher dicots	Oleaceae	*Notelaea lloydii*	Lloyd's native olive		V	V	10/10
plants	higher dicots	Oleaceae	*Jasminum didymum subsp. racemosum*			C		1
plants	higher dicots	Oleaceae	*Olea europaea subsp. cuspidata*		Y			2/2
plants	higher dicots	Oleaceae	*Notelaea*			C		3/3
plants	higher dicots	Oleaceae	*Olea europaea*	common olive	Y			1
plants	higher dicots	Oleaceae	*Notelaea ovata*	forest olive		C		3/2
plants	higher dicots	Oleaceae	*Jasminum simplicifolium subsp. australiense*			C		1
plants	higher dicots	Oleaceae	*Notelaea punctata*			C		1
plants	higher dicots	Oleaceae	*Notelaea microcarpa*			C		1/1
plants	higher dicots	Oleaceae	*Notelaea ipsviciensis*			E	CE	10/10
plants	higher dicots	Oleaceae	*Chionanthus ramiflorus*	northern olive		C		1/1
plants	higher dicots	Oleaceae	*Jasminum dianthifolium*			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Onagraceae	*Oenothera rosea*	rose evening primrose	Y			1/1
plants	higher dicots	Onagraceae	*Oenothera indecora subsp. bonariensis*		Y			1/1
plants	higher dicots	Onagraceae	*Oenothera stricta subsp. stricta*		Y			1/1
plants	higher dicots	Passifloraceae	*Passiflora foetida*		Y			1/1
plants	higher dicots	Passifloraceae	*Passiflora pallida*		Y			1/1
plants	higher dicots	Passifloraceae	*Passiflora suberosa*	corky passion flower	Y			1
plants	higher dicots	Passifloraceae	*Passiflora subpeltata*	white passion flower	Y			1
plants	higher dicots	Passifloraceae	*Passiflora suberosa subsp. litoralis*		Y			1/1
plants	higher dicots	Passifloraceae	*Passiflora herbertiana subsp. herbertiana*	native passionfruit		C		1
plants	higher dicots	Petiveriaceae	*Rivina humilis*		Y			1
plants	higher dicots	Phyllanthaceae	*Phyllanthus similis*			C		3/3
plants	higher dicots	Phyllanthaceae	*Phyllanthus simplex*			C		1/1
plants	higher dicots	Phyllanthaceae	*Breynia oblongifolia*			C		1
plants	higher dicots	Phyllanthaceae	*Phyllanthus virgatus*			C		1/1
plants	higher dicots	Phyllanthaceae	*Bridelia exaltata*			C		1
plants	higher dicots	Phyllanthaceae	*Phyllanthus hirtellus*			C		1/1
plants	higher dicots	Phyllanthaceae	*Glochidion ferdinandi*			C		1
plants	higher dicots	Pittosporaceae	*Bursaria spinosa subsp. spinosa*			C		1
plants	higher dicots	Pittosporaceae	*Auranticarpa rhombifolia*			C		1
plants	higher dicots	Pittosporaceae	*Pittosporum revolutum*	yellow pittosporum		C		1
plants	higher dicots	Plantaginaceae	*Plantago lanceolata*		Y			2/2
plants	higher dicots	Plantaginaceae	*Veronica plebeia*	trailing speedwell		C		1
plants	higher dicots	Polygonaceae	*Rumex hypogaeus*		Y			1/1
plants	higher dicots	Polygonaceae	*Persicaria decipiens*	slender knotweed		C		1/1
plants	higher dicots	Polygonaceae	*Persicaria attenuata*			C		1/1
plants	higher dicots	Polygonaceae	*Antigonon leptopus*		Y			2/2
plants	higher dicots	Polygonaceae	*Rumex crispus*	curled dock	Y			1/1
plants	higher dicots	Polygonaceae	*Acetosa vesicaria*		Y			2/2
plants	higher dicots	Portulacaceae	*Calandrinia pickeringii*			C		1/1
plants	higher dicots	Proteaceae	*Persoonia sericea*	silky geebung		C		1/1
plants	higher dicots	Proteaceae	*Grevillea robusta*			C		1
plants	higher dicots	Putranjivaceae	*Drypetes deplanchei*	grey boxwood		C		1
plants	higher dicots	Rhamnaceae	*Alphitonia excelsa*	soap tree		C		1
plants	higher dicots	Rhamnaceae	*Cryptandra longistaminea*			C		1/1
plants	higher dicots	Rhamnaceae	*Pomaderris lanigera*			C		1/1
plants	higher dicots	Rosaceae	*Malus pumila*		Y			1/1
plants	higher dicots	Rosaceae	*Eriobotrya japonica*	loquat	Y			1
plants	higher dicots	Rosaceae	*Rhaphiolepis indica*	Indian hawthorn	Y			1
plants	higher dicots	Rubiaceae	*Gynochthodes canthoides*			C		1
plants	higher dicots	Rubiaceae	*Hodgkinsonia ovatiflora*	golden ash		C		1
plants	higher dicots	Rubiaceae	*Cyclophyllum coprosmoides*			C		2
plants	higher dicots	Rubiaceae	*Psydrax odorata*			C		1
plants	higher dicots	Rubiaceae	*Everistia vacciniifolia*			C		1
plants	higher dicots	Rubiaceae	*Spermacoce multicaulis*			C		2/2
plants	higher dicots	Rubiaceae	*Opercularia diphylla*			C		1/1
plants	higher dicots	Rubiaceae	*Asperula geminifolia*			C		2/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Rubiaceae	*Richardia stellaris*		Y			4/4
plants	higher dicots	Rubiaceae	*Asperula conferta*			C		1/1
plants	higher dicots	Rubiaceae	*Pomax umbellata*			C		2/1
plants	higher dicots	Rutaceae	*Sarcomelicope simplicifolia subsp. simplicifolia*	yellow aspen		C		1
plants	higher dicots	Rutaceae	*Zieria smithii*			C		1
plants	higher dicots	Rutaceae	*Bergera koenigii*		Y			1/1
plants	higher dicots	Rutaceae	*Acronychia laevis*	glossy acronychia		C		1/1
plants	higher dicots	Rutaceae	*Boronia rosmarinifolia*	forest boronia		C		3/2
plants	higher dicots	Rutaceae	*Flindersia australis*	crow's ash		C		1
plants	higher dicots	Rutaceae	*Flindersia bennettii*			C		1
plants	higher dicots	Rutaceae	*Acronychia pauciflora*	soft acronychia		C		1
plants	higher dicots	Rutaceae	*Flindersia xanthoxyla*	yellow-wood		C		1
plants	higher dicots	Rutaceae	*Flindersia collina*	broad-leaved leopard tree		C		1
plants	higher dicots	Sapindaceae	*Mischocarpus pyriformis*			C		1
plants	higher dicots	Sapindaceae	*Cardiospermum grandiflorum*	heart seed vine	Y			6/5
plants	higher dicots	Sapindaceae	*Toechima tenax*	pitted-leaf steelwood		C		1
plants	higher dicots	Sapindaceae	*Harpullia hillii*			C		1
plants	higher dicots	Sapindaceae	*Jagera pseudorhus*			C		1
plants	higher dicots	Sapindaceae	*Alectryon connatus*	grey birds-eye		C		1
plants	higher dicots	Sapindaceae	*Mischocarpus anodontus*	veiny pearfruit		C		1
plants	higher dicots	Sapindaceae	*Alectryon tomentosus*			C		2/1
plants	higher dicots	Sapindaceae	*Alectryon subcinereus*			C		1
plants	higher dicots	Sapindaceae	*Dodonaea triangularis*			C		2/2
plants	higher dicots	Sapindaceae	*Elattostachys nervosa*	green tamarind		C		2/1
plants	higher dicots	Sapindaceae	*Cupaniopsis parvifolia*	small-leaved tuckeroo		C		1
plants	higher dicots	Sapindaceae	*Arytera divaricata*	coogera		C		1
plants	higher dicots	Sapotaceae	*Planchonella pohlmaniana*			C		1
plants	higher dicots	Sapotaceae	*Planchonella cotinifolia var. pubescens*			C		1
plants	higher dicots	Scrophulariaceae	*Eremophila debilis*	winter apple		C		1/1
plants	higher dicots	Scrophulariaceae	*Myoporum acuminatum*	coastal boobialla		C		1/1
plants	higher dicots	Simaroubaceae	*Ailanthus triphysa*	white siris		C		1
plants	higher dicots	Sparrmanniaceae	*Corchorus olitorius*	jute		C		1/1
plants	higher dicots	Stackhousiaceae	*Stackhousia muricata*			C		1/1
plants	higher dicots	Stylidiaceae	*Stylidium graminifolium*	grassy-leaved trigger-flower		C		1/1
plants	higher dicots	Stylidiaceae	*Stylidium debile*	frail trigger plant		C		1/1
plants	higher dicots	Thymelaeaceae	*Wikstroemia indica*	tie bush		C		1
plants	higher dicots	Thymelaeaceae	*Pimelea glauca*	smooth riceflower		C		3/3
plants	higher dicots	Thymelaeaceae	*Pimelea linifolia*			C		1
plants	higher dicots	Tropaeolaceae	*Tropaeolum majus*	garden nasturtium	Y			1/1
plants	higher dicots	Ulmaceae	*Aphananthe philippinensis*			C		1
plants	higher dicots	Ulmaceae	*Trema tomentosa var. aspera*			C		1
plants	higher dicots	Ulmaceae	*Celtis sinensis*	Chinese elm	Y			3/2
plants	higher dicots	Urticaceae	*Dendrocnide photinophylla*	shiny-leaved stinging tree		C		1
plants	higher dicots	Urticaceae	*Urtica incisa*	stinging nettle		C		1
plants	higher dicots	Violaceae	*Afrohybanthus stellarioides*			C		2/1
plants	higher dicots	Vitaceae	*Cayratia clematidea*	slender grape		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Vitaceae	*Clematicissus opaca*			C		1
plants	lower dicots	Annonaceae	*Polyalthia nitidissima*	polyalthia		C		1
plants	lower dicots	Apocynaceae	*Cascabela thevetia*	yellow oleander	Y			2/2
plants	lower dicots	Apocynaceae	*Marsdenia coronata*	slender milkvine		V		13/13
plants	lower dicots	Apocynaceae	*Secamone elliptica*			C		1
plants	lower dicots	Apocynaceae	*Alstonia constricta*	bitterbark		C		2/1
plants	lower dicots	Apocynaceae	*Parsonsia straminea*	monkey rope		C		1
plants	lower dicots	Apocynaceae	*Alyxia ruscifolia*			C		1
plants	lower dicots	Apocynaceae	*Gomphocarpus physocarpus*	balloon cottonbush	Y			1/1
plants	lower dicots	Apocynaceae	*Araujia sericifera*	white moth vine	Y			1/1
plants	lower dicots	Apocynaceae	*Parsonsia brisbanensis*	broad-leaved monkey vine		C		9/9
plants	lower dicots	Apocynaceae	*Marsdenia*			C		1
plants	lower dicots	Apocynaceae	*Carissa ovata*	currantbush		C		1
plants	lower dicots	Apocynaceae	*Nerium oleander*	oleander	Y			2/2
plants	lower dicots	Aristolochiaceae	*Aristolochia meridionalis subsp. meridionalis*			C		3/3
plants	lower dicots	Boraginaceae	*Cordia myxa*		Y			1/1
plants	lower dicots	Boraginaceae	*Echium plantagineum*	Paterson's curse	Y			1/1
plants	lower dicots	Convolvulaceae	*Ipomoea cairica*		Y			1/1
plants	lower dicots	Convolvulaceae	*Dichondra repens*	kidney weed		C		1
plants	lower dicots	Convolvulaceae	*Cuscuta campestris*	dodder	Y			1
plants	lower dicots	Convolvulaceae	*Polymeria calycina*	pink bindweed		C		1
plants	lower dicots	Hernandiaceae	*Hernandia bivalvis*	cudgerie		NT		1
plants	lower dicots	Lamiaceae	*Plectranthus amboinicus*	allspice	Y			1/1
plants	lower dicots	Lamiaceae	*Clerodendrum floribundum*			C		1
plants	lower dicots	Lamiaceae	*Plectranthus habrophyllus*			E	E	1/1
plants	lower dicots	Lamiaceae	*Westringia eremicola*	slender westringia		C		1/1
plants	lower dicots	Lamiaceae	*Leonotis nepetifolia*		Y			2/2
plants	lower dicots	Lamiaceae	*Mentha satureioides*	native pennyroyal		C		2/2
plants	lower dicots	Lamiaceae	*Lamium amplexicaule*	deadnettle	Y			1/1
plants	lower dicots	Lamiaceae	*Salvia coccinea*	red salvia	Y			1
plants	lower dicots	Lamiaceae	*Stachys arvensis*	stagger weed	Y			1/1
plants	lower dicots	Lamiaceae	*Plectranthus verticillatus*		Y			1/1
plants	lower dicots	Lauraceae	*Cryptocarya triplinervis var. triplinervis*			C		1/1
plants	lower dicots	Lauraceae	*Cryptocarya triplinervis*			C		1
plants	lower dicots	Lauraceae	*Cryptocarya sclerophylla*	totempole		C		1
plants	lower dicots	Lauraceae	*Cassytha filiformis*	dodder laurel		C		1/1
plants	lower dicots	Lauraceae	*Endiandra sieberi*	hard corkwood		C		1
plants	lower dicots	Menispermaceae	*Stephania japonica var. discolor*			C		1
plants	lower dicots	Menispermaceae	*Tinospora smilacina*	snakevine		C		1
plants	lower dicots	Menispermaceae	*Legnephora moorei*			C		1
plants	lower dicots	Menispermaceae	*Pleogyne australis*	wiry grape		C		1
plants	lower dicots	Papaveraceae	*Argemone ochroleuca subsp. ochroleuca*	Mexican poppy	Y			2/2
plants	lower dicots	Papaveraceae	*Fumaria officinalis subsp. officinalis*		Y			1/1
plants	lower dicots	Ranunculaceae	*Ranunculus sessiliflorus var. sessiliflorus*			C		1/1
plants	lower dicots	Ranunculaceae	*Ranunculus lappaceus*	common buttercup		C		1/1
plants	lower dicots	Ranunculaceae	*Ranunculus sceleratus subsp. sceleratus*		Y			3/3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	lower dicots	Solanaceae	*Solanum chrysotrichum*		Y			2/2
plants	lower dicots	Solanaceae	*Cestrum parqui*	green cestrum	Y			4/3
plants	lower dicots	Solanaceae	*Nicotiana glauca*	tree tobacco	Y			1/1
plants	lower dicots	Solanaceae	*Solanum nodiflorum*		Y			2/2
plants	lower dicots	Solanaceae	*Solanum pseudolulo*		Y			1/1
plants	lower dicots	Solanaceae	*Solanum mauritianum*	wild tobacco	Y			1/1
plants	lower dicots	Solanaceae	*Solanum stelligerum*	devil's needles		C		1
plants	lower dicots	Solanaceae	*Solanum elaeagnifolium*	silverleaf nightshade	Y			1/1
plants	lower dicots	Solanaceae	*Solanum seaforthianum*	Brazilian nightshade	Y			2/1
plants	lower dicots	Solanaceae	*Salpichroa origanifolia*	pampas lily of the valley	Y			1/1
plants	lower dicots	Solanaceae	*Datura ferox*	fierce thornapple	Y			1/1
plants	lower dicots	Verbenaceae	*Lantana camara*	lantana	Y			1
plants	lower dicots	Verbenaceae	*Lantana montevidensis*	creeping lantana	Y			3/2
plants	lower dicots	Verbenaceae	*Verbena bonariensis*	purpletop	Y			1
plants	monocots	Amaryllidaceae	*Crinum pedunculatum*	river lily		C		2/1
plants	monocots	Amaryllidaceae	*Zephyranthes carinata*		Y			1/1
plants	monocots	Araceae	*Pistia stratiotes*	water lettuce	Y			1/1
plants	monocots	Araceae	*Colocasia esculenta*	taro	Y			3/3
plants	monocots	Arecaceae	*Syagrus romanzoffiana*	Queen palm	Y			1
plants	monocots	Asparagaceae	*Asparagus virgatus*		Y			1/1
plants	monocots	Asparagaceae	*Asparagus africanus*	ornamental asparagus	Y			3/2
plants	monocots	Asparagaceae	*Asparagus plumosus*	feathered asparagus fern	Y			1
plants	monocots	Asphodelaceae	*Aloe maculata*		Y			2/2
plants	monocots	Asphodelaceae	*xGastrolea*			C		1/1
plants	monocots	Colchicaceae	*Iphigenia indica*			C		1/1
plants	monocots	Commelinaceae	*Commelina benghalensis*		Y			1/1
plants	monocots	Commelinaceae	*Aneilema acuminatum*			C		1
plants	monocots	Commelinaceae	*Commelina diffusa*	wandering jew		C		2/1
plants	monocots	Commelinaceae	*Callisia repens*		Y			1/1
plants	monocots	Commelinaceae	*Callisia fragrans*		Y			2/1
plants	monocots	Cyperaceae	*Fimbristylis microcarya*			C		1/1
plants	monocots	Cyperaceae	*Fimbristylis dichotoma*	common fringe-rush		C		1/1
plants	monocots	Cyperaceae	*Lepidosperma laterale*			C		1
plants	monocots	Cyperaceae	*Cyperus victoriensis*			C		1/1
plants	monocots	Cyperaceae	*Cyperus involucratus*		Y			1/1
plants	monocots	Cyperaceae	*Cyperus brevifolius*	Mullumbimby couch	Y			1/1
plants	monocots	Cyperaceae	*Abildgaardia ovata*			C		1/1
plants	monocots	Cyperaceae	*Gahnia aspera*			C		2/1
plants	monocots	Cyperaceae	*Cyperus fulvus*			C		1/1
plants	monocots	Cyperaceae	*Cyperus papyrus*	papyrus	Y			1/1
plants	monocots	Cyperaceae	*Caustis blakei*			C		1
plants	monocots	Dioscoreaceae	*Dioscorea transversa*	native yam		C		1
plants	monocots	Dracaenaceae	*Sansevieria trifasciata*	mother-in-law's tongue	Y			1
plants	monocots	Dracaenaceae	*Sansevieria trifasciata cv. Laurentii*		Y			1/1
plants	monocots	Hemerocallidaceae	*Dianella caerulea*			C		1
plants	monocots	Hemerocallidaceae	*Dianella longifolia*			C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Hemerocallidaceae	*Geitonoplesium cymosum*	scrambling lily		C		1
plants	monocots	Hemerocallidaceae	*Dianella brevipedunculata*			C		1/1
plants	monocots	Hemerocallidaceae	*Dianella longifolia var. stenophylla*			C		3/3
plants	monocots	Hypoxidaceae	*Hypoxis pratensis var. tuberculata*			C		2/2
plants	monocots	Iridaceae	*Patersonia sericea*			C		1
plants	monocots	Laxmanniaceae	*Lomandra filiformis subsp. filiformis*			C		1/1
plants	monocots	Laxmanniaceae	*Lomandra filiformis subsp. coriacea*			C		1/1
plants	monocots	Laxmanniaceae	*Eustrephus latifolius*	wombat berry		C		1
plants	monocots	Laxmanniaceae	*Lomandra multiflora*			C		1
plants	monocots	Laxmanniaceae	*Lomandra longifolia*			C		1
plants	monocots	Laxmanniaceae	*Laxmannia gracilis*	slender wire lily		C		2/2
plants	monocots	Laxmanniaceae	*Lomandra confertifolia subsp. pallida*			C		2/2
plants	monocots	Orchidaceae	*Chiloglottis*			C		1
plants	monocots	Orchidaceae	*Pterostylis nutans*			C		1
plants	monocots	Orchidaceae	*Microtis parviflora*	slender onion orchid		C		1
plants	monocots	Orchidaceae	*Chiloglottis diphylla*			C		2/2
plants	monocots	Orchidaceae	*Pterostylis ophioglossa*			C		1
plants	monocots	Orchidaceae	*Epidendrum x obrienianum*		Y			1/1
plants	monocots	Orchidaceae	*Acianthus*			C		1
plants	monocots	Poaceae	*Digitaria parviflora*			C		1
plants	monocots	Poaceae	*Dichanthium annulatum*	sheda grass	Y			1/1
plants	monocots	Poaceae	*Dichanthium aristatum*	angleton grass	Y			2/2
plants	monocots	Poaceae	*Dichelachne micrantha*	shorthair plumegrass		C		1
plants	monocots	Poaceae	*Eremochloa bimaculata*	poverty grass		C		2/2
plants	monocots	Poaceae	*Chrysopogon sylvaticus*			C		1/1
plants	monocots	Poaceae	*Dichanthium sericeum subsp. sericeum*			C		1/1
plants	monocots	Poaceae	*Anthosachne kingiana subsp. multiflora*			C		1/1
plants	monocots	Poaceae	*Enteropogon unispiceus*			C		1
plants	monocots	Poaceae	*Aristida leichhardtiana*			C		1/1
plants	monocots	Poaceae	*Eragrostis leptostachya*			C		1/1
plants	monocots	Poaceae	*Lachnagrostis filiformis*			C		1/1
plants	monocots	Poaceae	*Hyparrhenia rufa subsp. rufa*		Y			1/1
plants	monocots	Poaceae	*Cynodon dactylon var. dactylon*		Y			1/1
plants	monocots	Poaceae	*Echinopogon nutans var. nutans*			C		2/2
plants	monocots	Poaceae	*Austrostipa rudis subsp. nervosa*			C		1/1
plants	monocots	Poaceae	*Dinebra decipiens var. decipiens*			C		1/1
plants	monocots	Poaceae	*Megathyrsus maximus var. maximus*		Y			1
plants	monocots	Poaceae	*Panicum decompositum var. tenuius*			C		1/1
plants	monocots	Poaceae	*Bothriochloa bladhii subsp. bladhii*			C		1/1
plants	monocots	Poaceae	*Megathyrsus maximus var. pubiglumis*		Y			2/1
plants	monocots	Poaceae	*Microlaena stipoides var. stipoides*			C		1/1
plants	monocots	Poaceae	*Cynodon nlemfuensis var. nlemfuensis*		Y			1/1
plants	monocots	Poaceae	*Chloris gayana*	rhodes grass	Y			1/1
plants	monocots	Poaceae	*Melinis repens*	red natal grass	Y			2/1
plants	monocots	Poaceae	*Panicum simile*			C		1/1
plants	monocots	Poaceae	*Aristida vagans*			C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Poaceae	*Panicum effusum*			C		1/1
plants	monocots	Poaceae	*Urochloa mutica*		Y			1/1
plants	monocots	Poaceae	*Cynodon dactylon*		Y			1
plants	monocots	Poaceae	*Dichelachne rara*			C		1
plants	monocots	Poaceae	*Panicum pygmaeum*	dwarf panic		C		1
plants	monocots	Poaceae	*Sarga leiocladum*			C		1/1
plants	monocots	Poaceae	*Themeda triandra*	kangaroo grass		C		1/1
plants	monocots	Poaceae	*Urochloa foliosa*			C		1/1
plants	monocots	Poaceae	*Cenchrus setaceus*		Y			1/1
plants	monocots	Poaceae	*Entolasia stricta*	wiry panic		C		1
plants	monocots	Poaceae	*Urochloa whiteana*			C		1/1
plants	monocots	Poaceae	*Aristida personata*			C		1/1
plants	monocots	Poaceae	*Cenchrus purpureus*		Y			1
plants	monocots	Poaceae	*Eragrostis curvula*		Y			1/1
plants	monocots	Poaceae	*Oplismenus aemulus*	creeping shade grass		C		1
plants	monocots	Poaceae	*Urochloa decumbens*		Y			1/1
plants	monocots	Poaceae	*Digitaria ramularis*			C		1/1
plants	monocots	Poaceae	*Entolasia marginata*	bordered panic		C		1/1
plants	monocots	Poaceae	*Imperata cylindrica*	blady grass		C		2/1
plants	monocots	Poaceae	*Melinis minutiflora*	molasses grass	Y			1
plants	monocots	Poaceae	*Paspalidium distans*	shotgrass		C		1/1
plants	monocots	Poaceae	*Cymbopogon refractus*	barbed-wire grass		C		1
plants	monocots	Ripogonaceae	*Ripogonum album*	white supplejack		C		1
plants	monocots	Smilacaceae	*Smilax australis*	barbed-wire vine		C		1
plants	monocots	Xanthorrhoeaceae	*Xanthorrhoea latifolia subsp. latifolia*			C		1
plants	monocots	Xyridaceae	*Xyris complanata*	yellow-eye		C		1/1
plants	mosses	Bryophyte	*Bryophyte*			C		1/1
plants	mosses	Ptychomitriaceae	*Ptychomitrium australe*			C		1/1
plants		Rhodophyta	*Audouinella*			C		1/1
plants		Rhodophyta	*Caloglossa leprieurii var. angustata*			C		1/1
plants		Rhodophyta	*Caloglossa ogasawaraensis*			C		1/1
plants		Rhodophyta	*Compsopogon coeruleus*			C		1/1
protists	blue-green algae	Cyanophyceae	*Scytonema crispum*			C		1/1
protists	blue-green algae	Cyanophyceae	*Porphyrosiphon notarisii*			C		3/3
protists	blue-green algae	Cyanophyceae	*Aphanothece elabens*			C		1/1
protists	green algae	Chlorophyceae	*Cephaleuros parasiticus*			C		1/1
protists	green algae	Chlorophyceae	*Trentepohlia rigidula*			C		2/2
protists	green algae	Chlorophyceae	*Pithophora oedogonia var. oedogonia*			C		1/1
protists	uncertain	Algae	*Algae*			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 Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (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 V

VEGETATION MANAGEMENT REPORT AND PRE-CLEARING MAPPING

Department of Natural Resources, Mines and Energy



Vegetation management report

For Lot: 73 Plan: SP128662

Current as at 04/09/2018

Queensland Government

This publication has been compiled by Operations Support, Department of Natural Resources, Mines and Energy.

© State of Queensland, (2018)

The Queensland Government supports and encourages the dissemination and exchange of its information. The copyright in this publication is licensed under a Creative Commons - Attribution 4.0 International (CC BY) licence.

Under this licence you are free, without having to seek our permission, to use this publication in accordance with the licence terms.



You must keep intact the copyright notice and attribute the State of Queensland as the source of the publication.

Note: Some content in this publication may have different licence terms as indicated.

For more information on this licence, visit http://creativecommons.org/licenses/by/3.0/au/deed.en

The information contained herein is subject to change without notice. The Queensland Government shall not be liable for technical or other errors or omissions contained herein. The reader/user accepts all risks and responsibility for losses, damages, costs and other consequences resulting directly or indirectly from using this information.

Recent changes

New vegetation clearing laws

New vegetation management laws were passed by the Queensland Parliament on 3 May 2018 and may affect the clearing you can undertake on your property.

For more information, read about the new vegetation management laws (https://www.dnrme.qld.gov.au/land-water/initiatives/vegetation-management-laws/) or call 135VEG (13 58 34) between 8.30am and 4.30pm Monday to Friday.

Updated mapping

The Regulated Vegetation Management Map and Supporting Map was updated in March 2018 to reflect the most up to date information available in relation to regional ecosystems, essential habitat and wetland mapping (Version 10).

Overview

Based on the lot on plan details you have supplied, this report provides the following detailed information:

- *Vegetation management framework* - an explanation of the application of the framework.
- *Property details* - information about the specified Lot on Plan, lot size, local government area, bioregion(s), subregion(s), catchment(s), coastal or non coastal status, and any applicable area management plans associated with your property.
- *Vegetation management details for the specified Lot on Plan* - specific information about your property including vegetation categories, regional ecosystems, watercourses, wetlands, essential habitat, and protected plants.
- *Contact information.*
- *Maps* - a series of colour maps to assist in identifying regulated vegetation on your property.
- *Other legislation contact information.*

This information will assist you to determine your options for managing vegetation, which may include:

- exempt clearing work
- accepted development vegetation clearing code
- an area management plan
- a development approval.

Other laws

The clearing of native vegetation is regulated by both Queensland and Australian legislation, and some local governments also regulate native vegetation clearing. You may need to obtain an approval or permit under another Act, such as Queensland's Protected Plants framework or the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Section 6 of this guide provides contact details of other agencies you should confirm requirements with, before commencing vegetation clearing.

Table of Contents

1. Vegetation management framework . . . 5
1.1 Exempt clearing work . . . 5
1.2 Accepted development vegetation clearing codes . . . 5
1.3 Area management plans . . . 6
1.4 Development approvals . . . 6
2. Property details . . . 7
2.1 Tenure . . . 7
2.2 Property location . . . 7
3. Vegetation management details for Lot: 73 Plan: SP128662 . . . 8
3.1 Vegetation categories . . . 8
3.2 Regional ecosystems . . . 9
3.3 Watercourses . . . 9
3.4 Wetlands . . . 10
3.5 Essential habitat . . . 10
3.6 Protected plants (administered by the Department of Environment and Science (DES)) . . . 13
3.7 Emissions Reduction Fund (ERF) . . . 14
4. Contact information for DNRME . . . 14
5. Maps . . . 15
5.1 Regulated vegetation management map . . . 16
5.2 Vegetation management supporting map . . . 17
5.3 Coastal/non coastal map . . . 18
5.4 Protected plants map administered by DES . . . 19
6. Other relevant legislation contacts list . . . 20

1. Vegetation management framework

The *Vegetation Management Act 1999* (VMA), the Vegetation Management Regulation 2012, the *Planning Act 2016* and the Planning Regulation 2017, in conjunction with associated policies and codes, form the Vegetation Management Framework.

The VMA does not apply to all land tenures or vegetation types. State forests, national parks, forest reserves and some tenures under the *Forestry Act 1959* and *Nature Conservation Act 1992* are not regulated by the VMA. Managing or clearing vegetation on these tenures may require approvals under these laws.

The following native vegetation is not regulated under the VMA but may require permit(s) under other laws:

- grass or non-woody herbage;
- a plant within a grassland regional ecosystem prescribed under Schedule 5 of the Vegetation Management Regulation 2012; and
- a mangrove.

1.1 Exempt clearing work

Exempt clearing work is an activity for which you do not need to notify DNRME or obtain an approval. Exempt clearing work was previously known as exemptions.

In areas that are mapped as Category X (white in colour) on the regulated vegetation management map (see section 5.1), and where the land tenure is freehold, indigenous land and leasehold land for agriculture and grazing purposes, the clearing of vegetation is considered exempt clearing work and does not require notification or development approval. For all other land tenures, contact DNRME before commencing clearing to ensure that the proposed activity is exempt clearing work.

A range of routine property management activities are considered exempt clearing work. A list of exempt clearing work is available at
https://www.qld.gov.au/environment/land/vegetation/exemptions/.

Exempt clearing work may be affected if the proposed clearing area is subject to development approval conditions, a covenant, an environmental offset, an exchange area, a restoration notice, or an area mapped as Category A. Contact DNRME prior to clearing in any of these areas.

1.2 Accepted development vegetation clearing codes

Some clearing activities can be undertaken under an accepted development vegetation clearing code. The codes can be downloaded at
https://www.qld.gov.au/environment/land/vegetation/codes/

If you intend to clear vegetation under an accepted development vegetation clearing code, you must notify DNRME before commencing. The information in this report will assist you to complete the online notification form.

You can complete the online form at
https://apps.dnrm.qld.gov.au/vegetation/

1.3 Area management plans

Area Management Plans (AMP) provide an alternative approval system for vegetation clearing. They list the purposes and clearing conditions that have been approved for the areas covered by the plan. It is not necessary to use an AMP, even when an AMP applies to your property.

As a result of the new laws, AMPs for fodder harvesting, managing thickened vegetation and managing encroachment will continue for 2 years. New notifications cannot be made for these AMPs.

New notifications can be made for all other AMPs. These will continue to apply until their nominated end date.

If an area management plan applies to your property for which you can make a new notification, it will be listed in Section 2.2 of this report. Before clearing under one of these AMPs, you must first notify the DNRME and then follow the conditions and requirements listed in the AMP.
https://www.qld.gov.au/environment/land/vegetation/area-plans/

1.4 Development approvals

If your proposed clearing is not exempt clearing work, or is not permitted under an accepted development vegetation clearing code, or an AMP, you may be able to apply for a development approval. Information on how to apply for a development approval is available at
https://www.qld.gov.au/environment/land/vegetation/applying/

2. Property details

2.1 Tenure

All of the lot, plan and tenure information associated with property Lot: 73 Plan: SP128662, including links to relevant Smart Maps, are listed in Table 1. The tenure of the property (whether it is freehold, leasehold, or other) may be viewed by clicking on the Smart Map link(s) provided.

Table 1: Lot, plan and tenure information for the property

Lot	Plan	Tenure	Link to property on SmartMap
273	SP128662	State Land	https://apps.information.qld.gov.au/data/cadastre/GenerateSmartMap?q=273\SP128662
73	SP128662	Freehold	https://apps.information.qld.gov.au/data/cadastre/GenerateSmartMap?q=73\SP128662

The tenure of the land may affect whether clearing is considered exempt clearing work or may be carried out under an accepted development vegetation clearing code.

2.2 Property location

Table 2 provides a summary of the locations for property Lot: 73 Plan: SP128662, in relation to natural and administrative boundaries.

Table 2: Property location details

Local Government(s)
Ipswich City

Bioregion(s)	Subregion(s)
Southeast Queensland	Moreton Basin

Catchment(s)
Brisbane

For the purposes of the accepted development vegetation clearing codes and the State Development Assessment Provisions (SDAP), this property is regarded as*
Coastal

*See also Map 5.4

Area Management Plan(s): Nil

3. Vegetation management details for Lot: 73 Plan: SP128662

3.1 Vegetation categories

Vegetation categories are shown on the regulated vegetation management map in section 5.1 of this report. A summary of vegetation categories on the subject lot are listed in Table 3. Descriptions for these categories are shown in Table 4.

Table 3: Vegetation categories for subject property. Total area: 25.01ha

Vegetation category	Area (ha)
Category B	4.8
Category C	14.42
Category X	5.79

Table 4

Category	Colour on Map	Description	Requirements / options
A	red	Compliance areas, environmental offset areas and voluntary declaration areas	Special conditions apply to Category A areas. Before clearing, contact DNRME to confirm any requirements in a Category A area.
B	dark blue	Remnant vegetation areas	Exempt clearing work, or notification and compliance with accepted development vegetation clearing codes, area management plans or development approval.
C	light blue	High-value regrowth areas	Exempt clearing work, or notification and compliance with managing Category C regrowth vegetation accepted development vegetation clearing code.
R	yellow	Regrowth within 50m of a watercourse or drainage feature in the Great Barrier Reef catchment areas	Exempt clearing work, or notification and compliance with managing Category R regrowth accepted development vegetation clearing code or area management plans.
X	white	Clearing is considered accepted development on freehold land, indigenous land and leasehold land for agriculture and grazing purposes. Contact DNRME to clarify whether a development approval is required for other State land tenures.	No permit or notification required on freehold land, indigenous land and leasehold land for agriculture and grazing. A development approval may be required for some State land tenures.

Property Map of Assessable Vegetation (PMAV)

This report does not confirm if a Property Map of Assessable Vegetation (PMAV) exists on a lot. To confirm whether or not a PMAV exists on a lot, please check the PMAV layer on the Queensland Globe2, or contact DNRME on 135VEG (135 834).

3.2 Regional ecosystems

The endangered, of concern and least concern regional ecosystems on your property are shown on the vegetation management supporting map in section 5.2 and are listed in Table 5.

A description of regional ecosystems can be accessed online at
https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/descriptions/

Table 5: Regional ecosystems present on subject property

Regional Ecosystem	VMA Status	Category	Area (Ha)	Short Description	Structure Category
12.3.3	Endangered	B	0.52	Eucalyptus tereticornis woodland on Quaternary alluvium	Sparse
12.3.3	Endangered	C	3.72	Eucalyptus tereticornis woodland on Quaternary alluvium	Sparse
12.3.7	Least concern	B	0.03	Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca spp. fringing woodland	Sparse
12.3.7	Least concern	C	0.09	Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca spp. fringing woodland	Sparse
12.9-10.19	Least concern	C	1.59	Eucalyptus fibrosa subsp. fibrosa woodland on sedimentary rocks	Sparse
12.9-10.2	Least concern	B	4.13	Corymbia citriodora subsp. variegata +/- Eucalyptus crebra open forest on sedimentary rocks	Mid-dense
12.9-10.2	Least concern	C	6.89	Corymbia citriodora subsp. variegata +/- Eucalyptus crebra open forest on sedimentary rocks	Mid-dense
12.9-10.3	Of concern	B	0.03	Eucalyptus moluccana open forest on sedimentary rocks	Mid-dense
12.9-10.7	Of concern	B	0.09	Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp., E. melanophloia woodland on sedimentary rocks	Sparse
12.9-10.7	Of concern	C	2.12	Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp., E. melanophloia woodland on sedimentary rocks	Sparse
non-rem	None	X	5.79	None	None

Please note:

1. All area and area derived figures included in this table have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

2. If Table 5 contains a Category 'plant', please be aware that this refers to 'plantations' such as forestry, and these areas are considered non-remnant under the VMA.

The VMA status of the regional ecosystem (whether it is endangered, of concern or least concern) also determines if any of the following are applicable:

- exempt clearing work
- accepted development vegetation clearing codes
- performance outcomes in State Development Assessment Provisions (SDAP).

3.3 Watercourses

Vegetation management watercourses and drainage features for this property are shown on the vegetation management supporting map in section 5.2.

3.4 Wetlands

There are no vegetation management wetlands present on this property.

3.5 Essential habitat

Protected wildlife is native wildlife prescribed under the *Nature Conservation Act 1992* (NCA), and includes endangered, vulnerable or near-threatened wildlife.

Essential habitat for protected wildlife includes suitable habitat on the lot, or where a species has been known to occur up to 1.1 kilometres from a lot on which there is assessable vegetation. These important habitat areas are protected under the VMA.

Any essential habitat on this property will be shown as blue hatching on the vegetation supporting map in section 5.2.

If essential habitat is identified on the lot, information about the protected wildlife species is provided in Table 6 below. The numeric labels on the vegetation management supporting map can be cross referenced with Table 6 to outline the essential habitat factors for that particular species. There may be essential habitat for more than one species on each lot, and areas of Category A, Category B and Category C can be mapped as Essential Habitat.

Essential habitat is compiled from a combination of species habitat models and buffered species records. Regional ecosystem is a mandatory essential habitat factor, unless otherwise stated. Essential habitat, for protected wildlife, means an area of vegetation shown on the Regulated Vegetation Management Map as assessable vegetation -

1) that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database. Essential habitat factors are comprised of - regional ecosystem (mandatory for most species), vegetation community, altitude, soils, position in landscape; or
2) in which the protected wildlife, at any stage of its life cycle, is located.

If there is no essential habitat mapping shown on the vegetation management supporting map for this lot, and there is no table in the sections below, it confirms that there is no essential habitat on the lot.

Category A and/or Category B and/or Category C

Table 6: Essential habitat in Category A and/or Category B and/or Category C

Label	Scientific Name	Common Name	NCA Status	Vegetation Community	Altitude	Soils	Position in Landscape
860	Phascolarctos cinereus	koala	V	SEQ: Open eucalypt forest and woodland that has: a) multiple strata layers containing Eucalyptus, Corymbia, Angophora, Lophostemon or Melaleuca trees that-at 1.3 metres above the ground-have a diameter both greater and less than 30 centimetres; and b) at least 1 of the following species: Eucalyptus tereticornis, E. fibrosa, E. propinqua; E. umbra, E. grandis, E. microcorys, E. tindaliae, E. resinifera, E. populnea, E. robusta, E. nigra, E. racemosa, E. crebra, E. exserta, E. seeana, Lophostemon confertus, L. suaveolens, Melaleuca quinquenervia. Outside SEQ: Open eucalypt forest and woodland that contains Eucalyptus &/or Corymbia spp. Tree species used for food varies across State and can include Eucalyptus tereticornis, E. camaldulensis, E. coolabah; E. drepanophylla, E. platyphylla, E. orgadophilla, E. thozetiana, E. melanophloia, E. populnea, E. melliodora, E. dealbata, E. microtheca, E. crebra, E. exserta, E. blakelyi, E. papuana, Corymbia tessellaris, C. citriodora, Melaleuca quinquenervia, M. leucadendra.	Sea level to 1000m.	None	Riparian areas, plains and hill/escarpment slopes.
848	Petauroides volans	greater glider	V	Tall mature open wet and dry eucalypt forest (Eucalyptus &/or Corymbia spp.) to low open eucalypt woodland; presence of hollow-bearing trees.	Sea level to 1300m.	Usually on soils of relatively high fertility.	None
1107	Ninox strenua	powerful owl	V	Wet and dry tall open eucalypt forest (Eucalyptus pilularis, E. acmenoides, E. tereticornis, E. camaldulensis, E. crebra, E. melliodora, Corymbia citriodora & C. intermedia), including mountain forest gullies/gorges; forests aged 60+ years (large & old) on fertile soils with suitable hollows; roosting in dense foliage of closed forest (occasionally caves) and foraging in open forest and woodland including areas adjacent to urban/rural development. Nest in large hollows (45-75cm diameter, 50-180cm deep) 6-45m above ground, in large (>100cm dbh) old eucalypts on the side or at the head of heavily wooded gully.	Sea level to 1000m.	None	Gully.
2180	Notelaea ipsviciensis	Cooneana olive	E	dry sclerophyll eucalypt forest.; open forest of Eucalyptus fibrosa, Corymbia citriodora and C. henryii	0 to 300 m	shallow sandy to loam soil derived from sandstone substrates or stony clay soils	hill sides, gullies in hilly terrain

Label	Scientific Name	Common Name	NCA Status	Vegetation Community	Altitude	Soils	Position in Landscape
11205	Marsdenia coronata	slender milkvine	V	open forest of Eucalyptus pilularis, E. microcorys, Corymbia intermedia, or Eucalyptus propinqua, E. carnea with Themeda understorey, or Lophostemon confertus, Corymbia intermedia, Eucalyptus carnea, Allocasuarina littoralis, Banksia integrifolia, or Eucalyptus carnea, E. propinqua, or Eucalyptus carnea, E. propinqua, E. acmenoides, or Allocasuarina littoralis, Lophostemon confertus, Corymbia citriodora, Eucalyptus carnea, E. tindaliae; woodland to open forest of Eucalyptus fibrosa, Corymbia citriodora, or Eucalyptus fibrosa, C. henryi, or Corymbia citriodora, Eucalyptus dura, C. henryii, or Eucalyptus dura, Eucalyptus acmenoides; rocky heathland with Acacia blakei; wet sclerophyll forest dominated by Eucalyptus andrewsii, E. biturbinata	0 to 800 m	red brown loam to clay or sandy soil occasionally skeletal	mostly on steep ridge or hill slope sometimes on rock ledges along clifflines rarely on alluvial terrace

Label	Regional Ecosystem (mandatory unless otherwise specified)
860	SEQ: 11.3.2, 11.3.4, 11.3.25, 11.3.26, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.9, 12.2.5, 12.2.6, 12.2.7, 12.2.8, 12.2.10, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.6, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.14, 12.3.18, 12.3.19, 12.3.20, 12.5.1, 12.5.2, 12.5.3, 12.5.4, 12.5.6, 12.5.7, 12.5.10, 12.5.12, 12.8.1, 12.8.8, 12.8.9, 12.8.11, 12.8.12, 12.8.14, 12.8.16, 12.8.17, 12.8.20, 12.8.24, 12.8.25, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.7, 12.9-10.8, 12.9-10.11, 12.9-10.12, 12.9-10.14, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.21, 12.9-10.25, 12.9-10.26, 12.9-10.27, 12.9-10.28, 12.9-10.29, 12.11.2, 12.11.3, 12.11.5, 12.11.6, 12.11.7, 12.11.8, 12.11.9, 12.11.14, 12.11.16, 12.11.17, 12.11.18, 12.11.22, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.2, 12.12.3, 12.12.5, 12.12.6, 12.12.7, 12.12.8, 12.12.9, 12.12.11, 12.12.12, 12.12.14, 12.12.15, 12.12.23, 12.12.24, 12.12.25, 12.12.28. Outside SEQ: 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.3.8, 4.3.10, 4.3.11, 4.4.1, 4.5.3, 4.5.5, 4.5.6, 4.5.8, 4.5.9, 4.7.1, 4.7.7, 4.7.8, 4.9.6, 4.9.10, 4.9.12, 4.9.17, 6.3.1, 6.3.2, 6.3.3, 6.3.4, 6.3.5, 6.3.7, 6.3.8, 6.3.9, 6.3.11, 6.3.12, 6.3.17, 6.3.18, 6.3.22, 6.3.24, 6.3.25, 6.4.1, 6.4.2, 6.4.3, 6.4.4, 6.5.1, 6.5.2, 6.5.3, 6.5.5, 6.5.6, 6.5.7, 6.5.8, 6.5.9, 6.5.10, 6.5.11, 6.5.13, 6.5.14, 6.5.15, 6.5.16, 6.5.17, 6.5.18, 6.5.19, 6.6.2, 6.7.1, 6.7.2, 6.7.5, 6.7.6, 6.7.7, 6.7.9, 6.7.11, 6.7.12, 6.7.13, 6.7.14, 6.7.17, 6.9.3, 7.2.3, 7.2.4, 7.2.7, 7.2.11, 7.3.7, 7.3.8, 7.3.9, 7.3.12, 7.3.13, 7.3.14, 7.3.16, 7.3.19, 7.3.20, 7.3.21, 7.3.25, 7.3.26, 7.3.39, 7.3.40, 7.3.42, 7.3.43, 7.3.44, 7.3.45, 7.3.47, 7.3.48, 7.3.50, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.8.7, 7.8.8, 7.8.10, 7.8.15, 7.8.16, 7.8.17, 7.8.18, 7.8.19, 7.11.5, 7.11.6, 7.11.13, 7.11.14, 7.11.16, 7.11.18, 7.11.19, 7.11.20, 7.11.21, 7.11.31, 7.11.32, 7.11.33, 7.11.34, 7.11.35, 7.11.37, 7.11.41, 7.11.42, 7.11.43, 7.11.44, 7.11.45, 7.11.46, 7.11.47, 7.11.48, 7.11.49, 7.11.50, 7.11.51, 7.12.4, 7.12.5, 7.12.17, 7.12.21, 7.12.22, 7.12.23, 7.12.24, 7.12.25, 7.12.26, 7.12.27, 7.12.28, 7.12.29, 7.12.30, 7.12.33, 7.12.34, 7.12.35, 7.12.51, 7.12.52, 7.12.53, 7.12.54, 7.12.55, 7.12.56, 7.12.57, 7.12.58, 7.12.59, 7.12.60, 7.12.61, 7.12.62, 7.12.63, 7.12.65, 7.12.66, 7.12.69, 8.1.5, 8.2.3, 8.2.6, 8.2.7, 8.2.8, 8.2.11, 8.2.12, 8.2.13, 8.2.14, 8.3.1, 8.3.2, 8.3.3, 8.3.5, 8.3.6, 8.3.8, 8.3.10, 8.3.11, 8.3.13, 8.5.1, 8.5.2, 8.5.3, 8.5.5, 8.5.6, 8.5.7, 8.9.1, 8.10.1, 8.11.1, 8.11.3, 8.11.4, 8.11.5, 8.11.6, 8.11.8, 8.11.10, 8.11.12, 8.12.4, 8.12.5, 8.12.6, 8.12.7, 8.12.8, 8.12.9, 8.12.12, 8.12.14, 8.12.20, 8.12.22, 8.12.23, 8.12.25, 8.12.26, 8.12.27, 8.12.29, 8.12.31, 8.12.32, 9.3.1, 9.3.2, 9.3.3, 9.3.4, 9.3.5, 9.3.6, 9.3.7, 9.3.8, 9.3.10, 9.3.11, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.27, 9.4.1, 9.4.2, 9.4.3, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.15, 9.5.16, 9.5.17, 9.7.1, 9.7.2, 9.7.3, 9.7.4, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.3, 9.8.4, 9.8.5, 9.8.9, 9.8.10, 9.8.11, 9.8.13, 9.10.1, 9.10.3, 9.10.4, 9.10.5, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.10, 9.11.12, 9.11.13, 9.11.14, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.21, 9.11.22, 9.11.23, 9.11.24, 9.11.25, 9.11.26, 9.11.28, 9.11.29, 9.11.30, 9.11.31, 9.11.32, 9.12.1, 9.12.2, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.14, 9.12.15, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.25, 9.12.26, 9.12.27, 9.12.28, 9.12.29, 9.12.30, 9.12.31, 9.12.32, 9.12.33, 9.12.35, 9.12.36, 9.12.37, 9.12.38, 9.12.39, 9.12.44, 10.3.2, 10.3.3, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.17, 10.3.20, 10.3.27, 10.3.28, 10.4.3, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.2, 10.9.3, 10.9.5, 10.10.1, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.21, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.11, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.19, 11.12.20, 13.3.1, 13.3.2, 13.3.3, 13.3.4, 13.3.5, 13.3.7, 13.9.2, 13.11.1, 13.11.2, 13.11.3, 13.11.4, 13.11.5, 13.11.6, 13.11.8, 13.11.9, 13.12.1, 13.12.2, 13.12.3, 13.12.4, 13.12.5, 13.12.6, 13.12.8, 13.12.9, 13.12.10.

Label	Regional Ecosystem (mandatory unless otherwise specified)
848	7.3.7, 7.3.8, 7.3.9, 7.3.12, 7.3.13, 7.3.14, 7.3.16, 7.3.19, 7.3.20, 7.3.21, 7.3.25, 7.3.26, 7.3.39, 7.3.40, 7.3.42, 7.3.43, 7.3.44, 7.3.45, 7.3.47, 7.3.48, 7.3.50, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.8.7, 7.8.8, 7.8.10, 7.8.15, 7.8.16, 7.8.17, 7.8.18, 7.8.19, 7.11.5, 7.11.6, 7.11.13, 7.11.14, 7.11.16, 7.11.18, 7.11.19, 7.11.20, 7.11.21, 7.11.31, 7.11.32, 7.11.33, 7.11.34, 7.11.35, 7.11.37, 7.11.38, 7.11.41, 7.11.42, 7.11.43, 7.11.44, 7.11.45, 7.11.46, 7.11.47, 7.11.48, 7.11.49, 7.11.50, 7.11.51, 7.12.4, 7.12.5, 7.12.17, 7.12.21, 7.12.22, 7.12.23, 7.12.24, 7.12.25, 7.12.26, 7.12.27, 7.12.28, 7.12.29, 7.12.30, 7.12.33, 7.12.34, 7.12.35, 7.12.51, 7.12.52, 7.12.53, 7.12.54, 7.12.55, 7.12.56, 7.12.58, 7.12.59, 7.12.60, 7.12.61, 7.12.62, 7.12.63, 7.12.65, 7.12.66, 7.12.69, 9.3.1, 9.3.2, 9.3.3, 9.3.5, 9.3.6, 9.3.8, 9.3.10, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.24, 9.4.1, 9.4.2, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.13, 9.5.14, 9.5.15, 9.5.16, 9.5.17, 9.7.1, 9.7.2, 9.7.3, 9.7.4, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.4, 9.8.5, 9.8.9, 9.8.10, 9.8.11, 9.10.1, 9.10.3, 9.10.4, 9.10.5, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.10, 9.11.12, 9.11.13, 9.11.14, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.21, 9.11.22, 9.11.23, 9.11.24, 9.11.25, 9.11.26, 9.11.28, 9.11.29, 9.11.30, 9.11.31, 9.11.32, 9.12.1, 9.12.2, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.14, 9.12.15, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.25, 9.12.26, 9.12.27, 9.12.28, 9.12.29, 9.12.30, 9.12.31, 9.12.32, 9.12.33, 9.12.35, 9.12.36, 9.12.37, 9.12.38, 9.12.39, 9.12.40, 9.12.44, 10.3.2, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.7, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.7, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.7.1, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.10.1, 11.10.2, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.16, 11.12.17, 11.12.19, 11.12.20; 12.2.5, 12.2.6, 12.2.7, 12.2.8, 12.2.10, 12.2.11, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.6, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.12, 12.3.14, 12.3.15, 12.3.18, 12.3.19, 12.3.20, 12.5.1, 12.5.2, 12.5.3, 12.5.4, 12.5.5, 12.5.6, 12.5.7, 12.5.8, 12.5.10, 12.5.11, 12.5.12, 12.7.1, 12.7.2, 12.8.1, 12.8.2, 12.8.8, 12.8.10, 12.8.11, 12.8.12, 12.8.14, 12.8.16, 12.8.17, 12.8.20, 12.8.23, 12.8.24, 12.8.25, 12.8.26, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.7, 12.9-10.8, 12.9-10.11, 12.9-10.12, 12.9-10.13, 12.9-10.14, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.20, 12.9-10.21, 12.9-10.23, 12.9-10.24, 12.9-10.25, 12.9-10.26, 12.9-10.27, 12.9-10.28, 12.9-10.29, 12.11.2, 12.11.3, 12.11.5, 12.11.6, 12.11.7, 12.11.8, 12.11.9, 12.11.14, 12.11.15, 12.11.16, 12.11.17, 12.11.18, 12.11.19, 12.11.20, 12.11.21, 12.11.22, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.2, 12.12.3, 12.12.4, 12.12.5, 12.12.6, 12.12.7, 12.12.8, 12.12.9, 12.12.11, 12.12.12, 12.12.14, 12.12.15, 12.12.20, 12.12.21, 12.12.22, 12.12.23, 12.12.24, 12.12.25, 12.12.26, 12.12.27, 12.12.28, 13.3.1, 13.3.2, 13.3.3, 13.3.4, 13.3.5, 13.3.7, 13.9.2, 13.11.1, 13.11.2, 13.11.3, 13.11.4, 13.11.5, 13.11.6, 13.11.8, 13.11.9, 13.12.1, 13.12.2, 13.12.3, 13.12.4, 13.12.5, 13.12.6, 13.12.8, 13.12.9, 13.12.10
1107	8.2.2, 8.2.3, 8.2.4, 8.2.5, 8.2.6, 8.2.7, 8.2.8, 8.2.11, 8.2.13, 8.2.14, 8.3.1, 8.3.3, 8.3.6, 8.3.8, 8.3.9, 8.3.10, 8.3.11, 8.5.1, 8.8.1, 8.10.1, 8.11.2, 8.11.3, 8.11.5, 8.12.1, 8.12.2, 8.12.3, 8.12.4, 8.12.5, 8.12.7, 8.12.8, 8.12.11, 8.12.12, 8.12.14, 8.12.16, 8.12.17, 8.12.18, 8.12.19, 8.12.26, 8.12.27, 8.12.28, 8.12.29, 8.12.30, 8.12.31, 8.12.32, 11.2.2, 11.2.3, 11.3.1, 11.3.11, 11.3.12, 11.3.25, 11.3.26, 11.3.40, 11.4.1, 11.4.3, 11.4.7, 11.4.9, 11.5.7, 11.5.16, 11.8.1, 11.8.13, 11.9.1, 11.9.4, 11.9.5, 11.9.6, 11.9.10, 11.9.13, 11.10.1, 11.10.2, 11.10.5, 11.10.8, 11.10.9, 11.10.13, 11.11.3, 11.11.5, 11.11.13, 11.11.14, 11.11.18, 11.12.4, 11.12.13, 11.12.19, 11.12.21, 12.2.1, 12.2.2, 12.2.3, 12.2.4, 12.2.5, 12.2.7, 12.2.8, 12.3.1, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.15, 12.3.16, 12.3.17, 12.3.18, 12.3.19, 12.3.20, 12.3.21, 12.5.1, 12.5.3, 12.5.6, 12.5.7, 12.5.13, 12.8.1, 12.8.2, 12.8.3, 12.8.4, 12.8.5, 12.8.6, 12.8.7, 12.8.8, 12.8.9, 12.8.10, 12.8.11, 12.8.12, 12.8.13, 12.8.14, 12.8.18, 12.8.21, 12.8.22, 12.8.23, 12.8.24, 12.8.25, 12.8.26, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.6, 12.9-10.14, 12.9-10.16, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.20, 12.9-10.21, 12.9-10.23, 12.9-10.24, 12.9-10.25, 12.9-10.26, 12.9-10.29, 12.11.1, 12.11.2, 12.11.3, 12.11.4, 12.11.5, 12.11.6, 12.11.9, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.11.16, 12.11.17, 12.11.18, 12.11.19, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.1, 12.12.2, 12.12.3, 12.12.4, 12.12.5, 12.12.6, 12.12.11, 12.12.13, 12.12.15, 12.12.16, 12.12.17, 12.12.18, 12.12.20, 12.12.26, 12.12.28, 13.3.2, 13.3.3, 13.3.5, 13.9.2, 13.11.2, 13.11.5, 13.11.6, 13.11.7, 13.12.1, 13.12.4, 13.12.11
2180	12.9-10.19
11205	12.3.11, 12.8.19, 12.8.20, 12.9-10.17, 12.9-10.19, 12.11.3, 12.11.5, 12.11.6

3.6 Protected plants (administered by the Department of Environment and Science (DES))

In Queensland, all plants that are native to Australia are protected plants under the *Nature Conservation Act 1992* (NCA), with clearing of protected plants in the wild regulated by the Nature Conservation (Wildlife Management) Regulation 2006. These requirements apply irrespective of the classification of the vegetation under the *Vegetation Management Act 1999*.

Prior to clearing, if the plants proposed to be cleared are in the wild (see Operational policy: When a protected plant in Queensland is considered to be 'in the wild') and the exemptions under the Nature Conservation (Wildlife Management) Regulation 2006 are not applicable to the proposed clearing, you must check the flora survey trigger map to determine if any part of the area to be cleared is within a high risk area. The trigger map for this property is provided in section 5.5. The exemptions relate to:

- imminent risk of death or serious injury (refer s261A)
- imminent risk of serious damage to a building or other structure on land, or to personal property (refer s261B)
- *Fire and Emergency Service Act 1990* (refer 261C)
- previously cleared areas (refer s261ZB)
- maintenance activities (refer s261ZC)
- firebreak or fire management line (refer s261ZD)

- accepted development vegetation clearing code (refer s261ZE)
- conservation purposes (refer s261ZG)
- authorised in particular circumstances (refer s385).

Some exemptions under the NCA are the same as exempt clearing work (formerly known as exemptions) from the *Vegetation Management Act 1999* (i.e. listed in the Planning Regulations 2017) while some are different.

If the proposed area to be cleared is shown as blue (i.e. high risk) on the flora survey trigger map, a flora survey of the clearing impact area must be undertaken in accordance with the flora survey guidelines. The main objective of a flora survey is to locate any endangered, vulnerable or near threatened plants (EVNT plants) that may be present in the clearing impact area.

If a flora survey identifies that EVNT plants are not present within the clearing impact area or clearing within 100m of EVNT plants can be avoided, the clearing activity is exempt from a permit. An exempt clearing notification form must be submitted to the Department of Environment and Science, with a copy of the flora survey report, at least one week prior to clearing. The clearing must be conducted within two years after the flora survey report was submitted.

If a flora survey identifies that EVNT plants are present in, or within 100m of, the area to be cleared, a clearing permit is required before any clearing is undertaken. The flora survey report, as well as an impact management report, must be submitted with the application form clearing permit.

In an area other than a high risk area, a clearing permit is only required where a person is, or becomes aware that EVNT plants are present in, or within 100m of, the area to be cleared. You must keep a copy of the flora survey trigger map for the area subject to clearing for five years from the day the clearing starts. If you do not clear within the 12 month period that the flora survey trigger map was printed, you need to print and check a new flora survey trigger map.

Further information on protected plants is available at
http://www.ehp.qld.gov.au/licences-permits/plants-animals/protected-plants/

For assistance on the protected plants flora survey trigger map for this property, please contact the Department of Environment and Science at palm@des.qld.gov.au.

3.7 Emissions Reduction Fund (ERF)

The ERF is an Australian Government scheme which offers incentives for businesses and communities across the economy to reduce emissions.

Under the ERF, landholders can earn money from activities such as planting (and keeping) trees, managing regrowth vegetation and adopting more sustainable agricultural practices.

The purpose of a project is to remove greenhouse gases from the atmosphere. Each project will provide new economic opportunities for farmers, forest growers and land managers.

Further information on ERF is available at https://www.qld.gov.au/environment/land/state/use/carbon-rights/.

4. Contact information for DNRME

For further information on vegetation management:
Phone 135VEG (135 834)
Email vegetation@dnrme.qld.gov.au
Visit www.dnrme.qld.gov.au/our-department/contact-us/vegetation-contacts to submit an online enquiry.

For contact details for other State and Commonwealth agencies, please see Section 6.

5. Maps

The maps included in this report may also be requested individually at:

https://www.dnrme.qld.gov.au/qld/environment/land/vegetation/vegetation-map-request-form

and

http://www.ehp.qld.gov.au/licences-permits/plants-animals/protected-plants/map-request.php

Regulated vegetation management map

The regulated vegetation management map shows vegetation categories needed to determine clearing requirements. These maps are updated monthly to show new property maps of assessable vegetation (PMAV).

Vegetation management supporting map

The vegetation management supporting map provides information on regional ecosystems, wetlands, watercourses and essential habitat.

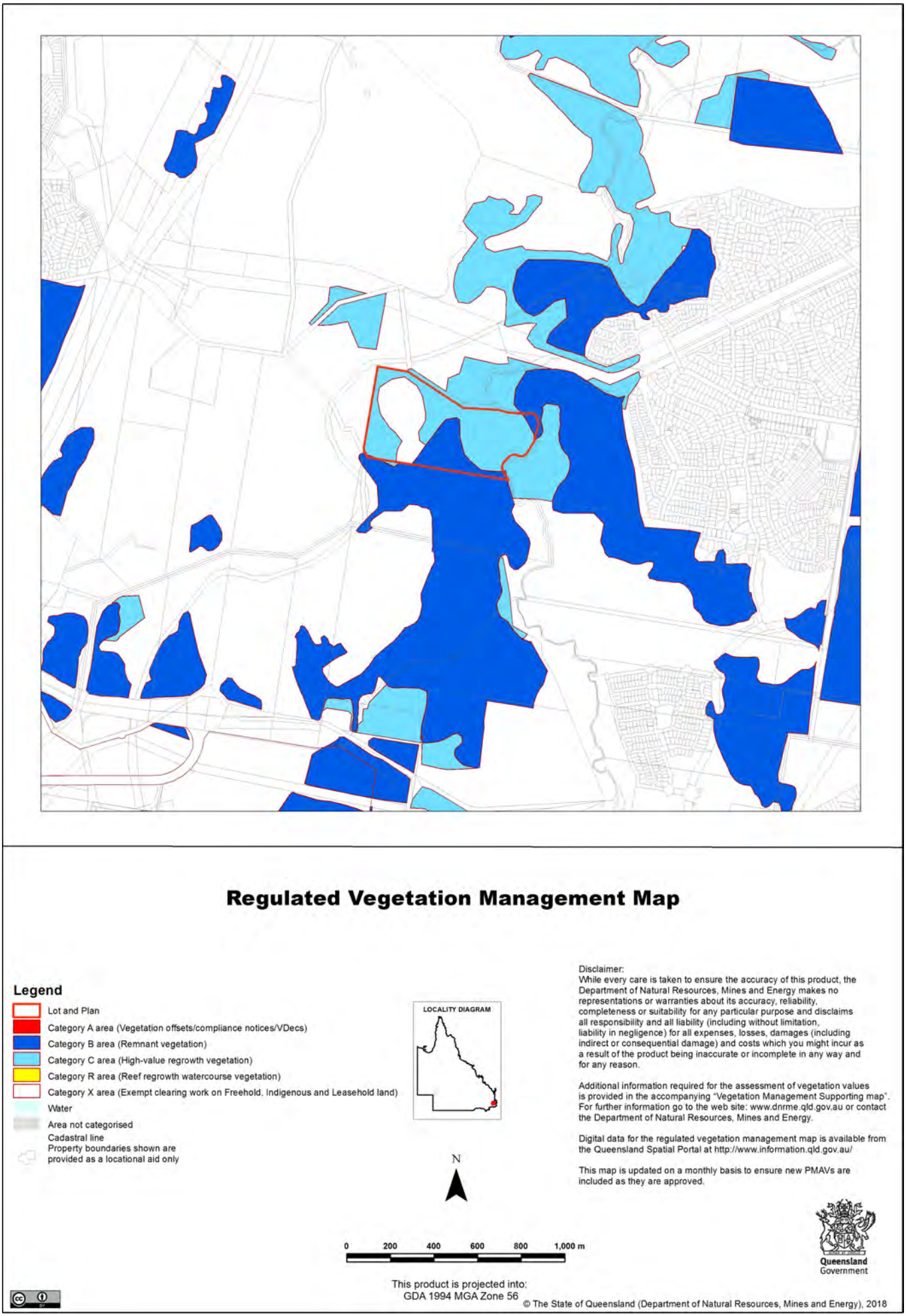
Coastal/non coastal map

The coastal/non-coastal map confirms whether the lot, or which parts of the lot, are considered coastal or non-coastal for the purposes of the accepted development vegetation clearing codes and the State Development Assessment Provisions (SDAP).

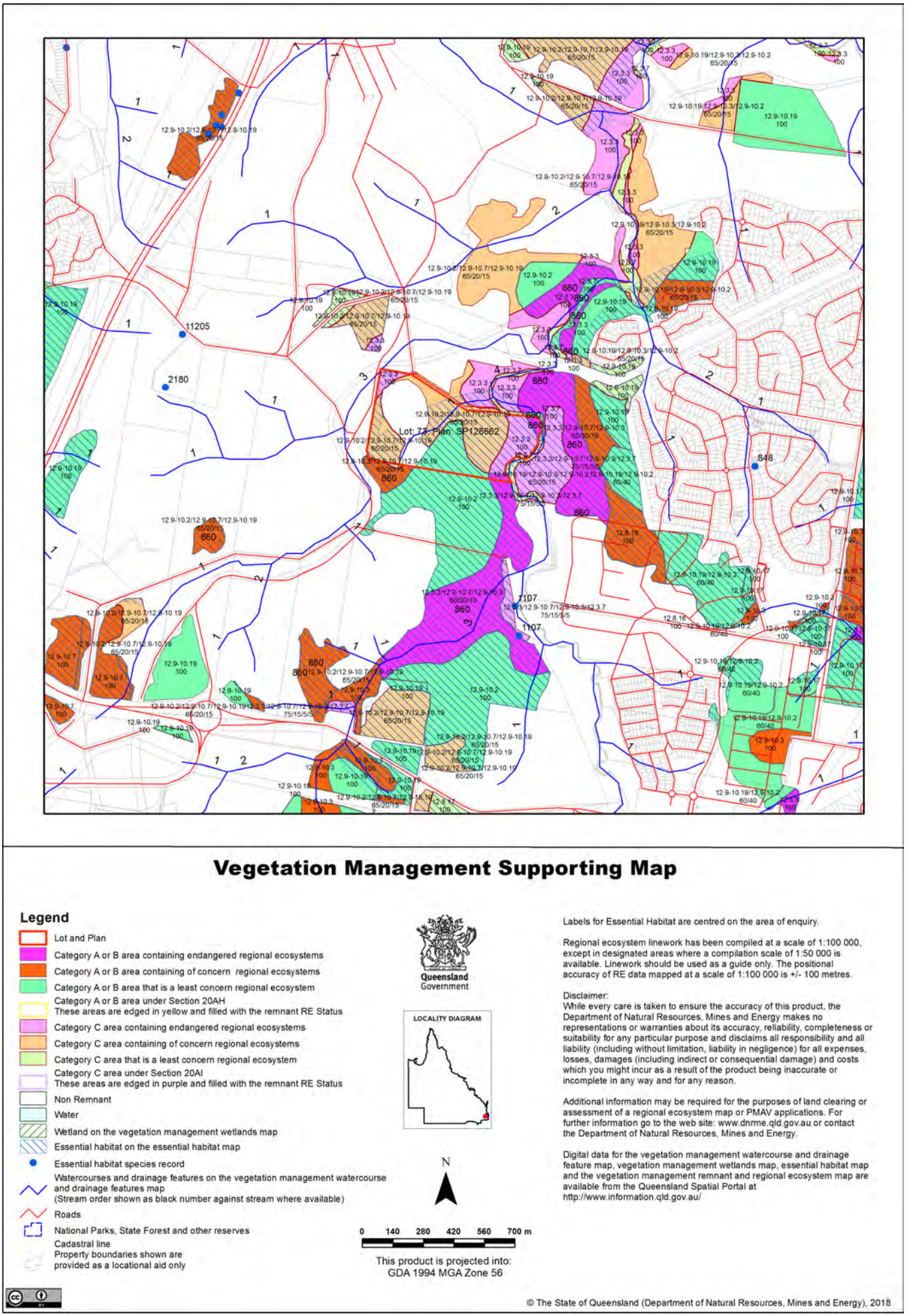
Protected plants map

The protected plants map shows areas where particular provisions of the *Nature Conservation Act 1992* apply to the clearing of protected plants.

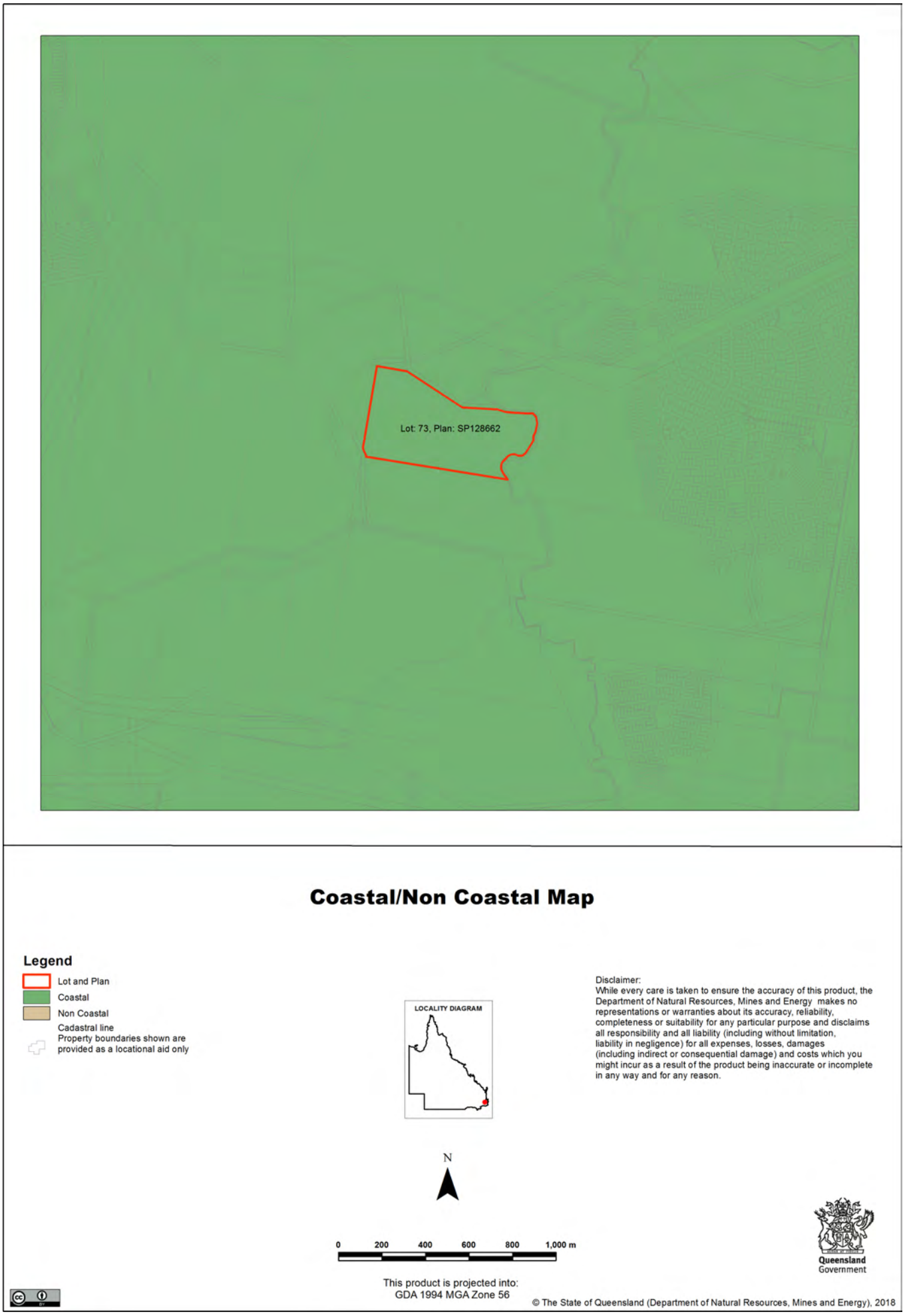
5.1 Regulated vegetation management map



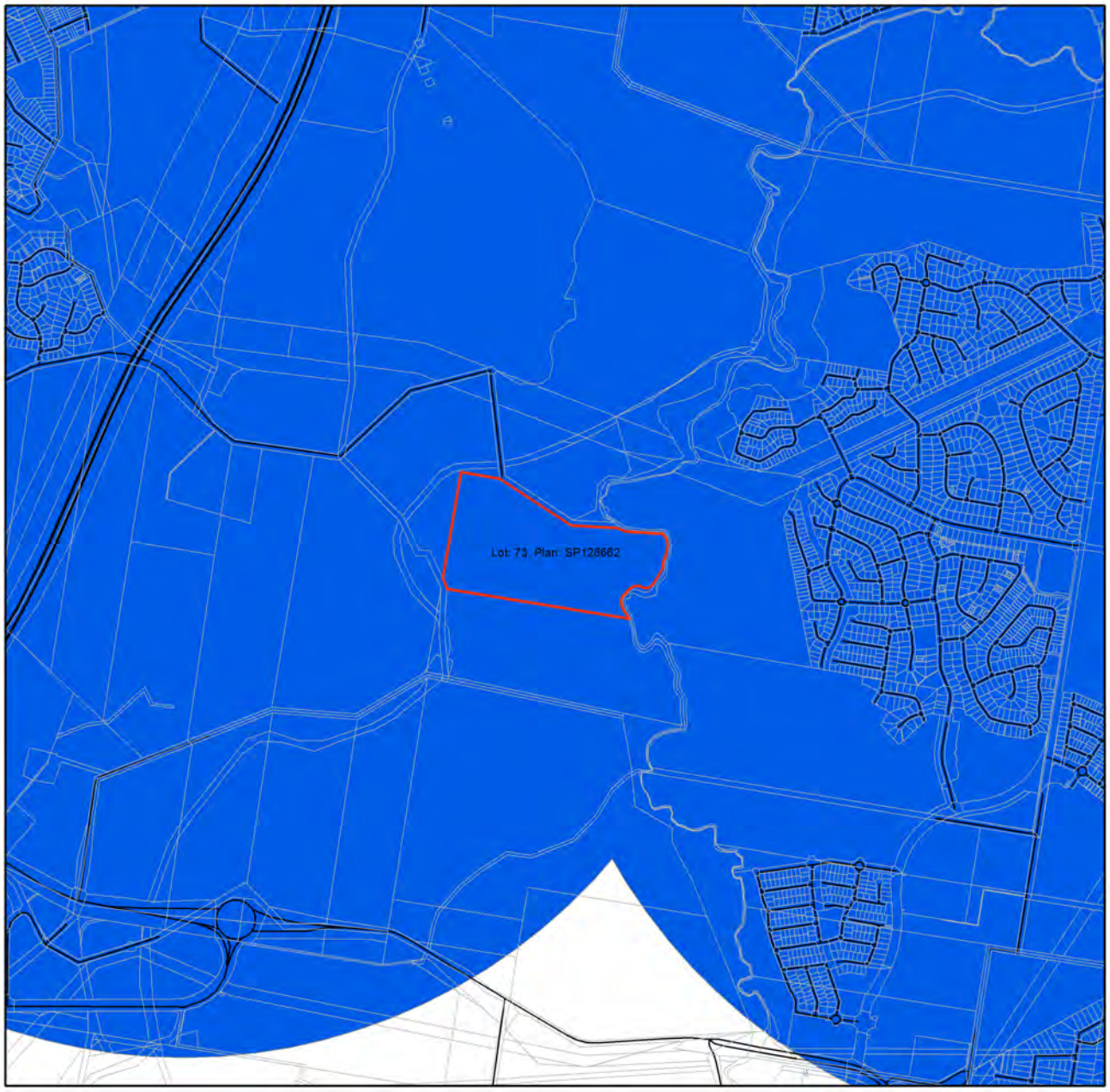
5.2 Vegetation management supporting map



5.3 Coastal/non coastal map



5.4 Protected plants map administered by DES



Protected Plants Flora Survey Trigger Map

Legend

- Lot and Plan
- High risk area
- Cadastral line
  Property boundaries shown are provided as a locational aid only
- Freeways / motorways / highways
- Secondary roads / streets

LOCALITY DIAGRAM



This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Science at palm@ehp.qld.gov.au

N

0 140 280 420 560 700 m

This product is projected into:
GDA 1994 MGA Zone 56

Disclaimer:
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

© The State of Queensland (Department of Environment and Science), 2018

6. Other relevant legislation contacts list

Activity	Legislation	Agency	Contact details
Interference with overland flow Earthworks, significant disturbance	*Water Act 2000* *Soil Conservation Act 1986*	Department of Natural Resources, Mines and Energy (Queensland Government)	Ph: 13 QGOV (13 74 68) www.dnrme.qld.gov.au
Indigenous Cultural Heritage	*Aboriginal Cultural Heritage Act 2003* *Torres Strait Islander Cultural Heritage Act 2003*	Department of Aboriginal and Torres Strait Islander Partnerships (Queensland Government)	Ph: 13 QGOV (13 74 68) www.datsip.qld.gov.au
Mining and environmentally relevant activities Infrastructure development (coastal) Heritage issues Protected plants and protected areas[1]	*Environmental Protection Act 1994* *Coastal Protection and Management Act 1995* *Queensland Heritage Act 1992* *Nature Conservation Act 1992*	Department of Environment and Science (Queensland Government)	Ph: 13 QGOV (13 74 68) www.des.qld.gov.au
Interference with fish passage in a watercourse, mangroves Forestry activities[2]	*Fisheries Act 1994* *Forestry Act 1959*	Department of Agriculture and Fisheries (Queensland Government)	Ph: 13 QGOV (13 74 68) www.daf.qld.gov.au
Matters of National Environmental Significance including listed threatened species and ecological communities	*Environment Protection and Biodiversity Conservation Act 1999*	Department of the Environment (Australian Government)	Ph: 1800 803 772 www.environment.gov.au
Development and planning processes	*Planning Act 2016* *State Development and Public Works Organisation Act 1971*	Department of State Development, Manufacturing, Infrastructure and Planning (Queensland Government)	Ph: 13 QGOV (13 74 68) www.dsdmip.qld.gov.au
Local government requirements	*Local Government Act 2009*	Department of Local Government, Racing and Multicultural Affairs (Queensland Government)	Ph: 13 QGOV (13 74 68) Your relevant local government office

1. In Queensland, all plants that are native to Australia are protected plants under the *Nature Conservation Act 1992*, which endeavours to ensure that protected plants (whether whole plants or protected plants parts) are not illegally removed from the wild, or illegally traded. Prior to clearing, you should check the flora survey trigger map to determine if the clearing is within a high-risk area by visiting www.des.qld.gov.au. For further information or assistance on the protected plants flora survey trigger map for your property, please contact the Department of Environment and Science on 13QGOV (13 74 68) or email palm@des.qld.gov.au.

2. Contact the Department of Agriculture and Fisheries before clearing:

- Any sandalwood on state-owned land (including leasehold land)
- On freehold land in a 'forest consent area'
- More than five hectares on state-owned land (including leasehold land) containing commercial timber species listed in parts 2 or 3 of Schedule 6 of the Vegetation Management Regulation 2012 and located within any of the following local government management areas-Banana, Bundaberg Regional, Fraser Coast Regional, Gladstone Regional, Isaac Regional, North Burnett Regional, Somerset Regional, South Burnett Regional, Southern Downs Regional, Tablelands Regional, Toowoomba Regional, Western Downs Regional.

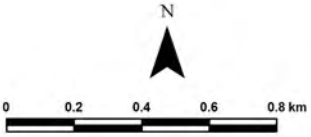


Pre-clearing Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups
BVG5M Description (BVG1M codes)

- Lot and Plan
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Water
- Cadastral Boundaries





This product is projected into GDA 1994 MGA Zone 56

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

© The State of Queensland, 2018

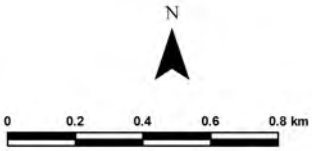


Remnant 2015 Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups
BVG5M Description (BVG1M codes)

- Lot and Plan
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Non-remnant vegetation, cultivated or built environment
- Water
- Cadastral Boundaries





This product is projected into GDA 1994 MGA Zone 56

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

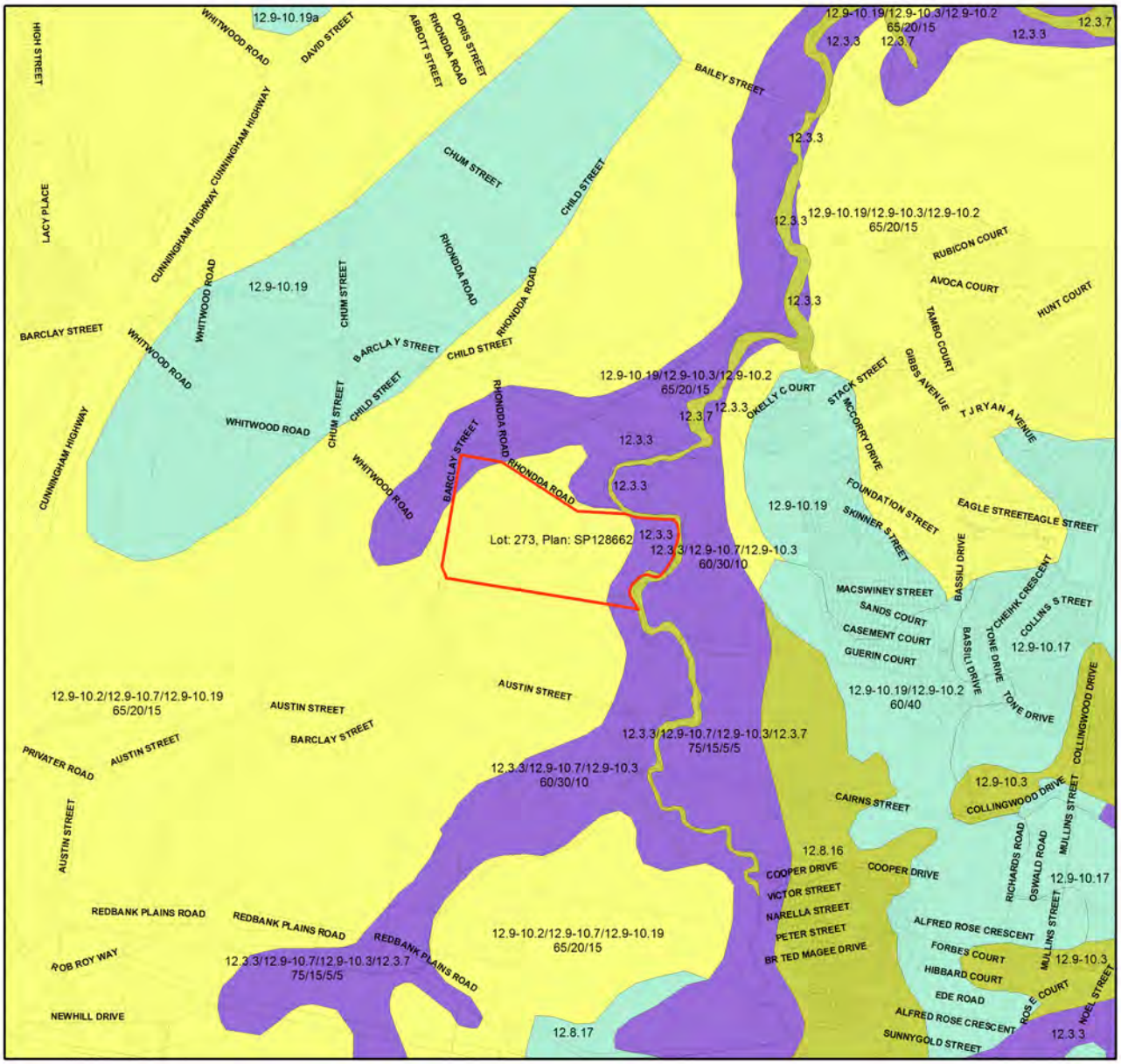
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

Non-remnant vegetation includes regrowth and disturbed native vegetation.

© The State of Queensland, 2018

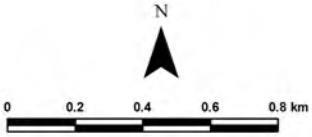


Pre-clearing Regional Ecosystems

Biodiversity Status

- Lot and Plan
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Water
- Cadastral Boundaries





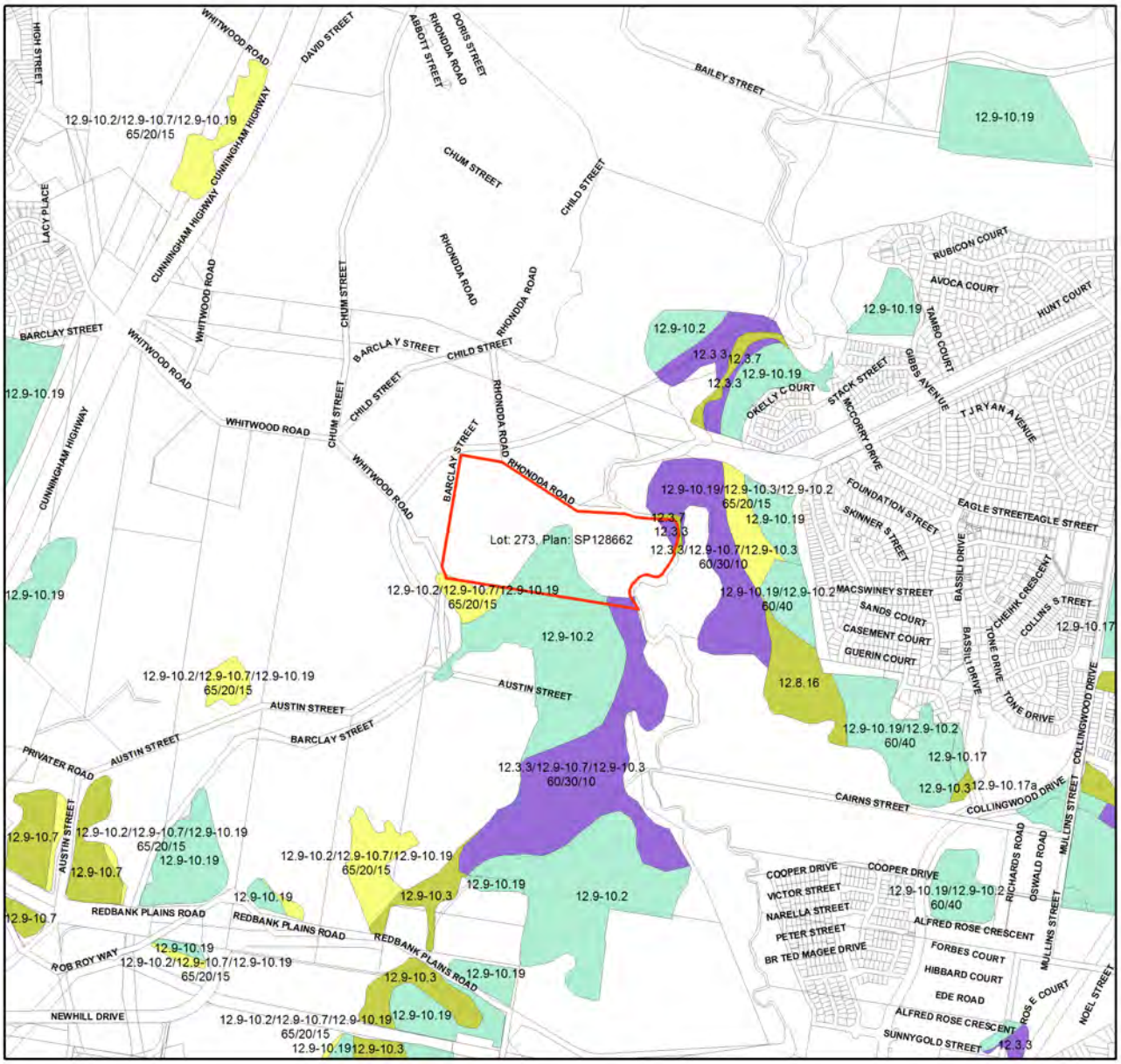
This product is projected into GDA 1994 MGA Zone 56

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

© The State of Queensland, 2018



Remnant 2015 Regional Ecosystems

Biodiversity Status

- Lot and Plan
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Non-remnant vegetation, cultivated or built environment
- Plantation
- Water
- Cadastral Boundaries

LOCALITY DIAGRAM



Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.

The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

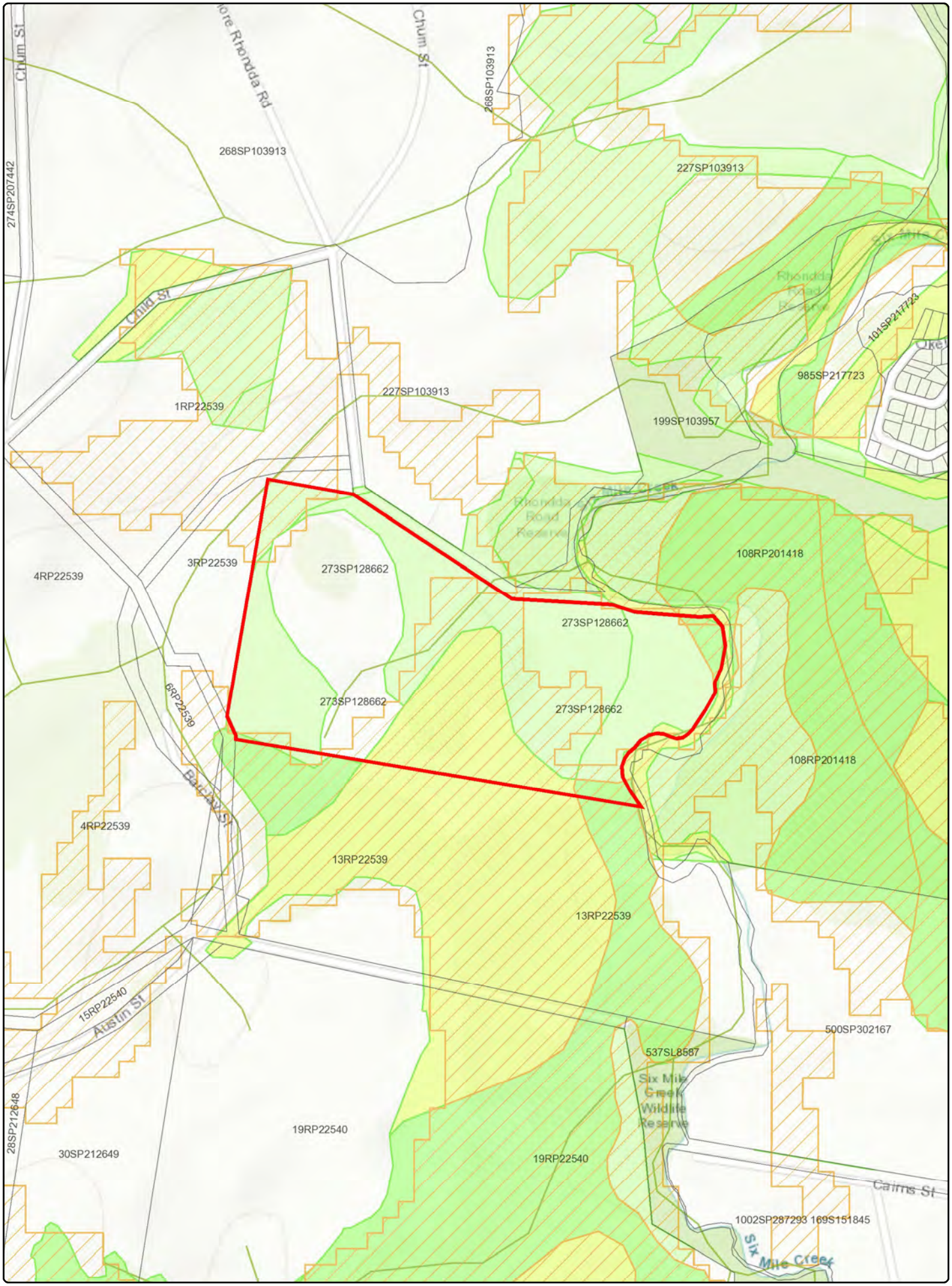
Non-remnant vegetation includes regrowth and disturbed native vegetation.

This product is projected into GDA 1994 MGA Zone 56

© The State of Queensland, 2018

APPENDIX VI

STATE PLANNING POLICY AND DEVELOPMENT ASSESSMENT MAPPING



State Planning Policy

Making or amending a local planning instrument and designating land for community infrastructure

Date: 28/09/2018

Department of State

0 140 280 420 560

Legend

Drawn Polygon Layer

Override 1

Cadastre (10k)



Cadastre (10k)

MSES - Regulated vegetation (intersecting a watercourse)

MSES - Regulated vegetation (intersecting a watercourse)

MSES - High ecological value waters (watercourse)

MSES - High ecological value waters (watercourse)

MSES - Wildlife habitat



MSES - Wildlife habitat

MSES - Strategic environmental areas (designated precinct)



MSES - Strategic environmental areas (designated precinct)

MSES - High ecological significance wetlands

MSES - High ecological significance wetlands

MSES - High ecological value waters (wetland)



MSES - High ecological value waters (wetland)

MSES - Legally secured offset area (offset register)



MSES - Legally secured offset area (offset register)

MSES - Legally secured offset area (regulated vegetation offsets)



MSES - Legally secured offset area (regulated vegetation offsets)

MSES - Protected areas (estate)



MSES - Protected areas (estate)

MSES - Protected areas (nature refuge)



MSES - Protected areas (nature refuge)

MSES - Marine park



MSES - Marine park

MSES - Declared fish habitat area



MSES - Declared fish habitat area

MSES - Regulated vegetation (category B)



MSES - Regulated vegetation (category B)

MSES - Regulated vegetation (category C)



MSES - Regulated vegetation (category C)

MSES - Regulated vegetation (category R)



MSES - Regulated vegetation (category R)

MSES - Regulated vegetation (essential habitat)



MSES - Regulated vegetation (essential habitat)

MSES - Regulated vegetation (wetland)



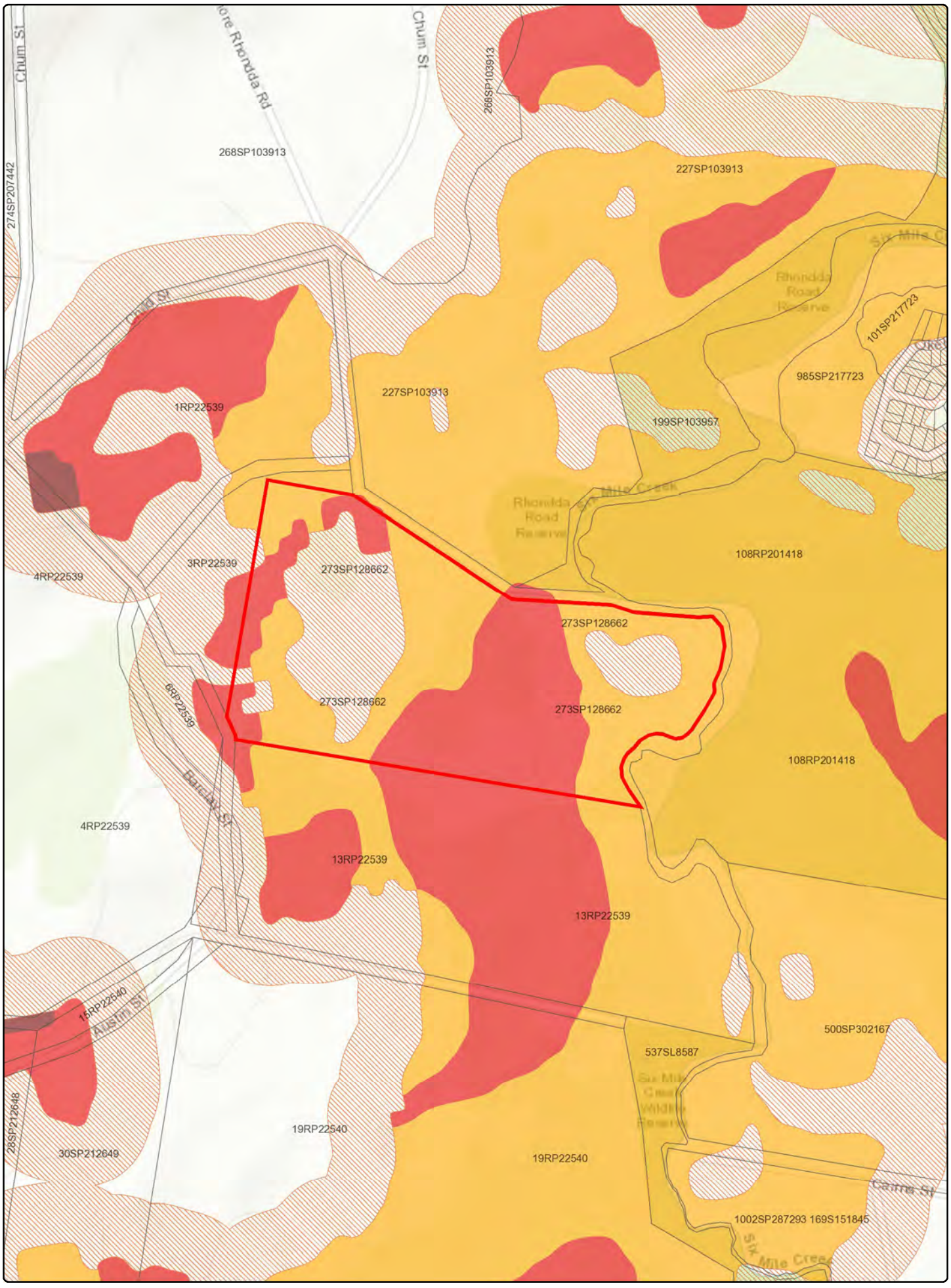
MSES - Regulated vegetation (wetland)

Date: 28/09/2018

State Planning Policy

Making or amending a local planning instrument and designating land for community infrastructure

Department of State



State Planning Policy

Making or amending a local planning instrument and designating land for community infrastructure

Date: 28/09/2018

Department of State

0 140 280 420 560

Legend

Drawn Polygon Layer

Override 1

Cadastre (10k)

Cadastre (10k)

High pressure gas pipeline

High pressure gas pipeline

Bushfire prone area

Very High Potential Bushfire Intensity

High Potential Bushfire Intensity

Medium Potential Bushfire Intensity

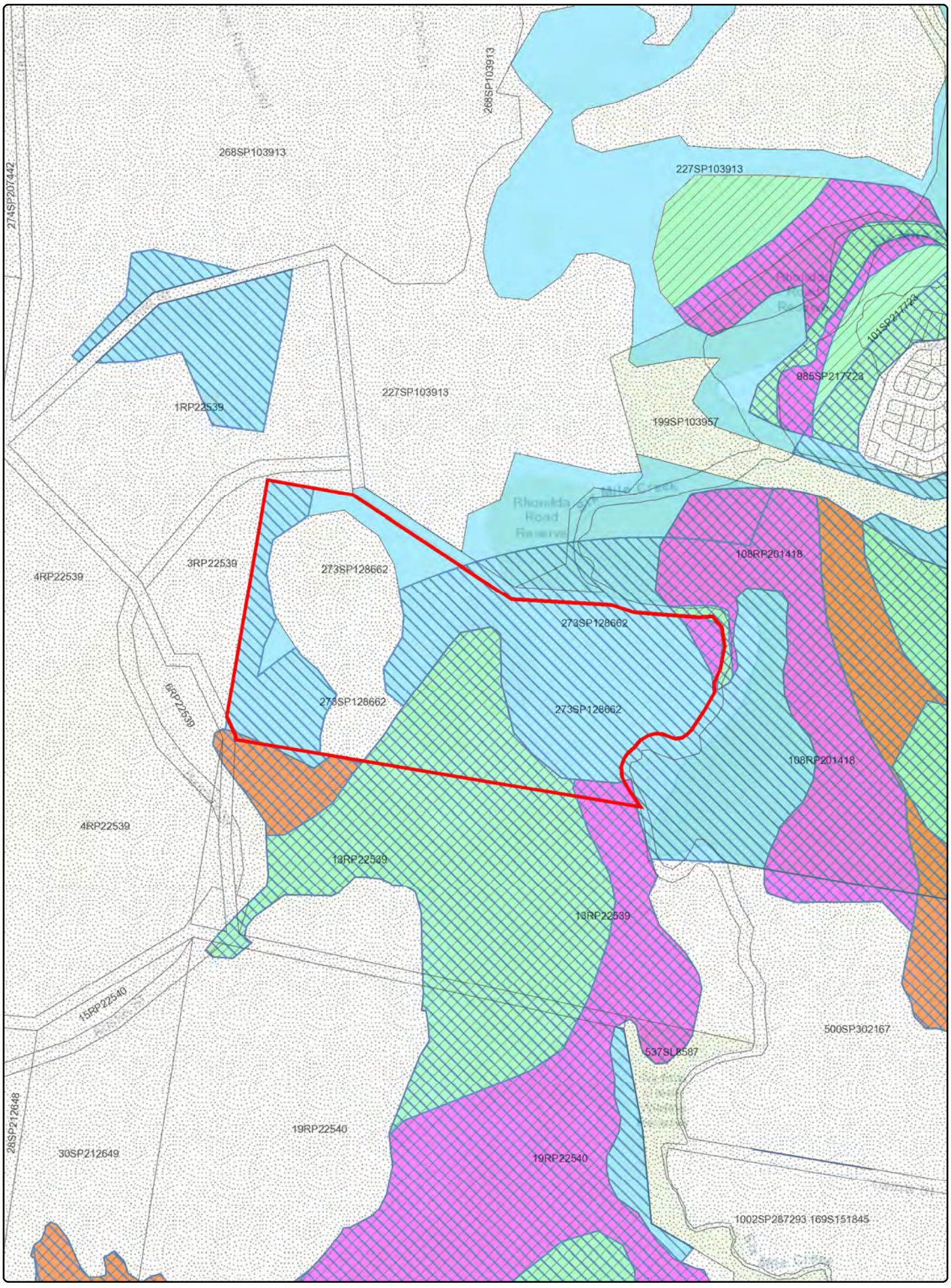
Potential Impact Buffer

Date: 28/09/2018

State Planning Policy

Making or amending a local planning instrument and designating land for community infrastructure

Department of State



DA Mapping System – Print Screen

Date: 28/09/2018

0 140 280 420 560

Metres

Department of State

Legend

Drawn Polygon Layer

Override 1

Cadastre (10k)

Cadastre (10k)

Regulated vegetation management map (Category A and B extract)

Category A on the regulated vegetation management map

Category B on the regulated vegetation management map

Essential habitat

Essential habitat

Regulated vegetation management map (other vegetation categories)

Category C on the regulated vegetation managment map

Category R on the regulated vegetation management map

Category X on the regulated vegetation management map

Vegetation management regional ecosystem map

Category A or B area containing endangered regional ecosystems

Category A or B area containing of concern regional ecosystems

Category A or B area that is a least concern regional ecosystem

Non remnant

Water

Vegetation management coastal and non-coastal bioregions and sub-regions

Coastal bioregions and sub-regions

Non coastal bioregions and sub-regions

DA Mapping System – Print Screen

Date: 28/09/2018

Department of State

APPENDIX VII

RED IMPORTED FIRE ANT MAPPING

National Red Imported Fire Ant Eradication Program: Fire ant biosecurity zones



Fire ant biosecurity zone 1

Acacia Ridge
Algester
Amberley
Archerfield
Augustine Heights
Basin Pocket
Bellbird Park
Berrinba
Bethania
Blackstone
Booval
Boronia Heights
Brookwater
Browns Plains
Buccan
Bundamba
Calamvale
Camira
Carole Park
Churchill
Coalfalls
Collingwood Park
Coopers Plains
Crestmead
Darra
Deebing Heights
Dinmore
Doolandella
Drewvale
Durack
East Ipswich
Eastern Heights
Ebbw Vale
Eight Mile Plains
Ellen Grove
Flinders View
Forest Lake
Forestdale
Gailes
Goodna
Greenbank
Heathwood
Heritage Park
Hillcrest
Holmview
Inala
Ipswich
Karawatha
Kingston
Kuraby
Larapinta
Leichhardt
Logan Central
Logan Reserve
Loganlea
Mackenzie
Mansfield
Marsden
Meadowbrook
Moggill
Moores Pocket
Munruben
New Chum
Newtown
North Booval
North Maclean
North Tivoli
One Mile
Oxley
Pallara
Park Ridge
Park Ridge South
Parkinson
Purga
Raceview
Redbank
Redbank Plains
Regents Park
Richlands
Ripley
Riverview
Rochedale
Rocklea
Runcorn
Sadliers Crossing
Silkstone
Slacks Creek
South Ripley
Spring Mountain
Springfield
Springfield Central
Springfield Lakes
Stretton
Sumner
Sunnybank
Sunnybank Hills
Swanbank
Tivoli
Underwood
Wacol
Waterford
Waterford West
West Ipswich
White Rock
Willawong
Willowbank
Wishart
Woodend
Woodridge
Wulkuraka
Yamanto

Fire ant biosecurity zone 2

Alberton
Alexandra Hills
Allenview
Anstead
Ashwell
Bahrs Scrub
Bannockburn
Barellan Point
Beenleigh
Belivah
Bellbowrie
Belmont
Blacksoil
Blenheim
Brassall
Burbank
Calvert
Camp Hill
Capalaba
Carbrook
Carina
Carina Heights
Carindale
Cedar Creek
Cedar Grove
Cedar Vale
Chambers Flat
Chandler
Chapel Hill
Chelmer
Chuwar
Cleveland
Coleyville
College View
Coomera
Coorparoo
Corinda
Cornubia
Crowley Vale
Daisy Hill
Eagleby
Ebenezer
Edens Landing
Fig Tree Pocket
Flagstone
Flinders Lakes
Forest Hill
Gilberton
Glen Cairn
Gleneagle Grove
Goolman
Graceville
Grandchester
Gumdale
Haigslea
Harrisville
Holland Park
Indooroopilly
Jacobs Well
Jamboree Heights
Jeebropilly
Jimboomba
Jindalee
Kagaru
Kairabah
Karalee
Karana Downs
Karrabin
Kenmore
Kents Lagoon
Kingsholme
Laidley
Laidley Heights
Laidley North
Laidley South
Lanefield
Lawes
Limestone Ridges
Logan Village
Loganholme
Lower Mount Walker
Luscombe
Lyons
Macgregor
Marburg
Merrivale
Middle Park
Milbong
Milora
Minden
Monarch Glen
Moorooka
Mount Cotton
Mount Crosby
Mount Forbes
Mount Gravatt East
Mount Marrow
Mount Mort
Mount Ommaney
Mount Walker
Mount Walker West
Mount Warren Park
Muirlea
Mundoolun
Mutdapilly
Nathan
New Beith
Norman Park
North Ipswich
Norwell
Ormeau
Ormeau Hills
Peak Crossing
Pimpama
Pinjarra Hills
Plainland
Priestdale
Radford
Redland Bay
Riverhills
Robertson
Rochedale South
Rosevale
Rosewood
Salisbury
Seventeen Mile Rocks
Shailer Park
Sheldon
Sherwood
Silverbark Ridge
Silverdale
Sinnamon Park
South Maclean
Springwood
Stapylton
Steiglitz
Stockleigh
Summerholm
Tallegalla
Tamborine
Tanah Merah
Tennyson
Thagoona
The Bluff
Thornlands
Tingalpa
Undullah
Upper Coomera
Upper Mount Gravatt
Victoria Point
Walloon
Warrill View
Westlake
Willow Vale
Wilsons Plains
Windaroo
Wolffdene
Woodhill
Woodlands
Wyaralong
Woongoolba
Yarrabilba
Yatala
Yeerongpilly
Yeronga

Fire ant biosecurity zone 3

Brisbane Airport
Eagle Farm
Lytton
Nudgee
Nudgee Beach
Pinkenba
Port Of Brisbane

Fire ant carrier movement restrictions

Fire ant biosecurity zone 1	Fire ant biosecurity zone 2	Fire ant biosecurity zone 3
Moving soil*? To move soil from a property within biosecurity zone 1 you must have a biosecurity instrument permit unless: - the soil remains within zone 1; or - the soil is moved to a waste facility within zone 1 or zone 2.	**Moving soil*?** To move soil from a property within biosecurity zone 2 you must have a biosecurity instrument permit unless: - the soil remains within zone 2 or is moved to zone 1; or - the soil is moved to a waste facility within zone 1 or 2.	**Moving soil*?** To move soil from a property within biosecurity zone 3 you must have a biosecurity instrument permit unless: - the soil remains within zone 3; or - the soil is moved to a waste facility within zone 3.
Moving mulch, manure, baled hay or straw, potted plants or turf? To move these fire ant carriers from a property within biosecurity zone 1 you must either : - follow procedures outlined in the Biosecurity Regulation 2016; or - move the material to a waste facility within zone 1 or 2; or - move the material within 24 hours of being on the property. If you are unable to fulfil the above conditions then you must request a biosecurity instrument permit from an inspector.	**Moving mulch, manure, baled hay or straw, potted plants or turf?** To move these fire ant carriers from a property within biosecurity zone 2 you must either : - follow procedures outlined in the Biosecurity Regulation 2016; or - move the material to a waste facility within zone 1 or 2; or - move the material within 24 hours of being on the property. If you are unable to fulfil the above conditions then you must request a biosecurity instrument permit from an inspector.	**Moving mulch, manure, baled hay or straw, potted plants or turf?** To move these fire ant carriers from a property within biosecurity zone 3 you must either : - follow procedures outlined in the Biosecurity Regulation 2016; or - move the material to a waste facility within zone 3; or - move the material within 24 hours of being on the property. If you are unable to fulfil the above conditions then you must request a biosecurity instrument permit from an inspector.
Moving other fire ant carriers i.e. mining/quarrying products or by-products; compost? To move these fire ant carriers from a property within biosecurity zone 1 you must either: - move the material to a waste facility within zone 1 or 2; or - move the material within 24 hours of being on the property; or - obtain a biosecurity instrument permit from an inspector.	**Moving other fire ant carriers** i.e. mining/quarrying products or by-products; compost? To move these fire ant carriers from a property within biosecurity zone 2 you must either: - move the material to a waste facility within zone 1 or 2; or - move the material within 24 hours of being on the property; or - obtain a biosecurity instrument permit from an inspector.	**Moving other fire ant carriers** i.e. mining/quarrying products or by-products; compost? To move these fire ant carriers from a property within biosecurity zone 3 you must either: - move the material to a waste facility within zone 3; or - move the material within 24 hours of being on the property; or - obtain a biosecurity instrument permit from an inspector.

For soil* movement within the zones you must meet the General Biosecurity Obligation, see www.daf.qld.gov.au/fireants for more information.
*soil includes fill, clay, scrapings and any material removed from the ground at a site where earthworks are being carried out

The State of Queensland does not warrant the accuracy of this map and disclaims any liability for loss arising from the use of this map beyond its intended purpose. Acknowledgements © State of Queensland (Department of Agriculture and Fisheries) 2018. © State of Queensland (Department of Natural Resources and Mines) 2018.

Fire Ant Biosecurity Zone Map – RIFA02
15 June 2018

- Fire ant biosecurity zone 1
- Fire ant biosecurity zone 2
- Fire ant biosecurity zone 3
- Suburb
- Local Government Area

Contact the Department of Agriculture and Fisheries for more information or request a biosecurity instrument permit at www.daf.qld.gov.au/fireants or call 13 25 23

Queensland Government

Revegetation Plan

Claypave South Project, New Chum

Prepared for
Ardent Group on behalf of Jackal Renewables Pty Ltd

Biodiversity Assessment and Management Pty Ltd
PO Box 1376
CLEVELAND 4163

BAAM ECOLOGICAL CONSULTANTS

Specialised ecological knowledge that reduces your risk

Document Control Sheet

File Number: 0410-009

Project Manager/s: Elizabeth Williams

Client: Ardent Group on behalf of Jackal Renewables Pty Ltd

Project Title: Revegetation Plan – Claypave South Project, New Chum

Project Author/s: Nicole Bonney, Elizabeth Willians

Project Summary: Prepare a Rehabilitation Plan to be utilised in conjunction with the Progressive Rehabilitation and Closure Plan for the “Claypave South” project in New Chum, Queensland.

Draft Preparation History:

Draft No.	Date draft completed	Reviewed by	Issued by
0410-009 Draft A	01/02/2024	Jedd Appleton	Nicole Bonney

Revision/ Checking History Track:

Version	Date of Issue	Checked by	Issued by
0410-009 Draft A	01/03/2024	Jedd Appleton	Jedd Appleton

Document Distribution:

Destination	Revision							
	1	Date Dispatched	2	Date Dispatched	3	Date Dispatched	4	Date Dispatched
Client Copy 1 - digital	A	01/02/2024	0	01/03/2024				
Cloud storage and backup	A	01/02/2024	0	01/03/2024				

NOTICE TO USERS OF THIS REPORT

Purpose of Report

Biodiversity Assessment and Management Pty Ltd has produced this report in its capacity as {consultants} for and on the request of Ardent Group on behalf of Jackal Renewables Pty Ltd for the sole purpose of preparing a Rehabilitation Plan to be utilised in conjunction with the Progressive Rehabilitation and Closure Plan for the “Claypave South” project in New Chum, Queensland (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.

This report has been produced solely for the benefit of the Client. Biodiversity Assessment and Management Pty Ltd does not accept that a duty of care is owed to any party other than the Client. This report is not to be used by any third party other than as authorised in writing by Biodiversity Assessment and Management Pty Ltd and any such use shall continue to be limited to the Specified Purpose. Further, Biodiversity Assessment and Management Pty Ltd does not make any warranty, express or implied, or assume any legal liability or responsibility for any third party's use in whole or in part of the report or application or use of any other information or process disclosed in this report and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by any person or body corporate arising from or in connection with the supply or use of the whole part of the report through any cause whatsoever.

Biodiversity Assessment and Management Pty Ltd has used information provided to it by the Client and governmental registers, databases, departments and agencies in the preparation of this report. Biodiversity Assessment and Management Pty Ltd does not know, nor does it have any reason to suspect, that the information provided to it was false, inaccurate, incomplete or misleading at the time of its receipt. This report is supplied on the basis that while Biodiversity Assessment and Management Pty Ltd believes all the information in it is deemed reliable at the time of publication, it does not warrant its accuracy or completeness and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by any person or body corporate arising from or in connection with the supply or use of the whole or any part of the information in this report through any cause whatsoever.

Copyright and reproduction

This report and all indexes, schedules, annexures or appendices are subject to copyright pursuant to the Copyright Act 1968 (Cth). Subject to statutory defences, no third party may reproduce, publish, adapt or communicate to the public, in whole or in part, the content of this report without the express written consent of Biodiversity Assessment and Management Pty Ltd.

Signed on behalf of
Biodiversity Assessment and Management Pty Ltd

Date: 01/03/2024



Director

Revegetation Plan
Claypave South Project, New Chum

Table of Contents

1.0 BACKGROUND 1
1.1 Pre-clear Regional Ecosystems and Current Vegetation 1

2.0 REHABILITATION AND REVEGETATION OBJECTIVES 4
2.1 Reference Data 5
2.1.1 Option 1 - Analogue Sites 5
2.1.2 Option 2 - Pre-clear RE BioCondition Benchmarks 6

3.0 REVEGETATION METHODS 8
3.1 Species Selection 10
3.2 Preferred Revegetation Techniques 11
3.3 Site Preparation 11
3.4 Direct Seeding 11
3.4.1 Seed supply 11
3.4.2 Seed treatment 12
3.4.3 Ecosystem succession 12
3.4.4 Seeding rate 12
3.4.5 Seed spreading 12
3.4.6 Timing of seeding 12
3.5 Container Planting 13
3.5.1 Planting density 13
3.5.2 Mulching 14
3.5.3 Tree Guards 14
3.6 Watering and Fertilising 14
3.7 Lacustrine Systems 15
3.8 Weed Management 16
3.9 Rehabilitation Team 16

4.0 MONITORING AND MAINTENANCE SCHEDULE 17
4.1 Timing 17
4.2 Monitoring Criteria 18
4.3 Milestone Criteria 19

5.0 REPORTING 20

6.0 REFERENCES 22

Table of Figures

Figure 1: Pre-clear Regional Ecosystems

Figure 2: Remnant and Regrowth Vegetation

Figure 3: Possible Analogue Sites

Figure 4: Rehabilitation Zones

Appendices

Appendix 1: SEQ Regional Ecosystem Technical Description - RE 12.9-10.2

Appendix 2: BioCondition Assessment Manual

Appendix 3: Revegetation Actions and Rationale

Table of Terms and Abbreviations

BAAM	Biodiversity Assessment and Management
DES	Department of Environment and Science
EA	Environmental Authority
EIS	Environmental Impact Statement
EMP	Environmental Management plan
ERC	Estimated Rehabilitation Cost
ML	Mining Lease
PMLU	Post-Mining Land Use
PRCP	Progressive Rehabilitation and Closure Plan
RE	Regional Ecosystem
WONS	Weed of National Significance

1.0 BACKGROUND

An open-cut shale extraction mine, referenced as "Claypave South", is situated within Lot 73 SP128662 near Ipswich in south-east Queensland, and is currently leased by Jackal Renewables under Mining Lease (ML) permit ML 50070. The current mining lease period extends until February 2044. The western sector of the mine also supports a Resource Recovery Centre that currently reprocesses fibre cement products and has approval for expansion of waste recycling and reprocessing operations.

A Progressive Rehabilitation and Closure Plan (PRCP) for Claypave South was submitted in early 2023, with the Department of Environment and Science (DES) requesting further information. This Revegetation Plan addresses specific components of the further information request and should be read in conjunction with the PRCP.

1.1 PRE-CLEAR REGIONAL ECOSYSTEMS AND CURRENT VEGETATION

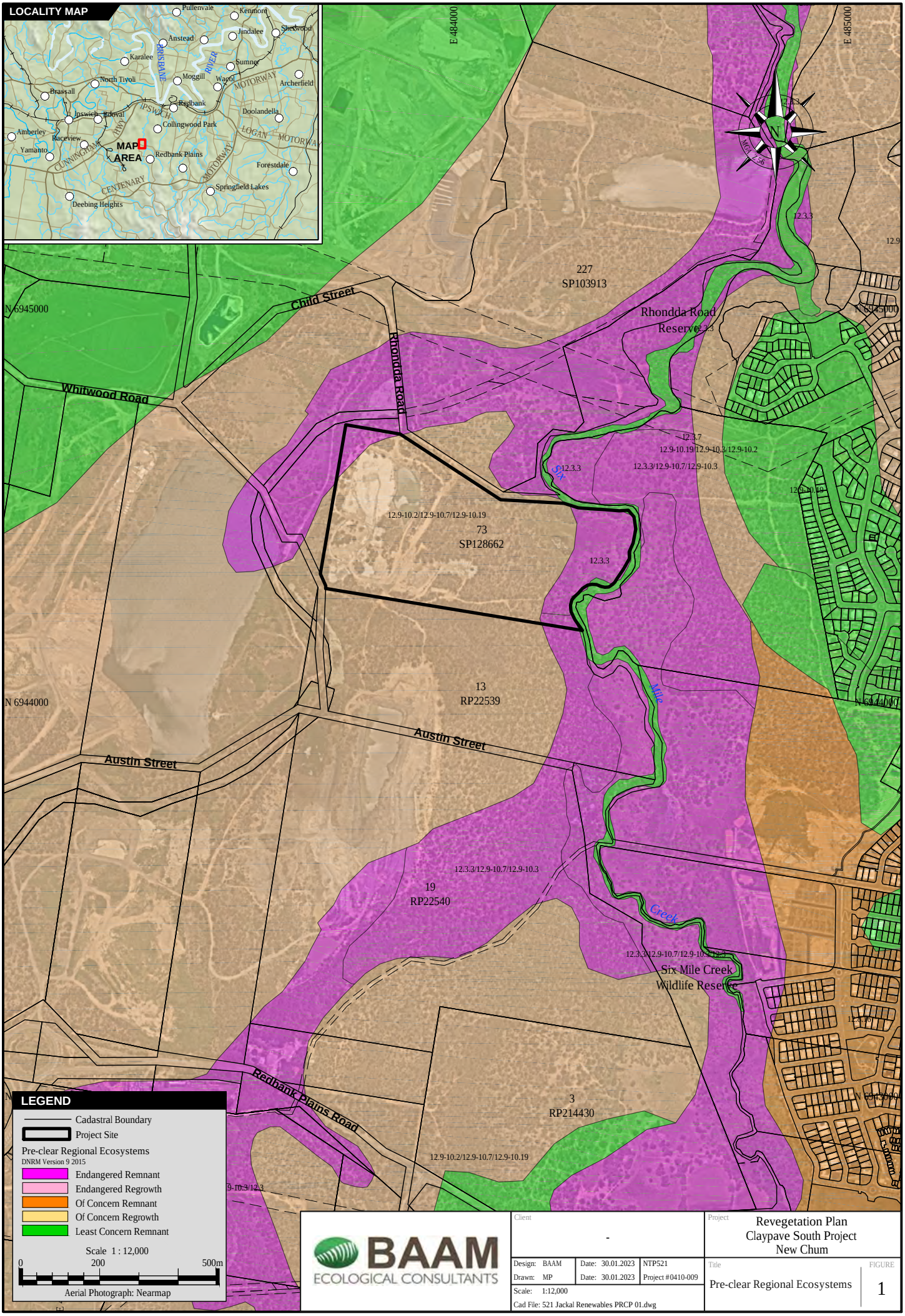
Historical aerial photography of the mining lease indicates the majority of the original vegetation has been cleared for underground and open cut coal mining since the 1800s. Much of the clearing occurred between 1900 to 1996, since before the development of the clay pit, and continues with consecutive mineral mining activities.

Queensland Government pre-clear Regional Ecosystem (RE) mapping for the mine lease and surrounding areas indicates several mixed polygon REs once occurred within the site, as described in **Table 1.1** and portrayed in **Figure 1**.

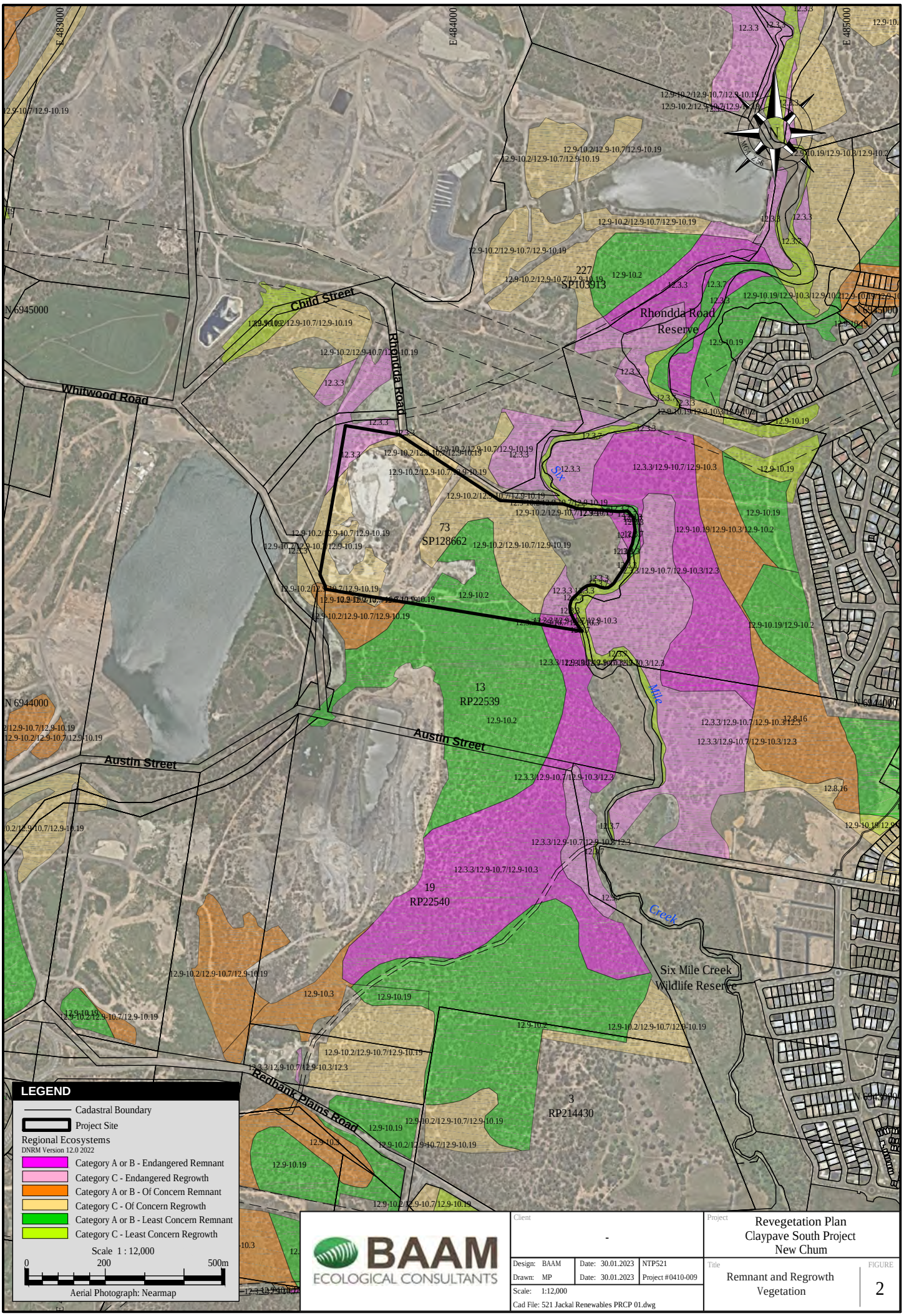
Queensland Government mapping of extant vegetation (**Figure 2**) indicates a portion of the centre of the mining lease currently supports remnant RE12.9-10.2, while a small portion of the lease to the south-west supports a mixed polygon of remnant REs 12.9-10.2 (65%), 12.9-10.7 (20%), and 12.9-10.19 (15%). A small mixed polygon of remnant vegetation of RE 12.3.3 (60%), 12.9-10.7 (30%) and 12.9-10.3 (10%) has been mapped in the far south-east corner of the mining lease. Remnant vegetation RE 12.3.7 is mapped along Six Mile Creek, which borders the site to the east, extending into the site in small areas but is mainly contained within the freehold lot outside of the mining lease area.

Table 1.1. Vegetation descriptions within and adjacent to the mining lease

Area	RE (Vegetation Management Class Status)	Short Description
Proposed rehabilitation area	12.9-10.2 (Least Concern)	*Corymbia citriodora subsp. variegata +/- Eucalyptus crebra* open forest on sedimentary rocks
	12.9-10.7 (Of Concern)	*Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp.* and *E. melanophloia* woodland on sedimentary rocks
	12.9-10.19 (Least Concern)	*Eucalyptus fibrosa* subsp. *fibrosa* woodland on sedimentary rocks
South-east mining lease	12.3.3 (Endangered)	*Eucalyptus tereticornis* woodland on Quaternary alluvium; 12.3.3a) *Eucalyptus crebra, C. tessellaris* woodland to open forest
East of the mining lease (freehold)	12.3.7 (Of Concern)	*Eucalyptus tereticornis*, *Casuarina cunninghamiana* subsp. *cunninghamiana +/- Melaleuca spp*. fringing woodland



© Biodiversity Assessment and Management Pty Ltd. While every care is taken to ensure the accuracy of this data, Biodiversity Assessment and Management makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.



BAAM ECOLOGICAL CONSULTANTS

Client	-		
Design: BAAM	Date: 30.01.2023	NTP521	
Drawn: MP	Date: 30.01.2023	Project #0410-009	
Scale: 1:12,000			
Cad File: 521 Jackal Renewables PRCP 01.dwg			

Project: Revegetation Plan
Claypave South Project
New Chum

Title: Remnant and Regrowth Vegetation

FIGURE 2

© Biodiversity Assessment and Management Pty Ltd. While every care is taken to ensure the accuracy of this data, Biodiversity Assessment and Management makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.

Queensland Government mapping indicates much of the REs on the mining lease are categorised as SEQ Koala Habitat Area – Core; as such, it is recommended any rehabilitated vegetation should be of an RE that is identified Koala habitat (e.g., see DES, 2023).

The PCMP indicates there is an existing 20 m vegetative buffer around the ML. It is unclear if this is remnant or regrowth vegetation; however, no rehabilitation undertaken to-date has been approved as progressively certified under the Queensland *Environmental Protection Act 1994*.

2.0 REHABILITATION AND REVEGETATION OBJECTIVES

The aim of rehabilitating a site is to reinstate ecosystem functionality and land productivity. However, in the case of mining rehabilitation, especially that of open cut mining, a different end point land use and species composition from the original ecosystem type is expected due to the protracted length of time for the soil profile and subsequent revegetation to achieve pre-disturbance conditions.

Often, the intent of end of mine restoration is to re-establish an ecosystem that develops along a successional pathway so that it assumes a similar, self-sustainable structure, function and composition to the original pre-mining ecosystem, whist recognising that these ecosystems may change over time depending on maintenance factors, weed invasion, fire regime, droughts, etc. (see *Mine Rehabilitation Leading Practice for Sustainable Development Program for the Mining Industry*, Australian Government 2016). Furthermore, this document states that, for mining companies in Australia, rehabilitation should be an integral component of their sustainable development strategies. Rehabilitation is invariably a key performance indicator against which companies' environmental performance is judged. Poorly rehabilitated mines provide significant legacy problems for all elements of society—governments, communities and companies.

The Environmental Authority EA0001386 indicates the approved PMLU for this rehabilitation is "Natural Ecosystem". **Table 2.1** Specifies the PMLU land use requirements as consistent with EA0001386.

Table 2.1. Final Land Use and rehabilitation schedule

Tenure	Disturbance & Current use	Rehabilitation outcome as per EA
ML50070	Western sector - old coal mine void (including backfill)	Native Ecosystem
	Western Sector – mine spoil dump	Native Ecosystem
	Mine excavation area	Native Ecosystem

In line with condition F6-1 Rehabilitation Outcome – Native Ecosystem for the purposes of Schedule F – (Final Land Use and Rehabilitation Outcome Criteria), areas that are to be rehabilitated to native ecosystem must comply with the following outcomes:

(a) Achievement of a self-sustaining native ecosystem with a species composition and distribution similar to the pre-mining species composition and distribution.

The understanding of "nativeness or natural vegetation" in relation to ecological restoration are complex (Trigger et al. 2008), and native ecosystem rehabilitation can mean different things to different people. In the context of mine rehabilitation, two options are generally recognised as "native" rehabilitation, these being:

- The establishment of an ecosystem using plants from a specific RE (e.g. pre-clear); or
- The establishment of an ecosystem using regionally local plant species, but not necessarily targeting a specific RE (e.g. regrowth mixed REs). This can include vegetation similar to that in the surrounding area, or that which "fits in" with the surrounding vegetation, often referenced to as a substitute natural ecosystem (Spain et al. 2023).

For this revegetation plan, the restoration of natural ecosystems is the goal of restoration ecology in the assigned PMLU. The species composition and relative abundances have been selected based on the pre-clear mapping of RE 12.9-10.2 (identified in **Section 3.4** and **Appendix 1**). This is the most prevalent RE both in single stand remnant and in percentage of the mixed polygons identified on and in the immediate area around the ML.

2.1 REFERENCE DATA

2.1.1 Option 1 - Analogue Sites

BioCondition surveys (based upon the Queensland BioCondition Assessment Framework) provide a measure of how well a terrestrial ecosystem is functioning in terms of biodiversity values. It is a site based, quantitative method allowing repeatable assessment that is summarised in a condition rating (Eyre et al., 2015).

Typically, benchmark analogue sites that are indicative of the pre-clear RE identifies attributes that are compared and scored against the rehabilitated area to determine rehabilitation success. Site based attributes are usually identified by the following criteria:

- Native plant species richness of trees, shrubs and groundcovers
- Percentage of tree canopy cover (%)
- Tree canopy height (m)
- Percentage of shrub layer cover (%)
- Percentage of native perennial grass cover (%)
- Number of large trees with a diameter at breast height over the provided threshold
- Coarse woody debris (m)
- Percentage of litter cover (%)

Mining operations tend to disturb the whole ecosystem, and restoration of the pre-clear RE is rarely attainable and not practicable due to alterations in geomorphology, hydrology and soil chemistry (see Doley and Audet 2013). As such, given regulatory requirements are to return the mine to 'a natural condition', rather than attempting to achieve the benchmark REs, it is recommended to restore the vegetation to that of the local area. To achieve this, BioCondition methods may be adapted to the specific conditions of the mine but continue to be based upon the Queensland BioCondition Assessment Framework. Rather than using mapped pre-clear RE BioCondition benchmarks, the scoring is rated against existing vegetation analogue sites that are on or local to the mine site.

A minimum of two analogue sites should be established, and measurable data between the two be averaged.

There are currently five RE types found across the mining lease, with the most dominant being RE 12.9-10.2. Several possible analogue sites exist within and around the mining lease, including the remnant vegetation within the mining lease. However, this is within the potential mine zones so may be cleared in the future, rendering it unsuitable for long-term monitoring and comparison to rehabilitation areas (see **Figure 3**).

Suggested offsite analogue sites of mapped remnant RE 12.9-10.2 for the purpose of rehabilitation benchmark scoring adjacent to the mining lease are identified in **Figure 3**. These include areas to the south of the mining lease that are contiguous to the remnant vegetation on the mining lease, as well as mapped remnant RE12.9-10.5 on Rhondda Road Reserve to the north and existing uncleared bushland off Schutt Street to the south. It should be noted that these possible analogue sites are not protected and, as such, require investigation into securing the areas for long-term monitoring.

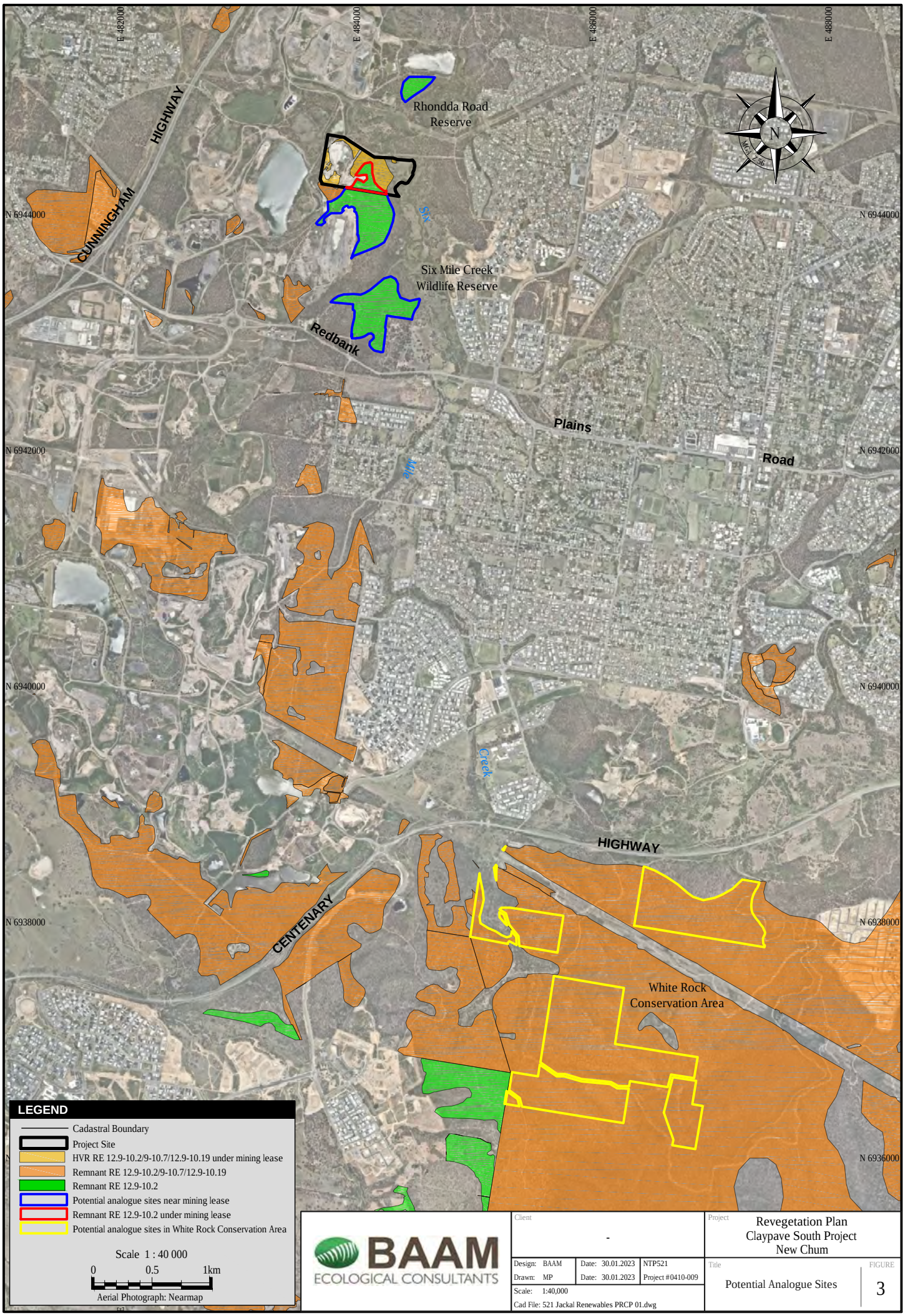
Alternatively, White Rock Conservation Park is approximately 6 km to the south-east of the mining lease, and contains remnant vegetation of mixed polygon RE 12.9-10.2/12.9-10.7/12.9-10.19, which is the RE type that the majority of the regrowth vegetation on the mining lease is mapped as. As the Conservation Park has a level of protection from future disturbance, it may be a suitable long-term option for monitoring and comparison.

Permanent transects should be set up within analogue sites as per the methodology outlined in the Queensland Herbarium BioCondition Assessment Manual (**Appendix 2**). The scorable data from the analogue site should be used as a benchmark to determine the success of the future rehabilitation areas once vegetative growth is underway. An exception to this is that the scoring criteria will need to be altered to account for the lack of large trees and coarse woody debris, as these criteria benchmarks will not be attainable over the rehabilitation monitoring life-time (Nelder et al.2014). However, height data and diameter at breast height of canopy tree species over time should be recorded to ensure continual survival and growth.

The rehabilitation areas are monitored and scored against the analogue sites, as described in **Appendix 2**, until equitable scoring between the analogue site and the rehabilitation area is achieved. Whilst vegetation specific to the desired return RE is indicated in the technical descriptions (**Appendix 1**), a full species list should be undertaken at the analogue sites at the time of their establishment to identify future seed and seedling procurement species.

2.1.2 Option 2 - Pre-clear RE BioCondition Benchmarks

Should analogue sites not be identified as satisfactory for the purpose required, or should analogue site data be otherwise unavailable, the official Biocondition benchmarks for RE 12.9-10.2 can be used, as identified in **Table 2.2**. However, this method of comparison is not ideal, and should only be used if analogue site data is unobtainable or unavailable.



BAAM ECOLOGICAL CONSULTANTS

Client: -

Project: Revegetation Plan
Claypave South Project
New Chum

Design: BAAM	Date: 30.01.2023	NTP521
Drawn: MP	Date: 30.01.2023	Project #0410-009

Scale: 1:40,000

Cad File: 521 Jackal Renewables PRCP 01.dwg

Title: Potential Analogue Sites

FIGURE 3

©Biodiversity Assessment and Management Pty Ltd. While every care is taken to ensure the accuracy of this data, Biodiversity Assessment and Management makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.

Table 2.2. Monitoring attributes in the BioCondition benchmark database for RE 12.9-10.2

BioCondition attribute	Benchmark
Recruitment (% dominant canopy species as saplings)	100
Non-native plant cover (%)	0
Tree species richness (number of species)	6
Shrub species richness (number of species)	7
Grass species richness (number of species)	7
Forb species richness (number of species)	13
Tree canopy height (m)	21
Tree subcanopy height (m)	12
Tree canopy cover (%)	64
Tree subcanopy cover (%)	20
Large eucalypt tree' threshold DBH (cm)	38
Total number of large eucalypt trees per hectare	38
Shrub canopy cover (%)	6
Native perennial grass cover (%)	21
Ground litter cover (%)	48
Woody debris (length in m/ha)	506

3.0 REVEGETATION METHODS

The PCMP indicates that the rehabilitation of the mine is comprised of five (5) rehabilitation zones. The rehabilitation is scheduled to occur progressively, and completion of rehabilitation is to commence as soon as practicable after the land becomes available. **Table 3.1** and **Figure 4** identify the rehabilitation areas.

Table 3.1. Rehabilitation zones for Claypave South

Rehabilitation area identifier	Activity/Area	Rehabilitation area size (ha)	Progressive rehabilitation and start date
RA1	Kerwick 1 Stage 1	1.65	Starting 2028
RA2	Kerwick 1 Stage 2	1.26	Starting 3023
RA3	Kerwick 1 Stage 3	0.99	Starting 2036
RA4	Kerwick 1 Stage 4	13.23	Starting 2039
	Kerwick 2		End of Mine
	Truck Hardstand		End of Mine
RA5	Powerline and access track	0.49	End of Mine

Revegetation techniques are generally recognised as being assisted or unassisted (Corr 2003). Unassisted revegetation is also known as natural regeneration. Assisted vegetation can be undertaken by direct seeding or planting of seedlings (tubestock).

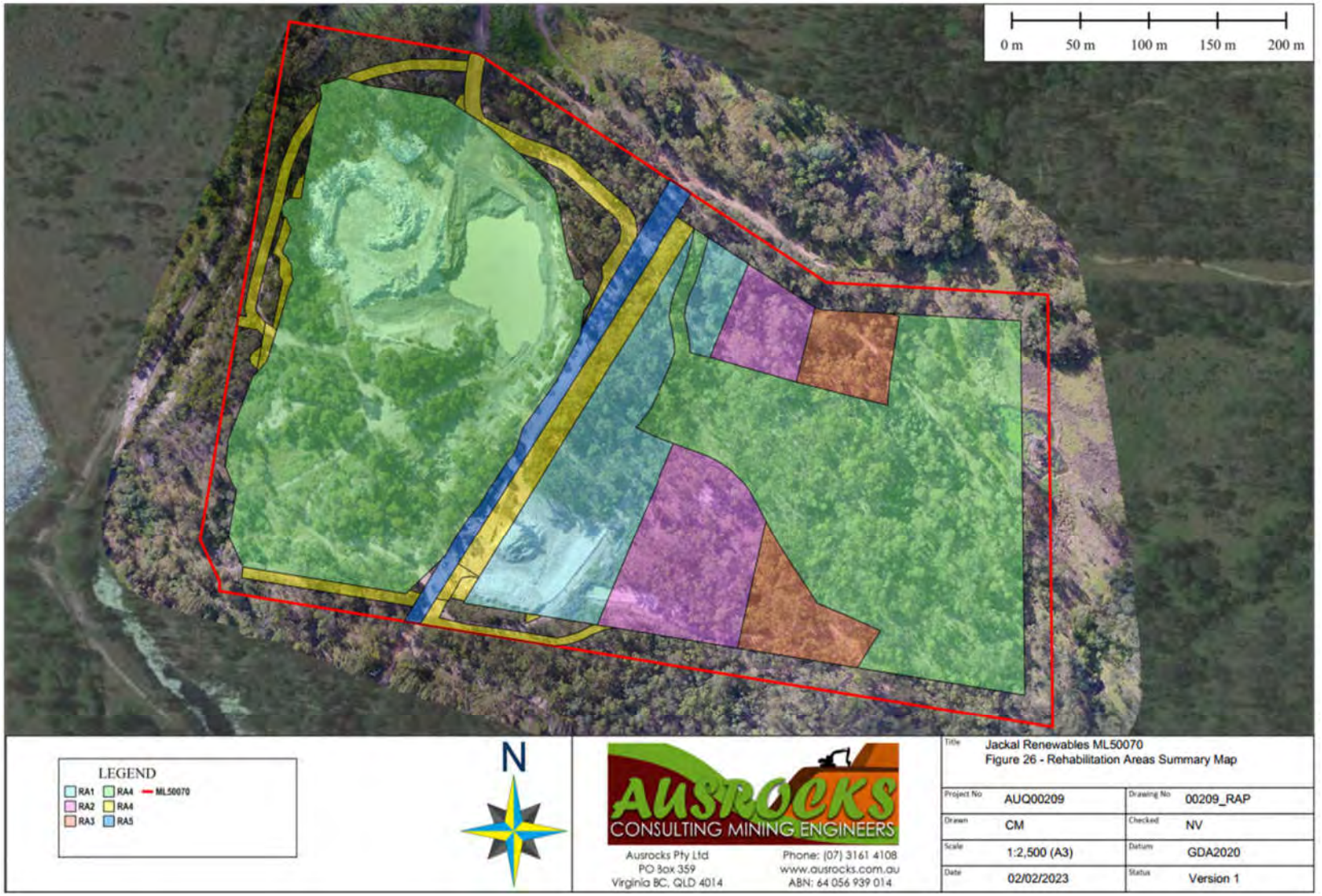


Figure 4 Rehabilitation zones (as provided in PRCP)

Assisted vegetation rehabilitation methodology techniques, in the form of seeding and tubestock planting, will be undertaken to achieve the desired end point outcomes of a "Return to Native Ecosystem" PMLU at the Claypave South mining lease.

A summary of required revegetation actions and rationale is provided in **Appendix 3.**

3.1 SPECIES SELECTION

The restoration planting will complement the existing vegetation on site. **Table 3.2** comprises a list of frequent species endemic to RE 11.9-10.2, which is the most prevalent RE currently identified on the mining lease.The revegetation plan planting pallet, species composition and relative abundances are to be based on the pre-clear RE technical descriptions as found in **Appendix 1**, as well as the mapped remnant vegetation identified during the establishment of the analogue site/s, and the species recorded on site.

Should any species be commercially unavailable, the rehabilitation contractor should (with approval) select alternative, suitable species that are native to the locality, prior to planting.

A suggested planting pallet for lacustrine systems has also been included for any return to natural ecosystem rehabilitation works that are to occur around the final voids, which will hold water at the end of mine use.

Table 3.2. Abridged list of species endemic to the RE 12.9-10.2 identified as remnant vegetation existing in the largest percentage across the mining lease. Lacustrine species have been selected for any void and water storage areas requiring end of mine rehabilitation.

RE	Trees	Shrubs	Grasses & Forbs
11.9-10.2	*Corymbia citriodora subsp. variegata* *Angophora leiocarpa* *Eucalyptus crebra Eucalyptus tereticornis Corymbia tessellaris Eucalyptus moluccana* *Eucalyptus melanophloia*	*Acacia disparrima subsp. disparrima* *Acacia maidenii* *Acacia leiocalyx* *Alstonia constricta* *Allocasuarina torulosa Alphitonia excelsa* *Jacksonia scoparia* *Hibiscus sturtii* *Hovea acutifolia*	*Entolasia stricta Cymbopogon refractus, Themeda triandra Eremochloa bimaculata Imperata cylindrica* *Panicum effusum Heteropogon contortus* *Dianella revoluta* *Eustrephus latifolius* *Dianella caerulea* *Lomandra multiflora* *Lomandra longifolia*
Lacustrine system	*Eucalyptus tereticornis* *Melaleuca bracteata* *Lophostemon suaveolens* *Eucalyptus moluccana*	*Melaleuca viminalis* *Mallotus philippensis* *Acacia sp.* *Eremophila bignoniiflora*	*Fimbristylis dichotoma* *Cyperus gracilis* *Philydrum lanuginosum* *Eleocharis sp.* *Oryza meridionalis* *Persicaria decipiens*

3.2 PREFERRED REVEGETATION TECHNIQUES

The final choice of revegetation techniques (direct seeding and/or tube stock planting) is at the discretion of the rehabilitation team and will be determined by a variety of factors including final land use, cost and maintenance capacities.

3.3 SITE PREPARATION

Where terrain is accessible, the existing topsoil is to be cultivated and a comprehensive soil survey carried out prior to rehabilitation to determine nutrition status. If required, ameliorants such as gypsum, lime (pH soil dependent) and/or fertilizer are to be added prior to revegetation. Soil testing to date indicates low phosphate slow-release fertilizer, and gypsum will be required to be added to the topsoil. Likewise, increased organic matter in the form of biosolids should be used to top-dress the topsoil prior to any revegetation works.

3.4 DIRECT SEEDING

Direct seeding is advised to be carried out in all rehabilitation areas,

Direct seeding involves the sowing of treated seeds directly onto a site to achieve germination and establishment and can be carried out mechanically or by hand.

Assuming site preparation is completed, mechanical direct seeding is regarded as the most cost-effective and labor-efficient revegetation technique for broad scale revegetation. The actual method used is a decision based upon site conditions, and commercial and contractor recommendations.

Prior to revegetation, ensure all weeds are controlled and a good soil moisture profile depth is available prior to seeding. Ripping is recommended to assist root development by re-aerating clay-loams, clay soils, hardpans, or compacted soils. Seeding or planting lines should be ripped to a depth of 30 to 60 cm where possible. Ripping is not recommended in waterlogged areas or wet soils, deep soils, stream ides/streambanks, cracking clays, and sites where there is a high level of intact native ground flora. In clay or sodic soils, it is best to use gypsum and to chisel plough these sites. Ripping should not be undertaken within root protection zones of existing native trees.

A number of aspects need to be taken into account to increase the chances of success with direct seeding and are outlined in the following sections.

3.4.1 Seed supply

Seed may be collected locally or purchased. Planning for locally sourced seed collection should commence at least one or two years prior to rehabilitation. Post collection, seed needs to be cleaned and stored under conditions that will maintain maximum viability over the storage period and minimise pest and/or pathogen attack.

3.4.2 Seed treatment

Seeds of many species may need to be treated to break dormancy for germination to occur. Treatment methods can include heat treatment, scarification or exposure to smoke or smoked water. Other seeds may require rhizobium inoculation or lime pelleting. Sources of information on which methods might be needed include seed suppliers and key references (such as Floradata 2001). Where rainfall is unpredictable, it may be prudent not to treat all the seed so that some remains viable for future years.

3.4.3 Ecosystem succession

To establish a diverse, sustainable native ecosystem, successional aspects of the ecosystem must be considered. Pioneer species that readily colonise disturbed areas should be included in the seed mix (e.g. Acacias), along with hardier, later successional stages species (e.g. eucalypts). The relative abundances of species will change as early colonisers die out and longer-lived species become proportionally more dominant. However, the typically lower mortality, high competitive advantage and/or high fecundity and recruitment of pioneer species, compared to later succession species, should be considered when determining suitable seeding/planting densities.

3.4.4 Seeding rate

Direct seeding relies on greater amounts of seed than techniques based on tube stock planting to obtain the required stem density. Under ideal conditions, 1 to 1.2 kilograms of mixed seed is required per hectare to establish approximately 3,000 seedlings (Corr 2003). However, seeding rates should be determined by trials at the mine site. The *Mine Rehabilitation Leading Practice for Sustainable Development Program for the Mining Industry* (Australian Government 2016) states rates for native tree and shrub species are 1–3 kg/ha, of which 25–35% of the total weight is seeds of canopy species such as eucalypts. The ultimate survival rate in direct sowing is typically 1–5% for fine-seed species and 5–10% for coarse-seed species. The application rate for each species in the seed mix should be based on the desired density (determined by RE stem density benchmark numbers) in rehabilitated areas, adjusted for seed viability, germinability and establishment rates. In areas of open woodland, additional native grass seeding rates of 10–20 kg/ha are recommended.

3.4.5 Seed spreading

The methods for spreading seed partly depend on what labour and equipment are available. They can include spreading by hand, agricultural seed spreader or the bulldozer doing the ripping. Note that some mechanical methods do not spread some seed types well.

3.4.6 Timing of seeding

Seed should be sown immediately before the expected onset of reliable rains. The PRCP indicates December through to March are the months of highest precipitation at the mine site (Ipswich). Native seeds may require specific moisture and temperature conditions to germinate, so that they establish at the optimal time of the year for survival.

3.5 CONTAINER PLANTING

Container planting at tube stock size can be undertaken in all return to native vegetation rehabilitation areas and be done in coordination with direct seedling.

Tubes may be planted in one single or multiple planting events if staging is desired; however, should seeding be occurring in the same area as tubestock planting, tube stock planting should be undertaken immediately after seeding has occurred.

All tubestock plants are to be fully sun-hardened prior to planting.

Each species is to be planted in a random, 'natural' manner across the rehabilitation area in groupings of 3, 5, 7 or 9, where possible.

All tube stock plants are to be planted into prepared holes that measure the depth and twice the width of the tubes. There must be a minimum amount of cultivated topsoil to accommodate the seedlings – either 150 mm depth or the minimum height of the tube stock seedling root ball. Tube stock seedlings are not to be planted into rock or clay substrate. There is an estimated 4,500 m^3 topsoil currently available in stockpiles for rehabilitation purposes. If no adequate topsoil is present, imported topsoil is required. Tube stock are to be planted in cultivated or augured soil as soon as practicable. Care is to be taken to prevent damage to the roots of existing trees.

Planting times can be all year round; however, for higher success rates, the preference is for planting to is to be carried out just prior to the wet season to allow maximum growing time prior to extreme conditions. Planting should be undertaken in the morning or late afternoon to avoid heat/desiccation stress.

To remove seedlings from tubes, the tubes are to be upended and the root ball lightly tapped out – i.e. do not pull out of the tube by the plant's stem.

Soil is to be backfilled around tube stock, once placed in the hole, and firmed in to ensure soil contact with root ball. To avoid ringbarking, the stem of the tube stock is not covered with soil or mulch. A small water catchment ring/dammed area is to be built up at the outside edge of the root ball, at the surface, to ensure water is captured and will flow down into the root zone and not runoff the soil pile.

Upon completion of planting, soak water around the root ball to ensure no air spaces remain. This is to occur within a reasonable time frame post planting, ensuring no wilting takes place between planting and watering-in. Tubes may need re-firming after initial watering if they develop leans.

3.5.1 Planting density

Tube stock is to be planted at a stem density ratio as described in the technical descriptions for the proposed return RE (see **Appendix 1**) and final vegetation cover must be comparable with the established comparable analogue site stem density. A percentage of overplanting is recommended in the event of losses and the stem density falling below the analogue benchmark. This level of overplanting is dependent on the species, but is typically comparable between strata (e.g., all canopy tree species overplanted by 10%).

3.5.2 Mulching

All tree tube stock is to be mulched with a clean, plastic and weed free, organic material-based mulch. Mulch is to be placed in a ring, with a minimum radius of 600 mm around each individual plant and to a depth of 100 mm. Mulch should not be placed directly against the stem of the seedling; a gap of 'mulch free' area of 100 mm around the stem will be established to prevent mulch decomposition ring barking the seedling.

3.5.3 Tree Guards

Tree guards are to be used if grazing macropods or other herbivores are present and are/have the potential to impact on plantings. These should be left in place until such time that the individual plants are of a size that is unaffected by predation; specifically, when plant height of the lower limbs is greater than the height of the herbivores. Biodegradable tree guards should be used, if possible, to minimise plastic pollution (through flooding or disintegration).

3.6 WATERING AND FERTILISING

A minimum of 5-10 L of water should be applied to each tube stock directly after planting. A diluted solution of SeaSol® liquid fertiliser may also be applied to reduce transplant shock and encourage root growth at the time of planting. A suitable fertiliser tablet for native species should be placed adjacent to but not touching the root ball. A follow-up application of fertiliser is unnecessary as native plants are generally adapted to low nutrient level in the soil.

The watering schedule should follow the recommendations in **Table 3.3**, although may be subject to change depending on rainfall frequency and intensity. Adjustments to watering frequency and quantity should be made according to visual inspection of site condition and plant health. Watering should be carried out early in the morning or late in the afternoon to avoid excessive water loss from evaporation.

Table 3.3. Watering schedule

Week	Frequency*
1 – 2	One watering event of all tubestock planted every second day
2 – 7	Two watering events of all tubestock planted cycles per week
7 – 12	Once watering event of all tubestock planted per week
12-20+	Site to be monitored for wilting of plants and watering to be undertaken as required

*During periods where rainfall events occur, watering will not be required.

As the hydrology or the rehabilitated soil has been altered, original ground water levels may have been altered. As such, monitoring will be required during drought periods, even a number of years into the rehabilitation process, to ensure adequate moisture provision for the seedlings/saplings.

All seeding should be undertaken during the predicted wet season after an initial significant rain event, ensuring a full moisture profile is evident. As such it may be unnecessary to supply additional watering if seeds are planted during wet season. In the event of an unexpected dry spell occurring after germination and if immediate watering doesn't occur subsequent seedling death is likely to occur; in this case, seed stock should be watered utilising a water truck spray unit.

As soils have been ameliorated (if found to be required) prior to seeding further fertilizing is not generally required for seed sown and growing vegetation.

3.7 LACUSTRINE SYSTEMS

Water storage and end of use mining voids that hold water will not return to terrestrial RE status, but are now classed as created or built lacustrine systems. Lacustrine systems (wetlands, lakes and dams) are very different in composition to terrestrial zones and are comprised of three zones:

- Riparian/fringing zone
- Emergent zone
- Aquatic zone

Revegetation of these zones should comprise native species that are representative of the region and encompass all three habitat zones.

Riparian/fringing zone densities of 1.5–2 m spacings will have the best rehabilitation potential, but up to 3 m is considered acceptable. Wider spacings will generally require more maintenance (weeding and mulching) for longer periods. Closely spaced plantings are preferred to encourage rapid canopy growth, especially in areas of intense weed competition. Emergent zone plant spacings of 0.2 -1 m are recommended at the waterline (Wetland Care 2008).

Natural regeneration can also be particularly successful for the aquatic zone. It is generally considered to be the best way to rehabilitate the floating/submerged vegetation.

Care requires to be taken during soil preparation and rehabilitation in these areas as they are prone to erosion and susceptible to sediment runoff.

General monitoring of lacustrine systems are observations of the site and its condition. Over time, monitoring is necessary to gauge improvements or otherwise. Determining which indicators are best for monitoring the progress of the site may depend on the original management goal of the rehabilitation. Photo-point monitoring and bird, fish or other fauna survey monitoring should be considered in these areas. It is also worth conducting extra monitoring, including for water quality, after a major flood event or other natural disturbance.

Continued monitoring and weed control is necessary in lacustrine systems as weed species are readily distributed by wildlife (birds in particular) that visit and utilize water bodies. Additionally, pest management needs to be considered as these zones are susceptible to different pests to those found in terrestrial rehabilitation areas (e.g. cane toads, tilapia, gambusia, pigs, etc.).

3.8 WEED MANAGEMENT

Appendix 3 Ecological Studies within the PRCP section 5.3 records 26 exotic weed species, with 15 species listed as invasive plants under the Biosecurity Act 2014, and three listed as Weeds of National Significance (WoNs). It is recommended that, prior to rehabilitation, a full weed assessment survey including mapping be undertaken and comprehensive weed management plan for the mine be implemented, particularly for WoNS and Category 3 Restricted Plants under the Queensland *Biosecurity Act 2014.*

Under the *Biosecurity Act 2014*, a person must not release restricted plants into the environment, give away or sell as a seed, plant or something infested with its seeds. The Act requires everyone to take all reasonable and practical measures to minimise the biosecurity risks associated with invasive plants under their control.

Weeds Australia (2023) provides, in a digital format, the best and most up to date invasive species information for land managers. Weed profiles including the most appropriate control management are available on this site. Note that any herbicides used on site must be registered for use within proximity to waterways, be used in strict accordance with the product label directions and applied by an appropriately qualified person in accordance with the Queensland Agricultural Chemicals Distribution Control Act 1966

There are recognised difficulties across the mining industry in managing weeds and the focus of weed management should be the removal of WoNS and Category 3 Restricted Invasive Plants. However, some exotic grass species historically used as pasture species and for bank stabilisation are particularly detrimental to native grasses by out-competing desirable native ground cover grasses and, in some cases, complete elimination of native flora recruitment. If these grasses are identified on the rehabilitation site, control of these species will need to be undertaken prior to any seeding or tube stock planting within the rehabilitation areas.

All rehabilitation areas will need to be monitored and maintained to prevent reinfestation. Ideally, a minimum of two weed control activities should be undertaken prior to seeding and tube stock planting. This will be dependent on species type and rate of weed regrowth. Ongoing monitoring the site should be undertaken using a range of resources including photo points, records and mapping of areas where works have occurred. This will help to determine the success or failure of weed control work and direct future weed control methodologies.

Additionally, weed control must be implemented and maintained within the analogue sites so as not to reduce the BioCondition scoring of these sites.

3.9 REHABILITATION TEAM

All works in the rehabilitation area associated with the rehabilitation methodology, as set out in this plan, must be carried out by a registered revegetation/rehabilitation contractor, who will undertake site preparation, planting works and follow up monitoring and maintenance. Any herbicides must be registered for use within proximity to waterways. Herbicides must be applied by appropriately qualified/supervised persons in strict accordance with the *Agricultural Chemicals and Distribution Control Act 1966*, at rates as identified on registered product labels, or on an Australian Pesticides and Veterinary Medicines Authority (APVMA) issued off-label permit, where applicable.

4.0 MONITORING AND MAINTENANCE SCHEDULE

4.1 TIMING

Monitoring and maintenance of the rehabilitation area will be undertaken as per **Table 4.1** until such time as systematic surveys determine that the area has reached the desired landscape objective, which in this case is a natural condition, and is comparable to the selected RE/s.

Table 4.1. Monitoring and maintenance schedule

Timing	Maintenance Task
1- 12 months	**Control weeds** – Check monthly for declared and/or detrimental competitive weeds across the rehabilitation site including analogue and control as required**,** taking care not to damage planted and regenerating native species, including grasses and forbs. **Watering** – Water each planted tubestock as per **Table 3.3**, depending upon prevailing weather conditions, and then monthly or as necessary until seedlings are established and self-sustaining (approximately 3 – 6 months). Watering for seeding required only if unexpected dry period after germination occurs. **Replacement Planting –** Replace dead or senescent plants according to the planting methods in this plan and continue replacement planting until RE stem density is achieved. **Monitoring** – Monitor health of planted and retained vegetation on a monthly basis (for pest and disease, as well as water stress). Identify growth burst, flowering or fruiting etc. Identify successful seed species that have germinated. **Reporting** – Internal: where required.
12-24 months	**Control weeds** – Check quarterly for declared weeds across the rehabilitation site including analogue sites and control as required**,** taking care not to damage planted and regenerating native species, including grasses and forbs. **Watering** –Any replacement seedlings should be watered weekly during the first month following planting, then water as necessary until seedlings are established (approximately 3 – 6 months after planting). Check requirement for watering on a monthly basis during drought conditions, and undertake if necessary. **Replacement Planting** – Replace dead or senescent plants according to the planting methods detailed in this plan and continue replacement planting until RE stem density is achieved. Do not replace during drought conditions, re-establish any rehabilitation revegetation (if required) upon return to “normal" rainfall regimen. **Monitoring** - Monitor health of planted and retained vegetation on a quarterly basis (for pest and disease). Identify growth burst, flowering or fruiting etc. Monitor for erosion after significant rain events and report/remedy accordingly. **Reporting** – Internal: where required. External: annual BioCondition monitoring (and compare with analogue sites).
24 months -15+ years	**Control weeds** – Continue biannual weed checks for declared weeds across the rehabilitation site including analogue sites and control as required. **Watering** – Any replacement seedlings should be watered weekly during the first month following planting, then water as necessary until seedlings are established (approximately 3 – 6 months after planting). Check requirement for watering on a monthly basis during drought conditions, and undertake if necessary. **Replacement Planting** – Replace dead or senescent plants according to the planting methods detailed in this plan and continue replacement planting until RE stem density is achieved. Do not replace during drought conditions, re-establish any rehabilitation revegetation (if required) upon return to “normal" rainfall regimen. **Monitoring** - Monitor health of planted and retained vegetation on a biannual basis. Identify any flowering or fruiting of regrowth species and determine recruitment of these species. Monitor for erosion after significant rain events and report/remedy accordingly. **Reporting –** Internal: where required. External: annual BioCondition monitoring (and compare with analogue sites). Milestone achievement submission, where relevant.

4.2 MONITORING CRITERIA

The preferred method of developing revegetation success criteria is to compare a number of variables between rehabilitation areas and existing ecosystems over time. Consequently, final revegetation success criteria will be based on relative success against baseline data from the analogue sites. Success is usually deemed as a self-sustaining (i.e., natural recruitment observed) and resilient ecosystem that requires no more management effort than surrounding, undisturbed areas. The *Mine Rehabilitation Leading Practice for Sustainable Development Program for the Mining Industry* (Australian Government 2016) indicates that it is highly unlikely that a rehabilitated revegetated site can demonstrate self-sustainability in less than five years following the end of mining, with typical rehabilitation requiring many more years.

For the purpose of this revegetation plan, various milestones and related criteria will require further consideration following analogue site selection, baseline monitoring on the mining lease and analogue sites, and operational site revegetation planning. Additionally, as described previously, the BioCondition Assessment framework will be used for setting vegetation benchmarks, such as those detailed in **Section 2.1** above.

In particular, following analogue site selection and baseline monitoring to determine benchmark values, criteria for the following milestones will be able to be identified:

- number of stems per/(ha) of identified key species;
- number of stems with minimum height (m) specified for identified key species;
- target groundcover biomass (%); and
- various other vegetation benchmark attributes within the BioCondition assessment to determine whether vegetation is comparable between the revegetation and the analogue sites.

Following baseline monitoring of the mining lease and analogue sites, criteria for the following milestones will be able to be determined:

- presence of native fauna (comparable to reference sites);
- number of species and cover of weeds; and
- presence of invasive pest species.

The following milestones will be dependent on the approach to rehabilitation and revegetation of the site, including whether revegetation will be staged and/or continuous.

- completed seeding of target species; and
- planting success (%).

Vegetation monitoring on this site should be undertaken utilising the Queensland Herbarium BioCondition Assessment Manual (**Appendix 2**) methodology. A full assessment should be undertaken at the determined analogue and this used as baseline data for comparison at the rehabilitation sites. Both analogue and revegetation sites attributes will be measured using a 100 m x 50 m nested plot design (see **Appendix 2**). A full species list will be required to be undertaken at the analogue site to determine target species.

The presence of fauna should be undertaken as per the Queensland Government's *Terrestrial Vertebrate Fauna Survey Guidelines* (Eyre et al 2022).

4.3 MILESTONE CRITERIA

The following milestone criteria (**Table 4.2**) have been recommended to assist in confirming success over the course of the vegetative rehabilitation. These milestones have been based upon studies where long-term commitment to revegetation strongly correlates with rehabilitation success (Gould 2010, Kosh and Hobs 2007).

Table 4.2 Current and future milestone targets for vegetative rehabilitation at Claypave South

Current Milestones in PCRP	KPI	Timeframe
Milestone 1	• Records of seeding, planting showing species and density in accordance with design • Monitoring of rehabilitation showing successful revegetation in line with targets: • 70% germination of groundcover species • Recruitment 50% naturally regenerating • 70% planted specimens have survived	1 year
Milestone 6	• Key species present include: – *Corymbia citriodora* – *Eucalyptus crebra* – *Eucalyptus tereticornis* – *Eucalyptus moluccana* – *Corymbia intermedia* • >30% of Foliage Projective Cover at analogue site	3 years
Milestone 7	• Key species present include: – *Corymbia citriodora* – *Eucalyptus crebra* – *Eucalyptus tereticornis* – *Eucalyptus moluccana* – *Corymbia intermedia* • >50% of number of native flora species/ha as present at analogue site	5 years
Proposed Milestones	**KPI**	**Timeframe**
Milestone 1 Revegetation and habitat development	1(a). Completed seeding of target species using a combination of tree, shrub, and ground cover species as per rates specified in section 3.4.4. for RE 12.9-10.2	1 year
Milestone 2 Germination success	2(a). Germination success 70% germination of groundcover species (seed) and 70% planted specimens (tubestock) have survived (b). Weeds are at a maximum of 10% of vegetation cover	2 years
Milestone 3 Achievement of surface requirements	3(a). 80% of the area achieves species density and diversity that is greater than 60% of the reference sites (b). New recruits are occurring from 60% of the understorey species (shrub and ground cover). (c). A minimum of five target canopy species present (as per RE 12.9-10.2 species list): Minimum of 4 m height for any NJKHT species. (d). Weed presence is at a maximum of 10 % of total vegetation cover (e). No new invasive plants and infestation density of invasive plants in the area are contained or reduced and consistent with reference sites (f). Evidence of fauna habitat features for invertebrate and vertebrate species (e.g. logs, rock piles, nest boxes, bird nests or perches)	7-10 years

Proposed Milestones	KPI	Time Frame
Milestone 4 Achievement of post mining land use to native bushland stable condition	4(a). An average of >250 stems / ha dominant tree canopy, of which at least 100 are eucalypt species (NJKHT) (b). NJKHT to have a minimum DBH of 10 cm (c). The measurable presence of a minimum 15 target vegetation species representative of RE 12.9-10.2 within the BioCondition transect comprising: • ≥ 3 species of grasses (native, not introduced pasture grasses) and forbs • ≥7 mid-storey (shrub) species • ≥5 canopy species, including – *Corymbia citriodora* – *Eucalyptus crebra* – *Eucalyptus tereticornis* – *Eucalyptus moluccana* – *Corymbia intermedia* (d). Canopy cover species to be self-sustaining (bearing viable seed, as evidenced by recruitment occurring over at least 60 % of the revegetation area) and with a minimum of 40 % dominant canopy vegetation (with a minimum of 2 NJKHT species) (e). Weeds are at a maximum of 10% of vegetation cover. No new invasive plants and infestation density of invasive plants in the area are contained or reduced and consistent with reference sites (f). 80% of the area has a vegetative groundcover of >70% for areas of low rock and logs, and >50% for areas of high rock and log content (g). Native bushland established that provides habitat opportunities for native invertebrate and vertebrate including: • Evidence of key invertebrate groups (e.g. ants, beetles and spiders) and soil faunal communities • Evidence of key native vertebrate groups (e.g. bird, mammal, reptile and amphibian) in the form of fauna spotting, spotlighting, scats and tracks	20+ years

5.0 REPORTING

Both internal and external monitoring is required to ensure rehabilitation is successful in an efficient manner (see **Table 4.1** above for timing). External monitoring audits determining rehabilitation progress are to be undertaken annually, and a BioCondition report (including photos) is to be supplied. Weed control monitoring and activities should be reported annually.

The *Mine Rehabilitation Leading Practice for Sustainable Development Program for the Mining Industry* (Australian Government 2016) states that the reporting of monitoring results to regulators and other stakeholders should be a part of compliance requirements, depending on the mine's initial approvals. Determining whom the reports go to and who interprets them is an iterative process between the regulators, the mining company and (sometimes) external stakeholders. A proactive approach during stakeholder and community consultation is to identify the lines of reporting and the frequency of the monitoring reports.

Reporting on rehabilitation should be progressive throughout the life of the mine to enable regular feedback, rather than happening as the final sign-off approaches. Periodic reporting builds confidence in the applied approaches and techniques for the company, the regulators and external stakeholders. It may also identify gaps in information, highlight issues requiring remediation and reduce the possibility of failing to meet closure criteria.

The rehabilitation and restoration sciences are still developing fields. It is, however, recognised within the industry that it is unlikely that fully realised ecosystem return conditions can be demonstrated in under five years. Yet there are a few accounts of longer term (20+ years) management of rehabilitated landscapes.

It is important that the mining industry shares findings and encourages further research into active and adaptive leading rehabilitation practices, as monitoring data helps inform future rehabilitation activities and characterises successfully established rehabilitation practices.

6.0 REFERENCES

Ardent Group (2023). Progressive Rehabilitation and Closure Plan – Jackal renewables Pty Ltd, "Claypave South".

Australian Government (2016) Mine Rehabilitation: Leading Practice Sustainable Development Program for the Mining Industry. Australian Department of Industry, Innovation and Science, and Australian Department of Foreign and Trade Affairs, Canberra. https://www.industry.gov.au/sites/default/files/2019-04/lpsdp-mine-rehabilitation-handbook-english.pdf

Baskerville, L., Spain, C.S., Nuske, S. and Gagen, E.J. (2023). Options for Native Ecosystem Mine Site Rehabilitation in Queensland: Stakeholder Survey Report. Queensland Government Office of the Queensland Mine Rehabilitation Commissioner, Brisbane.

Corr, K. (2003). Revegetation Techniques: A guide for establishing native vegetation in Victoria. Greening Australia.

Koch, J. M, Hobbs, R.J., (2007) Synthesis: Is Alcoa Successfully Restoring a Jarrah Forest Ecosystem after Bauxite Mining inWestern Australia?, *Restoration Ecology,* Vol. 15, No. 4, pp. 137-144.

DES (2023). Spatial modelling for koalas in South East Queensland: Report version 4.0. Koala Habitat Areas (KHA) v4.0, Locally Refined Koala Habitat Areas (LRKHA) v4.0, Koala Priority Areas (KPA) v1.0, Koala Habitat Restoration Areas (KHRA) v1.0. Queensland Department of Environment and Science, Brisbane.

Doley, D. and Audet, P. (2013). Adopting novel ecosystems as suitable rehabilitation alternatives for former mine sites. *Ecological Processes*, 2: 22. doi: 10.1186/2192-1709-2-22

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane.

Eyre, T.J., Kelly, A.L. and Neldner, V.J. (2017). Method for the Establishment and Survey of Reference Sites for BioCondition**,** Vol 3. Queensland Herbarium Science Delivery Division, Department of Science, Information Technology and Innovation, Brisbane.

Eyre, T.J., Ferguson, D.J., Smith, G.C., Mathieson, M.T., Venz, M.F., Hogan, L.D., Hourigan, C.L., Kelly, A.L. and Rowland, J. (2022). Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland, Version 4.0. Queensland Department of Environment and Science, Brisbane.

Floradata (2001). A guide to collection, storage and propagation of Australian native plant seed, ISBN 0957796617. http://www.acmer.com.au/publications/floradata.htm.

Gould, S., (2010). Comparison of Post-mining Rehabilitation with Reference Ecosystems in Monsoonal Eucalypt Woodlands, Northern Australia. *Restoration Ecology,* Vol 20, No 2. Pp.250-259.

Neldner, V.J., Ngugi, M.R., (2014) Application of the Biocondition assessment framework to mine vegetation rehabilitation, *Ecological Management & Restoration*.

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F, Addicott, E.P. and Appelman, C.N. (2020) Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 5.1. Updated March 2020. Queensland Herbarium, Queensland Department of Environment and Science, Brisbane.

Queensland Herbarium (2018). Technical Descriptions of Regional Ecosystems, (2018). Queensland Department of Environment and Science, Brisbane.

Spain, C.S., Nuske, S.J., Gagen, E.J. and Purtill, J. (2023). Evaluating native ecosystem rehabilitation options in Queensland. Queensland Government Office of the Queensland Mine Rehabilitation Commissioner, Brisbane.

Trigger, D., Mulcock, J., Gaynor, A. and Toussaint, Y. (2008). Ecological restoration, cultural preferences and the negotiation of “nativeness” in Australia. *Geoforum*, 39(3):1273–1283, doi:10.1016/j.geoforum.2007.05.010.

Weeds Australia (2023). Government weed strategies and lists. Centre for Invasive Species Solutions. https://weeds.org.au/overview/lists-strategies

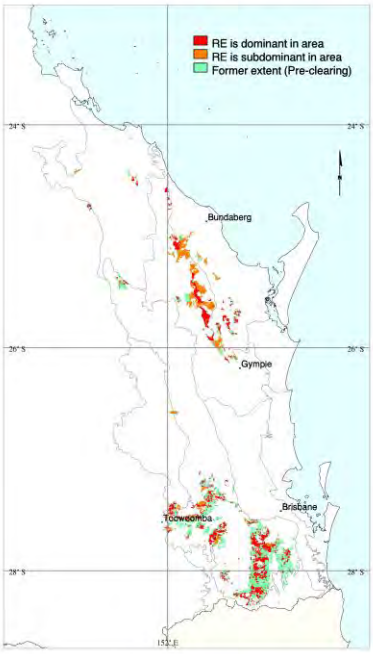
Wetland Care Australia (2008). Wetland Rehabilitation Guidelines for the Great Barrier Reef catchment. Compiled for Australian Department of the Environment, Water, Heritage and the Arts.

APPENDIX 1

Regional Ecosystem Technical Description

RE 12.9-10.2

Corymbia citriodora subsp. variegata +/- Eucalyptus crebra open-forest on sedimentary rocks



Pre-clearing area (ha), remnant area (ha) and per cent remaining:	227,046	88,197	39%

Species recorded: Total: 175; woody: 59; ground: 125; Avg. spp./site: 28.2; std dev.: 7.7, 15 site(s)

Basal area: Avg./site: 16.0 m²/ha, range: 8.0 - 30 m²/ha, std. deviation: 5 m²/ha, 15 site(s)

Structural formation: Open-forest: 73%; woodland: 27%, 15 site(s)

Representative sites: 14276, 14283, 15472, 15476, 15477, 15480, 15481, 15482, 15483, 15518, 15525, 15528, 15786, 15795, 40825.

Stratum: **T1**

Height avg. = 21.2m, range 18-25m, 15 sites

Crown cover avg. = 53.5%, range 25.0-71.0%, 15 sites

Dominant species (relative cover, frequency): Corymbia citriodora subsp. variegata (65, 100%), Angophora leiocarpa (28, 27%), Eucalyptus crebra (25, 80%)

Frequent species (cover, frequency): Corymbia citriodora subsp. variegata (34, 100%), Eucalyptus crebra (14, 80%), Angophora leiocarpa (16, 27%), Eucalyptus tereticornis (3, 20%), Corymbia tessellaris (13%), Eucalyptus moluccana (16, 13%), Eucalyptus siderophloia (9, 13%), Allocasuarina torulosa (7%), Alphitonia excelsa (7%), Alstonia constricta (7%), Brachychiton populneus (7%), Eucalyptus melanophloia (3, 7%)

Stratum: **T2**

Height avg. = 12.9m, range 9-17m, 14 sites

Crown cover avg. = 19.9%, range 2.0-40.0%, 14 sites

Dominant species (relative cover, frequency): Corymbia citriodora subsp. variegata (42, 73%), Eucalyptus crebra (36, 67%), Angophora leiocarpa (18, 27%)

Frequent species (cover, frequency): Corymbia citriodora subsp. variegata (10, 73%), Eucalyptus crebra (6, 67%), Angophora leiocarpa (3, 27%), Alphitonia excelsa (1, 20%), Acacia disparrima subsp. disparrima (14, 13%), Corymbia intermedia (4, 13%), Corymbia tessellaris (4, 13%), Eucalyptus major (7, 13%), Lophostemon confertus (14, 13%), Acacia maidenii (7%), Allocasuarina torulosa (7%), Eucalyptus melanophloia (4, 7%), Eucalyptus moluccana (4, 7%), Eucalyptus siderophloia (2, 7%), Eucalyptus tereticornis (3, 7%), Notelaea longifolia (7%)

Stratum: **T3**

Height avg. = 7.2m, range 5-10m, 6 sites

Crown cover avg. = 13.0%, range 8.0-20.0%, 6 sites

Dominant species (relative cover, frequency): Eucalyptus crebra (57, 27%), Corymbia citriodora subsp. variegata (34, 33%)

Frequent species (cover, frequency): Corymbia citriodora subsp. variegata (6, 33%), Eucalyptus crebra (5, 27%), Angophora leiocarpa (3, 13%), Acacia glaucocarpa (8, 7%), Allocasuarina luehmannii (13, 7%), Alphitonia excelsa (7%), Celastrus subspicata (7%), Corymbia tessellaris (1, 7%), Eucalyptus major (7, 7%)

Stratum: **S1**

Height avg. = 2.5m, range 1.5-5m, 15 sites

Crown cover avg. = 21.6%, range 2.0-50.0%, 15 sites

Dominant species (relative cover, frequency): Acacia disparrima subsp. disparrima (48, 40%), Alphitonia excelsa (24, 53%), Acacia leiocalyx (20, 40%), Eucalyptus crebra (16, 27%), Lantana camara (12, 40%)*

Frequent species (cover, frequency): Alphitonia excelsa (4, 53%), Corymbia citriodora subsp. variegata (1, 47%), Acacia disparrima subsp. disparrima (7, 40%), Acacia leiocalyx (4, 40%), Lantana camara (4, 40%), Eucalyptus crebra (2, 27%), Jacksonia scoparia (1, 27%), Alstonia constricta (4, 20%), Angophora leiocarpa (1, 20%), Acacia falcata (9, 13%), Acacia fimbriata (15, 13%), Acacia glaucocarpa (4, 13%), Acacia maidenii (2, 13%), Choretrum candollei (13%), Corymbia tessellaris (13%), Eremophila debilis (13%), Maytenus cunninghamii (13%), Myoporum montanum (1, 13%), Pittosporum angustifolium (1, 13%), Acacia amblygona (8, 7%), Acacia concurrens (7%), Acacia decora (7%), Acacia implexa (7%), Acacia irrorata (8, 7%), Acacia loroloba (1, 7%), Acacia neriifolia (7%), Alectryon diversifolius (5, 7%), Allocasuarina littoralis (18, 7%), Allocasuarina torulosa (2, 7%), Astrotricha latifolia (5, 7%), Brachychiton populneus (1, 7%), Brachychiton rupestris (7, 7%), Breynia oblongifolia (2, 7%), Citrus australis (5, 7%), Corymbia intermedia (7%), Cupaniopsis parvifolia (7%), Daviesia ulicifolia (7%), Eucalyptus major (2, 7%), Eucalyptus moluccana (4, 7%), Eucalyptus tereticornis (7%), Flindersia australis (7%), Gomphocarpus physocarpus* (7%), Hovea lorata (2, 7%), Indigofera australis (8, 7%), Lophostemon confertus (20, 7%), Persoonia sericea (7%), Psydrax odorata (4, 7%), Psydrax odorata forma buxifolia (7%), Pultenaea euchila (2, 7%), Solanum ellipticum (7%), Solanum seaforthianum* (7%), Swainsona galegifolia (7%), Wikstroemia indica (7%), Xanthorrhoea johnsonii (8, 7%)*

Stratum: **G**

Height avg. = 0.6m, range 0.15-1m, 15 sites

PFC avg. = 47.2%, range 10-90%, 15 sites

Dominant species (relative cover, frequency): Entolasia stricta (33, 27%), Cymbopogon refractus (28, 67%), Themeda triandra (24, 67%), Eremochloa bimaculata (20, 33%), Imperata cylindrica (17, 27%)

Frequent species (cover, frequency): GRAMINOIDS: Cymbopogon refractus (14, 67%), Themeda triandra (14, 67%), Panicum effusum (1, 60%), Heteropogon contortus (8, 47%), Aristida vagans (1, 40%), Eragrostis brownii (33%), Eremochloa bimaculata (5, 33%), Entolasia stricta (9, 27%), Imperata cylindrica (6, 27%), Cyperus gracilis (20%), Eragrostis spartinoides (2, 20%), Bothriochloa decipiens (1, 13%), Capillipedium spicigerum (13%), Chloris divaricata (20, 13%), Digitaria breviglumis (2, 13%), Gahnia aspera (1, 13%), Melinis repens (5, 13%), Scleria mackaviensis (13%), Aristida calycina (36, 7%), Aristida gracilipes (16, 7%), Aristida indet. (7%), Aristida personata (4, 7%), Aristida queenslandica var. queenslandica (7%), Bothriochloa bladhii (7%), Cleistochloa rigida (7%), Cyperus aggregatus* (7%), Dichanthium sericeum (7%), Digitaria didactyla* (7%), Digitaria parviflora (7%), Eriachne glabrata (7%), Fimbristylis dichotoma (7%), Lepidosperma laterale (2, 7%), Megathyrsus maximus var. pubiglumis* (1, 7%), Oplismenus aemulus (7%), Panicum decompositum (5, 7%), Paspalidium caespitosum (7%), Paspalidium distans (7%), Sarga leiocladum (7%), Scleria sphacelata (7%), Sporobolus elongatus (1, 7%), Urochloa foliosa (1, 7%)*
FORBS: Cyanthillium cinereum (47%), Dianella revoluta (1, 47%), Eustrephus latifolius (47%), Lantana camara (5, 40%), Glycine tabacina (33%), Peripleura hispidula var. hispidula (33%), Desmodium rhytidophyllum (27%), Eremophila debilis (27%), Lantana montevidensis* (3, 27%), Brunoniella australis (20%), Chrysocephalum apiculatum (20%), Galactia tenuiflora (20%), Hardenbergia violacea (20%), Opuntia stricta* (20%), Sida hackettiana (3, 20%), Achyranthes aspera (2, 13%), Bidens pilosa* (13%), Desmodium gunnii (13%), Dianella caerulea (13%), Dianella indet. (13%), Gomphocarpus physocarpus* (13%), Laxmannia gracilis (13%), Lobelia purpurascens (13%), Lomandra longifolia (1, 13%), Lomandra multiflora (1, 13%), Mentha diemenica (1, 13%), Opuntia tomentosa* (13%), Passiflora subpeltata* (15, 13%), Abutilon oxycarpum forma oxycarpum (7%), Acacia leiocalyx (1, 7%), Alphitonia excelsa (7%), Alstonia constricta (1, 7%), Asparagus africanus* (7%), Breynia oblongifolia (2, 7%), Brunonia australis (7%), Cassytha pubescens (7%), Cheilanthes sieberi (7%), Cheilanthes tenuifolia (7%), Clematicissus opaca (7%), Conyza bonariensis* (7%), Crotalaria montana (7%), Cynanchum bowmanii (1, 7%), Desmodium brachypodum (7%), Desmodium uncinatum* (7%), Desmodium varians (7%), Dianella brevipedunculata (1, 7%), Dianella caerulea var. vannata (7%), Einadia hastata (7%), Glycine indet. (7%), Goodenia hederacea (1, 7%), Goodenia rotundifolia (7%), Grewia latifolia (1, 7%), Gymnostachys anceps (7%), Hibiscus sturtii (1, 7%), Hovea acutifolia (7%), Jasminum didymum (7%), Jasminum didymum subsp. lineare (7%), Jasminum suavissimum (1, 7%), Leucopogon juniperinus (7%), Lissanthe strigosa (2, 7%), Lomandra confertifolia subsp. pallida (25, 7%), Lomandra filiformis (7%), Monotoca scoparia (7%), Myoporum montanum (7%), Opuntia indet. (7%), Ozothamnus diosmifolius (7%), Passiflora suberosa* (7%), Picris angustifolia subsp. carolorum-henricorum (7%), Plectranthus parviflorus (7%), Podolepis neglecta (7%), Pomax umbellata (7%), Pterocaulon redolens (7%), Pycnosorus chrysanthes (7%), Rhodanthe anthemoides (7%), Secamone elliptica (1, 7%), Sida cordifolia* (7%), Sida rhombifolia* (7%), Solanum nemophilum (1, 7%), Solanum stelligerum (7%), Stephania japonica (7%), Velleia paradoxa (7%), Velleia spathulata (7%), Wahlenbergia gracilis (7%), Wedelia spilanthoides (7%)*

APPENDIX 2

BioCondition Assessment Manual

Department of Science, Information Technology, Innovation and the Arts

BioCondition

A Condition Assessment Framework for Terrestrial Biodiversity in Queensland

Assessment Manual

Queensland Herbarium, Science Delivery

Version 2.2

February, 2015



Great state. Great opportunity.

Queensland Government

Prepared by

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J.
Queensland Herbarium
Science Delivery Division
Department of Science, Information Technology, Innovation and the Arts
PO Box 5078
Brisbane QLD 4001

© The State of Queensland (Department of Science, Information Technology, Innovation and the Arts) 2015

The Queensland Government supports and encourages the dissemination and exchange of its information. The copyright in this publication is licensed under a Creative Commons Attribution 3.0 Australia (CC BY) licence



Under this licence you are free, without having to seek permission from DSITIA, to use this publication in accordance with the licence terms.

You must keep intact the copyright notice and attribute the State of Queensland, Department of Science, Information Technology, Innovation and the Arts as the source of the publication.

For more information on this licence visit http://creativecommons.org/licenses/by/3.0/au/deed.en

Disclaimer

This document has been prepared with all due diligence and care, based on the best available information at the time of publication. The department holds no responsibility for any errors or omissions within this document. Any decisions made by other parties based on this document are solely the responsibility of those parties. Information contained in this document is from a number of sources and, as such, does not necessarily represent government or departmental policy.

If you need to access this document in a language other than English, please call the Translating and Interpreting Service (TIS National) on 131 450 and ask them to telephone Library Services on +61 7 3170 5725

Citation

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane.

Acknowledgements

This report has been prepared by the Department of Science, Information Technology, Innovation and the Arts (DSITIA). The development, testing and improvement of the BioCondition framework has been greatly enhanced through contributions by James Thiessen, Jeni Ward, Tony Bean, Don Butler, Kerstin Jones, Sandy Pollock, John Thompson, Rob Hassett, Juliana McCosker, Rosalie Buck, Jian Wang, Melanie Venz, David Akers, Jeanette Kemp, Andrew Burrows, Michael Mathieson, Gordon Guymer, Peter Young, Peter Taylor, and Steven Howell. Special thanks to Alex Kutt, Mick Quirk and Rodd Dyer (Meat & Livestock Australia), Greg Ford, and Chani Little for feedback and insights on the practical application of BioCondition assessment in different ecosystems and landscapes to those targeted by our research. Early development of BioCondition could not have proceeded without the generously provided insights of Sama Low Choy and Ben Stewart-Koster (Queensland University of Technology), David Parkes, Graeme Newell, Phil Gibbons, Sue Briggs, and Ian Oliver. We also thank Col Paton, Giselle Whish and Jane Hamilton for their grazing land condition expertise and for their contributions towards testing and refining the methods. Thanks to Jodi Rees, Jane Wickers and Kylie Goodall for their contributions at the very beginning.

February, 2015

Contents

Introduction 1
1.1 Drivers and Constraints 3
1.2 Version control 4
2 The assessment: getting started 5
2.1 Define the objective of the assessment 5
2.2 Resources required 5
2.3 Benchmarks 6
3 The assessment unit and site selection 7
3.1 Delineation of the assessment unit 7
3.2 Number and location of sites 8
3.3 When to assess 9
3.4 Setting up the assessment site 10
4 The assessable attributes and scores 12
4.1 The assessable attributes 13
4.2 Assessing regional ecosystems with naturally missing attributes 14
5 Assessment of site-based attributes 16
5.1 100 x 50 m plot 16
5.1.1 Large trees 16
5.1.2 Tree canopy height 17
5.1.3 Recruitment of dominant canopy species 18
5.1.4 Native tree species richness 18
5.2 100 m transect 19
5.2.1 Tree canopy cover 19
5.2.2 Shrub cover 21
5.3 50 x 20 m plot 21
5.3.1 Coarse woody debris 21
5.4 50 x 10 m plot 22
5.4.1 Native plant species richness 22
5.4.2 Non-native plant cover 22
5.5 1 x 1 m quadrats 23
5.5.1 Native perennial grass cover 23
5.5.2 Organic litter 25

6 Assessment of landscape-scale attributes 26

6.1 Fragmented landscapes 27

6.1.1 Size of patch 27

6.1.2 Connectivity 30

6.1.3 Context 31

6.2 Intact landscapes 32

6.2.1 Distance from permanent water 32

7 Calculating and classifying the BioCondition score 34

7.1 To obtain an overall BC score for an area 35

7.2 Categorising the BioCondition score to align with the ABCD framework 36

8 Glossary 39

9 References 42

10 Appendices 48

Appendix 1: Field assessment summary guide 49

Appendix 2: BioCondition field assessment sheet 53

Appendix 3: Resources/Contacts for further information 55

Appendix 4: Taking photos 59

Appendix 5: Measuring tree height 60

Appendix 6: Stratifying vegetation 63

Appendix 7: Life/growth forms used in BioCondition 71

Appendix 8: Life-form identification 73

Appendix 9: Aerial photograph area calculation guide 75

Appendix 10: A method to display BioCondition scores for attributes at a site 76

List of tables

Table 1: Examples of vegetation condition assessments within a matrix of increasing operational constraints and regulatory requirements 4

Table 2: Summary of the functional role of vegetation for biodiversity and indicators of those functions 13

Table 3: The assessable attributes and weightings for deriving the final BioCondition score 14

Table 4: The assessable attributes and weightings in ecosystems where attributes are naturally absent 15

Table 5: Description and scores for the number and habitat value of large trees 16

Table 6: Description and scores for tree canopy height 18

Table 7: Description and scores for the recruitment of canopy species 18

Table 8: Description and scores for tree canopy cover 19

Table 9: Description and scores for shrub cover 21

Table 10: Description and scores for number of CWD 21

Table 11: Description and scores for native plant species richness for each life form 22

Table 12: Description and scores for non-native plant cover 22

Table 13: Description and scores for native perennial grass species cover 23

Table 14: Description and scores for percentage of organic litter 25

Table 15: Description and scores for size of patch 28

Table 16: Description and scores for connectivity in the landscape. 30

Table 17: Description and scores for landscape context 32

Table 18: Description and scores for distance from permanent water. The description is relevant to the assessment site. 33

Table 19: Scoring and weighting of the site-based and landscape scale attributes 34

Table 20: Rules used to delineate the BioCondition '1234' classes 36

Table 21: Final classification of BioCondition scores into '1234' 36

Table 22. BioCondition scores relative to the maximum score for each attribute. 76

List of figures

Figure 1: Assignation of the assessment unit 9

Figure 2: BioCondition field site area and layout 11

Figure 3: Median height of the ecologically dominant Layer (EDL) 17

Figure 4: Example of assessing canopy cover percentage 20

Figure 5: Stylised examples of ground cover proportions. 24

Figure 6: Fragmented (yellow) and intact (green) regions of Queensland 27

Figure 7: Example of the delineation of the patch area. 29

Figure 8: Patch size of remnant vegetation (a) before, and (b) after segmentation of narrow (<200 m) linear landscape elements 29

Figure 9: Examples of landscape connectivity scores 31

Figure 10: Examples of landscape context scores 32

Figure 11: Example of '1234' condition states for Brigalow Belah RE 11.9.5 38

Figure 12: Taking a spot photo—try and keep the top of your feet out of the frame and angle the camera down as straight as possible 59

Figure 13: Taking landscape photos—record the bearing or direction of the photo in order to assist with replicate photos on subsequent visits. 60

Figure 14 BioCondition scores relative to the maximum score for each attribute 76

Introduction

The management of native vegetation to produce services such as food and fibre has meant that an estimated 62 per cent of Australia's native vegetation has been modified by agricultural and grazing enterprises (Thackway and Lesslie 2006). Knowledge of the extent of native vegetation by broad structural and floristic type is therefore considered integral for natural resource planning, management and environmental reporting. Consequently, vegetation mapping programs to describe structural and floristic type have been conducted across the majority of the states and territories of Australia.

Compared with vegetation *extent*, the assessment of vegetation *condition* is considerably less well documented in Queensland, and indeed most of Australia. It has only been relatively recently that policy demands and expectations have conceptualized vegetation condition as a major component of native vegetation management, primarily to assist decision making for developmental approvals, incentive payments and market-based investments (Keith and Gorrod 2006). Regional natural resource management groups are also interested in vegetation condition, given its listing as a national environmental indicator for reporting targets (MEWG 2004). At the property scale, land managers are increasingly becoming aware of the challenge to demonstrate duty of care (Bates 2001; Neldner 2006). A procedure to effectively assess vegetation condition is necessary to support these decision-making and reporting schemes, including the implementation of offsets and biobanking and comprehensive environmental accounts (Hawke 2009). The ability to assess and monitor vegetation condition is also essential for governments to administer legislation relating to the landscapes and biodiversity covered by their jurisdiction.

A simple, rapid assessment approach is highly desirable as compared with a time-consuming and complicated, if thorough, approach as it facilitates uptake of use by resource managers (Andreasen *et al.* 2001). Accordingly, a number of condition assessment tools have utilised key attributes or surrogates of biodiversity values that can be rapidly measured in the field (Gibbons and Freudenberger 2006). These include the 'Habitat Hectares' assessment framework in Victoria (Parkes *et al.* 2003) and 'BioMetric' in New South Wales (Gibbons *et al.* 2008).

Box 1: Definition of Biodiversity

Biodiversity is defined as:

'….the variety of life, its composition, structure and function, at a range of scales'
(Freudenberger and Harvey, 2003)

Composition:	the variation in species, populations and gene pools
Structure:	the physical variation of habitat and ecosystem components, such as tree, shrub and ground layers
Function:	"the way it all works together"; hard to see, but includes important processes such as carbon, nutrient and water cycling

BioCondition is a condition assessment framework for Queensland that provides a measure of how well a terrestrial ecosystem is functioning for biodiversity (Box 1) values. It is a site-based, quantitative and therefore repeatable assessment procedure that can be used in any vegetative

state, and provides a numeric score that can be summarised as a condition rating of 1, 2, 3 or 4, or functional through to dysfunctional condition for biodiversity. In BioCondition, ‘condition’ refers to the degree to which the attributes of a patch of vegetation differ from the attributes of the same vegetation in its reference state (Box 2).

Box 2: Definition of condition for biodiversity

Condition for biodiversity is defined as:

The similarity in key features of the regional ecosystem being assessed with those of the same regional ecosystem in its reference state.

The reference state refers to the natural variability in attributes of an ecosystem relatively unmodified since the time of European settlement, or the ‘best on offer’. Benchmarks for attributes are derived from this state.

In BioCondition, the reference state refers to the natural variability or range in attributes of an ecosystem that is relatively unmodified since European settlement, or ‘best on offer' (BOO). The reference approach has been criticized as being the construct of another Clementsian-based successional model (McCarthy *et al.* 2004), but this will depend on what state is used as the ‘desired’ state of condition for comparison (Gibbons and Freudenberger 2006). The BioMetric approach (Gibbons *et al.* 2008) aims to avoid this criticism by providing a range of values as the benchmark for vegetation communities, representing the natural alternative states that the community may display as a consequence of environmental variation or natural disturbance. In general, the ‘historical’ pristine natural state, with absence of post-European human disturbance is usually used as the reference state (e.g. Parkes *et al.* 2003). However, the use of sites in a ‘pristine’ state is unrealistic, given that impacts from post-European settlement management are widespread. Furthermore, it is extremely unlikely that a given patch of vegetation could be restored to historical states (Hobbs and Norton 1996; Oliver *et al.* 2002). Sites that have been least impacted by local threats should be of increased value for aspects of biodiversity, and thus constitute the best available benchmark representing the desired state (Landsberg and Crowley 2004).

The BioCondition method is designed for use by assessors who have a reasonable working knowledge of regional ecosystem (RE) mapping and vegetation assessment at the site scale. It provides a protocol for vegetation condition assessment at the patch, paddock or property scale. The BioCondition score does not provide an index of habitat *suitability* for fauna*,* as this will depend on many other factors that are not directly surrogates of condition, such as predator risk, and sheltering component of habitat such as rock cover and density of dead, hollow-bearing trees. Furthermore, we need to be cognisant that vegetation states other than the reference state may also be important for biodiversity in some situations.

Describing vegetation as ‘poor’ or ‘dysfunctional’ suggests that it is of little service to biodiversity, which is not always the case. For example, regrowth, thickened vegetation, and even swards of exotic grass all represent transitional vegetative states that provide some service to native fauna in the landscape, particularly within heavily modified landscapes (Bowen *et al*. 2007; Eyre *et al.* 2009a,b). Also, for some attributes, we still do not understand the complexities of their response to disturbance events (Eyre 2010). What constitutes a ‘natural state’ for benchmarking purposes for

some attributes remains questionable? For example, a dense or 'thickened' midstorey is often described as symptomatic of inappropriate land management, but it may be simply reflecting natural ecological dynamism (Fensham 2008). Whichever the case, patches of vegetation in the landscape with a dense midstorey are important refuge areas for diurnal birds (Maron and Kennedy 2007; Eyre *et al.* 2009a). Finally, BioCondition is not intended for use in regional planning or assessment of conservation significance, although outputs can contribute to this. The Biodiversity Planning Assessments (BPAs) have been prepared for these purposes and can be sourced from the Queensland Government website.

Box 3: Components of BioCondition

The primary components of BioCondition include:

1. the assessment unit
2. a suite of vegetation condition attributes that act as surrogates or indicators of biodiversity values
3. benchmarks for each of the attributes for each regional ecosystem
4. an assessment method
5. a scoring system that will provide a final 'condition' score.

1.1 Drivers and Constraints

In Australia, existing frameworks and procedures to assess vegetation condition for biodiversity differ in their approaches, and this is reflective of the various legislative, management and policy objectives, as well as the resources (such as time, expertise and budget) available to conduct the assessments. State-based condition assessment methodologies in Victoria (Habitat Hectares; Parkes *et al.* 2003) and New South Wales (BioMetric; Gibbons *et al.* 2005) have a legislative basis and are therefore more rigidly implemented and resourced relative to other available assessments. However, methods to assess resources for demonstration of sustainable use are usually less rigid in their implementation, and operator expertise is often less specialized (e.g. ABCD land condition assessment by landholders; Chilcott *et al.* 2003). Examples of existing condition assessment methodologies can be aligned relevant to the gradation between available resources and the rigor of the objectives required to conduct the assessments in a broad matrix (Table 1). The most challenging assessment frameworks to develop sit within the compartment of the matrix corresponding with high operational constraints and low regulatory rigor. In this compartment, the conduct of any assessment must provide as reliable an estimate of condition for as little effort as possible, given it is reliant on the self-motivation of a landholder without any financial or technical assistance.

Table 1: Examples of vegetation condition assessments within a matrix of increasing operational constraints and regulatory requirements

		Management or policy objectives		
		Sustainable use	**Protection**	**Regulation**
Operational constraints	**High**	**Self-motivated landholder assessment** e.g. Stocktake (Aisthorpe and Paton 2004) for assessing ABCD land condition (Chilcott *et al*. 2003)	**Incentive programs** e.g. Queensland Government Nature Assist for the establishment of Nature Refuges	**Regulatory-motivated landholder assessment**
	Medium	**Site-based monitoring** e.g. Landscape Function Analysis (Tongway and Hindley 2005)	**Incentive programs employing market-based instruments** e.g Habitat Hectares (Parkes *et al*. 2003) for BushTender auctions (Vic)	**Development applications** e.g. BioMetric (Gibbons *et al*. 2008) for clearing native vegetation (NSW); offsetting
	Low	**Regional long-term monitoring programs** e.g. TRAPS grazed woodland dynamics monitoring (Back *et al.* 1997); NFPP productive forest monitoring (QDPI 1995)	**Formal reservation** e.g. Biodiversity and habitat assessments (Eyre *et al.* 1998) for the South East Queensland Regional Forest Agreement	**Environmental impact assessment** e.g. for assessing impact of mining or petroleum activities under the *Environmental Protection Act 1994*

1.2 Version control

This version (Version 2.2) differs only slightly from the previous version (Version 2.1), including;

- Reformatting into the current Queensland Government template
- Removal and amendment of superfluous webpage links.
- References to retracted or changed Queensland Government policies and strategies have been removed or updated.

NOTE: There is no methodological change between V 2.1 and V 2.2.

2 The assessment: getting started

2.1 Define the objective of the assessment

For any assessment or monitoring program, the development and clear articulation of the objective for the assessment is a critical first step. The objective will clarify if a rapid condition assessment such as BioCondition is the appropriate method to use. The objective will also determine the spatial and temporal scale of the assessment required (i.e. how many assessment sites through space and time are required). It will determine how the assessment unit should best be delineated or if extra attributes may be needed. For example, if the objective is to assess the condition of a grazing paddock for biodiversity, then assessment units would be delineated for remnant and non-remnant vegetation in that paddock, but if the objective was to assess the condition of the remnant vegetation for biodiversity across a property, then the assessment units would be delineated based on remnant vegetation only. Having clear objectives will provide a foundation for assessing the value of the assessment program (Field *et al*. 2007).

2.2 Resources required

Prior to visiting an area to assess vegetation condition using BioCondition, it will be important to collate existing biodiversity and spatial (mapping) information relating to the area. Queensland Government spatial datasets can be downloaded from the Queensland Government's QSpatial website. Digital regional ecosystem mapping (showing remnant vegetation) will be desirable, as will any orthorectified digital imagery or aerial photographs.

Regrowth vegetation, as well as remnant vegetation, is assessable for BioCondition, and therefore mapping showing areas of regrowth will also be required. Regrowth mapping can be downloaded from the QSpatial website as *Vegetation Management Act former high value regrowth vegetation version 2.1*. This dataset maps areas of non-remnant woody vegetation that were used for vegetation management purposes before December 2013. The mapping was derived from the Queensland Government's Remote Sensing Centre 2006 Foliage Projective Cover (FPC) mapping and 1989 to 2007 'Woody Change' product mapping. Mapping and imagery should encompass the entire area to be assessed, including a buffer of at least 2 km.

The following equipment is desirable for completing a BioCondition assessment:

- 100 m transect tape
- 50 m transect tape (optional)
- 1 x 1 m quadrat for measuring ground cover (or some 1 m long sticks)
- compass (to lay out the site)
- star pickets for the 0 m and 50 m point along the transect for relocating the site
- diameter tape or a smaller measuring tape
- this manual (or a copy of Appendix 1) and copies of the BioCondition assessment datasheet (Appendix 2)

- access to the Internet in order to obtain information about the REs that occurs on the property or management area; RE maps (remnant, regrowth and pre-clear) and RE descriptions can also be obtained from the QSpatial website. With descriptions of REs available on the Queensland Government Website (http://www.qld.gov.au/).
- benchmark documents for each of the REs that will be assessed. (Available on the Queensland Government Website (http://www.qld.gov.au/).
- clinometer, hypsometer or ruler for measuring tree heights
- digital or print film camera
- clipboard, pencils and erasers
- flagging tape (not essential)
- plant identification books (not essential)
- Global Positioning System (GPS).

See Appendix 3 for further information on resources.

2.3 Benchmarks

Benchmarks are quantitative values derived from reference sites for each site condition attribute assessed in BioCondition, and are used as a reference value for comparison purposes. They are specific to each RE, and are based on the average or median value from reference or BOO sites. The aim of the benchmarks is to discriminate condition states between assessable sites. Benchmarks have now been developed for a number of REs in Southeast Queensland, New England Tablelands, Brigalow Belt, Mulga Lands, Northwest Highlands, Mitchell Grass Downs, Channel Country and Desert Uplands bioregions, and are currently available on the Queensland Government Website (http://www.qld.gov.au/).

The benchmark documents can be subject to periodic review and will be updated with addition of further reference site data. While every effort has been made to ensure that the information presented in the benchmarks is as reliable as possible, the State of Queensland accepts no liability and gives no assurance in respect of their accuracy and shall not be liable for any loss or damage arising from their use. Benchmarks are based on a combination of quantitative and qualitative information. The benchmarks have been generated from existing standardised floristic and habitat data collected from reference sites, and/or elicited from experts with knowledge on REs. Since there are data gaps for many REs and/or attributes within REs, expert elicitation is essential for the setting of appropriate benchmarks. A method to elicit expert knowledge specifically for the validation and/or development of benchmarks has been designed and tested specifically for BioCondition (Low Choy *et al.* 2009).

The natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes throughout the geographic extent of the RE has tried to be considered during benchmark development. The establishment and assessment of local reference sites may be required to account for this spatial and temporal (seasonal and annual) variability. Assessment of local reference sites will also be required in cases where benchmarks are not yet available for REs, or an assessment needs to be conducted during less than optimal conditions. Quantitative benchmark data can then be generated by locating and setting up a local BOO reference site. Reference site assessment does require reasonable botanical and habitat assessment experience

and skills, and entails detailed measurement and recording of vegetation floristics and structure. A reference site assessment protocol (Eyre *et al.* 2011) is available from the Queensland Government website.

3 The assessment unit and site selection

3.1 Delineation of the assessment unit

As for any assessment relying on a limited number of field sites, the location of these sites is very important for the overall adequacy of the assessment. The delineation of assessment units and the number of sites to assess will depend upon the overall objective of the assessment. Units of assessment are used to determine where and how many sites are needed to adequately assess the condition of the property or area of interest. Assessment units are relatively homogenous units defined by a unique RE and broad condition state (i.e. 'remnant' versus 'regrowth' versus 'non-remnant'). Non-remnant vegetation includes any vegetation that has not been otherwise mapped as remnant or regrowth vegetation by the Queensland Government. The non-remnant vegetation can be further delineated into two separate assessment units if required (e.g. for offsets), i.e. 'young woody regrowth' and 'non-remnant vegetation'. Although not currently mapped, this delineation can be obtained by using the woody cover mapping of SLATS and the pre-clearing RE mapping in areas that are not already mapped as remnant vegetation or high-value regrowth. Definitions of the broad condition states that can be used to delineate assessment units are given in Box 4.

Depending upon the objective of the assessment, there may be a requirement to assess all vegetation, or just components. Assessment units do not need to be continuous tracts, and can occupy two or more discrete areas, but should be larger than 1 ha in area (100 x 100 m) (see Figure 1). Assessments being conducted within discrete management areas, e.g. a cattle grazing property, can also use management units such as paddocks to delineate the assessment units. Ideally, to assess the condition of an area the aim would be to locate sites within each assessment unit, based on each broad condition state and RE. However, the purpose of the assessment and resources available to conduct an assessment of an area will ultimately influence the size and number of units to assess. For example, the purpose of an assessment may be to assist with prioritising ameliorative management practices within remnant and regrowth Endangered REs. Delineation of assessment units would then be restricted to remnant and regrowth Endangered REs, and exclude non-remnant vegetation.

It is best to generate a map of the area to be assessed showing the extent and types of remnant vegetation, the distribution of any mapped regrowth vegetation, the distribution of pre-cleared vegetation (if required), the position of roads, watering points and the location of fence lines so that assessment units can be mapped and area statements derived. This map can then be used in advance of conducting field assessments, to plan the locations of the assessment sites. Free RE maps and regrowth maps are available as downloadable hard copy maps for properties and as digital data from the Regional Ecosystems area of EHP's website www.ehp.qld.gov.au and Queensland government data website (https://data.qld.gov.au/). RE mapping is also available using the Biota Globe in the Queensland Globe using Google Earth (www.dnrm .qld.gov.au/). The hard copy maps and digital data can be used to produce a map specific for the area. The applicability of the RE mapping should be assessed in the field to check if it is relevant at the scale at which the assessment is being conducted. REs are defined at scales which range from 1:50 000

(e.g. South East Queensland) to 1:100 000 (e.g. rangeland bioregions) and a single polygon may contain several mapped REs (heterogeneous polygons).

Box 4: Definition of remnant vegetation and regrowth vegetation for delineating assessment units

Remnant vegetation is defined under the *Vegetation Management Act 1999* as vegetation shown on a regional ecosystem or remnant map.

Where there are no maps available, remnant vegetation is defined as vegetation where the dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and dominated by species characteristic of the vegetation's undisturbed canopy.

In grassland ecosystems, remnant status is assigned to grasslands that;

a) Have not been ploughed in the last 15 years (generally detectable on Landsat imagery) and;
b) Contain >20% of the native species normally found in the ecosystem under the same ecological and seasonal conditions (as defined in benchmark documents or REDD) and;
c) Have a high ratio of native species to exotic species (>5:1).

***High-value regrowth vegetation* is defined under the *Vegetation Management Act 1999* as vegetation;**

a) Located in areas that has not been cleared since 31 December 1989 and that is an endangered, of concern or a least concern regional ecosystem.
b) Under the Act, the definition applies to vegetation located on a lease issued under the Land Act 1994 for agriculture or grazing purposes (i.e., not freehold land). However, for the purposes of delineating assessment units for BioCondition, then the above definition can be used.

***Non-remnant vegetation* is defined as all vegetation that is not mapped as remnant vegetation or regrowth vegetation, as defined above.**

Non-remnant vegetation can be further delineated to include;

a) young woody regrowth, defined as woody vegetation of any endangered, of concern or least concern regional ecosystem that has been cleared since 31 December 1989. This can be mapped using SLATS woody cover and assigned to the most likely regional ecosystem by referring to the pre-clearing regional ecosystem mapping.
b) significantly modified vegetation that fails to meet the structural and/or floristic characteristics of remnant vegetation, and is not mapped as regrowth or cannot be mapped as young woody regrowth. It also includes urban and cropping land, and modified grasslands that do not match the criteria for remnant status.

3.2 Number and location of sites

As a guide it is best to aim for two to five sites per assessment unit, dependant on the area of each unit (i.e. assessment unit <60 ha, aim for at least two sites, assessment unit >500 ha, aim for five sites). Select a site location that is representative of the unit you are assessing, and at least 50 m from any major disturbance, such as a road or a dam. Also aim to locate sites at least 1 km apart. This is particularly important if it is intended to survey fauna at the sites, to ensure independence of the data between sites assessed (Eyre *et al.* 1998).

3.3 When to assess

It is not favourable to sample during the peak of summer or following a period of drought due to a reduction in plant diversity. The best time for assessment is at the end of the summer rainfall growing season, when plant diversity is greatest. For the majority of Queensland, this is often from late March to late May, but is dependent on local seasonal conditions. As a general rule of thumb, site assessment north of the Tropic of Capricorn should generally be conducted after the wet season, ideally between March and May, to ensure adequate sampling of ground cover species (Neldner *et al*. 2004). South of the Tropic of Capricorn, site assessment should be generally conducted in May or June following the wetter summer months. An exception would be sampling in spring following an unseasonably wet winter, when many plant species are flowering.

It is not always possible to assess condition during optimal times, particularly in areas experiencing long-term drought. In these cases, it is recommended that a “local” reference site/s within the RE of interest and representing the desirable condition state (i.e. mature and relatively undisturbed or a BOO site) is located and used to generate interim benchmarks with which the BioCondition assessment site can be compared. The reference site/s should be measured at the same time as the BioCondition sites to account for variation due to seasonal or drought effects, particularly in the attributes i) species richness; ii) tree canopy cover; and iii) perennial grass cover.

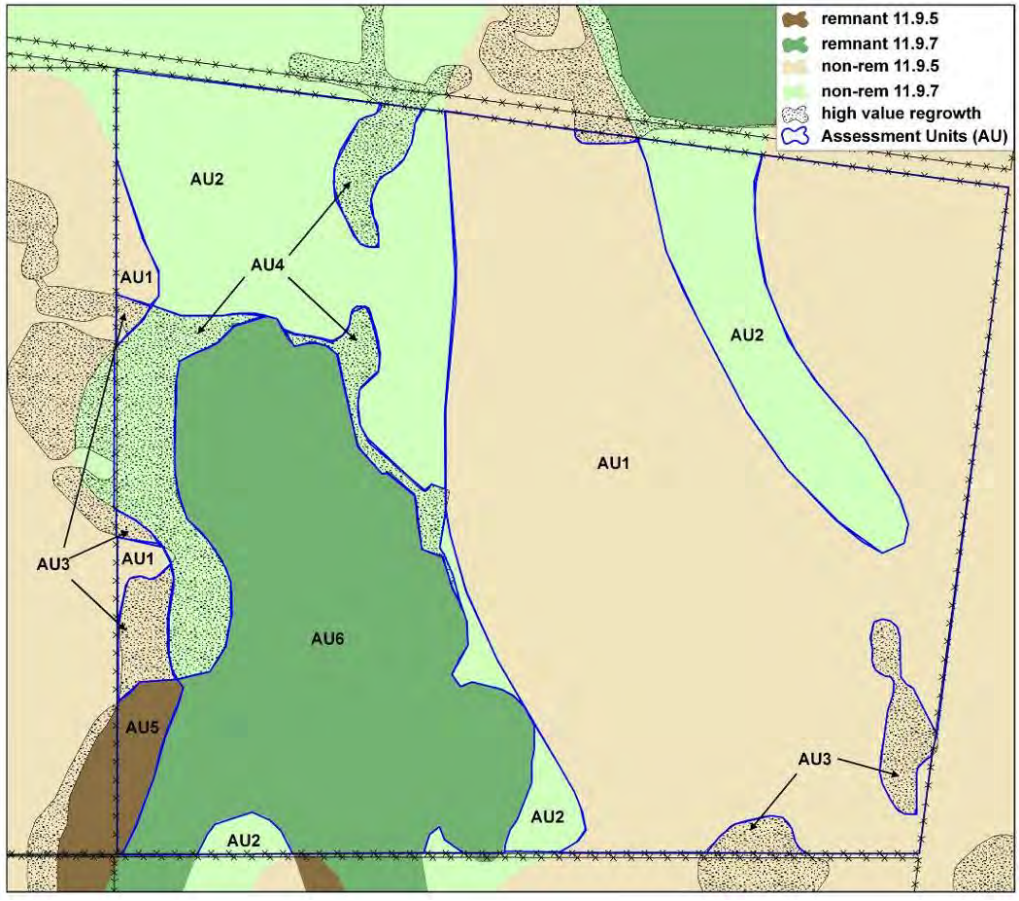


Figure 1: Assignation of the assessment unit

In this example (Figure 1), six assessment units (AU) have been identified for a paddock. AU1 represents an assessment unit delineated by a non-remnant area of brigalow and belah scrub 11.9.5 (mapped using the pre-cleared RE mapping); AU2 is non-remnant poplar box woodland 11.9.7; AU3 is regrowth RE 11.9.5 or; AU4 is regrowth RE 11.9.7; AU5 is remnant RE 11.9.5; and AU6 is remnant RE 11.9.7.

3.4 Setting up the assessment site

Details of the site assessment are presented here. A quick field guide is provided in Appendix 1. The assessment site constitutes a 100 m x 50 m (0.5 ha) area, within which 10 site-based attributes are measured. This correlates to the habitat and BioCondition reference site assessment area used to identify benchmarks for attributes (Eyre *et al.* 2011).

The site should be marked out by laying out a 100 m centre-line transect that follows the contour, i.e. along a slope as opposed to up or down a slope. Mark the 50 m point on the transect with a star picket or tyre on the ground[1]— this point acts as the centre of the assessment site. For REs characterised by a tree layer, marking out 25 m either side of the transect line forms the larger assessment area of 100 x 50 m. A greater need arises for precision when assessing the numbers of large trees within the site (it may require measuring out the distance when trees appear to be 'borderline' within the site). The assessment of the ten site-based attributes is conducted within five assessment areas within the 100 x 50 m site, as shown in Figure 2, and summarised as follows:

1. 100 x 50 m area: assessed for number of large trees, recruitment of canopy species, tree canopy height and native tree species richness. In long, linear assessment units (e.g. riparian areas), it may be necessary to adjust the configuration of the 100 x 50 m plot area so that these attributes are adequately sampled. In these cases, it is recommended that the plot area remains the same, if possible e.g. extend the length of the plot to 200 m, but reduce the width of the plot to 25 m.
2. 100 m transect: assessment of tree canopy cover and native shrub canopy cover.
3. 50 x 10 m sub-plot, centred from the 25 m point to the 75 m point along the centre transect, and encompassing 5 m either side of the transect: assessed for non-native plant cover and native plant species richness of shrubs, grass and non-grass species. This equates to the CORVEG standard plot area used by the Queensland Herbarium (Neldner et al. 2012).
4. 50 x 20 m sub-plot, centred from the 25 m point to the 75 m point along the transect, and encompassing 10 m either side of the transect: assessed for coarse woody debris.
5. Five 1 x 1m quadrats, starting at the 35 m point and located on alternate sides of the centre-line, 10 m apart along the 100 m transect: assessed for native grass cover and organic litter (an average value is derived over the five quadrats).

Photographs are recommended to be taken each time a BioCondition assessment is undertaken (Appendix 4). Spot photos of the 1 x 1 m quadrats can be taken to document change in ground cover over time, while a landscape or series of landscape photos provides a record of the tree and shrub layers and the general condition of the site. At the centre point of the transect it is useful to take four photos north, south, east and west of the 50 m plot centre.

[1] In more open areas, where there are cattle present, tyres can be preferential due to the tendency of cattle to use star pickets as scratching posts leading to concentrated disturbance around the posts.

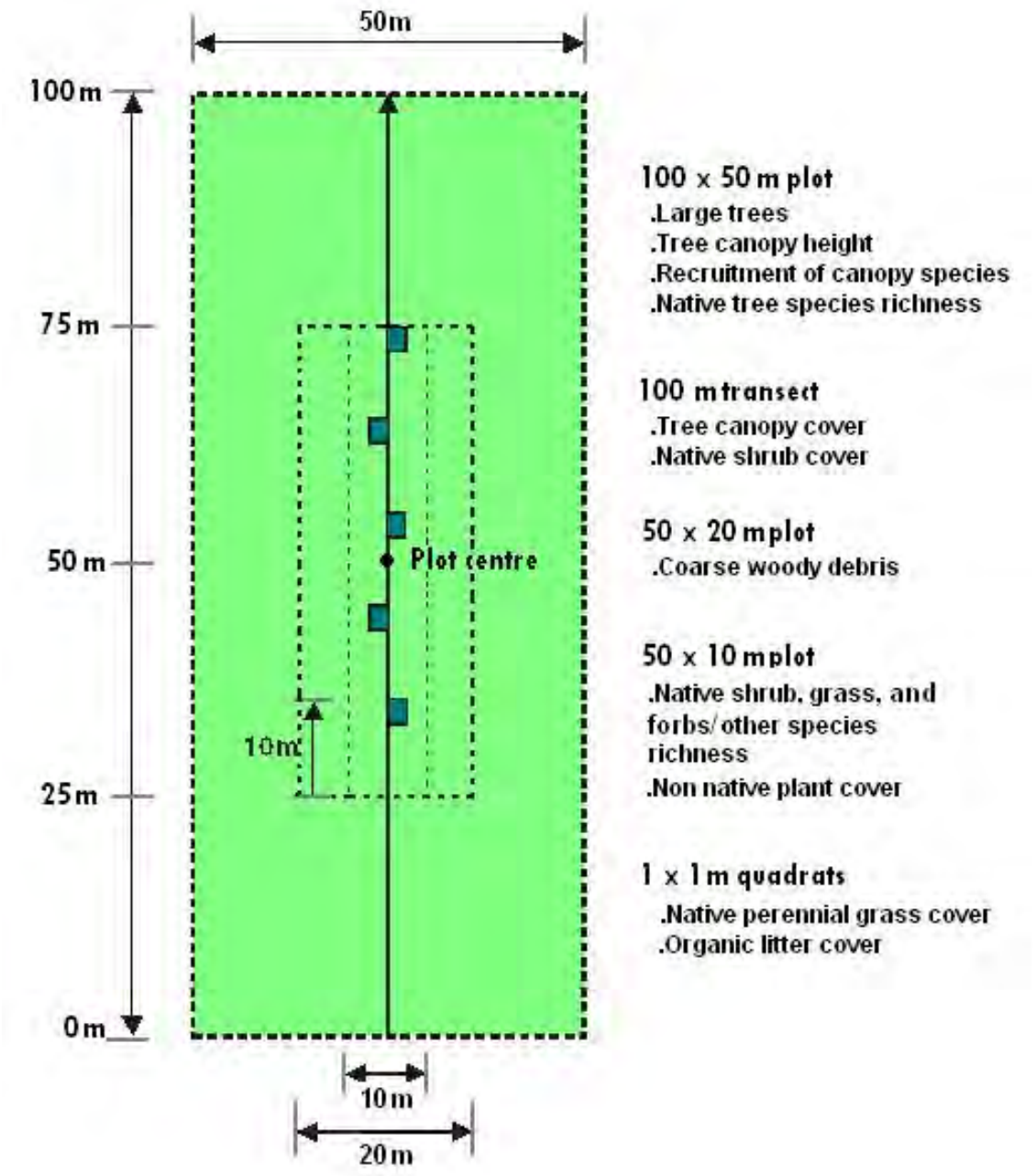


Figure 2: BioCondition field site area and layout

4 The assessable attributes and scores

A full species survey or census to quantify the biodiversity values of a patch of vegetation is expensive to conduct and requires high levels of technical expertise. As such, use of indicators of biodiversity, or measurable surrogates of biodiversity, is a relatively reliable and cost effective approach to assess or monitor biodiversity (Noss 1990, Sarkar and Margules 2002, McElhinny *et al.* 2005). At the site scale, biodiversity indicators are either based on key or 'indicator' species or structural aspects of the vegetation that are known to be important for biodiversity values (Lindenmayer *et al.* 2000; Parkes *et al.* 2003; McElhinny *et al.* 2005).

The approach using key indicator species is limited because relationships between species and biodiversity are yet to be established (Lindenmayer and Cunningham 1997; Margules *et al.* 2002), as well as other inherent issues with survey conditions and how these can influence detectability of species (e.g. Wayne *et al.* 2005). Experience and skills in species detection and identification can also limit efficacy of direct assessment of species. However, indicators based on key vegetative structural elements are proving to be a more reliable and cost effective approach for the assessment of biodiversity, and form the basis of assessment of vegetation condition elsewhere in Australia (Parkes *et al.* 2003; Oliver and Parkes 2003; Gibbons *et al.* 2008).

The suite of assessable attributes in BioCondition was selected based on:

- known or perceived surrogacy for biodiversity values and representation of ecological processes relative to composition, structure and function (Table 2)
- ease of measurability in field situations
- known or perceived sensitivity to change
- lack of correlation between each other
- ability to allow discrimination between sites
- value in educating or instructing on biodiversity values.





The dwarf grey skink (*Menetia greyii*) (left) and Burnett's skink (*Carlia foliorum*) both need woody debris and organic litter as habitat.

Table 2: Summary of the functional role of vegetation for biodiversity and indicators of those functions

Vegetation functions	Attributes that act as indicators of the functions
Structural aspects	
Provision of reliable foraging resources for wildlife (e.g. nectar, leaves, seeds)	Large trees Shrub cover Tree canopy cover Native perennial grass Coarse woody debris Organic leaf litter Ground cover
Provision of reliable sheltering resources and or breeding sites for wildlife	Large trees and/or hollow-bearing trees Coarse woody debris Tree canopy cover Shrub cover Organic litter Perennial grass cover
Functional aspects	
Nutrient and water cycling	Tree canopy cover Organic litter cover Coarse woody debris
Maintenance of soil condition	Organic litter cover Native perennial ‘decreaser’ grass species basal area Native perennial non-grass cover Coarse woody debris
Retention of plant propagules	Organic litter Coarse woody debris
Compositional aspects	
Maintenance of plant species diversity	Native plant species richness Recruitment of canopy species Native perennial ‘decreaser’ grass species basal area Non-native plant species cover (lack of)

4.1 The assessable attributes

In BioCondition, attributes are weighted to standardise relative ‘importance’, meaning the degree to which the attribute:

- has a potential impact upon long-term condition (e.g. non-native plants)
- is difficult or takes a long time to replace in a system if lost (e.g. large trees)
- has habitat value based on empirical research.

The attributes of biodiversity that are assessable in BioCondition, and their relative weightings that contribute to the overall condition score, are shown in Table 3.

Attributes collected for the BioCondition assessment represents the minimum that should be collected to make a robust condition assessment. In BioCondition, the assessor will need to distinguish between dominant plant species, although it is not required that they identify what those species are, although they will need to be able to distinguish between native and non-native species[2]. If sufficient expertise exists, assessors are encouraged to collect more comprehensive data, e.g. identify and list species present in each layer as a way of value adding to the information collected at each site.

Table 3: The assessable attributes and weightings for deriving the final BioCondition score

	Attribute	Weighting (%)
Site-based condition attributes	Large trees	15
	Tree canopy height	5
	Recruitment of canopy species	5
	Tree canopy cover (%)	5
	Shrub layer cover (%)	5
	Coarse woody debris	5
	Native plant species richness for four lifeforms	20
	Non-native plant cover	10
	Native perennial grass cover (%)	5
	Litter cover	5
Landscape attributes (fragmented subregions[3])	Size of patch	10
	Context	5
	Connectivity	5
OR Landscape attributes (intact subregions)	Distance to permanent water	20
TOTAL		100

4.2 Assessing regional ecosystems with naturally missing attributes

For treeless or non-woody species dominant REs, e.g. grassland REs (as defined in the glossary), the woody-type site attributes such as tree canopy cover, tree canopy height, large trees etc are not assessable and the final condition score is standardised accordingly. A similar standardisation is made for shrubland REs, which naturally lack large trees and coarse woody debris, and mangrove ecosystems, which naturally occur without native perennial grass cover. In such cases,

[2] Trials performed by a range of assessors with varying levels of botanical knowledge found that the native species richness counts were within 10% of each other.

[3] See Section 6 for definition and locality map of bioregions and subregions that contain fragmented landscapes, and bioregions and subregions that contain intact landscapes.

the benchmark value will be zero for these attributes, thus the maximum score for the attributes is adjusted to zero. **In general, if the benchmark document gives a zero for an attribute, then the attribute is discounted from the final score.** This has the effect of standardising the scoring for these REs to between 0 and 1 when calculating the total BioCondition score.

A grassland ecosystem, which naturally does not contain trees or shrubs, gets a maximum score of 50, incorporating a total possible score of 30 for the site-based attributes, plus a further possible score of 20 for the landscape scale attributes (Table 4). Similarly, a mangrove ecosystem which does not support grasses or litter means the attributes grass species richness, perennial grass cover and litter cover are not included in the BioCondition assessment or scoring procedure (Table 4). If the total score for an assessment site in grassland is 50, then it's standardised BioCondition score is 1.0, while a total score of 50 in a mangrove ecosystem would give a BioCondition score of 0.59, and in a wooded non-mangrove ecosystem the BioCondition score is 0.5.

Table 4: The assessable attributes and weightings in ecosystems where attributes are naturally absent

Attribute	Wooded ecosystems Weighting (%)	Grassland ecosystems Weighting (%)	Shrubland ecosystems Weighting (%)	Mangrove* ecosystems Weighting (%)
Site-based Large trees	15	0	0	15
Tree canopy height	5	0	0	5
Recruitment of dominant canopy species	5	0	5	5
Tree canopy cover (%)	5	0	0	5
Shrub layer cover (%)	5	0	5	5
Coarse woody debris	5	0	0	5
Native plant species richness - Trees - Shrubs - Grasses - Other	5 5 5 5	0 0 5 5	0 5 5 5	5 5 0 5
Non-native plant cover	10	10	10	10
Native perennial grass cover (%)	5	5	5	0
Litter cover	5	5	5	0
Total site score	**80**	**30**	**45**	**65**
Landscape Size of patch	10	10	10	10
Context	5	5	5	5*
Connectivity	5	5	5	5
OR Distance to artificial water	20	20	20	N/A
Total landscape score	20	20	20	20
TOTAL BioCondition SCORE	100	50	65	85

* ocean may be included as 'remnant'

5 Assessment of site-based attributes

5.1 100 x 50 m plot

5.1.1 Large trees

Large trees are an important resource within forest and woodland ecosystems. They provide greater leaf material, nectar and bark-surface area for foraging purposes, and are more likely to contain hollows and crevices for nesting and sheltering purposes. Large trees are defined as the number of living trees per hectare with a diameter at breast height (DBH) greater than the DBH threshold provided in the benchmark document. Native trees larger than the DBH threshold are counted within the 100 x 50 m assessment area (i.e. 0.5 hectare, this value will need to be doubled to compare with the benchmark value).

In some REs a large tree DBH threshold will be identified for both eucalypt[4] and non-eucalypt tree species due to the natural variation in potential size. For example, a mature mulga tree (*Acacia aneura*) can never reach the size of a mature poplar box (*Eucalyptus populnea*), therefore the large tree DBH threshold is smaller for mulga than for poplar box. Where the benchmark document specifies different diameter thresholds for large eucalypt and non-eucalypt trees, the benchmark number of large trees will be the number of large eucalypts and the number of large non-eucalypts added together to give one per hectare value which is then scored using Table 5. An example of scoring large trees is given in Box 5.

Table 5: Description and scores for the number and habitat value of large trees

Description	Score
No large trees present	0
0 to 50% of benchmark number of large trees	5
≥50% to 100% of benchmark number of large trees	10
≥ benchmark number of large trees	15

Box 5: Example of scoring large trees

Scoring large trees

RE 11.4.12: Benchmark document has a DBH threshold for eucalypts as 58 cm with the 12 large trees per ha. For non-eucalypts the DBH threshold is 26 cm with 16 large trees per ha. The benchmark is 12 + 16 = **28 large trees per ha**.

During the BioCondition assessment 6 large eucalypt trees (>58 cm DBH) were counted (i.e. 12 large eucalypt trees per ha) and 3 large non-eucalypt trees (>26 cm DBH) were counted (i.e. 6 large non-eucalypt trees per ha).

The assessment gives **18 large trees per ha**. This is within 64% of the benchmark value (i.e. 18/28 = 64%), which means the score will be on the third row of Table 10, receiving a score of **10.**

[4] Eucalypt includes species of genera *Eucalyptus, Corymbia, Angophora, Lophostemon* and *Syncarpia*.

5.1.2 Tree canopy height

Tree height is indicative of stand development and site productivity and is relatively simple to measure. Tree height and cover are used by the Queensland Herbarium in the definition of remnant vegetation in the production of the RE mapping (Neldner *et al*. 2012).

Tree canopy height (measured to the top of the highest leaves) refers to the median canopy height in metres, estimated for the trees in the ecologically dominant layer (EDL) or canopy layer (see Box 6) within the 100 x 50 m assessment area. The median canopy height is the height that has 50% of canopy trees higher and lower than it (Figure 3). This is generally synonymous with average height except when there are some trees that are substantially higher or lower than the median (Neldner *et al.* 2012). Description and scoring categories for assessing tree height are given in Table 6. A reliable method for assessing tree height is provided in Appendix 5. It is recommended that a clinometer or hypsometer be used if available.

For this attribute, if there is a distinct emergent or subcanopy layer in the appropriate RE benchmark, the height of each these layers (EDL, emergent and subcanopy) is measured and scored separately. In these cases, the score for each is then averaged to give one score for tree height. For disturbed/regrowth sites, which frequently only have one diffuse layer, the canopy height of the species present is compared to the values in the appropriate layer in the benchmark.

Box 6: Identifying vegetation layers for BioCondition assessment

In BioCondition, assessment of the **tree height**, **recruitment** and **tree canopy cover** attributes require consideration of the vegetation layers or strata that typify the RE of interest.

Where there is an emergent tree layer identified in the appropriate RE benchmark document, e.g. widely scattered popular box (*Eucalyptus populnea*) trees emerging above a dominant canopy of mulga (*Acacia aneura*), then the emergent layer species are assessed separately from the EDL species for the purposes of these three attributes. Similarly if a subcanopy layer is identified in the appropriate RE benchmark because it contributes a significant amount of biomass to the vegetation, e.g. a conspicuous subcanopy layer of *Allocasuarina littoralis* under a canopy of *Eucalyptus crebra*, then the subcanopy layer is assessed as well as the EDL species for the three attributes. The process for stratifying the vegetation into layers and examples are given in **Appendix 6**.

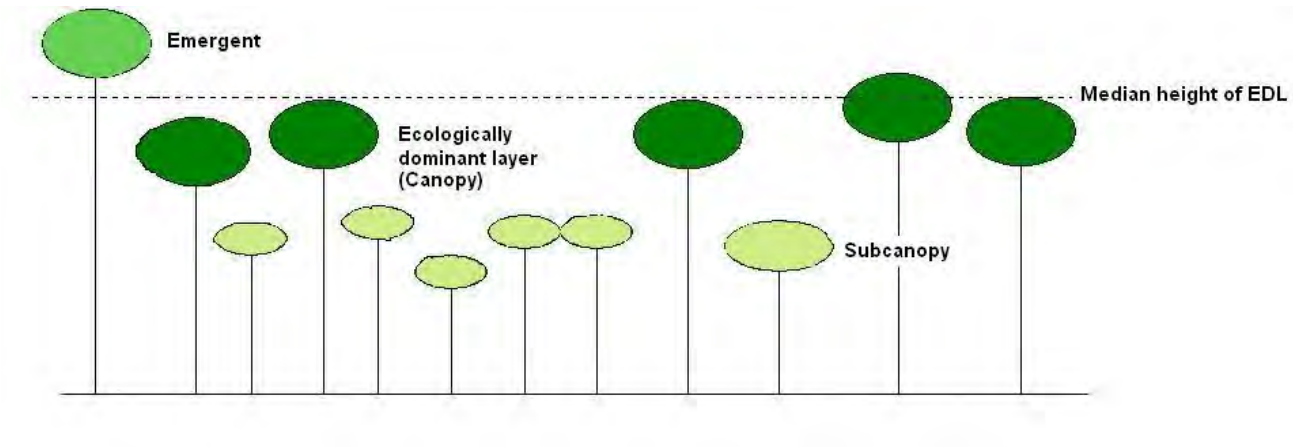


Figure 3: Median height of the ecologically dominant Layer (EDL)

Table 6: Description and scores for tree canopy height

Description	Score
<25% of benchmark height	0
≥25% to 70% of benchmark height	3
≥70% of benchmark height	5

5.1.3 Recruitment of dominant canopy species

Recruitment or regeneration is essential to the sustainability of any ecosystem. Some land management practices, such as burning or grazing, and natural processes such as drought, can affect the processes required for natural regeneration.

The recruitment attribute assesses the presence of regeneration of the dominant canopy species in the 100 x 50 m assessment area. The canopy equates to the EDL for forests and woodlands, plus the emergent and subcanopy layers if they contribute a significant amount of biomass (Box 6 and Appendix 6). Where the EDL is the shrub layer, then the recruitment of the dominant species from this layer and any emergent tree layer are included for this attribute. Due to the seasonal and therefore ephemeral nature of non-woody vegetation, the assessment of recruitment is restricted to woody perennial species only.

Recruitment is assessed as the proportion of dominant species present at a site that are regenerating, i.e. having individuals with a DBH <5 cm. For example, if four dominant canopy species occur at the site, but only two of these species are present as regeneration, then the proportion is 50%. This would be allocated a BioCondition score of 3 (Table 7).

Table 7: Description and scores for the recruitment of canopy species

Description	Score
<20% of dominant canopy* species present as regeneration	0
≥20 – 75% of dominant canopy* species present as regeneration	3
≥75% of dominant canopy* species present as regeneration	5

*canopy species are those species listed in the RE benchmark in the EDL, emergent and subcanopy layers or as identified in the RE description (REDD database) that make up the dominant proportion of the EDL, emergent and subcanopy layers (but does not include those listed as occurring as scattered individuals).

Note: As only the dominant species are assessed for Recruitment, not all of the species counted during the assessment of Native Tree[5] Species Richness (Section 5.1.4) will necessarily be included in the assessment of this attribute.

5.1.4 Native tree species richness

The richness of plants or flora species is recognised as an important attribute to assess in studies related to the assessment of condition for biodiversity. Not only does it reflect a portion of the

[5] Or shrubs in the case of shrub lands

biodiversity present on site, the number, and abundance of plant species can have a direct relationship on the fauna present and influence a whole range of functional processes reflective of the condition of a stand.

To simplify measurement, native plant species richness, rather than diversity (diversity measures incorporate abundance), is estimated for four life-forms: trees, shrubs, grasses and forbs/other (see Appendix 7 for a list of life-form groups categorised for BioCondition and Appendix 8 for a description of those life-forms). For native tree species richness assessment is based on the number of native tree species observed in the 100 x 50 m plot. For all other life forms (shrubs, grasses, forbs/others) species richness is assessed in the 50 x 10 m plot (see Section 5.4.1). Native tree species richness is scored with the other life-forms as described in Table 11.

5.2 100 m transect

5.2.1 Tree canopy cover

Tree canopy cover can be used to characterise stand productivity and the distribution and abundance of biomass (McElhinny 2002). It refers to the estimation of the percentage canopy cover of the living, native tree layer along the 100 m transect, using the line intercept method (Greig-Smith 1964). For this attribute, only the cover of the species making up the EDL or tree canopy cover is assessed for the majority of REs. Canopy cover equates to crown cover as defined by Walker and Hopkins (1990). The vertical projection of the tree canopy over the 100 m transect is recorded. The total length of the projected canopy of each layer is then divided by the total length of the tape to give an estimate of percentage canopy cover on the site, which then can be compared with the benchmark value. Over-abundance or under-abundance (e.g. thinning) in the tree canopy will result in lower scores (Table 8).

If there is, or should be, a distinct emergent or subcanopy layer (this will be defined by the benchmark document for the assessable RE), then the canopy cover of each of these layers (EDL, emergent and subcanopy) is assessed separately, then averaged to give one score for tree canopy cover. If exotic species are present in the canopy (e.g. camphor laurel *Cinnamomum camphora*, exotic pines *Pinus* spp.) then cover of these can be measured separately and indicated with an asterisk (*) but will not form part of the final scoring for the site. Figure 4 and Box 7 provide an example of tree canopy cover assessment and scoring.

Table 8: Description and scores for tree canopy cover

Percentage of Tree Canopy (EDL) Cover [6] relative to Benchmark	Score
<10% of benchmark	0
≥10% and <50%	2
≥50% or ≤200%	5
>200%	3

[6] (and Emergent and Subcanopy if these layers are identified in the benchmark document)

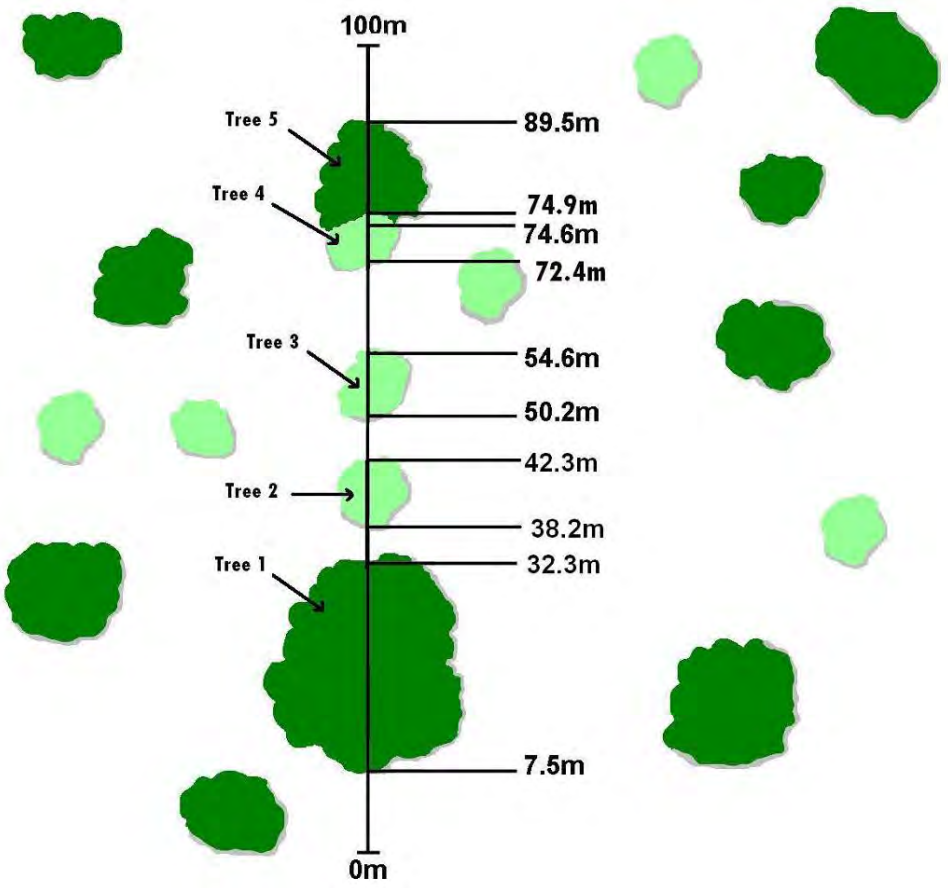


Figure 4: Example of assessing canopy cover percentage

Box 7: Example of scoring tree canopy cover

In Figure 4, this regional ecosystem has a canopy (EDL) and a subcanopy.

The canopy cover (EDL) is **39.7%**, calculated as:

= (canopy cover Tree 1) + (canopy cover Tree 5)

= (32.3–7.5) + (89.5–74.6) = 24.8 + 14.9 **= 39.7%**.

If the canopy benchmark for this regional ecosystem is **42%**, then the assessment is within **95%** of the benchmark (i.e. **39.7/42 = 94.5%**). This corresponds with the third row of Table 8, with a score of **5**.

The subcanopy cover is 11%, calculated as:

= (cover Tree 2) + (cover Tree 3) + (cover Tree 4)

= (42.3 – 38.2) + (54.6 - 50.2) + (74.9 –72.4) = 4.1 + 4.4 + 2.5 = **11%**

This is compared to the subcanopy benchmark of 30%, so the assessment is within 37% of the benchmark (i.e. **11/30 = 36.6%**), which corresponds with the second row of Table 8. Therefore, the assessment would receive a score of **2** for the subcanopy cover layer.

The averaged, final score for tree canopy cover is 3.5 (i.e. $\frac{5\text{ [canopy]} + 2\text{ [subcanopy]}}{2} = 7/2$)

5.2.2 Shrub cover

Shrub canopy cover refers to the estimate of the percentage cover of native shrubs recorded along the 100 m transect (similar to the estimation of tree canopy cover using a vertical projection of shrub crowns downwards over the centre line transect). Management and disturbance can result in shrub cover that is either insufficient, which has been shown to reduce habitat quality for birds in Queensland (Eyre *et al.* 2009a), or excessive, which may not represent a stable state, particularly in the rangelands (Witt *et al.* 2009). Consequently, the score is reduced if shrub cover is either under-abundant or overabundant (>200%) relative to the benchmark (Table 9). This is to account for the issue of woody vegetation thickening, which can arise under particular climatic conditions from the interactions of varying fire and grazing regimes. If non-native shrubs (e.g. *Lantana* spp.) are present along the transect line, these can be measured separately and indicated with an asterisk (*) but will not form part of the scoring of the site.

Table 9: Description and scores for shrub cover

Description	Score
<10% of benchmark shrub cover	0
>/= 10 to <50% or >200% of benchmark shrub cover	3
≥50% or ≤200% of benchmark shrub cover	5

5.3 50 x 20 m plot

5.3.1 Coarse woody debris

Coarse woody debris (CWD) is an important component in many aspects of ecosystem functioning (Woldendorp *et al.* 2002; Mackensen *et al.* 2003). It is primarily measured as a habitat surrogate for ground-dwelling fauna (MacNally and Horrocks 2002), but can also be used as a variable in the estimate of carbon biomass, and as an indicator of management disturbance (Eyre *et al.* 2010).

In BioCondition, coarse woody debris refers to logs or dead timber on the ground that is >10 cm diameter and >0.5 m in length (and more than 80% in contact with the ground). Assessment is conducted by measuring the length of all fallen woody logs and other coarse woody debris (>10 cm diameter and >0.5 m in length) to the boundary of the 50 x 20 m plot (i.e. 0.1 ha). The total measured value is multiplied by 10 for comparison with the benchmark which is a metre per hectare value). Scores are lower for sites where there is an over-abundance of CWD (Table 10), because in some ecosystems, such as silviculturally managed cypress pine, an overabundance of CWD is indicative of disturbance from selective clearing or silvicultural treatment.

Table 10: Description and scores for number of CWD

Description	Score
<10% of benchmark number or total length of CWD	0
>/= 10 to <50% or >200% of benchmark number or total length of CWD	2
≥50% or ≤200% of benchmark number or total length of CWD	5

5.4 50 x 10 m plot

5.4.1 Native plant species richness

To simplify measurement, native plant species richness, rather than diversity (diversity measures incorporate abundance), is estimated for four life-forms: trees, shrubs, grasses and forbs/other (see Appendix 7 for a list of life-form groups categorised for BioCondition and Appendix 8 for a description of those life-forms). For a species that may occur in a number of layers with different lifeforms, for example, *Acacia harpophylla,* which may occur as a tree in the canopy and also as a shrub in the shrub layer, then the species is counted for each layer it occurs in. Where a species has two lifeforms in the same layer, such as *Acacia aneura,* which may have a single stemmed 'tree' lifeform as well as multi-stemmed 'shrub' lifeform in the same layer, then it is classed as the most frequent lifeform in that layer. Assessment is based on the number of native shrub, grass and forb/other species observed in the 50 x 10 m plot for each benchmarked life-form group (Table 11). Native tree species richness is assessed over the 100 x 50 m plot (see Section 5.1.4).

Table 11: Description and scores for native plant species richness for each life form

Description	Score
<25% of benchmark number of species within each life-form	0
≥25% to 90% of benchmark number of species within each life-form	2.5
≥90% of benchmark number of species within each life-form	5

5.4.2 Non-native plant cover

Non-native plants are introduced or exotic plant species that cause major modification to native species richness, abundance and ecosystem function (Humphries *et al.* 1991: Grice 2004). Generally, two types of non-native plant invasion are recognised: introduction of exotic plants and movement of native species into new areas well outside their natural range. In the Australian rangelands, there are limited studies that quantify the effects of non-native plants on fauna, although the few studies available suggest a negative net effect (Grice 2004). The establishment of exotic pastures e.g. buffel grass *Cenchrus ciliaris* has been associated with a loss in native species and alterations in fire regimes (Fensham and Fairfax 2000; Franks 2002; Jackson 2005; Eyre *et al.* 2009b).

Non-native plant cover is the percentage cover of the total vegetation cover that is comprised of exotic and non-indigenous species, assessed within the 50 x 10 m sub-plot. Where there are non-native plants present in more than one layer, such as a grass in the ground layer and shrub in the shrub layer, then the cover in each layer are added together. The benchmark for non-native plant cover for any ecosystem type is zero (Table 12).

Table 12: Description and scores for non-native plant cover

Description	Score
>50% of vegetation cover are non-native plants	0
≥25 – 50% of vegetation cover are non-native plants	3
≥5 – 25% of vegetation cover are non-native plants	5
<5% of vegetation cover are non-native plants	10

5.5 1 x 1 m quadrats

5.5.1 Native perennial grass cover

In earlier versions of BioCondition, three components of the ground layer were scored based on cover: perennial grass species; perennial forb (non-grass) species; and annual grass and forb species. Perennial forb cover and annual species cover are no longer assessable in BioCondition as many assessors are not confident about the identification of annual species (Kelly et al. 2011), and there is high correlation between forb and perennial grass cover and that there is wide inter- and intra-seasonal variation that can occur particularly in the drier parts of Queensland.

Perennial grass cover refers to the average percentage cover of native perennial grasses, assessed within each of the five 1 x 1 m quadrats and averaged to give a value for the site which is then scored against the benchmark value (Table 13). The ground cover is measured by a vertical projection downwards of the living and attached plant material. A stylised guide is provided in Figure 5 to help estimate cover percent. This cover equates to the projected foliage cover in Walker and Hopkins (1990).

Table 13: Description and scores for native perennial grass species cover

Description	Score
<10% of benchmark native perennial (or preferred and intermediate) grass cover	0
≥10 to 50% of benchmark native perennial (or preferred and intermediate) grass cover	1
≥50 – 90% of benchmark native perennial (or preferred and intermediate) grass cover	3
≥90% of benchmark native perennial (or preferred and intermediate) grass cover	5

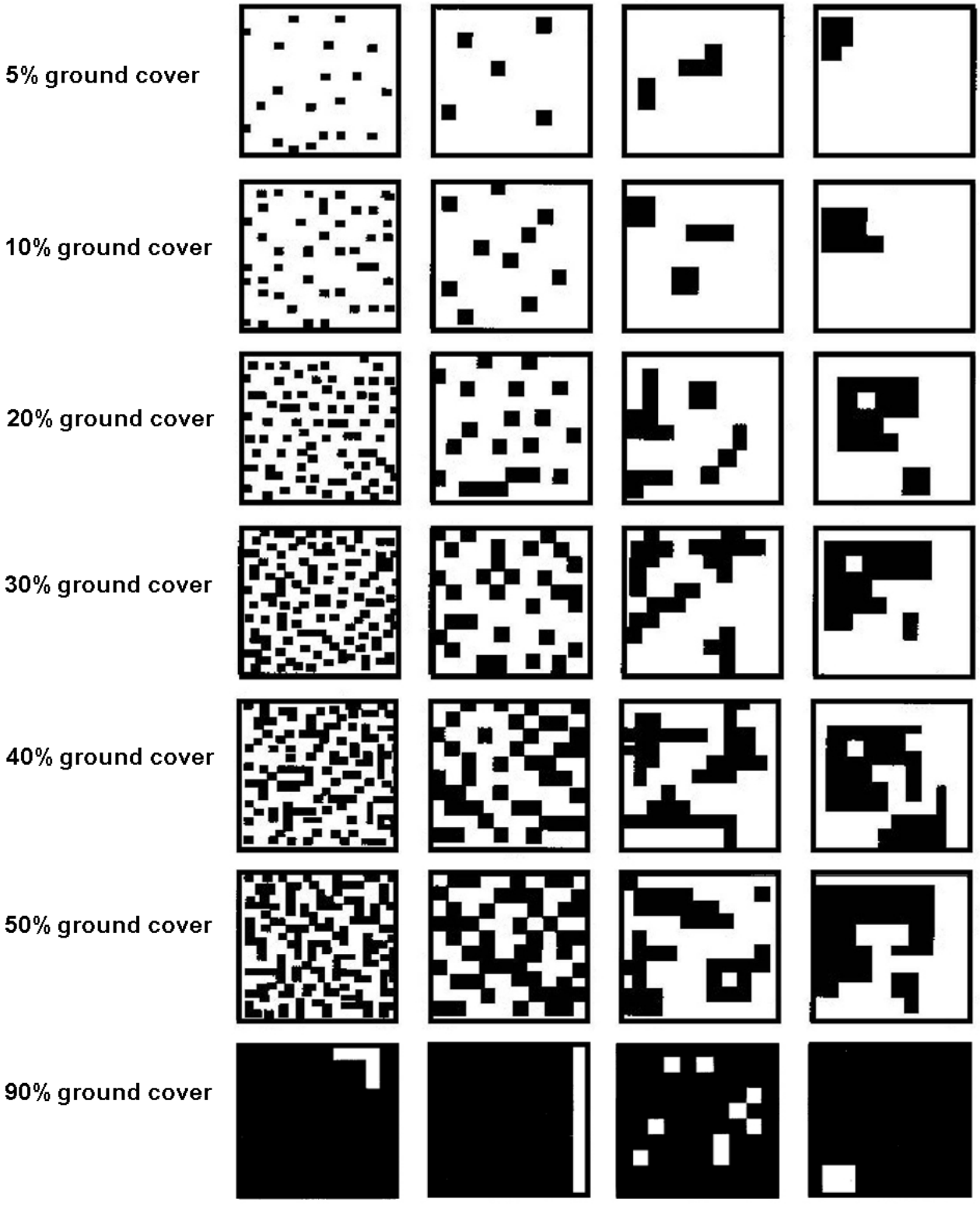


Figure 5: Stylised examples of ground cover proportions.

Various ground cover amounts (%) can be evenly spread across the quadrat or distributed in patches.

5.5.2 Organic litter

Litter is described as a key habitat component for wildlife and woodland functioning (McIntyre *et al.* 2002). Leaf and woody litter protects the soil from erosion and its decomposition provides continual nutrient supply into the ecosystem. It supports a diverse range of invertebrates, which in turn provide a food source for vertebrate species.

Litter is defined as including both fine and coarse organic material such as fallen leaves, twigs and branches <10 cm diameter. Organic litter cover refers to the average percentage cover assessed within each of the five 1 x 1 m quadrats. Note that within a quadrat, the sum of the native ground cover (shrubs, grasses and forbs etc), non-native plant ground cover, organic litter (including any CWD) and bare ground/rock cover should equal 100%.

Sites with over-abundance as well as under-abundance of organic litter cover receive lower scores (Table 14).

Table 14: Description and scores for percentage of organic litter

Description	Score
<10% of benchmark organic litter	0
≥ 10 to <50% or >200% of benchmark organic litter	3
≥50% or ≤200% of benchmark organic litter	5



Litter provides shelter during the day for ground geckos like this foraging thick-tailed gecko *Underwoodisaurus milii.*

6 Assessment of landscape-scale attributes

The context of the landscape surrounding the site is also assessed in BioCondition. This is because landscape context is known to have a significant influence on the long-term viability of the habitat patch for biodiversity values (Andren 1994; Fahrig 1997, 2001).

Landscape context does not only refer to fragmented landscapes with sharp or high contrast edged boundaries (e.g. vegetated versus cleared boundaries), but also intact landscapes where there are gradients of habitat quality or low contrast edges (e.g. increased grazing disturbance with distance from water points). These concepts correlate with ‘abrupt’ or ‘gradual’ boundaries used in landscape ecology (McIntyre and Barrett 1992; McAlpine and Eyre 2002).

In BioCondition, landscape context attributes are scored using different attributes depending upon whether the assessment is within a *fragmented landscape* (patch size, connectivity and context), or an *intact landscape* (distance to water). Fragmented landscapes can be defined as areas where the amount of remnant vegetation is less than 65% (McIntyre and Hobbs 2000). This includes subregions in South East Queensland, Brigalow Belt, New England Tableland, Central Queensland Coast and Wet Tropics bioregions. It also includes the West Balonne Plains, Eastern Mulga Plains, Nebine Plains, North Eastern Plains and Langlo Plains subregions in the Mulga Lands bioregion and the Jericho subregion in the Desert Uplands bioregion (Accad *et al*. 2010). Other subregions in the Mulga Lands, and Cape York Peninsula, Einasleigh Uplands, Gulf Plains, Northwest Highlands, Mitchell Grass Downs, Desert Uplands and Channel Country can be defined as intact landscapes (Figure 6).

The landscape context attributes are best calculated using data stored in Geographical Information Systems (GIS). RE mapping (remnant) and regrowth (non-remnant) vegetation mapping can be used to assess landscape context and is available from the Regional Ecosystem Maps section of the Queensland Government QSpatial website (http://qspatial.information.qld.gov.au/IQAtlas/) and the Queensland government data website (https://data.qld.gov.au/). Alternatively, Appendix 9 provides a method for the calculation of area using aerial photographs.



Figure 6: Fragmented (yellow) and intact (green) regions of Queensland

6.1 Fragmented landscapes

6.1.1 Size of patch

This attribute is a measure of the size of the patch of vegetation in which the assessment unit is located. The scoring reflects the importance of large patches in the landscape, and is based on the size of a patch of either remnant vegetation, or regrowth vegetation, or a combination of remnant and regrowth vegetation (Table 15). Larger patches are less susceptible to ecological edge effects and are more likely to sustain viable populations of native flora and fauna than smaller patches (McIntyre *et al.* 2000; Lindenmayer *et al.* 1999). Larger patches are also less susceptible to propagule pressure from exotic pasture species such as buffel grass (Eyre *et al.* 2009b).

The assessment unit may form a component of a patch that includes a range of other units of REs of varied condition states. For BioCondition assessments, an estimate of patch area will include any remnant or regrowth vegetation (i.e. irrespective of RE or tenure) that is contiguous with the assessment unit (Figure 7). In cases where the assessable patch is connected to larger areas of remnant vegetation, but through narrow corridors (<200 m in width) within 1 km radius of the site, then these areas should be treated as a different patch and not included in the calculation of patch size (e.g. Figure 8).

Patch size is assessed for vegetation mapped as either remnant and/or regrowth. Regrowth is included in the assessment of patch size in recognition of its contribution to increasing or maintaining biodiversity values, particularly in highly modified landscapes (Bowen *et al.* 2007).

Table 15: Description and scores for size of patch

Description	Score
<5 ha remnant **AND/OR** regrowth	0
≥5 – 25 ha remnant **AND/OR** regrowth	2
≥25 – 100 ha remnant **OR** ≥25 – 200 ha remnant and regrowth **OR** ≥25 – 200 ha regrowth	5
≥100 – 200 ha remnant **OR** >200 ha remnant and regrowth **OR** >200 ha regrowth	7
≥200 ha remnant	10

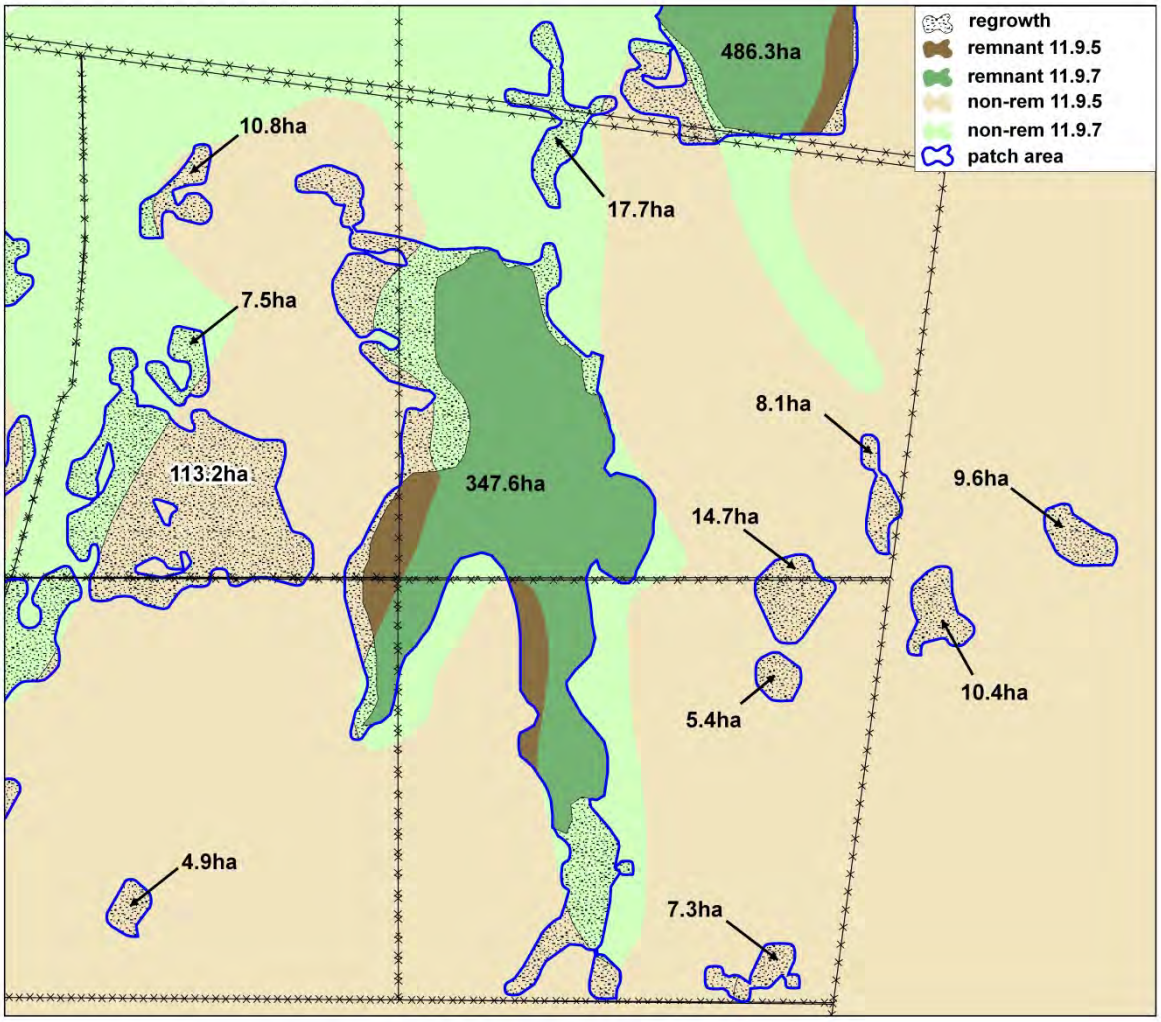


Figure 7: Example of the delineation of the patch area

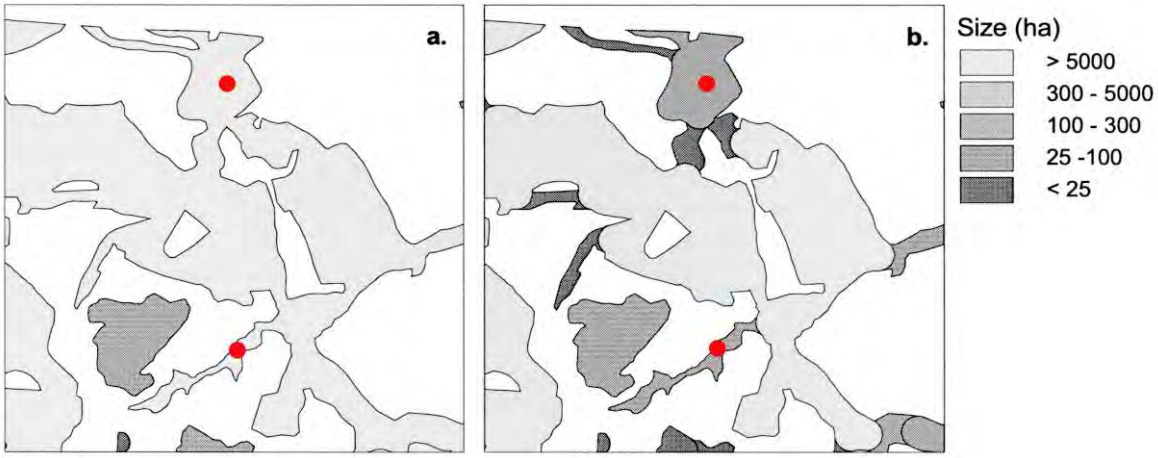


Figure 8: Patch size of remnant vegetation (a) before, and (b) after segmentation of narrow (<200 m) linear landscape elements

For example, before segmentation patch area of Site A >5000 ha, and after segmentation 25 to 100 ha. This site would therefore score 5 in BioCondition.

6.1.2 Connectivity

As a landscape level attribute, connectivity aims to assess the degree to which the assessment unit is connected with adjacent native vegetation. Connectivity relates to the capacity species have to disperse through the landscape between suitable patches of habitat, and therefore has important implications for species persistence (With 2004). A landscape with high connectivity is one in which a particular fauna species can readily move between suitable areas of habitat. A landscape with low connectivity means populations become largely isolated (Bennett *et al.* 2000). Immigration by a species into a single patch of habitat is related to connectivity at the landscape scale. However, other aspects such as the size of the patch (landscape attribute 1) and the amount of habitat in the landscape (landscape attribute 3), as well as the dispersal behaviour of species all contribute to the strength of the relationship (Tischendorf and Fahrig 2000).

In BioCondition there are four broad categories that describe the connectivity of the assessment unit within the landscape (Table 16 and Figure 9). Both remnant and regrowth vegetation are assessed within the connectivity attribute.

Table 16: Description and scores for connectivity in the landscape.

Category	Description	Score
Low	The assessment unit is not connected using any of the below descriptions.	0
Medium	The assessment unit: is connected with adjacent remnant vegetation along >10% to <50% of its perimeter **OR** is connected with adjacent remnant vegetation along <10% of its perimeter **AND** is connected with adjacent regrowth native vegetation > 25% of its perimeter.	2
High	The assessment unit: is connected with adjacent remnant vegetation along 50% to 75% of its perimeter.	4
Very high	The assessment unit: is connected with adjacent remnant vegetation along >75% of its perimeter **OR** includes > 500 ha remnant vegetation	5

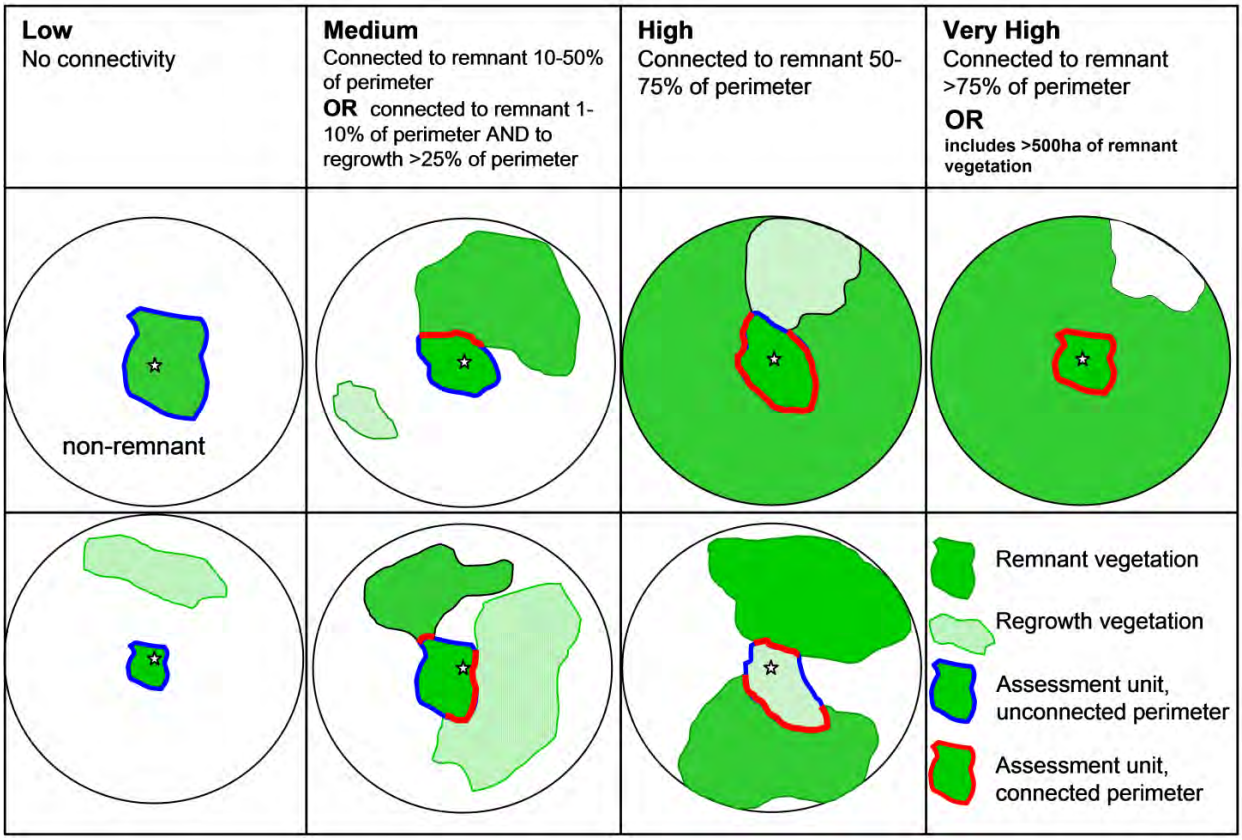


Figure 9: Examples of landscape connectivity scores

6.1.3 Context

The context attribute refers to the amount of native vegetation that is retained in the landscape proximal to the site being assessed. A 1 km radius buffer from the 50 m mark of the BioCondition transect is used to delineate a circular spatial extent. The scoring relates to the proportion of native remnant vegetation and/or regrowth vegetation) is retained within the 1 km radius landscape, and categorised as Low, Medium, High or Very High vegetation cover (Table 17, Figure 10).

The percent thresholds used to categorise the scores have been derived from the literature, which generally demonstrate that there is a 10 to 30% threshold of habitat loss within a landscape below which species will be lost from the ecosystem (Andren 1994; McIntyre *et al.* 2000; Radford *et al.* 2005).

Table 17: Description and scores for landscape context

Category	Description	Score
Low	<10% remnant vegetation AND <30% native non-remnant vegetation (regrowth)	0
Medium	≥10% to 30% remnant vegetation AND <30% regrowth **OR** <10% remnant vegetation AND ≥30% regrowth	2
High	≥30% to 75% remnant vegetation **OR** ≥10% to 30% remnant vegetation AND ≥30% regrowth	4
Very High	>75% remnant vegetation	5

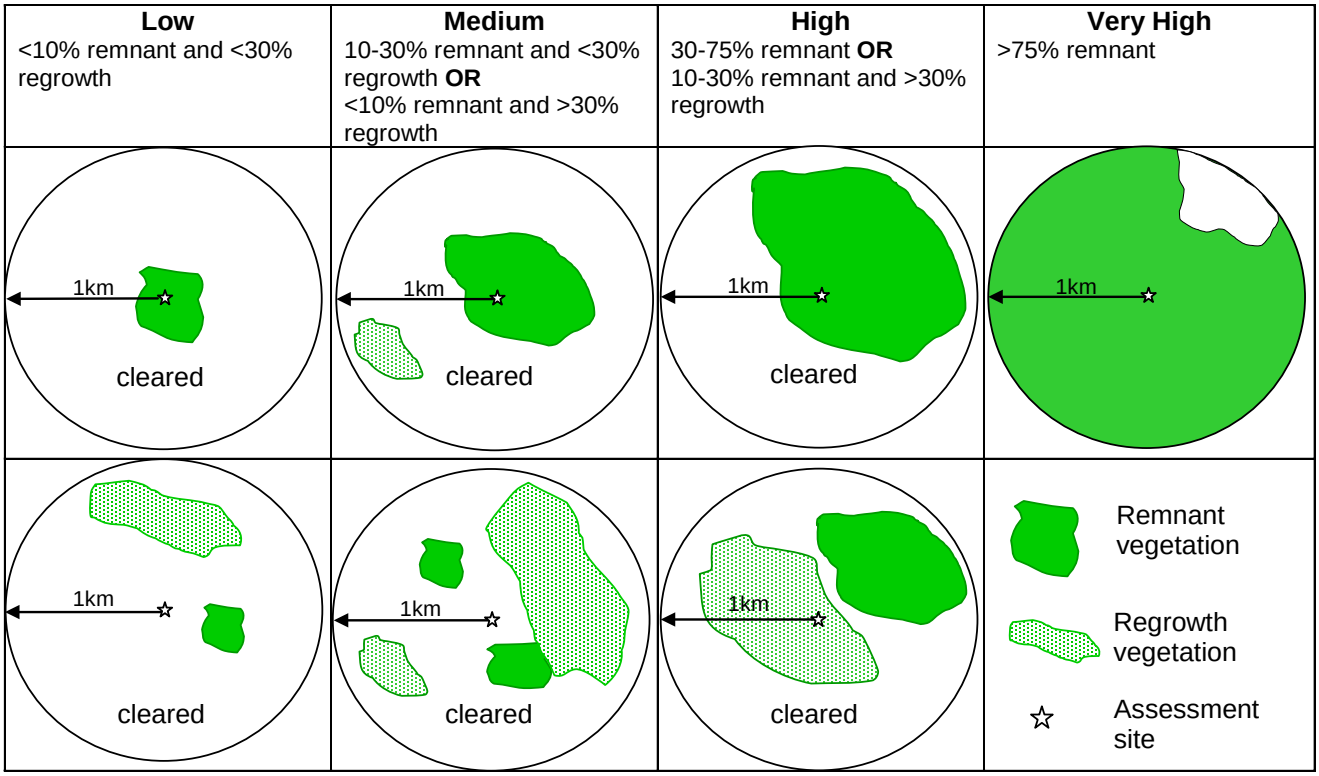


Figure 10: Examples of landscape context scores

6.2 Intact landscapes

6.2.1 Distance from permanent water

The intact landscapes of Queensland's arid and semi-arid rangelands include a diversity of relatively unfragmented ecosystems of tropical savannas, woodlands, shrublands and grasslands (James *et al.* 1999; Woinarski and Fisher 2003). The dominant landuse is grazing by domestic livestock with minimal deliberate landscape modification in terms of vegetation clearing (Freudenberger and Landsberg, 2000). However, natural permanent water is rare in the landscape

and to support the pastoral industry there has been an ongoing program of artificial waterpoint development since the late 1800s (Fensham and Fairfax 2008). This creates a pattern of grazing pressure, from stock as well as feral and native herbivores, that tends to radiate in intensity with distance from permanent water, known as a piosphere (James *et al.* 1999). Consequently, with increased densities of artificial water points in the rangelands, areas of water remoteness for grazing relief are becoming increasingly rare. The issue with piospheres is that species assemblages can change in response to variation in grazing intensities, with the loss of 'decreaser' species, or species sensitive to grazing pressure, closer to water points (Landsberg *et al*. 1999; Pringle and Landsberg 2004).

Distance from permanent water points is therefore a landscape level attribute that is measured and scored in BioCondition for the intact landscapes of the Queensland rangelands. Scoring is based on the shortest distance from the centre of the site to the nearest accessible permanent water point within the one fenced area (Table 18).

Three sources of water are used to provide permanent water for stock in the rangelands (James *et al.* 1999), including:

- unconfined aquifers, where water is pumped to the surface by windmill, solar or diesel pumps
- artesian and sub-artesian aquifers e.g. the Great Artesian Basin, where water is either naturally forced to the surface or pumped
- stored surface runoff, where surface runoff from rain is trapped in dams.

For the BioCondition assessment, permanent water points are typically dams (earth tanks), raised ring tanks and troughs on pipelines, but can include natural permanent water supplies such as rivers and waterholes.

Table 18: Description and scores for distance from permanent water. The description is relevant to the assessment site.

Description	Score
0 to 500 m from water point	0
500 m to 1 km from water point	2
1 km to 3 km from water point	5
3 km to 5 km from water point	10
>5 km from water point	20



Cattle drink from a ring tank in poplar box country, Brigalow Bioregion

7 Calculating and classifying the BioCondition score

The BioCondition (BC) score for the assessment site is determined by adding the scores obtained for each site-based and landscape level attribute (Table 19) and dividing by the maximum possible score for the RE (e.g. 100 for wooded REs, 50 for grassland REs, 65 for shrub land REs, or 85 for mangrove REs). Dividing the summed total by the maximum possible score standardises the total between 0 and 1, which allows equivalence between different ecosystems such as grasslands, for which the benchmark value of some attributes
is zero.

Table 19: Scoring and weighting of the site-based and landscape scale attributes

	Attribute	Weighting (%)
Site-based attributes		
a	Large trees	15
b	Tree canopy height	5
c	Recruitment of canopy species	5
d	Tree canopy cover (%)	5
e	Shrub layer cover (%)	5
f	Coarse woody debris	5
g	Native plant species richness for four life-forms	20
h	Non-native plant cover	10
i	Native perennial grass cover (%)	5
j	Litter cover	5
Landscape attributes		
k	Patch size	10
l	Connectivity	5
m	Context	5
n	Distance to water	20

The BioCondition score (BC) for a site can be calculated as:

Equation 1:

$$BC = \frac{a + b + c + d + e + f + g + h + i + j + \text{either } (k + l + m) \text{ or } (n)}{Y + Z}$$

Where:

a–n are the attributes a to n (from Table 18 above)

Y is the maximum site-based score that can be obtained site-based attributes (a–j) that are relevant to the RE being assessed e.g. in a wooded ecosystem *Y* = 80, and in a grassland *Y* = 30.

Z is the maximum site score that can be obtained for landscape attributes (k–m in fragmented landscapes or n in intact landscapes) (*Z* = 20).

If the site-based scores and landscape-scale scores are required to remain separate and yet still comparable across ecosystems, this can be achieved using the following calculations;

Site-based score (S_c)

$$S_c = \frac{a + b + c + d + e + f + g + h + i + j}{Y}$$

Landscape score (Lc)

In fragmented landscapes $Lc = \frac{k + l + m}{Z}$ OR in intact landscapes $Lc = \frac{n}{Z}$

A BioCondition score (BC) for an assessment site is:

$$BC = (S_c \times Y/(Y+Z)) + (L_c \times Z/(Y+Z))$$

Note that the above calculation is a re-expression of equation 1, in that it will give the same score if all attributes (site-based and landscape-scale) were simply added together and divided by 100 (or 50 for grassland REs, 65 for shrubland REs, or 85 for mangrove REs).

7.1 To obtain an overall BC score for an area

If an estimation of condition by area is required (as determined by the objective), an area-weighted score can be derived by relating the BC scores to the overall assessment unit. This type of calculation may be required for use in offsets. This is achieved by averaging the BC score for each assessment site within the assessment unit, and then multiplying the average by the area of the assessment unit. This will give a notional score on a per hectare basis.

1. Obtain the average BC for an assessment unit;

$$BC_{(average)} = \frac{BC_1 + BC_2 + \ldots BC_x}{N}$$

$BC_{(average)}$ Average BC score for an assessment unit

BC_x BC score for assessment site *x* within the assessment unit

N Number of assessment sites sampled within the assessment unit

2. Obtain an area-weighted BC score for the assessment unit.

$Z_y = (BC_{(average)} \times A)$

Z_y Area-weighted site score for assessment unit *y*

A Area in hectares of the assessment unit *y*

If the assessment unit Z_y is disjunct, or made up of discrete, separated units ($Z_{ya}..Z_{yx}$), then an area-weighted BC score is obtained by:

$Z_y = Z_{ya} + Z_{yb} +..Z_{yx}$

Where:

Z_{yx} is the area-weighted score for disjunct unit *x* of assessment unit *y*

3. Obtain the overall area-weighted BC score for the area of interest.

Overall area-weighted score for the area of interest $= Z_A + Z_B +….Z_X$

Z_A Area-weighted site score for assessment unit A

Z_B Area-weighted site score for assessment unit B

Z_X Area-weighted site score for assessment unit X

An example of the calculation procedure is given in Box 8.

7.2 Categorising the BioCondition score to align with the ABCD framework

To align with grazing land condition the 'ABCD' assessment framework (Chilcott *et al.* 2003; Karfs *et al.* 2009), BioCondition scores can also be categorised as a rating of 1 (for 'functional' biodiversity condition) to 4 (for 'dysfunctional' biodiversity condition). Figure 11 provides an example of various condition states of a Brigalow Belah RE (11.9.5), where BioCondition scores have been categorised into the '1234' classes.

An effective way to categorise the BioCondition score as '1234' is to use summary statistics (mean ± standard deviation) of all the BioCondition scores generated for the overall assessment (Table 20). However, this does require a range of BioCondition scores, from dysfunctional through to functional condition, and from a reasonably large sample of sites. Therefore, based on BioCondition scores for >190 sites evenly distributed across condition states (Eyre *et al.* unpublished data) the classification provided in Table 21 can be used.

Table 20: Rules used to delineate the BioCondition '1234' classes

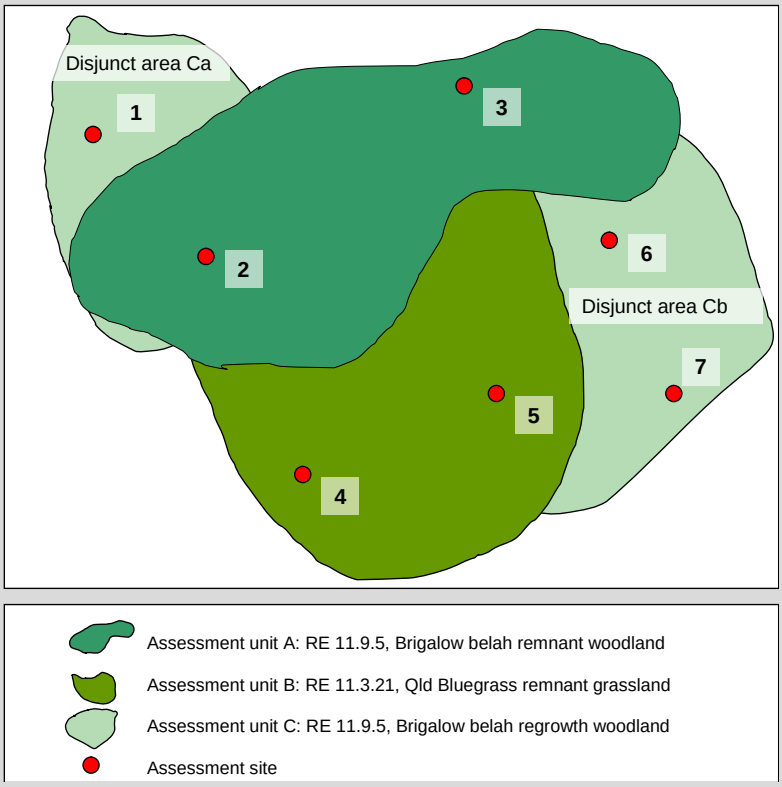
BioCondition class	Lower cut-off of site score for classification
1	Mean +1 standard deviation
2	Mean
3	Mean –1 standard deviation
4	All scores > Mean –1 standard deviation

Table 21: Final classification of BioCondition scores into '1234'

BioCondition class	% Value
1	>0.80
2	>0.60 – 0.80
3	0.40 – 0.59
4	<0.40

Box 8: Example of deriving an area-weighted BioCondition score

The objective of the assessment is to obtain an area-weighted score for the total area of remnant and regrowth vegetation



Seven BioCondition assessment sites were located between three assessment units, and each obtained the following scores:

Assessment site	Assessment unit	Ecosystem type	Site score (S_c)	Landscape score (L_c)	Total BC score
1	Ca	Wooded	35/80 = 0.44	13/20 = 0.65	0.48
2	A	Wooded	77/80 = 0.96	14/20 = 0.70	0.91
3	A	Wooded	71/80 = 0.89	12/20 = 0.60	0.83
4	B	Grassland	22/30 = 0.73	13/20 = 0.65	0.70
5	B	Grassland	24/30 = 0.80	14/20 = 0.70	0.76
6	Cb	Wooded	18/80 = 0.23	14/20 = 0.70	0.32
7	Cb	Wooded	20/80 = 0.25	12/20 = 0.60	0.32



Figure 11: Example of '1234' condition states for Brigalow Belah RE 11.9.5

8 Glossary

Annual species	Annual species are short-lived plants, completing their life-cycle within a single vegetative period, which can vary from a few weeks to several months. Annuals usually die within one year. Annual grasses are generally characterized by short growth, not forming large tussocks or root mass, no evidence of previous seasons growth (i.e. remains of last year's tiller bases, and absence of stolons or rhizomes), with reproduction generally from seed.
Assessment unit	Relatively homogenous unit that is one RE type in one broad condition state (remnant or non-remnant).
Benchmark	A description of a RE that represents the median or average characteristics of a mature and relatively undisturbed ecosystem of the same type.
BioCondition Score	The score assigned to the assessed site that indicates its condition relative to the benchmarks set for the RE being assessed. The score can be expressed as a percentage, on a scale of zero to one, or as a category of 1, 2, 3 or 4.
Biodiversity	The diversity of life forms from genes to kingdoms and the interactions and processes between.
Canopy	The layer formed collectively by the crowns of adjacent trees or shrubs in the case of shrub lands. It may be continuous or discontinuous. The canopy usually refers to the ecological dominant layer.
Cryptogam	Collective term which includes lichens, liverworts, mosses and hornworts.
Diameter at breast height (DBH)	DBH is a measure of the size of the tree and is consistently measured at 1.3 m from the ground. On sloping ground, DBH is measured on the high side of the tree from bare earth ground level. Ensure that the tape is horizontal or at a tangent to the trunk when reading the diameter. On leaning trees, on level ground, 1.3 m is measured from the underside of the lean. If a whorl, bump scar or other abnormality occurs at the 1.3 m mark, measure the diameter at a nominated height (measured in whole 0.1 m increments) above the defect. If a representative measure as described above cannot be taken (e.g. presence of strangler figs), a reasonable estimate of the diameter should be made viewing the tree from two different directions. For multiple stems, a diameter is recorded for each stem, when it divides below 1.3 m.
Dominant species	A species that contributes most to the overall above-ground biomass of a particular stratum (= predominant species).
Ecologically dominant (predominant) layer or species (EDL)	The layer or species making the greatest contribution to the overall biomass of the site and the vegetation community.
Emergent layer	The tallest layer/stratum is regarded as the emergent layer if it does not form the most above-ground biomass, regardless of its canopy cover e.g. poplar box (*Eucalyptus populnea*) trees above a low woodland of mulga (*Acacia aneura*).
Eucalypt species	Under BioCondition, a eucalypt species is any species from the following genera: *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon*, and *Syncarpia*.
Forb	Herbaceous or slightly woody, annual or sometimes perennial plant that is not a grass or life form defined under 'Other species'.

Grass	A collective term for the following plant life forms: tussock grass which forms discrete but open tussocks usually with distinct individual shoots; hummock grass which are coarse xeromorphic grasses with a mound-like form often dead in the middle e.g. genus *Triodia*; other grasses of the family Poaceae, but having neither a distinctive tussock nor hummock appearance.
Grassland RE	A remnant RE described as having a structure code that does not include the terms 'forest', 'scrub', 'vine land', 'shrub land', 'heath' or 'woodland' in the Regional Ecosystem Database.
High-value regrowth	Vegetation that is endangered, of concern and least concern REs that have not been cleared since 31 December 1989
Large tree	A living tree identified as 'large' by a DBH threshold as defined in the benchmark document relevant to a RE. In some REs a different large tree threshold will be identified for eucalypt and non-eucalypt species due to the variation in potential size of these two tree types. For the purpose of defining large trees eucalypts include trees of genera *Angophora, Eucalyptus, Corymbia* and *Lophostemon.* If a large DBH threshold is not provided in the benchmark document, then generic thresholds of >20 cm DBH for non-eucalypts and >30 cm DBH for eucalypts can be used.
Landscape Context	Relates to the size, connectivity and the context or neighbourhood landscape that the site sits within.
Layer	See stratum
Non-eucalypt species	Under BioCondition, a non-eucalypt species is defined as any species that is not listed as a eucalypt.
Non-native plant	Any plant that requires some form of action to reduce its harmful effects on the economy, the environment, human health and amenity. This definition includes both exotic and non-indigenous native species.
Non-remnant vegetation	Non-remnant vegetation is vegetation that fails to meet the structural and/ or floristic characteristics of remnant vegetation. It may include regrowth, heavily thinned or logged and significantly disturbed vegetation, and cleared areas. Non-remnant vegetation may retain significant biodiversity values and includes areas mapped as 'high-value' regrowth.
Organic litter	Includes both fine and coarse organic material such as fallen leaves, twigs and branches <10 cm diameter.
Other species	All plant life-forms that are not trees, shrubs, grasses or forbs.
Perennial species	Perennial species are long-lived plants, tending to persist for three or more years. Generally perennial grasses are characterized by larger bulk than annual grasses i.e. forming tussocks and large root mass with evidence of previous seasons growth i.e. remains of last years tiller bases, and presence of stolons or rhizomes.
Reference site	A site that represents an example of a RE in its reference state, i.e. the natural variability in attributes of an ecosystem relatively unmodified since the time of European settlement. As not all RE's will have examples of totally unmodified states, reference sites represent the "Best On Offer" reference state for that RE in a local area. Data obtained from reference sites are used to establish benchmarks for each of the attributes used within BioCondition (a separate method for collecting data at reference sites is available as a companion document to the BioCondition manual—see Eyre *et al.* (2011).

Regional Ecosystem (RE)	REs were defined by Sattler and Williams (1999) as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.
Remnant vegetation	Remnant vegetation is defined in the *Vegetation Management Act 1999* as vegetation shown on a RE or remnant map. A map showing remnant RE is the same as a 'remnant endangered (or of concern or not of concern) RE map' defined under the *Vegetation Management Act 1999.* Where there are no maps available, remnant vegetation is defined as vegetation where the dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and dominated by species characteristic of the vegetation's undisturbed canopy.
Shrub	Woody plant that is multi-stemmed from the base (or within 200 mm from ground level) or if single stemmed, less than 2 m tall.
Shrub canopy cover	The estimation of the percentage canopy cover of the living shrub layer (see Shrub).
Shrub canopy height	The median canopy height in metres, as estimated for the shrub layer (see Shrub canopy cover).
Stratum	A layer in a community produced by the occurrence at approximately the same level (height) of an aggregation of plants of the same habit (Beadle and Costin 1952).
Tree	Woody plants, more than 2 m tall with a single stem or branches well above the base.
Tree canopy cover	Refers to the estimation of the percentage canopy cover of the canopy tree layer
Tree canopy height	The median canopy height in metres, as estimated for the canopy tree layer (see Tree canopy cover).

9 References

Accad, A, Neldner, V.J, Wilson, B. A, and Niehus, R.E. (2010). Remnant Vegetation in Queensland. Subregion and Bioregion Analysis of Remnant Vegetation 1997-2006, including Regional Ecosystem Information. Queensland Herbarium, Brisbane

Aisthorpe, J., and Paton, C. (2004). Stocktake. Balancing supply and demand. Department of Primary Industries and Fisheries, Brisbane.

Andreasen, J.K., O'Neill, R.V., Noss, R., and Slosser, N.C. (2001). Considerations for the development of a terrestrial index of ecological integrity. Ecological Indicators 1, 21–35.

Andren, H. (1994). Effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat: a review. Oikos 71, 355–366.

Back, P.V., Anderson, E.R., Burrows, W.H., Kennedy, M.K.K., and Carter, J.O. (1997). TRAPS Transect Recording and Processing System: Field guide and software manual. Department of Primary Industries, Rockhampton

Bates, G. (2001). A Duty of Care for the Protection of Biodiversity on Land. Report to the Productivity Commission. AusInfo, Canberra.

Beadle, N.C.W., and Costin, A.B. (1952). Ecological classification and nomenclature. Proceedings of the Linnaean Society of New South Wales 77, 61–82.

Bennett, A., Kimber, S., and Ryan, P. (2000). Revegetation and Wildlife: A guide to enhancing Revegetation Habitats for Wildlife Conservation in Rural Environments. Bushcare National and Research and Development Program Research Report 2/00. Environment Australia, Canberra.

Bowen, M.E., McAlpine, C.A., House, A.P.N., and Smith, G.C. (2007). Regrowth forests on abandoned agricultural land: a review of their habitat values for recovering forest fauna. Biological Conservation 140, 273–296.

Chilcott, C. R., Paton, C. J., Quirk, M. F., and McCallum, B. S. (2003). Grazing Land Management Education Package Workshop Notes – Burnett. Meat and Livestock Australia Limited, Sydney.

Eyre, T.J. (2010). Seven Lessons from Southern Queensland Woodlands. In Lindenmayer, D., Bennett, A., and Hobbs, R. (Eds.), Temperate Woodland Conservation and Management, CSIRO Publishing, Collingwood, pp. 353–359.

Eyre, T.J., Butler, D.W., Kelly, A.L., and Wang, J. (2010). Effects of forest management on structural features important for biodiversity in mixed-age hardwood forests in Australia's subtropics. Forest Ecology and Management 259, 543–546.

Eyre, T.J., Kelly, A.L., and Neldner, V.J. (2011). Method for the Establishment and Survey of Reference Sites for BioCondition. Version 2.0. Department of Environment and Resource Management, Brisbane.

Eyre, T.J., Kreiger, G., Venz, M. F., Haseler, M., Hines, B., Hannah, D., and Schulz, M. (1998). Systematic Vertebrate Fauna Survey Project: Stage I – Vertebrate Fauna Survey in the Southeast Queensland Bioregion. Report for Queensland Comprehensive Regional Assessment/Regional Forest Agreement Steering Committee. Queensland State and Commonwealth Governments, Brisbane.

Eyre, T.J., Maron, M., Mathieson, M.T., and Haseler, M. (2009a). Impacts of grazing, selective logging and hyper-aggressors on diurnal bird fauna in intact forest landscapes of the Brigalow Belt, Queensland. Austral Ecology 34, 705–716.

Eyre, T.J., Wang, J., Venz, M.F., Chilcott, C., and Whish, G. (2009b). Buffel grass in Queensland's semiarid woodlands: response to local and landscape scale variables, and relationship with grass, forb and reptile species. The Rangeland Journal 31, 293–308.

Fahrig, L. (1997). Relative affects of habitat loss and fragmentation on population extinction. Journal of Wildlife Management 61, 603–610.

Fahrig, L. (2001). How much habitat is enough? Biological Conservation 100, 65–74.

Fensham, R. (2008). Leichardt's maps: 100 years of change in vegetation structure in inland Queensland. Journal of Biogeography 35, 141–156.

Fensham, R.J., and Fairfax, R.J. (2000). The effect of exotic pasture development on floristic diversity in central Queensland, Australia. Biological Conservation 94, 11-21.

Fensham, R.J., and Fairfax, R.J. (2008). Water-remoteness for grazing relief in Australian arid-lands. Biological Conservation 141, 1447–1460.

Field, S. A., O'Connor, P. J., Tyre, A. J., and Possingham, H. P. (2007) Making monitoring meaningful. Austral Ecology 32, 485–491.

Franks, A.J. (2002). The ecological consequences of Buffel Grass Cenchrus ciliaris establishment within remnant vegetation of Queensland. Pacific Conservation Biology 8, 99-107.

Freudenberger, D., and Harvey, J. (2003). Assessing the benefits of vegetation enhancement for biodiversity: A draft framework. Report for Environment Australia. CSIRO Sustainable Ecosystems, Canberra.

Freudenberger, D., and Landsberg, J.L. (2000). Management of stock watering points and grazing to maintain landscape function and biological diversity in rangelands. In Hale, P., Petrie, A., Moloney, D., and Sattler, P. (Eds.), Management for Sustainable Ecosystems, University of Queensland, Brisbane, pp. 71–77.

Gibbons, P., Ayers, D., Seddon, J., Doyle, S., and Briggs, S. (2008). Biometric, Version 2.0. A Terrestrial Biodiversity Assessment Tool for the NSW Property Vegetation Plan Developer – Operational Manual. NSW Department of Environment and Climate Change, Canberra.

Gibbons, P., and Freudenberger, D. (2006). An overview of methods to assess vegetation condition at the scale of the site. Ecological Management and Restoration 7, S10-S17.

Greig-Smith, P. (1964). Quantitative Plant Ecology. Butterworths, London.

Grice, A. C. (2004). Weeds and the monitoring of biodiversity in Australian rangelands. Austral Ecology 29, 51–58.

Hawke, A. (2009). Report of the independent review of the Australian Environment Protection and Biodiversity Conservation Act 1999. Department of the Environment, Water, Heritage and the Arts, Canberra.

Hnatiuk RJ, Thackway R and Walker J 2009, 'Vegetation', in The National Committee on Soil and Terrain, *Australian soil and land survey field handbook* (3rd edition), CSIRO Publishing, Melbourne, pp. 73-126.

Hobbs, R.J., and Norton, D.A. (1996). Towards a conceptual framework for restoration ecology. Restoration Ecology 4, 93–110.

Humphries, S.E., Groves, R.H., and Mitchell, D.S. (1991). Plant invasions: The incidence of Environmental Weeds in Australia. Australian National Parks and Wildlife service, Canberra.

Jackson, J. (2005). Is there a relationship between herbaceous species richness and buffel grass (Cenchrus ciliaris)? Austral Ecology 30, 505 – 517.

James, C.J., Landsberg, J.L., and Morton, S. (1999). Provision of watering points in the Australian arid zone: a review of effects on biota. Journal of Arid Environments 41, 87–121.

Karfs, R.A., Abbott, B.N., Scarth, P.F., and Wallace, J.F. (2009). Land condition monitoring information for reef catchments: a new era. The Rangeland Journal 31, 69–86.

Keith, D., and Gorrod, E. (2006). The meanings of vegetation condition. Ecological Management and Restoration 7, S7–S9.

Kelly, A.L., Franks, A.J. and Eyre, T.J (2011). Assessing the assessors: Quantifying observer variation in vegetation and habitat assessment. Ecological Management and Restoration 12, 144-148.

Landsberg, J., and Crowley, G. (2004). Monitoring rangeland biodiversity: Plants as indicators. Austral Ecology 29, 59–77.

Landsberg, J., James, C.D., and Morton, S.R. et al. (1999). The Effects of Artificial Sources of Water on Rangeland Biodiversity. Environment Australia, Canberra.

Lindenmayer, D.B., and Cunningham, R.B. (1997). Patterns of co-occurrence among arboreal marsupials in the forests of central Victoria, south-eastern Australia. Australian Journal Ecology 22, 340–346.

Lindenmayer, D.B., Cunningham, R.B, Pope, M.L., and Donnelly, C. F., (1999). The response of arboreal marsupials to landscape context: A large scale fragmentation study. Ecological Applications 9, 594-611.

Lindenmayer, D.B., Margules, C.R., and Botkin, D.B. (2000). Indicators of biodiversity for ecologically sustainable forest management. Conservation Biology 14, 941–950.

Low Choy. S., O'Leary, R., and Mengersen, K. (2009). Elicitation by design in ecology: using expert opinion to inform priors for Bayesian statistical models. Ecology 90, 265-277.

Mackensen, J., Bauhus, J., and Webber, E. (2003). Decomposition rates of coarse woody debris – a review with particular emphasis on Australian tree species. Australian Journal of Botany 51, 27 – 37.

MacNally, R., and Horrocks, G. (2002). Habitat change and restoration: responses of forest-floor mammal species to manipulations of fallen timber in floodplain forests. Animal Biodiversity and Conservation 1, 41-52.

Maron, M., and Kennedy, S. (2007). Roads, fire and aggressive competitors: determinants of bird distribution in subtropical production forests. Forest Ecology and Management 240, 24-31.

Margules, C.R, Pressey, R.L., and Williams, P.H. (2002). Representing biodiversity: data and procedures for identifying priority areas for conservation. Journal of Bioscience 27, 309–326.

McAlpine, C.A., and Eyre, T.J. (2002). Testing landscape metrics as indicators of habitat loss and fragmentation in continuous eucalypt forests (Queensland, Australia). Landscape Ecology 17, 711–728.

McCarthy, M.A., Parris, K.M., van der Ree, R., McDonnell, M.J., Burgman, M.A., Williams, N.S.G., McLean, N., Harper, M., Meyer, R., Hahs, A., and Coates, T. (2004). The habitat hectares approach to vegetation assessment: an evaluation and suggestions for improvement. Ecological Management and Restoration 5, 24–27.

McElhinny, C. (2002). Forest and Woodland Structure as an index of Biodiversity: A review. Commissioned by NSW NPWS, January 2002. Forestry, ANU, Canberra, ACT, Australia.

McElhinny, C., Gibbons, P., Brack, C., and Bauhus, J. (2005). Forest and woodland stand structural complexity: Its definition and measurement. Forest Ecology and Management 218, 1–24.

McIntyre, S., and Barrett, G.W. (1992). Habitat variegation, an alternative to fragmentation. Conservation Biology 6, 235–260.

McIntyre, S., McIvor, J.G., and Macleod, N.D. (2000). Principles for sustainable grazing in eucalypt woodlands: landscape scale indicators and the search for thresholds. In Hale, P., Petrie, A., Moloney, D., and Sattler, P. (Eds.), Management for Sustainable Ecosystems, University of Queensland, Brisbane, pp. 92–100.

McIntyre, S., and Hobbs, R. (2000). Human impacts on landscapes: matrix condition and management priorities. In: Craig, J.L., Mitchell, and Saunders, D.A. (Eds.), Nature Conservation 5: Nature Conservation in Production Environments: Managing the Matrix, Surrey Beatty & Sons, Melbourne, pp. 301–307.

McIntyre, S., McIvor, J. G. and Heard, K.M. (editors) (2002). Managing and conserving grassy woodlands. CSIRO publishing, Collingwood.

MEWG (Monitoring and Evaluation Working Group) (2004). An interim approach to the native vegetation condition (indicator status: for advice). Canberra

Neldner, V.J. (1984). South Central Queensland. Vegetation Survey of Queensland. Botany Bulletin No. 3. Queensland Department of Primary Industries, Brisbane.

Neldner, V.J. (2006). Why is vegetation condition important to government? A case study from Queensland. Ecological Management and Restoration 7, S5-S7.

Neldner, V.J., Kirkwood, A.B., and Collyer, B.S. (2004). Optimum time for sampling floristic diversity in tropical eucalypt woodlands of northern Queensland. The Rangeland Journal 26, 190-203.

Neldner, V.J., Wilson, B.A., Thompson, E.J., and Dillewaard, H.A. (2012). Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 3.2..Updated August 2012. Queensland Herbarium, Queensland Department of Science, Information Technology, Innovation and the Arts, Brisbane.

Neldner, V.J. and Ngugi, M.R. (2014). Application of the BioCondition assessment framework to mine vegetation rehabilitation. Ecological Management and Restoration 15,158-161.

Noss, R.F. (1990). Indicators for monitoring biodiversity: a hierarchical approach. Conservation Biology 4, 355–364.

Oliver, I., and Parkes, D. (2003). A prototype toolkit for scoring the biodiversity benefits of land use change, Version 5.1. Department of Infrastructure, Planning and Natural Resources, Parramatta.

Oliver, I., Smith, P.L., Lunt, I., and Parkes, D. (2002). Pre-1750 vegetation, naturalness and vegetation condition: what are the implications for biodiversity conservation. Ecological Management and Restoration 3, 176–178.

Oliver, I., Eldridge, D.J., Nadolny, C., and Martin, W.K. (2014). What do site condition multi-metrics tell us about species biodiversity? Ecological Indicators 38, 262-271.

Parkes, D., Newell, G., and Cheal, D. (2003). Assessing the quality of native vegetation: The 'habitat hectares' approach. Ecological Management and Restoration 4, 29–38.

Pringle, H.J.R., and Landsberg, J. (2004). Predicting the distribution of livestock grazing pressure in rangelands. Austral Ecology 29, 31–39.

QDPI (Queensland Department of Primary Industries) (1995). Native Forest Permanent Plot System (Native Forests). Queensland Department of Primary Industries Forest Service, Brisbane.

Radford, J.Q., Bennett, A.F., and Cheers, G.J. (2005). Landscape-level thresholds of habitat cover for woodland-dependent birds. Biological Conservation 124, 317–337.

Sarkar, S., and Margules, C. (2002). Operationalising biodiversity for conservation planning. Journal of Bioscience 27, 299–308.

Sattler, P.S., and Williams, R.D. (eds) (1999). The Conservation Status of Queensland's Bioregional Ecosystems. Environmental Protection Agency, Brisbane.

Tischendorf, L., and Fahrig, L. (2000). How should we measure landscape connectivity? Landscape Ecology 15, 633–641.

Thackway, R., and Lesslie, R. (2006). Reporting vegetation condition using the Vegetation Assets, States and Transitions (VAST) framework. Ecological Management and Restoration 7, S53–S62.

Tongway, D.J., and Hindley, N.L. (2005). Landscape Function Analysis: Procedures for Monitoring and Assessing Landscapes, with Special Reference to Minesites and Rangelands. CSIRO Sustainable Ecosystems, Canberra.

Wayne, A.F., Cowling, A., Rooney, J.F., Ward, C.G., Wheeler, I.B., Lindenmayer, D.B., and Donnelly, C.F. (2005). Factors affecting the detection of possums by spotlighting in Western Australia. Wildlife Research 32, 689–700.

Walker, J., and Hopkins, M.S. (1990). Vegetation. In McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J., and Hopkins, M.S. (Eds.), Australian Soil and Land Survey Field Handbook. Second edition. Inkata Press, Melbourne, pp. 58–86.

With, K.A. (2004). Metapopulation dynamics: perspectives from landscape ecology. In: Hanski, I., and Gaggiotti, O. (Eds.), Ecology, Genetics and Evolution of Metapopulations. Elsevier, San Diego, pp.23–44.

Witt, G.B., Harrington, R.A., and Page, M.J. (2009). Is 'vegetation thickening' occurring in Queensland's mulga lands – a 50-year aerial photographic analysis. Australian Journal of Botany 57, 572–582.

Woinarski, J.C.Z., and Fisher, A. (2003). Conservation and the maintenance of biodiversity in the rangelands. Journal of Rangeland Management 46, 556–590.

Woldendorp, G., Spencer, R.D., Keenan, R.J., and Barry, S. (2002). An analysis of sampling methods for coarse woody debris in Australian forest ecosystems. A report for the National

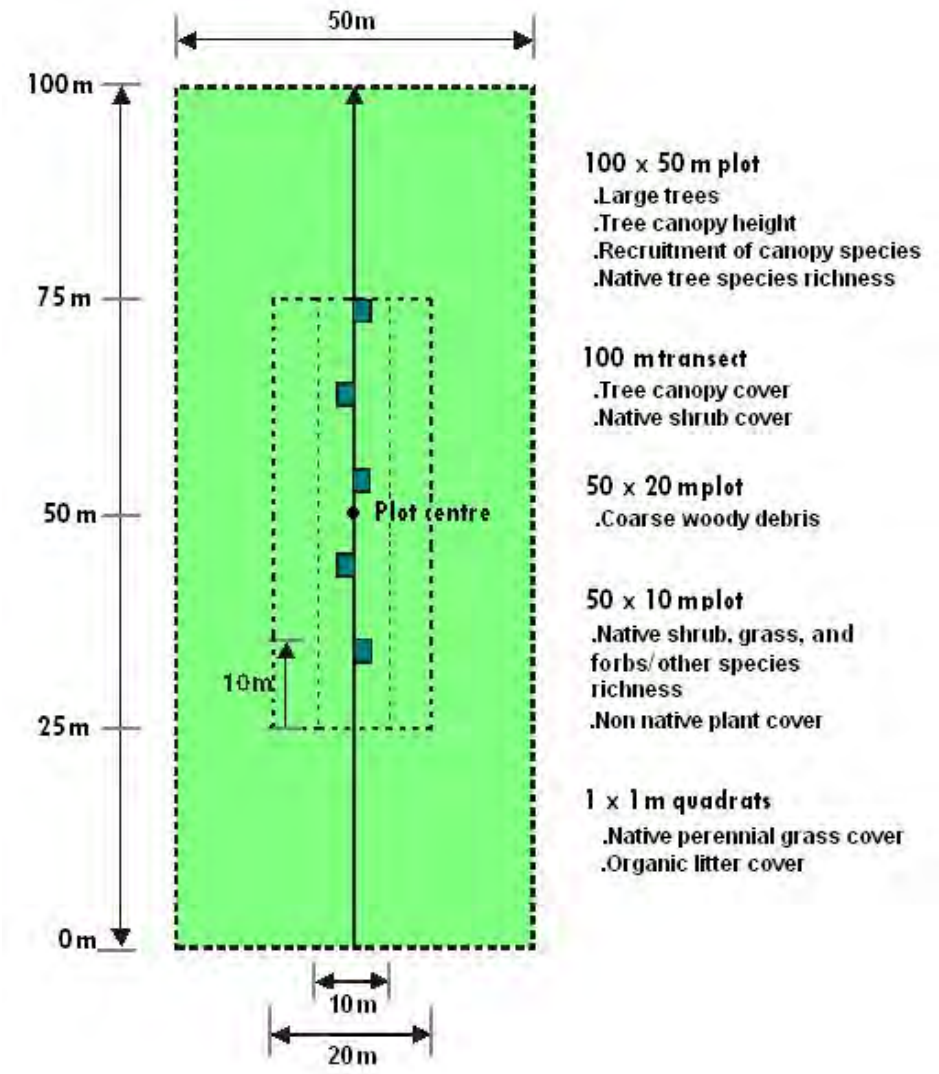
Greenhouse strategy, Module 6.6 (Criteria and indicators of sustainable forest management). Bureau of Rural Sciences, Canberra.

10 Appendices

Appendix 1: Field assessment summary guide

Step 1: **Lay out the plot -** The site can be marked with a 100 m transect that follows the contour i.e. along a slope as opposed to up or down a slope. Mark the 50 m point on the transect with a star picket or temporary marker—this point acts as the centre of the assessment site. Record the compass bearing that the transect follows from the zero point, and also record the location of the zero metre point by GPS.

Step 2: **The field assessment -** Start at the centre of the plot (50 m mark on the transect), and record the site number, Regional Ecosystem (RE), the date of assessment and the property or location name. Using a GPS, mark the position of the 50 m point on the transect. Take landscape photos north, south, east and west (Appendix 4), to provide a record of the tree and shrub layers and the general condition of the site. The assessment of the 10 site-based attributes is conducted within five assessment areas on the 100 x 50 m site, as shown in figure below.



Step 3: Area 1; 50 x 10 m sub-plot, incorporates 25 m to 75 m along the transect, and encompasses 5 m either side of the transect.

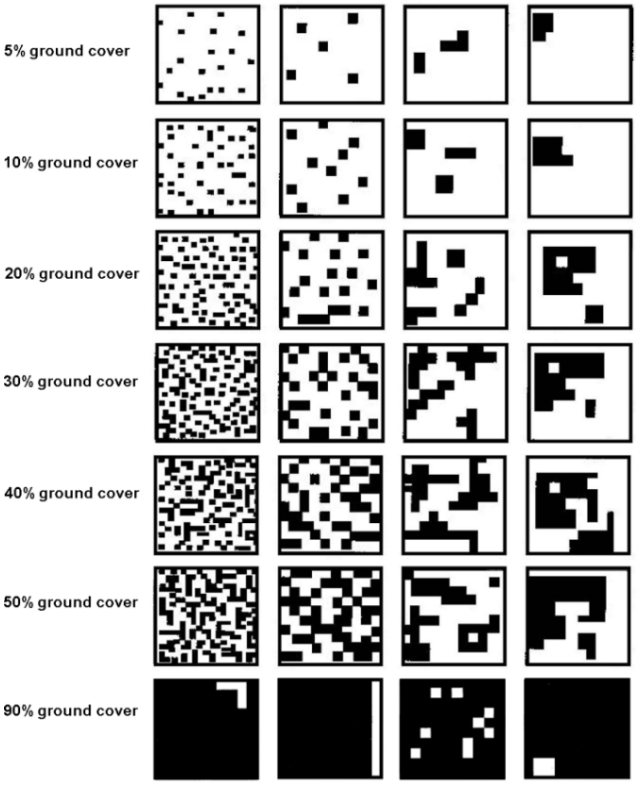
- **Native plant species richness** is assessed by slowly walking along each side of the centre-line and tallying the number of species in each of three life-forms: shrubs, grasses and forbs/other. *NB: Tree species richness is assessed in the 50 x 100 m plot.*

- **Non-native plant cover** is assessed by estimating the cover of exotic species as a component of the overall vegetation cover. The estimate can be improved by dividing the 50 x 10 m plot into smaller areas and then averaging the cover estimate over the entire area. For example, 20 x 5 x 5 m (i.e. 10 plots each side of the tape).

Step 4: Area 2; 50 x 20 m sub-plot, incorporates 25 m to 75 m along the transect, and encompasses 10 m either side of the transect.

- **Coarse woody debris** is assessed by measuring the length of all logs >10 cm diameter, 0.5 m in length and within the 50 x 20 m sub-plot. Logs are assessed if 80% of the log is in contact with the ground. Measure only the portion of the log that is greater than 10 cm diameter or lies within the sub-plot, i.e. only measure the length of the log to the boundary of the sub-plot.

Step 5: Area 3; Five 1 x 1 m sub-plots, starting at the 35 m point, assess ground cover in 1 x 1 m quadrats located 10 m apart, on alternate sides along the transect. If the quadrat location coincides with a feature such as a tree or large log it is acceptable to move the quadrat 1 m up or down the transect. Assess each of the ground cover components so that the cover totals 100% (use figure below as a guide on cover estimates). Although not all components are used in the scoring for BioCondition, assessment of all attributes improves ability to estimate cover of the assessable attributes. Spot photos can be taken of each quadrat to document change in ground cover over time.



- **Native perennial grass cover** refers to the percentage cover of native perennial grasses, assessed within each of the five 1 x 1 m quadrats and averaged to give a value for the site. Depending on the nature of your assessment all perennial grasses can be assessed, or the native perennial grass cover can be split into those species listed in the land type documents as preferred and intermediate or as non-preferred.

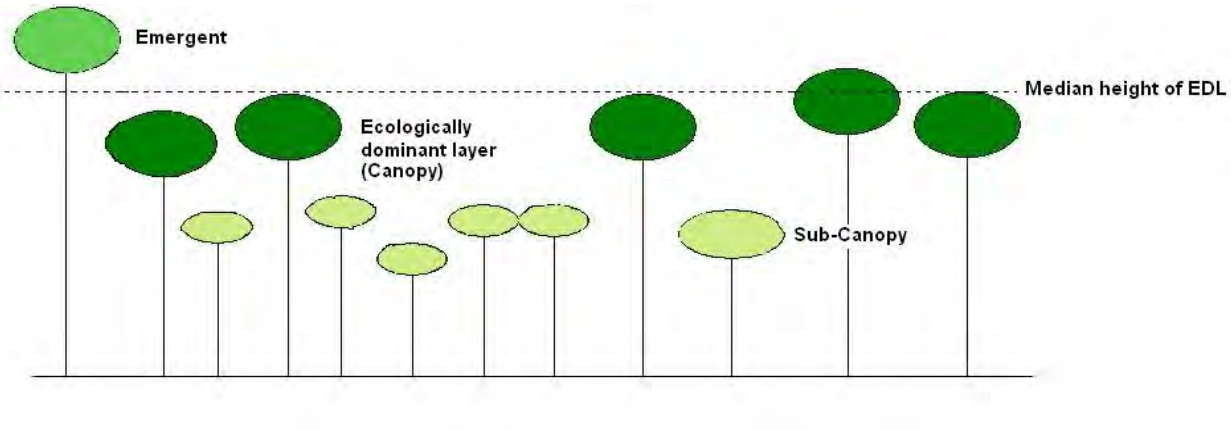
- **Organic litter** is assessed by estimating the cover of fine and coarse organic material such as fallen leaves, twigs and branches <10 cm diameter from the five quadrats and then averaged.

Step 6: Area 4: 100 x 50 m area: Visualising or marking out 25 m either side of the transect line forms the larger assessment area of 100 x 50 m. A greater need arises for precision when assessing the numbers of large trees (i.e. measuring the distance to trees that appear to be 'borderline' within the site). Refer to the benchmark document to determine if there are separate benchmarks for the canopy, emergent and/or subcanopy layers. If more than one layer is identified in the benchmark document, then assessment of each layer is required for the recruitment, canopy height and cover attributes.

- **Number of large trees** is assessed by counting the number of trees within the 100 x 50 m plot area over a certain size threshold, as recorded on the benchmark document for the RE that you are assessing. If no benchmark exists for the RE of interest, use the threshold of 30 cm DBH for 'eucalypt' trees (genera *Eucalyptus, Corymbia, Angophora, Lophostemon* and *Syncarpia*) and 20 cm DBH for 'non-eucalypts'.

- **Recruitment of canopy species** is assessed by observing the proportion of the dominant canopy (EDL) species regenerating (<5 cm DBH) within the 100 x 50 m plot area. Only one regenerating individual is required of each species (e.g. if there are four dominant species of trees then four species need to occur as regeneration to get 100%).

- **Tree canopy height** (measured to the top of the highest leaves) refers to the median canopy height in metres (see figure below), estimated for trees in the EDL (canopy layer). If there are emergent and/or subcanopy layers identified in the benchmark document, median height of these layers needs to be assessed also. The median canopy height is the height that has 50% of canopy trees larger and smaller than it. It is recommended that a clinometer or hypsometer be used if available.



- **Tree species richness** is the count of different tree (single stemmed over 2m) species over the whole 100 x 50m area.

Step 7: Area 5: 100 m transect: tree canopy and shrub canopy cover are assessed along the 100m transect using the line intercept method.

- **Tree canopy cover** refers to the estimation of the percentage canopy cover of the living, native tree canopy overlapping the 100 m transect. For this attribute, in the majority of

cases, only the cover of the trees making up the canopy layer are included. The canopy equates to the ecologically dominant layer (EDL) for forests and woodlands. However, if the benchmark document lists values for more than one layer, then the heights and covers of these layers are assessed separately. Assessors work along the transect line and record the start and finish distance of tree canopies that overlap the transect line[7]. If overlapping trees are in the same layer then they can be recorded as the one tree group.

- **Native shrub canopy cover** uses the same method as for tree canopy cover using a vertical projection of shrub crowns downwards and above the line.

[7] and assign them to canopy and/or subcanopy and/or emergent layers if these layers are distinguished within the benchmark document

Appendix 2: BioCondition field assessment sheet

BIOCONDITION SITE ASSESSMENT DATASHEET

Queensland Government

OFFICE USE ONLY
Entered:..................
Checked:..................
Corrected:..................

Site ID: ....
DATE: ...../...../.....
BioCon survey number:...................
OBSERVERS: ....

SITE INFORMATION

General habitat survey number:..................

LOCATION: (GPS reference) Bioregion: _ _ _ _ _ _ _ _ _ _ _ _

Datum: ☐ AGD84 ☐ GDA94 (WGS84) OTHER: _ _ _ _ _ Location derivation: _ _ _ _ _ _

Road: zone: _ _ easting: _ _ _ _ _ _ northing: _ _ _ _ _ _ _ Plot Centre Direction: _ _ _ m at _ _ _ degrees

Plot Origin: zone: _ _ easting: _ _ _ _ _ _ northing: _ _ _ _ _ _ _ Accuracy: _ _ _

Plot Centre zone: _ _ easting: _ _ _ _ _ _ northing: _ _ _ _ _ _ _ Accuracy: _ _ _

Plot bearing: _ _ _ Plot alignment description: _

Locality description (include tenure and reserve number): _

REGIONAL ECOSYSTEM AND TREE HEIGHTS:

Habitat Description _

Regional Ecosystem: _ _ _ _ _ Tree Canopy (EDL*) height:....... Tree subcanopy and/or emergent ht: S:....... E:.......

SITE PHOTOS:
(Photo Numbers)
Plot centre:
North ☐ South ☐ East ☐ West ☐
Landscape photo(s): ☐ Spot photo(s): ☐

50 x 20m area: (NB: All logs >10cm, >0.5m within 50 x 20m area measured to the plot boundary)

Coarse woody debris:

Length: ....

Site Total:
Per ha Total:

100 x 50m area: (NB: *Ecologically Dominant Layer. Tree defined as single stemmed over 2m. All tree species in the 100 x 50m (not just EDL species)

Total native tree spp richness:

....

Total:

Proportion of dominant canopy (EDL) species with evidence of recruitment: .... %

50 x 10m area: Native Plant Spp Richness: (NB: List species if known or count if unknown. Shrub is defined as single stemmed below 2m or multi-stemmed from base or below 20cm)

	Total
Shrub spp. richness:	
Grass spp. richness:	
Forbs and others spp. richness:	

Non-native plant cover (%): .... %

Version 2.2 27/01/2015 The Database Manager, DSITIA Queensland Herbarium: 3896 9230

BIOCONDITION SITE ASSESSMENT DATASHEET cont....

Five 1 x 1m plots: *attributes are essential to assess as used in scoring, however assessment of all attributes improves your ability to more accurately visualise proportions of each of the attributes.

Ground Cover:	1	2	3	4	5	Mean
Native perennial ('decreaser') grass cover*						
Native other grass (if relevant)*						
Native forbs and other species (non-grass)						
Native shrubs (<1m in height)						
Non-native grass						
Non-native forbs and shrubs						
Litter*						
Rock						
Bare ground						
Cryptograms						
Total	100%	100%	100%	100%	100%	

100 x 50m area: *from benchmark doc.
Eucalypt large tree DBH*: .....
Non-eucalypt large tree DBH*: .....

No. of large eucalypt trees: .....
No. of large non-eucalypt trees: .....

Total large trees: .....

100m transect:
Tree Canopy Cover: (Only assess Emergent (E) or Subcanopy (S) layers if the benchmark document stipulates that layers are present *If trees are in the same layer and continuous along the transect you can group them)

Tree or tree group* (C or S or E)	Distance (m)	Total	Tree or tree group* (C or S or E)	Distance (m)	Total	Tree or tree group* (C or S or E)	Distance (m)	Total	Tree or tree group* (C or S or E)	Distance (m)	Total
										Total C:	
										Total S:	
										Total E:	

Shrub Canopy Cover: * denote as native or exotic. Only native shrub cover is used in the scoring.

Shrubs*	Distance (m)	Total	Shrubs*	Distance (m)	Total	Shrubs*	Distance (m)	Total	Shrubs*	Distance (m)	Total	Shrubs*	Distance (m)	Total
													Total native:	
													Total exotic:	

Version 2.2 27/01/2015 The Database Manager, DSITIA Queensland Herbarium: 3896 9230

Appendix 3: Resources/Contacts for further information

Contacts

Dr Teresa Eyre, Principal Ecologist

Queensland Herbarium, DSITIA

Mt Coot-tha Brisbane Botanic Gardens

Mt Coot-tha Road Toowong Q 4066

Ph. 07 3896 9834

teresa.eyre@dsitia.qld.gov.au

Ms Annie Kelly, Senior Ecologist

Queensland Herbarium, DSITIA

Mt Coot-tha Brisbane Botanic Gardens

Mt Coot-tha Road Toowong Q 4066

Ph. 07 3896 9878

annie.kelly@dsitia.qld.gov.au

Dr John Neldner, Science Leader

Queensland Herbarium, DSITIA

Mt Coot-tha Brisbane Botanic Gardens

Mt Coot-tha Road Toowong Q 4066

Ph. 07 3896 9322

john.neldner@dsitia.qld.gov.au

Plant identification guides

Queensland - general

Andrews, S.B. (1990) Ferns of Queensland. Queensland Department of Primary Industries, Brisbane.

Auld, B.A. and Medd, R.W. (1992) Weeds – An illustrated botanical guide to the weeds of Australia. Inkata Press, Melbourne, Sydney

Boland, D.J., Brooker, M.I.H., Chippendale, G.M., Hall, N., Hyland, B.P.M., Johnston, R.D., Kleinig, D.A. and Turner, J.D. (1984) Forest Trees of Australia (Fourth edition revised and enlarged). CSIRO, Australia.

Bostock, P.D. and Holland, A.E. (2007) *Census of the Queensland Flora*. Queensland Herbarium, Environmental Protection Agency, Brisbane.

Brooker, M.I.H. and Kleinig, D.A. (1994) *Field Guide to Eucalyptus, Volume 3*. Inkata Press, Sydney.

Hacker, J.B. (1990) *A Guide to Herbaceous and Shrub Legumes of Queensland*. University of Queensland Press, Australia.

Jones, D.J. and Gray, B. (1988) *Climbing Plants of Australia*. Reed, Sydney.

Jones, D.J. (1988) *Native Orchids of Australia*. Reed, Sydney.

Kleinschmidt, H.E. and Johnson, R.W. (1979) *Weeds of Queensland* (Reprinted with corrections 1987). Queensland Department of Primary Industries, Brisbane.

Kleinschmidt, H.E., Holland, A. and Simpson, P. (1996)) *Suburban Weeds (Third Edition)*. Department of Primary Industris, Queensland.

Low, T. (1991) *Wild Herbs of Australia and New Zealand (Revised Edition)*. Angus & Robertson, New South Wales.

Pedley, L. (1987) *Acacia in Queensland*. Department of Primary Industries, Queensland.

Sharpe, P.R. (1986) *Keys to Cyperaceae, Restionaceae and Juncaceae of Queensland.* Queensland Botany Bulletin No. 5, Department of Primary Industris, Queensland.

Williams, K.A.W. (1979) Native Plants of Queensland, Volume 1. Keith A.W. Williams, North Ipswich.

Williams, K.A.W. (1984) Native Plants of Queensland, Volume 2. Keith A.W. Williams, North Ipswich.

Williams, K.A.W. (1987) Native Plants of Queensland, Volume 3. Keith A.W. Williams, North Ipswich.

Williams, K.A.W. (1999) Native Plants of Queensland, Volume 4. Keith A.W. Williams, North Ipswich.

Central Queensland

Anderson, E. (2003) *Plants of central Queensland, their identification and uses*. Department of Primary Industris, Queensland.

Pearson, S. and Pearson, A. (1991) *Plants of Central Queensland*. The society for Growing Australian Plants, Kangaroo Press, New South Wales.

Meltzer, R. and Plumb, J. (2005) *Plants of Capricornia*. Capricorn Conservation Council. Queensland

Southern Queensland

Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. and Leigh, J.H. (1992) *Plants of Western New South Wales.* Inkata Press, Melbourne, Sydney.

Henry, D.R., Hall, T.J., Jordan, D.J., Milson, J., Schefe, C.M. and Silcock, R.G. (1995) *Pasture Plants of Southern Inland Queensland*. Department of Primary Industris, Queensland.

Lithgow, G. (1997) *60 Wattles of the Chinchilla and Murilla Shires*. Chinchilla, Queensland.

Harden, G.J. (1990) *Flora of New South Wales Volume 1*. Royal Botanic Gardens, Sydney.

Harden, G.J. (1991) *Flora of New South Wales Volume 2*. Royal Botanic Gardens, Sydney.

Harden, G.J. (1992) *Flora of New South Wales Volume 3*. Royal Botanic Gardens, Sydney.

Harden, G.J. (1993) *Flora of New South Wales Volume 4*. Royal Botanic Gardens, Sydney.

Tothill, J.C. and Hacker, J.B. (1996) The Grasses of Southern Queensland, The Tropical Grassland Society of Australian Inc. Queensland.

South East Queensland

Floyd, A.G. (1989) Rainforest Trees of Mainland South-eastern Australia. Inkata Press, Sydney.

Harden, G.J., McDonald, W.J.F. and Williams, J.B. (2007) *Rainforest Climbing Plants a field guide to their identification.* Gwen Harden Publishing, New South Wales.

Harden, G.J., McDonald, W.J.F. and Williams, J.B. (2006) *Rainforest Trees and Shrubs a field guide to their identification.* Gwen Harden Publishing, New South Wales.

Harrold, A. (1994) Wildflowers of the Noosa – Cooloola Area. An Introduction to the Trees and Wildflowers of the Wallum, Noosa Parks Association Inc., Noosa Heads.

Haslam, S. (2004) *Noosa's Native Plants*. Noosa Integrated Catchment Association Inc. Queensland.

Podberscek M. (1991) Field guide to the Eucalypts of the Gympie, Imbil and Maryborough Forestry Districts. Technical Paper. Queensland Forest Service, Brisbane.

Stanley T.D. and Ross E.M. (1983) *Flora of south-eastern Queensland Vol. 1.* Queensland Department of Primary Industries, Brisbane.

Stanley T.D. and Ross E.M. (1986) *Flora of south-eastern Queensland Vol. 2.* Queensland Department of Primary Industries, Brisbane.

Stanley T.D. and Ross E.M. (1989) *Flora of south-eastern Queensland Vol. 3.* Queensland Department of Primary Industries, Brisbane.

Tame, T. (1992) *Acacias of Southeast Australia.* Kangaroo Press, Kenthurst.

North Queensland

Beasley, J. (2009) *Plants of Cape York. The Compact Guide.* John Beasley, Cairns.

Brock, J. (1993) *Native Plants of Northern Australia.* Reed, Sydney.

Clarkson, J. (2009) *A Field Guide to the Eucalypts of the Cape York Peninsula Bioregion.* Queensland Government.

Hyland, B.P.M. and Whiffin, T. (1993) *Australian Tropical Rain Forest Trees.* CSIRO, Australia.

Smith, N.M. (2002) *Weeds of the Wet/Dry Tropics of Australia. A Field Guide.* Environment Centre NT Inc., Darwin.

Wheeler, J.R., Rye, B.C., Kock, B.L. and Wilson, A.J.G. (1992) *Flora of the Kimberley Region.* Department of Conservation and Land Management, Western Australia.

North-west Queensland

Barr, S. (1999) *Plants of the Outback. A Field Guide to the Native Plants around Mount Isa.* Safety, Heal and Environment Department, Mount Isa Mines Limited.

Milson, J. (2000) *Pasture Plants of North-West Queensland*. Department of Primary Industries, Queensland.

Milson, J. (2000) *Trees and Shrubs of North-West Queensland*. Department of Primary Industries, Queensland.

West and south-west Queensland

Alexander, R. (2005) *A field guide to the plants of the channel Country Western Queensland*. Channel Landcare Group, Queensland.

Jessop, J. (1981) *Flora of Central Australia*. The Australian Systematic Botany Society, Reed, Sydney.

Milson, J. (1995) *Plant Identification in the Arid Zone*. Department of Primary Industries, Queensland.

Moore, P. (2005) *A Guide to Plants of Inland Australia.* Reed, Sydney.

Santos (2003) *Field Guide to the common plants of the Cooper Basin (South Australia and Queensland).* Santos Ltd. Adelaide, South Australia.

Santos (2007) *Field Guide to Trees and Shrubs of Eastern Queensland Oil and Gas Fields.* Santos Ltd. Adelaide, South Australia.

Appendix 4: Taking photos

(Adapted from Land Manager's Monitoring Guide Photopoint Monitoring, and Land Management Agreement - Rural Leasehold Land Self-Assessment Guideline and BioCondition v1.6).

Taking photographs of site features from a fixed point is a great way to keep a permanent visual record of how attributes have changed over time. Photographs can be the most reliable and useful record collected in any monitoring program, as they best represent how things were over time, in comparison to our memories which aren't as reliable as we think.

Each time you do an assessment, two photo types are recommended to be taken at each site.

1. Spot photo

This is a photo taken from head height looking nearly vertically down on a spot marked with a one square metre frame or quadrat, as shown in Figure 12. You can use the base of your plot centre marker to relocate the same spot each time you visit. Spot photos provide a detailed picture of the ground cover, organic litter and plant species for a standard-sized area. It is common to find a great variety in ground cover at any given site so taking more spot photos will help record this variation. It is important to have a system that allows you to take the spot photos in the same place each time you do an assessment. For example, spot photos could be taken along the transect line where you are doing your ground and litter cover assessments (i.e. 35, 45, 55, 65 and 75 m).



Figure 12: Taking a spot photo—try and keep the top of your feet out of the frame and angle the camera down as straight as possible

2. Landscape photo

Landscape photos are taken of features in the intermediate distance or further to provide an overview of the entire site and its surrounds. They illustrate the general condition of the site, showing changes in tree, shrub and ground layers over time. These site specific landscape photos can also be used to record particular disturbance events such as flood levels and damage or the impacts of a bushfire.

The landscape photo is taken from near the plot centre, holding your camera so that the image is taken with a 'landscape' perspective—that is where the picture is wider than it is high. Stand next to the plot centre marker (Figure 13), facing south (recommended direction – see 'photo tips'), and position the horizon so it cuts the photo frame in half (half above the horizon and half below). Then take the photo focusing on infinity. Recording how the photo was lined up or simply taking a copy

of the picture with you on future visits will make lining up the shot easier. Alternatively, taking a series of plot centre landscape photos in a north, south, east and west direction (with the aid of a compass), allows you to pick up more of the variation across the site and is easy to replicate next time an assessment is done.



Figure 13: Taking landscape photos—record the bearing or direction of the photo in order to assist with replicate photos on subsequent visits.

Photo tips

- *Any type of camera from colour print film to a digital camera can be used to take these photos. Digital cameras are ideal, allowing instant review of an image for clarity and colour—this ensures you always have a good photo for your records.*
- *The best photos are generally taken on a clear day between 9 am and 3 pm. Before 9 am and after 3 pm will generally result in more shadowing and different colour cast which may conceal some important features. Overcast days are great for photography in closed communities such as rainforests, scrubs and thickets, as the even light removes much of the shadowing.*
- *A common problem is too much light blanking out the colour and detail of the image. If you have control over your camera settings, this can be reduced by setting the exposure compensation to a negative setting. This is done by using the auto-exposure lock (AE lock) or by using spot metering. Your camera's user guide will explain how to use these functions on your particular camera. The troubleshooting section is often a good place to find these and other useful solutions.*
- *You will always get a better photo by having the sun behind you with the sunlight shining on the landscape facing you. If you are only taking one photo it is best to be facing south to avoid having the sun shining into your lens.*
- *For each photograph, record the relevant area, land type and site, the date the photo was taken, and the direction the photo was taken (N/S/E/W). The date stamp feature on your camera may be useful if it does not obscure important components of a photograph. Photos can be stored in a database (scanned if not digital) and/or printed and kept on file with the monitoring records.*

Appendix 5: Measuring tree height

a) Stick or pencil method

(Extracted from Abed, T., and Stephens, N.C. (2002). *Tree measurement manual for farm foresters - Practical guidelines for farm foresters undertaking basic inventory in farm forest plantation stands*. National Forest Inventory, BRS, Canberra.)

1. Take a straight stick of known length (preferably 30 – 40 cm long)
2. Place a mark on the stick at the point 1/10th of its length from the bottom. For example, if the stick is 30 cm long, place the mark at 3 cm from the bottom.
3. Holding the stick vertically at full arm's length, walk backwards from the tree you wish to measure, until the top and bottom of the stick match with the top and bottom of the tree.
4. Note where your mark lines up with the tree trunk and have your co-worker, standing at the tree, put their hand up to this point on the tree trunk. Then measure the distance from the ground to this point on the tree. Call this the 'tree mark height'.
5. As the mark on the stick was 1/10th of it total length, the mark on the tree is also 1/10th of the total tree height. Therefore multiply the tree mark height by 10 to get the total tree height.

Hint 1: Depending on the height of the trees you may need a longer or shorter stick. Alternatively a tape measure or ruler can be used instead of a stick.

Hint 2: The stick or pencil method has the disadvantage of having a high level of error and is time consuming. It is recommended that, if possible, a vertex hypsometer or clinometer (see next section) should be used to determine tree height. Optical hypsometers use lasers to calculate the horizontal distance to the tree, and then automatically calculate the height of the tree once the angle to the highest part of the tree and to its base is recorded.



b) Clinometer method

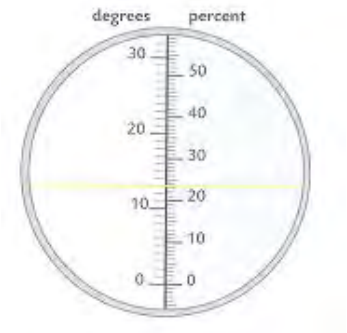
(Extracted from Abed and Stephens 2002)

The Suunto clinometer (clino) is a tool commonly used by foresters to measure tree heights and slope angles. At the rear of the clino is a peephole, which shows a percentage scale and a horizontal line (see figure below).

1. First measure the horizontal distance between the base of the tree and the operator.
2. Looking through the peephole, line up the horizontal line with the top of the tree (the highest part of the tree—usually foliage) and read off the corresponding number from the percentage scale, which is on the right hand side. The scale on the left is in degrees and should not be used.
3. Line up the horizontal line with the base of the tree and again read off the corresponding number from the percentage scale.
4. If the base of the tree is above you (i.e. you're on the downward slope) then subtract the number from step 3 from the number in step 2 and multiply by the horizontal distance to get a total tree height.
5. If the base of the tree is level with you or below you (i.e. you're on the upward slope) then add the numbers together and multiply by the horizontal distance to get a total tree height.
6. If the tree is leaning, stand at right angles to the lean so the tree isn't leaning towards or away from you. If the highest part of the tree is not directly above the trunk, then adjust the horizontal distance so that it relates directly to the highest part of the tree.

Hint: If you can't see the bottom of the tree because of branches or understorey, sight to a point up the stem that can be seen and treat this as the base of the tree and continue with the procedure as described above. Then add the height from the base to the point you could see to get your estimate of total height.

Looking through a clinometer



Using a clinometer



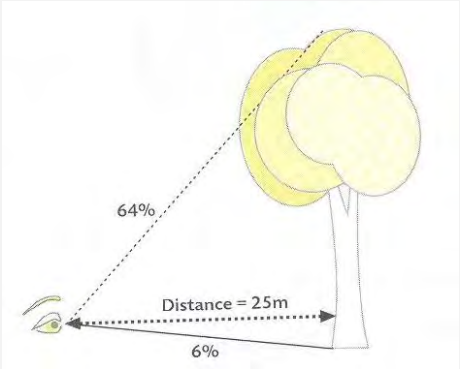
The heights of the crown can also be measured using a laser instrument called a hypsometer. Where the top of the tree is not directly above the base of the trunk, it is important to also measure the point directly below the highest point of the tree canopy to get an accurate crown height.

EXAMPLE:

Jenny wants to determine the height of two trees, with the first tree slightly below her and the second tree slightly above her. Using a tape measure, she measures the distance between her and the first tree, which is 25 m away. Using the clinometer, she sights to the top of the tree and sees the horizontal line align with the percentage number 64, she then sights to the base of the tree and finds the percentage number to be 6. She adds both percentage numbers and multiplies the distance to get a tree height of 17.5 m.

Tree height = 25 x (0.64 + 0.06)

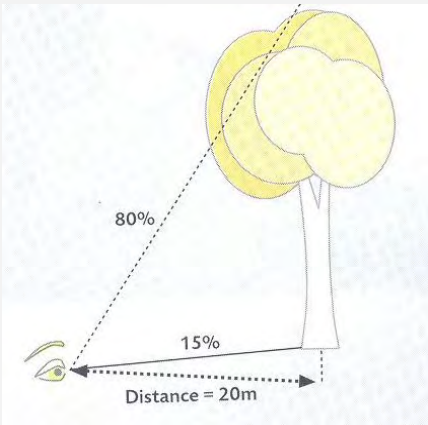
= 17.5 m



Jenny then repeats the procedure with the second tree and measures a distance of 20 m from the tree. The percentage to the top of the tree is 80. The percentage to the bottom of the tree is 15. Therefore tree height of the second tree is 13 m.

Tree height = 20 x (0.8 –0.15)

= 13 m



Appendix 6: Stratifying vegetation

In BioCondition, assessment of the tree height, recruitment and tree canopy cover attributes require consideration of the distinct vegetation layers or strata that make up the community. In general, site-based assessment of vegetation uses structure (vertical and horizontal distribution of vegetation: its growth form, height, cover and strata) and floristics (dominant genera or species in various strata and characteristic species) (Hnatiuk *et al*. 2009). In Queensland, the structural and floristic characteristics of the vegetation are used in defining and describing REs. Details of the methods used to classify vegetation and regional ecosystems in Queensland are described in Neldner *et al.* (2012).

Determining the ecologically dominant layer

Once the vegetation community has been classified into strata (see Box 9), the determination of the ecologically dominant layer (EDL) is made. The EDL contains the greatest amount of above-ground vegetation biomass (Neldner 1984).

Example 1: EDL; RE 3.5.24, *Eucalyptus chlorophylla* open-woodland (EDL), Cape York Peninsula

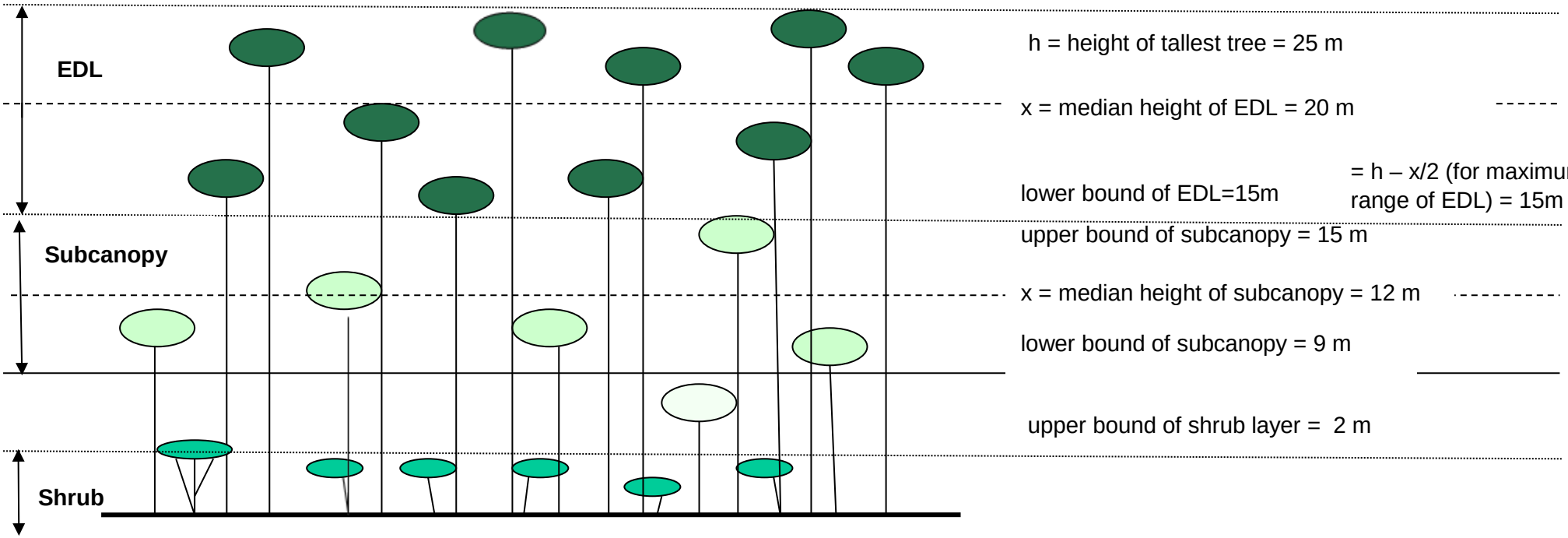
EDL



Here the above-ground biomass of the trees is estimated to be larger than the grass layer, and is the EDL. Generally if the tree layer in these situations has a canopy cover of 8% or more, then the trees will form the EDL.

In the majority of cases in wooded communities, it is the tallest layer that forms the most above-ground biomass, except in the case of widely scattered emergent trees. Therefore, in most cases only the EDL layer is assessed for the attributes tree canopy cover, height and recruitment in BioCondition. Exceptions include rainforest canopies with emergent species and mixed genus woodlands (e.g. poplar box and mulga woodlands).

Box 9: Method to determine vegetation strata, when not obvious



1. The median EDL tree height (x) is 80% of the height of the tallest tree (excluding emergents).
2. The height range for the EDL = x/2
3. The lower height bound of the EDL = h – x/2.
4. Repeat the process to obtain the height range for the subcanopy.
5. The shrub layer contains all woody plants that are either multi-stemmed from the base (or within 200 mm from ground level) or if single stemmed, less than 2 m tall.

Example (above diagram): height of tallest tree h = 25 m. Therefore the height range for the EDL is 15 to 25 m with a median = 20 m (80% of h); the subcanopy is 9 to 15 m, the shrub layer is <2 m.

Example 2: Emergent layer and EDL; RE 5.7.2, *Acacia catenulata* low woodland (EDL) with emergent *Eucalyptus thozetiana*.



Example 3: EDL and shrub layer; RE 2.5.15, *Melaleuca viridiflora* low woodland (EDL) with a distinct shrub layer of *Petalostigma banksii* on western Cape York Peninsula.



Example 4: EDL and shrub layer; RE 2.5.12, *Eucalyptus pruinosa* low woodland (EDL) with low shrub layer of *Acacia* spp.



Example 5: Multi-layers: RE 8.5.1, coastal *Corymbia* spp. woodland (EDL) with a subcanopy layer of *Melaleuca viridiflora* and immature canopy trees. The layers in some forest communities can be relatively indistinct.



The impact of disturbance on vegetation structure

While in an undisturbed state, a vegetation community will develop a distinct structure (height and cover) based on the growth forms of the species present and their abundance. Frequently different species define and dominate different layers. However, within an ecosystem the structural attributes (height and cover) will frequently vary depending on the environmental conditions at the site (e.g. rainfall and soil depth). Where there has been significant natural (e.g. cyclones, fires or floods) or human disturbance (e.g. clearing or logging), the structure and floristics of the vegetation can be significantly altered. At these sites, the development of distinct layers may not occur or be indefinite, and the resultant communities may develop a number of structural outcomes (see below). In these situations, it is important to compare the heights and canopy covers of the vegetation at the site to the defined layers in the benchmark documents. For example, in the RE 6.5.3 *Eucalyptus populnea* predominates forming a distinct but discontinuous canopy (10 - 20 m tall). A lower tree layer (subcanopy) of *Acacia aneura* is sometimes present. After disturbance, at least three structures may develop (1) *E. populnea* woodland with little or no subcanopy, (2) *A. aneura* woodland with none or only scattered *E. populnea* emergents, or (3) regenerating woodland of both species. In each structural type it is important to compare the heights and covers of both *E. populnea* and *A. aneura* with the layers they dominate in the benchmark site.



RE 6.5.3: *Eucalyptus populnea* predominates forming a distinct but discontinuous canopy (10 – 20 m tall) (EDL). A subcanopy of *Acacia aneura* is sometimes present.

Examples of benchmarks for REs with more than one layer



RE 6.5.3 *Eucalyptus populnea* woodland with *A. aneura* subcanopy.

Canopy (EDL) of *Eucalyptus populnea*
Benchmark height = 15 m. Benchmark canopy cover = 18%

Subcanopy of *Acacia aneura*
Benchmark height = 8 m. Benchmark canopy cover = 30%

SCENARIO 1. Assessment of 6.5.3, where the site has all or most of *A. aneura* cleared, and remaining vegetation is *E. populnea* woodland.



All *Acacia aneura* cleared.

Height of canopy (EDL) = 15 m, height of subcanopy = 0 m. Measured canopy (EDL) cover = 18%, subcanopy cover = 0%. Using BioCondition scores, this site will score 5 for canopy (EDL) height (15/15 = 100% of benchmark) and a score of 5 for canopy (EDL) cover (18/18 = 100% of benchmark), but 0 for subcanopy height (0/8 = 0% of benchmark) and subcanopy cover (0/30 = 0% of benchmark). Therefore, when the scores for canopy and subcanopy are averaged for the attributes height and cover, the overall scores are 2.5 for height and 2.5 for canopy cover.

SCENARIO 2. All or most of *E. populnea* has been cleared, and remaining vegetation is *A. aneura* low woodland.



Most *Eucalyptus populnea* cleared

Even though *A. aneura* is the EDL at this site, values are compared to subcanopy benchmarks as this is where it dominates in the undisturbed state. Height of subcanopy (*A. aneura*) = 8 m, height of canopy (EDL, *E. populnea*) is 15 m. Measured subcanopy cover = 30%, canopy (EDL) cover = 8%. This site scores 5 for height (15/15 =100% of canopy benchmark gets score of 5 and 8/8 = 100% of subcanopy benchmark gets score of 5) and 4 for cover (8/18 = 44% of canopy benchmark gets score of 3 and 30/30 = 100% of subcanopy benchmark gets score of 5).

SCENARIO 3. All vegetation has been cleared, and regrowth vegetation is an *E. populnea, A. aneura* low woodland



All vegetation cleared. Single layer of regrowth.

Height of canopy = 5 m (both species). Measured canopy cover = 15% *E. populnea* and 30% *A. aneura.* This site scores 3 for canopy height (5/15 = 33% of benchmark) and 5 for subcanopy height (5/8 = 63% of benchmark), giving an average score of 4 for height. This site scores 5 for both canopy and subcanopy cover (15/18 = 83% of canopy benchmark and 100% of subcanopy benchmark), giving an average score of 5 for cover.

Appendix 7: Life/growth forms used in BioCondition

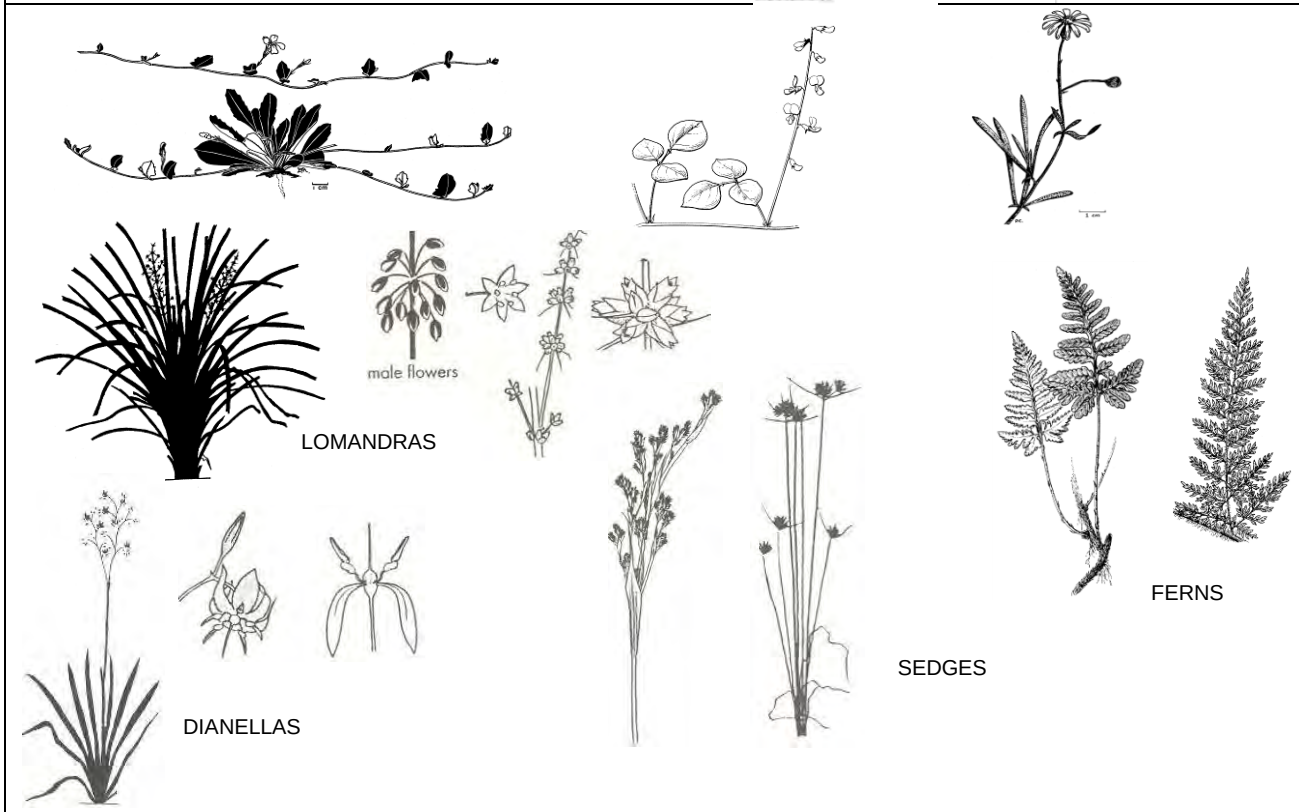
Code	Name	Description	BioCondition Category
T	TREE	Woody plants, more than 2 m tall with a single stem or branches well above the base	Tree
M	TREE MALLEE	Woody perennial plant usually of the genus *Eucalyptus*. Multi-stemmed with fewer than 5 trunks of which at least 3 exceed 10 cm diameter at breast height (DBH). Usually 8 m or more.	Tree
S	SHRUB	Woody plant multi-stemmed from the base (or within 200 mm from ground level) or if single stemmed, less than 2 m.	Shrub
Y	MALLEE SHRUB	Commonly less than 8 m tall, usually with 5 or more trunks, of which at least three of the largest do not exceed 10 cm DBH.	Shrub
Z	HEATH SHRUB	Shrub usually less than 2 m, commonly with ericoid leaves (nanophyll or smaller). Often a member of one of the following families: Ericaceae, Myrtaceae, Fabaceae and Proteaceae. Commonly occur on nutrient-poor substrates.	Shrub
C	CHENOPOD SHRUB	Single or multi-stemmed, semi-succulent shrub of the family Chenopodiaceae exhibiting drought and salt tolerance.	Shrub
U	SAMPHIRE SHRUB	Genera (of Tribe Salicornioideae, viz: *Sarcocornia*, and *Tecticornia*) with articulate branches, fleshy stems and reduced flowers within the Chenopodiaceae family, succulent chenopods. Also the genus *Suaeda*.	Shrub
G	TUSSOCK GRASS	Forms discrete but open tussocks usually with distinct individual shoots, or if not, then forming a hummock. These are the common agricultural grasses.	Grass
H	HUMMOCK GRASS	Coarse xeromorphic grass with a mound-like form often dead in the middle; genus *Triodia*	Grass
W	OTHER GRASS	Member of the family Poaceae, but having neither a distinctive tussock nor hummock appearance.	Grass
V	SEDGE	Herbaceous, usually perennial erect plant generally with a tufted habit and of the families Cyperaceae and Restionaceae.	Other
R	RUSH	Herbaceous, usually perennial erect plant. Rushes are grouped into families Juncaceae, Typhaceae, Restionaceae and the genera *Lomandra* and *Dianella*.	Other
F	FORB	Herbaceous or slightly woody, annual or sometimes perennial plant; not a grass, and including ground orchids.	Forbs
D	TREE FERN	Spirally arranged crowns on erect trunks several metres high (U.N.E 1989), characterised by large and usually branched leaves (fronds), arborescent and terrestrial; spores in sporangia on the leaves.	Shrubs
E	FERNS AND FERN ALLIES	Characterised by large and usually branched leaves (fronds), herbaceous to arborescent and terrestrial to aquatic; spores in sporangia on the leaves.	Other

Code	Name	Description	BioCondition Category
B	BRYOPHYTE	Mosses and Liverworts. Mosses are small plants usually with a slender leaf-bearing stem with no true vascular tissue. Liverworts are often moss-like in appearance or consisting of a flat, ribbon-like green thallus.	Other
N	LICHEN	Composite plant consisting of a fungus living symbiotically with algae; without true roots, stems or leaves.	Other
K	EPIPHYTE	Epiphytes (including orchids), mistletoes and parasites. Plant with roots attached to the aerial portions of other plants. Often could also be another growth form, such as fern or forb.	Other
L	VINE	Climbing, twining, winding or sprawling plants usually with a woody stem.	Other
P	PALM	Palms and other arborescent monocotyledons. Members of the Arecaceae family or the genus *Pandanus*. (*Pandanus* is often multi-stemmed).	Trees
X	XANTHORRHOEA	Australian grass trees. Members of the family Xanthorrhoeaceae.	Shrubs
A	CYCAD	Members of the families Cycadaceae and Zamiaceae	Shrubs
J	SEAGRASS	Flowering angiosperms forming sparse to dense mats of material at the subtidal and down to 30m below MSL. Occasionally exposed.	Grass
Q	AQUATIC	Plant growing in a waterway or wetland with the majority of its biomass under water for most of the year. Fresh, saline or brackish water.	Other
O	LOWER PLANT	Alga, fungus.	Other
UNK	UNKNOWN		Other

Appendix 8: Life-form identification

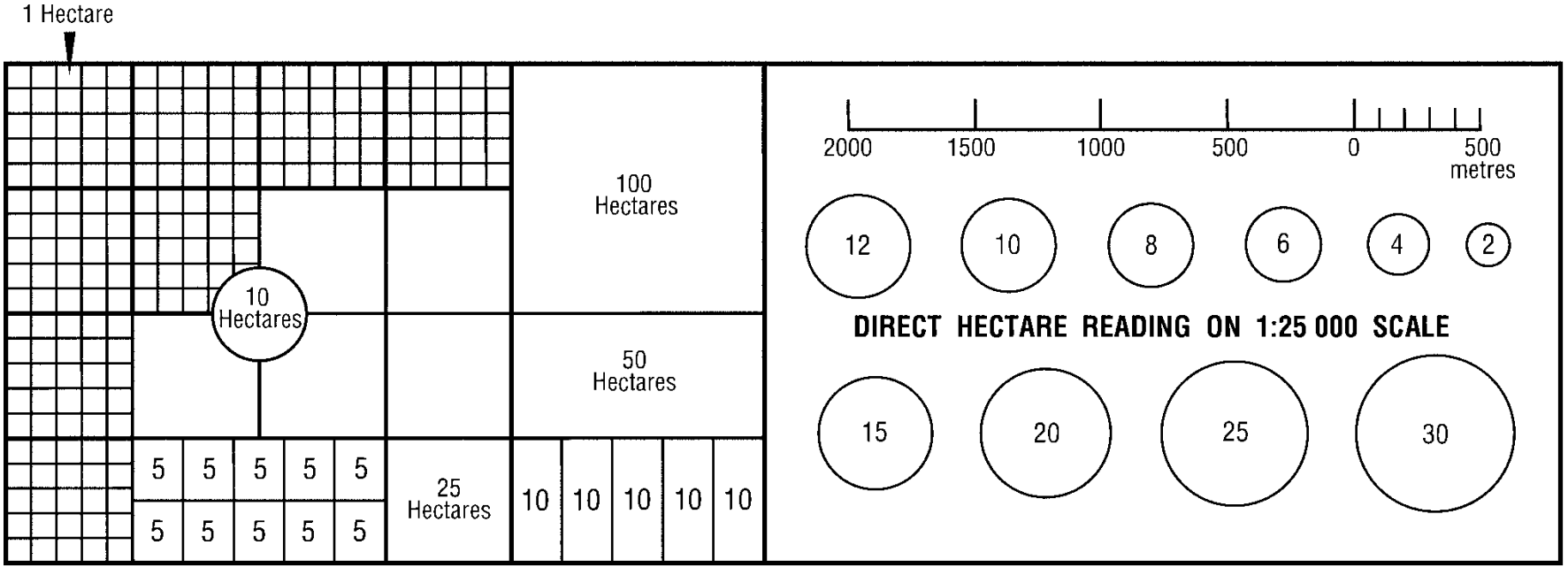
Diagrams reproduced from the Queensland Herbarium and with permission from Robinson, L. (1991). *Field guide to the Native Plants of Sydney*. Kangaroo Press, Sydney.

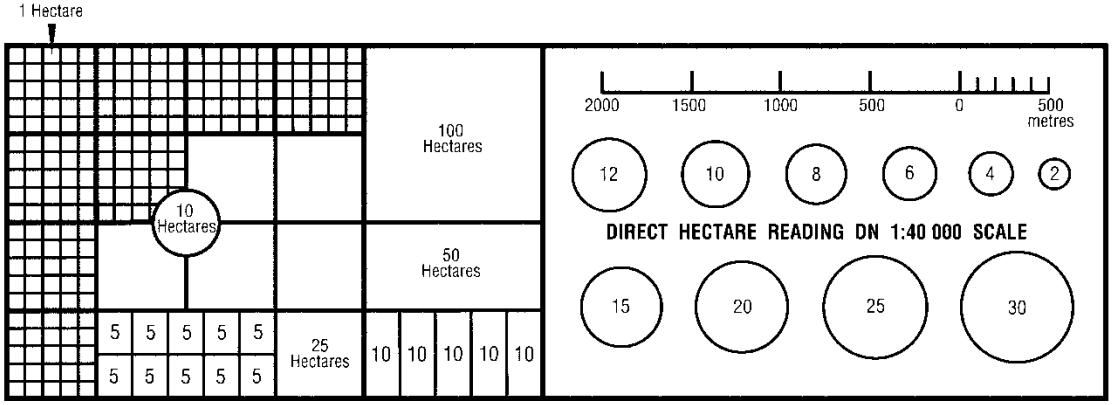
Diagrams (not to scale)	Description
	**Trees:** Trees include all single stemmed woody plants (with the exception of mallee species, which are multi-stemmed) greater than 2 m tall.
	**Shrubs:** Includes woody plants with multiple stems (excluding mallees.). Includes Cycads and Xanthorrhoeas.

Diagrams (not to scale)	Description
	**Grasses:** Includes all perennial and annual grasses (annual grasses are characterised by short growth, and don't form large tussocks or root mass like perennial grasses, no evidence of previous seasons growth (i.e. remains of last year's tiller bases, and absence of stolons or rhizomes, tussock, hummock and other grass species belonging to the family Poaceae).
	**Forbs:** Herbaceous or slightly woody, annual or sometimes perennial plants other than grasses. **Other species**: Slightly woody plants (subshrubs) or ferns, vines, sedges or rushes. Less than 1 m. Sedges and rushes such as Lomandra and Dianella can often be mistaken for grass. Distinction is based on the flowers. In the case of Lomandra the leaves are often flat with some parallel venation and are often quite tough. Although some species have cylindrical leaves and can be difficult to distinguish unless there are flowers, which are typically yellow. Dianella are similar often with broad flat leaves, usually arising from a flat base, flowers tend to be rich blue.

Appendix 9: Aerial photograph area calculation guide

From: Jones, K.L. (2000) *Aerial Photography Interpretation standards and guidelines for mapping forest resource and condition in Queensland.* Department of Natural Resources, Brisbane. ISBN 073451 6584.





Appendix 10: A method to display BioCondition scores for attributes at a site

There are a number of methods that have been used to display the results of vegetation condition site assessments (Neldner and Ngugi 2014; Oliver et al. 2014). One of these is the radar or "spider web" graphs which can be constructed in Microsoft Excel. The spider web diagrams of the BioCondition attribute scores provide a comparison between site scores and the benchmark for each attribute. This can assist in the clear detection of attributes requiring management attention during monitoring programs in vegetation rehabilitation and/or areas undergoing changes in management.

Table 22. BioCondition scores relative to the maximum score for each attribute.

Attribute	Large trees	Tree canopy height	Recruit-ment	Tree canopy cover	Shrub layer cover	Coarse woody debris	Native plant species richness	Non-native plant cover	Native perennial grass cover	Litter cover
maximum score for attribute	15	5	5	5	5	5	20	10	5	5
score _2010	5	2	3	3	3	2	10	10	3	3
site score relative to maximum score_2010	33.33	40	60	60	60	40	50	100	60	60
score _2013	10	3	3	3	5	5	14	5	3	5
site score relative to maximum score_2013	66.67	60	60	60	100	100	70	50	60	100
score _2015	10	5	5	5	5	5	17.5	5	5	5
site score relative to maximum score_2015	66.67	100	100	100	100	100	87.5	50	100	100

The example in Figure 14 shows the change in site scores relative to the maximum score for each attribute from measurements made at a site in 2010, 2013 and 2015, using a radar graph. The sub-scores for each of the life-forms contributing to the native plant species richness attribute score (i.e. trees, shrubs, grasses and forbs/other) could be also be graphed if required. Similarly, the landscape attributes could also be displayed on the graph.

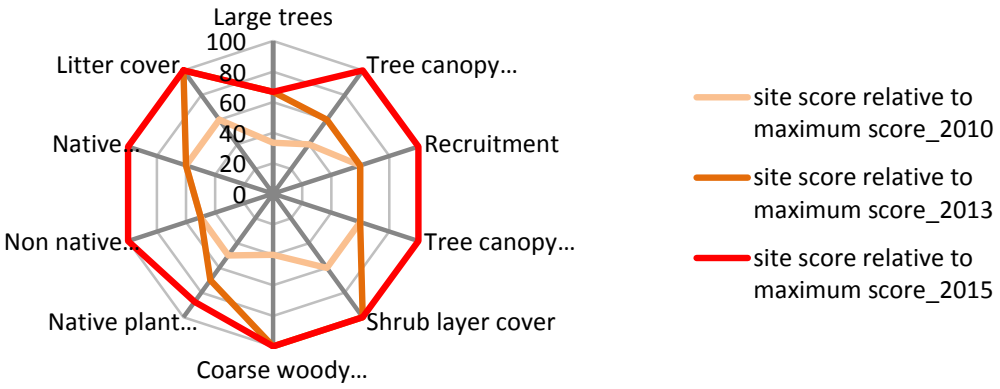


Figure 14 BioCondition scores relative to the maximum score for each attribute

APPENDIX 3

Revegetation Actions and Rationale

Timeline/Stage	Action	Rationale
1.0 Delineation of revegetation areas *Aim: To define the revegetation areas as they become available during progressive rehabilitation determining what revegetation technique will be undertaken and the amount of preparation required prior to ensure suitable areas for re-establishing RE12.9-10.2* *Note, PMLU is 'Return to Natural Ecosystem'*	1.1 Determine revegetation area	Identify and physically mark out the areas that will be rehabilitated as they become available for rehabilitation.
	1.2 Evaluate imagery and vegetation of mine lease and surrounds	Collate and evaluate vegetation data in relation to mapping of remnant vegetation communities across the wider region to assist in validation of rehabilitation RE choice, and compared with ground truthing. Identify local species and stem density in remnant vegetation at analogue sites.
	1.3 Soil testing, surveying and mapping in revegetation areas	Undertake soil testing to determine soil conditions: pH, electrical conductivity (EC), available Bray phosphorus, Emerson Aggregate Test, organic carbon, plant available water-holding capacity (PAWC), hydraulic conductivity (Ksat), and particle size distribution. Consideration may need to be given to testing for macro and microelements, heavy metals, and persistent organochloride pesticides (Dieldrin). This will provide information on possible required ameliorants. All methods to be undertaken as per the *Australian Soil and Land Survey Field Handbook* (National Committee on Soil and Terrain, 2009) and *Guidelines for Surveying Soil and Land Resources* (McKenzie et al., 2008).
	1.4 Identify analogue sites	Conduct field surveys to locate potential analogue sites (in the required RE) to use as a benchmark for comparison with rehabilitated areas that are earmarked for return to native ecosystem rehabilitation. Species lists to be determined for identification of future seed or tubestock required for revegetation of RE. Analogue plot set up including photo point and finessing site attribute scoring criteria to be undertaken as per Queensland Herbarium *Method for the Establishment and Survey of Reference Sites for BioCondition, Vol 3*. **If no analogue site available, RE remnant benchmark attributes to be used as comparable scoring alternative**
2.0 Site preparation *Aim: To prepare site for revegetation activities*	2.1 Weed management	Weed and exotic pasture grass management is to be conducted, and Weeds of National Significance and State listed Category 3 restricted plants (refer PCRP, Section 5.2) are to be controlled, in revegetation areas prior to revegetation.
	2.2 Ground preparation	Rows should be ripped according to individual site conditions (e.g., rotary hoeing or equivalent may be required if clodding is apparent).
	2.3 Soil amelioration	Soil amelioration may be required if recommended by an appropriately qualified person following soil testing and mapping.
	2.4 Row preparation	Following ripping and soil amelioration (if required), rows are to be prepared for planting tubestock or direct seeding. Tubestock is to be mulched directly around planted individuals, with plants positioned at a distance derived from the density indicated in the RE technical descriptions. Consideration of row dimensions to allow for weed control of re-emerging exotic grasses and weeds through mechanical slashing and spraying between rows (if required).
3.0 Revegetation *Aim: To reinstate predetermined RE*	3.1 Priority species selection for RE, determined by prior collated species and technical description	Species have been selected considering both the technical description for the RE, the analogue site assessments and the native species detected on site during field surveys. The latter are particularly relevant as these species are able to persist in the current conditions of the site. The technical description for RE 12.9-10.2 is provided in **Appendix 1**, which provides species found in this RE. The final restoration target density is also provided (stem density), with the planting density to be determined based on environmental and climatic considerations, as well as the form of plantings (tubestock vs seeding). In particular, increased planting density (compared to target density) is required to account for seedling or sapling mortality; however, each site needs to consider mortality factors such as current weather conditions (e.g. drought), capacity/requirement to provide on-going watering, weed management and pest management.
	3.2 Seed collection and trials	Seed collection and storage is required to be undertaken every 1-2 years to ensure quantities and seed capture of endemic species with irregular seed set cycles (e.g. those that only flower every two years). Trials are required to determine viability of seeds and if any they require dormancy breaking. This will also assist in determining rates of required seed sowing.
	3.3 Planting - General	Revegetation areas are to be sprayed with a suitable herbicide prior to planting. Herbicides must be registered by the Australian Pesticides and Veterinary Medicine Authority for use within proximity to waterways, be used in strict accordance with the product label directions and applied by an appropriately qualified person in accordance with the *Agricultural Chemicals Distribution Control Act 1996*. Planting is to be carried out at the beginning of the growing season to allow maximum growing time prior to extreme temperatures, particularly summer heat. Planting must be undertaken in the morning or late afternoon to avoid heat/desiccation stress and must be within seven days of at least 25 mm of rainfall. Species can be seeded over ripped rows or planted as tubestock. If using tubestock, these must be sun-hardened prior to planting, and tree mulch rings are recommended. Tree guards are required to prevent herbivory by native or pest animals (e.g. Eastern Grey Kangaroo, European Hare).
	3.4 Watering regime	All plants must be watered in their pots prior to planting, as well as after placement in the soil. Watering must be with low pressure water stream only. The method of water delivery and distribution is to be determined based on the most suitable methods for the site conditions. Further watering will be subject to weather conditions and planting season (more watering required during dry weather). Plant health and soil moisture levels must be assessed by site inspection at least weekly in the first month after planting; a water schedule is provided in **Table 3.3** in the Revegetation Plan.
4.0 Monitoring and management *Aim: To monitor revegetation areas to guide management activities*	4.1 Monitor revegetation areas to guide management actions	Monitoring is to include: • Weed species present and spatial spread (to guide weed control requirements), including weed monitoring at analogue sites • Revegetation health (to provide information on whether additional plants, water or other revegetation requirements are needed) • Presence and extent of erosion (to provide information for additional site stability works, if required) Monitoring timeframes are provided in **Table 4.1** in the Revegetation Plan.
	4.2 Weed management	Undertake weed management activities on and adjacent to revegetation areas to ensure no detrimental impact on plants, until the revegetation meets the RE criteria.
	4.3 Fire management	Fire breaks will be required to be established and maintained around revegetation areas. Fire is to be excluded from within the revegetation areas for a minimum of 15-20 years, or until it meets the RE criteria.
	4.4 Monitoring revegetation for progress of rehabilitation at annual intervals	Monitoring transects are to be established at the time of first planting, and permanently identified by both GPS and survey markers (e.g. star picket with yellow caps at centre and end points) to ensure consistent monitoring and photo locations over time. Annual monitoring is to follow the BioCondition survey process used when analogue sites were established to ensure consistent data collection, assessment, and reporting. In addition to data, this includes standardised photos of each plot locations (see Attachment 2 of the *BioCondition Assessment Manual*). Tree density counts are also to be undertaken. This data will be disseminated and produced as a report for relevant stakeholders. An adaptive management approach should be undertaken following each monitoring event, whereby management and revegetation activities are modified if necessary to ensure the revegetation areas are progressing towards the intended target (e.g. replacement plantings, etc).

BAAM
ECOLOGICAL CONSULTANTS

specialised ecological knowledge
that reduces your risk

13 August 2021

Conservation and Biodiversity Policy Unit
Department of Environment and Science

To whom it may concern,

RE: Certification by suitably qualified person, Protected Flora Survey

I, Dr Jarrah Wills, Senior Ecologist at Biodiversity Assessment and Management Pty Ltd (BAAM), completed a targeted flora survey within areas of vegetation proposed to be cleared at the 'Jackal Renewables' facility located at 149 Rhondda Road, New Chum (Lot 273 on SP128662)

In accordance with the Queensland *Flora Survey Guidelines – Protected Plants* (Version 2.01, 2020), I hereby certify that:

a). I have adhered to all statutory requirements and flora survey guideline requirements; and
b) In the area surveyed I have not found any plants (as detailed in this report) that are currently listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable or near threatened in the *Nature Conservation (Plants) Regulation 2020*; and
c). The ecological assessment report provides an accurate and full account of the flora survey.

A copy of my CV that demonstrates I have the necessary qualifications and experience to undertake flora surveys in accordance with the Queensland *Flora Survey Guidelines – Protected Plants* (Version 2.01, 2020) is included in the attached report.



Dr Jarrah Wills
Senior Ecologist
Biodiversity Assessment and Management Pty Ltd

Document Control Sheet

File Number: 0410-005

Project Manager: Dr Jarrah Wills

Client: Ardent Group Pty Ltd

Project Title: Protected Flora Survey Report – Jackal Renewables

Project Author/s: Shelley Trevaskis

Project Summary: This report presents the results of a flora survey for protected plant species, undertaken in accordance with the Queensland *Flora Survey Guidelines – Protected Plants*, for a proposed clearing impact area at 149 Rhondda Road, New Chum (Lot 273 on SP128662), to accompany an application for a protected plant clearing permit or activity exemption under the Queensland *Nature Conservation Act 1992*.

Draft Preparation History

Draft	Date Issued	Checked By	Issued By
0410-005 Draft A	20/08/2021	Jedd Appleton	Shelley Trevaskis

Revision/Checking History Track

Version	Date Issued	Checked By	Issued By
0410-005 Version 0	8/09/2021	Jedd Appleton	Jarrah Wills

Destination	Revision					
		Date Dispatched		Date Dispatched		Date Dispatched
Client Copy 1 – digital	A	20/08/2021	0	8/09/2021		
Client Copy 1 – hard copy						
PDF server	A	20/08/2021	0	8/09/2021		
PDF backup – archived	A	20/08/2021	0	8/09/2021		
Hard copy – BAAM library						

NOTICE TO USERS OF THIS REPORT

Purpose of Report

Biodiversity Assessment and Management Pty Ltd has produced this report in its capacity as {consultants} for and on the request of Ardent Group Pty Ltd (the "Client") for the sole purpose of documenting the results of a flora survey for protected plant species, undertaken in accordance with the Queensland *Flora Survey Guidelines – Protected Plants*, for a proposed clearing impact area at 149 Rhondda Road, New Chum (Lot 273 on SP128662), to accompany an application for a protected plant clearing permit or activity exemption under the Queensland *Nature Conservation Act 1992* (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.

This report has been produced solely for the benefit of the Client. Biodiversity Assessment and Management Pty Ltd does not accept that a duty of care is owed to any party other than the Client. This report is not to be used by any third party other than as authorised in writing by Biodiversity Assessment and Management Pty Ltd and any such use shall continue to be limited to the Specified Purpose. Further, Biodiversity Assessment and Management Pty Ltd does not make any warranty, express or implied, or assume any legal liability or responsibility for any third party's use in whole or in part of the report or application or use of any other information or process disclosed in this report and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by any person or body corporate arising from or in connection with the supply or use of the whole part of the report through any cause whatsoever.

Biodiversity Assessment and Management Pty Ltd has used information provided to it by the Client and governmental registers, databases, departments and agencies in the preparation of this report. Biodiversity Assessment and Management Pty Ltd does not know, nor does it have any reason to suspect, that the information provided to it was false, inaccurate, incomplete or misleading at the time of its receipt. This report is supplied on the basis that while Biodiversity Assessment and Management Pty Ltd believes all the information in it is deemed reliable at the time of publication, it does not warrant its accuracy or completeness and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by any person or body corporate arising from or in connection with the supply or use of the whole or any part of the information in this report through any cause whatsoever.

Copyright and reproduction

This report and all indexes, schedules, annexures or appendices are subject to copyright pursuant to the Copyright Act 1968 (Cth). Subject to statutory defences, no third party may reproduce, publish, adapt or communicate to the public, in whole or in part, the content of this report without the express written consent of Biodiversity Assessment and Management Pty Ltd.

Signed on behalf of
Biodiversity Assessment and Management Pty Ltd

Date: 8/09/2021



Director

PROTECTED FLORA SURVEY REPORT 'JACKAL RENEWABLES' - 149 RHONDDA ROAD, NEW CHUM

Table of Contents

1.0 INTRODUCTION 1
1.1. BACKGROUND AND PURPOSE 1
1.2. REPORT CONTENT 1
1.3. PROPOSED CLEARING AREA 1
2.0 METHODOLOGY 1
2.1. INITIAL DESKTOP REVIEW 1
2.2. FIELD SURVEY APPROACH 1
2.3. QUALIFICATIONS OF FIELD TEAM 4
2.4. SURVEY TIMING 4
3.0 RESULTS 4
3.1. DESKTOP ASSESSMENT 4
3.2. FIELD ASSESSMENT 4
4.0 POTENTIAL IMPACTS 8
5.0 CONFIRMATION OF EXEMPT CLEARING NOTIFICATION AND SUBMISSION REQUIREMENTS 8
6.0 REFERENCES 9

List of Figures

Figure 1.1 Site Location
Figure 2.1 Survey Effort

List of Appendices

Appendix 1 Flora Survey Trigger Map of the Site
Appendix 2 Wildlife Online Database Search Results
Appendix 3 DNRM Regulated Vegetation and Essential Habitat Mapping
Appendix 4 Survey Personnel Curriculum vitae

List of Abbreviations

BAAM	Biodiversity Assessment and Management Pty Ltd
DES	Queensland Department of Environment and Science
EVNT	Endangered, Vulnerable or Near Threatened
NC Act	Queensland *Nature Conservation Act 1992*
RE	Regional Ecosystem

1.0 INTRODUCTION

1.1. BACKGROUND AND PURPOSE

Biodiversity Assessment and Management Pty Ltd (BAAM) has prepared this report for Ardent Group Pty Ltd to document the results of a survey undertaken in accordance with the Queensland *Flora Survey Guidelines - Protected Plants* (DES, 2020) for the clearing of vegetation at the 'Jackal Renewables Pty Ltd' facility located at 149 Rhondda Road, New Chum (Lot 273 on SP128662) (**Figure 1.1**).

As the vegetation proposed to be cleared is identified as occurring within a high risk area on the Queensland Department of Environment and Science (DES) flora survey trigger map (**Appendix 1**), targeted searches for flora species listed as Endangered, Vulnerable or Near Threatened (EVNT) under the Queensland *Nature Conservation Act 1992* (NC Act) are required to be undertaken in accordance with the Queensland *Flora Survey Guidelines - Protected Plants* (DES, 2020) before a clearing permit or exemption can be applied for under the NC Act.

1.2. REPORT CONTENT

In accordance with the Queensland *Flora Survey Guidelines - Protected Plants* (DES, 2020), the following information is provided in the subsequent sections of this report:

- A description of the location and map of the area to be cleared.
- A description of the survey methodology, including:
  - survey techniques;
  - a statement to justify the suitability and qualifications of the person undertaking the flora survey; and
  - justification of the timing of the flora survey (with details of any limitations associated with the timing).
- A description of the habitat types identified for the clearing impact area and a map of the GPS data showing the on-ground surveys undertaken and extent of the clearing impact area.

1.3. PROPOSED CLEARING AREA

The proposed works areas include three separate locations within the Jackal Renewables facility (Study Area) (**Figure 1.1**). The vegetation in these locations was generally disturbed and featured eucalypt open forest regrowth with a partially weed infested understorey.

The surrounding landscape includes cleared and highly disturbed lands, water bodies, minor roadways and bushland.

2.0 METHODOLOGY

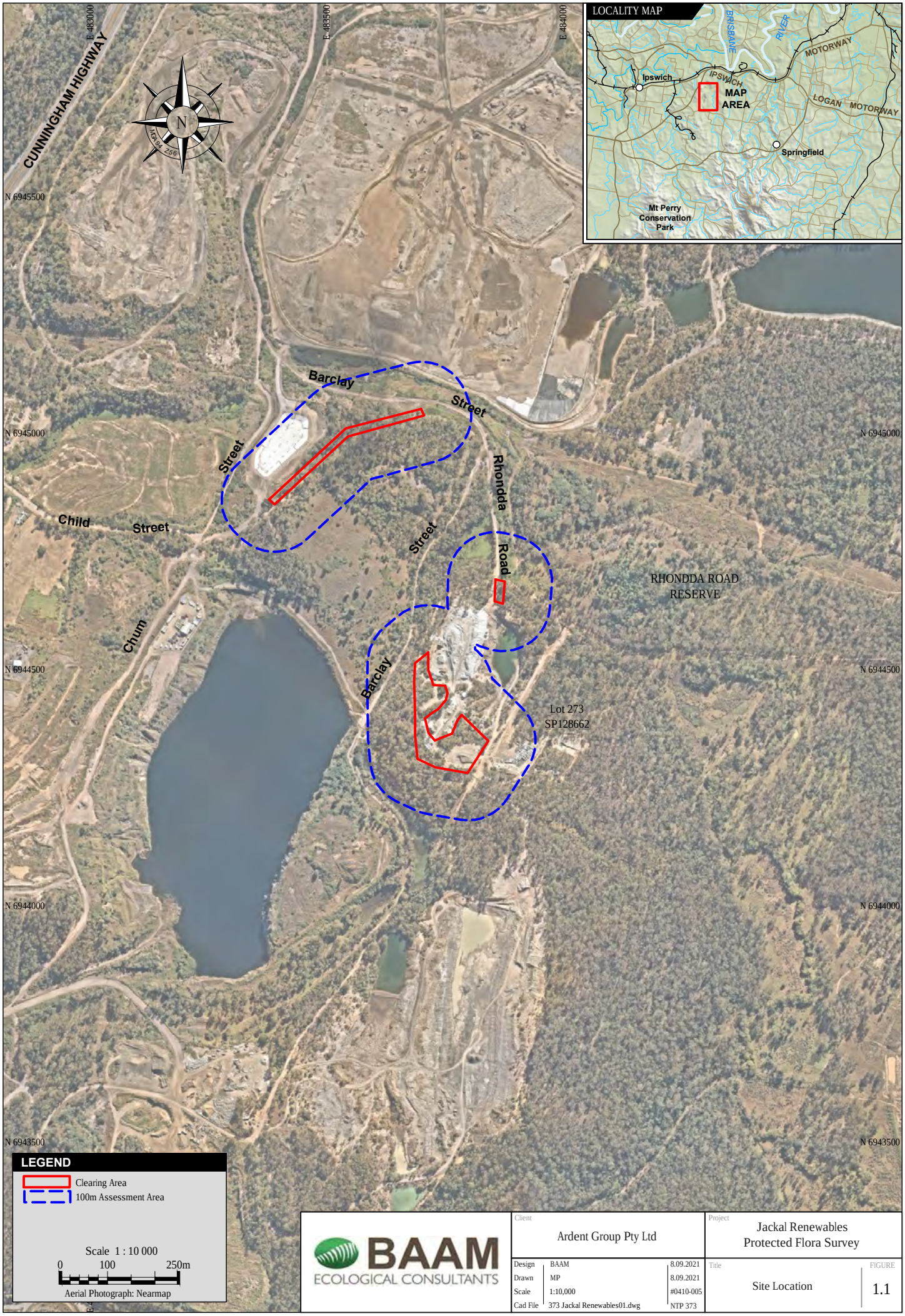
2.1. INITIAL DESKTOP REVIEW

A review of available information was undertaken to determine which EVNT flora species may occur within the proposed clearing area and immediate surrounds, such that survey effort could be targeted towards confirming the presence or absence of these species. Specifically, this involved accessing and reviewing:

- DES's Wildlife Online Database (**Appendix 2**) and the Atlas of Living Australia online database, to determine whether any EVNT species listed under the NC Act have been previously recorded within the vicinity.
- State mapping of regulated vegetation and associated Essential Habitat (**Appendix 3**), to determine whether preferred habitats for potentially occurring EVNT flora species may occur; and
- Reference material on the target species (species profiles, etc.) to confirm habitat requirements and distinguishing features to assist field identification.

2.2. FIELD SURVEY APPROACH

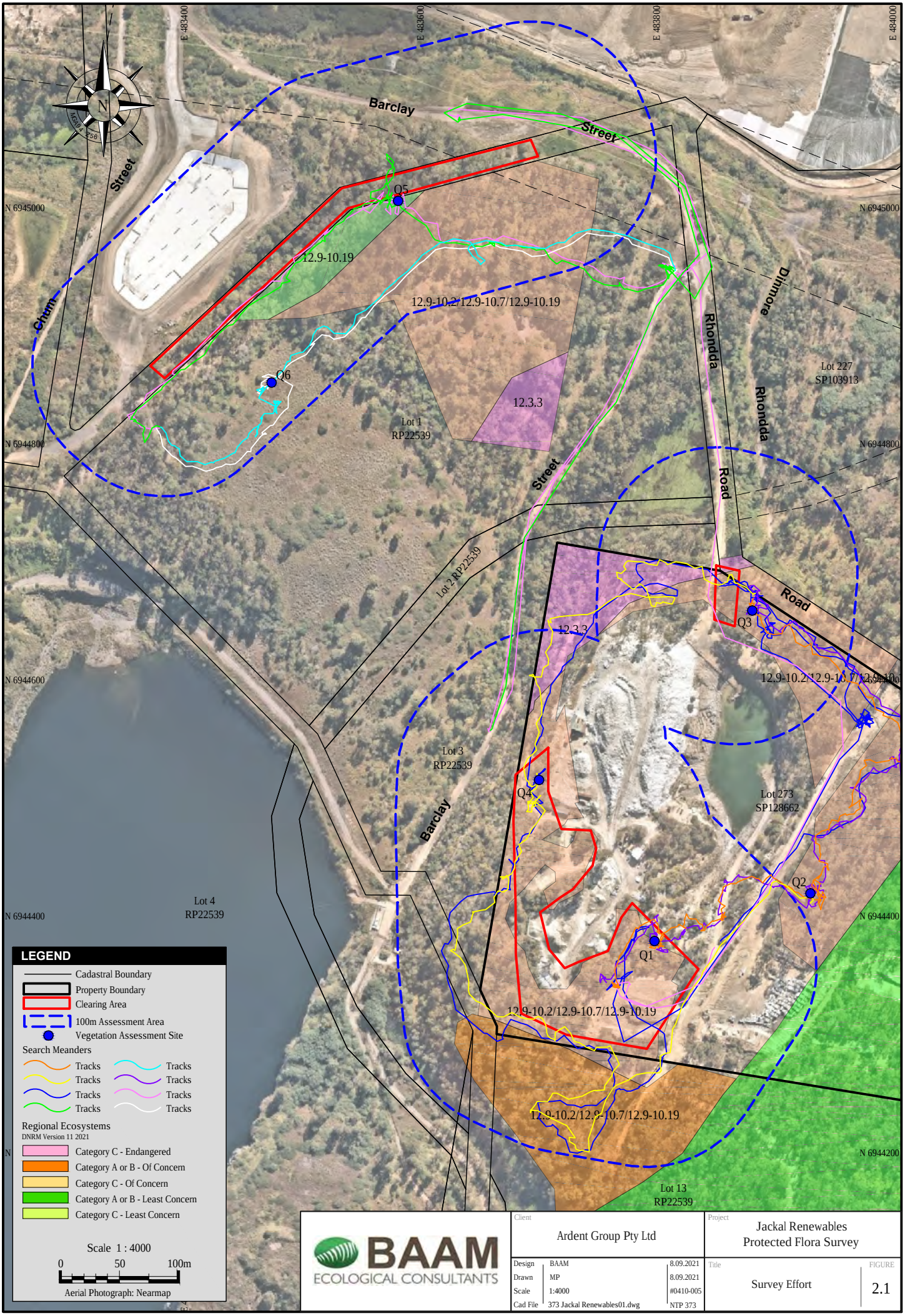
The flora survey covered the areas to be cleared as well as a 100m buffer around each proposed clearing area. This combined area is hereafter referred to as the 'clearing impact area' (refer **Figure 2.1**).



BAAM ECOLOGICAL CONSULTANTS

Client	Ardent Group Pty Ltd	Project	Jackal Renewables Protected Flora Survey
Design	BAAM	8.09.2021	
Drawn	MP	8.09.2021	
Scale	1:10,000	#0410-005	
Cad File	373 Jackal Renewables01.dwg	NTP 373	
Title	Site Location	FIGURE	1.1

©Biodiversity Assessment and Management Pty Ltd. While every care is taken to ensure the accuracy of this data, Biodiversity Assessment and Management makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.



BAAM ECOLOGICAL CONSULTANTS

Client	Ardent Group Pty Ltd		
Project	Jackal Renewables Protected Flora Survey		
Design	BAAM	8.09.2021	
Drawn	MP	8.09.2021	
Scale	1:4000	#0410-005	
Cad File	373 Jackal Renewables01.dwg	NTP 373	
Title	Survey Effort	FIGURE	2.1

©Biodiversity Assessment and Management Pty Ltd. While every care is taken to ensure the accuracy of this data, Biodiversity Assessment and Management makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.

In accordance with the *Flora Survey Guidelines - Protected Plants* (DES, 2020), the survey involved timed, random meander surveys of each habitat type within the clearing impact area.

The clearing impact area was dominated by one habitat type, this being eucalypt open forest/woodland. This community featured remnant, regrowth and non-remnant areas in a patchy mosaic – all of which were included in survey meanders.

All three clearing sites are located in regrowth vegetation mapped as a heterogeneous community of regional ecosystem (RE) 12.9-10.2/ RE12.9-10.7/RE12.9-10.19. For the southernmost clearing area, the clearing impact area (within the 100 metre buffer) also included one smaller area of remnant RE12.9-10.19.

For each clearing area, portions of the 100m buffer were completely cleared, highly disturbed land (highly modified environments) (refer **Figure 1.1**), which were not included in meanders.

Overall, eight meanders were completed in the clearing impact areas, as shown in **Figure 2.1**.

For the random meanders, a starting point was selected, and the starting time noted. The area of interest was then traversed as a random meander, searching carefully for EVNT plant species. Whenever the survey was interrupted, the survey time was paused until the survey started again. The random meander was terminated once no new species had been recorded for 30 minutes of active survey or when the entire area of the habitat type had been surveyed, whichever happened sooner.

2.3. QUALIFICATIONS OF FIELD TEAM

The targeted flora survey was led by Dr Jarrah Wills (Senior Ecologist) on 13th August 2021. Jarrah is suitably qualified to undertake protected plants assessments as prescribed under the Queensland *Flora Survey Guidelines – Protected Plants* (DES, 2020) – his certification statement is provided as a front cover to this report and his curriculum vitae is provided in **Appendix 4**.

2.4. SURVEY TIMING

The protected plant survey was commissioned to be undertaken in August 2021 to achieve operational timeframes. Rainfall during the months leading up to the survey was average. Conditions during the survey were mild and fine.

The protected plants survey methodology is designed to confirm the presence or absence of potentially occurring EVNT flora species, preferably at an optimal time for detection of species being targeted. All targeted species in this survey were expected to have identifiable foliage and bark characteristics present at the time of survey.

3.0 RESULTS

3.1. DESKTOP ASSESSMENT

A search of the DES Wildlife Online database (**Appendix 2**) and the ALA database found that nine EVNT flora species listed under the NC Act have been previously recorded within 5 km of the clearing impact area since 1980. The results of these searches, together with the preferred habitat and likelihood of occurrence of each species on this site, are presented in **Table 3.1**.

The State regulated vegetation mapping (**Appendix 3**) shows the clearing impact area predominantly occurs within non-remnant and regrowth vegetation, and one small area of remnant vegetation in the 100m buffer of the southernmost clearing area. No Essential Habitat mapping for flora species is associated with this RE.

3.2. FIELD ASSESSMENT

The habitat types recorded in the clearing impact area are described in **Table 3.2**. The location of vegetation assessment sites Q1 to Q6 are indicated in **Figure 2.1**.

Of the EVNT flora species recorded within 5km of the impact area, preferred habitat was present for *Eucalyptus curtissii, Marsdenia coronata* and *Notelaea ipsviciensis* (all of which occur in dry sclerophyll forest) (**Table 3.1**). However, no EVNT flora species were detected during the survey, despite thorough searching of the clearing area and adjacent vegetation.

Table 3.1. EVNT flora species recorded within 5km of the site and likelihood of occurrence

Species	Status (NCA)	Preferred Habitat	Likelihood of occurrence
Callitris baileyi	Near Threatened	Rocky slopes, hilly or mountainous areas, in shallow and often clay soils. It is found in eucalypt woodland, commonly associated with ironbark, blue gum and spotted gum (DES, 2019b).	**Unlikely**. Whilst marginal habitat for the species is present on site, extensive searches did not record the species. It is also noted that much of the Study Area displays landforms that have been historically disturbed.
Coleus habrophyllus	Endangered	Known only from near Ipswich and near Ormeau in south-east Queensland where it is associated with shaded gullies on rocky sediment substrates, often adjacent to dry rainforest (DoE, 2021a).	**Unlikely**. Dry rainforest was not recorded on site. Marginal habitat occurs in the form of gullies; however extensive searches in gully habitat did not record the species.
Eucalyptus curtisii	Near Threatened	The larger growth form occurs as scattered individuals on better drained soils in the more open areas of mixed eucalypt forests (DES, 2019d).	**Unlikely**. Whilst preferred habitat for the species is present on site, extensive searches did not record the species. It is also noted that much of the Study Area displays landforms that have been historically disturbed.
Hernandia bivalvis	Near Threatened	Mainly grows in rainforest on rock pavements and outcrops with shallow soils. Most Queensland Herbarium records are from either vine thicket or microphyll vine forest (DES, 2019c).	**Unlikely**. No suitable habitat occurs in the Study Area.
Lilaeopsis brisbanica	Endangered	Grows along tidal riverbanks in grey saline mud, in association with mangrove trees. Although occurring naturally in areas near saline waters, fresh water is satisfactory (DES, 2019).	**Unlikely**. Specimens have bee recorded on the Bremer and Brisbane Rivers well north of the Study Area. No suitable habitat occurs in the Study Area.
Marsdenia coronata	Vulnerable	Commonly found in open eucalypt forest/woodland communities on hillslopes and ridge tops at altitudes of 40–780 m above sea level. Also known from rocky outcrops along cliff lines. Most commonly recorded with *E. carnea, Corymbia citriodora, C. henryi, E. acmenoides* and *E. propinqua*. (DoE, 2021b)	**Unlikely** Potentially suitable habitat occurs in the Study Area. However extensive searches of representative habitats did not record the species. It is also noted that much of the Study Area displays landforms that have been historically disturbed.
Notelaea ipsviciensis	Critically Endangered	Known from three closely clustered sub-populations in the Ipswich area. Occurs as an understorey plant in degraded, eucalypt dominated, dry sclerophyll vegetation communities (DoE, 2021c).	**Unlikely**. Whilst preferred habitat for the species is present on site, extensive searches did not record the species. It is also noted that much of the Study Area displays landforms that have been historically disturbed.
Notelaea lloydii	Vulnerable	Found in the ecotone between eucalypt open forests and vine thicket on undulating to hilly terrain either in moist gullies or on dry slopes, rarely on rocky outcrops. (DoE. 2021d).	**Unlikely**. Vine thicket is not present on site. No suitable habitat occurs in the Study Area.
Rhodomyrtus psidioides	Critically Endangered	Grows in warmer rainforest and on rainforest margins; coastal districts (PlantNet, 2021).	**Unlikely**. No suitable habitat occurs in the Study Area.

Table 3.2. Description of vegetation within the clearing impact area (* exotic species)

Site	Habitat description	Representative photo
Q1	**Brief description:** Disturbed regrowth and non-remnant vegetation on highly disturbed landform. **Canopy (T1):** Sparse. Height range 7-14m; median height 12m. *Eucalyptus tereticornis, Acacia disparrima, Eucalyptus fibrosa.* **Sub-canopy (T2):** Sparse. Height range 3-6m; median height 4m: *Acacia leiocalyx.* **Shrub (S1)** nil **Groundcover:** Very sparse. Height range 0.0-0.5m; median height 0.3m. *Entolasia stricta.*	
Q2	**Brief description:** Eucalypt open forest - mapped regrowth but has achieved remnant status. **Canopy (T1):** Mid-dense. Height range 16-21m; median height 19m. *Eucalyptus fibrosa, Corymbia citriodora.* **Sub-canopy (T2):** Dense. Height range 2-5m; median height 3m: *Acacia leiocalyx*, *Alphitonia excelsa, Hovea acutifolia, Dodonaea triangularis, Acacia* sp. **Shrub (S1)** Dense: Height range 1-2m; median height 1.5m. *Acacia* sp. **Groundcover:** Sparse. Height range 0.0-1.0m; median height 0.3m. *Entolasia stricta*, *Aristida sp., Lomandra multiflora, Eragrostis corrollii.*	
Q3	**Brief description:** Eucalypt open forest - mapped regrowth but has achieved remnant status. Disturbed understorey. **Canopy (T1):** Mid-dense. Height range 18-21m; median height 20m. *Corymbia citriodora.* **Sub-canopy (T2):** Dense. Height range 2-4m; median height 3m: *Acacia leiocalyx.* **Shrub (S1)** Mid-dense: Height range 1-2m; median height 1.2m. *Alphitonia excelsa, Lantana camara** **Groundcover:** Sparse. Height range 0.0-1.0m; median height 0.5m. *Entolasia stricta*.	

Site	Habitat description	Representative photo
Q4	**Brief description:** non-remnant Acacia regrowth. **Canopy (T1):** Sparse. Height range 2.5-6m; median height 4m. *Acacia leiocalyx, Alphitonia excelsa, Eucalyptus tereticornis.* **Sub-canopy (T2):** nil **Shrub (S1)** nil **Groundcover:** Mid-dense. Height range 0.0-1.0m; median height 0.8m. *Melinis repens*; Pennisetum alopecuroides*, Senecio madagascariensis*, Cyanthillium cinereum**	
Q5	**Brief description:** Eucalypt open forest – mapped regrowth but has achieved remnant status. **Canopy (T1):** Sparse. Height range 17-22m; median height 20m. *Eucalyptus fibrosa, Corymbia citriodora.* **Sub-canopy (T2):** Mid-dense**.** Height range 2-4m; median height 3m: *Acacia fimbriata*. **Shrub (S1)** nil **Groundcover**: Sparse. Height range 0.0-1.0m; median height 0.5m. *Entolasia stricta*.	
Q6	**Brief description:** non-remnant rank grassland **Canopy (T1):** *nil* **Sub-canopy (T2):** nil **Shrub (S1):** nil **Groundcover:** Dense. Height range 0.0-1.0m; median height 0.8m. *Andropogon virginicus**	

4.0 POTENTIAL IMPACTS

As no EVNT species were detected within the clearing impact area, no direct or indirect impacts on EVNT plants are expected.

5.0 CONFIRMATION OF EXEMPT CLEARING NOTIFICATION AND SUBMISSION REQUIREMENTS

The *Flora Survey Guidelines – Protected Plants* (DES, 2020) stipulate that, where no EVNT species are identified within the clearing "impact" area (which includes the 100m buffer), an exempt clearing notification is required to be submitted to DES. This Protected Flora Survey Report should accompany the notification as an attachment.

Section 261ZA requires that the exemption and supporting report are submitted at least one week before clearing commences, but no later than one year after the completion of the flora survey that was undertaken for the report (i.e. by 13th August, 2022). Following submission of the exemption, the applicant will receive a receipt of the submission providing approval for the clearing to commence. Clearing under this exemption may be conducted within two years after the flora survey report is submitted.

6.0 REFERENCES

Atlas of Living Australia (2021). https://www.ala.org.au/

Department of the Environment (2021a). *Approved Conservation Advice: Plectranthus habrophyllus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/sprat

Department of the Environment (2021b). *Approved Conservation Advice: Marsdenia coronata* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/cgi-in/sprat/public/publicspecies.pl?taxon_id=20632

Department of the Environment (2021c). *Notelaea ipsviciensis* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/cgi-in/sprat/public/publicspecies.pl?taxon_id=81858

Department of the Environment (2021d). *Notelaea lloydii* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=15002

Department of Environment and Science (2019) *Lilaeopsis brisbanica* https://apps.des.qld.gov.au/species-search/details/?id=18503

Department of Environment and Science (2019b) *Callitris baileyi* https://apps.des.qld.gov.au/species-search/details/?id=14766

Department of Environment and Science (2019c) *Hernandia bivalvis.* https://apps.des.qld.gov.au/species-search/details/?id=14766

Department of Environment and Science (2019d) *Eucalyptus curtisii.* https://apps.des.qld.gov.au/species-search/details/?id=17256

Department of Environment and Science (DES) (2020). *Flora Survey Guidelines – Protected Plants* (Version 2.01). Department of Environment and Heritage Protection Queensland Government, Brisbane.

Leiper et al (2008). *Mountain to Mangroves* revised edition. Society for Growing Australian Plants. Logan Branch.

PlantNet (2021) *Rhodomyrtus psidioides.* Found at: https://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Rhodomyrtus~psidioides

APPENDIX 1
FLORA SURVEY TRIGGER MAP FOR THE SITE

09/07/2020 12:32:16
Lot: 73 Plan: SP128662



Protected Plants Flora Survey Trigger Map

Legend

- Selected Lot and Plan
- High risk area
- Other land parcel boundaries
- Freeways / motorways / highways
- Secondary roads / streets

LOCALITY DIAGRAM



N

0 140 280 420 560 700 m

This product is projected into:
GDA 1994 Queensland Albers

This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

Land parcel boundaries are provided as locational aid only.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Science at palm@ehp.qld.gov.au

Disclaimer:
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

© The State of Queensland (Department of Environment and Science), 2020

Queensland Government

Protected plants flora survey trigger map

The protected plants flora survey trigger map identifies 'high risk areas' where endangered, vulnerable or near threatened plants are known to exist or are likely to exist. Under the *Nature Conservation Act 1992* (the Act) it is an offence to clear protected plants that are 'in the wild' unless you are authorised or the clearing is exempt, for more information see section 89 of the Act.

Please see the Department of Environment and Science webpage on the clearing of protected plants for information on what exemptions may apply in your circumstances, whether you may need to undertake a flora survey, and whether you may need a protected plants clearing permit.

Updates to the data informing the flora survey trigger map

The flora survey trigger map will be reviewed, and updated if necessary, at least every 12 months to ensure the map reflects the most up-to-date and accurate data available.

Species information

Please note that flora survey trigger maps do not identify species associated with 'high risk areas'. While some species information may be publicly available, for example via the Queensland Spatial Catalogue, the Department of Environment and Science does not provide species information on request. Regardless of whether species information is available for a particular high risk area, clearing plants in a high risk area may require a flora survey and/or clearing permit. Please see the Department of Environment and Science webpage on the clearing of protected plants for more information.

Queensland Government

APPENDIX 2
WILDLIFE ONLINE DATABASE SEARCH RESULTS

Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: Plants (including other non-animals such as fungi and protists)
Type: Native
Status: Rare and threatened species
Records: Confirmed
Date: Since 1980
Latitude: -27.621
Longitude: 152.831
Distance: 5
Email: jarrah@baamecology.com
Date submitted: Wednesday 13 Jan 2021 13:32:35
Date extracted: Wednesday 13 Jan 2021 13:40:02

The number of records retrieved = 9

Disclaimer

As the DSITIA 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
plants	land plants	Apiaceae	*Lilaeopsis brisbanica*			E		3/3
plants	land plants	Apocynaceae	*Marsdenia coronata*	slender milkvine		V		13/13
plants	land plants	Cupressaceae	*Callitris baileyi*	Bailey's cypress		NT		1
plants	land plants	Hernandiaceae	*Hernandia bivalvis*	cudgerie		NT		1
plants	land plants	Lamiaceae	*Coleus habrophyllus*			E	E	1/1
plants	land plants	Myrtaceae	*Rhodomyrtus psidioides*	native guava		CR	CE	1
plants	land plants	Myrtaceae	*Eucalyptus curtisii*	Plunkett mallee		NT		6/5
plants	land plants	Oleaceae	*Notelaea lloydii*	Lloyd's native olive		V	V	13/13
plants	land plants	Oleaceae	*Notelaea ipsviciensis*	Cooneana olive		CR	CE	15/15

CODES

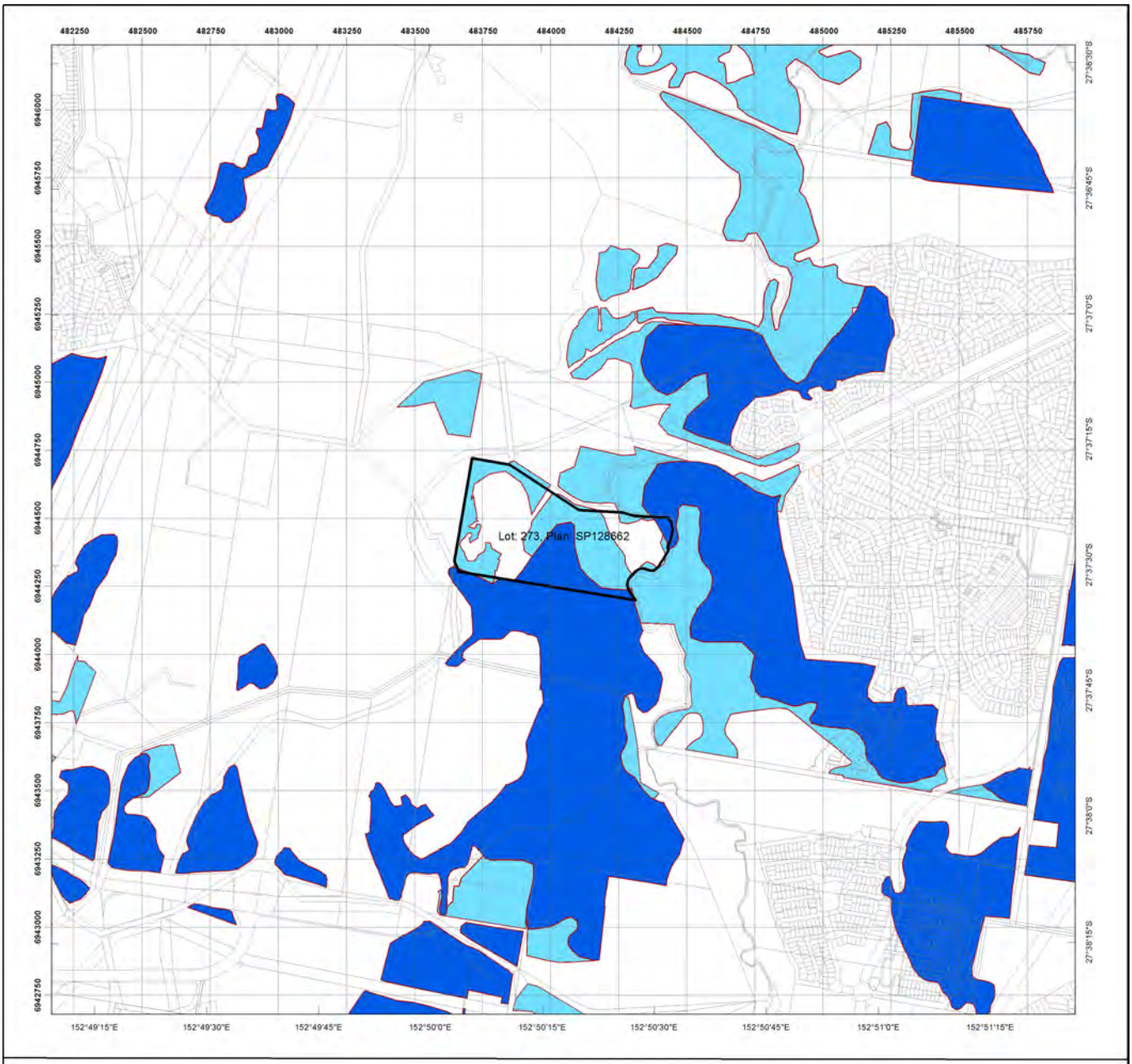
I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.* The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (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 3
DNRM REGULATED VEGETATION AND ESSENTIAL HABITAT MAPPING



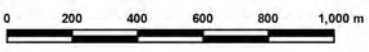
Regulated Vegetation Management Map

Legend

- Selected Lot and Plan
- Category A area (Vegetation offsets/compliance notices/VDecs)
- Category B area (Remnant vegetation)
- Category C area (High-value regrowth vegetation)
- Category R area (Reef regrowth watercourse vegetation)
- Category X area (Exempt clearing work on Freehold, Indigenous and Leasehold land)
- Water
- Area not categorised
- Other land parcel boundaries







This product is projected into:
GDA 1994 MGA Zone 56

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Resources makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

Additional information required for the assessment of vegetation values is provided in the accompanying "Vegetation Management Supporting map". For further information go to the web site: www.resources.qld.gov.au or contact the Department of Resources.

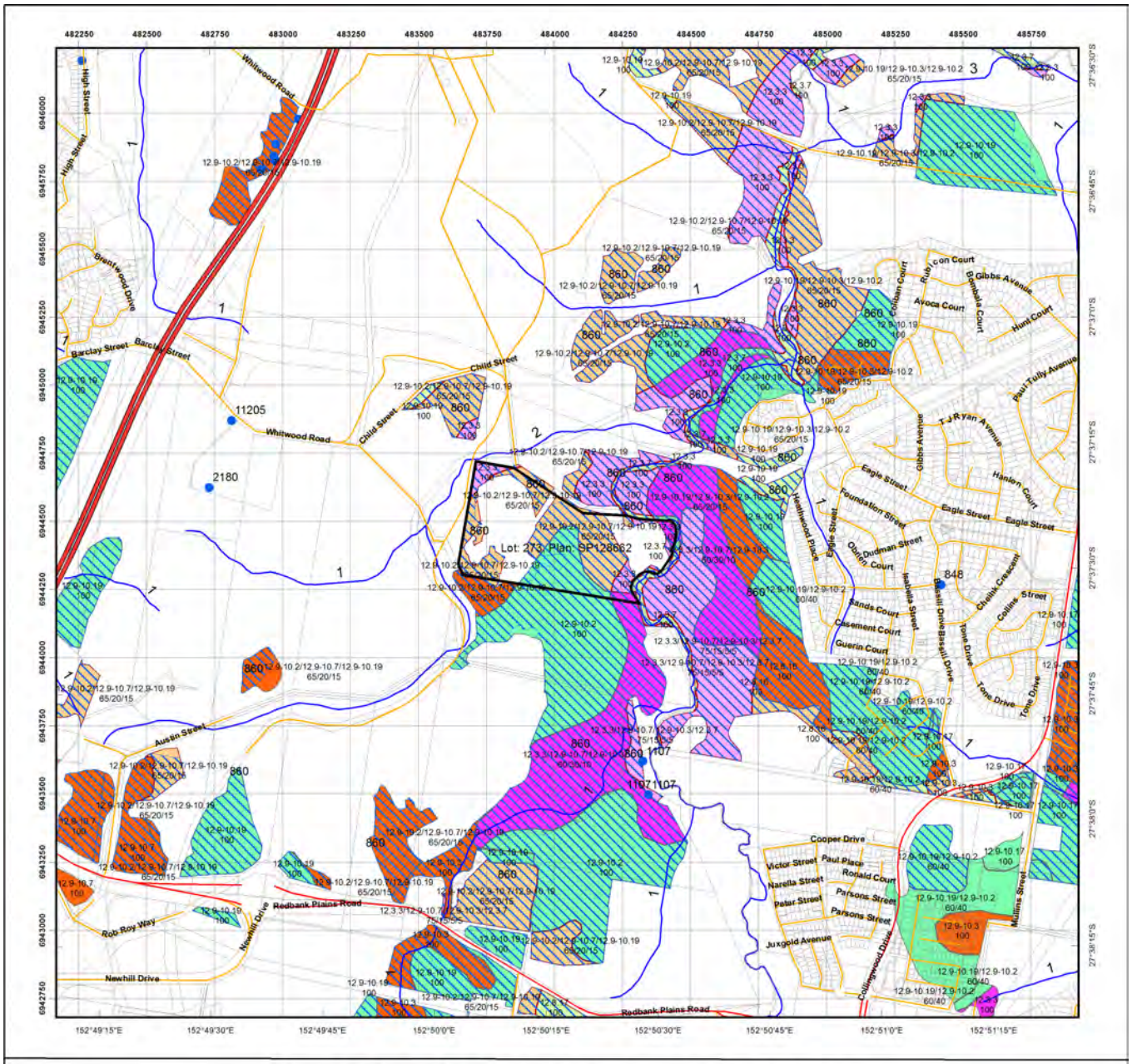
Digital data for the regulated vegetation management map is available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries are provided as locational aid only.

This map is updated on a monthly basis to ensure new PMAVs are included as they are approved.

Queensland Government

© The State of Queensland (Department of Resources), 2021



Vegetation Management Supporting Map

Legend

- Selected Lot and Plan
- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystem
- Category A or B area under Section 20AH
  These areas are edged in yellow and filled with the remnant RE Status
- Category C or R area containing endangered regional ecosystems
- Category C or R area containing of concern regional ecosystems
- Category C or R area that is a least concern regional ecosystem
- Category C area under Section 20AI
  These areas are edged in purple and filled with the remnant RE Status
- Category X area
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourses and drainage features on the vegetation management watercourse and drainage features map
  (Stream order shown as black number against stream where available)
- Highway
- Connector
- Street/Local Road
- National Parks, State Forest and other reserves
- Other land parcel boundaries

Queensland Government

LOCALITY DIAGRAM



N

0 140 280 420 560 700 m

This product is projected into:
GDA 1994 MGA Zone 56

Labels for Essential Habitat are centred on the area of enquiry.

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.

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Resources makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

Additional information may be 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.resources.qld.gov.au or contact the Department of Resources.

Digital data for the vegetation management watercourse and drainage feature map, vegetation management wetlands map, essential habitat map and the vegetation management remnant and regional ecosystem map are available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries are provided as locational aid only.

© The State of Queensland (Department of Resources), 2021

Vegetation Management Act 1999 - Extract from the essential habitat database

Essential habitat is required for assessment under the:

- State Development Assessment Provisions - State Code 16: Native vegetation clearing which sets out the matters of interest to the state for development assessment under the *Planning Act 2016*; and
- Accepted development vegetation clearing codes made under the *Vegetation Management Act 1999*

Essential habitat for one or more of the following species is found on and within 1.1 km of the identified subject lot/s on the accompanying essential habitat map.

This report identifies essential habitat in Category A, B and Category C areas.

The numeric labels on the essential habitat map can be cross referenced with the database below to determine which essential habitat factors might exist for a particular species.

Essential habitat is compiled from a combination of species habitat models and buffered species records.

The Department of Resources website (http://www.dnrme.qld.gov.au) has more information on how the layer is applied under the State Development Assessment Provisions - State Code 16: Native vegetation clearing and the *Vegetation Management Act 1999*.

Regional ecosystem is a mandatory essential habitat factor, unless otherwise stated.

Essential habitat, for protected wildlife, means a category A area, a category B area or category C area shown on the regulated vegetation management map-

1) that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or

2) in which the protected wildlife, at any stage of its life cycle, is located.

Protected wildlife includes critically endangered, endangered, vulnerable or near-threatened native wildlife prescribed under the *Nature Conservation Act 1992*.

Essential habitat in Category A and/or Category B and/or Category C

Label	Scientific Name	Common Name	NCA Status	Vegetation Community	Altitude	Soils	Position in Landscape
860	Phascolarctos cinereus	koala	V	SEQ: Open eucalypt forest and woodland that has: a) multiple strata layers containing Eucalyptus, Corymbia, Angophora, Lophostemon or Melaleuca trees that-at 1.3 metres above the ground-have a diameter both greater and less than 30 centimetres; and b) at least 1 of the following species: Eucalyptus tereticornis, E. fibrosa, E. propinqua; E. umbra, E. grandis, E. microcorys, E. tindaliae, E. resinifera, E. populnea, E. robusta, E. nigra, E. racemosa, E. crebra, E. exserta, E. seeana, Lophostemon confertus, L. suaveolens, Melaleuca quinquenervia. Outside SEQ: Open eucalypt forest and woodland that contains Eucalyptus &/or Corymbia spp. Tree species used for food varies across State and can include Eucalyptus tereticornis, E. camaldulensis, E. coolabah; E. drepanophylla, E. platyphylla, E. orgadophilla, E. thozetiana, E. melanophloia, E. populnea, E. melliodora, E. dealbata, E. microtheca, E. crebra, E. exserta, E. blakelyi, E. papuana, Corymbia tessellaris, C. citriodora, Melaleuca quinquenervia, M. leucadendra.	Sea level to 1000m.	None	Riparian areas, plains and hill/escarpment slopes.
848	Petauroides volans	greater glider	V	Tall mature open wet and dry eucalypt forest (Eucalyptus &/or Corymbia spp.) to low open eucalypt woodland; presence of hollow-bearing trees.	Sea level to 1300m.	Usually on soils of relatively high fertility.	None
1107	Ninox strenua	powerful owl	V	Wet and dry tall open eucalypt forest (Eucalyptus pilularis, E. acmenoides, E. tereticornis, E. camaldulensis, E. crebra, E. melliodora, Corymbia citriodora & C. intermedia), including mountain forest gullies/gorges; forests aged 60+ years (large & old) on fertile soils with suitable hollows; roosting in dense foliage of closed forest (occasionally caves) and foraging in open forest and woodland including areas adjacent to urban/rural development. Nest in large hollows (45-75cm diameter, 50-180cm deep) 6-45m above ground, in large (>100cm dbh) old eucalypts on the side or at the head of heavily wooded gully.	Sea level to 1000m.	None	Gully.
2180	Notelaea ipsviciensis	Cooneana olive	E	dry sclerophyll eucalypt forest.; open forest of Eucalyptus fibrosa, Corymbia citriodora and C. henryii	0 to 300 m	shallow sandy to loam soil derived from sandstone substrates or stony clay soils	hill sides, gullies in hilly terrain
11205	Marsdenia coronata	slender milkvine	V	open forest of Eucalyptus pilularis, E. microcorys, Corymbia intermedia, or Eucalyptus propinqua, E. carnea with Themeda understorey, or Lophostemon confertus, Corymbia intermedia, Eucalyptus carnea, Allocasuarina littoralis, Banksia integrifolia, or Eucalyptus carnea, E. propinqua, or Eucalyptus carnea, E. propinqua, E. acmenoides, or Allocasuarina littoralis, Lophostemon confertus, Corymbia citriodora, Eucalyptus carnea, E. tindaliae; woodland to open forest of Eucalyptus fibrosa, Corymbia citriodora, or Eucalyptus fibrosa, C. henryi, or Corymbia citriodora, Eucalyptus dura, C. henryii, or Eucalyptus dura, Eucalyptus acmenoides; rocky heathland with Acacia blakei; wet sclerophyll forest dominated by Eucalyptus andrewsii, E. biturbinata	0 to 800 m	red brown loam to clay or sandy soil occasionally skeletal	mostly on steep ridge or hill slope sometimes on rock ledges along cliftlines rarely on alluvial terrace

Label	Regional Ecosystem (mandatory unless otherwise specified)
860	SEQ: 11.3.2, 11.3.4, 11.3.25, 11.3.26, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.9, 12.2.5, 12.2.6, 12.2.7, 12.2.8, 12.2.10, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.6, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.14, 12.3.18, 12.3.19, 12.3.20, 12.5.1, 12.5.2, 12.5.3, 12.5.4, 12.5.6, 12.5.7, 12.5.10, 12.5.12, 12.8.1, 12.8.8, 12.8.9, 12.8.11, 12.8.12, 12.8.14, 12.8.16, 12.8.17, 12.8.20, 12.8.24, 12.8.25, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.7, 12.9-10.8, 12.9-10.11, 12.9-10.12, 12.9-10.14, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.21, 12.9-10.25, 12.9-10.26, 12.9-10.27, 12.9-10.28, 12.9-10.29, 12.11.2, 12.11.3, 12.11.5, 12.11.6, 12.11.7, 12.11.8, 12.11.9, 12.11.14, 12.11.15, 12.11.16, 12.11.17, 12.11.18, 12.11.22, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.2, 12.12.3, 12.12.5, 12.12.6, 12.12.7, 12.12.8, 12.12.9, 12.12.11, 12.12.12, 12.12.14, 12.12.15, 12.12.23, 12.12.24, 12.12.25, 12.12.28. Outside SEQ: 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.3.8, 4.3.10, 4.3.11, 4.4.1, 4.5.3, 4.5.5, 4.5.6, 4.5.8, 4.5.9, 4.7.1, 4.7.7, 4.7.8, 4.9.6, 4.9.10, 4.9.12, 4.9.17, 6.3.1, 6.3.2, 6.3.3, 6.3.4, 6.3.5, 6.3.7, 6.3.8, 6.3.9, 6.3.11, 6.3.12, 6.3.17, 6.3.18, 6.3.22, 6.3.24, 6.3.25, 6.4.1, 6.4.2, 6.4.3, 6.4.4, 6.5.1, 6.5.2, 6.5.3, 6.5.5, 6.5.6, 6.5.7, 6.5.8, 6.5.9, 6.5.10, 6.5.11, 6.5.13, 6.5.14, 6.5.15, 6.5.16, 6.5.17, 6.5.18, 6.5.19, 6.6.2, 6.7.1, 6.7.2, 6.7.5, 6.7.6, 6.7.7, 6.7.9, 6.7.11, 6.7.12, 6.7.13, 6.7.14, 6.7.17, 6.9.3, 7.2.3, 7.2.4, 7.2.7, 7.2.11, 7.3.7, 7.3.8, 7.3.9, 7.3.12, 7.3.13, 7.3.14, 7.3.16, 7.3.19, 7.3.20, 7.3.21, 7.3.25, 7.3.26, 7.3.39, 7.3.40, 7.3.42, 7.3.43, 7.3.44, 7.3.45, 7.3.47, 7.3.48, 7.3.50, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.8.7, 7.8.8, 7.8.10, 7.8.15, 7.8.16, 7.8.17, 7.8.18, 7.8.19, 7.11.5, 7.11.6, 7.11.13, 7.11.14, 7.11.16, 7.11.18, 7.11.19, 7.11.20, 7.11.21, 7.11.31, 7.11.32, 7.11.33, 7.11.34, 7.11.35, 7.11.37, 7.11.41, 7.11.42, 7.11.43, 7.11.44, 7.11.45, 7.11.46, 7.11.47, 7.11.48, 7.11.49, 7.11.50, 7.11.51, 7.12.4, 7.12.5, 7.12.17, 7.12.21, 7.12.22, 7.12.23, 7.12.24, 7.12.25, 7.12.26, 7.12.27, 7.12.28, 7.12.29, 7.12.30, 7.12.33, 7.12.34, 7.12.35, 7.12.51, 7.12.52, 7.12.53, 7.12.54, 7.12.55, 7.12.56, 7.12.57, 7.12.58, 7.12.59, 7.12.60, 7.12.61, 7.12.62, 7.12.63, 7.12.65, 7.12.66, 7.12.69, 8.1.5, 8.2.3, 8.2.6, 8.2.7, 8.2.8, 8.2.11, 8.2.12, 8.2.13, 8.2.14, 8.3.1, 8.3.2, 8.3.3, 8.3.5, 8.3.6, 8.3.8, 8.3.10, 8.3.11, 8.3.13, 8.5.1, 8.5.2, 8.5.3, 8.5.5, 8.5.6, 8.5.7, 8.9.1, 8.10.1, 8.11.1, 8.11.3, 8.11.4, 8.11.5, 8.11.6, 8.11.8, 8.11.10, 8.11.12, 8.12.4, 8.12.5, 8.12.6, 8.12.7, 8.12.8, 8.12.9, 8.12.12, 8.12.14, 8.12.20, 8.12.22, 8.12.23, 8.12.25, 8.12.26, 8.12.27, 8.12.29, 8.12.31, 8.12.32, 9.3.1, 9.3.2, 9.3.3, 9.3.4, 9.3.5, 9.3.6, 9.3.7, 9.3.8, 9.3.10, 9.3.11, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.27, 9.4.1, 9.4.2, 9.4.3, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.13, 9.5.14, 9.5.15, 9.5.16, 9.5.17, 9.7.1, 9.7.2, 9.7.3, 9.7.4, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.4, 9.8.5, 9.8.9, 9.8.10, 9.8.11, 9.10.1, 9.10.3, 9.10.4, 9.10.5, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.8, 9.11.9, 9.11.10, 9.11.11, 9.11.12, 9.11.13, 9.11.14, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.21, 9.11.22, 9.11.23, 9.11.24, 9.11.25, 9.11.26, 9.11.28, 9.11.29, 9.11.30, 9.11.31, 9.11.32, 9.12.1, 9.12.2, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.8, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.14, 9.12.15, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.25, 9.12.26, 9.12.27, 9.12.28, 9.12.29, 9.12.30, 9.12.31, 9.12.32, 9.12.33, 9.12.35, 9.12.36, 9.12.37, 9.12.38, 9.12.39, 9.12.44, 10.3.2, 10.3.3, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.17, 10.3.20, 10.3.27, 10.3.28, 10.4.3, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.2, 10.9.3, 10.9.5, 10.10.1, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.21, 11.3.22, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.7, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.11, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.12, 11.10.13, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.4, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.19, 11.12.20, 13.3.1, 13.3.2, 13.3.3, 13.3.4, 13.3.5, 13.3.7, 13.9.2, 13.11.1, 13.11.2, 13.11.3, 13.11.4, 13.11.5, 13.11.6, 13.11.8, 13.11.9, 13.12.1, 13.12.2, 13.12.3, 13.12.4, 13.12.5, 13.12.6, 13.12.8, 13.12.9, 13.12.10.
848	7.3.7, 7.3.8, 7.3.9, 7.3.12, 7.3.13, 7.3.14, 7.3.16, 7.3.19, 7.3.20, 7.3.21, 7.3.25, 7.3.26, 7.3.39, 7.3.40, 7.3.42, 7.3.43, 7.3.44, 7.3.45, 7.3.47, 7.3.48, 7.3.50, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.8.7, 7.8.8, 7.8.10, 7.8.15, 7.8.16, 7.8.17, 7.8.18, 7.8.19, 7.11.5, 7.11.6, 7.11.13, 7.11.14, 7.11.16, 7.11.18, 7.11.19, 7.11.20, 7.11.21, 7.11.31, 7.11.32, 7.11.33, 7.11.34, 7.11.35, 7.11.37, 7.11.41, 7.11.42, 7.11.43, 7.11.44, 7.11.45, 7.11.46, 7.11.47, 7.11.48, 7.11.49, 7.11.50, 7.11.51, 7.12.4, 7.12.5, 7.12.17, 7.12.21, 7.12.22, 7.12.23, 7.12.24, 7.12.25, 7.12.26, 7.12.27, 7.12.28, 7.12.29, 7.12.30, 7.12.33, 7.12.34, 7.12.35, 7.12.51, 7.12.52, 7.12.53, 7.12.54, 7.12.55, 7.12.56, 7.12.58, 7.12.59, 7.12.60, 7.12.61, 7.12.62, 7.12.63, 7.12.65, 7.12.66, 7.12.69, 9.3.1, 9.3.2, 9.3.3, 9.3.5, 9.3.6, 9.3.8, 9.3.10, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.24, 9.4.1, 9.4.2, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.13, 9.5.14, 9.5.15, 9.5.16, 9.5.17, 9.7.1, 9.7.2, 9.7.3, 9.7.4, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.4, 9.8.5, 9.8.9, 9.8.10, 9.8.11, 9.10.1, 9.10.3, 9.10.4, 9.10.5, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.10, 9.11.12, 9.11.13, 9.11.14, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.21, 9.11.22, 9.11.23, 9.11.24, 9.11.25, 9.11.26, 9.11.28, 9.11.29, 9.11.30, 9.11.31, 9.11.32, 9.12.1, 9.12.2, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.14, 9.12.15, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.25, 9.12.26, 9.12.27, 9.12.28, 9.12.29, 9.12.30, 9.12.31, 9.12.32, 9.12.33, 9.12.35, 9.12.36, 9.12.37, 9.12.38, 9.12.39, 9.12.40, 9.12.44, 10.3.2, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.7, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.7, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.10.1, 11.10.2, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.16, 11.12.17, 11.12.19, 11.12.20; 12.2.5, 12.2.6, 12.2.7, 12.2.8, 12.2.10, 12.2.11, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.6, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.12, 12.3.14, 12.3.15, 12.3.18, 12.3.19, 12.3.20, 12.5.1, 12.5.2, 12.5.3, 12.5.4, 12.5.5, 12.5.6, 12.5.7, 12.5.8, 12.5.10, 12.5.11, 12.5.12, 12.7.1, 12.7.2, 12.8.1, 12.8.2, 12.8.8, 12.8.10, 12.8.11, 12.8.12, 12.8.14, 12.8.16, 12.8.17, 12.8.20, 12.8.23, 12.8.24, 12.8.25, 12.8.26, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.7, 12.9-10.8, 12.9-10.11, 12.9-10.12, 12.9-10.13, 12.9-10.14, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.20, 12.9-10.21, 12.9-10.23, 12.9-10.24, 12.9-10.25, 12.9-10.26, 12.9-10.27, 12.9-10.28, 12.9-10.29, 12.11.2, 12.11.3, 12.11.5, 12.11.6, 12.11.7, 12.11.8, 12.11.9, 12.11.14, 12.11.15, 12.11.16, 12.11.17, 12.11.18, 12.11.19, 12.11.20, 12.11.21, 12.11.22, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.2, 12.12.3, 12.12.4, 12.12.5, 12.12.6, 12.12.7, 12.12.8, 12.12.9, 12.12.11, 12.12.12, 12.12.14, 12.12.15, 12.12.20, 12.12.21, 12.12.22, 12.12.23, 12.12.24, 12.12.25, 12.12.26, 12.12.27, 12.12.28, 13.3.1, 13.3.2, 13.3.3, 13.3.4, 13.3.5, 13.3.7, 13.9.2, 13.11.1, 13.11.2, 13.11.3, 13.11.4, 13.11.5, 13.11.6, 13.11.8, 13.11.9, 13.12.1, 13.12.2, 13.12.3, 13.12.4, 13.12.5, 13.12.6, 13.12.8, 13.12.9, 13.12.10
1107	8.2.2, 8.2.3, 8.2.4, 8.2.5, 8.2.6, 8.2.7, 8.2.8, 8.2.11, 8.2.13, 8.2.14, 8.3.1, 8.3.3, 8.3.6, 8.3.8, 8.3.9, 8.3.10, 8.3.11, 8.5.1, 8.8.1, 8.10.1, 8.11.2, 8.11.3, 8.11.5, 8.12.1, 8.12.2, 8.12.3, 8.12.4, 8.12.5, 8.12.7, 8.12.8, 8.12.11, 8.12.12, 8.12.14, 8.12.16, 8.12.17, 8.12.18, 8.12.19, 8.12.26, 8.12.27, 8.12.28, 8.12.29, 8.12.30, 8.12.31, 8.12.32, 11.2.2, 11.2.3, 11.3.1, 11.3.11, 11.3.12, 11.3.25, 11.3.26, 11.3.40, 11.4.1, 11.4.3, 11.4.7, 11.4.9, 11.5.7, 11.5.16, 11.8.1, 11.8.13, 11.9.1, 11.9.4, 11.9.5, 11.9.6, 11.9.10, 11.9.13, 11.10.1, 11.10.2, 11.10.5, 11.10.8, 11.10.9, 11.10.13, 11.11.3, 11.11.5, 11.11.13, 11.11.14, 11.11.18, 11.12.4, 11.12.13, 11.12.19, 11.12.21, 12.2.1, 12.2.2, 12.2.3, 12.2.4, 12.2.5, 12.2.7, 12.2.8, 12.3.1, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.15, 12.3.16, 12.3.17, 12.3.18, 12.3.19, 12.3.20, 12.3.21, 12.5.1, 12.5.3, 12.5.6, 12.5.7, 12.5.13, 12.8.1, 12.8.2, 12.8.3, 12.8.4, 12.8.5, 12.8.6, 12.8.7, 12.8.8, 12.8.9, 12.8.10, 12.8.11, 12.8.12, 12.8.13, 12.8.14, 12.8.18, 12.8.21, 12.8.22, 12.8.23, 12.8.24, 12.8.25, 12.8.26, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.6, 12.9-10.14, 12.9-10.16, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.20, 12.9-10.21, 12.9-10.23, 12.9-10.24, 12.9-10.25, 12.9-10.26, 12.9-10.29, 12.11.1, 12.11.2, 12.11.3, 12.11.4, 12.11.5, 12.11.6, 12.11.9, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.11.16, 12.11.17, 12.11.18, 12.11.19, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.1, 12.12.2, 12.12.3, 12.12.4, 12.12.5, 12.12.6, 12.12.11, 12.12.13, 12.12.15, 12.12.16, 12.12.17, 12.12.18, 12.12.20, 12.12.26, 12.12.28, 13.3.2, 13.3.3, 13.3.5, 13.9.2, 13.11.2, 13.11.5, 13.11.6, 13.11.7, 13.12.1, 13.12.4, 13.12.11
2180	12.9-10.19
11205	12.3.11, 12.8.19, 12.8.20, 12.9-10.17, 12.9-10.19, 12.11.3, 12.11.5, 12.11.6

APPENDIX 4
CURRICULA VITA OF FIELD PERSONNEL

DR JARRAH WILLS

SENIOR ECOLOGIST

SPECIALISATION

- Ecological Survey
- Protected Plant Survey
- Vegetation and Rehabilitation Management Plans
- Biocondition Assessment
- Plant Identification
- Bush Regeneration
- Project Management



EDUCATION & PROFESSIONAL QUALIFICATIONS

PhD Plant Ecology, University of Queensland (2017)

BSc Ecology, Queensland University of Technology (2012)

Chemical Application Licence, Axiom College (2008)

Chainsaw Operations, In Training Systems (2008)

KEY EXPERIENCE

Jarrah Wills is a Senior Ecologist at BAAM Pty Ltd. His areas of expertise are botanical and ecological surveys, ecological restoration and how they relate to ecosystem functioning and subsequent services. Jarrah has over 10 years' experience in vegetation management, and 6 years' experience in undertaking vegetation surveys within Australia and Internationally.

RECENT PROJECT EXPERIENCE

- Comprehensive baseline ecological surveys for Saraji and Saraji South Mines for BHP, including vegetation assessment and ground-truthed mapping, biocondition assessment and habitat assessment.
- Ground-verification of ecological values for the Cooloola Great Walk project.
- Large scale tree surveys, Vegetation Mapping, Vegetation Condition Assessments and Comparisons, Food Web Analysis for the Terrestrial Ecology, and on-going technical advice for the rehabilitation of the Old Petrie Mill site.
- Planning, direction and monitoring of weeding and rehabilitation works at Hilliards Creek for Department of Agriculture and Fisheries.
- Protected Flora Surveys undertaken in accordance with state guidelines – various locations throughout south-east Queensland.
- National assessment of the impact of myrtle rust – Threatened Species Recovery Hub (NESP)
- Vegetation survey – Gulkula Mining vegetation assessment and comparative analysis, Gove
- Forest Resource Survey – Rio Tinto mining lease pre-clearing forest resource assessment, Gove and Weipa

PROFESSIONAL HISTORY

2019-present	**BAAM Pty Ltd** Senior Ecologist
2017-2018	**University of Queensland Queensland Herbarium** Post-doctoral research fellow
2016-2017	**University of the Sunshine Coast** Researcher
2013-2017	**University of Queensland** PhD Researcher
2006-2018	**Mt Nebo and Mt Glorious Environmental Protection Agency Inc** Ecologist/Bush Regenerator
2012-2013	**Davanco Environmental Pty Ltd** Bush Regenerator
2006-2010	**Brisbane Bush Care Pty Ltd** Bush Regenerator

SELECTED PUBLICATIONS

Fensham, R.J.et al. and **Wills, J** (2020) Imminent Extinction of Australian Myrtaceae by Fungal Disease. Trends in Ecology and Evolution.

Wills, J. et al (2018) Leaf economic trade-offs are stronger for sub-canopy trees: leaf traits reveal little about growth rates in canopy trees. Ecological Applications, 28: 1116-1125

Wills, J., (2018) Myrtle Rust Is Here. Science for Saving species, Threatened Species Recovery Hub.

Wills, J., et al. (2017) Next-generation tropical forests: reforestation type affects recruitment of species and functional diversity in a human-dominated landscape. Journal of Applied Ecology, 54: 772-783

PART B – ATTACHMENTS PRCP SCHEDULE

Appendix 1 – PRCP Schedule
Appendix 2 – EA0001386 – Land Outcome Document
Appendix 3 – Ecological Studies
Appendix 4 – Mine Planning Report
Appendix 5 – Topsoil Assessment
Appendix 6 – Hydrogeological Assessment

Jackal Renewables Pty Ltd; ML50070

Appendix 4 – Mine Planning Report

ML50070 Mine Planning Report

Prepared for Jackal Renewables

December 2023

AUQ00209

DOCUMENT CONTROL

Status	Final
Version	V1.4
Print Date	21/12/2023
Approval State	Internally Reviewed
Author(s)	Faraz Ferdosian, Carl Morandy
Reviewed By	Carl Morandy
Path Name	00209_Jackal Renewables\Mine Planning
File Name	ML50070 Mine Planning Report
Project No	AUQ00209
Distribution	Ardent Group, Jackal Renewables Pty Ltd

Document Change Control

Version	Description (section(s) amended)	Author(s)	Date
1.1	Draft Document for Internal Review	CA, CM	19/12/2022
1.2	Document for Client Review	CA, CM	02/02/2023
1.3	Final Document for Distribution	CA, CM	03/02/2023
1.4	Final Document for IR	FF, CM	21/12/2023

Document Review and Sign Off

Name	Position	Role	Signature	Date Issued
Carl Morandy	Managing Director (Ausrocks)	RPEQ (22981) & QA Review		21/12/2023

This document has been prepared for the exclusive use of the Client based on instructions, information and data supplied by the Client as of December 2023. This document has been prepared by Ausrocks Pty Ltd (Ausrocks). Ausrocks has no financial association with the Client other than carrying out this report as requested by the Client.

Final Landform Considerations

The following factors were considered when determining the appropriate design parameters for the mine:

- Geological factors and geotechnical stability of the materials (Topsoil, Sandstone, Shale, Clay, Mudstone and Gravel).
- Groundwater runoff (assuming water table is below the pit floor).
- Site specific boundaries (Property Boundary and Mining Lease Boundary) and buffers (Powerline).
- Final land use 'Final Landform Design'.

1.1 Location Factors

The site is located in an area steeped with coal mining history and significant disturbance over a long period of time. The landform profile proposed is not elevated above surrounding topographic highs (proposed max of 52m AHD vs 126m AHD 1km north of the site) and is not lower than the surrounding free-draining creeks (proposed min of 20m AHD vs 11m AHD 0.7km north of the site). The shape of the landform is likely to be more camouflaged into the landscape than the large waste dumps that surround the site to the north and west.

1.2 Slope

The design assumption of 1V in 3H for geotechnical stability has been selected by assessing the local landscape in the immediate vicinity of the site for natural and man-made landscapes. The region contains significant coal mining disturbances which date back over 100 years, with spoil piles providing an example of landform stability. Whilst waste dumps have been observed to the north of site with slopes up to 45%, this is considered to pose a significant risk to the longevity of the final landform. East of the site there are slopes with mature remnant vegetation up to 40% over elevation rises of 10m. These slopes are examples of the possibilities, however the conservative 1V:3H slope (33%) has been selected for the site which is considered to be an industry average for similar landforms. Provided there are appropriate controls for the placement of fill material or controls over excavation conditions a 1 in 3 slope over 10-15m vertical distance is considered low risk to the overall landform stability.

1.3 Water Management

All final landform surfaces are designed to be water shedding (free-draining), natural earth, suitable for native ecosystem establishment. The location of the mine is at the top of a sub-catchment with limited inflows from surrounding catchments. The highest mapped flood level on site (QLD Globe) is the 1974 Brisbane and Bremer River event. The mapping only overlaps the northeast corner of the mining lease by approximately 40m. The final landform will result in a surface that is approximately 2.5m above this flood level. Therefore, the development is considered to have a low likelihood of flood impacts to the final landform.

The mine has no requirement for containment or seepage collection as there are no known contaminants, only benign products are extracted and processed on site. Surface water will be allowed to permeate through the landform similar to the pre-existing condition and recharge the groundwater table naturally. With appropriate erosion and sediment controls including groundcover, slope gradient controls and soil amelioration, the water quality of runoff from the rehabilitated landform will be adequate for direct discharge to the receiving environment. The extraction does not interfere with groundwater and therefore no impermeable layers are required.

1.4 Pit Backfill

Two types of pit backfill are proposed on site;

- Fill Type A: general overburden backfilling into the proposed mine excavations and filling above natural ground in the western area.
- Fill Type B: the backfilling of the historical Kerwicks #2 pit.

Fill Type A is proposed to be undertaken on a campaign basis over the life of the mine, with material excavated from the active mine areas, and dumped directly by articulated dump truck to the rehabilitation areas (mined out pits). The

fill source material is considered benign and naturally occurring on site, with appropriate gradation for backfilling operations. The material is then pushed and contoured using a dozer with track rolling in layers up to 0.5m in depth. Due to the relative slow nature of the backfill method, natural settlement will be allowed to occur and it is anticipated to have minimal impact on the overall landform due to additional material continually being placed on top prior to the final surface.

Standard mine QA/QC processes will be maintained, due to the relatively small footprint and simple nature of the process it is anticipated that the site supervisor will have adequate control over the process to ensure overfilling and/or ineffective compaction is avoided. Weekly pit inspections will be sufficient to monitor the activities and standard non-conformance practices will be upheld throughout the process. Rectification works will be possible using on-site machinery if identified early in the campaign, therefore proactive management will be the key to success.

The total depth of backfill will be up to 12m against the pit walls, reducing to several metres at the base of the pit at a 1V:3H slope. During the initial stages of rehabilitation, a trial will be conducted to assess the rate of subsidence observed on the slope by comparing drone survey data from placement to completion. Using the findings from this trial the future slopes will be overfilled by the approximated level of subsidence to offset any long-term landform slope changes.

Fill Type B will be managed as a single campaign for the sub-surface pit fill works. This is due to the requirement for dewatering the pit and the increased depth of fill required to completely fill the pit. These works will be subcontracted to a civil construction company to ensure appropriate controls are in place for the duration of the works. Fill for this area will be sourced from clean, earthen sources in the local area. It is noted that several land development projects are active in the region and the availability of quality fill materials in the required quantity is considered highly likely. A quality control process will be established to ensure the process complies with the following requirements:

- Source material:
  - Is inspected by the Site Supervisor prior to placement
  - Is free from contaminants
  - Plasticity Index (PI) <50%
  - Similar composition to the virgin ground conditions of the fill location (grading, material type)
  - Non-acid forming
- General earthworks to be carried out in accordance with AS3798.
- Earthworks to be carried out in the dry season with upslope diversions in place.
- Maximum thickness of uncompacted layer to be ≥2x maximum rock size.
- Mechanical compaction methods such as a Padfoot drum roller to be used.
- The compaction of material below natural ground, within the Kerwicks #2 Pit will be verified through compaction testing to AS1289.5.4.1.
- Fill Material shall have a minimum four-day soaked CBR of 3% when tested at 97% standard compaction and optimum moisture.
- Final surface to be free draining (no ponding of water)

Note that due to the relatively good quality of material used for backfilling, there is no need for re-establishment of the subsoil profile.

1.5 Rehabilitation Strategy

The staged rehabilitation plan (refer **Figures 13 to 16**) is designed to minimise the disturbance footprint as the mine progresses. This strategy also has benefits with respect to stakeholders in the area by reducing the potential for visual amenity impacts over the life of the mine. There are no direct residential neighbours to the mine, and limited line of sight to the pit workings from the housing estate to the east of the site due to topographic constraints. As discussed in previous sections, rehabilitation trials will be conducted to predict the success of the final landform design. The rehabilitation areas will be assessed for success factors and updates to the design incorporated into future rehabilitation activities.

1.6 Final Design Parameters

The design parameters selected for the mine are shown in **Table 1** below.

Table 1 – Design Parameters

Parameter		Value	Comment
Roads	Road Width	10m	Based on a 2x road truck width standard including provision for drainage and bunding.
	Road Gradient	10%	1 in 10 gradient which is suitable for road trucks.
Offsets	Mining Lease Boundary	20m	As per EA001386
	Powerline	25m	Powerline runs between the Western and Eastern Pits
Benches	Bench Height	12m	Risk assessment required for operations under benches >12m high. Forward planning restricts bench height to 12m.
	Batter Angle	70 degrees	Consistent with similar operations. Low geotechnical risk.
Rehabilitation	Batter Angle	1 in 3	Stable final landform that has been geotechnically assessed by an AQP as stable with FoS ≥1.5
	Floor Backfill	25m AHD	The pit floor is backfilled to 25m AHD to achieve a free draining final landform
	Floor Slope	2%	The pit floor is backfilled with a gentle slope towards the north of 2% to achieve a free draining final landform

Pit Floor

The pit floor was generated by the floor point of the drillholes provided by the client with minor amendments to BH3 (floor constrained), BH11 (excluded data) and BH15 (lithology assumption). Drillhole data was provided by the client from a drilling campaign in August 2014. In 2017/2018 a Resource Assessment was conducted on the site with a corresponding report titled "*ML50070 Shale Resource Assessment*" prepared for Jackal Renewables Pty Ltd by Ausrocks Pty Ltd in May 2018. This data is shown in **Table 2**.

Table 2 – Drillhole Data

Hole	From	To	Thickness	Rock Type	Comments
BH1	0	1	1	Topsoil	
BH1	1	2	1	Sandstone	
BH1	2	5	3	Shale	
BH1	5	7	2	Clay	
BH1	7	11	4	Mudstone	
BH1	11	12	1	Shale	
BH2	0	1	1	Shale	
BH2	1	4	3	Sandstone	
BH2	4	8	4	Clay	
BH2	8	11	3	Mudstone	
BH2	11	12	1	Shale	
BH3	0	1	1	Topsoil	
BH3	1	4	3	Sandstone	
BH3	4	8	4	Shale	
BH3	8	18	4	Mudstone	The pit floor was constrained to **12m**
BH4	0	2	2	Shale	
BH4	2	3	1	Sandstone	
BH4	3	7	4	Shale	
BH4	7	11	4	Mudstone	
BH4	11	12	1	Shale	
BH5	0	1	1	Topsoil	
BH5	1	2	1	Sandstone	
BH5	2	5	3	Clay	
BH5	5	7	2	Sandstone	
BH5	7	10	3	Shale	
BH5	10	12	2	Mudstone	
BH6	0	1	1	Topsoil	
BH6	1	3	2	Gravel	
BH6	3	5	2	Sandstone	
BH6	5	7	2	Shale	
BH6	7	10	3	Mudstone	
BH7	0	1	1	Topsoil	
BH7	1	3	2	Sandstone	
BH7	3	5	2	Clay	
BH7	5	8	3	Shale	
BH7	8	12	4	Mudstone	

BH8	0	1	1	Topsoil	
BH8	1	4	3	Clay	
BH8	4	7	3	Shale	
BH8	7	12	5	Mudstone	
BH9	0	1	1	Sandstone	
BH9	1	2	1	Shale	
BH9	2	4	2	Clay	
BH9	4	5	1	Sandstone	
BH9	5	6	1	Clay	
BH9	6	7	1	Sandstone	
BH9	7	10	3	Shale	
BH9	10	12	2	Mudstone	
BH10	0	1	1	Shale	
BH10	1	6	5	Sandstone	
BH10	6	8	2	Shale	
BH10	8	9	1	Mudstone	
BH10	9	12	3	Shale	
BH11	0	3	3	Sandstone	
BH11	3	5	2	Clay	
BH11	5	6	1	Mudstone	Disregarded from floor grid – assumed DH terminated early
BH12	0	1	1	Sandstone	
BH12	1	3	2	Clay	
BH12	3	4	1	Sandstone	
BH12	4	5	1	Shale	
BH12	5	6	1	Sandstone	
BH12	6	7	1	Shale	
BH12	7	12	5	Mudstone	
BH13	0	2	2	Sandstone	
BH13	2	4	2	Shale	
BH13	4	6	2	Gravel	
BH13	6	12	6	Shale	
BH13	12	13	1	Mudstone	
BH14	0	4	4	Sandstone	
BH14	4	6	2	Clay	
BH14	6	9	3	Shale	
BH14	9	12	3	Mudstone	
BH15	0	1	1	-	*No rock type provided - assumed to be topsoil*
BH15	1	3	2	Sandstone	
BH15	3	7	4	Clay	
BH15	7	8	1	Shale	
BH15	8	9	1	Sandstone	
BH15	9	12	3	Mudstone	

In-Situ Pit Volume Estimation

The Resource and Waste volumes were determined by calculating the global ratio of Resource (Shale, Clay and 50% Mudstone) against Waste (Topsoil, Sandstone, Gravel and 50% Mudstone) as logged in the provided drillhole data. The ratio of Resource/Waste was 58% / 42%. The ratio of Resource/Waste was assumed consistent in each stage of the pit design (e.g., 58% Resource in Stage 1 with a volume of 215,511.78m^3 is 124,573.18m^3).

Table 3 – In-situ Volume Estimate

Pit Stages	Pit Surface Area (m^2)	Pit Design Total Volume (m^3)	Resource Volume (m^3)	Waste Volume (m^3)	Topsoil Volume (m^3)
Stage 1	22,619	215,512	124,573	90,939	3,393
Stage 2	21,255	246,560	142,520	104,040	3,188
Stage 3	23,109	274,361	158,590	115,771	3,466
Stage 4	23,399	187,767	108,536	79,231	3,510
Total		**924,199**	534,218	389,980	13,557

Pit Design and Extraction

A four staged pit design was generated as part of the ML50070 Mine Planning to underpin the PRCP. The pit design continues the sites extracting of the resource in the most economically viable, safe and environmentally sound methodology. Mining operations of the “Eastern Pit” are extracting the resource from the western area progressing towards the east. The Eastern Pit is constrained by a 20m buffer from the Mining Lease Boundary and a 25m buffer from the powerline that runs between the Western and Eastern Pits. The Eastern Pit is accessed via a 10% ramp from the north-western side which is 10m wide.

The upper surface of the assessment is defined by a LiDAR survey dated 2014 downloaded from the Elevation and Depth – Foundation Spatial Data (elevation.fsdf.org.au). The resource is a clay/shale/mudstone deposit and so the design parameters have been set accordingly to allow these materials to be less impactful on the long-term stability of the mine face. Table 4 details the estimated production for the mine and the expected timeframe for each of the Pit stages.

Table 4 – Mine Stage Volume Summary

Stages	Resource (m^3)	Number of Years Operation (yr)	Production Rate (m3/yr)	Calendar Year (start)	Calendar Year (finish)
Stage 1	124,573	5.0	25,000	2023	2028.0
Stage 2	142,520	4.1	35,000	2028.0	2032.1
Stage 3	158,590	4.5	35,000	2032.1	2036.6
Stage 4	108,536	3.1	35,000	2036.6	2039.7
Total	534,218	16.7			

Pit Design – Stage 1

Stage 1 of the Pit Design (**Figure 1**) commences immediately outside of the 25m buffer from the powerline. The pit is accessed from a 10% ramp in the northwestern corner which is 10m wide. The pit floor ranges from 17-39m AHD with the floor plunging towards the north, following the resource floor. The pit is excavated with a 70^0 batter which is 12m high. The pit is constrained by a 20m buffer from the Mining Lease Boundary.

Figure 1 – Pit Design – Stage 1



Pit Design – Stage 2

Stage 2 of the Pit Design (**Figure 2**) continues the excavation towards the east. The pit access is expected to change due to progressive rehabilitation as shown in **Figure 13**. The pit floor ranges from 17-36m AHD with the floor plunging towards the north, following the resource floor. The pit is excavated with a 70^0 batter which is 12m high. The pit is constrained by a 20m buffer from the Mining Lease Boundary.

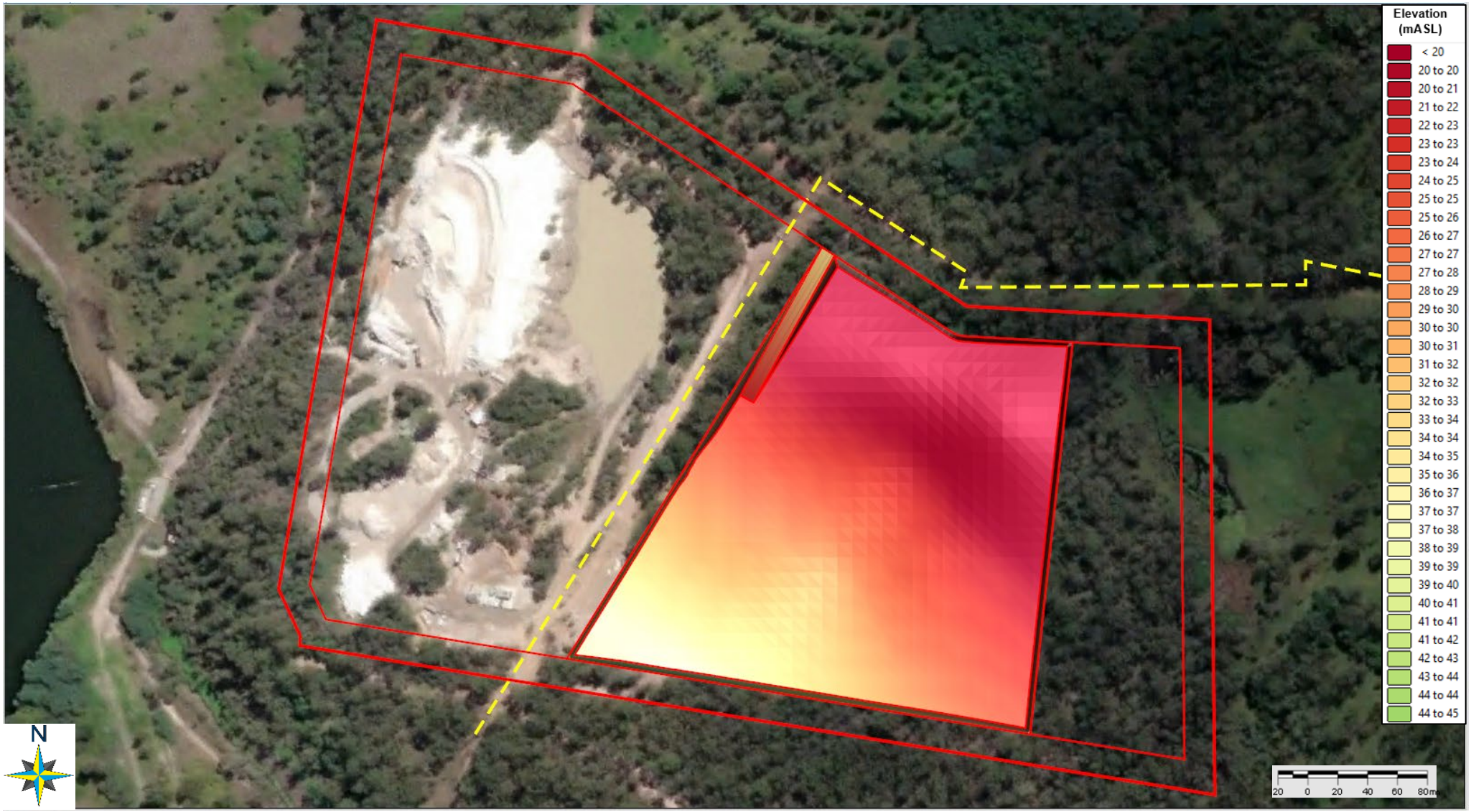
Figure 2 – Pit Design – Stage 2



Pit Design – Stage 3

Stage 3 of the Pit Design (**Figure 3**) continues the excavation towards the east. The pit floor ranges from 17-30m AHD with the floor plunging towards the north, following the resource floor. The pit is excavated with a 70^0 batter which is 12m high. The pit is constrained by a 20m buffer from the Mining Lease Boundary.

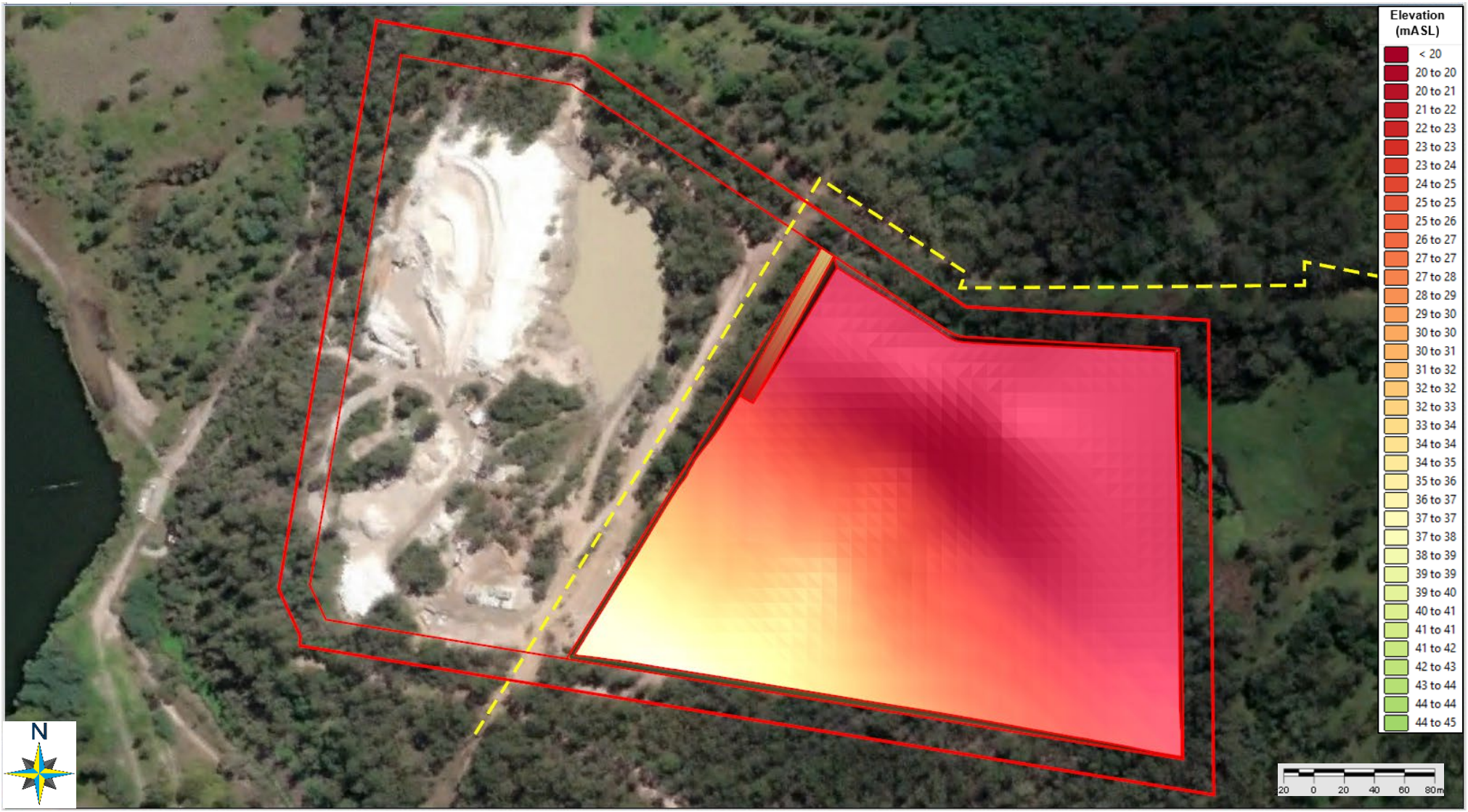
Figure 3 – Pit Design – Stage 3



Pit Design – Stage 4

Stage 4 of the Pit Design (**Figure 4**) continues the excavation towards the pit limit. The pit floor ranges from 17-24m AHD with the floor plunging towards the north, following the resource floor. The pit is excavated with a 70^0 batter which is 12m high. The pit is constrained by a 20m buffer from the Mining Lease Boundary.

Figure 4 – Pit Design – Stage 4



Pit Design – Cross Sections

Figures 5-12 detail cross sections plotted roughly East-West and North-South through the pit design. The sections are vertically exaggerated 2x for viewing purposes.

Figure 5 – Pit Design – Stage 1 East-West Cross Section (Looking North)

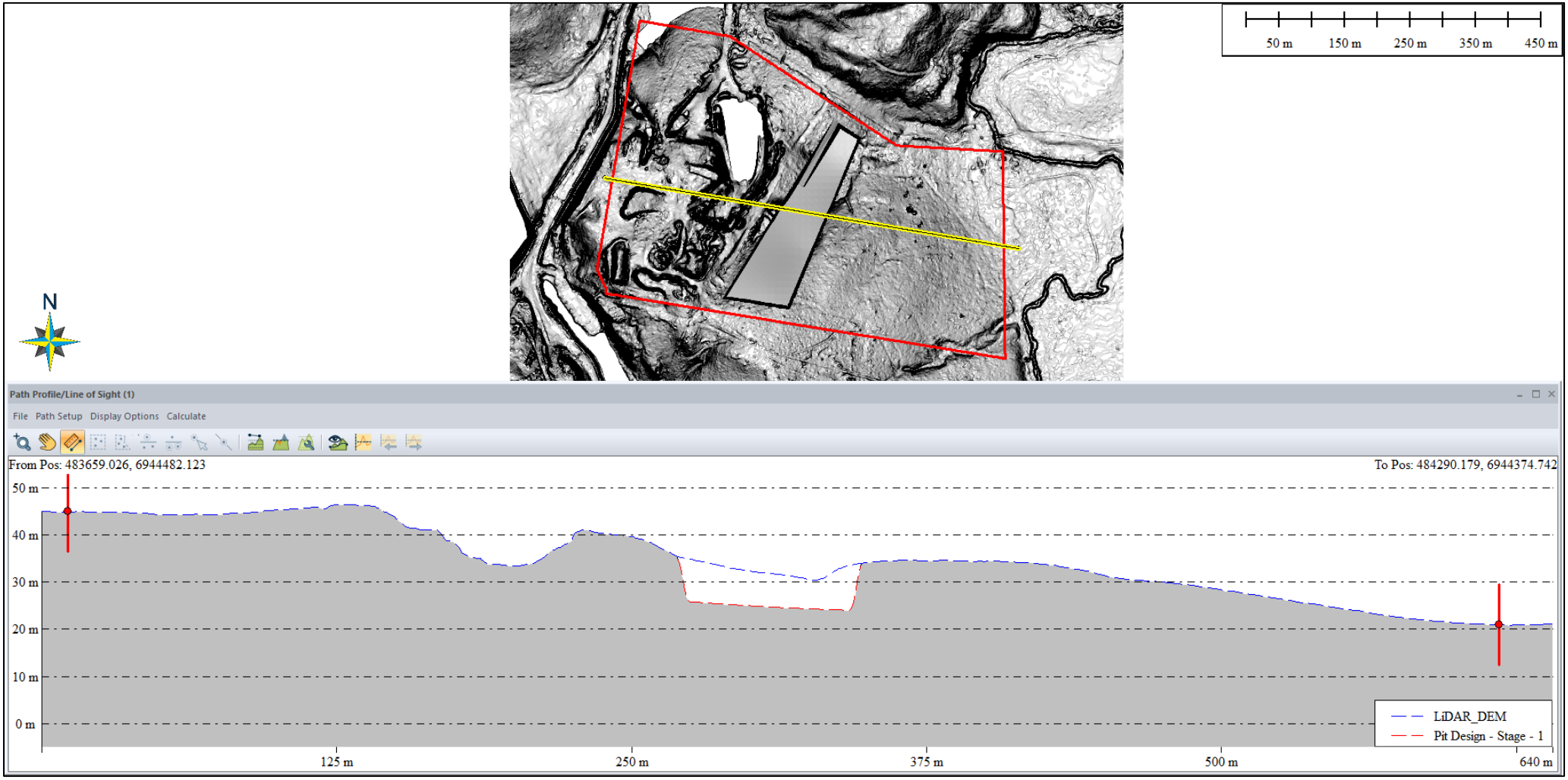


Figure 6 – Pit Design – Stage 1 South-North Cross Section (Looking West)

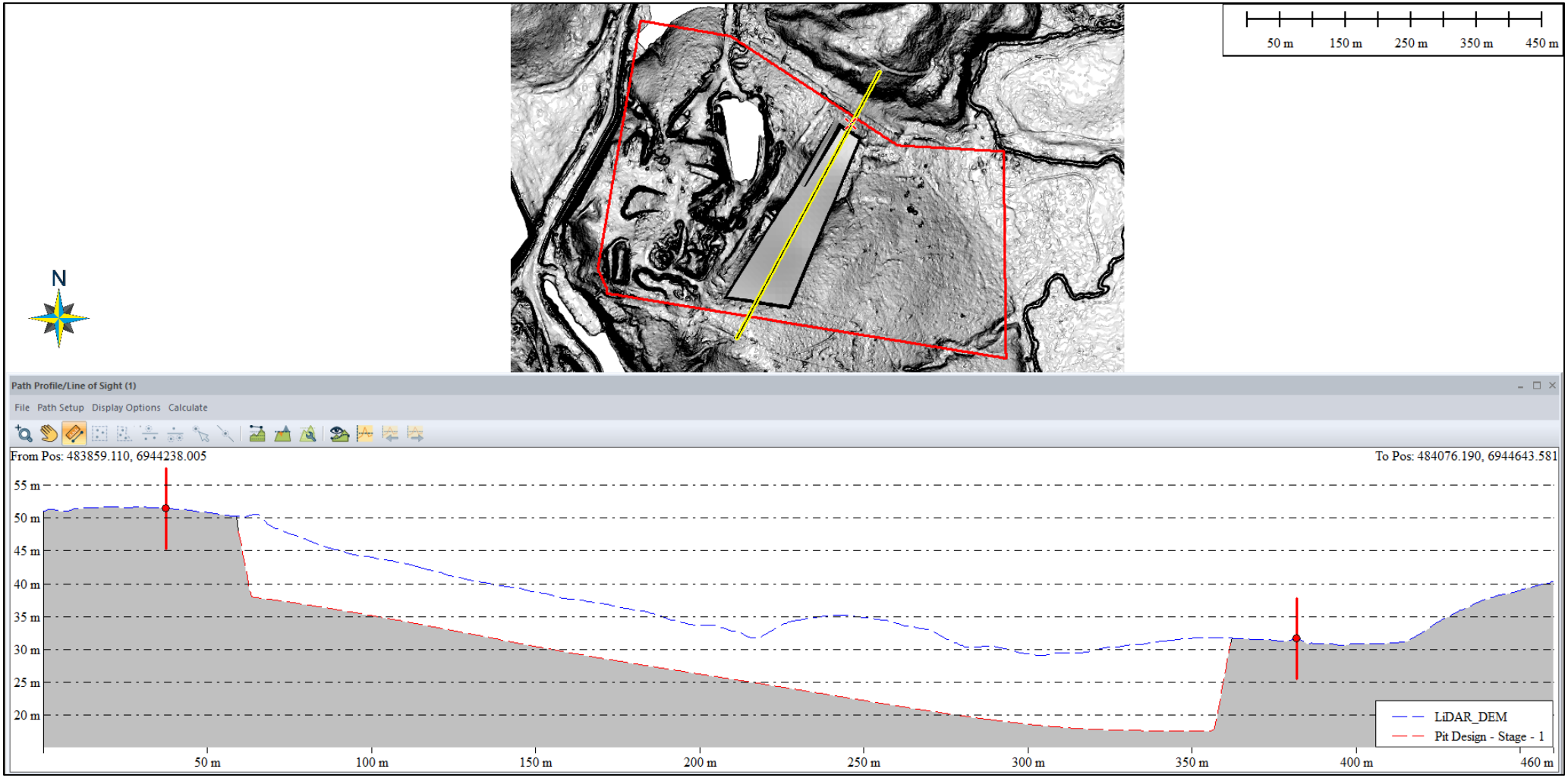


Figure 7 – Pit Design – Stage 2 East-West Cross Section (Looking North)

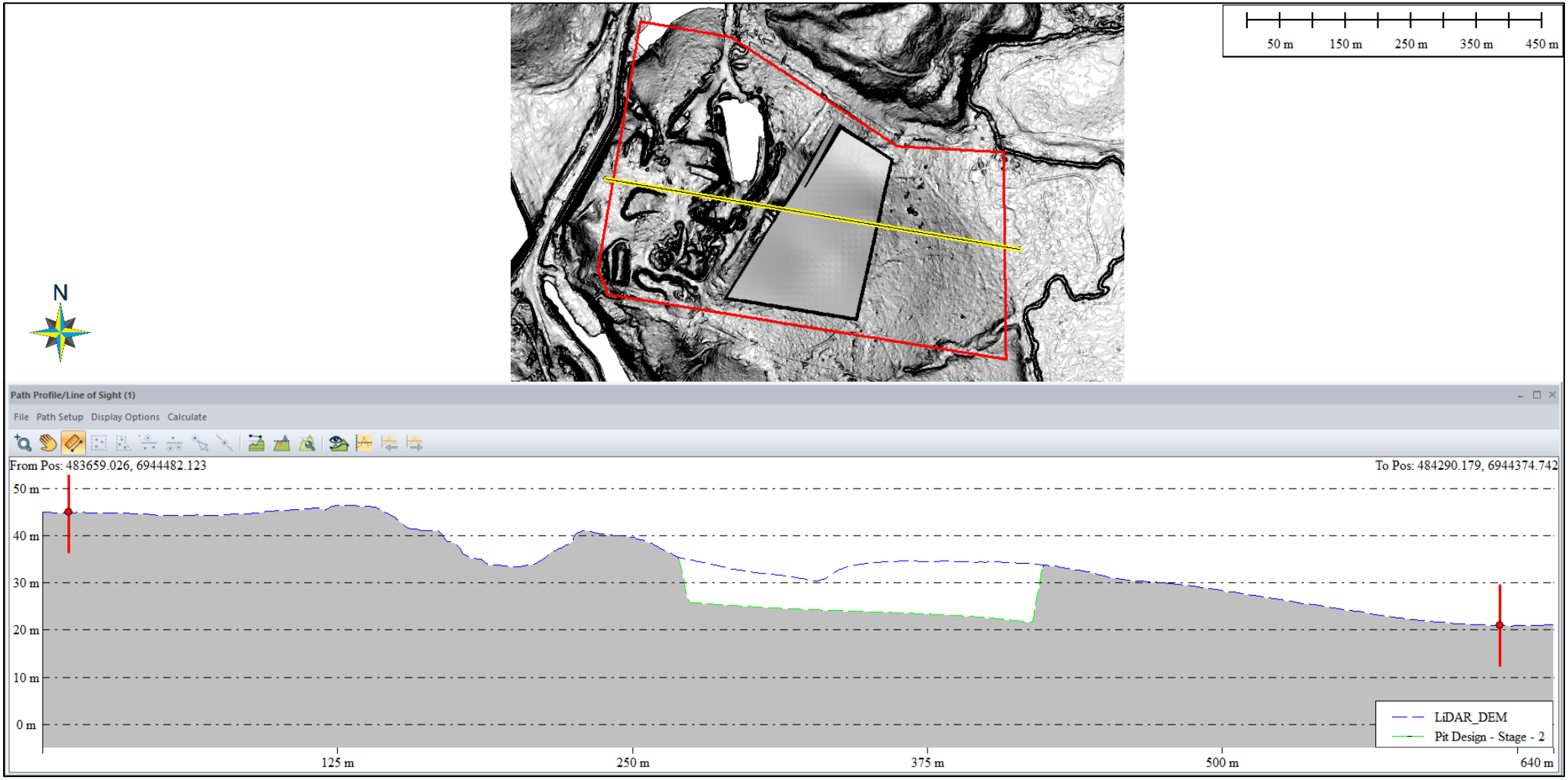


Figure 8 – Pit Design – Stage 2 South-North Cross Section (Looking West)

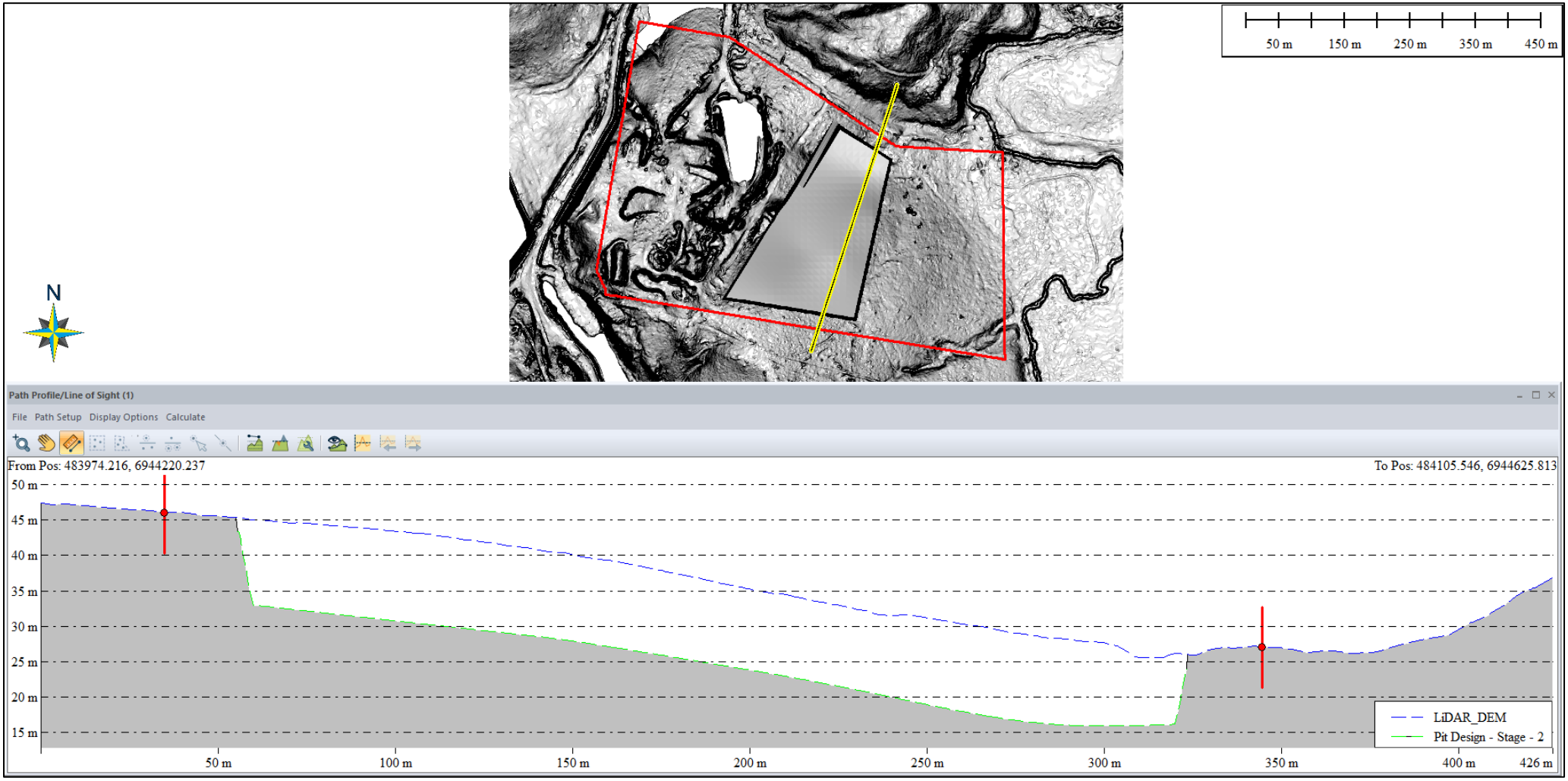


Figure 9 – Pit Design – Stage 3 East-West Cross Section (Looking North)

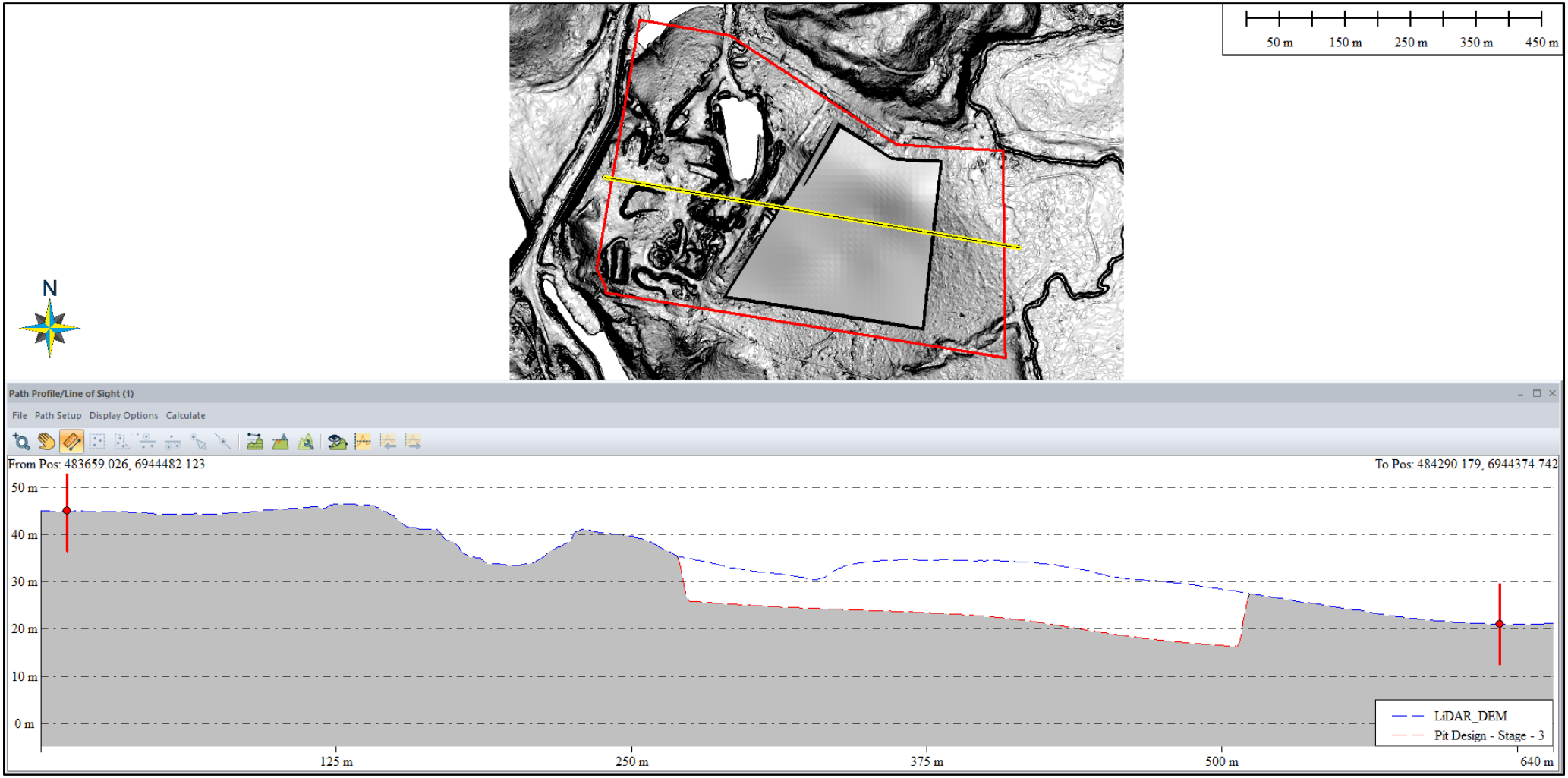


Figure 10 – Pit Design – Stage 3 South-North Cross Section (Looking West)

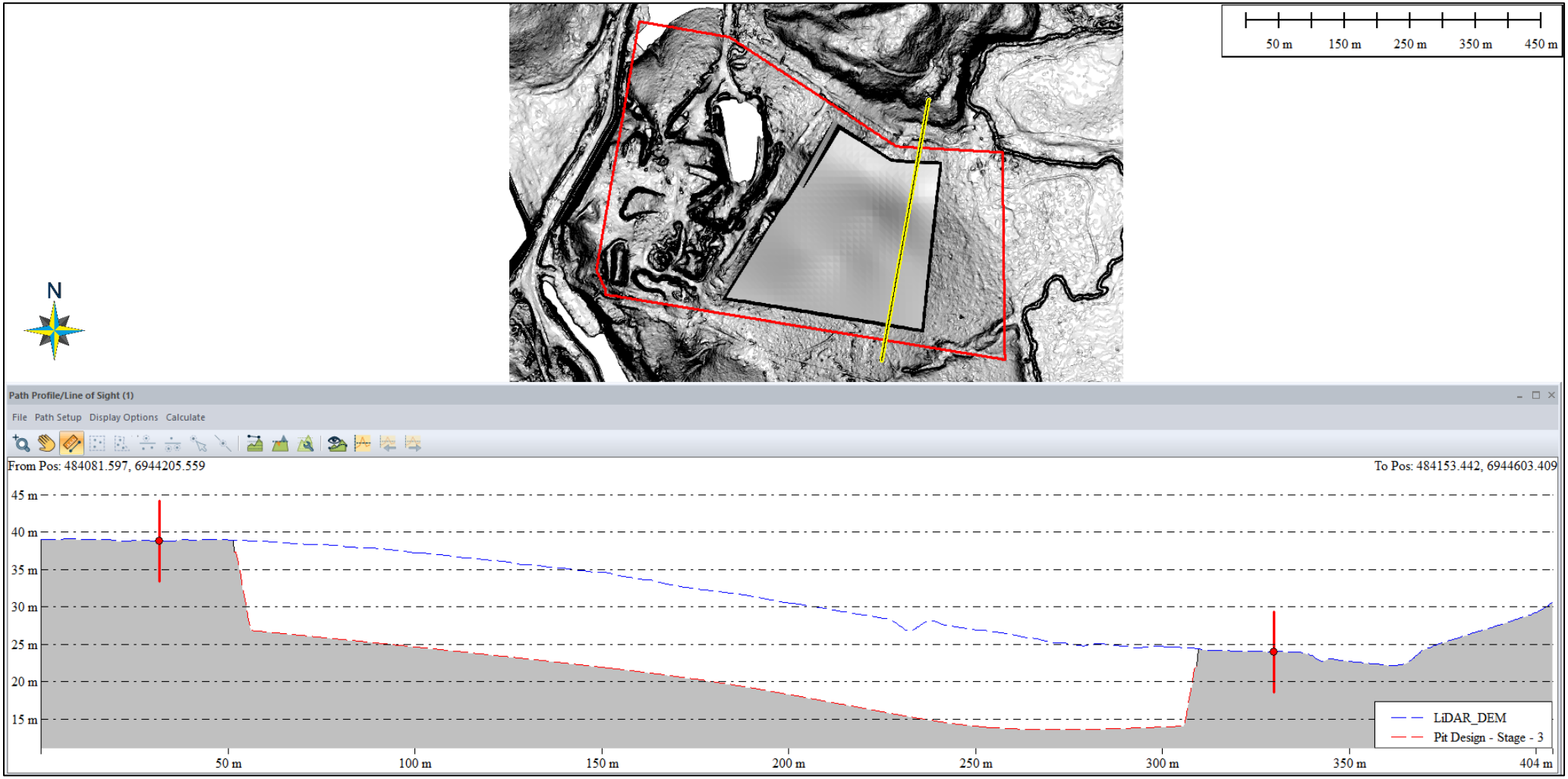


Figure 11 – Pit Design – Stage 4 East-West Cross Section (Looking North)

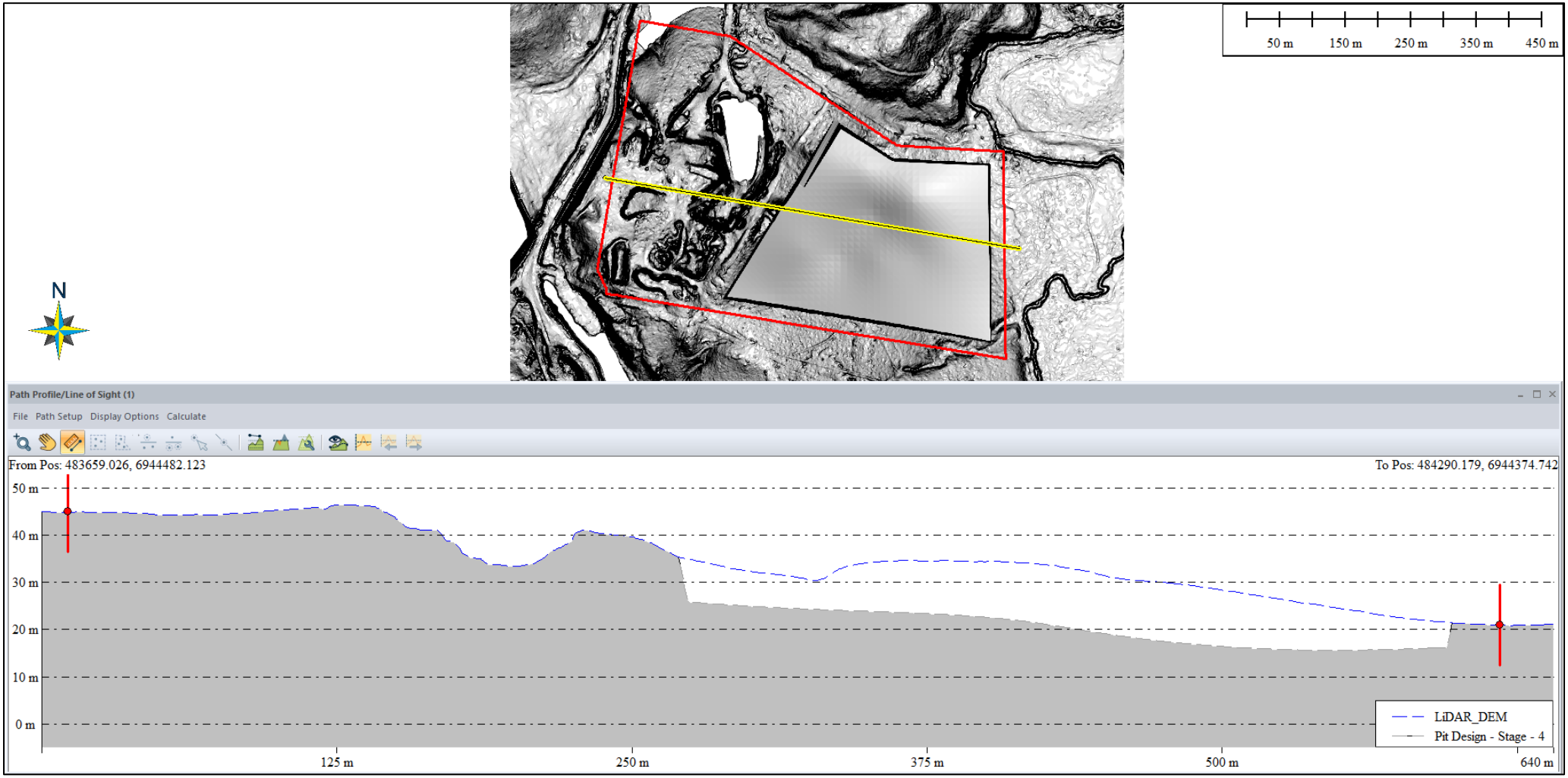
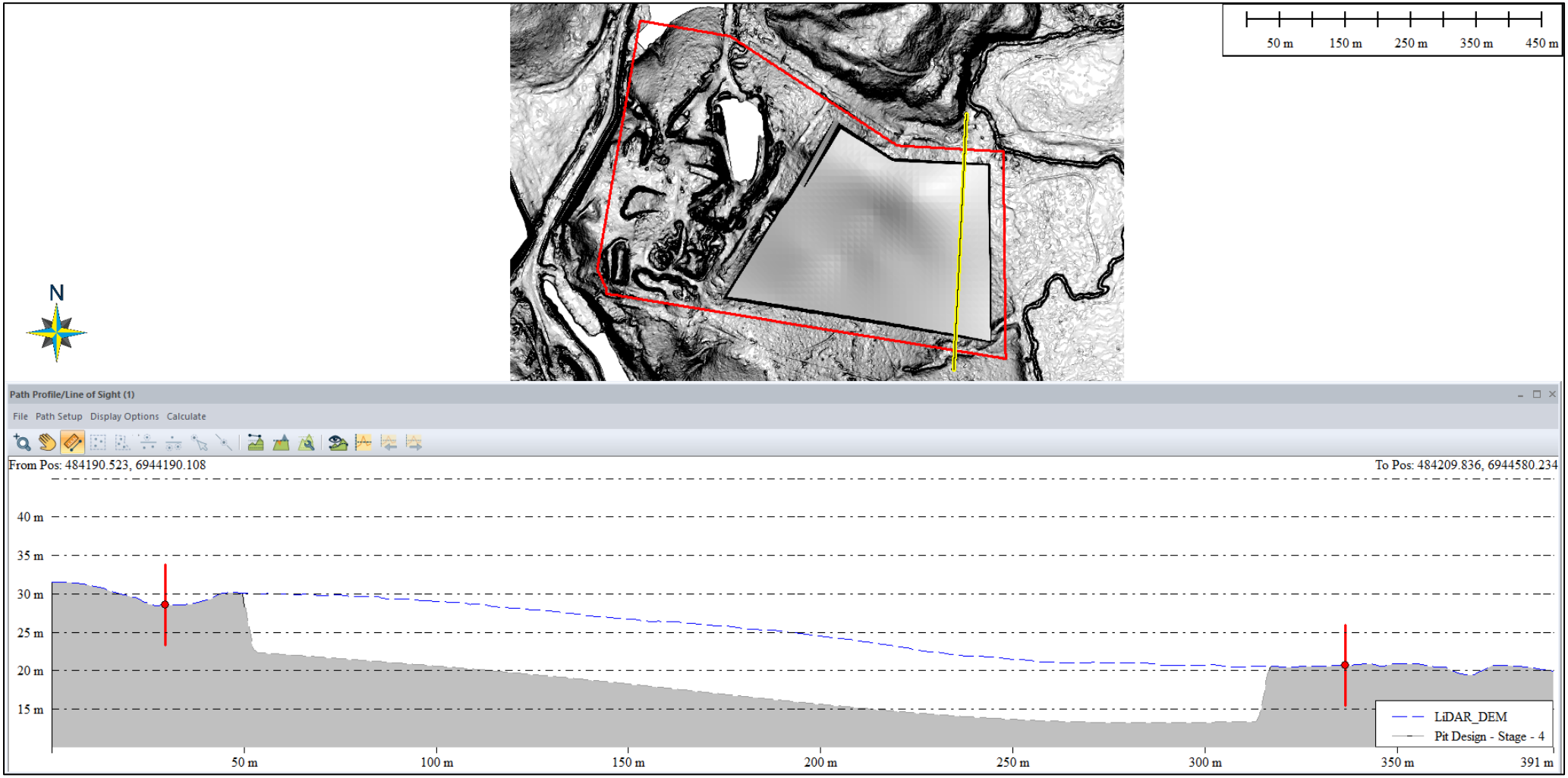


Figure 12 – Pit Design – Stage 4 South-North Cross Section (Looking West)



Progressive Rehabilitation Design

The mine is progressively rehabilitated to minimise environmental impact. The objective of the Final Landform Design is to be geotechnically stable and free draining. As such, the pit batters are reduced to a 1 in 3 slope and the floor is backfilled to 25m AHD with a gentle slope (2%) towards the north.

Table 5 – Rehabilitation Material Balance

Rehabilitation Stages	Rehabilitation Area((RA)	Surface Area (m^2)	Rehabilitation Cut (m^3)	Rehabilitation Fill (m^3)	Rehabilitation Total (m^3)	Topsoil Volume (m^3)
Stage 1	RA1	16,454	0	79,385	79,385	2,468
Stage 2	RA2	12,619	0	67,177	67,177	1,893
Stage 3	RA3	9,877	0	117,987	117,987	1,482
Stage 4 (Eastern Pit)	RA4	51,435	0	165,414	165,414	7,715
Stage 4 (Laydown/hardstand area, cleared area & access tracks)		80,871	36,070	267,977	231,907	12,131
Powerline	RA5	4,963	-	-	-	-
Total		**176,219**	**36,070**	**697,940**	**661,870**	**25,688**

Rehabilitation fill will be sourced from a number of locations, including:

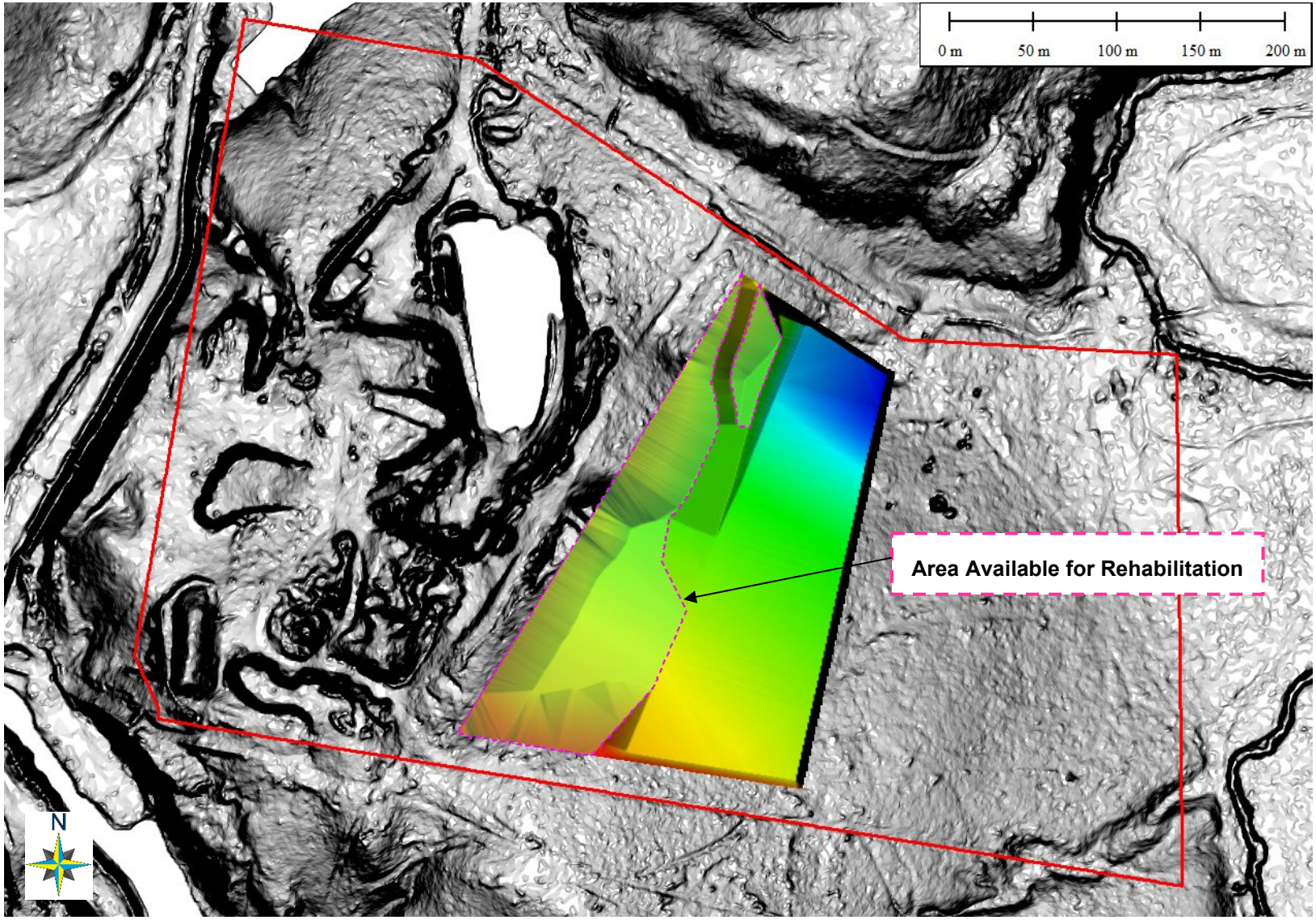
- Overburden/Waste Rock excavated from the Pit,
- Cut from the Western Pad
- Other sources of material as required.

Material excavated from site has been assumed with a swell factor of ~15%, resulting in a shortfall of ~171,913m^3

Progressive Rehabilitation Design – Stage 1

Stage 1 of the Progressive Rehabilitation Design is shown in **Figure 13**. The pit access is changed to allow for rehabilitation of the original pit access. The pit batters are reduced to a 1 in 3 slope and the floor is backfilled to 25m AHD with a gentle slope (2%) towards the north to ensure a geotechnically stable and free draining final landform.

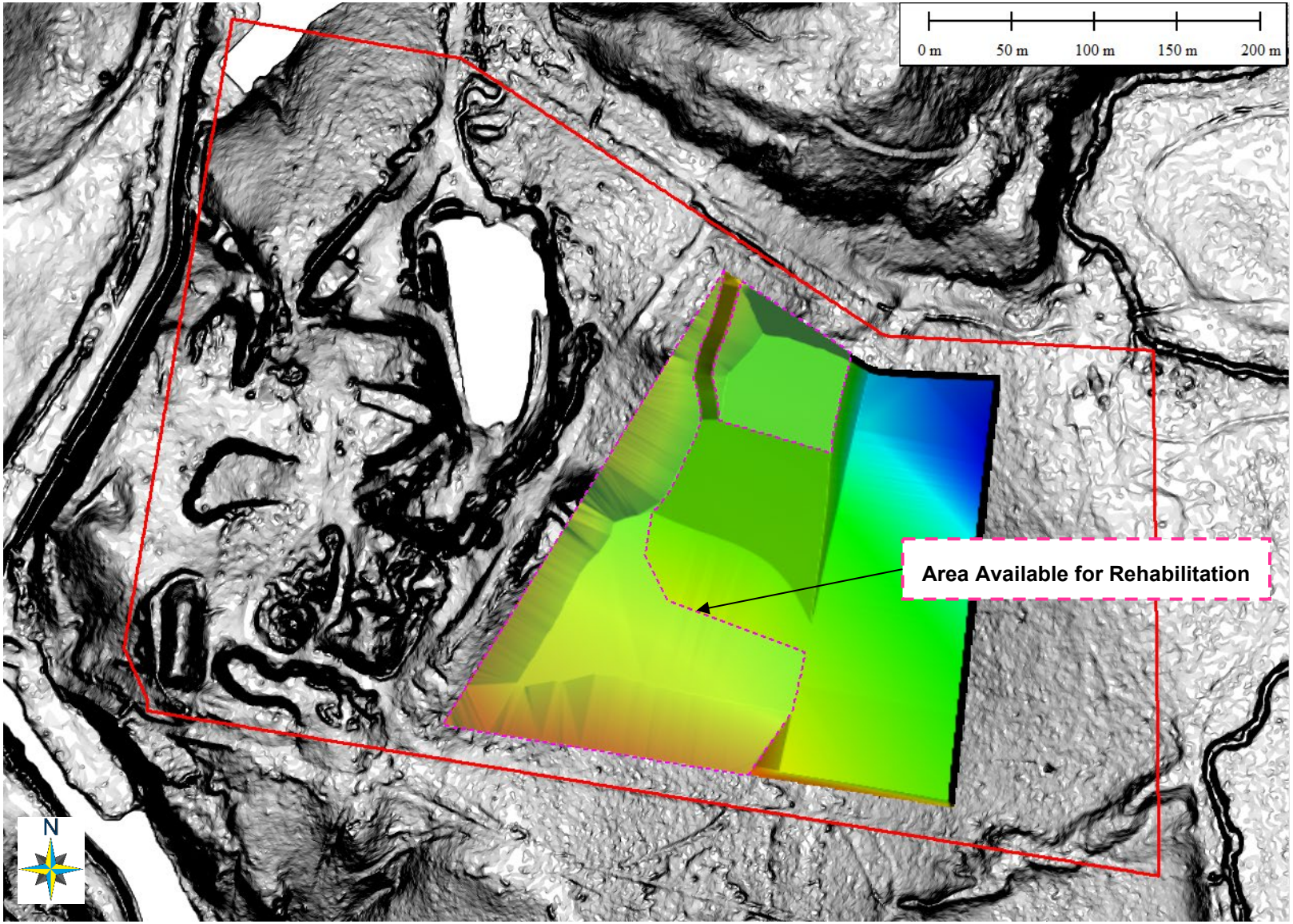
Figure 13 – Progressive Rehabilitation Design – Stage 1



Progressive Rehabilitation Design – Stage 2

Stage 2 of the Progressive Rehabilitation Design is shown in **Figure 14**. The pit batters are reduced to a 1 in 3 slope and the floor is backfilled to 25m AHD with a gentle slope (2%) towards the north to ensure a geotechnically stable and free draining final landform.

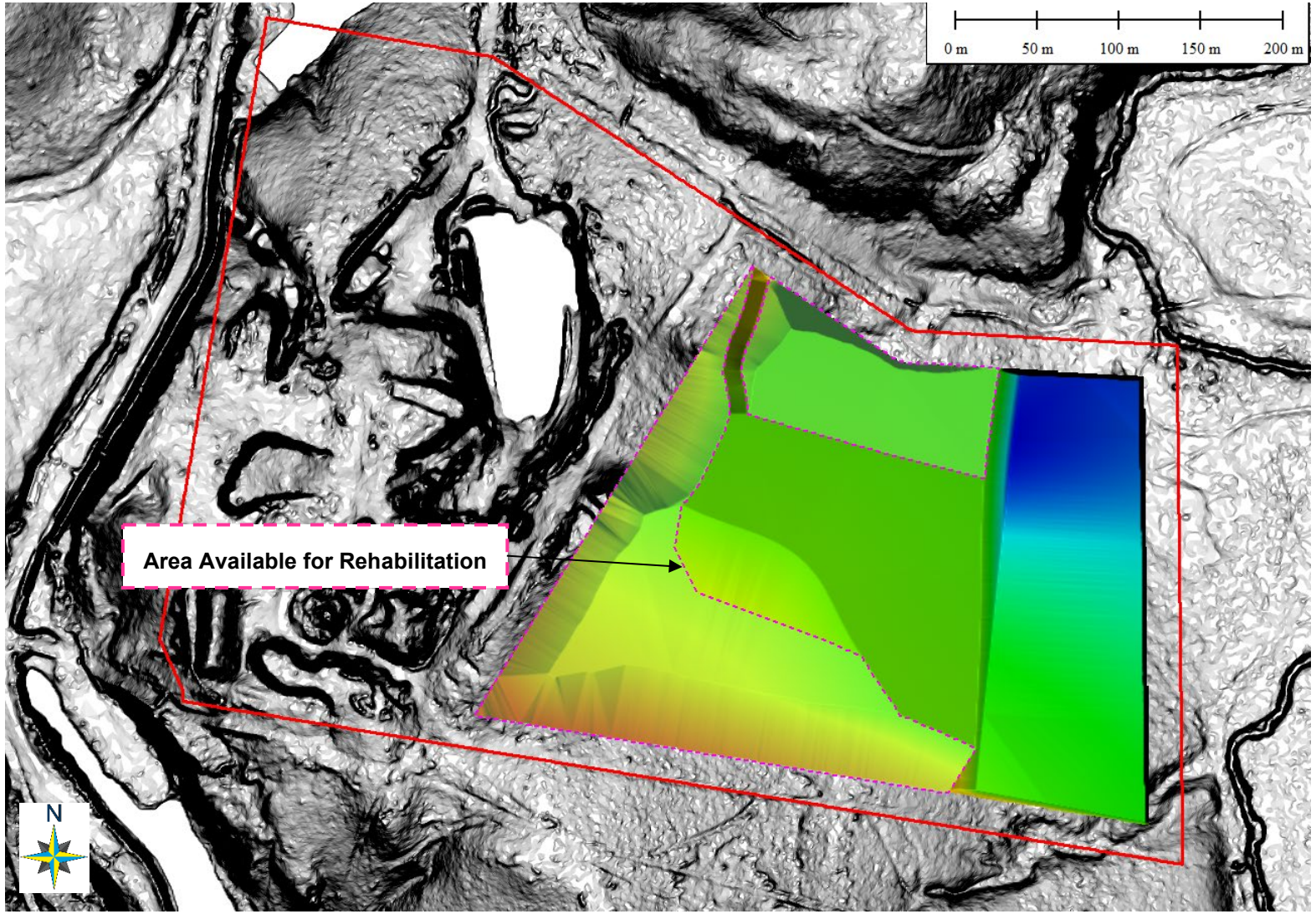
Figure 14 – Progressive Rehabilitation Design – Stage 2



Progressive Rehabilitation Design – Stage 3

Stage 3 of the Progressive Rehabilitation Design is shown in **Figure 15**. The pit batters are reduced to a 1 in 3 slope and the floor is backfilled to 25m AHD with a gentle slope (2%) towards the north to ensure a geotechnically stable and free draining final landform.

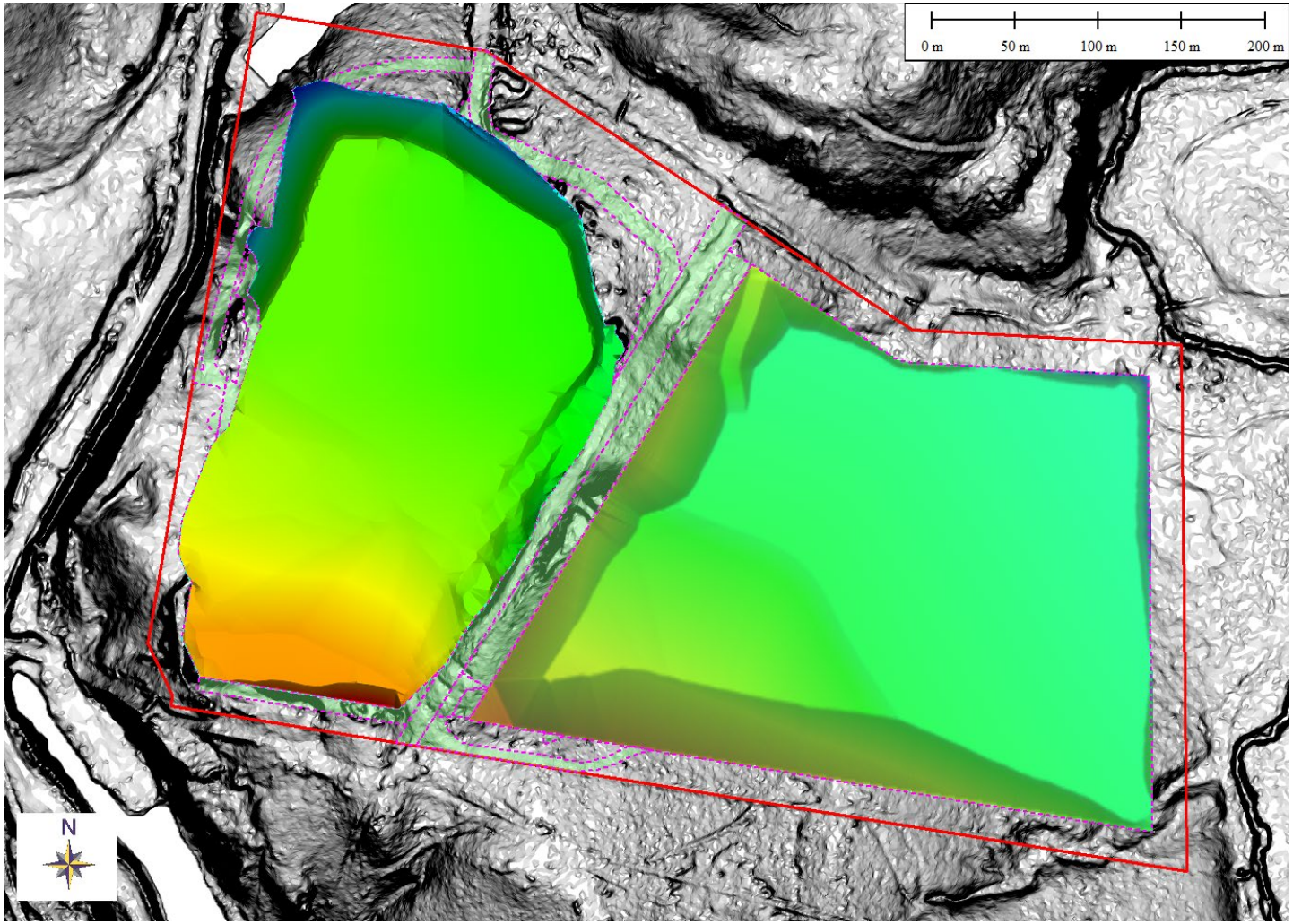
Figure 15 – Progressive Rehabilitation Design – Stage 3



Progressive Rehabilitation Design – Stage 4

The **Final Landform Design** is achieved in Stage 4 of the Progressive Rehabilitation Design (**Figure 16**). All pit batters are reduced to a 1 in 3 slope and the floor is backfilled to 25m AHD with a gentle slope (2%) towards the north to ensure a geotechnically stable and free draining final landform. This stage also includes the Western Pad reprofiling works. The western pad is designed to be free-draining to the north-east at ~1% grade, with a 1:3 (18.4 degrees) batter slope around the western, northern and eastern sides. It also incorporates a 1:10 gradient ramp on the eastern side to facilitate access to the pad from the northern access. Roads and other areas are also rehabilitated as shown.

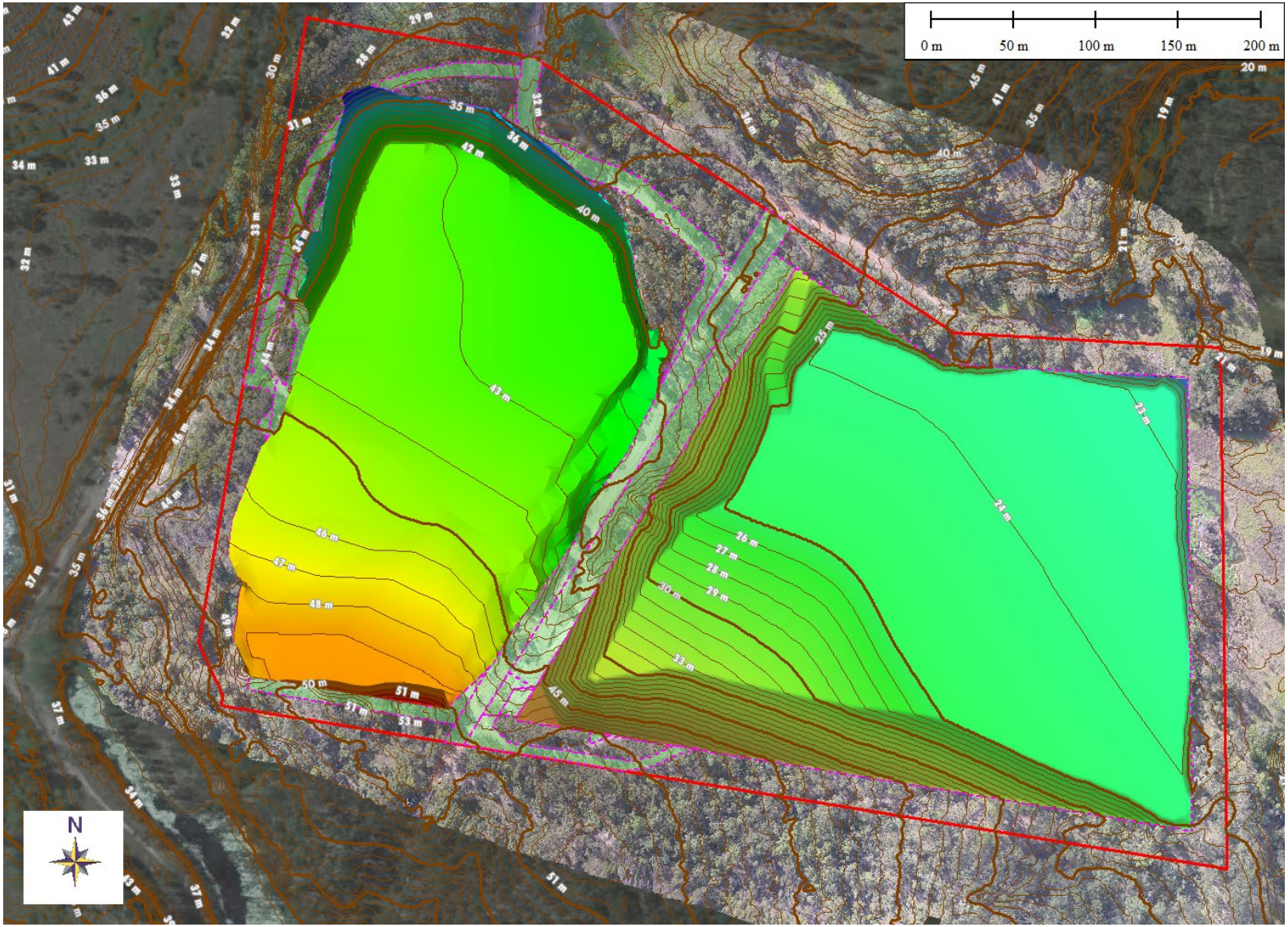
Figure 16 – Progressive Rehabilitation Design – Stage 4



Final Landform Design

The Final Landform Design incorporates the Stage 4 Pit rehabilitation along with the Western Pad reprofiling works. **Figure 17** shows the final landform with 1m contours.

Figure 17 – Final Landform Design – Pit & Western Pad



Figures 18-20 detail a series of cross sections through the final landform design. The pit shell has also been included for reference. The area between the western pad and the southern ML boundary has been flattened to represent boundary rehabilitation works to remove historic topsoil stockpiles in this area.

Figure 18 – Final Landform Design East-West Cross Section (Looking North)

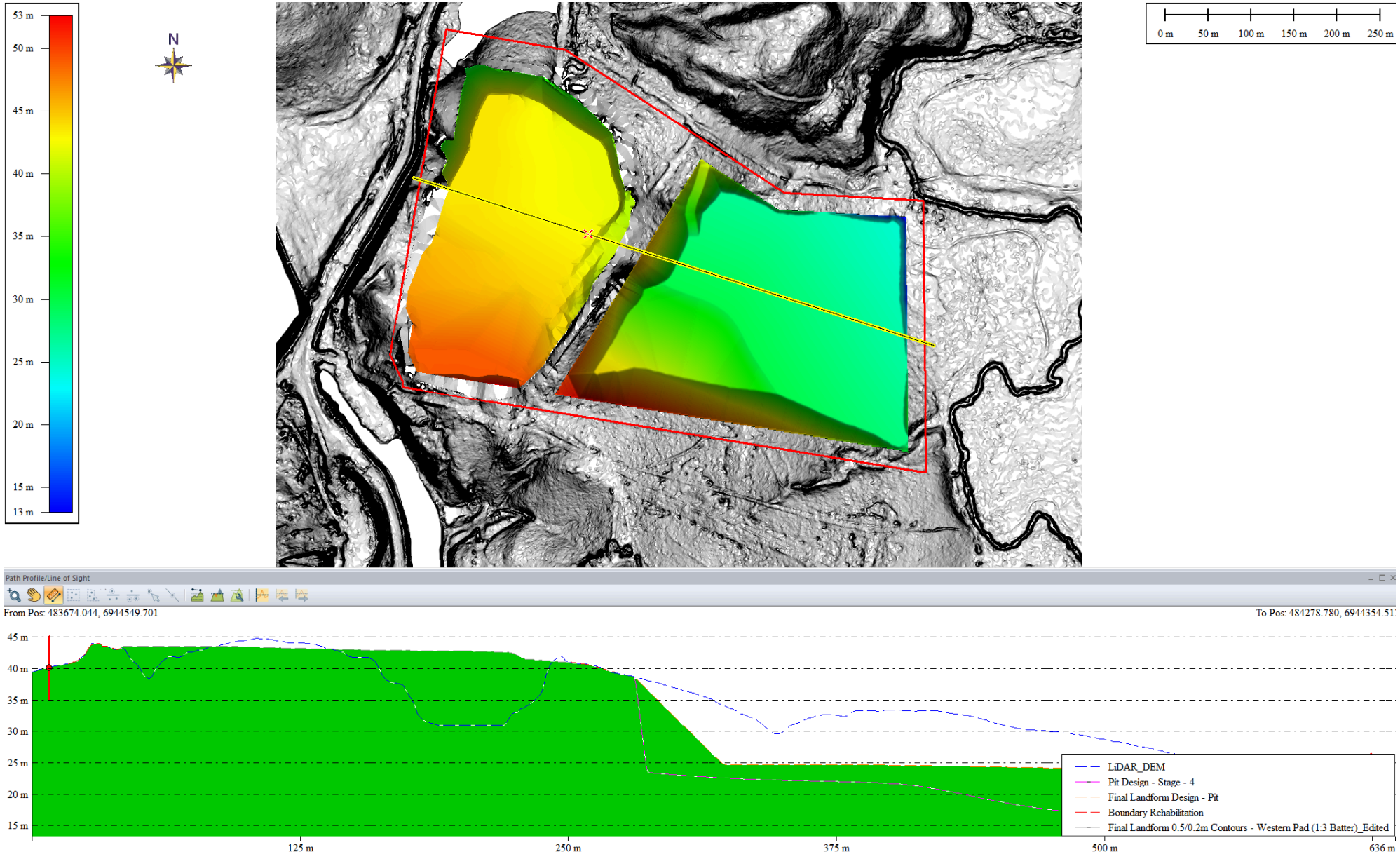
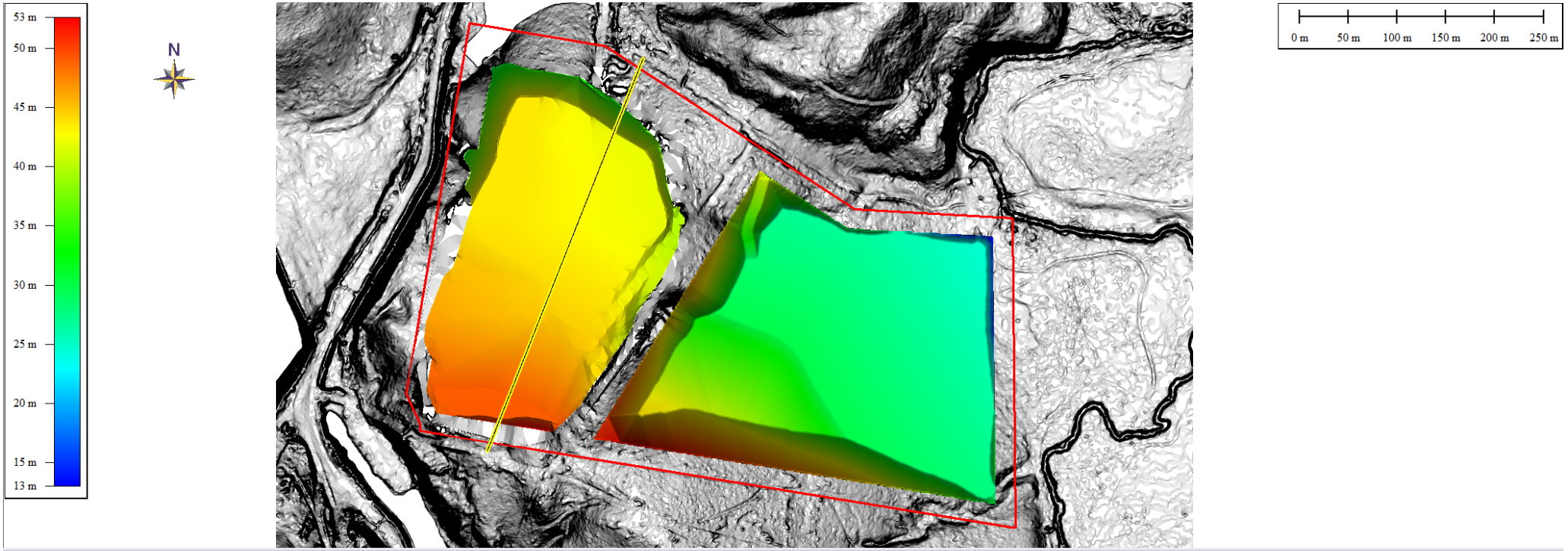


Figure 19 – Final Landform Design South-North Cross Section_Western Pad (Looking West)



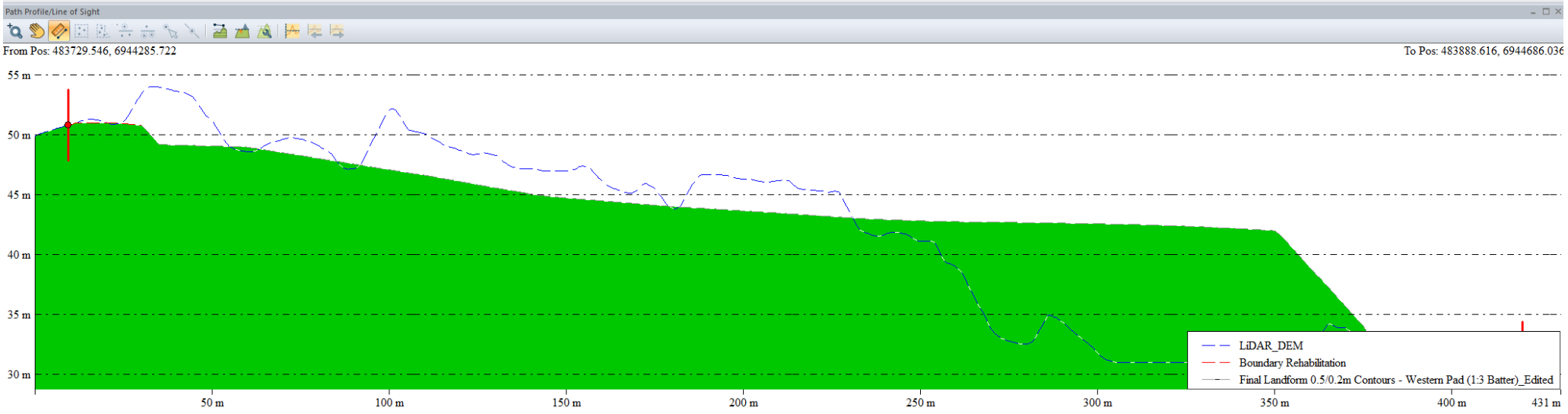
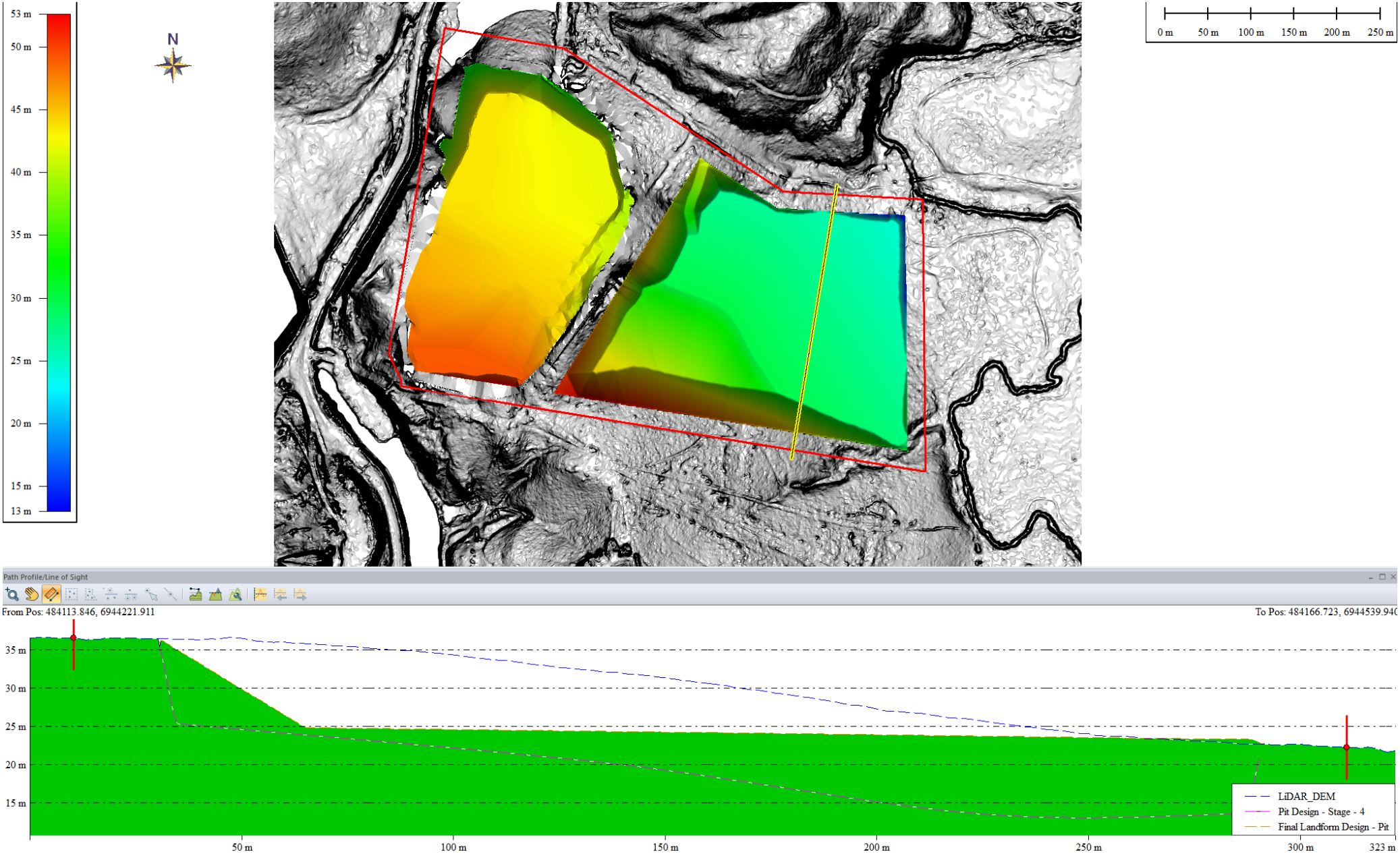


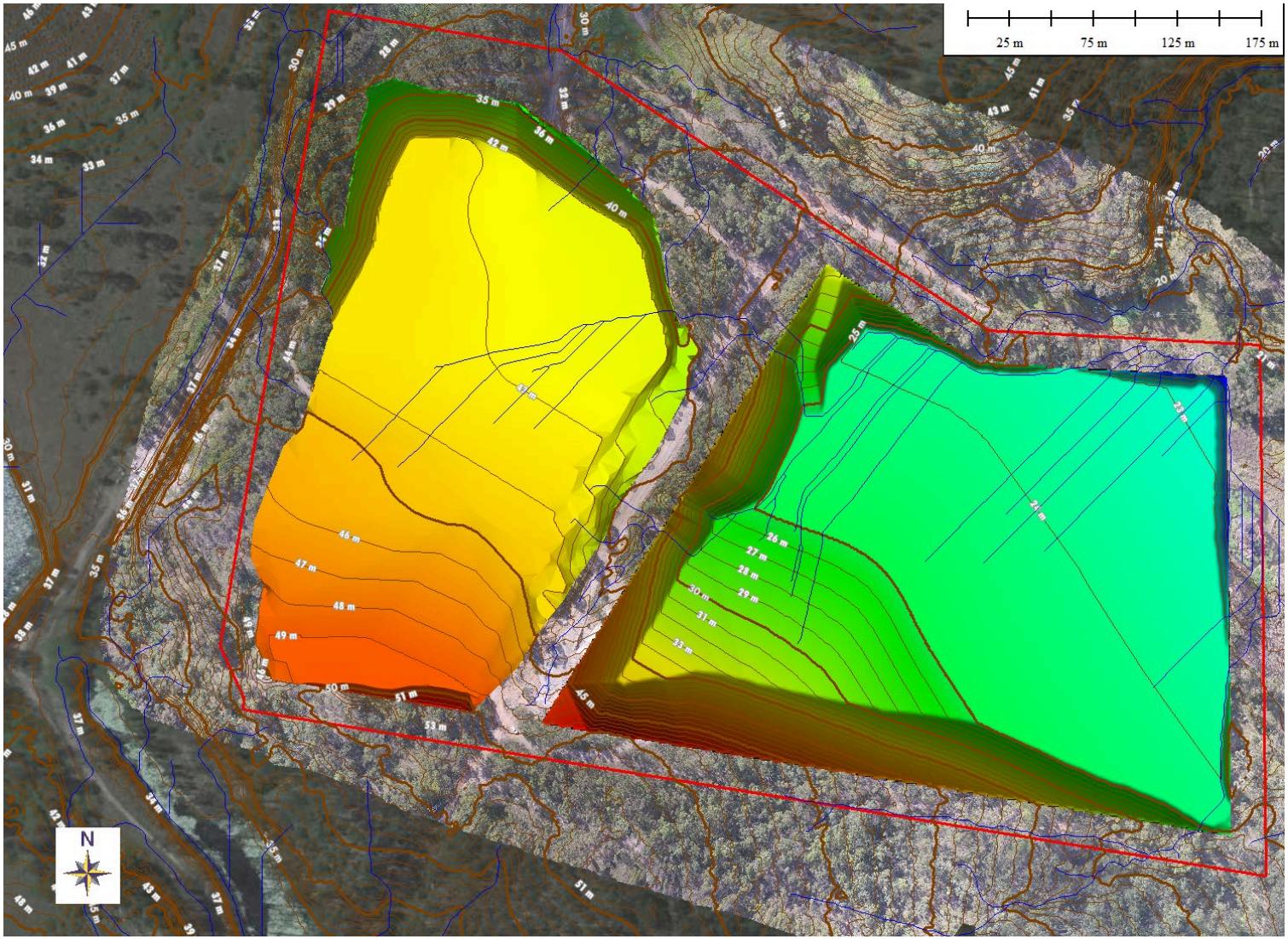
Figure 20 – Final Landform Design South-North Cross Section_Pit Design (Looking West)



Watershed Analyses – Final Landform Design

The **Final Landform Design** is a free draining final landform (**Figure 21**). The floor is backfilled to 25m AHD with a gentle slope (2%) towards the north to ensure a geotechnically stable and free draining final landform. Water flowing off the western pad surface and down the embankment will have a rock lined chute to prevent scouring and erosion. Detailed drainage designs may be warranted as part of the final rehabilitation stage to guide long term water flows and ensure stability of the landform.

Figure 21 – Watershed Analyses – Final Landform Design



PART B – ATTACHMENTS PRCP SCHEDULE

Appendix 1 – PRCP Schedule
Appendix 2 – EA0001386 – Land Outcome Document
Appendix 3 – Ecological Studies
Appendix 4 – Mine Planning Report
Appendix 5 – Topsoil Assessment
Appendix 6 – Hydrogeological Assessment

Appendix 5 – Topsoil Assessment

3 Water Street Red Hill 4059
T: +61 7 3368 1033
E: information@ardent-group.com.au
W: ardent-group.com.au
ABN: 38 609 696 764

TOPSOIL ASSESSMENT

JACKAL RENEWABLES PTY LTD

MINING LEASE (ML) 50070

FEBRUARY 2024

JKR005

Document Control Sheet

Ardent Group Pty Ltd	
Street Address:	3 Water Street, Red Hill Qld 4059
Postal Address:	PO Box 320 Red Hill Qld 4059
Phone:	+61 7 3368 1033
Email:	information@ardent-group.com.au
Web:	www.ardent-group.com.au

Project:	JKR005	**Issue Date:**	6 February 2024
Title:	Topsoil Assessment		
Project Manager:	Richard Davis		
Author:	Jacob Arnold / Joseph Castellan		
Client:	Jackal Renewables Pty Ltd		
Client Contact:	Rob Howe		

Revision Number	Date
Rev A	06/12/2023
Rev B	06/02/2024
Rev C	
01	13/02/2024
02	

Number of Copies									
Revision Number	**A**	**B**	**C**	**D**	**01**	**02**	**03**	**04**	**05**
Ardent Group File	1	1			1				
Client					1				
Department									

Contents

1. Introduction 3
1.1 Scope of work 3
1.2 Previous Sampling 3
1.3 Experience and Qualifications 3
2. Field Investigation 4
2.1 Method 4
2.2 Field Observations 6
3. Laboratory Results and Discussion 8
3.1 2023 Sampling Results 8
3.2 2021 Sampling Results 9
3.3 Discussion of Results 10
4. Conclusion 12

Figures

Figure 1 ML 50070 Topsoil Sample Locations 5
Figure 2 ML 50070 Interpreted Topsoil Thickness 7

Tables

Table 1 2023 Soil Sample Locations 4
Table 2 Topsoil Description 6
Table 3 2023 Soil Sampling Laboratory Results 8
Table 4 2021 Soil Sampling Laboratory Results 9
Table 5 Soil Analysis Results Comparison 11

Appendices

Appendix 1 Field Records
Appendix 2 Photos
Appendix 3 Laboratory Results

1. Introduction

1.1 Scope of work

A limited topsoil survey was undertaken on 31 October 2023 by Ardent Group Pty Ltd (Ardent Group), on behalf of Jackal Renewables Pty Ltd (Jackal Renewables). The objective of the topsoil survey was to understand the depth of the topsoil across Mining Lease (ML) 50070, in particular future mining areas, for the purpose of determining topsoil characteristics for later rehabilitation.

The survey was undertaken with reference to Australian Standard (AS) 1726:2017 "*Geotechnical Site Investigations*" and the "*Australian Soil and Land Survey Field Handbook*" ("yellow book").

1.2 Previous Sampling

Ardent Group previously conducted soil sampling within ML 50070 on 17 June 2021. This involved seven soil samples taken from the western portion of the future mining area.

1.3 Experience and Qualifications

Soil sampling was undertaken by Richard Davis and Joseph Castellan. Richard Davis has a BSc(Hons) in Geology, is a Certified Environmental Practitioner (#263) and is suitably qualified and experienced for the scope of this work. Joseph Castellan was a Graduate Environmental Consultant with BA(Hons) in Environmental Studies. Soil analysis was conducted by Australian Laboratory Services Pty Ltd (ALS) Environmental Brisbane. ALS is accredited by National Association of Testing Authorities (NATA) (#825) for the analysis undertaken.

2. Field Investigation

2.1 Method

Five soil survey sites (in addition to the 2021 sampling sites) were identified across the future mining area (eastern portion of ML 50070). These locations are detailed in **Table 1** and shown in **Figure 1** (along with the 2021 sampling locations). A hand soil auger used to drill down to at least 50cm below surface (or refusal) at each location.

Observations on soil characteristics and depth were made at each site. Samples of the identified topsoil layer were placed into the appropriate sampling containers and kept cool until delivery to the laboratory. ALS analysed the soil samples for the following parameters:

- pH;
- Electrical conductivity (EC)
- Moisture content
- Exchange acidity;
- Exchangeable cations;
- Inorganic nitrogen;
- Bicarbonate extractable phosphorus; and
- Organic matter.

During sampling, the following actions were taken to ensure appropriate quality control (QC)/ quality assurance (QA):

- Nitrile gloves were worn by the sampler, with a new pair of gloves donned at each site;
- Sample sites were recorded on paper;
- Samples were kept cool until delivered to the laboratory; and
- A NATA accredited laboratory was selected to complete the analysis.

In addition, the laboratory undertakes internal QA/QC checks, as part of their NATA accreditation.

Table 1 2023 Soil Sample Locations

Sample ID	Easting	Northing
SS8	484243	6944322
SS9	484115	6944306
SS10	484125	6944428
SS11	484211	6944446
SS12	484013	6944499

Coordinates are GDA2020 MGA Zone 56



0 10 20 30 40 50
m

JACKAL RENEWABLES PTY LTD

Project Overview

N
W E
S

GDA2020, MGA Zone 56

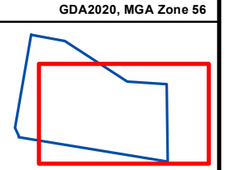
ARDENT GROUP PTY LTD

Figure 1 - ML50070 Topsoil Sample Locations

Drawn By:	Chris Schlebusch
Requested by:	Joseph Castellan
Date:	7/12/2023

Sheet No.
RTPL_ARD_STW001_MAP_1027_A

- ML50070 Boundary
- Property Boundary
- Contour (2m)
- Contour (10m)
- Topsoil Sample



Data sources:
© State of Queensland, Department of Resources

Path: S:\Plans\Project_Specific\Ardent\STW001\RTPL_ARD_STW001_MAP_1027_A A3L ML50070 and Topsoil Sample Locations.mxd

2.2 Field Observations

A brief description of the topsoil and its depth recorded at each site during the sampling has been included in **Table 2**. The complete field observations for each site have been attached at **Appendix 1**. Photos for each site sampled during the 2023 survey have been attached **Appendix 2**. In each photo, the right-hand pile is the shallowest sample (0-10cm). Piles placed to the left are in 10cm increments as digging continued.

Table 2 Topsoil Description

Sample ID	Soil Description	Topsoil Depth (cm)
SS8	Light brown, fine grain sandy topsoil. Dry with a few roots and low organic matter.	0-10
SS9	Light brown, very fine-grained sand with silt. Slightly moist with a few roots and low organic matter.	0-10
SS10	Brown to light Brown, fine grain and sandy. Low organic matter.	0-10
SS11	Brown to light brown, fine grained topsoil. Slightly moist with high amounts organic matter.	0-20
SS12	Dark brown fine grained and dry topsoil with high organic content.	0-15

The topsoil thickness varied across the site from 10 to 20cm. In the northeastern flatter and lower elevated area of ML 50070, topsoil thickness is approximately 20cm. While in the more elevated northwestern area of the future mining area, topsoil is approximately is 15cm. The majority of the remaining gently sloping future mining area has a topsoil thickness of 10cm.

The soil observations in the 2021 all recorded 10cm topsoil thickness, apart from the SS5 and SS6 sites in a minor drainage gully.

Figure 2 illustrates the interpreted topsoil thickness across the future mining area of ML 50070.



0 10 20 30 40 50
m

JACKAL RENEWABLES PTY LTD

Project Overview

N
W E
S
GDA2020, MGA Zone 56

ML50070 Boundary	Interpreted Topsoil Thickness
Property Boundary	10cm
Contour (2m)	15cm
Contour (10m)	20cm
Survey Boundary	

ARDENT GROUP PTY LTD

ML50070

Interpreted Topsoil Thickness

Drawn By:	Chris Schlebusch
Requested by:	Joseph Castellan
Date:	11/12/2023

Sheet No.
RTPL_ARD_STW001_MAP_1028_A

Data sources:
© State of Queensland, Department of Resources

Path: S:\Plans\Project_Specific\Ardent\STW001\RTPL_ARD_STW001_MAP_1028_A A3L ML50070 and Interpreted Topsoil Thickness.mxd

3. Laboratory Results and Discussion

3.1 2023 Sampling Results

The laboratory results for the 2023 soil sampling have been summarised in **Table 3**, with the complete laboratory reports attached at **Appendix 3**.

Review of the QA/QC results reported by the laboratory has indicated:

- No Method Blank value outliers occur;
- No Duplicate outliers occur;
- No Laboratory Control outliers occur;
- No Matrix Spike outliers occur;
- For all regular sample matrices, no surrogate recovery outliers occur;
- Analysis holding times exist for pH, EC and moisture content; and
- No Quality Control Sample Frequency Outliers exist.

Table 3 2023 Soil Sampling Laboratory Results

Analyte	Unit	Limit of Reporting	SS8	SS9	SS10	SS11	SS12
pH	pH Unit	0.1	5.5	4.8	5.2	5.6	5.8
Electrical Conductivity	µS/cm	1	18	22	32	23	36
Moisture Content	%	0.1	3.2	2.3	4.2	3.9	4.4
Inorganic Nitrogen as N	mg/kg	20	<20	<20	<20	<20	<20
Bicarbonate Extractable Phosphorus	mg/kg	5	<5	<5	<5	<5	<5
Organic Matter	%	0.5	2	1.7	4.1	2.1	5.4
Exchange Acidity							
Exchange Acidity	meq/100g	0.1	2.6	1.9	0.8	0.8	0.5
Exchangeable Aluminium	meq/100g	0.1	0.1	1.3	0.4	0.4	0.2
Exchangeable Cations							
Exchangeable Calcium	meq/100g	0.1	1.1	<0.1	1.4	0.7	3.1
Exchangeable Magnesium	meq/100g	0.1	0.8	0.4	1.6	0.9	3.7
Exchangeable Potassium	meq/100g	0.1	0.3	0.2	0.5	0.3	0.4
Exchangeable Sodium	meq/100g	0.1	<0.1	<0.1	0.1	0.1	0.3
Cation Exchange Capacity	meq/100g	0.1	4.8	2.5	4.4	2.8	8
Exchangeable Sodium Percent	%	0.1	3	7.9	3.4	5.1	3.7
Calcium/Magnesium Ratio	-	0.1	1.4	<0.1	0.9	0.8	0.8
Magnesium/Potassium Ratio	-	0.1	2.8	1.8	3.4	3.1	8

3.2 2021 Sampling Results

For comparison purposes, the 2021 soil monitoring results have been summarised in **Table 4**. The 2021 samples were not analysed for inorganic nitrogen, bicarbonate extractable phosphorous and organic matter.

Table 4 2021 Soil Sampling Laboratory Results

Analyte	Unit	Limit of Reporting	SS1	SS2	SS3	SS4	SS5	SS6	SS7
pH	pH Unit	0.1	5.9	6.0	5.8	5.9	5.6	5.2	5.4
Electrical Conductivity	µS/cm	1	12	10	17	6	34	34	18
Moisture Content	%	0.1	7.4	8.1	12.7	6.9	11.6	10.6	6.2
Exchange Acidity									
Exchange Acidity	meq/100g	0.1	0.9	0.6	1.9	0.5	1.4	2.0	1.3
Exchangeable Aluminium	meq/100g	0.1	0.6	0.3	1.4	0.2	0.9	1.4	0.8
Exchangeable Cations									
Exchangeable Calcium	meq/100g	0.1	1.0	2.8	2.3	1.2	1.7	0.7	1.2
Exchangeable Magnesium	meq/100g	0.1	2.8	2.5	6.0	1.3	4.7	3.4	1.6
Exchangeable Potassium	meq/100g	0.1	0.3	0.5	0.6	0.4	0.5	0.3	0.5
Exchangeable Sodium	meq/100g	0.1	0.3	0.1	0.7	<0.1	0.5	0.4	0.2
Cation Exchange Capacity	meq/100g	0.1	5.4	6.5	11.6	3.6	8.9	7.0	4.9
Exchangeable Sodium Percent	%	0.1	6.2	2.2	7.3	2.4	6.7	8.5	4.3
Calcium/Magnesium Ratio	-	0.1	0.4	1.1	0.4	0.9	0.4	0.2	0.8
Magnesium/Potassium Ratio	-	0.1	8.3	4.9	9.0	2.9	9.4	11.0	3.3

3.3 Discussion of Results

Soils in the future mining area are mapped as a tenosol in the level 4 Australian Soil Classification Mapping on the Australian Soil Resource Information System (ASRIS). Tenosols are poorly developed soils which generally, have low fertility and low water-holding capacity.

The results have been reviewed against relevant criteria from '*AS 4419-2018: Soils for Landscaping and Garden Use'*, as shown in **Table 5**. The comparison shows that the soil in the future mining area naturally has very low electrical conductivity, and the exchangeable sodium and potassium are in the correct range. However, the existing soils are naturally calcium deficient, low in available nitrogen and generally low in organic matter.

Table 5 Soil Analysis Results Comparison

Property		Criteria in AS 4419 (Low Organic, Low Phosphorous Soils)	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12
EC (µS/cm)		<750	12	10	17	6	34	34	18	18	22	32	23	36
Na (% of ECEC)	No pre-treatment for soluble salts	<20	0.3	0.1	0.7	<0.1	0.5	0.4	0.2	<0.1	<0.1	0.1	0.1	0.3
K (% of ECEC)		3-15	5.6	7.7	5.2	11.1	5.6	4.3	10.2	6.3	8.0	11.4	10.7	5.0
Ca (% of ECEC)	Acid and neutral soils	50-80	18.5	43.1	19.8	33.3	19.1	10.0	24.5	22.9	<LOR	31.8	25.0	38.8
Mg (% of ECEC)		10-30	51.9	38.5	51.7	36.1	52.8	48.6	32.7	16.7	16.0	36.4	32.1	46.3
Available P (mg/kg)		<30	-	-	-	-	-	-	-	<5	<5	<5	<5	<5
Organic Matter (%dwb)		3-6	-	-	-	-	-	-	-	2	1.7	4.1	2.1	5.4
Total available N (NO_3 + NH_4) (mg/kg)		>20	0.4	1	0.4	0.6	0.7	0.2	0.5	-	-	-	-	-

Note: <LOR denotes that the laboratory result was below the limit of reporting.

4. Conclusion

The topsoil thickness varied across the site from 10 to 20cm. In the northeastern flatter lower elevated area of ML 50070, topsoil thickness is approximately 20cm. In a drainage gully in the elevated northwestern area of the future mining area, topsoil is approximately is 15cm. The majority of the remaining future mining area has a topsoil thickness of 10cm.

Laboratory analysis of the topsoil has been compared against the relevant criteria from *'AS 4419-2018: Soils for Landscaping and Garden Use'*. The comparison shows that the soil in the future mining area naturally has very low electrical conductivity and the exchangeable sodium and potassium are in the correct range. However, the existing soils are naturally calcium deficient, low in available nitrogen and generally low in organic matter.

TOPSOIL ASSESSMENT
JACKAL RENEWABLES PTY LTD

Appendix 1 Field Records

Site	SS8		Easting	484,243	Northing	6,944,322
From	**To**	**Horizon**	**Description**			
0cm	10cm	A	Light brown, fine grained sandy topsoil, dry roots, dry, low organic matter			
10cm	20cm	B	As above but lighter in colour, few roots			
20cm	30cm	B	Light brown (lighter), find sand-silt, transition from above			
30cm	50cm	B-C	Tan, light tan, fine sand, silt, dry			

Site	SS9		Easting	484,115	Northing	6,944,306
From	**To**	**Horizon**	**Description**			
0cm	10cm	A	Light brown, very fine grained sand, minor silt, slightly moist, roots			
10cm	20cm		Dark grey, very fine grained sand, dry, few roots			
20cm	40cm		Light grey, very fine sand, lumpy texture, orange mottles horizons			

Site	SS10		Easting	484,125	Northing	6,944,428
From	**To**	**Horizon**	**Description**			
0cm	10cm	A	Brown, very fine grain sand, minor lead litter, roots, dry			
10cm	30cm		Lighter brown, fine sand, minor orange mottling.			
30cm	50cm		Light grey, very fine sand, dry			

Site	SS11		Easting	484,211	Northing	6,944,446
From	**To**	**Horizon**	**Description**			
0cm	20cm		Light brown, organic matter, very fine grain sand, minor charcoal, slight moisture			
20cm	30cm		Light brown very fine sand, minor gravel – 5%, moist			
30cm	40cm		Brown, fine sand, orange mottles, moist			

Site	SS12		Easting	484,013	Northing	6,944,499
From	**To**	**Horizon**	**Description**			
0cm	15cm		Dark brown, dry, very fine sand, gravel			
15cm			Refusal – cobbles of sandstone			

*Coordinates are GDA2020 MGA Zone 56

TOPSOIL ASSESSMENT
JACKAL RENEWABLES PTY LTD

Appendix 2 Photos

SS8



SS9



SS10



SS11



SS12



TOPSOIL ASSESSMENT
JACKAL RENEWABLES PTY LTD

Appendix 3 Laboratory Results

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ADELAIDE 3/1 Burma Road Pooraka SA 5095 Ph: 08 8162 5130 E: adelaide@alsglobal.com

☐BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

☐GLADSTONE 48 Callemondah Drive Gladstone QLD 4680 Ph: 07 4978 7944 E: gladstone@alsglobal.com

☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

☐MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

☐NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com

☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

☐WOLLONGONG 1/19-21 Ralph Black Drive, Nth Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: Ardent Group Pty Ltd	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☑ Standard TAT (List due date):	**FOR LABORATORY USE ONLY (Circle)**
OFFICE:		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes No N/A
PROJECT: Jackal Renewables **PROJECT NO.:**	**ALS QUOTE NO.:** EN/222/20	**COC SEQUENCE NUMBER (Circle)**	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER: **PURCHASE ORDER NO.:**	**COUNTRY OF ORIGIN:**	COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: R. DAVIS	**CONTACT PH:** 07 3368 1033	OF: 1 2 3 4 5 6 7	Other comment:
SAMPLER: RICHARD DAVIS	**SAMPLER MOBILE:** 0417000512	**RELINQUISHED BY:**	**RECEIVED BY:**
COC Emailed to ALS? (YES / NO)	**EDD FORMAT (or default):**	*Richard Davis*	S.A
Email Reports to (will default to PM if no other addresses are listed): richard.davis@ardent-group.com.au		DATE/TIME: 16/11/23 830AM	DATE/TIME: 16/11 1455
Email Invoice to (will default to PM if no other addresses are listed): **richard.davis@ardent-group.com.au**		**RELINQUISHED BY:** DATE/TIME:	**RECEIVED BY:** DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Please also email the reports to richard.davis@ardent-group.com.au

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED Including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL BOTTLES	pH (EA031), EC (EA032), CEC (ED006), Extractable P (EK080),	Organic Matter (EP004), Moisture Conten (EA055)	Inorganic Nitrogen (EK063)						Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	SS8	31/10/2023 15:00	S	Glass jar	1	☑	☑	☑						
2	SS9	31/10/2023 15:00	S	Glass jar	1	☑	☑	☑						
3	SS10	31/10/2023 15:00	S	Glass jar	1	☑	☑	☑						
4	SS11	31/10/2023 15:00	S	Glass jar	1	☑	☑	☑						
5	SS12	31/10/2023 15:00	S	Glass jar	1	☑	☑	☑						
				TOTAL	5									

Environmental Division
Brisbane
Work Order Reference
EB2336107

Telephone : + 61-7-3243 7222

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2336107**	Page	: 1 of 7
Client	: **ARDENT GROUP**	Laboratory	: Environmental Division Brisbane
Contact	: MR RICHARD DAVIS	Telephone	: +61-7-3243 7222
Project	: Jackal Renewables	Date Samples Received	: 16-Nov-2023
Site	: ----	Issue Date	: 28-Nov-2023
Sampler	: RICHARD DAVIS	No. of samples received	: 5
Order number	: ----	No. of samples analysed	: 5

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002: pH 1:5 (Soils)						
Soil Glass Jar - Unpreserved						
SS8, SS9, SS10, SS11, SS12	23-Nov-2023	07-Nov-2023	**16**	----	----	----
EA010: Conductivity (1:5)						
Soil Glass Jar - Unpreserved						
SS8, SS9, SS10, SS11, SS12	23-Nov-2023	07-Nov-2023	**16**	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)						
Soil Glass Jar - Unpreserved						
SS8, SS9, SS10, SS11, SS12	----	----	----	21-Nov-2023	14-Nov-2023	**7**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002: pH 1:5 (Soils)							
Soil Glass Jar - Unpreserved (EA002)							
SS8, SS9, SS10, SS11, SS12	**31-Oct-2023**	**23-Nov-2023**	07-Nov-2023	×	**23-Nov-2023**	23-Nov-2023	✓
EA010: Conductivity (1:5)							
Soil Glass Jar - Unpreserved (EA010)							
SS8, SS9, SS10, SS11, SS12	**31-Oct-2023**	**23-Nov-2023**	07-Nov-2023	×	**23-Nov-2023**	21-Dec-2023	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA031: pH (saturated paste)							
Soil Glass Jar - Unpreserved (EA031)							
SS8, SS9, SS10, SS11, SS12	**31-Oct-2023**	**----**	----	----	**17-Nov-2023**	28-Apr-2024	✓
EA032: Electrical Conductivity (saturated paste)							
Soil Glass Jar - Unpreserved (EA032)							
SS8, SS9, SS10, SS11, SS12	**31-Oct-2023**	**----**	----	----	**17-Nov-2023**	28-Apr-2024	✓
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
SS8, SS9, SS10, SS11, SS12	**31-Oct-2023**	**----**	----	----	**21-Nov-2023**	14-Nov-2023	×
ED005: Exchange Acidity							
Soil Glass Jar - Unpreserved (ED005)							
SS8, SS9, SS10, SS11, SS12	**31-Oct-2023**	**24-Nov-2023**	28-Nov-2023	✓	**27-Nov-2023**	28-Nov-2023	✓
ED006: Exchangeable Cations on Alkaline Soils							
Soil Glass Jar - Unpreserved (ED006)							
SS8, SS9, SS10, SS11, SS12	**31-Oct-2023**	**27-Nov-2023**	28-Nov-2023	✓	**27-Nov-2023**	28-Nov-2023	✓
ED007: Exchangeable Cations							
Soil Glass Jar - Unpreserved (ED007)							
SS8, SS9, SS10, SS11, SS12	**31-Oct-2023**	**24-Nov-2023**	28-Nov-2023	✓	**27-Nov-2023**	28-Nov-2023	✓
ED008: Exchangeable Cations							
Soil Glass Jar - Unpreserved (ED008)							
SS8, SS9, SS10, SS11, SS12	**31-Oct-2023**	**24-Nov-2023**	28-Nov-2023	✓	**27-Nov-2023**	28-Nov-2023	✓
EK080: Bicarbonate Extractable Phosphorus (Colwell)							
Soil Glass Jar - Unpreserved (EK080)							
SS8, SS9, SS10, SS11, SS12	**31-Oct-2023**	**23-Nov-2023**	28-Apr-2024	✓	**28-Nov-2023**	28-Apr-2024	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP004: Organic Matter							
Soil Glass Jar - Unpreserved (EP004)							
SS8, SS9, SS10, SS11, SS12	**31-Oct-2023**	**27-Nov-2023**	28-Nov-2023	✓	**27-Nov-2023**	28-Nov-2023	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Bicarbonate Extractable P (Colwell)	EK080	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (Saturated Paste)	EA032	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchange Acidity by 1M Potassium Chloride	ED005	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (Saturated Paste)	EA031	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Bicarbonate Extractable P (Colwell)	EK080	3	5	**60.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (Saturated Paste)	EA032	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (Saturated Paste)	EA031	2	5	**40.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Bicarbonate Extractable P (Colwell)	EK080	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (Saturated Paste)	EA032	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchange Acidity by 1M Potassium Chloride	ED005	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Bicarbonate Extractable P (Colwell)	EK080	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Electrical Conductivity (1:5)	EA010	SOIL	In house: Referenced to Rayment and Lyons 3A1 and APHA 2510. Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
pH (Saturated Paste)	* EA031	SOIL	In house: Referenced to USEPA 600/2 - 78 - 054 - pH determined on a saturated paste by ISE.
Electrical Conductivity (Saturated Paste)	* EA032	SOIL	In house: Referenced to USEPA 600/2 - 78 - 054 - conductivity determined on a saturated paste.
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Exchange Acidity by 1M Potassium Chloride	* ED005	SOIL	In house: referenced to Rayment and Lyons, method 15G1. This method is unsuitable for near neutral and alkaline soils. NATA accreditation does not cover performance of this service.
Exchangeable Cations on Alkaline Soils	* ED006	SOIL	In house: Referenced to Soil Survey Test Method C5. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with alcoholic ammonium chloride at pH 8.5. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil.
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
Exchangeable Cations with pre-treatment	ED008	SOIL	In house: Referenced to Rayment & Lyons Method 15A2. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
Inorganic Nitrogen as N (NH3 + NOx) by Discrete Analyser	EK063G	SOIL	In house: Referenced to APHA 4500 NH3 / NO3- Inorganic Nitrogen is determined as the sum of Ammonia and Oxidised Nitrogen each determined seperately as N.
Bicarbonate Extractable P (Colwell)	EK080	SOIL	In house: Referenced to Rayment & Lyons Method 9B1 Phosphorus is extracted from the soil using 0.5M NaHCO3 at a 1:100 soil:solution ratio and determined by FIA.
Organic Matter	EP004	SOIL	In house: Referenced to AS1289.4.1.1. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Exchangeable Cations Preparation Method (Alkaline Soils)	* ED006PR	SOIL	In house: Referenced to Rayment and Lyons method 15C1.
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Lyons method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
Sample Preparation for Bicarbonate Extractable P (Colwell)	EK080-PR	SOIL	In house: Referenced to Rayment & Lyons Method 9B1 Phosphorus is extracted from the soil using 0.5M NaHCO3 at a 1:100 soil:solution ratio.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Organic Matter	EP004-PR	SOIL	In house: Referenced to AS1289.4.1.1. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM Schedule B(3).

QUALITY CONTROL REPORT

Work Order	: **EB2336107**	Page	: 1 of 5
Client	: **ARDENT GROUP**	Laboratory	: Environmental Division Brisbane
Contact	: MR RICHARD DAVIS	Contact	: Customer Services EB
Address	: 3 WATER STREET REDHILL 4059	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3368 1033	Telephone	: +61-7-3243 7222
Project	: Jackal Renewables	Date Samples Received	: 16-Nov-2023
Order number	: ----	Date Analysis Commenced	: 17-Nov-2023
C-O-C number	: ----	Issue Date	: 28-Nov-2023
Sampler	: RICHARD DAVIS		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 5		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Soil Preparation, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA002: pH 1:5 (Soils) (QC Lot: 5439780)									
EB2336413-006	Anonymous	EA002: pH Value	----	0.1	pH Unit	5.7	5.7	0.0	0% - 20%
EB2336107-001	SS8	EA002: pH Value	----	0.1	pH Unit	5.5	5.4	0.0	0% - 20%
EA010: Conductivity (1:5) (QC Lot: 5439781)									
EB2336413-006	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	35	36	3.1	0% - 20%
EB2336107-001	SS8	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	18	19	0.0	0% - 50%
EA031: pH (saturated paste) (QC Lot: 5432544)									
EB2336107-001	SS8	EA031: pH (Saturated Paste)	----	0.1	pH Unit	5.6	5.7	0.0	0% - 20%
EA032: Electrical Conductivity (saturated paste) (QC Lot: 5432545)									
EB2336107-001	SS8	EA032: Electrical Conductivity (Saturated Paste)	----	1	µS/cm	111	124	11.1	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 5439788)									
EB2336107-001	SS8	EA055: Moisture Content	----	0.1	%	3.2	3.2	0.0	0% - 20%
EB2336413-006	Anonymous	EA055: Moisture Content	----	0.1	%	6.8	6.8	0.0	0% - 20%
ED005: Exchange Acidity (QC Lot: 5449032)									
EB2336107-001	SS8	ED005: Exchange Acidity	----	0.1	meq/100g	2.6	2.7	0.0	0% - 20%
		ED005: Exchangeable Aluminium	----	0.1	meq/100g	0.1	0.2	0.0	No Limit
ED007: Exchangeable Cations (QC Lot: 5449031)									
EB2336107-001	SS8	ED007: Exchangeable Calcium	----	0.1	meq/100g	1.1	1.0	0.0	0% - 50%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	0.8	0.8	0.0	No Limit
		ED007: Exchangeable Potassium	----	0.1	meq/100g	0.3	0.3	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	0.0	No Limit
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QC Lot: 5446017)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QC Lot: 5446017) - continued									
EB2336107-001	SS8	EK080: Bicarbonate Ext. P (Colwell)	----	5	mg/kg	<5	<5	0.0	No Limit
EP004: Organic Matter (QC Lot: 5436650)									
EB2336107-001	SS8	EP004: Organic Matter	----	0.5	%	2.0	2.0	0.0	No Limit
EB2336321-036	Anonymous	EP004: Organic Matter	----	0.5	%	<0.5	<0.5	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002: pH 1:5 (Soils) (QCLot: 5439780)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	101	98.0	102
				----	7 pH Unit	100	98.0	102
EA010: Conductivity (1:5) (QCLot: 5439781)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	101	97.0	103
EA031: pH (saturated paste) (QCLot: 5432544)								
EA031: pH (Saturated Paste)	----	----	pH Unit	----	4 pH Unit	100	99.0	101
				----	7 pH Unit	100	99.0	101
EA032: Electrical Conductivity (saturated paste) (QCLot: 5432545)								
EA032: Electrical Conductivity (Saturated Paste)	----	1	µS/cm	<1	1413 µS/cm	99.2	97.0	103
ED005: Exchange Acidity (QCLot: 5449032)								
ED005: Exchange Acidity	----	0.1	meq/100g	<0.1	----	----	----	----
ED005: Exchangeable Aluminium	----	0.1	meq/100g	<0.1	----	----	----	----
ED007: Exchangeable Cations (QCLot: 5449031)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	8.9 meq/100g	97.7	79.0	113
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	9.52 meq/100g	91.6	85.0	115
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	1.49 meq/100g	94.0	70.0	122
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	1.3726 meq/100g	94.4	76.0	112
ED007: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	21.283 meq/100g	94.5	82.0	112
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QCLot: 5446017)								
EK080: Bicarbonate Ext. P (Colwell)	----	5	mg/kg	<5	100 mg/kg	92.0	90.0	110
				<5	20.7 mg/kg	86.5	70.0	130
				<5	155 mg/kg	108	80.0	120
EP004: Organic Matter (QCLot: 5436650)								
EP004: Organic Matter	----	0.5	%	<0.5	80 %	92.4	83.0	115

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Matrix Spike (MS) Report		
Spike	SpikeRecovery(%)	Acceptable Limits (%)

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QCLot: 5446017)							
EB2336107-002	SS9	EK080: Bicarbonate Ext. P (Colwell)	----	40 mg/kg	89.2	70.0	130
EP004: Organic Matter (QCLot: 5436650)							
EB2336107-002	SS9	EP004: Organic Matter	----	4 %	95.8	70.0	130

CERTIFICATE OF ANALYSIS

Work Order	: **EB2336107**	Page	: 1 of 4
Client	: **ARDENT GROUP**	Laboratory	: Environmental Division Brisbane
Contact	: MR RICHARD DAVIS	Contact	: Customer Services EB
Address	: 3 WATER STREET REDHILL 4059	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3368 1033	Telephone	: +61-7-3243 7222
Project	: Jackal Renewables	Date Samples Received	: 16-Nov-2023 14:55
Order number	: ----	Date Analysis Commenced	: 17-Nov-2023
C-O-C number	: ----	Issue Date	: 28-Nov-2023 14:11
Sampler	: RICHARD DAVIS		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 5		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Soil Preparation, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA031 (Saturated Paste pH): NATA accreditation does not cover the performance of this service.
- EA032 (Saturated Paste EC): NATA accreditation does not cover the performance of this service.
- ALS is not NATA accredited for the analysis of Exchangeable Aluminium and Exchange Acidity in soils when performed under ALS Method ED005.
- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SS8	SS9	SS10	SS11	SS12
			Sampling date / time	31-Oct-2023 15:00	31-Oct-2023 15:00	31-Oct-2023 15:00	31-Oct-2023 15:00	31-Oct-2023 15:00
Compound	CAS Number	LOR	Unit	EB2336107-001	EB2336107-002	EB2336107-003	EB2336107-004	EB2336107-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	5.5	4.8	5.2	5.6	5.8
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	18	22	32	23	36
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	5.6	4.5	5.0	5.4	5.4
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	111	77	180	172	155
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	3.2	2.3	4.2	3.9	4.4
ED005: Exchange Acidity								
ø Exchange Acidity	----	0.1	meq/100g	2.6	1.9	0.8	0.8	0.5
ø Exchangeable Aluminium	----	0.1	meq/100g	0.1	1.3	0.4	0.4	0.2
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	1.1	<0.1	1.4	0.7	3.1
Exchangeable Magnesium	----	0.1	meq/100g	0.8	0.4	1.6	0.9	3.7
Exchangeable Potassium	----	0.1	meq/100g	0.3	0.2	0.5	0.3	0.4
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	0.1	0.1	0.3
Cation Exchange Capacity	----	0.1	meq/100g	4.8	2.5	4.4	2.8	8.0
Exchangeable Sodium Percent	----	0.1	%	3.0	7.9	3.4	5.1	3.7
Calcium/Magnesium Ratio	----	0.1	-	1.4	<0.1	0.9	0.8	0.8
Magnesium/Potassium Ratio	----	0.1	-	2.8	1.8	3.4	3.1	8.0
EK063: Inorganic Nitrogen as N (Ammonia + NOx)								
^ Inorganic Nitrogen as N	----	20	mg/kg	<20	<20	<20	<20	<20
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	5	mg/kg	<5	<5	<5	<5	<5
EP004: Organic Matter								
Organic Matter	----	0.5	%	2.0	1.7	4.1	2.1	5.4

PART B – ATTACHMENTS PRCP SCHEDULE

Appendix 1 – PRCP Schedule
Appendix 2 – EA0001386 – Land Outcome Document
Appendix 3 – Ecological Studies
Appendix 4 – Mine Planning Report
Appendix 5 – Topsoil Assessment
Appendix 6 – Hydrogeological Assessment

Jackal Renewables Pty Ltd; ML50070

Appendix 6 – Hydrogeological Assessment

3 Water Street Red Hill 4059
T: +61 7 3368 1033
E: information@ardent-group.com.au
W: ardent-group.com.au
ABN: 38 609 696 764

HYDROGEOLOGICAL ASSESSMENT

JACKAL RENEWABLES PTY LTD

MINING LEASE (ML) 50070

FEBRUARY 2024

JKR005

Document Control Sheet

Ardent Group Pty Ltd	
Street Address:	3 Water Street, Red Hill Qld 4059
Postal Address:	PO Box 320 Red Hill Qld 4059
Phone:	+61 7 3368 1033
Email:	information@ardent-group.com.au
Web:	www.ardent-group.com.au

Project:	JKR005	**Issue Date:**	22 February 2024
Title:	Hydrogeological Assessment		
Project Manager:	Richard Davis		
Author:	Richard Davis / Jacob Arnold		
Client:	Jackal Renewables		
Client Contact:	Rob Howe		

Revision Number	Date
Rev A	22/02/2024
Rev B	
Rev C	
01	22/02/2024
02	

Number of Copies									
Revision Number	**A**	**B**	**C**	**D**	**01**	**02**	**03**	**04**	**05**
Ardent Group File	1				1				
Client					1				
Department									

Contents

1. Introduction 4
1.1 Background 4
1.2 Scope 4
1.3 Basis of Assessment 4
2. Project Description 5
2.1 Topography and Drainage 7
2.2 Water Management 7
3. Geological Setting 12
3.1 Regional Geology 12
3.2 Site Geology 12
4. Mining History 15
5. Hydrogeological Conditions 17
5.1 Hydrogeological Properties 17
5.2 Previous Drilling and Registered Bores 18
5.3 Historical Mining Activities Impacts on Groundwater 19
5.4 Groundwater Quality 19
5.5 Groundwater Potentiometric Surface and Flow Direction 21
5.6 Local and Regional Groundwater Use 21
5.7 Surface Water – Groundwater Interactions 24
5.8 Conceptual Site Model 24
6. Groundwater Impact Assessment 26
7. Conclusion 27
8. References 27

Figures

Figure 1 Site Location 6
Figure 2 Pre-Surface Mining Site Topography (Moreton Geotechnical Services, 2018) 9
Figure 3 ML 50070 Regional Topography 10
Figure 4 ML 50070 Stormwater Features on Site 11
Figure 5 Site Geology Plan (Moreton Geotechnical Services, 2018) 14
Figure 6 Historical Mining on Site 16
Figure 7 Pressure Gradient Contour Map 23
Figure 8 Conceptual Site Model 25

Tables

Table 1 Real Property Description Underlying ML 50070 5
Table 2 Water Quality Monitoring Results 8
Table 3 Geological Description 13
Table 4 Hydrogeological Properties 17
Table 5 CS4 Water Quality 20

Appendices

Appendix 1 Desktop Mining Study

1. Introduction

1.1 Background

Jackal Renewables Pty Ltd (Jackal) operates the site at 149 Rhondda Road, New Chum, (Lot 73 on SP128662) including Mining Lease (ML) 50070. ML 50070 is operated under the environmental authority (EA) EA0001386 and authorises the following environmentally relevant activity (ERA):

- Resource Activity, Schedule 2A, 20: Clay pit mining, dimension stone mining or mining gemstones (including the material from which gemstones are extracted), (a) at least 5,000t but not more than 100,000t in a year.

Jackal also operates the site as a Resource Recovery Centre. This was approved via a negotiated decision notice from Ipswich City Council (ICC) on 4 February 2020 for Development Approval No. 2491/2018/MCU for a Material Change of Use application for Special Industry (Waste recycling and reprocessing – waste transfer station, crushing, milling or grinding), Caretakers Residence and Environmentally Relevant Activities (ERA33, ERA54(1) and ERA62(1)(a)) over Lot 73 on SP128662. These operations are subject to EA EA0001872 and include the following ERAs:

- ERA 33 - Crushing, milling, grinding or screening, Crushing, grinding, milling or screening more than 5000t of material in a year;
- ERA 54 - Mechanical waste reprocessing, 1: Operating a facility for receiving and mechanically reprocessing, in a year, more than 5,000t of inert, non-putrescible waste or green waste only; and
- ERA 62 - Resource recovery and transfer facility operation, 1: Operating a facility for receiving and sorting, dismantling, baling or temporarily storing-, (a) scrap metal, non-putrescible waste or green waste only.

1.2 Scope

Ardent Group Pty Ltd (Ardent Group) has been engaged by Jackal to assess the hydrogeology of the subject site (ML50070) and all connected strata, and develop a conceptual model of the site's groundwater systems. The scope of this hydrogeological assessment includes:

- determining the groundwater occurrence including the existence of, and depth to, aquifers and aquitards;
- locating groundwater recharge and discharge locations locally and regionally;
- groundwater quality within each of the aquifers and from surface expressions (i.e. seeps and springs);
- current and potential future uses of groundwater including existing groundwater extraction bores;
- groundwater flow direction and velocity;
- the development of a conceptual model; and
- The prediction of water quality impacts from mining activities to determine appropriate measures for the containment and management of contaminants and the potential impacts on environmental values should they be released.

1.3 Basis of Assessment

This hydrogeological has largely comprised of a review of available data obtained from public access sources as well as technical studies from the subject site, and adjacent sites.

2. Project Description

ML 50070 (also known as "Claypave South") is located at New Chum, approximately 7km east of Ipswich, in south-east Queensland. ML 50070 is located entirely within a parcel of land held in freehold title. The real property description and current ownership is provided in **Table 1**. The 21.58ha mining lease is 1.75km from the Cunningham Highway and accessed via the following sealed and unsealed roads: Whitwood Road, Child Street and Rhondda Road.

Table 1 Real Property Description Underlying ML 50070

Specifications	Details
Background Tenure	Lot 73 on SP128662
Tenure type	Freehold
Owner	Jackal Renewables Pty Ltd
Local government area	Ipswich City Council
Underlying land parcels	Lot 273 on SP128662

Note that Lot 273 is a volumetric title and lies under Lot 73 but commences approximately 25m below the current ground surface. Lot 273 is unallocated State Land.

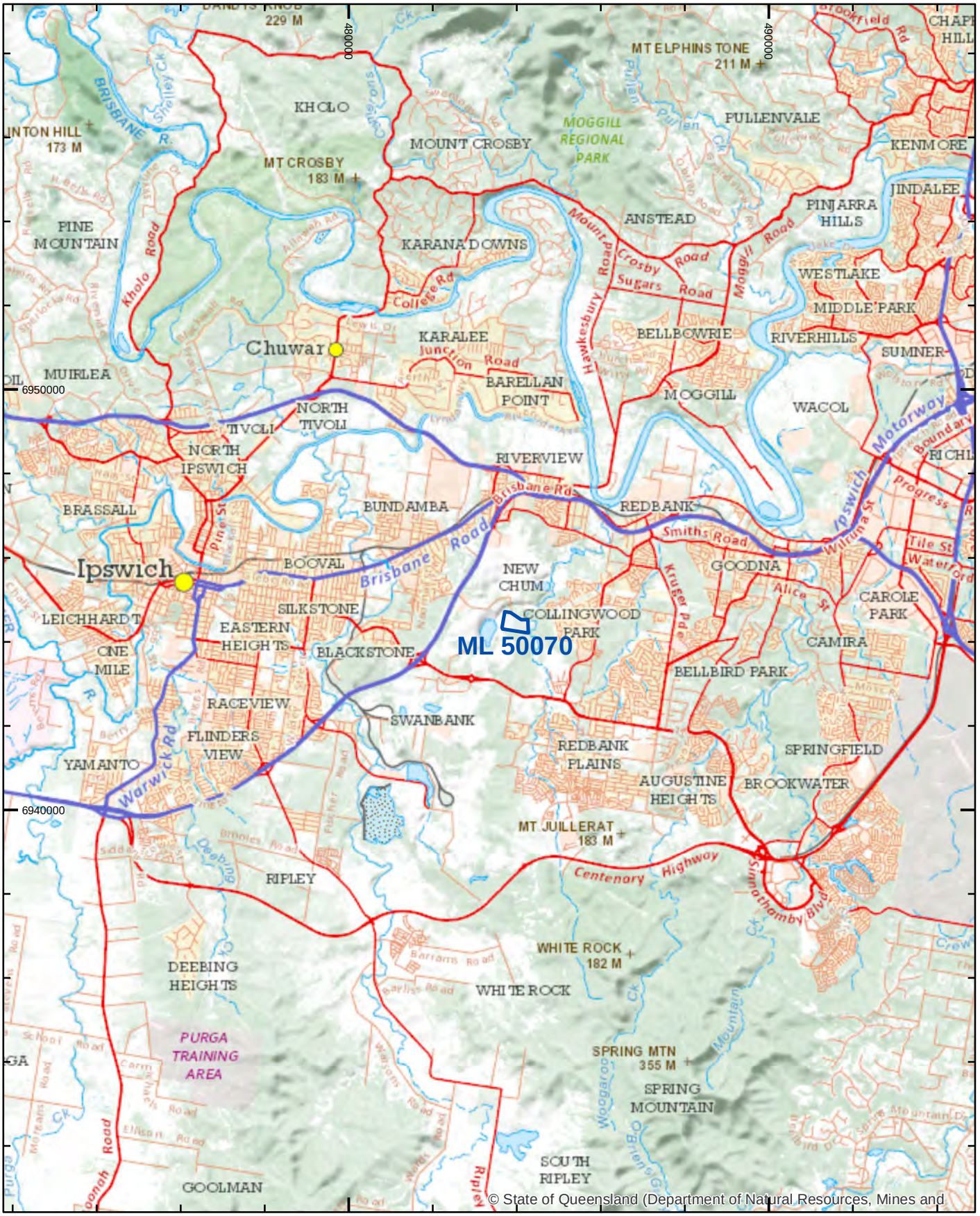
ML 50070 was granted on 24 February 1994 and is currently set to expire on 29 February 2044. Mining on ML 50070 has been granted for the following minerals:

- Clay- Brick Clay;
- Clay – Fire Clay;
- Clay – Pottery / White Ware; and
- Shale.

Common with other clay pit operations in the area, works are currently conducted when required on a campaign basis according to market demand from brick manufacturers in South East Queensland. The type of clay required is based primarily on its firing characteristics and colour. Extraction from ML 50070 is up to 100,000 tonnes per annum. The mining method generally employed on ML 50070 comprises of the following steps:

- Vegetation clearing (limited as necessary);
- Topsoil and overburden stripping (as necessary);
- Clay/shale extraction (in situ) or reclamation (old spoil dumps) (dozer, excavator, front end loader or similar);
- Clay/shale stockpiling; and
- Clay/shale haulage.

Material is transported off the lease to customers, on demand.



0 1 2 3 4 5

Kilometers

JACKAL RENEWABLES PTY LTD

ML 50070

N W E S

GDA94, MGA Zone 56

ARDENT GROUP PTY LTD

Figure 1-
Site Location

Legend

ML boundary

Drawn By:	Chris Schlebusch
Requested by:	Richard Davis
Date:	6/07/2018

Sheet No.
ADMG_ARD_JKRGEN_MAP_0001_B

Data sources:
Old Department of Natural Resources, Mines & Energy, Geoscience Australia

Path: S:\Plans\Project_Specific\Ardent\JKRGEN\ADMG_ARD_JKRGEN_MAP_0001_B Regional Location Opt B.mxd

2.1 Topography and Drainage

Generally, the landform is elevated in the western portion, up to a height of approximately 54m (Australian height datum (AHD)). The landform of the western portion of the site is impacted by past and current mining activities, including a sizable excavation subject to clay and shale extraction. The approximate pre-surface mining landform slopes to the east, to a flood plain (at height of approximately 22m AHD), adjacent to Six Mile Creek, as shown in **Figure 2 (**Moreton Geotechnical Services, 2018)**.** Regional topography is shown in **Figure 3** .

The Project area lies within the Brisbane River drainage sub-basin. The environmental values and water quality objectives for the waters located in the Project region are detailed in the '*Sandy, Six Mile, Wolston, Woogaroo and Goodna Creeks environmental values and water quality objectives*' as prescribed in Schedule 1 of the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019*. The environmental values for the Lower Six Mile Creek fresh waters are:

- Aquatic ecosystems;
- Stock water;
- Farm supply / use;
- Secondary recreation;
- Visual recreation;
- Industrial use; and
- Cultural and spiritual values.

2.2 Water Management

In accordance with Environmental Authority EA0001386 Conditions C1-1 and C2-1;

- Contaminants must not be released from the site to any waters or the bed and banks of any waters.
- There must be no release of stormwater runoff that has been in contact with any contaminants at the site to any waters, roadside gutter or stormwater drain.

There is no processing plant on site that generates wastewater, therefore there are no mine water management dams located on ML 50070. All stormwater runoff from disturbed areas to the west of the powerline largely flows toward the excavated clay pit ("Kerwick #2") and is either used onsite by the landowner, infiltrated or evaporated. The estimated volume of the Kerwick #2 pit is approximately 2,300m^3.

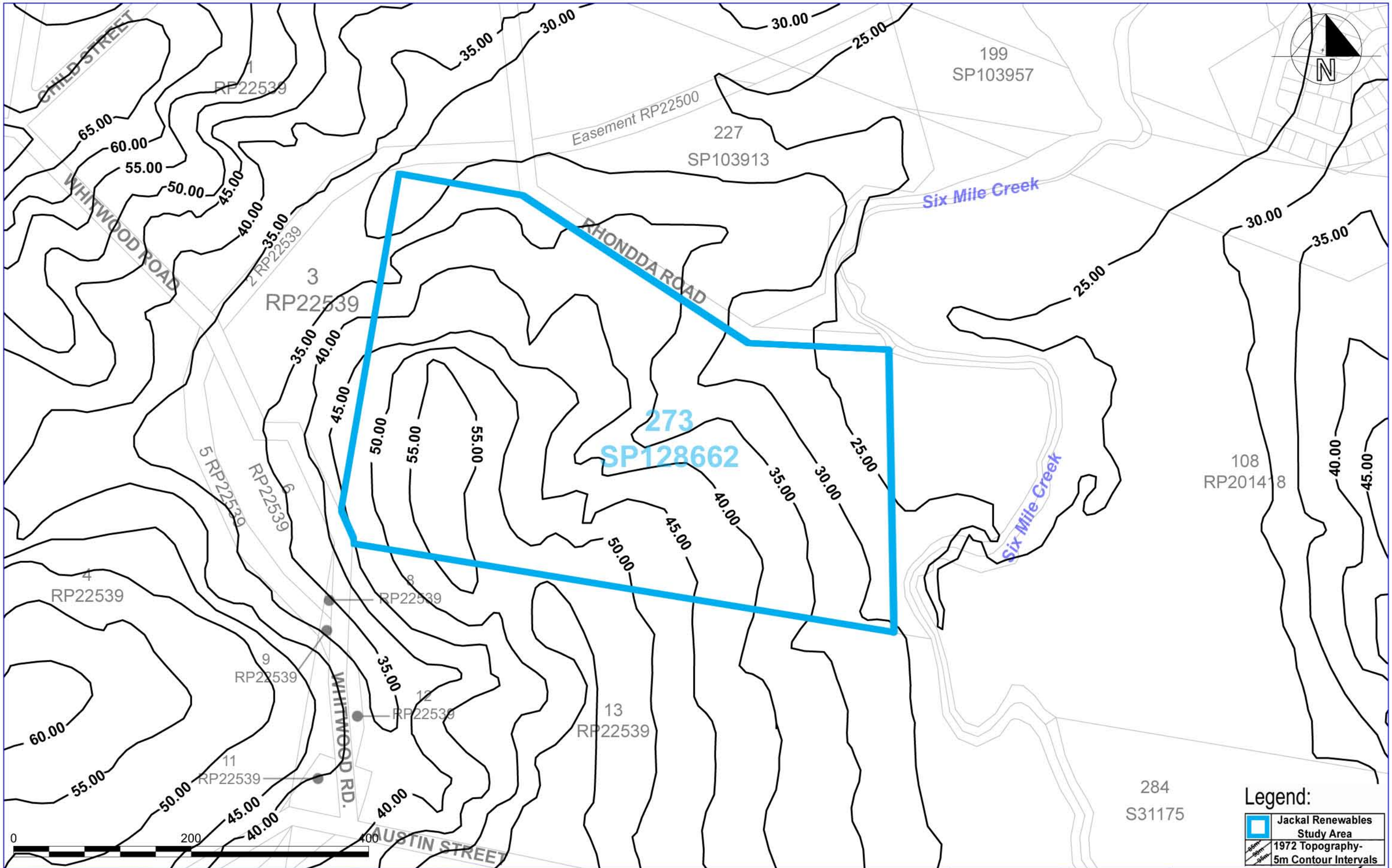
Sediment dams and settling ponds are located at low points to the east of the powerline to collect the site's surface water runoff that occurs from the Kerwick #1 pit, to the east of the powerline (**Figure 4**). The remainder of the stormwater from the undisturbed portions of the site flows through vegetated areas east towards Six Mile Creek to the east. Six Mile Creek flows to the north, into the Brisbane River.

Due to the ridge lines within the site, the property has very little external catchment entering the site.

The water collected in the Kerwick #2 pit is not particularly acidic or saline and does not require treatment. Water monitoring is undertaken on a regular basis and results from the latest round of monitoring undertaken on 2 November 2023 is presented in **Table 2**.

Table 2 Water Quality Monitoring Results

Parameter	Units	Result
pH (Field Test)	pH unit	8.55
EC (Field Test)	µS/cm	1439
Temperature (Field Test)	°C	26.2
pH	pH unit	8.34
EC	µS/cm	1500
Suspended Solids	mg/L	<5
Turbidity	NTU	2
Nitrite + Nitrate as N	mg/L	<0.01
Total Kjeldahl Nitrogen as N Calculated	mg/L	0.3
Total Nitrogen as N	mg/L	0.5
Total Phosphorous as P	mg/L	<0.01
Arsenic as As	mg/L	0.001
Cadmium as Cd	mg/L	<0.0001
Chromium as Cr	mg/L	<0.001
Copper as Cu	mg/L	0.002
Lead as Pb	mg/L	<0.001
Nickel as Ni	mg/L	0.003
Zinc as Zn	mg/L	0.016
Mercury as Hg	mg/L	<0.0001



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

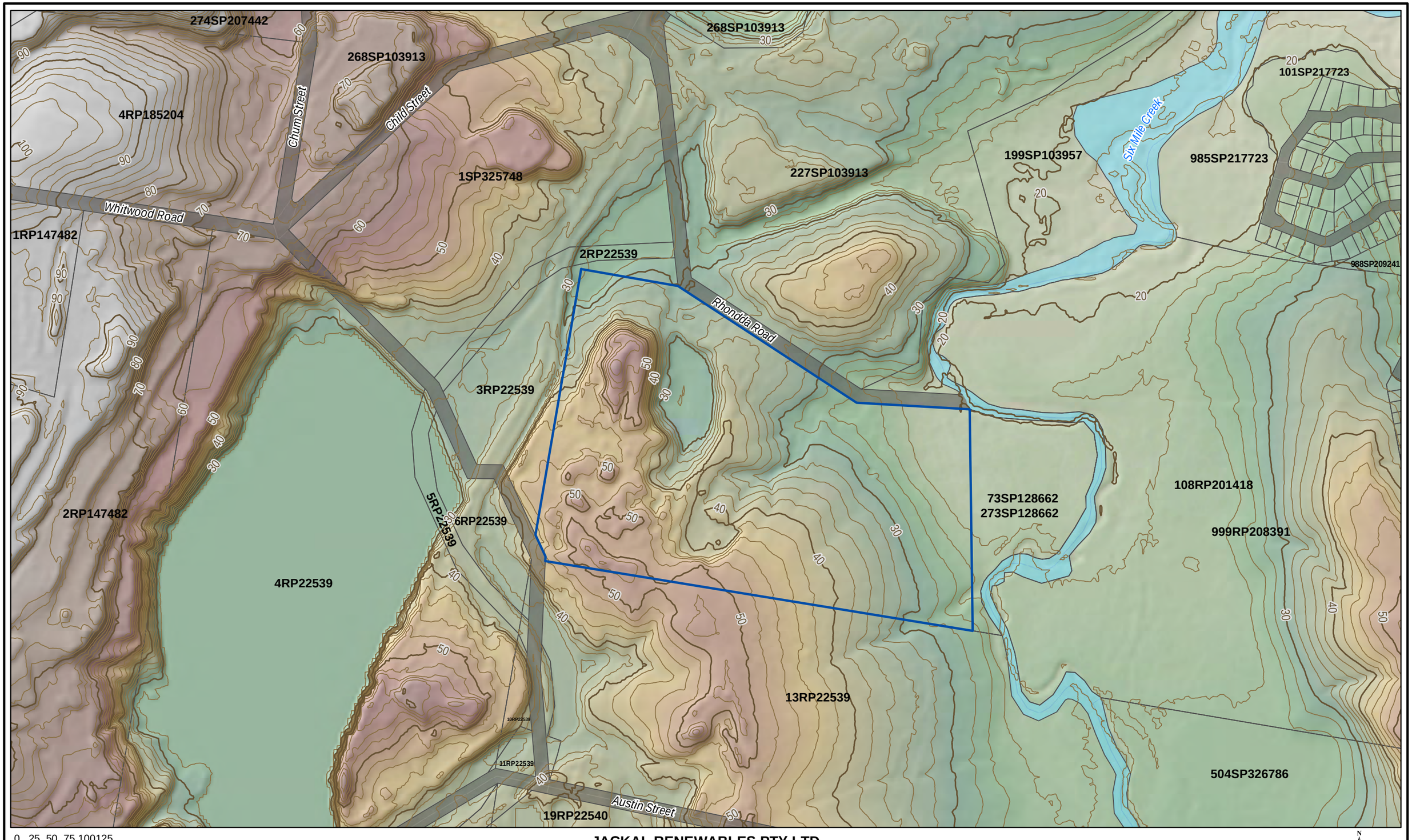
ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 3 - Contour Plan
1972 Map View Contours

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Three (3 of 16)	Folder: 2018.02.09_03

Taylor Mining Services Pty Ltd
Redbank Plains Road
Blackstone QLD 4305
Ph: (07) 3816 2311 Fax: (07) 3816 2377
www.taylorminingservices.com.au

FIGURE 2 Pre Surface Mining Site Topography



0 25 50 75 100125

Meters

JACKAL RENEWABLES PTY LTD

Project Overview

N W E S

GDA2020, MGA Zone 56

ARDENT GROUP PTY LTD

Figure 3 - ML 50070 Regional Topography

Drawn By: Chris Schlebusch

Requested by: Richard Davis

Date: 24/01/2023

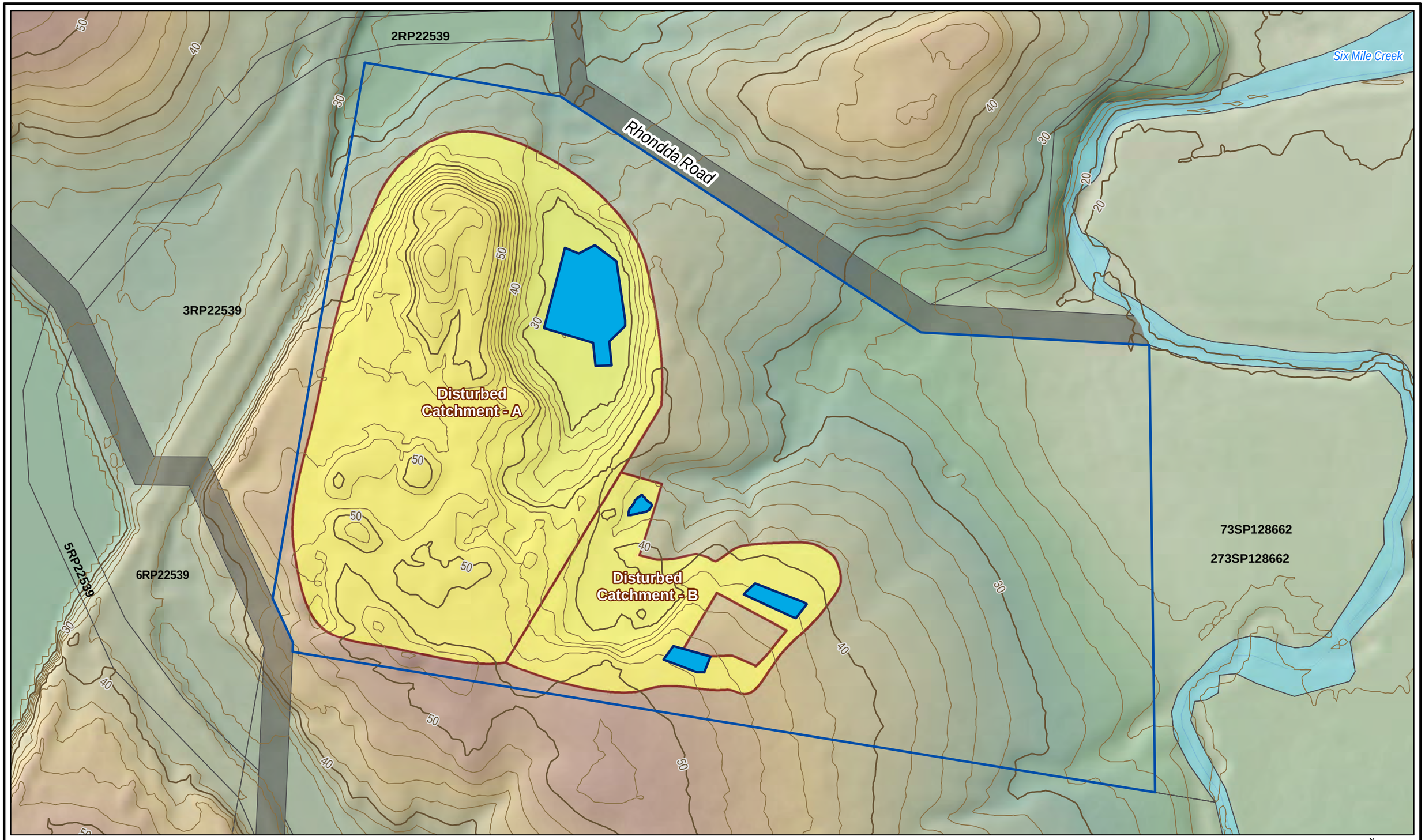
Sheet No.
RTPL_ARD_STW001_MAP_1018_A

Legend

- ML50070 Boundary
- Property Boundary
- Road Parcel
- Watercourse Parcel
- Contour (2m)
- Contour (10m)

Data sources:
© State of Queensland, Department of Resources

Path: S:\Plans\Project_Specific\Ardent\STW001\RTPL_ARD_STW001_MAP_1018_A A3L Topo ML50070 and Surrounds.mxd



0 10 20 30 40 50

Meters

JACKAL RENEWABLES PTY LTD

Project Overview

N W E S

GDA2020, MGA Zone 56

Figure 4 - ML 50070 Stormwater Features on Site

Legend

- ML50070 Boundary
- Property Boundary
- Road Parcel
- Watercourse Parcel
- Water Storage and Sediment Pond
- Contour (2m)
- Contour (10m)
- Disturbed Catchment (catchment boundaries approximate)

Drawn By:	Chris Schlebusch
Requested by:	Richard Davis
Date:	6/02/2023

Sheet No.
RTPL_ARD_STW001_MAP_1019_C

Data sources:
© State of Queensland, Department of Resources

Path: S:\Plans\Project_Specific\Ardent\STW001\RTPL_ARD_STW001_MAP_1019_C A3L ML50070 and Disturbed Catchments.mxd

3. Geological Setting

3.1 Regional Geology

Regionally, the ML 50070 is located in the Triassic to Middle Jurassic age Clarence Moreton Basin (Geology of Queensland, 2013). This basin extends over approximately 10,000km^2 of south-eastern Queensland and northern New South Wales. In Queensland, the western boundary of the basin continues into the Surat Basin, while the other directions are bounded by older metamorphic and volcanic terrains. The Clarence Moreton Basin is mainly a fluvial - environment basin, with lesser coal swamp and lacustrine facies developed in some areas.

The Clarence Moreton Basin overlies the Ipswich Basin, a Middle Triassic age alluvial, fluvial and lacustrine environment basin, which includes the Ipswich Coal Measures. The Ipswich Coal Measures were the dominant coal resource targeted by historical to recent coal mining in the Ipswich coal field.

3.2 Site Geology

Site geology was described in Ausrocks 2018. The local geology indicates that rocks to the west of ML 50070 which comprise part of the Late Triassic Blackstone Formation (the upper part of the Ipswich Coal Measures – Ipswich Basin), include shale, siltstone, coal (including the Bluff Seam) and sandstone (Cranfield et al, 1989) (**Figure 5**). The beds and seams dip to the east and southeast under the site, i.e. in the order of 7 – 10 degrees due to the location of the site on the eastern flank of the Bundamba Anticline.

The rocks exposed at surface within the subject site are dominated by the Bundamba Group of the Clarence – Moreton Basin (or Woogaroo Subgroup as they are now known (Cranfield and Schwarzbock, 1972)). The constituent formations in this area are the Aberdare Conglomerate and Raceview Formation. The Aberdare Conglomerate, which disconformably overlies the Blackstone Formation does not crop out within the lease, but is likely exposed in the high wall of the Kerwick #2 pit. The Raceview Formation consists of fine to medium grained, sub-labile to quartzose sandstone, shale, mudstone, thin coal seams and siltstone. The siltstone is fissile, with plant fragments and mica flakes on the bedding planes. The clay-shale resource that is the target of this mining lease, is the Raceview Formation.

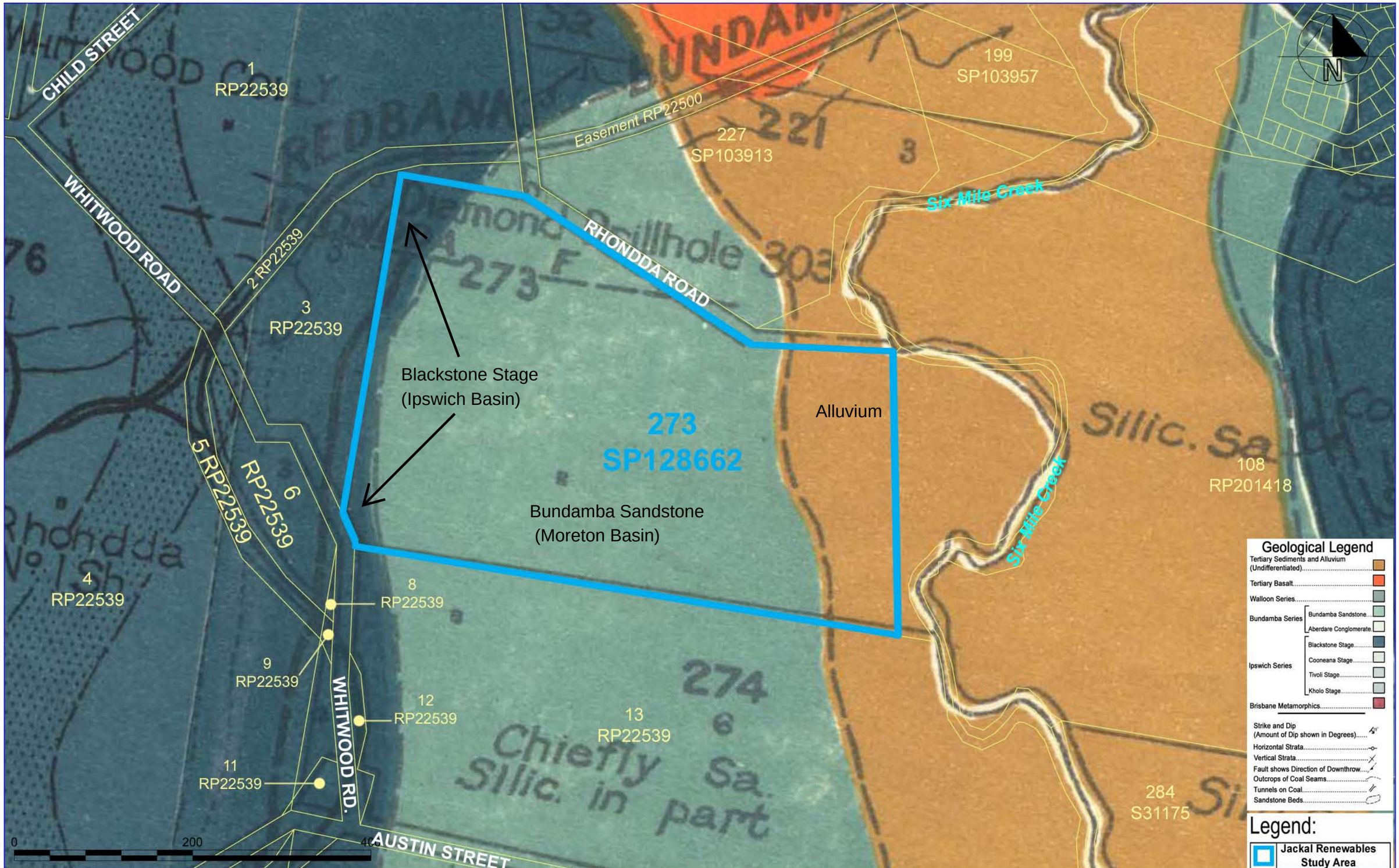
Forming the top of the sequence in the area is the Tertiary Redbank Plains Formation composed of poorly consolidated lacustrine interbedded multi-coloured claystone, shale, and labile sandstone. This unit lies unconformably on the Raceview Formation (Staines, 1961).

The lithological summary for the formations is as detailed in **Table 3** below.

Table 3 Geological Description

Rock Unit	Constituents	Age	Dominant Rock	Lithological Summary
Quaternary Alluvial		Quaternary	Alluvium	Clay, silt, sand and gravel; flood-plain alluvium
Redbank Plains Formation		Tertiary	Claystone, shale, sandstone	Claystone, shale, sandstone
Bundamba Sandstone	Raceview Formation Aberdare Conglomerate	Late Triassic	Arenite-Mudrock	Sublabile to quartzose sandstone, shale, mudstone, thin coal seams, siltstone
Blackstone Stage (Formation)	Blackstone Formation Tivoli Formation	Mid Triassic	Arenite-Mudrock	Lacustrine interbedded multi-coloured claystone, shale, labile sandstone

There is extensive open cut overburden material across the western side of the site. An exposed low-wall on the south side of the relict open cut, and part of the exposed highwall on the eastern side of the relict open cut void, also revealed the presence of easterly dipping beds of shale (and some coal) of the Blackstone Stage with a capping of strong sandstone of the Bundamba Sandstone or Aberdare Conglomerate Formations. The strong sandstone is also exposed at ground level around the crestal area in the southwest corner of the site. The Bluff Seam was noted to outcrop (come to the surface) to the west of ML 50070 in a deep drainage channel that had been previously excavated in the bedrock.



Moreton Geotechnical Services Pty Ltd
PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au
MGS Ref: 2018/11
ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 5 - Geology Plan
Image Source - Denmead, 1955

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Five (5 of 16)	Folder: 2018.02.09_05

Taylor Mining Services Pty Ltd
Redbank Plains Road
Blackstone QLD 4305
Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au

FIGURE 5 - Site Geology Plan

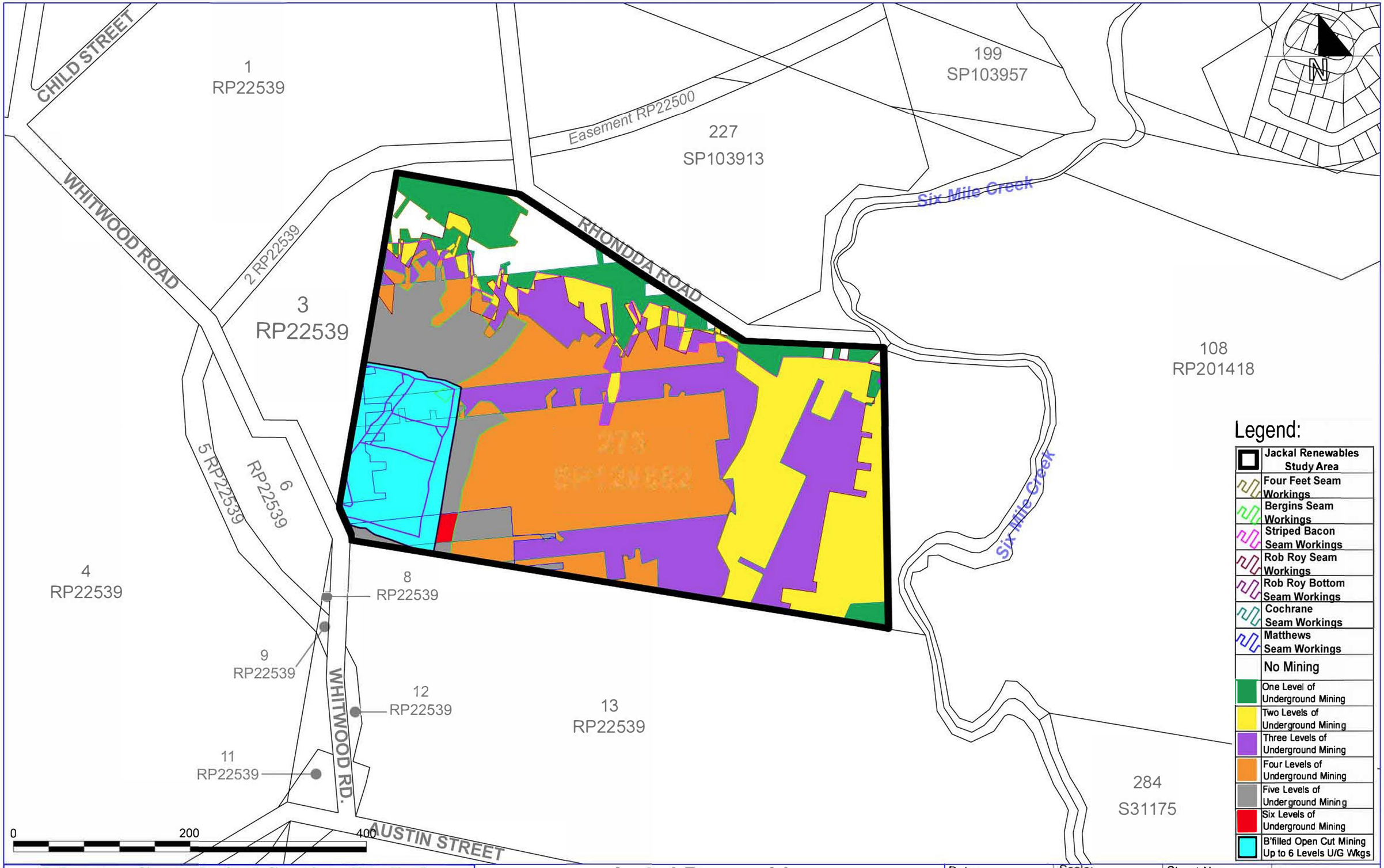
4. Mining History

A desktop study was conducted in 2018 (Moreton Geotechnical Services, 2018) which summarised the extensive historical mining conditions of the site and is summarised in **Figure 6**. The desktop study has been attached at **Appendix 1**.

Historical mining extended from Bundamba Creek in the south to Old Ipswich Road in the north, being bounded to the east by Six Mile Creek and to the west by the Cunningham Highway. The site experienced extensive underground and open cut mining from the commencement of Rhondda Collieries Pty Ltd operations in 1900 to the last mining in 1996.

Underground mining principally occurred from the Four Foot, Bergins, Striped Bacon, Rob Roy, Cochrane and Matthews Seams. There is between one and six levels of underground mining below the site, ranging from 90m below ground to 280m below the site. Underground mining was by Welsh and conventional bord and pillar methods as well as in second workings by floor stripping, pillar splitting and full pillar extraction. The site has also been open cut mined along the Bluff Seam prior to substantial backfilling of the void.

Open cut coal mining has occurred on and adjacent to the site. Subsequent quarrying for shale for paver making has also slightly modified the backfilled open cut landform including extending on the initial open cut coal mine void.



Moreton Geotechnical Services Pty Ltd
PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au
MGS Ref: 2018/11
ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 16 - Constraints Plan

Date: March, 2018 | Scale: 1:4000 | Sheet No: Sixteen (16 of 16) | File: S12.21_ Folder: 2018.02.09_16

Taylor Mining Services Pty Ltd
Redbank Plains Road
Blackstone QLD 4305
Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au

Figure 6 - Historical Mining on Site

5. Hydrogeological Conditions

Due to the extensive past mining activities, both underground and surface, within the site and surrounds, the regional hydrogeological conditions are complex. Within the site, the hydrogeological conditions are influenced by the presence of underground workings that extend across the majority of the site, with workings directly connected through tunnels and shafts. Groundwater within the site is hosted within two discrete zones, being in situ basement sequences and underground mine workings. The geology of the site can be assigned to four main hydrogeological units:

Unit 1 – Alluvium; near surface sands, clays, gravels, associated with local creeks.

Unit 2 – Raceview Formation; claystone, shale, minor sandstone, Clarence – Moreton Basin.

Unit 3 – Bundamba Sandstone; sandstone and conglomerate, clay shale, Clarence – Moreton Basin.

Unit 4 – Blackstone Stage; complex unit of sandstone, siltstone, coal seams – Ipswich Basin.

The clay-shale resource that is the target of this mining lease, is the Raceview Formation, part of the Clarence Moreton Basin sequence. The basement sequences, comprising sandstone, shale and coal seams of the Ipswich Coal Measures, would naturally comprise well cemented/consolidated, fine-grained sediments. These sequences would be tightly bedded and therefore would generally have low transmissivity and comprised low bulk permeabilities, in addition to low storage potential and yield. On the other hand, the mine workings would have higher permeability and groundwater storage capacity due to workings remaining open or collapsed and filled with coarse material.

5.1 Hydrogeological Properties

There has been no site-specific test work of aquifer hydraulic properties on the site. A search of publicly available information in the region has also not revealed any readily available information.

Hydraulic properties have been inferred (Table 4), based on reference to relevant subject textbooks (i.e. Freeze and Cherry 1979).

Table 4 Hydrogeological Properties

Age	Unit	Aquifer Behaviour	Confined/ Unconfined	Inferred Hydraulic Conductivity (K, m/s)	Comment
Tertiary	**Unit 1 – Alluvium**	Aquifer (in sand & gravel dominated lithology units)	Unconfined	10^{-5}	Unconsolidated alluvium
Jurassic to Late Triassic Bundamba Group	**Unit 2 – Raceview Formation**	Aquitard	n/a	10^{-9} shales	Target formation for clay-shale mining
	Unit 3 – Bundamba Sandstone	Aquifer overall	Unconfined in the subject site	10^{-7} sandstone	

Age	Unit	Aquifer Behaviour	Confined/ Unconfined	Inferred Hydraulic Conductivity (K, m/s)	Comment
Late Triassic Ipswich Coal Measures	**Unit 4 – Blackstone Stage**	Mixed aquifer and aquitard, depending on lithology	Confined, artesian	10^{-7} sandstone 10^{-9} shales	Mine workings impact on aquifer behaviour (increased permeability in underground workings)

5.2 Previous Drilling and Registered Bores

There are no groundwater monitoring bores on site. Based on ATC Williams 2018, there is a bore, MW3 (not a registered bore), located approximately 100m to the southwest of the site, on the BMI site (ML 50115) and standing water level is 28.11 m AHD, within shales. This report concluded that the water level in MW3 correlated with the water level in the adjacent Wattle Glen North open pit (~ 30m AHD).

Bore RN181903 was drilled a few hundred metres north of the site, and intersected groundwater in shales, at a depth of 36m below ground level (approximately -6m AHD). The aquifer is interpreted to be within the Raceview Formation. The standing water level recorded is 27m AHD, indicating a significant pressure head on this aquifer. There are no groundwater quality details available from this bore.

Bore CS4 is located in the southeast corner of the ML, and is artesian (flows at surface), with the water level at 23m AHD (also ground level). This bore is not registered. There are no drill logs available for this drill hole (it is not noted in the Qld Bore Register), information from Hugh Taylor (per comm 2017) indicated a total depth of 324m, and intersection of the Cochrane Seam at approximately 268m. The Cochrane seam is in the formation below the Blackstone Stage. This drill hole is likely to be responding to water under pressure in underground coal workings, deep in the Ipswich Coal Measures – Blackstone Stage (i.e. from depths of over 50m below ground level).

Drill logs are available for hole NS145 drilled on the river flats adjacent Six Mile Creek, immediately north of the site (Geological Survey Queensland Publication 293) indicate the base of the Bundamba Sandstone is approximately 165m below the surface in this location.

Exploration drilling carried out across the site, up to 18m below surface (i.e. down to approximately 10m AHD) did not record groundwater in the drill holes. These holes were drilled entirely within the Raceview Formation, to depths below the proposed pit floor.

Review of groundwater levels over time in selected registered bores on the adjacent landfill site has indicated large changes in groundwater levels, over 10 to 20m changes in height. These significant changes may reflect the backfilling of voids (in licenced landfill) and / or changes to underground conditions (i.e. collapse of underground workings).

5.3 Historical Mining Activities Impacts on Groundwater

There has been significant underground and open cut mining in the area, for the last 100 years. The underground workings have impacted on the permeability of the aquifers by introducing openings (drifts, stopes, vent raises) that have increased permeability and also enhanced connectivity. Subsequent instability and collapse of underground workings has further introduced structural connections between aquifer and aquitard layers.

Open pit workings have in some areas remined into historical underground workings, providing a direct connection between relic pit lakes and underground workings.

There are surface drillholes in the area that are also known to provide a connection between aquifer units and in some cases the surface (artesian drillholes)

5.4 Groundwater Quality

There is minimal and insufficient data on groundwater quality for the site and more regionally. In October 2023, the Department of Environment and Science (DES) released a draft report "*Regional groundwater chemistry zones: South East Queensland region summary and results*" which forms a technical basis for the development of groundwater environmental values (EVs), water quality objectives (WQOs) and management intent mapping in the South East Queensland region pursuant to the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP Water). This is the most contemporary regional groundwater assessment and is based on data collected mostly between the 1940s and the present, however there are 170 records collected before 1940, going back to 1919. This represents a comprehensive dataset, although there are spatial and temporal variations in coverage. Groundwater chemistry data was extracted from the Queensland Government Groundwater Database and comprises 11,951 samples.

The comprehensive assessment identifies six major aquifer classes, with the classes divided into multiple groundwater chemistry zones. The site is identified as containing the following aquifer classes and zones:

- **Aquifer Class 1**: Unconsolidated Alluvium
  - **Groundwater Chemistry Zone**: Lower Brisbane River
- **Aquifer Class 2**: Fractured rock
  - **Groundwater Chemistry Zone**: Toowoomba Region Basalts Weathered
- **Aquifer Class 3**: Cainozoic deposits including sediments overlying the GAB
  - **Groundwater Chemistry Zone**: Sediments overlying coal measures
- **Aquifer Class 9**: Earlier sedimentary basins underlying the GAB
  - **Groundwater Chemistry Zone**: Ipswich coal measures

From this comprehensive assessment, there was insufficient data to determine water quality trends and groundwater quality characteristics for the 'Ipswich coal measures', 'Sediments overlying coal measures' and 'Toowoomba Region Basalts Weathered'. There was poor data sufficiency for the "Lower Brisbane River", but the groundwater chemistry has been characterised as moderate saline, but electrical conductivity can be variable.

The only available groundwater quality data from the site is from an artesian bore, CS4, located in the southeast corner of the ML. There are no available records from the construction of this bore. However, discussions between Hugh Taylor of Taylor Mining Services Pty Ltd and Ausrocks Pty Ltd

indicated that CS4 was drilled in the M W Haenke Mine Cochrane Seam workings. The hole likely intersected the Cochrane and Striped Bacon Seams, then later having a direct connection with the Wattle Glen North open cut. Discharge from the hole is likely due to the high-water level in the Wattle Gully Open Cut to the west, within ML 50115.

The water from this flowing bore has been sampled twice, exhibiting high salinity. The results have been detailed in **Table 5**. This water quality is interpreted to reflect the Ipswich Coal Measures water quality.

Table 5 CS4 Water Quality

Parameter	Unit	27/09/2018	17/12/2020
pH	pH unit	7.79	8.02
Conductivity @ 25°C	µS/cm	3300	3220
Suspended Solids	mg/L	<5	<5
Turbidity	NTU	0.3	1.4
Nitrite + Nitrate as N	mg/L	-	0.01
Total Kjeldahl Nitrogen as N Calculated	mg/L	-	1
Total Nitrogen as N	mg/L	-	1
Total Phosphorous as P	mg/L	-	0.02
Arsenic as As	mg/L	<0.001	<0.001
Cadmium as Cd	mg/L	<0.0001	<0.0001
Chromium as Cr	mg/L	<0.001	<0.001
Copper as Cu	mg/L	<0.001	<0.001
Lead as Pb	mg/L	<0.001	<0.001
Nickel as Ni	mg/L	<0.001	<0.001
Zinc as Zn	mg/L	<0.005	<0.005
Mercury as Hg	µg/L	<0.0001	<0.0001
Fluoride	mg/L	1.2	-
Chloride	mg/L	393	417
Hydroxide Alkalinity as CaCO3	mg/L	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	<1	<1
Bicarbonate Alkalinity as CaCO3	mg/L	566	530
Total Alkalinity as CaCO3	mg/L	566	530
Total Hardness as CaCO3	mg/L	449	-
Sulfate as SO4 - Turbidimetric	mg/L	790	799
Calcium	mg/L	66	57
Magnesium	mg/L	69	64
Sodium	mg/L	620	610
Potassium	mg/L	16	15
Total Anions	meq/L	38.8	39
Total Cations	meq/L	36.3	35
Ionic Balance	%	3.32	5.35

5.5 Groundwater Potentiometric Surface and Flow Direction

Review of water level records in registered (and unregistered) bores in the district has been undertaken. The assessment of the data indicates;

- Groundwater in the Bundamba Group and Ipswich Coal measures is generally sub-artesian – that is the pressure level for the groundwater is above the depth that groundwater was intersected
- Groundwater level is variable and influenced by regional industrial and mining activities (for example, groundwater levels to the north vary significantly over time, likely reflecting the activities at the landfill affecting groundwater level)
- Groundwater level within fill sequences to the north of site are very different to groundwater level within undisturbed formations
- Where there are adjacent drill holes to different depths (Bundamba Group and Ipswich Coal Measures) the standing water levels are very similar, indicating a connection between these formations
- Pit Lake level in the Wattle Glen North Pit is approximately 30m AHD, and locally influences groundwater level in the formations surrounding the pit.
- The bed level of Six Mile Creek to the east is approximately 20m AHD and would provide an upper limit on the potential groundwater level in this zone. There are no seeps observed on the site, within Six Mile Creek, so it is unlikely that groundwater has reached 20m AHD.
- The variability of groundwater standing water levels makes it difficult to map the potentiometric surface, however the broad trends indicate groundwater flow direction is to the north – east.

The map of registered bores and standing water levels (in metres, Australian Height Datum) is included in **Figure 7**.

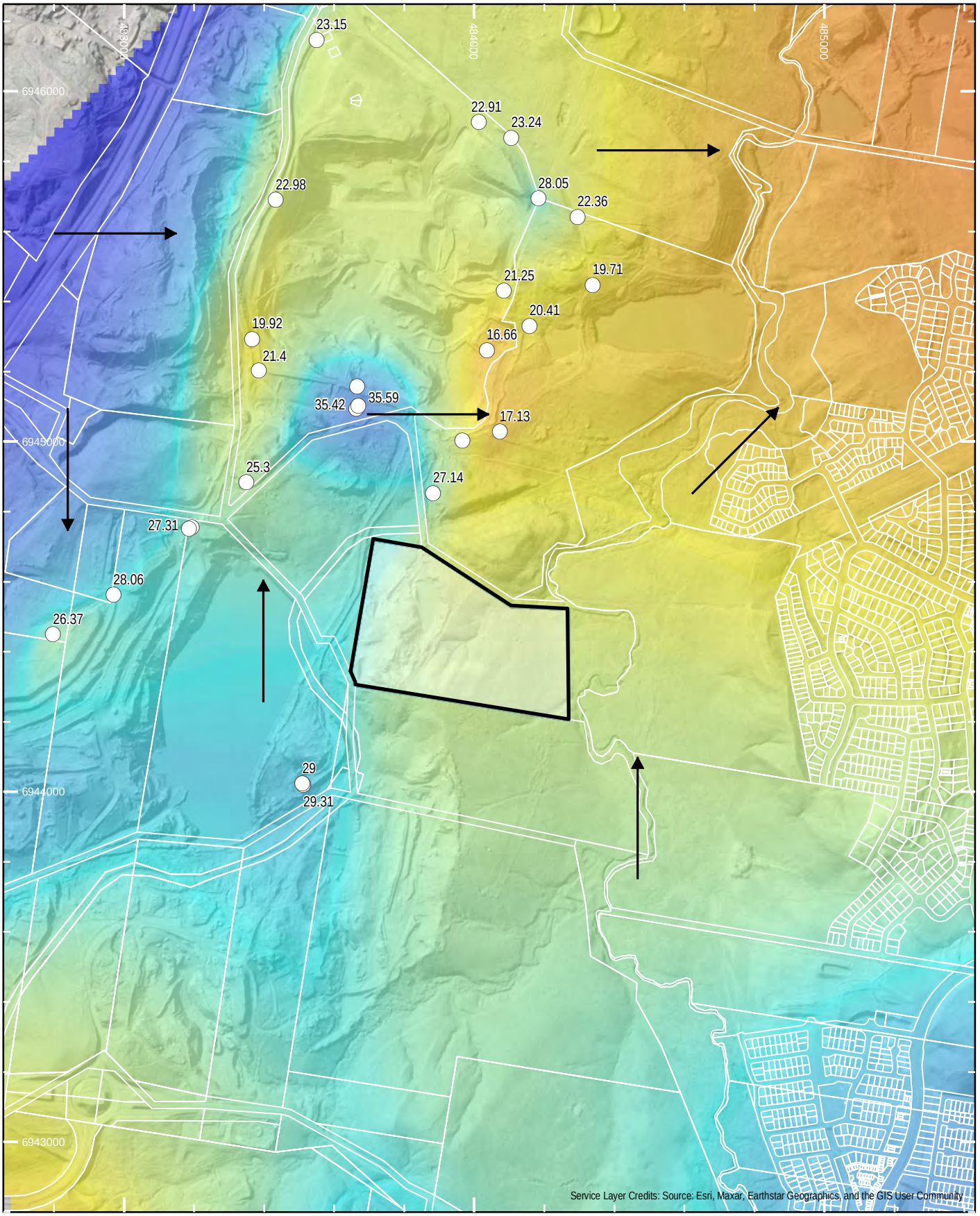
5.6 Local and Regional Groundwater Use

There is no known extraction of groundwater from the aquifers immediately surrounding the site. Registered bores surrounding the site are largely monitoring bores associated with current mining and industrial activities.

The nearest registered bore that does not occur on an industrial or mining site, is located approximately 1.6km to the south of the site (RN 145828). This bore was drilled to a total depth of 32m, in “sands” and is interpreted to be drawing water from the alluvial aquifer associated with Six Mile Creek. This bore would be located up-groundwater gradient from the site, and therefore not impacted by activities on the site.

The nearest registered bore that is likely to be down groundwater gradient of the site (that does not occur on an industrial or mining site) is approximately 3.5 km north of the site (RN 138323). This bore was drilled to a total depth of 49m, and intersected water in Sandstones of the Tivoli Formation (Ipswich Coal Measures). The mining activities on the Jackal Renewables site only intersect the

Raceview Formation and possibly the Bundamba Group. Therefore, site activities would not impact on the groundwater in RN138323.



0 100 200 300 400 500

m

JACKAL RENEWABLES PTY LTD

Lot 73 on SP 128662

N
W E
S

GDA2020, MGA Zone 56

ARDENT GROUP PTY LTD

Standing Water Level

Drawn By:	Chris Schlebusch
Requested by:	Tommi Mason
Date:	1/03/2024

Sheet No.
RTPL_ARD_STW001_MAP_1029_B

ML 50070
Property Boundary
Registered Groundwater Bore (with SWL RL AHD)
Flow Direction

NOTE:
Flow direction based on gridded SWL only.
No geology or landform factors incorporated.

SWL (RL AHD)
62
-9

Data sources:
©State of Queensland, Department of Resources

Path: S:\Plans\Project_Specific\Ardent\STW001\RTPL_ARD_STW001_MAP_1029_B Topo ML50070 SWL Water Pressure.mxd

5.7 Surface Water – Groundwater Interactions

Six Mile Creek, at the eastern portion of the site may also be influencing shallow groundwater levels, with the bed level in the creek at approximately 20m AHD. The bed level of Six Mile Creek would likely control shallow water table levels in this vicinity (i.e. groundwater level would be at or below 20m AHD). There are no seeps observed in the Kerwick #2 Pit. Standing water level in Kerwick #2 Pit was recorded at 23.5m AHD on 27 September 2018 after a long dry period. This pit is excavated into clay-shales which may form a natural seal at the base of the pit. Six Mile Creek does dry out completely during the dry season and is not supported by groundwater discharge (seeps) during the dry season.

5.8 Conceptual Site Model

A conceptual site model transecting ML 50070 from west to east is provided as **Figure 8**, which provides the basis for characterising hydrogeological conditions under current conditions. To provide context for the assessment of groundwater conditions within the subject site and the development of the conceptual model, a review of a past assessment at the adjacent Bogside Mining Industries Pty Ltd (BMI) site ML 50115 has been undertaken (ATC Williams, 2018).

It would be anticipated that groundwater recharge occurs from incident rainfall within the surrounding area into the sandstones of the Ipswich Basin and Moreton Basin outcropping areas. In addition, some groundwater recharge may take place from the base of exhausted mine pits in the region. Groundwater discharge areas (soaks) are not locally known, unless artificially created by uncapped artesian bores. It is likely that groundwater provides some base flow to the Brisbane River, approximately 3.5km north of the site. Groundwater flow direction in shallow sedimentary aquifers is likely to follow general topography towards the northeast, from the site.

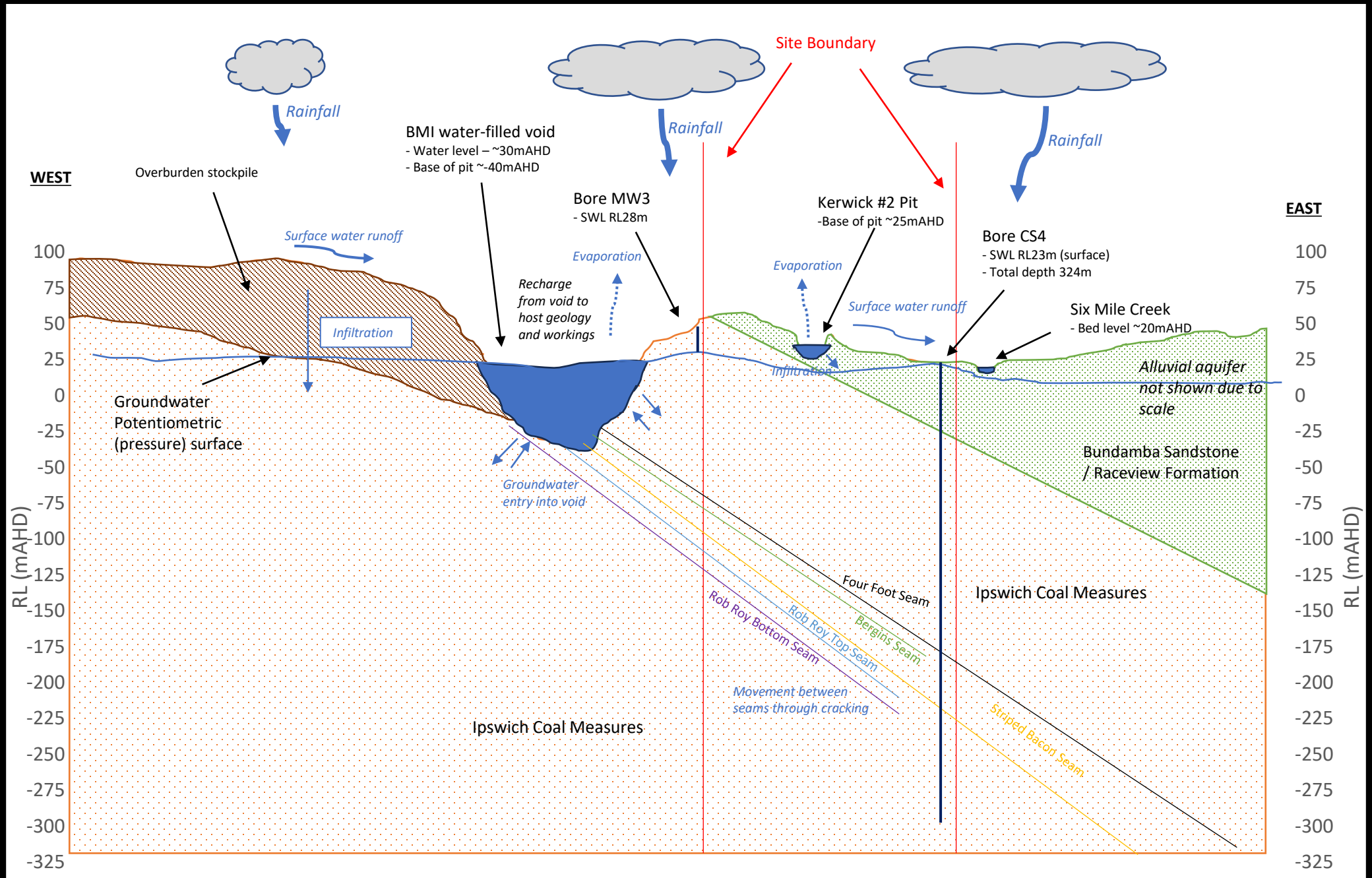


Figure 8 –Conceptual Site Model

Note: not to scale, conceptual only

6. Groundwater Impact Assessment

The proposed activity on the subject site is clay and clay-shale mining of the Raceview Formation (Bundamba Group) in an open pit. The base of the open pit is designed to a lowest level of approximately 14 m AHD.

Based on this hydrogeological assessment, the shallowest groundwater intersection in the Raceview Formation (adjacent to the subject site) is at a depth of approximately -6m AHD. This is supported by the observation that the exploration drillholes drilled to the base of the proposed pit throughout the clay deposit in the eastern area of the mining lease did not detect or intersect groundwater.

Since no groundwater was detected in exploration bores and the current mine plan will not exceed the depth of the exploration drillholes, mining is likely to be above groundwater level and the mineral extraction is not likely to interfere with groundwater on the subject site.

Therefore, no impacts on groundwater by the proposed mining activity are currently predicted.

7. Conclusion

An extensive review of site and regional geology, previous assessments from nearby sites and registered and unregistered drill holes has been undertaken to form the basis for this hydrogeological assessment.

The dominant rocks outcropping and underlying the subject site are the Bundamba Group (Aberdare Conglomerate and Raceview Formation), underlain by the Blackstone Formation of the Ipswich Coal Measures. The site is located on the eastern limb of the Bundamba Anticline, with the geological units dipping 7 – 10 degrees to the east.

The geology of the site can be assigned to four main hydrogeological units:

Unit 1 – Alluvium; near surface sands, clays, gravels, associated with local creeks.

Unit 2 – Raceview Formation; claystone, shale, minor sandstone, Clarence – Moreton Basin.

Unit 3 – Bundamba Sandstone; sandstone and conglomerate, clay shale, Clarence – Moreton Basin.

Unit 4 – Blackstone Stage; complex unit of sandstone, siltstone, coal seams – Ipswich Basin.

Extensive open cut and underground coal (and more recently clay-shale) mining has taken place on, beneath and adjacent to the subject site. Contemporary mining activities and commercial landfill operations occur in the near vicinity. Together, these activities have influenced and continue to influence the hydraulic properties of the formations and the groundwater pressure levels of the area.

Assessment of the data has indicated that the shallowest groundwater adjacent (and likely underlying) the site is in the Raceview Formation, at approximately -6m AHD. The pressure level (potentiometric surface) is approximately 27m AHD.

There is little groundwater quality information from the public record. An artesian bore located on the subject site, which intersects the Ipswich Coal Measures, indicates water quality is poor (pH ~8.0 and EC ~3300 uS/cm, ~800mg/L sulfate).

The proposed activity on the subject site is clay and clay-shale mining of the Raceview Formation (Bundamba Group) in an open pit. The base of the open pit is designed to a lowest level of approximately 10 m AHD. Since the proposed mining pit is above the interpreted groundwater level, there are no predicted impacts on groundwater from the proposed mining.

8. References

Ausrocks 2018, ML50070 Shale Resource Assessment

ATC Williams 2018, Ipswich Resource Recovery Facility – Hydrogeology Assessment Report

Geology of Queensland, 2013, Peter Jell, editor, Geological Survey of Queensland

Cranfield et al, 1989 , 1:100 000 Geological Map Commentary - Ipswich Sheet 9442, Queensland. Queensland Department of Mines.

Cranfield and Schwarzbock, 1972, Nomenclature of some Mesozoic rocks in the Brisbane and Ipswich area, Queensland. Queensland Government Mining Journal, 414 - 416.

Staines, 1961, Coal Resources West Moreton (Ipswich) Coalfield - Part 14 P.D.T.S Nos 11,12 and 14 mine areas, Rhondda. Geological Survey of Queensland Publication 298.

Moreton Geotechnical Services, 2018, Desktop Mining Study on Part of Lot 273 SP128662 Rhondda Road new Chum.

Freeze and Cherry 1979, Groundwater, Prentice Hall

Geological Survey Queensland Publication 293, Coal Resources, West Moreton (Ipswich) Coalfield.

HYDROGEOLOGICAL ASSESSMENT

JACKAL RENEWABLES PTY LTD

Appendix 1 Desktop Mining Study

MORETON GEOTECHNICAL SERVICES PTY. LTD.

PO Box 915 Ipswich 4305

Telephone (07) 3294 6988
Facsimile (07) 3294 6988
Email mgs@gil.com.au

A.C.N. 055 833 120
A.B.N. 24 055 833 120

Ref. 2018/11

9 March 2018

Hunt Michel and Partners
24 Darling Street East
Ipswich
4305

Att. Mr. Dan Michel

Re: **DESKTOP MINING STUDY ON PART OF LOT 273 SP 128662 RHONDDA ROAD NEW CHUM**

1.0 INTRODUCTION

The work in this study was carried out at the request of Mr Rob Howe (email of 23 February 2018) of Jackal Renewables P/L (formerly Shiftwaste) in order to meet with Council's requirements. The work in this study was also carried out in general accordance with the details in our email of 16 February 2018.

It is understood that the proposed development essentially comprises a plasterboard recycling facility with some flexible and demountable structures. A perimeter haulage road, which will involve cutting and filling, is also proposed to access the processing pad, waste transfer station, the cogeneration areas, the workshop and caretakers residence. Most of the surface area is also understood to comprise bare ground with a weatherproof covered area and stump/demountable type caretakers residence. It is in addition understood that the current shale extraction operation, for paver making, will continue on the site.

Work in this study has included a site inspection (Messrs Richard Davis from the Ardent Group P/L, Hugh Taylor from Taylor Mining Services P/L, yourself and the undersigned) on 1 March 2018, obtaining mine plans, researching maps, reports and publications, the production of 16 plans in electronic format and reporting by the undersigned Engineering Geologist. Taylor Mining Services P/L have also assisted in the study.

The following plans are attached to this report:

1. site plan
2. aerial image

3. 1972 contour plan
4. 2017 contour plan
5. geology plan
6. mine plan - Four Foot Top and Main Four Foot Seam
7. mine plan - Bergins Seam
8. mine plan - Striped Bacon Seam
9. mine plan - Rob Roy Seam
10. mine plan - Cochrane Seam
11. mine plan - Matthews Seam
12. tunnels and shaft plan
13. open cut mine plan
14. mining lease plan
15. development plan
16. constraints plan

2.0 INVESTIGATION RESULTS

2.1 SITE

Plan 1 attached shows that the site comprises most of Lot 273 SP 128662 at the southern end of Rhondda Road.

Plan 2 attached shows that most of the site is covered in trees, also that the cleared areas include material for recycling, an open void (remnant open cut void), a shale extraction area and a track that truncates the site. The site inspection confirmed the general details shown on Plan 2, also that an electricity line extends through the site.

Plan 3 attached shows that the 1972 pre open cut mining topography essentially comprised a hilltop in the south west corner with north easterly slopes down to Six Mile Creek. A north easterly trending drainage line also truncated the topography. The site elevations ranged from 55m AHD at the hilltop down to 25m AHD adjacent to Six Mile Creek.

Plan 4 attached shows the 2017 topography with the general profile essentially similar to the 1972 profile except that the 25m AHD area shown on the 1972 plan is shown as 22m or less and the open cut void (partially backfilled) is shown to extend down to 31m AHD.

2.2 GEOLOGY

Plan 5 attached shows that the overall site spans three geological units i.e. the youngest Quaternary Alluvium (orange) adjacent to Six Mile Creek, the older non-productive Bundamba Sandstone (light blue) and the oldest productive Blackstone Stage (dark blue) of the Ipswich Coal Measures along the western boundary.

The Blackstone Stage comprises sandstone, shale and coal including in increasing age and depth the Aberdare, Bluff, Four Foot, Bergins, Striped Bacon and Rob Roy Seam. The beds and seams dip to the east and south east under the site, i.e. in the order of 7 – 10 degrees due to the location of the site on the eastern flank of the Bundamba Anticline.

The Cooneana Stage of the Ipswich Coal Measures underlies the Blackstone Stage. This stage includes beds of sandstone, shale and the previously productive Cochrane, Ritchie, Taylor, Livermore and Matthews Seams.

The Rhondda Fault is a westerly to easterly trending fault that truncates the beds across the northernmost part of the site as also shown on Plan 5. This fault has downthrown the beds by 40m to the north.

The site inspection revealed the presence of extensive open cut overburden material across the western side of the site. An exposed low-wall on the south side of the relict open cut, and part of the exposed highwall on the eastern side of the relict open cut void, also revealed the presence of easterly dipping beds of shale (and some coal) of the Blackstone Stage with a capping of strong sandstone of the Bundamba Sandstone or Aberdare Conglomerate Formations. The strong sandstone is also exposed at ground level around the crestal area in the south west corner of the site. The Bluff Seam was noted to outcrop (come to the surface) just across the western boundary in a deep drainage channel that had been previously excavated in the bedrock.

2.3 MINING

2.3.1 GENERAL

This site has experienced extensive underground and open cut mining from the commencement of Rhondda Collieries Pty Ltd operations in 1900 to the last mining in 1996.

An attempt to open a coal mine at Rhondda first commenced about 1886 but the venture failed due to extensive cartage costs to transport the coal to the

nearest rail line or river and then to markets. The construction of the Bundamba to Redbank Loop Line commencing in 1901 however encouraged Rhondda and then many other mines to open in the Swanbank, Blackstone and New Chum areas. The alignment of this early 1900s railway line is still identifiable today via the registered easement close to the north west corner of this site.

The coal seams of past economic importance in the Blackstone Stage of the Ipswich Coal Measures that have been mined under this site, include the Bluff, Four Foot Top, main Four Foot Seam, Bergins, Striped Bacon and Rob Roy Seams, also the Cochrane and Matthews Seams of the lower Cooneana Stage.

2.3.2 UNDERGROUND MINING

Underground mining commenced with the original New Chum and Ebbw Vale Collieries to the north of the site in the 1880s whereas the last underground mining took place from the M.W. Haenke No. 2 Colliery under this site in 1996. The Noblevale, Aberdare, Whitwood, New Whitwood, Rylance, Rhondda, Belmont and Haenke Collieries made up most of the underground collieries in the general area. Mining was by Welsh and conventional bord and pillar methods as well as in second workings by floor stripping, pillar splitting and full pillar extraction.

2.3.2.1 Rhondda No.1 Colliery - Four Foot Seam

Plan 6 shows the extent of Four Foot Top and Four Foot Main Seam mining from the Rhondda No. 1 and 2 Collieries as well as the Jones No. 1 Colliery under this site.

Mining at Rhondda Collieries recommenced in 1900 with the new operators initially driving a tunnel in from the seam outcrop and soon after sinking the Rhondda No. 1 Colliery vertical production shaft to reach the Four Foot Seam. A poppet head was erected to raise the coal skips to the surface.

In 1907 the new Rhondda Collieries No. 2 Shaft was commenced to again work the Four Foot Seam. By 1919 fires and creep (subsidence over a large area) were being experienced in the mine workings and the No. 2 Shaft was soon abandoned.

The Four Foot Seam here is made up of the coalesced Four Foot Top Seam and the Four Foot Main or Bottom Seam. In the Jones No. 1 Colliery the Top Seam was mined.

Coal was initially mined to the rise of the shaft and later to the dip towards this site. The method of mining was by Welsh bord and pillar methods. The main Four Foot Seam was traditionally mined to reflect the name of the seam i.e. 4 ft or 1.2m high. Access roadways would have been mined up to 1.8 to 2.1m high (6 or 7 ft). The Top Seam was mined in parts up to 1.8m high and possibly higher.

The Four Foot Seam workings are located at approximately 90m depth under the proposed development area.

2.3.2.2 Rhondda No. 1 Colliery - Bergins Seam

Plan 7 shows the extent of the Bergins Seam mine workings from this colliery under the site. The workings from the Jones No. 1 Colliery also extend close up to the north west corner of the site.

In 1919 with fires and creep (major subsidence) in the Four Foot Seam workings, the No. 2 Shaft was abandoned and the No. 1 Shaft was recommenced by deepening it a further 22.5m to the Bergins Seam.

Mining on the Bergins Seam commenced by 1921 from the Rhondda No. 1 Shaft as well as an additional horse tunnel to the north west of the No. 1 Shaft.

The method of mining was bord and pillar type mining. The working height varied but was often up to 3.5m high. The mine workings extended to the rise and dip towards this site from the No. 1 Shaft.

The Bergins Seam workings are located at approximately 110m depth under the proposed development area.

2.3.2.3 Rhondda No. 1 Colliery - Striped Bacon Seam

Plan 8 shows the extent of the Striped Bacon Seam mine workings from this colliery under the site.

In 1936 the Rhondda No. 1 Shaft was again deepened a further 22m to reach the Striped Bacon Seam. The shaft was now 75.5m deep to the floor of the Striped Bacon Seam.

Coal was again worked over an extensive area to the rise from the shaft and then an extensive distance to the dip under this site.

The bord and pillar method of mining to 2.5m high was used and pillar extraction has taken place.

The Striped Bacon Seam workings are located at approximately 130m depth under the proposed development area.

2.3.2.4 Rhondda No. 1 Colliery – Rob Roy Seam

Plan 9 shows the extent of these Rob Roy Seam mine workings under the site.

In 1942, immediately south of the bottom of the Rhondda No. 1 Shaft on the Striped Bacon Seam, a level cross measure drift was driven to the west to intersect and gain access to the Rob Roy Top Seam. The Rob Roy Seam varies in depth between 10m to 20m below the Striped Bacon Seam. The Rob Roy Seam is also split into a Top and Bottom section with the separation varying between less than 1m in the north to 10m in the southern part of the site.

Coal was again mined over an extensive area to the rise from the drift and then an extensive area to the dip under this site. The rise workings connected to some earlier workings on the Rob Roy Seam from Millers Tunnel. Another tunnel known as Briggenshaws Adit connected to the Rob Roy Seam and was used initially as a horse tunnel and later as a man and materials access using rubber tyred mine vehicles.

The seam dips at 7 to 10 degrees to the east and has generally been worked by bord and pillar methods up to 2.2m high. Some floor stripping has also been carried out in the eastern part of this site producing a working height of up to 4.0m.

The Rob Roy Seam workings are located a approximately 140m depth under the proposed development area.

2.3.2.5 M.W. Haenke No. 1 Colliery – Cochrane Seam

Plan 10 shows the extent of the Cochrane Seam mine workings under this site.

The M.W. Haenke No. 1 Colliery commenced in 1970 from tunnels and shafts. This site is virtually fully undermined by these workings.

The seam dips at 7 to 10 degrees to the east and has generally been worked up to 2.5m high. Extensive areas of this mine have been partly or fully pillar-extracted.

The Cochrane Seam workings are located approximately 225m depth under the proposed development area.

2.3.2.6 M.W. Haenke No. 2 Colliery – Matthews Seam

Plan 11 shows the extent of the Matthews Seam mine workings under this site.

The M.W. Haenke No. 2 Colliery commenced in 1981 from tunnels and shafts initially to mine the higher Livermore Seam.

The seam dip at 7 to 10 degrees to the east and has generally been worked by bord and pillar methods up to 2.5m high.

The Matthews Seam workings are located at approximately 280m depth under the proposed development area.

2.3.2.7 Tunnels and Shafts

Many tunnel entries and exploration shafts and airshafts were located in the general area of the site during and after underground mining along the main Four Foot, Bergins, Striped Bacon, Rob Roy and Rob Roy Bottom Seams. Many of these features were removed during subsequent open cut mining operations.

Plan 12 attached shows the locations of two trial tunnel entries, one trial shaft, a dewatering borehole and Borehole NS 147.

The trial tunnel close to the western boundary could not be located during the site inspection and the other features were not inspected as these were away from the area of interest.

2.3.3. OPEN CUT MINING

Open cut mining commenced in the 1960s when suitable earthmoving equipment became available. The Wattle Glen North mine was the last open cut mine to operate until 1996. The Rylance, Aberdare incorporating Whitwood, New Whitwood, Rhondda and Rhondda (Wattle Glen) Collieries made up most of the open cut collieries in the site area.

Open cut mining was by truck and shovel, blast and strip methods with the overburden material generally placed around the progressing void or back into the completed section of void. Open cut voids typically extended down to 30m to 50m below original ground levels and occasionally down to approximately 100m below original ground levels.

The Four Foot Top, main Four Foot and Bergins were the main seams mined by open cut methods in the general area, however the Bluff, Striped Bacon and Rob Roy Seams were also mined to some extent by open cut methods.

Plan 13 attached shows the extent of this open cut mine along the Bluff Seam on this site. This open cut was mined in the 1970s and was mostly backfilled leaving only a small void. Subsequently the site was sold to and operated by Claypave for the shale and clay resources located there for use in their New Chum brick and paver manufacturing plant.

Part of the open cut works appears to have been extended for the extraction of shale for paver manufacture. This aspect is currently being checked, with any updated information to be supplied in a supplementary report.

2.3.4 MINING LEASES

Plan 14 attached shows the mining leases that cover the site and surrounding areas. From the plan it can be seen that ML 50070 covers the site. The lease is held by Claypave P/L.

3.0 COMMENT

Plan 15 attached shows that the proposed development is located on the western side of the site covered in this study.

Plan 16 attached has been constructed with a view to summarising the mining conditions on the whole site.

In summary the work in this study has revealed that the proposed development area:-

- has a trial tunnel, which appears to be located under fill, close to the western boundary

- is undermined along the Four Foot, Bergins, Striped Bacon, Rob Roy, Cochrane and Matthews Seams

- has been open cut mined along the Bluff Seam prior to substantial backfilling of the void. Subsequent quarrying for shale for paver making has also slightly modified the backfilled open cut landform including extending on the initial open cut coal mine void.

- is covered by a current mining lease for the ongoing extraction of shale for the manufacture of pavers

Specifically, the work in this study has revealed that all of the proposed structures are located on a disturbed surface including open cut buried and partially exposed walls and backfilling in the order of 35m maximum thickness on the eastern side to 15m on the western side with six levels of underground mining. The northern part of the processing pad by comparison is located over a disturbed surface over natural ground with five levels of underground mining.

Settlement, and particularly differential settlement, of fill along the line of open cut walls that are buried or proposed to be buried represents the main potential ongoing issue, whereas potential subsidence from the multilevel underground flooded mine levels represent a secondary consideration. Notwithstanding this, the proposed development can be described as low risk in terms of settlement and subsidence due to its flexible and demountable nature, also mainly due to the proposed bare surfaces. This nonetheless assumes that structures are placed away from buried or exposed open cut walls as much as possible, also that potential ongoing maintenance can be accepted as or when required e.g. by regrading the perimeter haulage road and open hardstand and other surface areas, relevelling the workshop and residence, resurfacing or replacing any minor concrete slabs e.g. for the workshop etc.

Finally, the trial tunnel near the western boundary is not considered to be an issue in general terms. The tunnel location will however need to be identified prior to construction of the perimeter haulage road thereabouts to ensure the safety of workers at the construction stage.

In conclusion, the work in this study has identified the extensive mining history of the site. Notwithstanding this, the specific area of interest for the proposed development appears to be a low risk application for the reasons stated above. Supplementary work is being carried out to establish the extent to which any open cut activity may have been extended for shale extraction after the main coal open cut and backfilling operation.

4.0 LIMITATIONS

This report, which may contain attachments in the form of plans, borehole record sheets, laboratory test results etc, must be read in its entirety.

The work in this report was produced for Hunt Michel & Partners and their Client and Associates on the basis of information available at the time of writing. This report will not contain sufficient information for other parties and purposes.

While care has been taken in producing this report, it needs to be said that there will always be some risk associated with utilising these settings. Recommendations put forward in this report are aimed at highlighting the risk for the proposed works on this site.

This company accepts no responsibility for works which do not fully comply with the recommendations in this report.

MORETON GEOTECHNICAL SERVICES PTY LTD



K. B. GRUBB
M.App.Sc., MIE Aust., CP Eng., RPEQ 2811

CHILD STREET

1
RP22539

199
SP103957

Easement RP22500

227
SP103913

WHITWOOD ROAD

2 RP22539

RHONDDA ROAD

Six Mile Creek

3
RP22539

273
SP128662

5 RP22539

6
RP22539

Six Mile Creek

108
RP201418

4
RP22539

8
RP22539

9
RP22539

WHITWOOD RD.

12
RP22539

13
RP22539

11
RP22539

284
S31175

0 200 400

AUSTIN STREET

N

Legend:

Jackal Renewables Study Area

Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

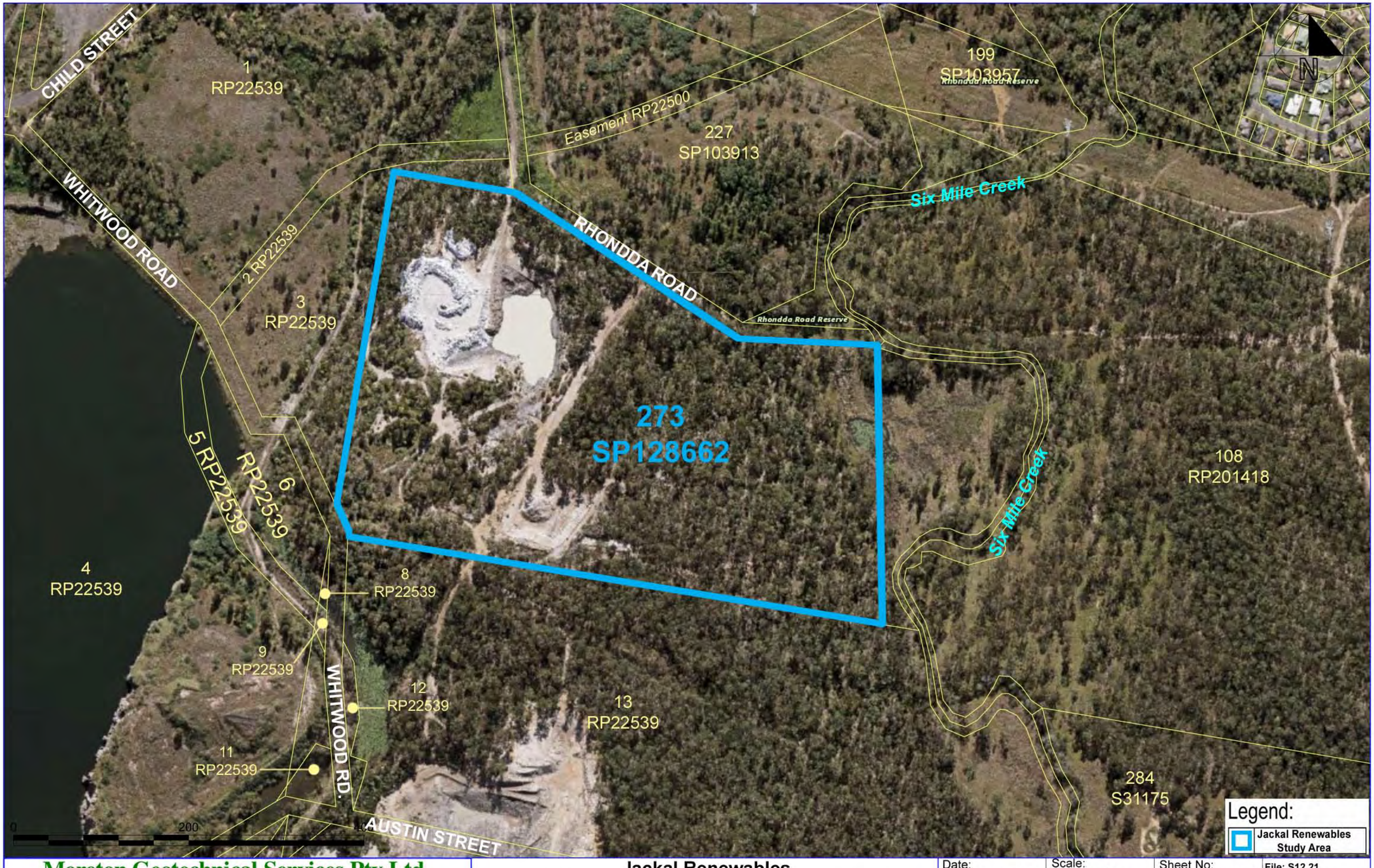
ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 1 - Site Plan

Date: March, 2018
Scale: 1:4000
Sheet No: One (1 of 16)
File: S12.21_
Folder: 2018.02.09_01

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305
Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

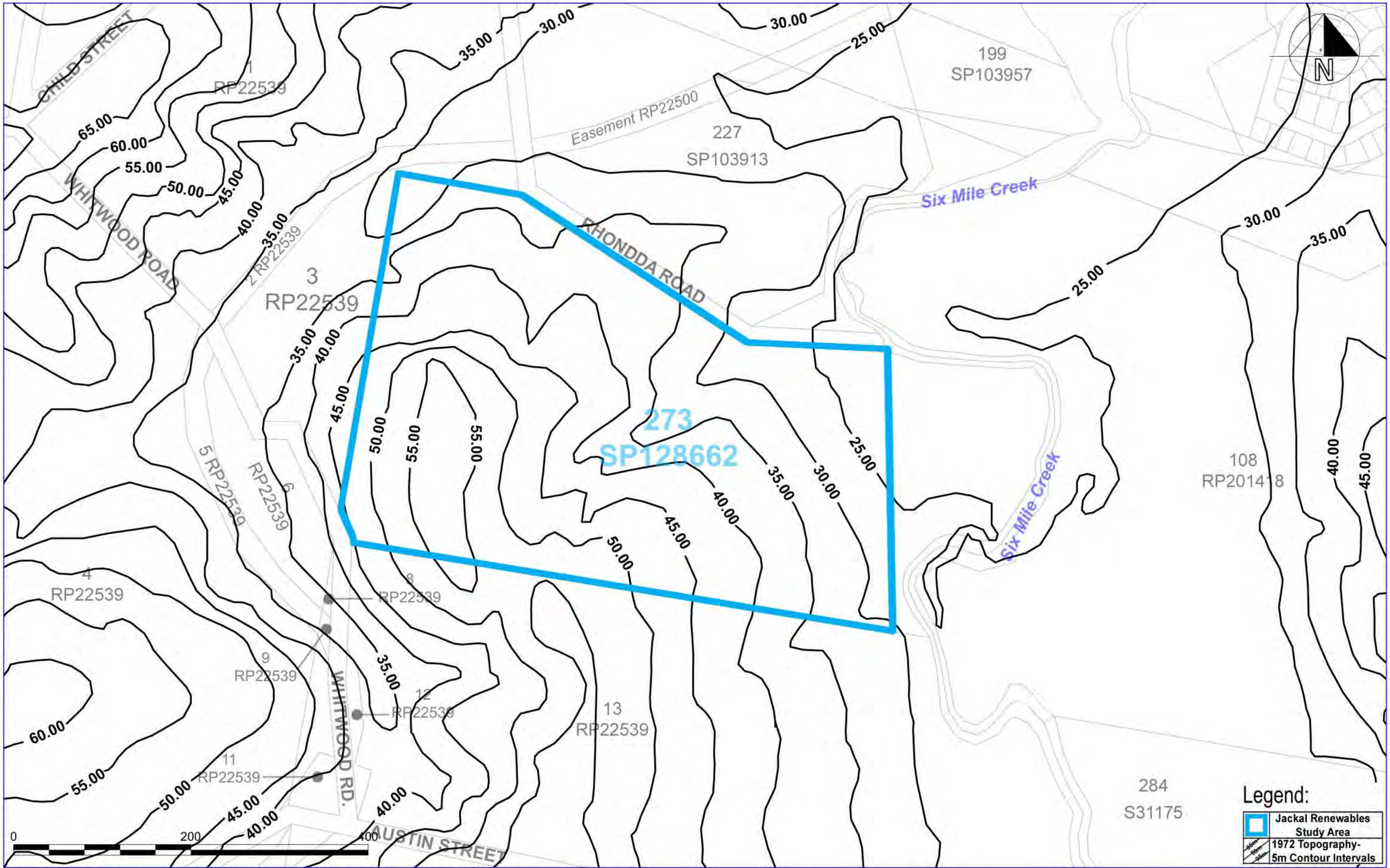
Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 2 - Aerial Plan
Image Source - Queensland Globe/State of Queensland 2018

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Two (2 of 16)	Folder: 2018.02.09_02

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

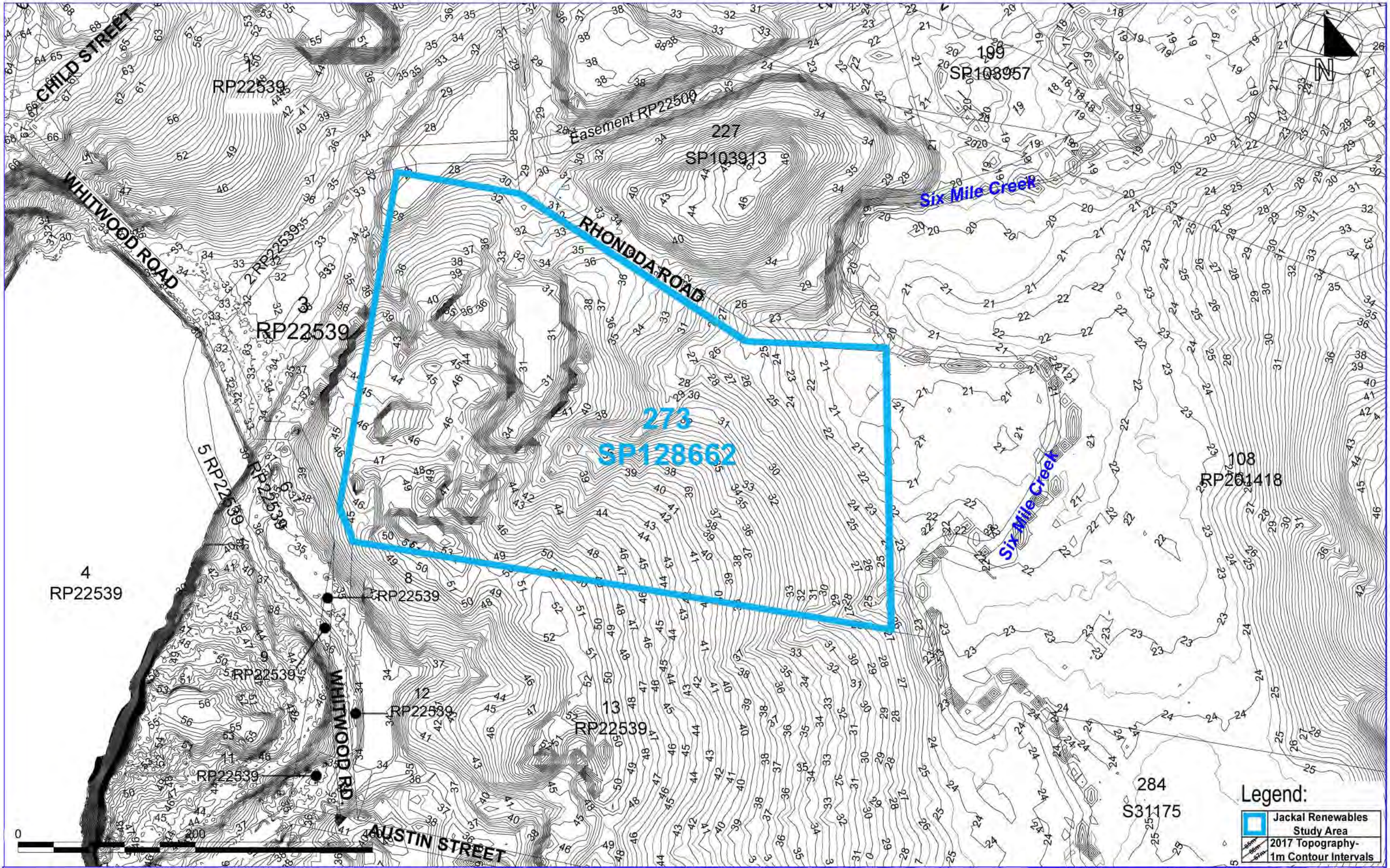
MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 3 - Contour Plan
1972 Map View Contours

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Three (3 of 16)	Folder: 2018.02.09_03

Taylor Mining Services Pty Ltd
Redbank Plains Road
Blackstone QLD 4305
Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

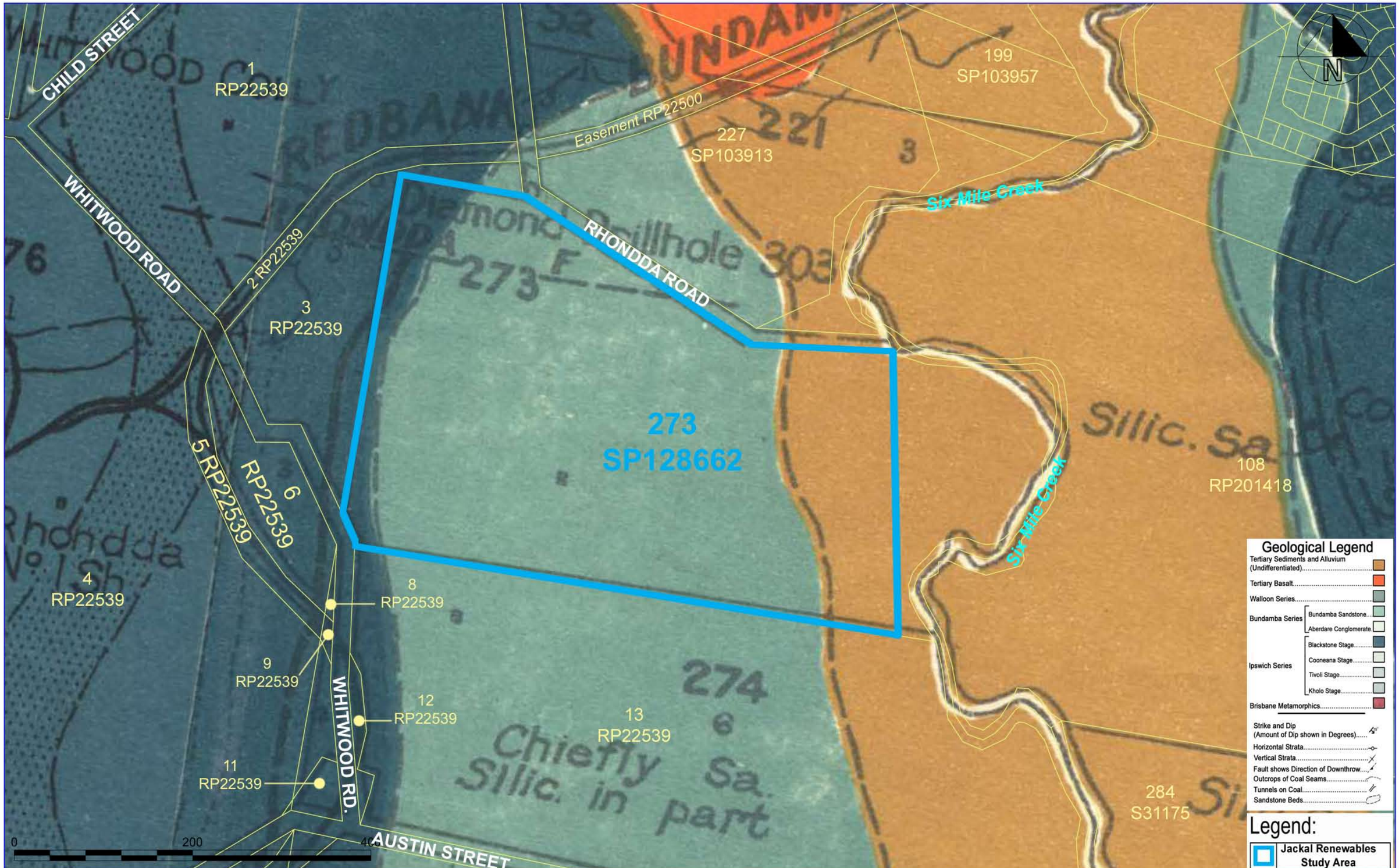
Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 4 - Contour Plan
2017 Contours

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Four (4 of 16)	Folder: 2018.02.09_04

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 5 - Geology Plan
Image Source - Denmead, 1955

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Five (5 of 16)	Folder: 2018.02.09_05

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au

CHILD STREET

1
RP22539

Jones No.1 Colliery - Four Feet and Four Feet Top Seam Workings

WHITWOOD ROAD

2 RP22539

3
RP22539

Rhondda No.1 Colliery - Four Feet Seam Workings

5 RP22539

RP22539 6

4
RP22539

8
RP22539

9
RP22539

WHITWOOD RD.

12
RP22539

13
RP22539

11
RP22539

AUSTIN STREET

Easement RP22500

227
SP103913

RHONDDA ROAD

199
SP103957

Six Mile Creek

273
SP128662

Rhondda No.2 Colliery - Four Feet Seam Workings

Six Mile Creek

108
RP201418

284
S31175

N

0 200 400

Legend:

- Jackal Renewables Study Area
- Four Feet Seam Workings

Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

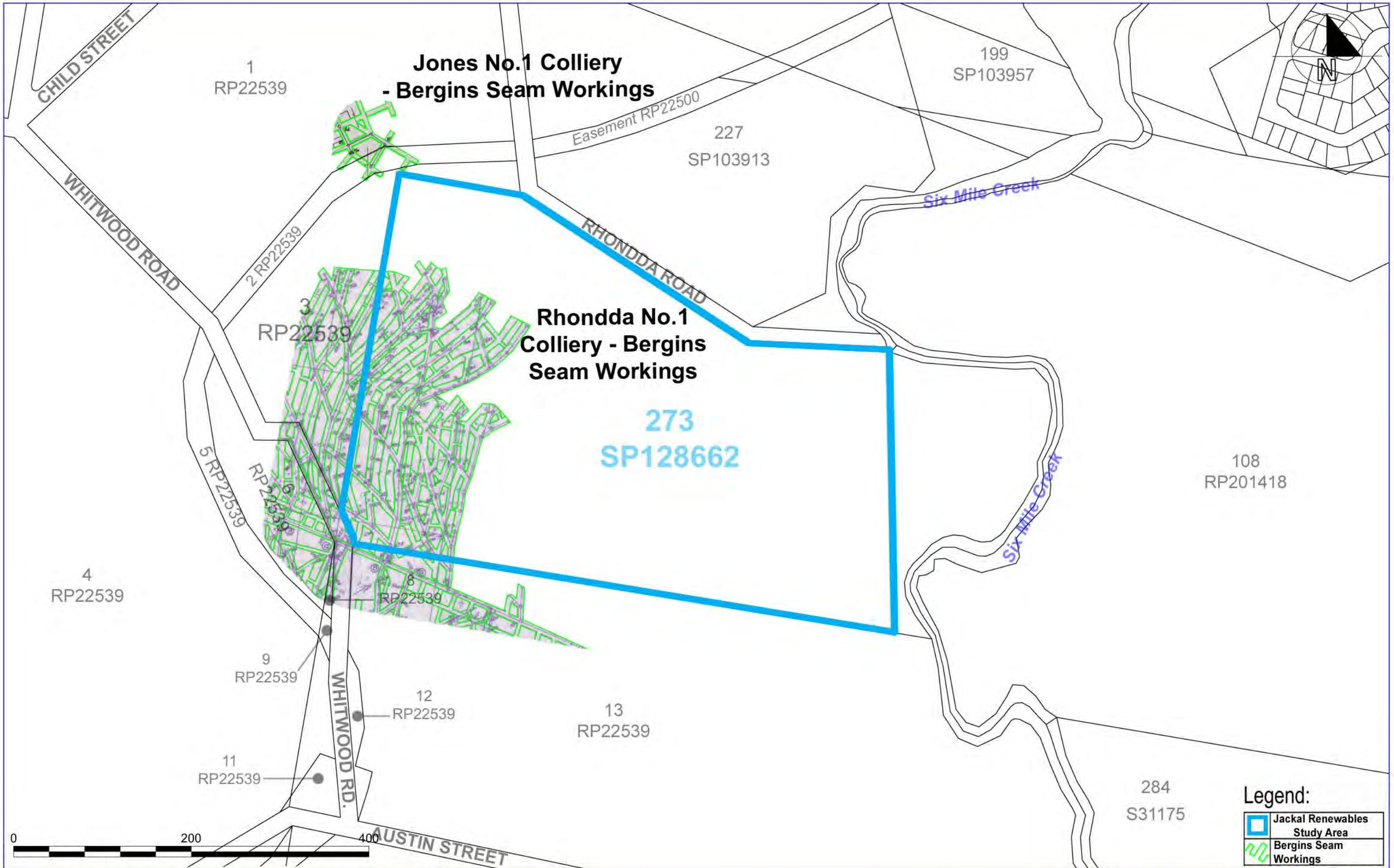
Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 6 - Underground Mining Plan
Four Feet and Four Feet Top Seam Workings

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Six (6 of 16)	Folder: 2018.02.09_06

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311 Fax: (07) 3816 2377
www.taylorminingservices.com.au



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 7 - Underground Mining Plan
Bergins Seam Workings

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Seven (7 of 16)	Folder: 2018.02.09_07

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au

CHILD STREET

WHITWOOD ROAD

1
RP22539

Easement RP22500

227
SP103913

199
SP103957

RHONDDA ROAD

Six Mile Creek

2 RP22539

3
RP22539

5 RP22539

6
RP22539

273
SP128662

108
RP201418

Six Mile Creek

4
RP22539

8
RP22539

9
RP22539

12
RP22539

13
RP22539

11
RP22539

WHITWOOD RD.

AUSTIN STREET

284
S31175

N

0 200 400

Rhondda No.1 Colliery - Striped Bacon Seam Workings

Legend:

- Jackal Renewables Study Area
- Striped Bacon Seam Workings

Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

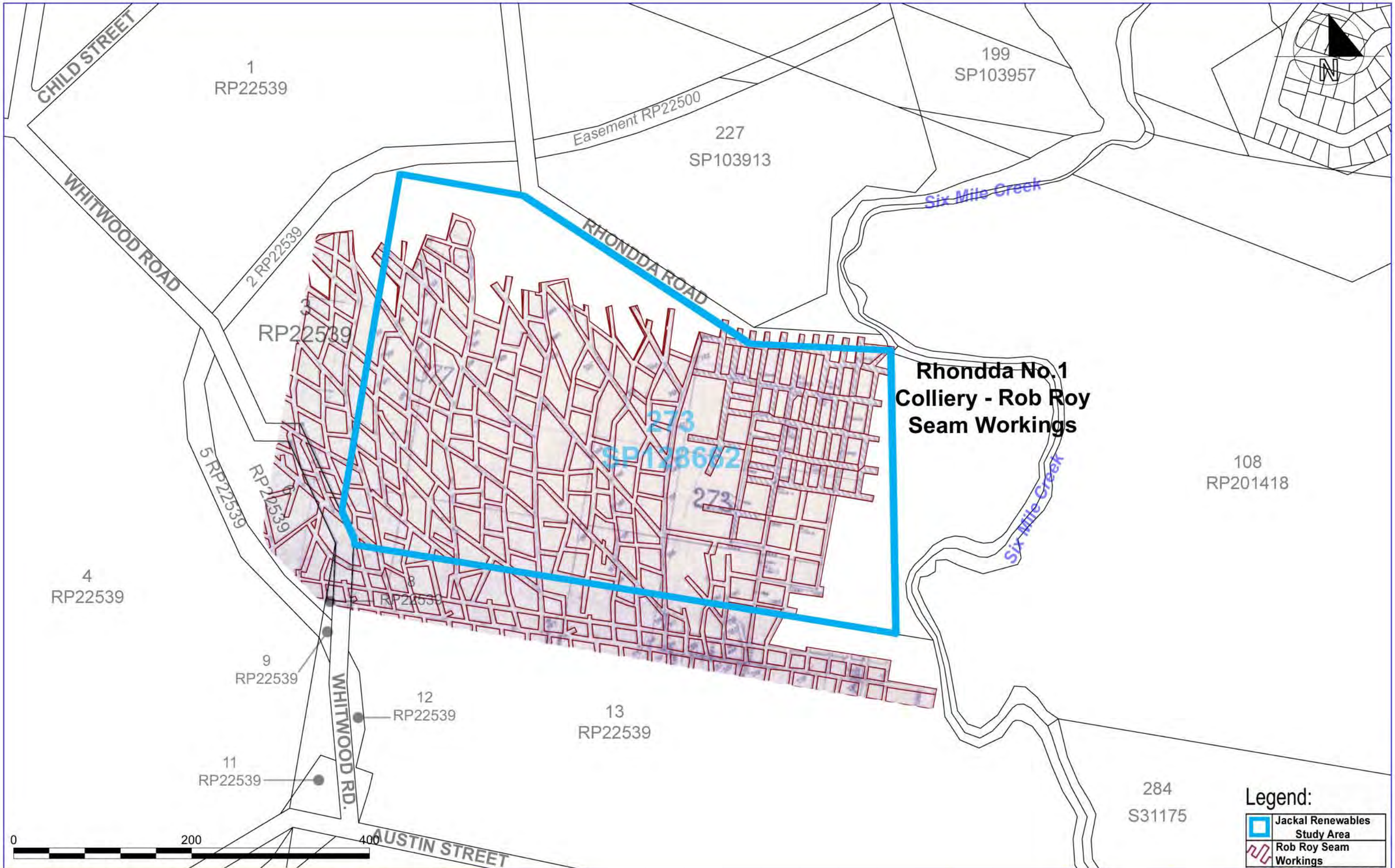
Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 8 - Underground Mining Plan
Striped Bacon Seam Workings

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Eight (8 of 16)	Folder: 2018.02.09_08

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 9 - Underground Mining Plan
Rob Roy Seam Workings

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Nine (9 of 16)	Folder: 2018.02.09_09

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311 Fax: (07) 3816 2377
www.taylorminingservices.com.au

CHILD STREET

WHITWOOD ROAD

1
RP22539

Easement RP22500

227
SP103913

199
SP103957

Six Mile Creek

RHONDDA ROAD

2 RP22539

RP22539

5 RP22539

RP22539

RP22539

4
RP22539

9
RP22539

12
RP22539

13
RP22539

11
RP22539

WHITWOOD RD.

AUSTIN STREET

M.W. Haenke No.1 Colliery - Cochrane Seam Workings

S31/20662

108
RP201418

284
S31175

N

0 200 400

Legend:

- Jackal Renewables Study Area
- Cochrane Seam Workings

Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 10 - Underground Mining Plan
Cochrane Seam Workings

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Ten (10 of 16)	Folder: 2018.02.09_10

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au

CHILD STREET

WHITWOOD ROAD

1
RP22539

Easement RP22500

227
SP103913

199
SP103957

Six Mile Creek

RHONDDA ROAD

2 RP22539

3
RP22539

M.W. Haenke No.2 Colliery
- Matthews Seam Workings

273
SP128662

5 RP22539

RP22539 6

108
RP201418

4
RP22539

8
RP22539

9
RP22539

12
RP22539

13
RP22539

11
RP22539

WHITWOOD RD.

284
S31175

AUSTIN STREET

N

0 200 400

Legend:

- Jackal Renewables Study Area
- Matthews Seam Workings

Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

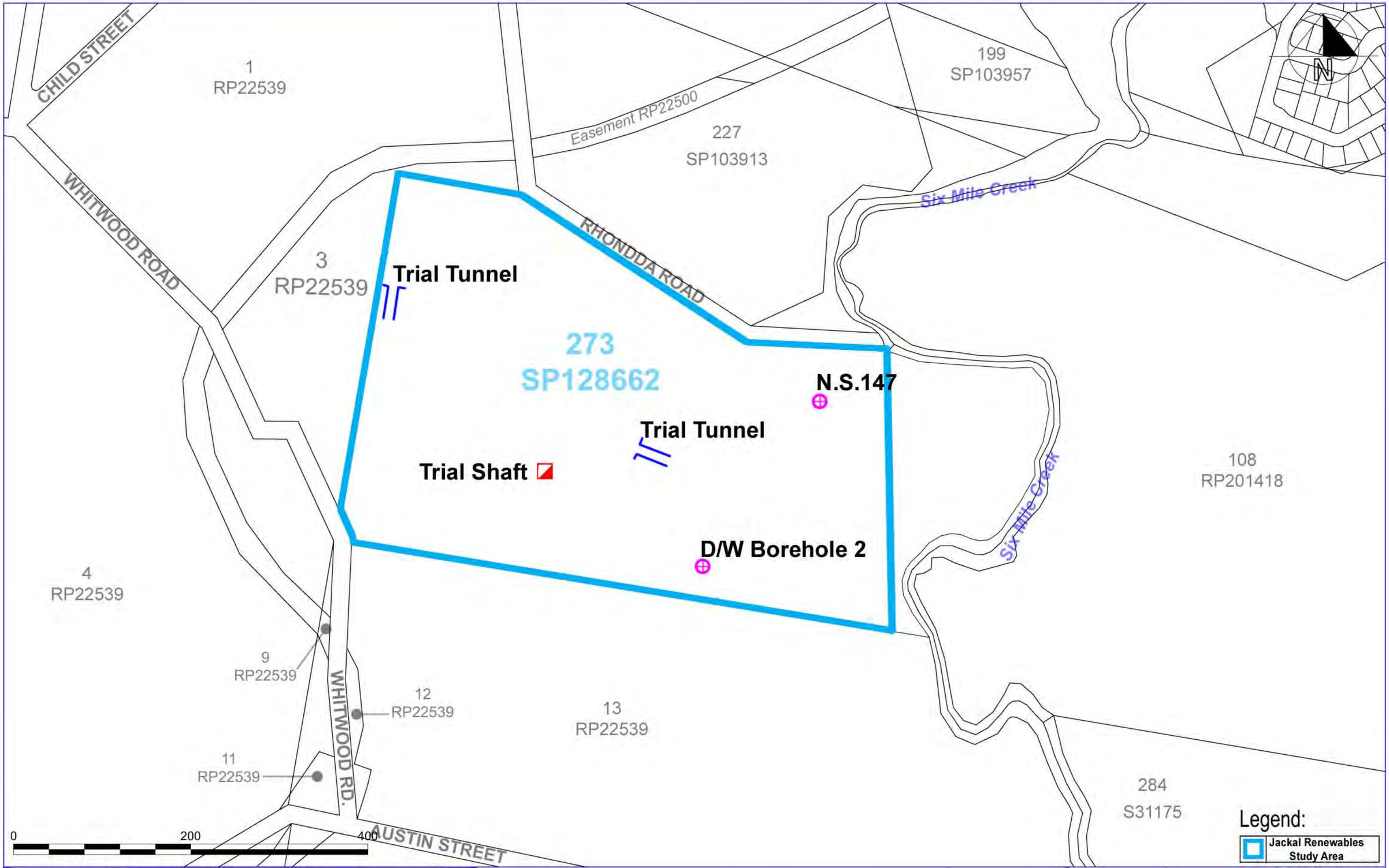
Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 11 - Underground Mining Plan
Matthews Seam Workings

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Eleven (11 of 16)	Folder: 2018.02.09_11

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311 Fax: (07) 3816 2377
www.taylorminingservices.com.au



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 12 - Tunnels and Shafts Plan

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Twelve (12 of 16)	Folder: 2018.02.09_12

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au

CHILD STREET

1
RP22539

Easement RP22500

227
SP103913

199
SP103957

N

RHONDDA ROAD

Six Mile Creek

Wattle Glen North Open Cut
- Mixed Seams

RP22539

273
SP128662

Rhondda No.1 Open Cut
- Bluff Seam

5 RP22539

6
RP22539

108
RP201418

Six Mile Creek

4
RP22539

8
RP22539

9
RP22539

12
RP22539

13
RP22539

WHITWOOD RD.

11
RP22539

284
S31175

0 200 400

AUSTIN STREET

Legend:

	Jackal Renewables Study Area
	Bluff Seam
	Four Feet Seam
	Bergins Seam
	Rob Roy Seam
	Striped Bacon Seam

Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 13 - Open Cut Mining Plan
Various Seams

Date:	Scale:	Sheet No:	File: S12.21_
March, 2018	1:4000	Thirteen (13 of 16)	Folder: 2018.02.09_13

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au

CHILD STREET

1
RP22539

ML50116

199
SP103957

Easement RP22500

227
SP103913

Six Mile Creek

WHITWOOD ROAD

2 RP22539

RHONDDA ROAD

3
RP22539

ML50070

273
SP128662

5 RP22539

6
RP22539

ML50115

108
RP201418

Six Mile Creek

4
RP22539

8
RP22539

9
RP22539

WHITWOOD RD.

12
RP22539

13
RP22539

ML50116

11
RP22539

284
S31175

0 200

AUSTIN STREET

N

Legend:

- Jackal Renewables Study Area
- Mining Lease 4622
- Mining Lease 50070
- Mining Lease 50115
- Mining Lease 50116

Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

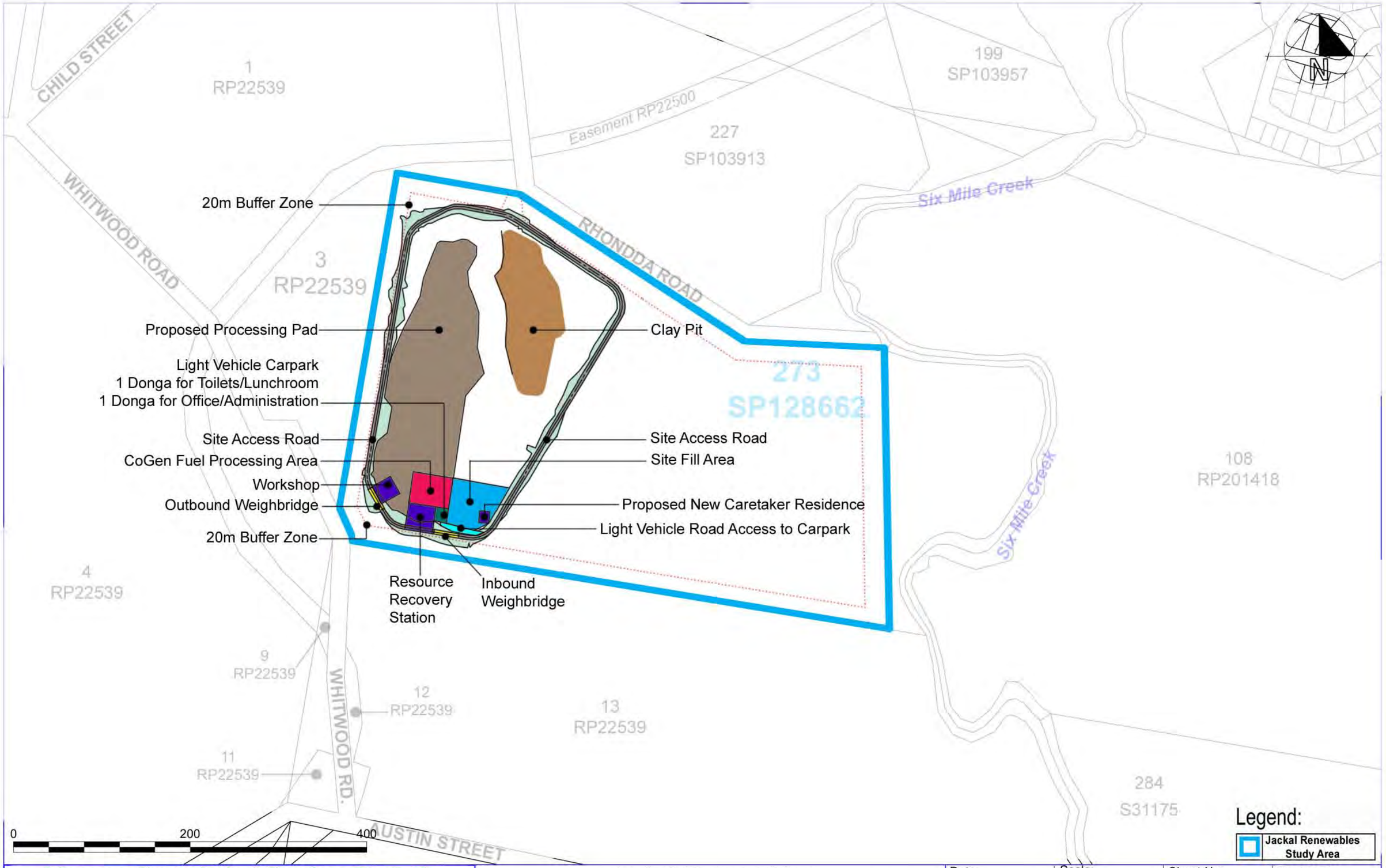
Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 14 - Mining Lease Plan

Date: March, 2018
Scale: 1:4000
Sheet No: Fourteen (14 of 16)
File: S12.21_
Folder: 2018.02.09_14

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

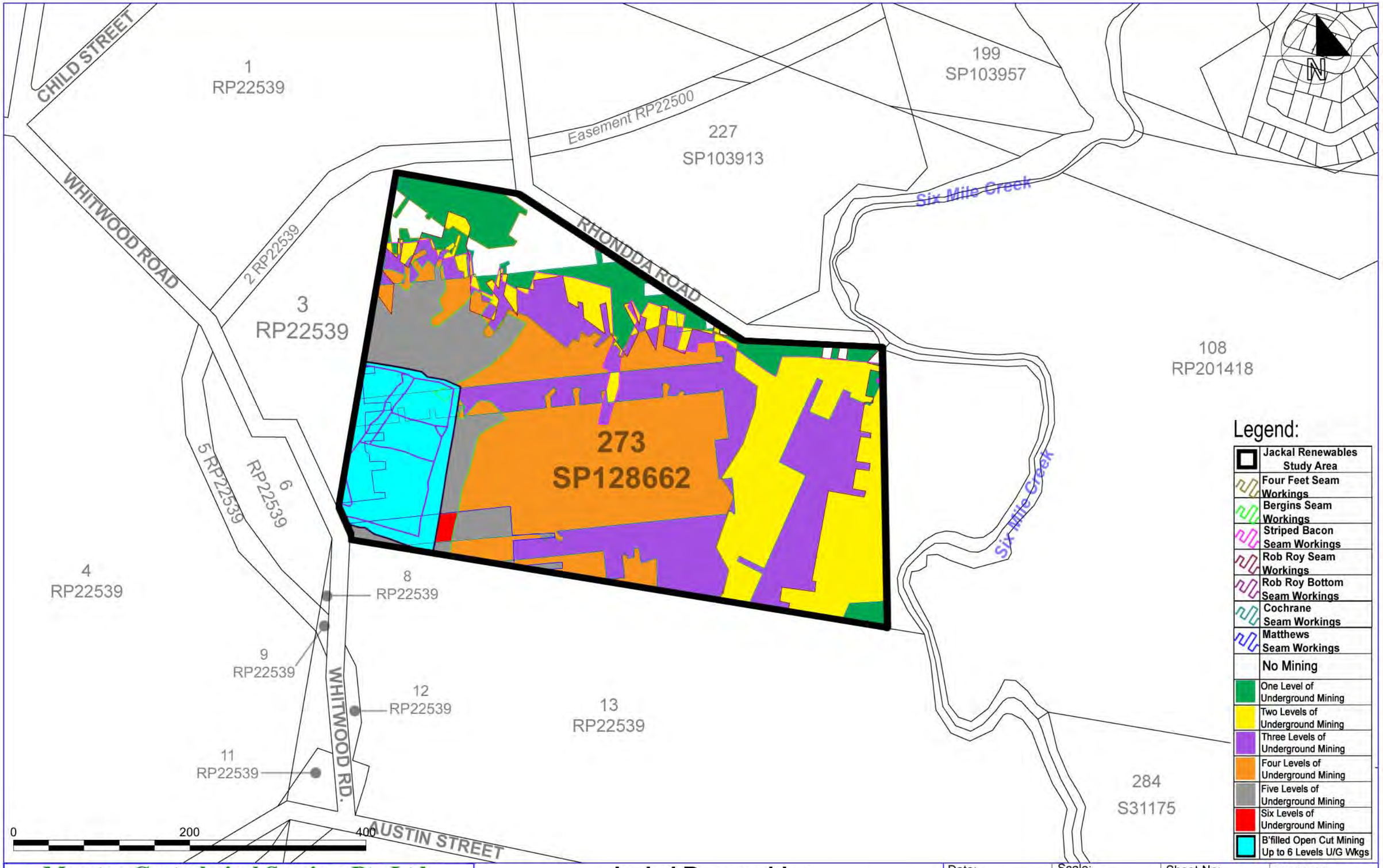
Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 15 - Proposed Development Plan

Date:	Scale:	Sheet No:	File:
March, 2018	1:4000	Fifteen (15 of 16)	S12.21_ Folder: 2018.02.09_15

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au



Moreton Geotechnical Services Pty Ltd

PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au

MGS Ref: 2018/11

ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 16 - Constraints Plan

Date: March, 2018 | Scale: 1:4000 | Sheet No: Sixteen (16 of 16) | File: S12.21_ Folder: 2018.02.09_16

Taylor Mining Services Pty Ltd

Redbank Plains Road
Blackstone QLD 4305

Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au

MORETON GEOTECHNICAL SERVICES PTY. LTD.

PO Box 915 Ipswich 4305

Telephone (07) 3294 6988
Facsimile (07) 3294 6988
Email mgs@gil.com.au

A.C.N. 055 833 120
A.B.N. 24 055 833 120

Ref. 2018/11/02

13 March 2018

Hunt Michel and Partners
24 Darling Street East
Ipswich
4305

Att. Mr. Dan Michel

Re: **DESKTOP MINING STUDY ON PART OF LOT 273 SP 128662 RHONDDA ROAD NEW CHUM - SUPPLEMENTARY REPORT**

This report forms a supplement to our report reference 2018/11 of 9 March 2018, to which the reader is referred.

The site inspection of the proposed development area on 1 March 2018 revealed the location of a large void in the north, an exposed corner rock wall in the south, as well as a minor 'scraped' area in the south beyond the proposed haulage road and outside of the specific area of interest. These features were noted to be at odds with the information that we had on the location of the known backfilled 1970's vintage Rhondda No. 1 coal open cut mine in the south west corner of the proposed development area as shown on Plan 13 of our initial report.

A check on available aerial photographs, e.g. 1998, was carried out in an attempt to establish more information on these quarry type features. The aerial photograph check revealed that extensive quarrying, mainly for shale with some clay and sandstone cover, had taken place after completion of the earlier open cut coal mining.

The locations of the quarry areas, presumably mainly for the production of pavers, is shown together with the location of the backfilled open cut coal mine, on Plan 13A attached. The plan also shows the location of the proposed perimeter haulage road which closely follows the eastern edge of the main exposed quarry highwall in places. The southern end of the quarry, which appears to have been partially backfilled in the past, is also proposed for

future filling to facilitate the construction of the perimeter haulage road there.

In conclusion, the work in this supplementary report has revealed that extensive quarrying (mainly for shale for paver making) has taken place in the past, in addition to the past backfilled open cut mining, in the area of the proposed development.

Finally, recommendations made in our initial report, as applicable, still stand. Notwithstanding this, our two reports should also be supplied to your various Engineers so that the available information can assist in producing appropriate outcomes.

MORETON GEOTECHNICAL SERVICES PTY LTD



K. B. GRUBB
M.App.Sc., MIE Aust., CP Eng., RPEQ 2811

CHILD STREET

1
RP22539

Easement RP22500

227
SP103913

199
SP103957

Six Mile Creek

RHONDDA ROAD

Site Access Road

3
RP22539

**Rhondda No.1
Open Cut
- Bluff Seam**

Site Access Road

5 RP22539

6
RP22539

273
SP128662

108
RP201418

Six Mile Creek

4
RP22539

8
RP22539

9
RP22539

WHITWOOD RD.

12
RP22539

13
RP22539

11
RP22539

284
S31175

0 200 400

AUSTIN STREET

N

Legend:

- Jackal Renewables Study Area
- Rhondda No.1 Backfilled Open Cut
- Clay and Shale Pit Quarry Outline

Moreton Geotechnical Services Pty Ltd
PO Box 915 Ipswich QLD 4305
Tele/Fax: (07) 3294 6988
Emaill: mgs@gil.com.au
MGS Ref: 2018/11
ACN 055 833 120
ABN 24 055 833 120

Jackal Renewables
Rhondda Road, New Chum, Queensland
Plan 13A - Open Cut Mining Plan
Various Seams

Date: March, 2018 | Scale: 1:4000 | Sheet No: ThirteenA (1 of 1) | File: S12.21_ Folder: 2018.02.09_13A

Taylor Mining Services Pty Ltd
Redbank Plains Road
Blackstone QLD 4305
Ph: (07) 3816 2311
Fax: (07) 3816 2377
www.taylorminingservices.com.au