

**MIDDLEMOUNT COAL MINE
NORTH-EASTERN EXTENSION (EPBC 2016/7717)
EPBC Act Preliminary Assessment Documentation**

DECEMBER 2016



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NORTH-EASTERN EXTENSION (EPBC 2016/7717)

EPBC ACT PRELIMINARY ASSESSMENT DOCUMENTATION



DECEMBER 2016
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Attachment A	EPBC Act Referral for the Middlemount Coal Mine North-eastern Extension
Attachment B	Request for Preliminary Documentation
Attachment C	Middlemount Coal Mine North-eastern Extension Offset Proposal
Attachment D	Middlemount Coal Mine North-eastern Extension Offset Management Plan/Vegetation Management Plan

EXECUTIVE SUMMARY

The Middlemount Coal Mine is an existing open cut coal mine located approximately 7 kilometres to the south-west of the Middlemount township within the Isaac Regional Local Government Area, Queensland.

On 31 May 2016, Middlemount Coal Pty Ltd (MCPL), an incorporated joint venture between Peabody Energy Australia Pty Ltd and Yancoal Australia Ltd, lodged a referral with the Commonwealth Department of the Environment and Energy (DEE) for the extension of the currently approved East Dump beyond part of the eastern extent of Mining Lease 70417 (the Action [North-eastern Extension]) using the same overburden emplacement methodology currently employed at the Middlemount Coal Mine.

On 7 July 2016, a delegate of the Commonwealth Minister declared the Action to be a controlled action for the purposes of the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) due to likely impacts on listed threatened species and communities (sections 18 and 18A) which is a controlling provision under Part 3 of the EPBC Act. The delegate of the Commonwealth Minister also determined that the Action is to be assessed by Preliminary Documentation and further information was requested on 29 July and 26 October 2016 pursuant to section 95(A) of the EPBC Act.

This Preliminary Documentation addresses the information requirements of the DEE, to enable assessment and approval of the Action under the EPBC Act.

Three threatened fauna species listed under the EPBC Act are considered likely to occur within the Action area, namely the Squatter Pigeon (southern) (*Geophaps scripta scripta*), Koala (*Phascolarctos cinereus*) and South-eastern Long-eared Bat (*Nyctophilus corbeni*). Potential impacts on these Matters of National Environmental Significance as a result of the Action have been investigated within this document and mitigation measures to reduce the potential impacts have been proposed. A biodiversity offset package addressing the potential significant impact on the Squatter Pigeon (southern) has also been proposed by MCPL. In addition, the proposed offset area would provide suitable habitat resources for the Koala and South-eastern Long-eared Bat.

The biodiversity offset package has been developed in accordance with the Commonwealth *EPBC Act Environmental Offsets Policy* (and the *EPBC Act Offsets Assessment Guide*) via a land-based offset which would compensate for the loss of approximately 181 hectares of potential habitat for the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat.

An Offset Management Plan/Vegetation Management Plan for the land-based offset has been prepared as a draft. The contents of this document may change through consultation with the DEE and the Queensland Department of Environment and Heritage Protection.

1 INTRODUCTION

1.1 BACKGROUND

On 31 May 2016, Middlemount Coal Pty Ltd (MCPL), an incorporated joint venture between Peabody Energy Australia Pty Ltd and Yancoal Australia Ltd, lodged a referral (Attachment A) with the Commonwealth Department of the Environment and Energy (DEE) for the extension of the currently approved East Dump beyond part of the eastern extent of Mining Lease 70417 (the Action [North-eastern Extension]) using the same overburden emplacement methodology currently employed at the Middlemount Coal Mine.

On 7 July 2016, a delegate of the Commonwealth Minister declared the Action to be a controlled action for the purposes of the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) due to likely impacts on listed threatened species and communities (sections 18 and 18A) which is a controlling provision under Part 3 of the EPBC Act. The delegate of the Commonwealth Minister also determined that the Action is to be assessed by Preliminary Documentation and further information was requested on 29 July and 26 October 2016 pursuant to section 95(A) of the EPBC Act. A copy of the request for preliminary documentation is provided in Attachment B.

This Preliminary Documentation addresses the information requirements of the DEE, to enable assessment and approval of the Action under the EPBC Act.

This Preliminary Documentation is structured as follows:

Section 1	Provides a summary of the proposed Action and assessment requirements.
Section 2	Provides the further information that was requested in regard to listed threatened species and communities, including the proposed biodiversity offset package.
Section 3	Provides the further information that was requested in regard to economic and social impacts.
Section 4	Provides the further information that was requested in regard to ecologically sustainable development.
Section 5	Provides the further information that was requested in regard to outcomes-based conditions.
Section 6	Provides a conclusion of the information provided in this document.
Section 7	Lists the references cited in this document.

Attachments to the main text are also provided as follows:

Attachment A	EPBC Act Referral for the Middlemount Coal North-eastern Extension.
Attachment B	Request for Preliminary Documentation.
Attachment C	Middlemount Coal Mine North-eastern Extension Offset Proposal.
Attachment D	Middlemount Coal Mine North-eastern Extension Offset Management Plan/Vegetation Management Plan.

1.2 SUMMARY OF PROPOSED ACTION

The Middlemount Coal Mine is an existing open cut coal mine located approximately 7 kilometres (km) to the south-west of the Middlemount township within the Isaac Regional Local Government Area, Queensland (QLD) (Figure 1).

The approved Middlemount Coal Mine is an open cut mining operation extracting run-of-mine coal up to 24 hours per day, seven days per week, using a conventional truck and shovel fleet at a rate of up to 5.4 million tonnes per annum. The general arrangement of the Middlemount Coal Mine is presented on Figure 2.

The Action would involve the extension of the currently approved East Dump beyond part of the eastern extent of Mining Lease (ML) 70417 (Figure 3), using the same overburden emplacement methodology currently employed at the Middlemount Coal Mine. The Action does not involve any change to the currently approved mining rate, operating hours, open cut footprint, processing rate or workforce.

A detailed description of the Action is provided in the EPBC Act (2016/7717) referral (Attachment A).

1.3 ASSESSMENT REQUIREMENTS

Table 1 outlines the assessment requirements provided by the DEE on 29 July 2016 (Attachment B) and the corresponding section in this document where the information is provided.

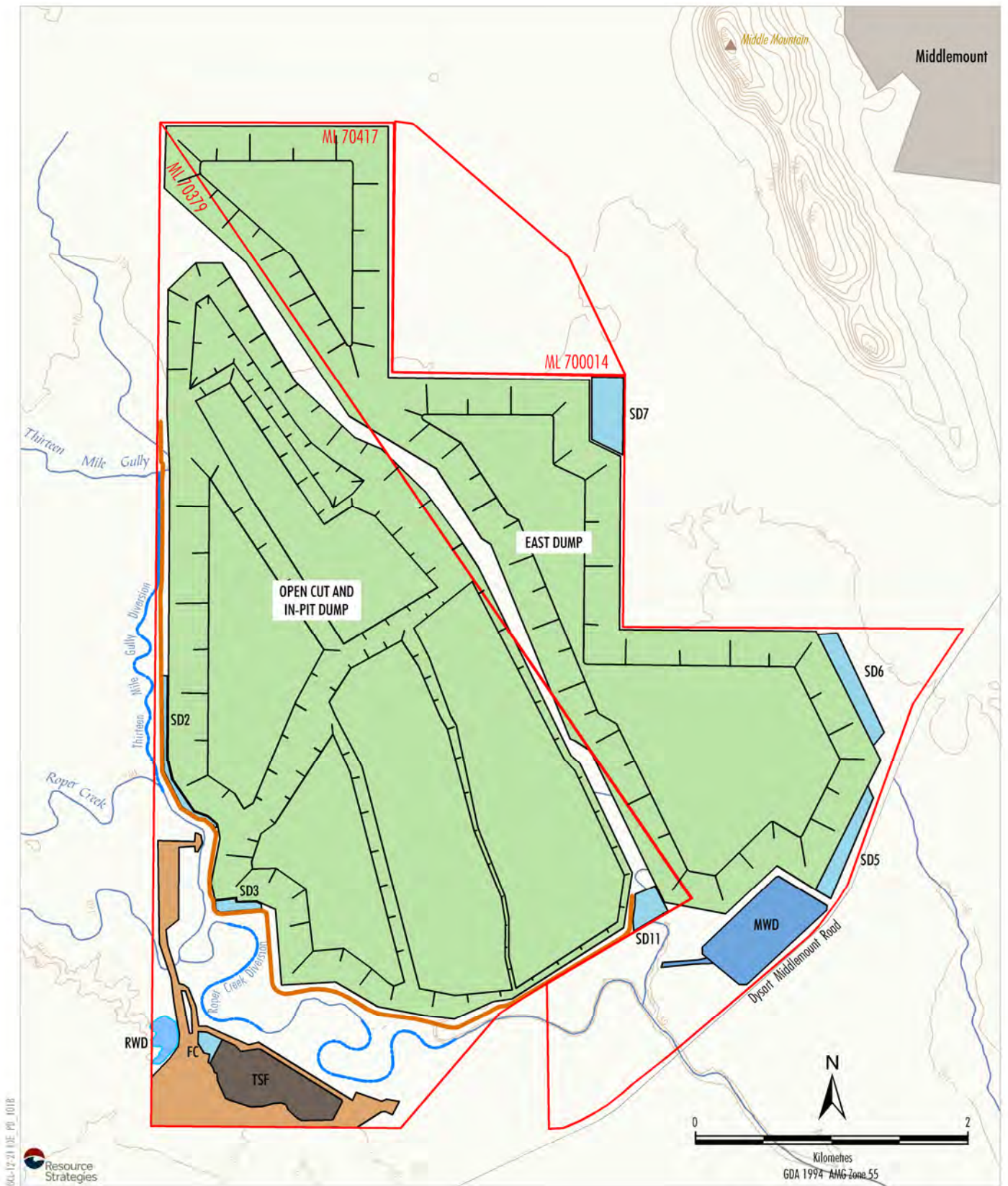
Table 1
EPBC Act Assessment Requirements (Additional Information Request) – Reference Summary

Section	Assessment Requirement	Reference
1	Listed Threatened Species and Communities <i>The Department considers that insufficient details have been provided to determine whether a significant impact is likely to occur upon the following four protected matters:</i> <i>Koala (Phascolarctos cinereus) – vulnerable;</i> <i>South-eastern long eared bat (Nyctophilus corbeni) – vulnerable;</i> <i>Ghost bat (Macroderma gigas) – vulnerable; and</i> <i>Yakka skink (Egernia rugosa) – vulnerable.</i>	N/A
	<i>Please provide further information regarding survey methods employed and their adequacy in assessing impacts on the above listed matters including, but not limited to:</i>	Section 2.1
	<i>An explanation about how surveys for koalas were conducted including, but not limited to, methodology used, maps showing transects/trail searched and why those transects were considered to be appropriate;</i>	Section 2.1.1
	<i>Justification for figures used in koala assessment table, as per the Referral Guidelines for the Koala (2014);</i>	Section 2.1.1



middlemount
coal PTY LTD

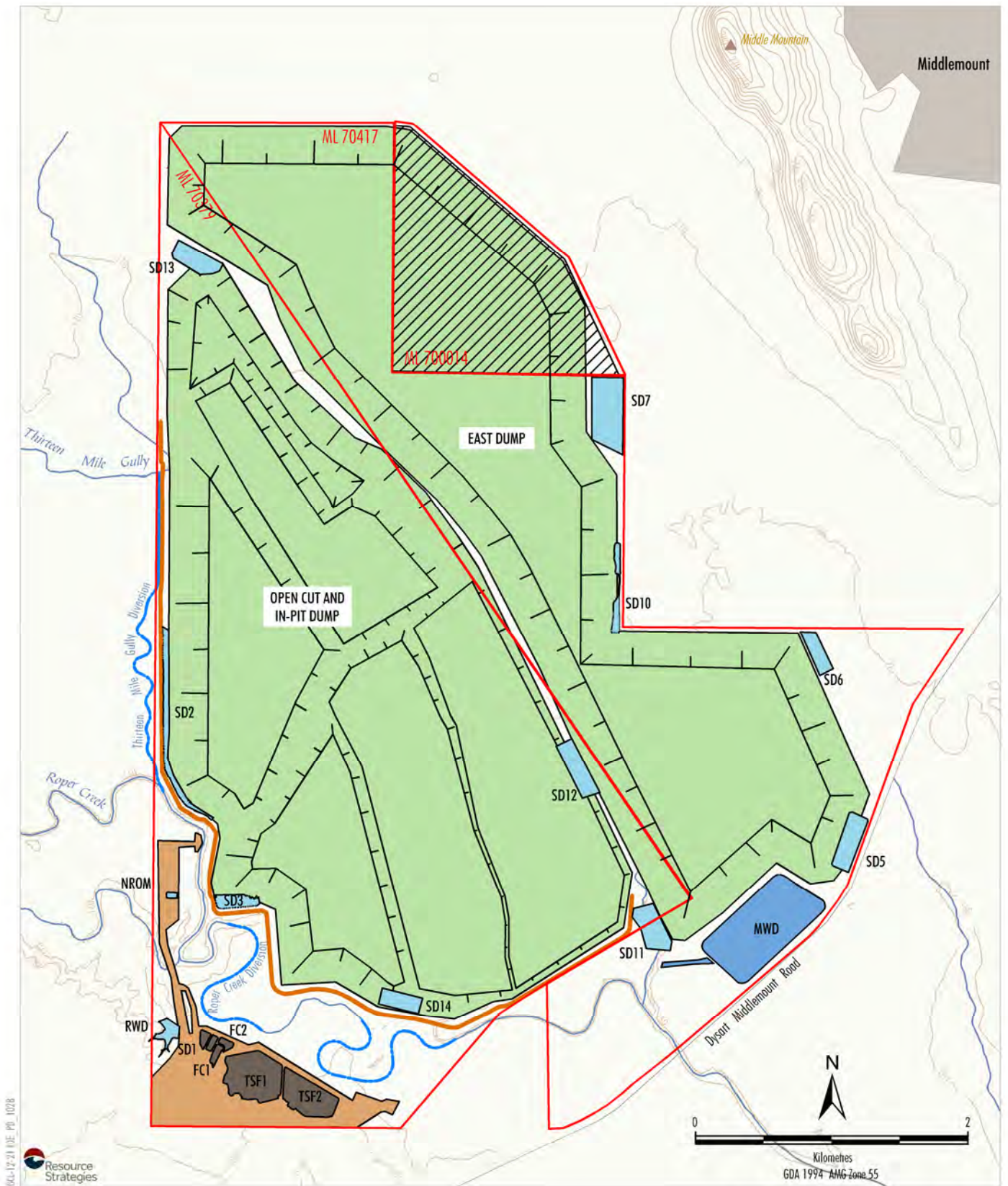
Figure 1



Source: Environmental Authority EPML00716913 - Middlemount Coal Mine

middlemount
coal
NORTH-EASTERN EXTENSION
Middlemount Coal Mine
General Arrangement

Figure 2



LEGEND

- Mining Lease Boundary
- Approximate Extent of North-eastern Extension (the Action)
- Mining Pit and Spoil
- Mine Infrastructure Area
- Mine Water Dam
- Sediment Dam
- Tailings Storage Facility
- Watercourse
- Watercourse Diversion
- Levee
- Contours

NORTH-EASTERN EXTENSION

General Arrangement of the
Middlemount Coal Mine
Incorporating the Action

Figure 3

Table 1 (Continued)
EPBC Act Assessment Requirements (Additional Information Request) – Reference Summary

Section	Assessment Requirement	Reference
1 Cont.	c. <i>Justification for not returning to conduct bat surveys using working equipment; or</i>	Section 2.1.2
	d. <i>Results of a recent ANABAT survey and/or survey results for nocturnal flying species using mist nets;</i>	Section 2.1.2
	e. <i>Appraisal of habitat appropriateness within the project for each of the above four species; and</i>	Sections 2.1.1 to 2.1.4
	f. <i>Whether based on this new information a significant impact is likely and if so, what offsets are proposed (using the information requested below for the squatter pigeon as a guideline).</i>	Sections 2.1.1 to 2.1.4 and 2.2.3
	<i>Please also provide a more detailed assessment of direct and indirect impacts for the above listed threatened species, including, but not limited to:</i>	
	g. <i>a description of proposed avoidance and mitigation measures to deal with any relevant impacts of the action, including mitigation measures proposed to be taken by the Queensland Government and local governments;</i>	Section 2.2.4
	h. <i>assessment of the expected or predicted effectiveness of the avoidance and mitigation measures for each species, including the scale and intensity of impacts of the proposed action and the on-ground benefits to be gained through each of these measures. Where an impact on a species is avoided this should be stated;</i>	Section 2.2.4
	i. <i>any statutory or policy basis for the mitigation measures;</i>	
	ii. <i>the cost of the mitigation measures;</i>	
	iii. <i>survey effort and methodology;</i>	
	iv. <i>amount and type of habitat to be impacted;</i>	
	v. <i>indirect impacts (for example weed invasion or fragmentation); and</i>	
	vi. <i>maps depicting habitat to be impacted.</i>	
	i. <i>Address how the proposed action is not inconsistent with relevant conservation advice, recovery plans and threat abatement plans;</i>	Sections 2.2.3 and 2.3.7
	<i>Based on the information provided in the referral and pre-referral, the Department has a view that a significant impact on the vulnerable squatter pigeon (southern)(Geophaps scripta scripta) is likely should the project proceed. In the event that impacts upon the squatter pigeon cannot be avoided or mitigated, please provide details for offsets for loss of squatter pigeon habitat, including:</i>	
	a. <i>The type of offsets proposed (direct/indirect);</i>	Section 2.3.2 and Attachment C
	b. <i>The location (including a geo-referenced map) and suitability of proposed direct offsets for squatter pigeons;</i>	Section 2.3.3 and Attachment C
	c. <i>Conservation gain to be achieved by the offset, ie, positive management strategies that will improve the site or avert future loss and degradation or damage to the protected matter;</i>	Section 2.3.4, Attachments C and D
	d. <i>Current habitat quality scores of the project site and the offset site;</i>	Section 2.3.6 and Attachment C
	e. <i>Target habitat quality scores at the proposed offset site;</i>	
	f. <i>Time it will take to achieve the proposed conservation gain;</i>	
	g. <i>Level of certainty that the proposed offset will be successful;</i>	

Table 1 (Continued)
EPBC Act Assessment Requirements (Additional Information Request) – Reference Summary

Section	Assessment Requirement	Reference
1 Cont.	<i>h. Current land tenure of any proposed offset and the method of securing enduring protection of the offset site and managing the offset for the life of the impact;</i>	Section 2.3.5 and Attachment C
	<i>i. How the proposed offset is consistent with the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (October 2012); and</i>	Section 2.3.6 and Attachment C
	<i>j. How the proposed offset will address the relevant conservation advice and threat abatement plans related to the squatter pigeon.</i>	Sections 2.3.3, 2.3.7 and Attachment C
	<i>Please note that all figures used to determine the suitability of offsets including habitat quality scores at the project site must be derived using a suitably robust and repeatable framework. Details about each framework must also be provided.</i>	Attachment C
2	Economic and Social Matters <i>Please provide details on the social and economic costs and/or benefits of undertaking the proposed action, including the:</i>	
	<i>a. Basis for any estimations of costs and/or benefits;</i>	Section 3.1
	<i>b. Potential employment opportunities expected to be generated during development and operation of the proposed action;</i>	
	<i>c. If economic benefits and employment opportunities are in addition to what would have been expected if the action were not to take place; and</i>	
	<i>d. Details of any public stakeholder consultation activities, including the outcomes.</i>	Section 3.2
3	Ecologically Sustainable Development <i>Please provide a description of the proposed action in relation [sic] the principles of ecologically sustainable development, as defined in section 3A of the EPBC Act.</i>	Section 4
4	Outcomes Based Conditions <i>If you wish to pursue outcomes-based conditions in the event that the action is approved with conditions, the preliminary documentation should provide information on the outcomes that will be achieved for matters of national environmental significance.</i> <i>Outcomes need to be specific, measurable and achievable, and should be based on robust baseline data. Outcomes should be developed in consideration of the Department's Outcomes-based Conditions Policy (2016) and Outcomes-based Conditions Guidance (2016), with suitable justification for considerations identified in the policy and guidance.</i> <i>To allow application of the outcomes-based conditions, the preliminary documentation should include:</i>	Section 5
	<i>a. The specific environmental outcomes to be achieved, and reasoning for these in reference to relevant statutory recovery plans, conservation advices and threat abatement plans.</i>	
	<i>b. For each proposed environmental outcome:</i>	
	<i>i. The risks associated with achieving the outcome;</i>	
	<i>ii. The measurability of the outcome, including all suitable performance measures;</i>	
	<i>iii. Appropriate baseline data upon which the outcome has been defined and justified;</i>	
	<i>iv. The likely impacts that the proposed outcome will address;</i>	
	<i>v. Demonstrated willingness and capability of achieving the outcome;</i>	

Table 1 (Continued)
EPBC Act Assessment Requirements (Additional Information Request) – Reference Summary

Section	Assessment Requirement	Reference
4 Cont.	vi. <i>The level of knowledge about the protected matter or its surrogate, upon which outcomes were based;</i>	Section 5
	vii. <i>Commitments to independent and periodic audits of performance towards achieving outcomes;</i>	
	viii. <i>Assessment of the likely level of control that the proponent will have over achieving the outcome;</i>	
	ix. <i>Discussion of the appropriateness of any surrogates for protected matter outcomes; and</i>	
	x. <i>Details of proposed management measures to achieve the outcome, including, but not limited to performance indicators, periodic milestones, proposed monitoring and adaptive management, and record keeping, publication and reporting procedures.</i>	
	<i>Once you have provided the Department with the information requested in this letter, you will then be issued with a direction to publish including details on what you are required to publish and for how long.</i>	
5	Presentation <i>Preliminary documentation should be bound in a single volume and must be accompanied by an index identifying what documents are included. Information must be presented using language that is intelligible to the general reader, and accompanied by maps, figures, tables, etc where appropriate.</i>	N/A

On 26 October 2016, the DEE provided further EPBC Act Assessment Requirements following review of the draft Preliminary Documentation. Table 2 outlines the assessment requirements provided by the DEE and the corresponding section in this document where the information is provided.

Table 2
Further EPBC Act Assessment Requirements
(Additional Information Request) – Reference Summary

#	Relevant Matter	Comment	Reference
1	Offsets for the squatter pigeon	<i>In order to assess the suitability of the proposed offset, the draft preliminary documentation should include an offset proposal supported by an EBPC Act Environmental Offset Guide, as well as an Offset Management Plan. The information request dated 28 July 2016 outlines what information should be included in these documents and requires that figures quoted in the EBPC Act Environmental Offset Guide must be supported by a robust and repeatable framework. The Queensland Government's Guide to determining terrestrial habitat quality (DEHP, 2014), is an example of an acceptable framework.</i>	Attachments C and D
2	Koalas	<i>I note that the draft preliminary documentation includes a description of what survey methods were used targeting koalas. However, there is little detail regarding the location of surveys or duration of effort.</i>	Section 2.1.1 and Figure 6
3	Threatened bats	<i>The information provided in the draft preliminary documentation provides some discussion regarding the presence or absence of the ghost bat and south-eastern long-eared bat. However, the survey information provided is from 2009 and from an adjacent property. Please provide more recent and site-specific information. While suitable breeding (inferred by the presence of tree hollows), roosting and foraging habitat have been identified for the southeastern long-eared bat, the documents claim that no habitat critical to the survival of the species exists with the action area. Further information needs to be provided to explain and justify this statement.</i>	Sections 2.1.2, 2.2.3.2 and 2.1.3

2 LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES

2.1 OCCURRENCE OF THE SPECIES AND/OR ITS HABITAT

Further information has been requested by the DEE (dated 29 July and 26 October 2016) regarding the survey methodology for, and potential impacts to, the following species:

- Koala (*Phascolarctos cinereus*);
- South-eastern Long-eared Bat (*Nyctophilus corbeni*);
- Ghost Bat (*Macroderma gigas*); and
- Yakka Skink (*Egernia rugosa*).

The following subsections provide additional information regarding the species distribution, targeted survey methods employed within the Action area, potential habitat within the Action area and the likelihood of occurrence of each of these four species.

Further information regarding the survey methodology for, and potential impacts to, the Squatter Pigeon (southern) (*Geophaps scripta scripta*) has not been requested by the DEE and is therefore not provided in this section. Information on how the proposed biodiversity offset package addresses potential impacts on the Squatter Pigeon (southern) is provided in Section 2.3.

2.1.1 Koala

The Koala is listed as 'Vulnerable' under the EPBC Act. The 'Vulnerable' listing of the Koala under the EPBC Act applies to populations of QLD, New South Wales and the Australian Capital Territory.

The Koala was not recorded within the Action area despite targeted survey work (Naturecall, 2016a), however, it has been previously recorded in the Middlemount Coal Mine area (Figure 4).

Distribution

The Koala has a fragmented distribution throughout eastern Australia from north-east QLD to the Eyre Peninsula in South Australia (Van Dyck and Strahan, 2008). In 2006, between 100,000 and 300,000 Koalas were estimated to occur in QLD (Environmental Protection Authority [EPA], 2006). The greatest concentration of Koala occurs in South East QLD (Department of Environment and Heritage [DEHP], 2012), although the species extends to Cooktown (Natural Resource Management Ministerial Council, 2009).

This species is widespread in sclerophyll forest and woodland on foothills and plains on both sides of the Great Dividing Range from about Chillagoe, QLD to Mt Lofty Ranges in South Australia (Menkhorst and Knight, 2011). The Koala inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by species from the genus *Eucalyptus* (Martin and Handasyde, 1999). Essentially any forest or woodland containing species which are known Koala food trees, or shrubland with emergent food trees provides potential Koala habitat. Koalas are known to occur in modified or regenerating native vegetation communities (DEE, 2016).

The Koala has been previously recorded within the wider surrounds on a number of occasions, with the closest record being located approximately 5 km to the south-west of the Action area (Figure 5).



LEGEND

- Mining Lease Boundary
- Approximate Extent of North-eastern Extension (the Action)
- Regional Ecosystem Mapping
- 11.5.3 (Of Least Concern)
- 11.5.3b (Of Least Concern)
- Threatened Species Records
- ▲ Koala
- Squatter Pigeon

Reference: 1 Parsons Brinckerhoff (2009-2010)

4 Naturecall Environmental (2013)

5 Naturecall Environmental (2014)

Note: There are no references 2 and 3 on this figure.

Source: MCPL (2014); Department of Natural Resources and Mines (2016);

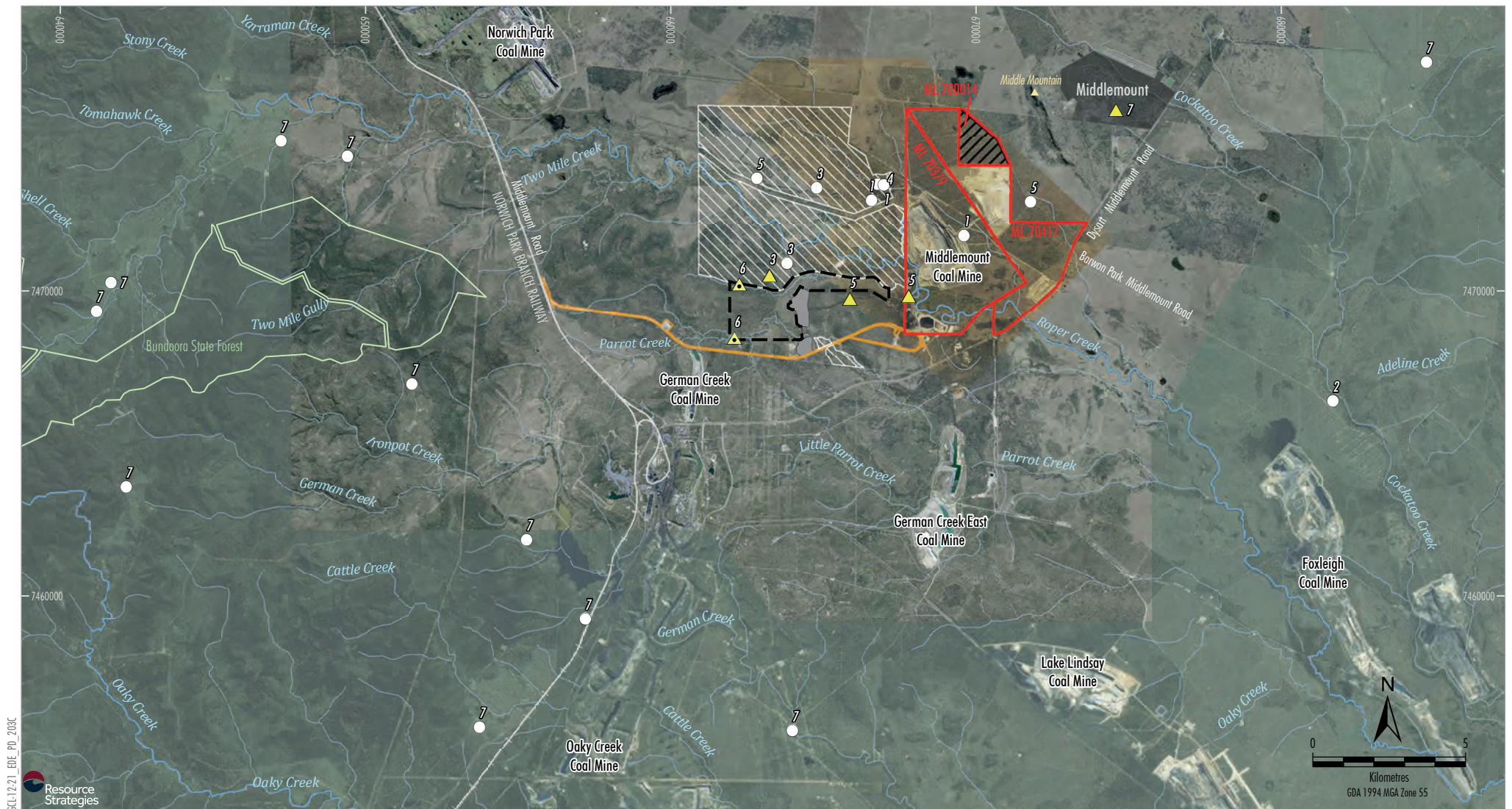
Naturecall (2015)

Orthophoto: MCPL (2014, 2012)



NORTH-EASTERN EXTENSION
Ground-truthed Regional Ecosystem Mapping
and Recorded EPBC Act Listed Fauna Species
in the Action Area and Immediate Surrounds

Figure 4



5CL12-21 EDE PD 203C



- LEGEND**
- Mining Lease
 - Approximate Extent of North-eastern Extension
 - Parrot Quarry
 - Existing Offset Area
 - Proposed Offset Area
 - Threatened Species Records
 - ▲ Koala
 - ▲● Koala Scratches/Scats
 - Squatter Pigeon

Reference: 1 Parsons Brinckerhoff (2009-2010)
 2 Ecological (2009-2010)
 3 Ecology and Heritage Partners (2012)
 4 Naturecall Environmental (2013)
 5 Naturecall Environmental (2014)
 6 Naturecall Environmental (2016)
 7 Atlas of Living Australia (2016)

Source: MCPL (2014); Department of Natural Resources and Mines (2016);
 State of Queensland (Department of National Parks, Sport and Racing) (2016)
 Department of Environment and Heritage Protection (2016)
 Orthophoto: MCPL (2014, 2012); Esri Basemap



NORTH-EASTERN EXTENSION
 Location of the Proposed Offset Area

Figure 5

Targeted Surveys

Naturecall (2016a) describe that they undertook targeted surveys in the Action area for the Koala from 12 to 16 October 2015 in accordance with the following Commonwealth guidelines:

- *EPBC Act Referral Guidelines for the Vulnerable Koala (Combined Populations of Queensland, New South Wales and the Australian Capital Territory)* (Department of the Environment [DotE], 2014); and
- *Survey Guidelines for Australia's Threatened Mammals* (Department of Sustainability, Environment, Water, Population and Communities [SEWPaC], 2011a).

These guidelines identify a number of survey techniques which could be employed to detect the presence of the Koala, including diurnal transect searches, nocturnal spotlighting, call playback and remote sensor activated cameras (DotE, 2014; SEWPaC, 2011a).

As prescribed by these guidelines, the following survey methodologies were employed by Naturecall (2016a) to survey for the Koala:

- call playback;
- camera traps;
- diurnal and nocturnal transects; and
- opportunistic observations.

In addition, habitat assessments were conducted to determine whether the Action area provided suitable habitat for the Koala (Naturecall, 2016a).

Figure 6 show the location of the fauna survey sites surveyed by Naturecall (2016a) in the Action area. The survey effort (duration of surveys) is described below.

Call Playback

Koala calls were played through a portable MP3 player from the rear of a car. The methodology involved an initial period of listening and spotlighting; followed by the broadcasting of Koala calls simulating a natural pattern (Naturecall, 2016a). This was followed by 10 minutes of listening and 15-20 minutes spotlighting for fauna attracted by the calls (but not responding vocally), within a 100 metre (m) radius of the playback point.

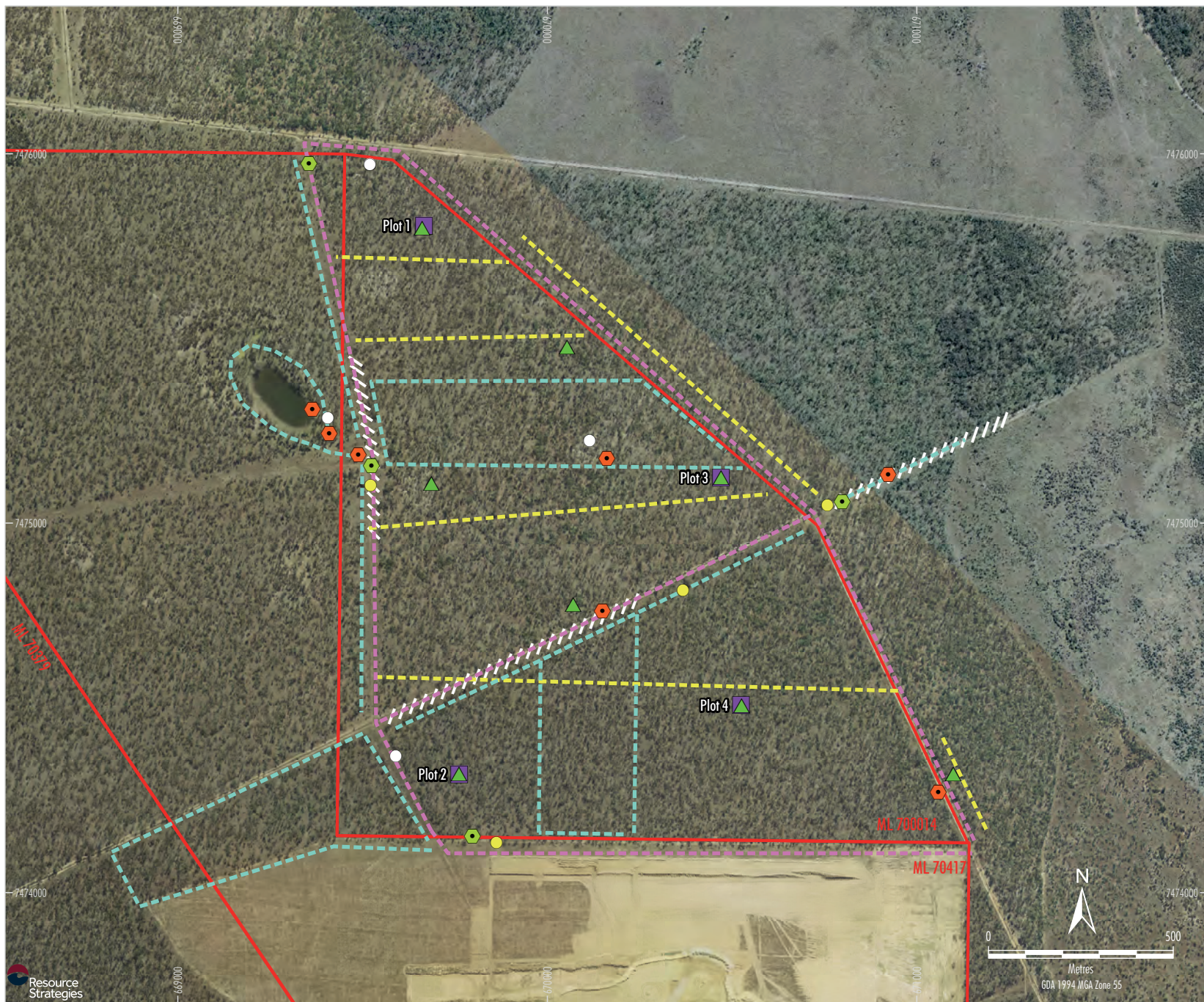
Calls were generally played soon after dusk, when such calls are typically heard. Playback was utilised over the Action area over four nights for a total of four hours.

Camera Traps

Four infra-red cameras were deployed at various locations across the Action area either in forested areas or facing a road/track. The cameras were set for four consecutive nights, and were moved to a new location after the second night.

Diurnal and Nocturnal Transects

Diurnal searches for scats, tracks, feeding marks on trees and scratch marks on trees were undertaken along three walking transects and at eight additional survey sites.



- LEGEND**
- Mining Lease Boundary
 - Terrestrial Habitat Quality/Vegetation Survey Plot
 - Dedicated Threatened Flora Transect
 - ▲ Herpetofauna/Scat and Track Plot
 - Bird Survey (Morning)
 - Bird Survey (Evening)
 - ⬡ Call Playback
 - ⬢ PIR Camera
 - Scat and Track Transect
 - Spotlight Transect (Driving)
 - Spotlight Transect (Walking)

Source: Naturecall (2016); MCPL (2014); Department of Natural Resources and Mines (2016)
 Orthophoto: MCPL (2014, 2012)



NORTH-EASTERN EXTENSION
Survey Effort

Figure 6

As identified in the *EPBC Act Referral Guidelines for the Vulnerable Koala (Combined Populations of Queensland, New South Wales and the Australian Capital Territory)* (DotE, 2014), daytime transects are relevant when Koala activity and density is high.

Given the Koala density in the Action area was not considered to be high, nocturnal spotlighting transects were favoured during the field surveys. Nocturnal spotlighting transects were conducted approximately one hour after dusk for 1.5-2 hours per night for four nights over the Action area. This involved driving transects from a vehicle moving at walking pace along roads and tracks and walking transects using hand-held spotlights through both vegetated areas and along tracks (Naturecall, 2016a).

All habitat components (e.g. understorey/canopy trees for arboreal fauna), the ground and terrestrial strata (e.g. logs, areas with good leaf litter accumulations, etc.) were searched for terrestrial fauna.

Opportunistic Observations

Species were identified opportunistically whilst walking around the Action area and between survey sites.

Habitat in the Action Area and Surrounds

Koalas mainly feed on the foliage of *Eucalyptus* spp. however they may also feed on related genera such as *Corymbia* spp.. Queensland Blue Gum (*Eucalyptus tereticornis*) and River Red Gum (*Eucalyptus camaldulensis*) are recognised as important for the species in the northern part of their range (Van Dyck and Strahan, 2008). In addition, a list of known Koala food trees within south-east and south-west QLD is provided in *Land for Wildlife Queensland: Note A4 Koalas* (Land for Wildlife, 2014) which also identifies Queensland Blue Gum and River Red Gum as important species.

Koalas are also known to favour habitat where the food trees are growing on more fertile soils and in close proximity to watercourses (DEHP, 2016; Millard, 2012).

Table 3 provides justification for the Koala habitat assessment score which has been calculated in accordance with the *EPBC Act Referral Guidelines for the Vulnerable Koala (Combined Populations of Queensland, New South Wales and the Australian Capital Territory)* (DotE, 2014).

Table 3
Koala Habitat Appraisal

Attribute ¹	Score ¹	Habitat Appraisal ²
Koala occurrence	0	This attribute is rated 0 as there is no evidence of a koala within 2 km of the edge of the Action area within the last 10 years.
Vegetation composition	2	This attribute is rated 2 as the woodland within the Action area has two or more known Koala food tree species in the canopy (e.g. Blue Gum and Poplar Box) (Naturecall, 2016a).
Habitat connectivity	2	This attribute is rated 2 as the Action area is part of a contiguous landscape 1,000 hectares (ha).
Key existing threats	0	This attribute is rated 0 as Koala occurrence has been scores as a 0 and the Action area is determined to have a significant dog threat (Naturecall, 2016a).
Recovery value	0	This attribute is rated 0 as the habitat in the Action area is unlikely to be important for achieving the interim recovery objectives listed in with the <i>EPBC Act Referral Guidelines for the Vulnerable Koala (Combined Populations of Queensland, New South Wales and the Australian Capital Territory)</i> (DotE, 2014).
Total	4	

¹ DotE (2014).

² Naturecall (2016a).

In accordance with the *EPBC Act Referral Guidelines for the Vulnerable Koala (Combined Populations of Queensland, New South Wales and the Australian Capital Territory)* (DotE, 2014), the Action area is not considered to support habitat critical to the survival of the Koala (Naturecall, 2016a).

The presence of Queensland Blue Gums (identified as an important Koala food tree [Van Dyck and Strahan, 2008; Land for Wildlife, 2014]) is minimal within the Action area with only one patch of less than five small trees identified (Naturecall, 2016a). Naturecall (2016a) also conclude that the soils within the Action area are of poor quality resulting in a low quality of habitat for the Koala, were it to occur.

Better quality potential habitat for the Koala is more widespread in the landscape outside the Action area (e.g. more abundant important Koala food trees [Queensland Blue Gum – *Eucalyptus tereticornis*] occur along the watercourses to the south-west of the Middlemount Coal Mine) (Naturecall, 2016b).

Likelihood of Occurrence

Naturecall (2016a) determined that the Action area only provides low quality habitat for the Koala given the lack of Koala records within the Action area, limited occurrence of important Koala food trees and the poor soil quality.

Given this it is unlikely that the Koala would utilise the habitat within the Action area. Any Koalas that may occur within the Action area would be transient and much more likely to rely on the better quality habitat in the surrounding locality.

2.1.2 South-eastern Long-eared Bat

The South-eastern Long-eared Bat is listed as 'Vulnerable' under the EPBC Act.

Distribution

The South-eastern Long-eared Bat is found in southern central QLD, central western New South Wales, north-western Victoria and eastern South Australia, where it is patchily distributed, with most of its range in the Murray Darling Basin (Duncan et al., 1999). Most records are from inland of the Great Dividing Range (Parnaby, 2009). The species is uncommon within this distribution and is rarely recorded (DotE, 2014), except in some areas including the Nandewar and Brigalow Belt South bioregions in New South Wales and QLD. The species occurs in a number of national parks and nature reserves across its range.

Approximately 30% of the total distribution of the species occurs in QLD, although there are records from fewer than 30 localities, mainly from within the Brigalow Belt South bioregion (DEE, 2016). The South-eastern Long-eared Bat is mainly recorded in the Brigalow Belt South Bioregion, extending eastwards to the Bunya Mountains National Park and has been recorded as far north as the Expedition Range and Dawson River areas (DEE, 2016; DEHP, 2014).

There are no confirmed records of the South-eastern Long-eared Bat within 250 km of the Action area (Atlas of Living Australia [ALA], 2016).

Targeted Surveys

Parsons Brinckerhoff (2010) describe that they conducted targeted bat surveys within the Middlemount Coal Mine in accordance with the Commonwealth *Survey Guidelines for Australia's Threatened Bats* (SEWPaC, 2010) during November 2009 and February 2010. Survey methods included active and passive Anabat surveys (a total of 16 survey nights) and utilisation of harp traps (a total of 12 trap nights). Parsons Brinckerhoff (2010) recorded a total of 12 bat species. No *Nyctophilus* species were recorded during these surveys.

In addition, Naturecall (2014; 2015) describe that they conducted bat surveys in the existing offset areas in accordance with the Commonwealth *Survey Guidelines for Australia's Threatened Bats* (SEWPaC, 2010) and a number of native bat species were recorded (e.g. Little Pied Bat, Eastern Cave Bat, Eastern Bentwing-bat, etc). A *Nyctophilus* sp. was recorded during these surveys¹. As this species was potentially recorded by Naturecall (2014), this document conservatively assumes the South-eastern Long-eared Bat occurs in the locality.

While ANABAT surveys were attempted by Naturecall over four nights within the Action area, no useable data was able to be obtained for analysis (Naturecall, 2015). However, given the wide range of the potentially occurring threatened bat species and the continuity of habitats between the Action area, the Middlemount Coal Mine and existing offset area, the surveys in the adjacent areas are considered to provide a good indication of the presence (or likelihood of occurrence) of threatened bat species within the Action area. As described in further detail below, on the basis that the Action area is considered to contain potential foraging and roosting habitat for the South eastern Long-eared Bat, the proposed offset area provides for the conservation of 339 ha of potential foraging and roosting habitat resources (Section 2.3).

Habitat in the Action Area and Surrounds

The South-eastern Long-eared Bat occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodlands. The species also occurs in Buloke woodland, Brigalow woodland, Belah woodland, Smooth-barked Apple (*Angophora leiocarpa*), woodland; River Red Gum (*Eucalyptus camaldulensis*), forests lining watercourses and lakes, Black Box (*Eucalyptus largiflorens*), woodland, and dry sclerophyll forest (DEE, 2016). Individuals used a number of different roost sites in the same night (Schulz and Lumsden, 2010; DEE, 2016).

Habitat assessments were conducted to determine whether the Action area provided suitable habitat for the South-eastern Long-eared Bat by Naturecall (2016a). The Action area contains predominantly Poplar Box woodland which would provide suitable foraging habitat for this species. In addition, hollow-bearing trees are common throughout the Action area and would potentially provide suitable roosting habitat for the South-eastern Long-eared Bat, were it to occur.

No habitat within the Action area has been identified as important or critical habitat for the South-eastern Long-eared Bat in any recovery plans or listed on the EPBC Act *Register of Critical Habitat* maintained by the Minister of the Environment under the EPBC Act (DEE, 2016).

Although potential South-eastern Long-eared Bat habitat exists within the Action area, better quality potential habitat for this species is more widespread in the landscape outside the Action area (e.g. more abundant foraging and roosting resources occurs in suitable habitat to the south-west of the Middlemount Coal Mine) (Naturecall, 2016b).

¹ *Nyctophilus* sp. calls recorded via bat recording devices were identified to genus level only as calls could not be distinguished from other potential occurring bat species.

Likelihood of Occurrence

As described above, the Action area contains potential foraging and roosting habitat for the South eastern Long-eared Bat, were it to occur within the locality. Based on the presence of potential habitat and the wide distribution of this species it is possible that the South-eastern Long-eared Bat could occur within the Action area.

As described in Sections 2.2.3.2 and 2.3, the proposed offset area provides for the conservation and management of 339 ha of potential foraging and roosting habitat resources for the South-eastern Long-eared Bat and 193 ha of derived grassland that would be managed to encourage natural regeneration to provide a net gain in habitat.

2.1.3 Ghost Bat

The Ghost Bat is listed as 'Vulnerable' under the EPBC Act.

Distribution

The Ghost Bat's range is discontinuous, with geographically disjunct colonies occurring in the Pilbara, Kimberley (including several islands), Northern Territory (including Groote Eylandt), the Gulf of Carpentaria, coastal and near coastal eastern QLD from Cape York to near Rockhampton, and western QLD (Threatened Species Scientific Committee [TSSC], 2016). Only 14 breeding sites are currently known (TSSC, 2016).

The QLD subpopulations are predominantly located in four highly disjunct localities (i.e. Mt Etna near Rockhampton, Cape Hillsborough near Mackay, Camooweal [bordering the Northern Territory] and Kings Plain near Cooktown) (TSSC, 2016). Limited information is available for any other colonies, but most are considered to be small with fewer than 50 individuals.

There are no records of the Ghost Bat within approximately 130 km of the Action area (ALA, 2016).

Targeted Surveys

Parsons Brinckerhoff (2010) describe that they conducted targeted bat surveys within the Middlemount Coal Mine in accordance with the Commonwealth *Survey Guidelines for Australia's Threatened Bats* (SEWPaC, 2000) during November 2009 and February 2010. Survey methods included active and passive Anabat surveys (a total of 16 survey nights) and utilisation of harp traps (a total of 12 trap nights). Parsons Brinckerhoff (2010) recorded a total of 12 bat species. The Ghost Bat was not recorded during these surveys.

In addition, Naturecall (2014; 2015) describe that they conducted bat surveys in the existing offset areas in accordance with the Commonwealth *Survey Guidelines for Australia's Threatened Bats* (SEWPaC, 2010) and a number of native bat species were recorded (e.g. Little Pied Bat, Eastern Cave Bat, Eastern Bentwing-bat, etc). The Ghost Bat was not recorded during these surveys.

Given the wide range of the potentially occurring threatened bat species and the continuity of habitats between the Action area, the Middlemount Coal Mine and existing offset area, the surveys in the adjacent areas are considered to provide a good indication of the presence (or likelihood of occurrence) of threatened bat species within the Action area.

Habitat in the Action Area and Surrounds

Ghost Bats occupy habitats ranging from the arid Pilbara to tropical savanna woodlands and rainforests. During the daytime this species roost in caves, rock crevices and old mines. Roost sites are generally deep natural caves or disused mines with a relatively stable temperature and a moderate to high relative humidity (TSSC, 2016).

Ghost Bats are carnivores, with a broad diet comprising small mammals including other bats, birds, reptiles, frogs and large insects (TSSC, 2016). They move between a number of caves seasonally or as dictated by weather conditions, and require a range of cave sites (TSSC, 2016). Most breeding sites appear to require multiple entranced caves (TSSC, 2016). Ghost bats disperse widely when not breeding, but concentrate in a relatively few roost sites when breeding.

Habitat assessments were conducted to determine whether the Action area provided suitable habitat for the Ghost Bat by Naturecall. The Action area does not contain caves, rock crevices or disused mine shafts that would provide habitat for this species. The Action area contains foraging resources for the Ghost Bat (i.e. small mammals and birds), however the lack of suitable roosting habitat nearby would significantly reduce the likelihood that the Ghost Bat would forage within the Action area.

No habitat within the Action area has been identified as important or critical habitat for the Ghost Bat in any recovery plans or listed on the EPBC Act *Register of Critical Habitat* maintained by the Minister of the Environment under the EPBC Act.

Likelihood of Occurrence

The distribution of this species throughout QLD is predominantly restricted to four key populations (none of which occur near the Action area) and there are no database records of this species within approximately 130 km of the Action area. In addition, the Action area does not contain suitable roosting habitat for this species (hence no habitat critical to the survival of the species). Given this, it is unlikely that the Ghost Bat would utilise the habitat within the Action area, and therefore the Action would not result in a significant impact to this species.

As such, no further assessment of potential impacts to the Ghost Bat is considered warranted.

2.1.4 Yakka Skink

The Yakka Skink is listed as 'Vulnerable' under the EPBC Act.

Distribution

The Yakka Skink is endemic to QLD where its distribution is patchy. Isolated populations occur throughout subhumid areas in the interior of QLD from St George in the south, to Coen and Cape York in the north. In the southern half of the Brigalow Belt it occurs near Rockhampton, south to St George and west to Chesterton Range National Park. The core habitat of this species is within the Mulga Lands and Brigalow Belt South Bioregions (TSSC, 2014). Other populations have been recorded throughout the Brigalow Belt North and Einasleigh Uplands Bioregions (TSSC, 2014). Populations have been recorded across a range of land tenures including Thrushton National Park and Culgoa Floodplain National Park.

There are no records of the Yakka Skink within approximately 100 km of the Action area (ALA, 2016).

Targeted Surveys

Naturecall (2016a) describe that they undertook targeted surveys for the Yakka Skink from 12 to 16 October 2015 in accordance with the following Commonwealth guidelines:

- *Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles* (SEWPaC, 2011b); and
- *Survey Guidelines for Australia's Threatened Reptiles* (SEWPaC, 2011c).

These guidelines identify a number of survey techniques which could be employed to detect the presence of the Yakka Skink, including searching for burrow systems and communal defecation sites, and nocturnal spotlighting (DEE, 2016; SEWPaC, 2011c).

As prescribed by these guidelines Naturecall (2016a) conducted herpetofauna searches and nocturnal spotlighting to survey for the Yakka Skink (Figure 6).

Herpetofauna Searches

Searches targeting the Yakka Skink were undertaken within 50 m x 50 m quadrats at eight locations within the Action area.

Searching for burrow systems and communal defecation sites involved active diurnal lifting up and rolling of timber and debris, inspection of dense vegetation and leaf litter, observation of likely basking sites and for a total of 60 person minutes per site. Nocturnal herpetofauna torch searches were carried out in conjunction with walking spotlight transects.

Spotlighting

Spotlighting was conducted approximately one hour after dusk for 1.5-2 hours per night for four nights over the Action area. This involved driving transects from a vehicle moving at walking pace along roads and tracks and walking transects using hand-held spotlights through both vegetated areas and along tracks.

Habitat in the Action Area and Surrounds

The Yakka Skink is found in open dry sclerophyll forest or woodland (Cogger, 2014). This species will often take refuge among dense ground vegetation, large hollow logs, cavities in soil-bound root systems of fallen trees and beneath rocks (Cogger, 2014). They may also excavate burrow systems among low vegetation or below logs (TSSC, 2014). In cleared habitat, Yakka Skinks may persist where shelter sites such as tunnel erosion, rabbit warrens and log piles exist (TSSC, 2014).

The Action area is considered to offer low quality/marginal habitat for the Yakka Skink due to the lack of preferred vegetation associations and substrates (e.g. Brigalow and clay soils), the disturbance history of the site and extent of local fragmentation (Naturecall, 2016a). Better quality potential habitat for this species is more widespread in the landscape outside the Action area (e.g. more abundant suitable habitat occurs to the south-west of the Middlemount Coal Mine) (Naturecall, 2016b).

Likelihood of Occurrence

Given this species has not been recorded within approximately 100 km of the Action area and that only low quality/marginal habitat is available for the Yakka Skink, it is unlikely that this species would utilise the habitat within the Action area, and therefore the Action would not result in a significant impact to this species. As such, no further assessment of potential impacts to the Yakka Skink is considered warranted.

2.2 ASSESSMENT OF POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

This section describes the potential direct and indirect adverse impacts on Matters of National Environment Significance (MNES) from the Action (Sections 2.2.1 and 2.2.2) including an assessment of significance for each potentially occurring MNES against the Commonwealth *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DotE, 2013) (Section 2.2.3) and proposed mitigation measures to be implemented by MCPL (Section 2.2.4).

2.2.1 Direct Impacts

The Action would require the removal of approximately 181 ha of Regional Ecosystem (RE) 11.5.3 (Poplar Box Woodland) (Figure 4). In a local and regional context, the removal of vegetation associated with the Action would account for only a fraction (less than 2%) of the remaining extent of RE 11.5.3.

Table 4 identifies the area of potential habitat for the Koala and South-eastern Long-eared Bat which is proposed to be cleared by the Action. The description of the habitat within the Action area provided in Table 4 highlights the conservative nature of the potential habitat estimates.

Table 4
Potential Habitat Clearance

MNES	Area of Habitat to be Cleared (ha) ¹	Description
Koala	181	Comprised entirely of RE 11.5.3. This habitat is located on poor quality soils and contains minimal Queensland Blue Gums (identified as an important Koala food tree [Van Dyck and Strahan, 2008; Land for Wildlife, 2014]) with only one patch of less than five small trees identified.
South-eastern Long-eared Bat	181	Comprised entirely of RE 11.5.3. This habitat has been subject to past disturbance for cattle grazing and no bat roosts or confirmed records of the South eastern Long-eared Bat are located within this habitat. The habitat in the impact area is lacking complexity.

¹ Refer to Figure 4.

2.2.2 Indirect Impacts

As described in Section 1.2, the Action comprises the extension of an approved waste dump (i.e. no additional mining activities are proposed). Although the Action would result in clearance of native vegetation it is unlikely that it would result in any indirect impacts which could significantly impact MNES (Naturecall, 2016a).

Potential indirect impacts associated with the Action may include erosion and sedimentation, dust, noise and vibration, artificial lighting and/or the introduction of introduced species (Naturecall, 2016a). These potential impacts would be reduced by the existing mitigation measures already implemented by MCPL at the Middlemount Coal Mine (e.g. erosion and sedimentation control, noise and dust management and control of introduced/exotic species).

2.2.3 Assessment of Significance

The potential impacts of the Action on MNES that are known or likely to occur within the Action area are assessed in this section in accordance with DotE (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*. This includes the Koala and South-eastern Long-eared Bat.

Relevant Plan/Agreements

Relevant plan/agreements which have been considered include:

- *EPBC Act Referral Guidelines for the Vulnerable Koala (Combined Population in Queensland, New South Wales and the Australian Capital Territory)* (DotE, 2014).
- *Commonwealth Conservation Advice on Phascolarctos cinereus (Combined Population in Queensland, New South Wales and the Australian Capital Territory)* (TSSC, 2012a).
- *Listing Advice for Phascolarctos cinereus (Koala)* (TSSC, 2012b).
- *National Koala Conservation and Management Strategy 2009-2014* (Natural Resource Management Ministerial Council, 2009).
- *Approved Conservation Advice for Nyctophilus corbeni (South-eastern Long-eared Bat)* (TSSC, 2015a).
- *Commonwealth Listing Advice on Ten Species of Bats* (TSSC, 2001).
- *Threat Abatement Plan for Predation by the European Red Fox* (QLD Department of Environment, Water, Heritage and the Arts [DEWHA], 2008a).
- *Threat Abatement Plan for Predation by Feral Cats* (DEWHA, 2008b).

The Action is not inconsistent with any relevant recovery plans, conservation advice or agreements.

2.2.3.1 Koala (*Phascolarctos cinereus*)

Table 5 provides an assessment of adverse impacts on the Koala in accordance with DotE's (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* and considering the assessment guidelines.

Table 5
Likelihood of a Significant Adverse Impact on the Koala

EPBC Act Assessment Criteria ¹	Assessment
Is the action likely to:	
Lead to a long-term decrease in the size of an important population of a species?	The Action would result in the removal/modification of approximately 181 ha of potential habitat resources for the Koala (Figure 4; Table 4). No critical habitat would be removed by the Action. The removal/modification of a portion of habitat for the Koala is unlikely to disrupt the lifecycle such that a local viable population of this species would be placed at risk of extinction given: • the Koala has not been recorded within the Action area; • minimal Queensland Blue Gums (identified as an important Koala food tree [Van Dyck and Strahan, 2008; Land for Wildlife, 2014]) are located within the Action area with only one patch of less than five small trees identified;

Table 5 (Continued)
Likelihood of a Significant Adverse Impact on the Koala

EPBC Act Assessment Criteria¹ Is the action likely to:	Assessment
Lead to a long-term decrease in the size of an important population of a species? (Cont.)	- soils within the Action area are of poor quality resulting in a low quality of habitat for the Koala, were it to occur; - better quality potential habitat for the Koala is more widespread in the landscape outside the Action area (e.g. important koala food trees [Queensland Blue Gum – <i>Eucalyptus tereticornis</i>] occur along the watercourses to the south-west of the Middlemount Coal Mine); and - Koala records are widespread in the landscape outside the Action area, as demonstrated by numerous Koala records in the wider surrounds (Figure 5). A number of measures would be implemented for the Action to minimise potential impacts on flora and fauna which would be relevant to occurrences of this species within the Action area and adjacent lands. Mitigation measures would include a vegetation clearance protocol and feral animal control (Section 2.2.4). The potential indirect impacts on the Koala associated with the Action (e.g. vehicle strike, noise, vibration, artificial lighting and/or the introduction of introduced species) are considered to be minimal and would only incrementally increase the likelihood of existing indirect impacts associated with the existing mining operations. Therefore, removal/modification of this area of habitat would have minimal impact on resources for the Koala and would not lead to a decrease in the size of the population.
Reduce the area of occupancy of an important population?	There is no evidence of Koala breeding within the locality and no critical koala habitat would be disturbed by the Action. The Action would not reduce the area of occupancy of a population.
Fragment an existing important population into two or more populations?	While potential habitat clearing would occur as a result of the Action, the nature of clearing would reduce the area of habitat rather than fragment it or further isolate habitat. This species is known to move across open paddocks/grasslands to locate suitable food resources. Given the mobile nature of the species and lack of records within the Action area, the loss of the vegetation within the Action area would not fragment the wider Koala population.
Adversely affect habitat critical to the survival of a species?	Table 3 provides an appraisal of the habitat within the Action area. Based on the rating system provided in the EPBC Act Referral Guidelines for the Koala (DotE, 2014), the habitat in the Action area does not constitute critical habitat for this species.
Disrupt the breeding cycle of an important population?	There is no evidence of Koala breeding within the locality. The Action would not disrupt the breeding cycle of the wider Koala population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The habitat which would be removed/modified as a result of the Action (Figure 4) is expected to have a minimal impact on resources for this species and would not lead the species declining given: - the Koala has not been recorded within the Action area; - minimal Queensland Blue Gums (identified as an important Koala food tree [Van Dyck and Strahan, 2008; Land for Wildlife, 2014]) are located within the Action area with only one patch of less than five small trees identified; - soils within the Action area are of poor quality resulting in a low quality of habitat for the Koala, were it to occur; - better quality potential habitat for the Koala is more widespread in the landscape outside the Action area (e.g. important koala food trees [Queensland Blue Gum – <i>Eucalyptus tereticornis</i>] occur along the watercourses to the south-west of the Middlemount Coal Mine); and - Koala records are widespread in the landscape outside the Action area, as demonstrated by numerous Koala records in the wider surrounds (Figure 5).

Table 5 (Continued)
Likelihood of a Significant Adverse Impact on the Koala

EPBC Act Assessment Criteria ¹ Is the action likely to:	Assessment
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	Feral pests which pose a threat to the Koala are already present in the Action area (i.e. feral cats, dogs and foxes) and are likely to displace into adjoining areas during construction, however, the number of feral pests that would be displaced would be reduced by controlling feral pests in the Action area. The control of feral pests is an existing measure at the Middlemount Coal Mine that would be adopted for the Action and wider area. With the implementation of management measures, the potential impacts to Koala associated with feral animals is likely to be low. The Action is not inconsistent with the Threat Abatement Plan for Predation by the European Red Fox (DEWHA, 2008a).
Introduce disease that may cause the species to decline?	There are no known diseases potentially spread by soil movement or mining equipment that would affect the Koala.
Interfere substantially with the recovery of the species?	The Action would not have a negative impact on Koala numbers, or significantly reduce available resources in the immediate landscape. Whilst potential Koala habitat would be cleared it is effectively not currently utilised by the species and therefore very unlikely to substantially interfere with the species recovery.

¹ As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013).

The woodland/forest vegetation types in the Action area could provide potential habitat for the Koala. Approximately 181 ha of foraging habitat resources may be removed/modified. Consistent with the *EPBC Act Significant Impact Guidelines* criteria, this small loss of habitat is not expected to significantly affect this 'Vulnerable' species (after DotE, 2013), because the Action removes potential foraging habitat which is common in the surrounding landscape.

Notwithstanding the above, the proposed offset area provides for the conservation and management of 306 ha of potential foraging habitat resources for the Koala and 193 ha of derived grassland that would be managed to encourage natural regeneration to provide a net gain in habitat (Section 2.3).

2.2.3.2 South-eastern Long-eared Bat (*Nyctophilus corbeni*)

Table 6 provides an assessment of adverse impacts on the South-eastern Long-eared Bat in accordance with DotE's (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table 6
Likelihood of a Significant Adverse Impact on the South-eastern Long-eared Bat

EPBC Act Assessment Criteria ¹ Is the action likely to:	Assessment
Lead to a long-term decrease in the size of an important population of a species?	The Action would result in the removal/modification of approximately 181 ha of potential habitat for the South-eastern Long-eared Bat (Figure 4). The Action is unlikely to significantly impact the South-eastern Long-eared Bat given: - this species has not been confirmed to occur within 250 km of the Action area despite targeted surveys on surrounding land; - much of the known and potential habitat to be cleared has been subject to past disturbances for cattle grazing; and - better quality potential habitat for this species is more widespread in the landscape outside the Action area (e.g. more abundant foraging and roosting resources occurs in suitable habitat to the south-west of the Middlemount Coal Mine).

Table 6 (Continued)
Likelihood of a Significant Adverse Impact on the South-eastern Long-eared Bat

EPBC Act Assessment Criteria¹ Is the action likely to:	Assessment
Lead to a long-term decrease in the size of an important population of a species? (Cont.)	A number of measures would be implemented for the Action to minimise potential impacts on flora and fauna which would be relevant to occurrences of this species within the Action area and adjacent lands. Mitigation measures would include a vegetation clearance protocol and feral animal control (Section 2.2.4). The potential indirect impacts on the South-eastern Long-eared Bat associated with the Action (e.g. noise, vibration, artificial lighting and/or the introduction of introduced species) are considered to be minimal and would only incrementally increase the likelihood of existing indirect impacts associated with the existing mining operations. Therefore, removal/modification of this area of habitat would have minimal impact on resources for the South-eastern Long-eared Bat and would not lead to a decrease in the size of the population.
Reduce the area of occupancy of an important population?	There is no evidence of South-eastern Long-eared Bat breeding within the Action area and no roosts have been identified (Naturecall, 2016a). The Action would not reduce the area of occupancy of a population.
Fragment an existing important population into two or more populations?	Given the highly mobile and dispersive nature of this species, the loss of the vegetation within the Action area would not fragment the wider South-eastern Long-eared Bat population.
Adversely affect habitat critical to the survival of a species?	No habitat within the Action area has been identified as important or critical habitat for the South-eastern Long-eared Bat in any recovery plans or listed on the EPBC Act <i>Register of Critical Habitat</i> maintained by the Minister of the Environment under the EPBC Act. The habitat in the Action area is not considered to be critical to the survival of the species as: - the small extent of habitat (with minimal carrying capacity) and the greater extent of habitat in the locality and species range; - existing threatening processes have degraded the habitat (the habitat is grazed by livestock, prone to impacts by feral animals and weeds); - the species is more widely distributed in the region and the habitat in the action area is not at a limit of the species range; - the habitat is lacking complexity (e.g. the habitat in the proposed offset area contains ten more regional ecosystems and riparian habitats along creeks); and - the closest record is 250 km from the action area.
Disrupt the breeding cycle of an important population?	There is no evidence of South-eastern Long-eared Bat breeding within the Action area and no roosts have been identified (Naturecall, 2016a). The Action would not disrupt the breeding cycle of the wider South-eastern Long-eared Bat population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The habitat which would be removed/modified as a result of the Action is expected to have a negligible impact on resources for this species and would not lead the species declining, given: - this species has not been confirmed to occur within 250 km of the Action area despite targeted surveys on surrounding land; - much of the known and potential habitat to be cleared has been subject to past disturbances for cattle grazing; and - better quality potential habitat for this species is more widespread in the landscape outside the Action area (e.g. more abundant foraging and roosting resources occurs in suitable habitat to the south-west of the Middlemount Coal Mine).

Table 6 (Continued)
Likelihood of a Significant Adverse Impact on the South-eastern Long-eared Bat

EPBC Act Assessment Criteria¹ Is the action likely to:	Assessment
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	The impact of feral predation is unknown but has been documented as a threat for bat species closely related to South-eastern Long-eared Bat (DEE, 2016). Bats have been recorded being evicted from tree hollows by feral species, including the Common Starling (<i>Sturnus vulgaris</i>) (DEE, 2016). Feral pests which pose a threat to the South-eastern Long-eared bat are already present in the Action area (i.e. feral cats, dogs and foxes) and are likely to displace into adjoining areas during construction, however, the number of feral pests that would be displaced would be reduced by controlling feral pests in the Action area. The control of feral pests is an existing measure at the Middlemount Coal Mine that would be adopted for the Action and wider area.
Introduce disease that may cause the species to decline?	There are no known diseases potentially spread by soil movement or mining equipment that would affect South-eastern Long-eared Bat.
Interfere substantially with the recovery of the species?	The Action would not have a negative impact on South-eastern Long-eared Bat numbers, or significantly reduce available resources in the immediate landscape. Thus the Action would not interfere with the recovery of the species.

¹ As defined by the *Significance Significant Impact Guidelines 1.1 Matters of National Environmental* (DotE, 2013).

The woodland/forest vegetation types in the Action area could provide potential habitat for the South-eastern Long-eared Bat. Approximately 181 ha of foraging and roosting habitat resources may be removed/modified. Consistent with the *EPBC Act Significant Impact Guidelines* criteria, this small loss of habitat is not expected to significantly affect this 'Vulnerable' species (after DotE, 2013), because the Action removes potential foraging habitat which is common in the surrounding landscape.

Notwithstanding the above, the proposed offset area provides for the conservation and management of 339 ha of potential foraging and roosting habitat resources for the South-eastern Long-eared Bat and 193 ha of derived grassland that would be managed to encourage natural regeneration to provide a net gain in habitat (Section 2.3).

2.2.4 Mitigation Measures

Table 7 provides a consolidated list of avoidance and mitigation measures proposed to be undertaken to minimise the impacts of the Action on the Koala and the South-eastern Long-eared Bat, including:

- a description of proposed avoidance and mitigation measures to deal with relevant impacts of the Action;
- assessment of the expected or predicted effectiveness of the mitigation measures;
- a description of the outcomes that the avoidance and mitigation measures are likely to achieve; and
- statutory or policy basis for the proposed mitigation measures.

The management and mitigation measures proposed as part of the Action are considered consistent with current best practice in the mining industry. The majority of these matters have substantial evidence of success over a long period of time (e.g. feral pest control).

MCPL is the proponent for the Action and would be responsible for undertaking and funding the management measures.

Table 7
MNES and Mitigation Measures

Common Name	Conservation Status under the EPBC Act ¹	List of Avoidance and Mitigation Measures	Description	Predicted Effectiveness	Outcome	Statutory Or Policy Basis
Koala	V	Vegetation clearance protocol	Provides for the avoidance of impacts on individuals of this species which may be present at the time of clearance.	There is a moderate to high likelihood that this measure would effectively minimise direct impacts to this species.	Impacts to Koalas on site at the time of clearance (were they to occur) would be minimised.	<i>EPBC Act Referral Guidelines for the Vulnerable Koala</i> (DotE, 2014) <i>Listing Advice for Phascolarctos cinereus</i> (Koala) (TSSC, 2012b)
		Feral pest control	Provides for the avoidance of impacts from predation or competition to the Koala.	There is a high likelihood that this measure would effectively mitigate potential impacts as a result of feral animals.	Impacts from exotic fauna (e.g. predation and competition) to the Koala (were they to occur) would be minimised.	<i>Threat Abatement Plan for Predation by the European Red Fox</i> (DEWHA, 2008a) <i>Threat Abatement Plan for Predation by Feral Cats</i> (DEWHA, 2008b)
South-eastern Long-eared Bat	V	Vegetation clearance protocol	Provides for the avoidance of impacts on individuals of this species which may be present at the time of clearance.	There is a moderate to high likelihood that this measure would effectively minimise direct impacts to this species.	Impacts to South-eastern Long-eared Bats on site at the time of clearance (were they to occur) would be avoided.	<i>Commonwealth Listing Advice on Ten Species of Bats</i> (TSSC, 2001) <i>Approved Conservation Advice for Nyctophilus corbeni</i> (southeastern long-eared bat) (TSSC, 2015a)
		Feral pest control	Provides for the avoidance of impacts from predation or competition to South-eastern Long-eared Bat.	There is a high likelihood that this measure would effectively mitigate potential impacts as a result of feral animals.	Impacts from exotic fauna (e.g. predation and competition) to South-eastern Long-eared Bat (were they to occur) would be minimised.	<i>Threat Abatement Plan for Predation by the European Red Fox</i> (DEWHA, 2008a) <i>Threat Abatement Plan for Predation by Feral Cats</i> (DEWHA, 2008b)

¹ Threatened species status under the EPBC Act (current at August 2016).

V = Vulnerable.

2.2.5 Conclusions

This assessment provides more detailed information than available at the time the Action was referred to the Commonwealth government. This assessment describes how the removal of limited potential habitat would not significantly impact any threatened species or communities listed under the EPBC Act (Table 8).

Table 8
Assessment Summary

Common Name	Scientific Name	Conservation Status ¹	Assessment Summary
Mammals			
Koala	<i>Phascolarctos cinereus</i>	V	The Koala is unlikely to be significantly impacted by the Action given: - the Koala has not been recorded within the Action area; - minimal Queensland Blue Gums (identified as an important Koala food tree [Van Dyck and Strahan, 2008; Land for Wildlife, 2014]) are located within the Action area with only one patch of less than five small trees identified; - soils within the Action area are of poor quality resulting in a low quality of habitat for the Koala, were it to occur; - better quality potential habitat for the Koala is more widespread in the landscape outside the Action area (e.g. important Koala food trees [Queensland Blue Gum – <i>Eucalyptus tereticornis</i>] occur along the watercourses to the south-west of the Middlemount Coal Mine); and - Koala records are widespread in the landscape outside the Action area, as demonstrated by numerous Koala records in the wider surrounds (Figure 5).
South-eastern Long-eared Bat	<i>Nyctophilus corbeni</i>	V	The South-eastern Long-eared Bat is unlikely to be significantly impacted by the Action given: - this species has not been confirmed to occur within 250 km of the Action area despite targeted surveys on surrounding land; - much of the known and potential habitat to be cleared has been subject to past disturbances for cattle grazing; and - better quality potential habitat for this species is more widespread in the landscape outside the Action area (e.g. more abundant foraging and roosting resources occurs in suitable habitat to the south-west of the Middlemount Coal Mine).

¹ Threatened species status under the EPBC Act (current as at August 2016).

V = Vulnerable.

The Action is not inconsistent with any relevant recovery plans, conservation advice or agreements.

The impacts of the Action at a local scale would be minimal. Impacts on protected matters would be localised and negligible on a regional, state and national scale. The Action would not have a significant negative impact on the conservation status, condition or trend of any MNES at a local or regional scale.

2.3 PROPOSED BIODIVERSITY OFFSET PACKAGE

While MCPL does not consider that the Action would have a significant impact on MNES (Section 2.2), DEE has determined the North-eastern Extension to be a Controlled Action, and requires an offset to mitigate potential impacts to the Squatter Pigeon (southern). Accordingly, MCPL has prepared a biodiversity offset package to mitigate potential impacts to the Squatter Pigeon (southern).

Further details of the proposed biodiversity offset package are provided in the Middlemount Coal Mine North-eastern Extension Offset Proposal within Attachment C and the Middlemount Coal Mine North-eastern Extension Offset Management Plan/Vegetation Management Plan within Attachment D.

2.3.1 Relevant MNES

A proposed biodiversity offset package to mitigate the clearance of Squatter Pigeon (southern) habitat associated with the Action is described in this section. In addition, the proposed offset area would provide suitable habitat resources for the Koala and South-eastern Long-eared Bat.

Table 9 identifies the MNES relevant to the proposed biodiversity offset package along with the area of potential habitat to be cleared by the Action.

Table 9
MNES Relevant to the Proposed Biodiversity Offset Package

Species	Conservation Status under the EPBC Act ¹	Habitat Clearance (ha)
Squatter Pigeon (southern)	V	181
Koala	V	181
South-eastern Long-eared Bat	V	181

¹ Threatened fauna species status under the EPBC Act (current at August 2016).

V = Vulnerable.

The proposed biodiversity offset package for the Action is described in the following subsections.

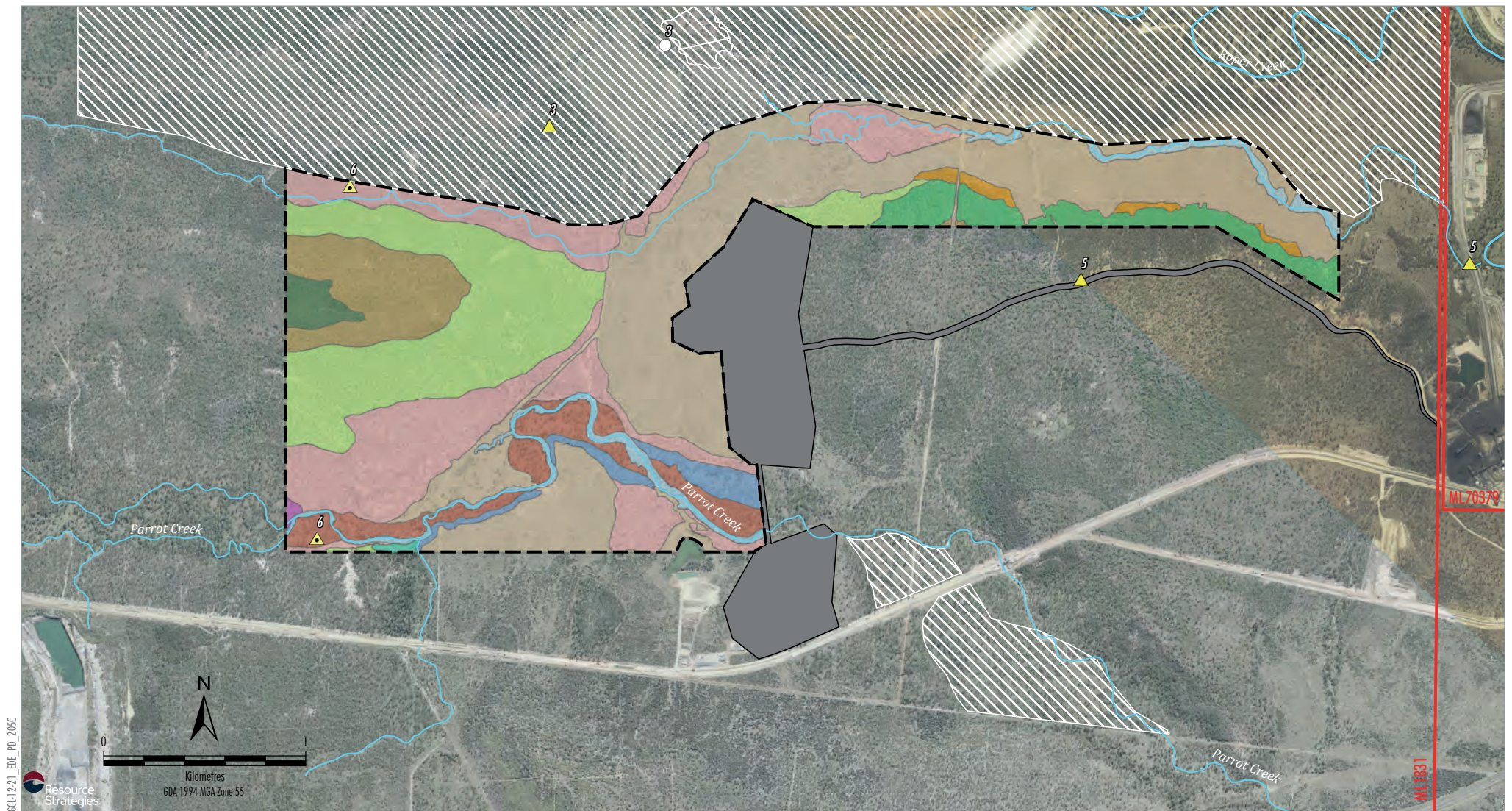
2.3.2 Type of Offset Proposed

The offset proposed for the Action is a land-based offset on land owned by MCPL.

2.3.3 Location and Suitability of Offset

The proposed offset area is located approximately 7 km south-west of the Middlemount township (Figure 5). It falls within in the Isaac-Comet Downs subregion of the North Brigalow Belt Bioregion, within the Fitzroy catchment and is adjacent to two existing offset areas secured for previous stages of the Middlemount Coal Mine (Figure 5).

The proposed offset area includes a combination of forested/woodland areas along with cleared grazing land. A total of 11 remnant REs have been mapped within the proposed offset area by Naturecall (2016b) (Table 10; Figure 7).



- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Existing Offset Area
 - Proposed Offset Area
 - Threatened Species Records
 - ▲ Koala
 - ▲ Koala Scratches/Scats
 - Squatter Pigeon

Regional Ecosystem Mapping			
 11.3.2	 11.5.2a		
 11.3.25	 11.5.3		
 11.3.4	 11.5.9		
 11.3.4a	 11.7.2		
 11.4.8	 11.7.4		
 11.5.18	 Non-remnant		

Reference: 3 Ecology and Heritage Partners (2012)
 5 Naturecall Environmental (2014)
 6 Naturecall Environmental (2016)

Note: There are no references 1, 2 and 4 on this figure.

Source: Naturecall (2016); MCPL (2014);
 Department of Natural Resources and Mines (2016)
 Orthophoto: MCPL (2014, 2012)



NORTH-EASTERN EXTENSION
 Ground-truthed Regional Ecosystem Mapping and
 Recorded EPBC Act Listed Fauna Species in the
 Proposed Offset Area and Immediate Surrounds

Figure 7

Table 10
Regional Ecosystems Mapped within the Proposed Offset Area

Regional Ecosystem Number	Regional Ecosystem Name	Area Mapped within Offset Area (ha) ¹
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains.	12.5
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines.	18.5
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains.	28.0
11.3.4a	Floodplain (other than floodplain wetlands). <i>Corymbia tessellaris</i> woodland. On alluvial sand ridges to elevated levees and level terraces adjacent to larger stream channels which are irregularly flooded or possibly relict.	0.5
11.4.8	<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains.	1.0
11.5.18	<i>Micromyrtus capricornia</i> shrubland on Cainozoic sand plains/remnant surfaces.	6.5
11.5.2a	<i>Allocasuarina luehmannii</i> low tree layer with or without emergent woodland.	98.0
11.5.3	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces.	108.0
11.5.9	<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and/or remnant surfaces.	34.5
11.7.2	<i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone.	26.5
11.7.4	<i>Eucalyptus decorticans</i> and/or <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> woodland on Cainozoic lateritic duricrust.	5.0
Total		339
-	Non-remnant Vegetation	193

¹ Refer to Figure 7.

The proposed biodiversity offset package is consistent with the principles of the *EPBC Act Environmental Offsets Policy* (SEWPaC, 2012a), and the *EPBC Act Offsets Assessment Guide* (SEWPaC, 2012b) was used to determine the appropriate size of the offset area in order to exceed 100% of the offset requirement (Table 11; Attachment C). Attachment C contains the inputs and outputs for the Commonwealth offset calculator (i.e. the *EPBC Act Offset Assessments Guide*).

Table 11
Habitat for MNES Known or Considered Likely to Occur in the Action Area and
Proposed Offset Area and Summary of Percentage Offset Requirements Met

MNES	Conservation Status ¹	Area of Habitat to be Impacted (ha) ²	Total Area of Existing Habitat in Offset Area (ha) ³		Recorded in Offset Area	Percent Offset by Commonwealth Offset Areas
			Remnant Vegetation	Non-Remnant Vegetation		
Squatter Pigeon (southern) (<i>Geophaps scripta scripta</i>)	V	181	339	193	No	139.03%
Koala (<i>Phascolarctos cinereus</i>)	V	181	306	193	Yes	128.11%
South-eastern Long-eared Bat (<i>Nyctophilus corbeni</i>)	V	181	339	193	No	114.36%

¹ Threatened species status under the EPBC Act (current as at August 2016).

² Area based on vegetation mapped by Naturecall (2016a).

³ Area based on vegetation mapped by Naturecall (2016b).

V = Vulnerable.

2.3.4 Conservation Gain

The proposed offset area would result in a net conservation gain for the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat. This conservation gain would be achieved through the implementation of environmental management strategies that would improve the site and avert future loss/degradation to habitat features utilised by each of these MNES.

A key step to achieving this conservation gain would be through an arrangement for the enduring protection and management of the proposed offset area (Section 2.3.7). Once this arrangement is in place, it is highly unlikely that the habitat features relevant to the Squatter Pigeon (southern), Koala or South-eastern Long-eared Bat would be lost with the proposed offset area.

Consistent with MCPL's existing approved Offset Management Plan/Vegetation Management Plan for the existing offset areas, a number of measures would be implemented by MCPL to allow for this conservation gain to occur (Table 12). The Middlemount Coal Mine North-eastern Extension Offset Management Plan/Vegetation Management Plan is provided within Attachment D.

Table 12
Management Measures to be Implemented in the Proposed Offset Area

Management Measure	Description
Management of livestock in the offset area	Livestock grazing will be strategically used in the proposed offset area. Rotational livestock grazing may be used as a method of managing Buffel Grass and reducing fuel loads in the proposed offset area. It is intended that the regeneration areas progressively change from a grassland dominated system to woodland/forest. Livestock will be excluded from the offset areas once it is no longer required for strategic management of weed species.
Management of weeds	The spread and introduction of weeds/declared plants to and within the proposed offset area would be minimised by restricting vehicles to designated access tracks. The introduction, establishment and spread of non-native weeds will be minimised through regular monitoring and treatment activities.
Control of feral animal populations	Appropriately qualified persons will be engaged to undertake pest animal control. Control measures would consider the relevant guidelines and legislation. Control methods will target feral pigs, wild dogs, European Rabbits, Feral Cats and European Foxes.
Setting up the proposed offset area on the ground	After protection of the proposed offset area has been established, the area will be set-up on the ground by: - identifying/establishing fire trails/access tracks required for fire management or other management purposes; - fencing the perimeter of the proposed offset area to manage grazing livestock; - installing locks on gates; and - installing signage along main access roads which recognised that the area is protected for conservation purposes to deter third party access into the area.
Fire management	Fire management activities will be undertaken including identifying/establishing fire trails, consultation with local fire wardens and development of fire awareness and response procedures. Ground fuel loads may be controlled through the strategic rotational grazing of cattle to prevent thick grass biomass from accumulating over time.

Table 12 (Continued)
Management Measures to be Implemented in the Proposed Offset Area

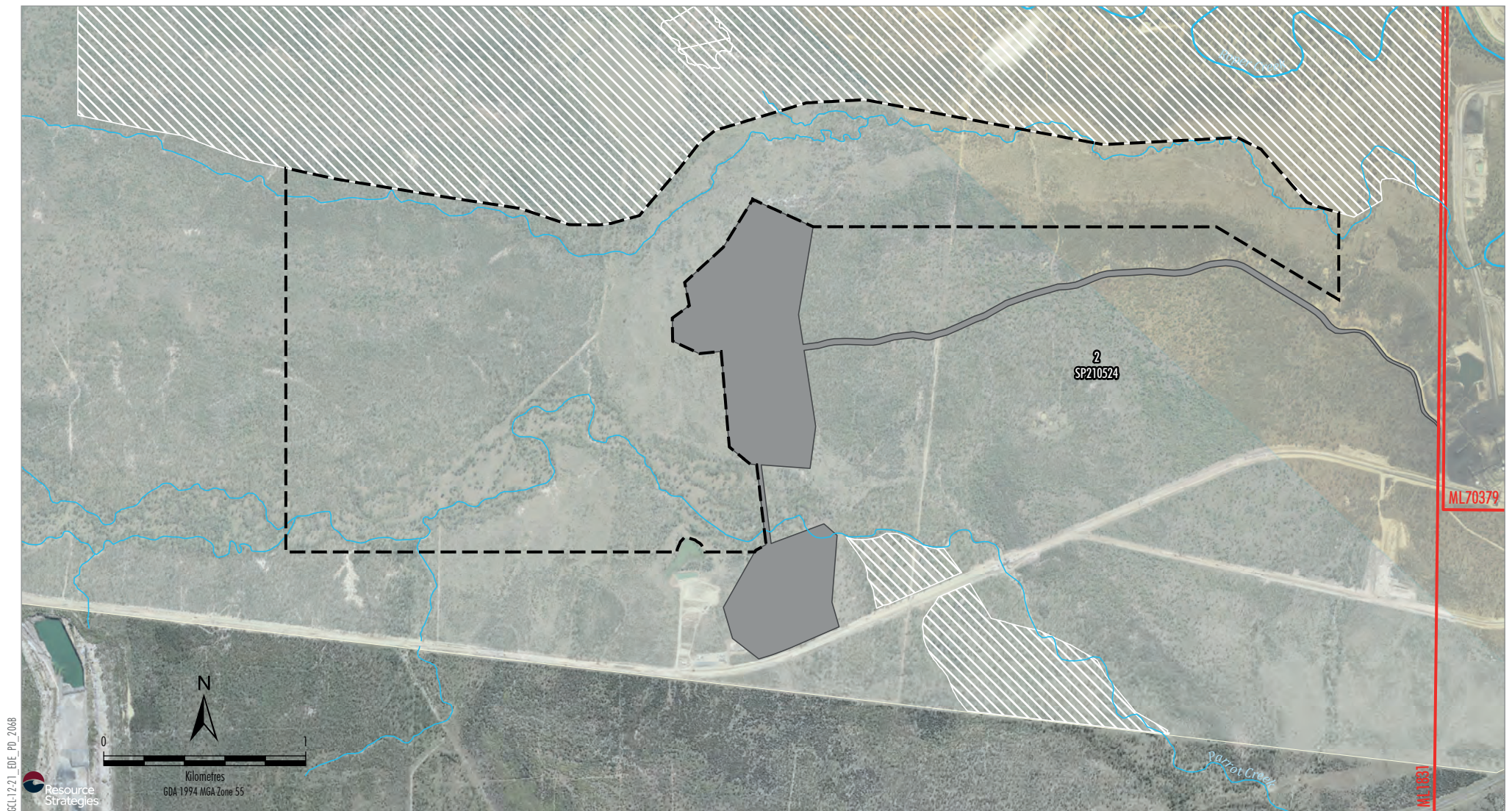
Management Measure	Description
Erosion and sediment control	Erosion potential in the proposed offset area will be reduced by grazing management, restricting vehicle access to the proposed offset area and control of animal pests. Selective plantings/direct seeding of local endemic species may be undertaken to stabilise the soil and or the use of surface water management structures.
Restrictions to access	Access into the proposed offset area will be restricted to authorised personnel. Locks will be installed on gates into the proposed offset area. Vehicles will be restricted to designated access tracks.

Within the next 20 years, without the offset, it is considered that there is a risk that the ecological values relevant to the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat will be lost.

2.3.5 Land Tenure and Proposed Offset Security Mechanism

The proposed offset area is located entirely on freehold land owned by MCPL. The land tenure information is shown on Figure 8.

MCPL would secure the proposed offset area through a legally binding mechanism such as a voluntary declaration of an area of high nature conservation value (VDec) under the *QLD Vegetation Management Act, 1999* or by providing DEHP with a *Request for Environmental Offset Protection Area Declaration* in accordance with section 30 of the *QLD Environmental Offsets Act, 2014*.



- LEGEND**
- Mining Lease
 - Parrot Quarry
 - Existing Offset Area
 - Proposed Offset Area
 - MCPL Owned Land

Source: MCPL (2014);
 Department of Natural Resources and Mines (2015)
 Orthophoto: MCPL (2014, 2012); Esri Basemap


 NORTH-EASTERN EXTENSION
 Proposed Offset Area
 Land Tenure

Figure 8

2.3.6 Reconciliation against EPBC Act Offset Policy

A reconciliation of the proposed biodiversity offset package against the Commonwealth offset principles is presented in Table 13.

Table 13
Reconciliation of the Proposed Biodiversity Offset Package
against the Commonwealth Offset Principles

Offset Principles ¹	Elements of the Proposed Biodiversity Offset Package that Address these Requirements
<i>Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environmental law and affected by the action.</i>	The proposed offset area is specifically tailored to the relevant protected matters (i.e. Squatter Pigeon [southern], Koala and South-eastern Long-eared Bat) and to deliver an overall conservation outcome that improves or maintains the viability of each protected matter.
<i>Be built around direct offsets but may include other compensatory measures.</i>	The <i>EPBC Act Offsets Assessment Guide</i> (SEWPaC, 2012b) was used to assess the proposed offset area against the Commonwealth biodiversity offset requirements (Section 2.3.3). The proposed offset area is a direct offset which satisfies 100% of the offset requirements under the EPBC Act. The proposed offset area is owned by MCPL. MCPL intends to reach an agreement with the Commonwealth Government for the enduring protection and management of the offset area.
<i>Be in proportion to the level of statutory protection that applies to protected matters.</i>	The <i>EPBC Act Offsets Assessment Guide</i> (SEWPaC, 2012b), which was used for the Action, accounts for the level of statutory protection (vulnerable to critically endangered [Table 9]) of the relevant protected matters in calculating the offset requirement.
<i>Be of a size and scale proportionate to the impacts on the protected matter.</i>	The size and scale of the offset was determined using the <i>EPBC Act Offsets Assessment Guide</i> (SEWPaC, 2012b). The following was considered: - the level of statutory protection (vulnerable to critically endangered [Table 9]); - specific attributes of the relevant protected matters and its habitat (Section 2.3.3); - the quality and importance of the habitat; - the level of risk to the habitat in the offset area without the Action (e.g. grazing); - the time it would likely take for a conservation gain for each relevant protected matter; and - the risk of the conservation gain not occurring. With reference to the <i>EPBC Act Environmental Offsets Policy</i> (SEWPaC, 2012a), the impacts of the Action are conservatively assumed to be permanent for the purpose of the offset requirement, but in reality the Action area would be rehabilitated and revegetated.
<i>Effectively account for and manage the risks of the offset not succeeding.</i>	The Action would result in residual impacts on the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat (through the loss of habitat). The potential impacts on the protected matters have been evaluated and it is concluded that none of the protected matters are likely to be significantly impacted (Section 2.2.5). However, the offset areas would compensate for the impacts on the protected matters and help maintain the viability of the protected matters. The <i>EPBC Act Offsets Assessment Guide</i> (SEWPaC, 2012b), which was used for the Action, accounts for the risks of the offset area not succeeding in calculating the offset requirement.
<i>Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs.</i>	The offset areas are beyond existing requirements, in that it is not part of any private conservation reserve system. The offset areas are new and additional under duty of care or any environmental planning laws.

Table 13 (Continued)
Reconciliation of the Proposed Biodiversity Offset Package
against the Commonwealth Offset Principles

Offset Principles ¹	Elements of the Proposed Biodiversity Offset Package that Address these Requirements
<i>Be efficient, effective, transparent, proportionate, scientifically robust and reasonable.</i>	The offset areas would efficiently and effectively compensate for the impacts on the protected matters and help maintain the viability of the protected matters. Flora and fauna surveys of the offset areas were undertaken by Naturecall (2016b).
<i>Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.</i>	MCPL intends to reach an agreement with the Commonwealth Government for the enduring protection and management of the offset area.

¹ SEWPaC, 2012a.

2.3.7 Relevant Conservation Advice and Threat Abatement Plans

Referral guidelines, conservation advice, management strategies and threat abatement plans relevant to the proposed offset area which have been considered include:

- *Approved Conservation Advice Geophaps scripta scripta (Squatter Pigeon [Southern])* (TSSC, 2015b).
- *EPBC Act Referral Guidelines for the Vulnerable Koala* (DotE, 2014).
- *Commonwealth Conservation Advice on Phascolarctos cinereus (Combined Population in Queensland, New South Wales and the Australian Capital Territory)* (TSSC, 2012a).
- *Listing Advice for Phascolarctos cinereus (Koala)* (TSSC, 2012b).
- *National Koala Conservation and Management Strategy 2009-2014* (Natural Resource Management Ministerial Council, 2009).
- *Approved Conservation Advice for Nyctophilus corbeni (South-eastern Long-eared Bat)* (TSSC, 2015a).
- *Commonwealth Listing Advice on Ten Species of Bats* (TSSC, 2001).
- *Threat Abatement Plan for Predation by the European Red Fox* (DEWHA, 2008a).
- *Threat Abatement Plan for Predation by Feral Cats* (DEWHA, 2008b).

Given the conservation of habitat within the proposed offset area and the implementation of management measures described in Section 2.2.4, MCPL considers that the proposed offset area described in this document is consistent with the above-listed referral guidelines, conservation advice, management strategies and threat abatement plans.

3 ECONOMIC AND SOCIAL IMPACTS

3.1 COSTS AND BENEFITS ASSOCIATED WITH THE ACTION AND EMPLOYMENT OPPORTUNITIES

The Action does not involve any change to the currently approved operating hours or workforce. The existing mine workforce would continue to be employed for the Action and therefore the Action would not materially result in any additional demand for employees/contractors.

As such, it is not anticipated that there will be any negative impacts to population, infrastructure, services or housing in the local community. Road use is also anticipated to remain consistent, with no additional negative impacts as a result of the Action.

3.2 STAKEHOLDER CONSULTATION

MCPL held a pre-lodgement meeting with DEHP regarding the Action (and the amendment application to Environmental Authority (EA) EPML00716913) on 9 December 2015.

The application was publically notified in accordance with sections 152(2)(a) and 153 of the *QLD Environmental Protection Act, 1994* (EP Act) and section 252B of the *QLD Mineral Resources Act, 1989*. As part of this process, MCPL has:

- given written notice (an 'Application Notice') to each owner of land to which the amendment relates (the 'relevant land') and any other land necessary for access to the relevant land;
- given the Application Notice to each holder, or applicant for, an exploration permit or mineral development licence over the relevant land for a mineral other than a mineral to which the proposed amendment relates;
- given the Application Notice to the local government; and
- published the Application Notice in a newspaper circulating in the locality of the Action (in this case, the Central Queensland News).

Consultation with the Barada Barna People and BBKY #4 native title claimants will be conducted in accordance with the requirements of the *QLD Native Title Act, 1993* in relation to Native Title issues. Consultation in relation to Indigenous cultural heritage will be conducted in accordance with the requirements of the *QLD Aboriginal Cultural Heritage Act, 2003*.

4 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

4.1 OVERVIEW

The concept of sustainable development came to prominence at the World Commission on Environment and Development (1987), in the report titled *Our Common Future*, which defined sustainable development as:

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

In recognition of the importance of sustainable development, the Commonwealth Government developed a *National Strategy for Ecologically Sustainable Development* (NSED) (Commonwealth of Australia, 1992) that defines Ecologically Sustainable Development (ESD) as:

using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.

The NSED was developed with the following core objectives:

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

In addition, the NSED contains the following goal:

Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

In accordance with the core objectives and a view to achieving this goal, the NSED presents private enterprise in Australia with the following role:

Private enterprise in Australia has a critical role to play in supporting the concept of ESD while taking decisions and actions which are aimed at helping to achieve the goal of this Strategy.

In accordance with the DEE Preliminary Documentation Information Request (Attachment B), an assessment of the consistency of the Action with section 3A of the EPBC Act has been undertaken. The principles of ESD as outlined in section 3A of the EPBC Act are as follows:

- (a) *decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;*
- (b) *if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;*
- (c) *the principle of inter-generational equity--that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;*
- (d) *the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making;*
- (e) *improved valuation, pricing and incentive mechanisms should be promoted.*

The design, planning and assessment of the Action has been carried out applying the principles of ESD, through:

- incorporation of risk assessment and analysis at various stages in the detailed design, environmental assessment and decision-making processes;
- adoption of high standards for environmental and workplace health and safety performance;
- consultation with relevant regulatory and community stakeholders; and
- consideration of social and economic benefits to the community arising from the development of the Action.

In addition, it can be demonstrated that the Action can be operated in accordance with ESD principles through the application of mitigation and management measures to minimise environmental impacts of the Action. The following sub-sections describe the consideration and application of the principles of ESD to the Action.

4.2 LONG-TERM AND SHORT-TERM CONSIDERATIONS

The integration of long-term and short-term economic, environmental, social and equitable considerations is recognised as a principle of ESD in section 3A(a) of the EPBC Act.

Assessment of potential short and long-term impacts of the Action have been carried out during the preparation of this assessment on aspects of land, surface water and groundwater, ecology, air quality, noise emissions, water and socio-economics.

The Action also includes offset measures to maintain or improve biodiversity values in the surrounding region in the medium to long-term (Section 2.3).

The assessments undertaken for the Action also included other environmental considerations (Section 2), socio-economic considerations (Section 3) and equity considerations (this section).

4.3 PRECAUTIONARY PRINCIPLE

The precautionary principle (i.e. where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation) is recognised as a principle of ESD in section 3A(b) of the EPBC Act.

Environmental assessment involves predicting what the environmental outcomes of a development are likely to be. The precautionary principle reinforces the need to take risk and uncertainty into account, especially in relation to threats of irreversible environmental damage.

A range of mitigation measures have been adopted as components of the Action design to minimise the potential for serious impacts to the environment, including the continuation of environmental management and monitoring programmes and compensatory measures.

Minimal uncertainty regarding the information used in these specialist assessments is expected given:

- the number of site-based surveys and assessments conducted at the Middlemount Coal Mine, surrounding offset areas and for the Action;
- the comprehensive nature of the assessments; and
- the consultation process conducted with key stakeholders (Section 3.2).

4.4 SOCIAL EQUITY

Social equity is defined by inter-generational and intra-generational equity. Inter-generational equity is the concept that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations, while intra-generational equity is applied within the same generation.

The principles of social equity are addressed through:

- assessment of the social and economic impacts of the Action, including the distribution of impacts between stakeholders (Section 3);
- management measures to be implemented in relation to the potential impacts of the Action on ecology (Section 2);
- implementation of environmental management and monitoring programmes (Section 2) to minimise potential environmental impacts (which include environmental management and monitoring programmes covering the life of the Action); and
- implementation of compensatory measures over the life of the Action to compensate for potential localised impacts that have been identified for the development, such as the offset strategy described in Section 2.3.

In addition, the Action would benefit current and future generations through the maintenance of employment. It would also provide continued significant stimulus to local and regional economies, thus contributing to future generations through social welfare, amenity and infrastructure.

4.5 CONSERVATION OF BIOLOGICAL DIVERSITY AND ECOLOGICAL INTEGRITY

The consideration of the conservation of biological diversity and ecological integrity in decision-making is recognised as a principle of ESD in section 3A(d) of the EPBC Act.

Biological diversity or 'biodiversity' is considered to be the number, relative abundance, and genetic diversity of organisms from all habitats (including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are a part) and includes diversity within species and between species as well as diversity of ecosystems (Lindenmayer and Burgman, 2005). For the purposes of this assessment, ecological integrity has been considered in terms of ecological health and ecological values.

Measures to Maintain or Improve the Biodiversity Values of the Surrounding Region

A range of impact avoidance, mitigation and offset measures would be implemented for the Action to maintain or improve the biodiversity values of the surrounding region in the medium to long-term, as described below.

Section 2 summarises a number of measures that would assist in maintaining the biodiversity of the region. A biodiversity offset package has been developed to address the potential residual impacts on biodiversity values associated with the Action, such that biodiversity values of the region are maintained or improved in the medium to long term.

In addition, the disturbance areas associated with the Action would be progressively rehabilitated. The rehabilitation objectives for the existing Middlemount Coal Mine would be applied to the Action, including the following:

- to ensure the final landform is safe to humans and wildlife;
- to ensure the site is non-polluting;
- to ensure the final landform is stable; and
- to ensure the site is able to sustain an agreed post-mining land use.

Rehabilitation of the Action area would commence within two years of the areas becoming available.

Plants would be selected to establish a vegetative cover to prevent erosion and recreate RE 11.5.3 (*Eucalyptus populnea* ± *E. Melanophloia* ± *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces). The proposed final land use of a recreated native ecosystem of RE 11.5.3 would be representative of the existing ecosystem within and adjacent to the Action area.

4.6 VALUATION

The adoption and promotion of improved valuation, pricing and incentive mechanisms is recognised as a principle of ESD in section 3A(e) of the EPBC Act.

One of the common broad underlying goals or concepts of sustainability is economic efficiency, including improved valuation of the environment. Resources should be carefully managed to maximise the welfare of society, both now and for future generations.

In the past, some natural resources have been misconstrued as being free or underpriced, leading to their wasteful use and consequent degradation. Consideration of economic efficiency, with improved valuation of the environment, aims to overcome the underpricing of natural resources and has the effect of integrating economic and environment considerations in decision making, as required by ESD.

While historically, environmental costs have been considered to be external to development costs, improved valuation and pricing methods attempt to internalise environmental costs and include them within development costing. The economic benefit associated with the Action has, where possible, considered the environmental costs (e.g. biodiversity offset costs) associated with the Action.

5 OUTCOMES-BASED CONDITIONS

MCPL is not proposing to pursue outcomes-based conditions for the Action. MCPL is of the understanding that prescriptive conditions or systems-based conditions would be better suited to the Action. As such, this document does not include the information required to allow for the development of outcomes-based conditions. Should outcomes-based conditions be required to be developed for the Action, these would be done in consultation with the Commonwealth DEE.

6 CONCLUSION

Three threatened fauna species listed under the EPBC Act are considered likely to occur within the Action area, namely the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat.

Potential impacts on these MNES as a result of the Action have been investigated within this document, including an assessment of significance for each potentially occurring MNES against the Commonwealth *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*. Mitigation measures to reduce the potential impacts on MNES have been proposed by MCPL, including implementation of a vegetation clearance protocol and weed and feral pest control measures. A biodiversity offset package addressing the potential significant impact on the Squatter Pigeon (southern) has also been proposed by MCPL. In addition, the proposed offset area would provide suitable habitat resources for the Koala and South-eastern Long-eared Bat.

The proposed biodiversity offset package has been developed in accordance with the Commonwealth *EPBC Act Environmental Offsets Policy* (and the *EPBC Act Offsets Assessment Guide*) via a land-based offset which would compensate for the loss of approximately 181 ha of potential habitat for the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat.

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**MIDDLEMOUNT COAL MINE
NORTH-EASTERN EXTENSION (EPBC 2016/7717)
EPBC Act Preliminary Assessment Documentation**

Attachment A

EPBC Act Referral for the
Middlemount Coal Mine North-eastern Extension



Referral of proposed action

Action title: MIDDLEMOUNT COAL NORTH-EASTERN EXTENSION

1 Summary of proposed action

1.1 Short description

Middlemount Coal Pty Ltd (MCPL), an incorporated joint venture between Peabody Energy Australia Pty Ltd and Yancoal Australia Ltd, owns and operates the Middlemount Coal Mine. The Middlemount Coal Mine is an existing open cut coal mine located approximately 7 kilometres (km) to the south-west of the Middlemount township within the Isaac Regional Local Government Area, Queensland (QLD) (Figure 1).

The Middlemount Coal Mine is approved under the QLD *Environment Protection Act, 1994* (EP Act) via Environmental Authority (EA) EPML00716913.

The approved Middlemount Coal Mine is an open cut mining operation extracting run-of-mine (ROM) coal up to 24 hours per day, seven days per week, using a conventional truck and shovel fleet at a rate of up to 5.4 million tonnes per annum (Mtpa). ROM coal is mined in a general west to east direction within Mining Lease (ML) 70379, with overburden and interburden material emplaced in-pit behind the advancing open cut operations, and within the East Dump, located within ML 70417. The general arrangement of the approved Middlemount Coal Mine is presented on Figure 2.

Approvals History

Stage 1 of the Middlemount Coal Mine was initially approved for the production of 1.8 Mtpa of ROM coal, designated under ML 70379, and an amended EA (Mining Activities) Non Code Compliant Level 1 MIN100646307 – Middlemount Coal Mine, effective from 24 November 2009. Stage 1 of the approved Middlemount Coal Mine was subject to a self-assessment under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) and based on advice received in 2007 from the then Commonwealth Department of Environment, Water Heritage and the Arts (now the Commonwealth Department of the Environment [DotE]), Stage 1 was not referred.

The Middlemount Coal Mine EA was amended on 29 June 2012 to approve the expansion of open cut mining operations within ML 70379 and ML 70417 (referred to as “Stage 2” of the Middlemount Coal Mine). The EA was most recently amended on 8 February 2016. Stage 2 of the approved Middlemount Coal Mine was determined to be a Controlled Action on 16 April 2010 (EPBC 2010/5394).

This Referral

MCPL has lodged an amendment application to the Middlemount Coal Mine EA EPML00716913 in accordance with section 224 of the EP Act to approve the extension of the East Dump at the Middlemount Coal Mine (herein referred to as the Middlemount Coal Mine North-eastern Extension Action [the Action]).

This referral under the EPBC Act relates only to the North-eastern Extension Action, including the extension of the approved East Dump beyond part of the eastern extent of ML 70417 (Figure 3).

The Action does not include the approved Middlemount Coal Mine that has either been previously referred and determined to be a Controlled Action or previously determined not to require referral under the EPBC Act but has received all relevant State approvals.

Further clarification of the details of the Action that are the subject of this referral and the aspects of existing operations that are not the subject of this referral are provided in Section 2.1.

1.2 Latitude and longitude

The location points in Table 1 provide the approximate extents of the Action area, as presented on Figure 3.

Table 1
Location of the Action

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
1	-22	48	54	148	39	3
2	-22	48	54	148	39	8
3	-22	49	26	148	39	49
4	-22	49	54	148	40	3
5	-22	49	54	148	39	3

1.3 Locality and property description

The Action is located immediately adjacent to the approved Middlemount Coal Mine, on freehold land owned by MCPL (Lot 3 SP210524), within Mining Lease Application (MLA) 700014. The land within the Action area is currently used for low intensity cattle grazing under an agistment agreement.

Middlemount township is located approximately 2.4 km to the east of the Action, at its nearest point. The Action and the town are separated by Middle Mountain which rises approximately 100 metres (m) above the surrounding landscape (to a height of approximately 280 m Australian Height Datum [AHD]) (Figure 2).

1.4 Size of the development footprint or work area (hectares)	The Action covers an area of approximately 189 hectares (ha). Vegetation clearance associated with the Action is estimated to be approximately 174 ha.
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1.5 Street address of the site	The Middlemount Coal Mine is located along Dysart Middlemount Road.
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1.6 Lot description

The Action would involve development within MLA 700014 (Figure 3), on freehold land owned by MCPL (Lot 3 SP210524). Relevant land tenure information is presented on Figure 4.

1.7 Local Government Area and Council contact (if known)

The Action is located within the Isaac Regional Local Government Area (Figure 1). The Action is not subject to a local government planning approval, however, does require planning approval from the QLD Department of Environment and Heritage Protection (DEHP).

1.8 Time frame

It is anticipated that construction and operational activities associated with the Action would commence as soon as practicable after all necessary consents, approvals and licences for the Action have been obtained.

The Action would be developed in two phases. The south-west quarter of the North-eastern extension would be developed initially (nominally from 2016-2018), with the remainder developed in a second stage some years later (nominally from 2024-2026). It is noted that a number of factors may influence the development of the Middlemount Coal Mine (e.g. coal prices and operating conditions) which would influence the timing of the development of the Action.

1.9 Alternatives to proposed action		No
	✓	Yes, you must also complete section 2.2
1.10 Alternative time frames etc	✓	No
		Yes, you must also complete Section 2.3. For each alternative, location, time frame, or activity identified, you must also complete details in Sections 1.2-1.9, 2.4-2.7 and 3.3 (where relevant).
1.11 State assessment		No
	✓	Yes, you must also complete Section 2.5
1.12 Component of larger action	✓	No
		Yes, you must also complete Section 2.7
1.13 Related actions/proposals		No
	✓	Yes, provide details: The Action is separate from, but related to, the approved Middlemount Coal Mine. The Middlemount Coal Mine is approved under the EP Act via Environmental Authority EPML00716913. Stage 2 of the approved Middlemount Coal Mine was determined to be a Controlled Action on 16 April 2010 (EPBC 2010/5394). Further clarification of the details of the Action that are the subject of this referral and the aspects of existing operations that are not the subject of this referral are provided in Section 2.1.
1.14 Australian Government funding	✓	No
		Yes, provide details:
1.15 Great Barrier Reef Marine Park	✓	No
		Yes, you must also complete Section 3.1 (h), 3.2 (e)

2 Detailed description of proposed action

2.1 Description of proposed action

MCPL has identified an opportunity to improve the mining efficiency and rehabilitation outcomes at the approved Middlemount Coal Mine by extending the East Dump beyond part of the eastern extent of ML 70417 (Figure 3). The extension would alleviate the “saw tooth” layout of the currently approved dump (i.e. overburden emplacement) design which would in-turn improve the efficiency of the mine plan and reduce the area of the dump slope that requires rehabilitation.

The Action would involve the extension of the currently approved East Dump beyond part of the eastern extent of ML 70417 (Figure 3), using the same overburden emplacement methodology currently employed at the Middlemount Coal Mine. The Action does not involve any change to the currently approved mining rate, operating hours, open cut footprint, processing rate or workforce.

Vegetation Clearance and Topsoil Stockpiling

Prior to overburden placement, the Action area would be progressively cleared and topsoil would be stripped and stockpiled for use in rehabilitation works. Where topsoil cannot be directly used for progressive rehabilitation it would be stockpiled for use at a later date.

Overburden Removal and Handling

Overburden would be transported from the open cut to the East Dump using the existing Middlemount Coal Mine overburden haul fleet.

The East Dump extension would be constructed to the same height as the currently approved East Dump (i.e. up to 64 m above existing ground level).

Geochemical testwork has found that there is a low to negligible risk of acid mine drainage from overburden at the Middlemount Coal Mine. Notwithstanding, laboratory characterisation of overburden material during operations would be conducted to confirm acid generation potential, consistent with existing operations. Any material that is found to be potentially acid forming will not be used as capping material and would continue to be buried within the overburden dump with material that has a positive acid neutralising capacity (MCPL, 2011).

Water Management

Consistent with the site's existing water management strategy, runoff from undisturbed areas would be diverted around mining activities.

No new sediment dams to those already constructed or approved (as described in MCPL, 2011) are required to manage runoff from the Action, however the increased area of the East Dump (approximately 189 ha) would result in an increased runoff volume of approximately 156 megalitres from the East Dump for the 10 year Average Recurrence Interval (ARI) 24-hour design event, which would report to Sediment Dam 7. The capacity of Sediment Dam 7 would need to be increased by approximately 191 megalitres to manage the additional runoff reporting to it. This would be achieved by excavating the base of Sediment Dam 7 by approximately 2.7 m. A detailed design for the works to increase Sediment Dam 7 would be prepared by a suitably qualified person.

Runoff from the Action area would report to Sediment Dam 7 via a new drainage channel, constructed in accordance with the Erosion and Sediment Control Plan (ESCP) to provide effective separation of clean and sediment laden water for a 100 year ARI 24-hour design event.

The overburden dump design incorporates water management principles including contour banks and rock lined drains. Rehabilitation of the overburden dump will include measures to minimise erosion, including compost blankets, gravel/rock application, mulching and revegetation. Overburden dumps would be rehabilitated to control drainage, including the use of rock lined drains to reduce sediment load where required.

Rehabilitation and Post-Mining Land Use

The rehabilitation objectives for the existing Middlemount Coal Mine would be applied to the Action, including the following:

- to ensure the final landform is safe to humans and wildlife;
- to ensure the site is non-polluting;
- to ensure the final landform is stable; and
- to ensure the site is able to sustain an agreed post-mining land use.

The Action would be rehabilitated consistent with the existing rehabilitation landform design criteria and post mining land use described in the EA.

2.2 Alternatives to taking the proposed action

Alternatives to the proposed Action including the location and scale have been considered by MCPL, along with the option of not proceeding with the Action. An overview of some considerations is provided below:

- **Action location** – The presence of the existing East Dump, an open cut mining area, the extent of current mining tenements, land tenure and the presence of existing approved offset areas to the west of the Middlemount Coal Action determines the location of the Action.
- **Scale** - The footprint of the Action has been minimised where possible, based on the volume of waste rock required to be emplaced, in consideration of the dump design. A more uniform dump design (i.e. by removing part of the “saw tooth” configuration) will also improve mining efficiency and the overall viability of the Middlemount Coal Mine.
- **No Action** – MCPL has considered not extending the East Dump of the approved Middlemount Coal Mine. However, in the event that the Action is not developed, MCPL would forgo opportunities to improve mining efficiency and rehabilitation outcomes at the Middlemount Coal Mine. The Action would alleviate the “saw tooth” layout of the currently approved dump design which will in-turn improve the efficiency of the mine plan and reduce the area of the dump slope that requires rehabilitation.

2.3 Alternative locations, time frames or activities that form part of the referred action

Alternatives that have been considered for the Action are discussed in Section 2.2. The timing of the Action is dependent on the scheduled development of the open cut.

2.4 Context, planning framework and state/local government requirements

Commonwealth Environment Protection and Biodiversity Conservation Act, 1999

The Action is being referred to the Commonwealth Minister for the Environment for consideration as to whether the Action is a ‘Controlled Action’ and requires approval under the EPBC Act.

QLD Environmental Protection Act, 1994

Approval for the Action is proposed via the EA amendment provisions under Chapter 5, Part 7 of the EP Act.

An EA amendment application was lodged with DEHP on 27 July 2015. DEHP subsequently made its Assessment Level Decision on 7 August 2015 that the proposed amendment is a major amendment requiring public notification. DEHP issued an Information Request on 11 September 2015 to request additional information from MCPL to enable it to make a decision on the application. An Environmental Assessment Report (EAR) was prepared to provide MCPL's response to the Information Request. This EAR is currently on public exhibition.

QLD Mineral Resources Act, 1989

Concurrent to the EA amendment application, MCPL is applying for a Mining Lease for infrastructure across the Action area under the *QLD Mineral Resources Act, 1989* (MR Act). The Action is located within a Restricted Area 384 zone under the MR Act, however the restriction does not apply to infrastructure, including overburden emplacements.

Public notification of the application for a Mining Lease is being conducted at the same time as the public notification for the EA amendment application.

QLD Aboriginal Cultural Heritage Act, 2003

MCPL has approved Cultural Heritage Management Plans (CHMPs) in place with the Barada Barna People and BBKY #4 native title claimants. Management of Aboriginal cultural heritage will continue to be conducted in accordance with the CHMPs.

Other Leases, Licences and Approvals

No further approvals under the *QLD Water Act, 2000*, the *QLD Sustainable Planning Act, 2009* or the *QLD Vegetation Management Act, 1999* are required for the Action.

2.5 Environmental impact assessments under Commonwealth, state or territory legislation

MCPL has lodged an amendment application to the Middlemount Coal Mine EA EPML00716913 in accordance with section 224 of the EP Act to approve the Action. An EAR has been prepared to assess the potential environmental impacts associated with the development of the Action in accordance with the DEHP's Information Request. Tara Smith is the relevant contact officer at the DEHP and the application reference number is EPML00716913.

A description of the public consultation process is provided in Section 2.6 below.

2.6 Public consultation (including with Indigenous stakeholders)

MCPL held a pre-lodgement meeting with DEHP regarding the Action (and the amendment application to EA EPML00716913) on 9 December 2015.

The application is being publically notified in accordance with sections 152(2)(a) and 153 of the EP Act and section 252B of the *QLD Mineral Resources Act, 1989*. As part of this process, MCPL has:

- given written notice (an 'Application Notice') to each owner of land to which the amendment relates (the 'relevant land') and any other land necessary for access to the relevant land;
- given the Application Notice to each holder, or applicant for, an exploration permit or mineral development licence over the relevant land for a mineral other than a mineral to which the proposed amendment relates;
- given the Application Notice to the local government; and
- published the Application Notice in a newspaper circulating in the locality of the Action (in this case, the Central Queensland News).

Consultation with the Barada Barna People and BBKY #4 native title claimants will be conducted in accordance with the requirements of the QLD *Native Title Act, 1993* in relation to Native Title issues. Consultation in relation to Indigenous cultural heritage will be conducted in accordance with the requirements of the QLD *Aboriginal Cultural Heritage Act, 2003*.

2.7 A staged development or component of a larger project

The Action is not a staged development or a component of a larger Action.

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

3.1 (a) World Heritage Properties

Description

No World Heritage Properties are situated in the Action area or surrounds. The closest World Heritage Property to the Action is the Great Barrier Reef, situated, at its closest point, approximately 112 km to the east of the Action (DotE, 2016a).

Nature and extent of likely impact

The Action is unlikely to have an impact on any World Heritage Properties given that there is no real chance or possibility that it will cause:

- one or more of the World Heritage values to be lost;
- one or more of the World Heritage values to be degraded or damaged; or
- one or more of the World Heritage values to be notably altered, modified, obscured or diminished.

As such, the Action would not have, and is not likely to have, a significant impact on the World Heritage values of any World Heritage Properties.

3.1 (b) National Heritage Places

Description

No National Heritage Places are situated in the Action area or surrounds. The closest National Heritage Place to the Action is the Great Barrier Reef, situated, at its closest point, approximately 112 km to the east of the Action (DotE, 2016b).

Nature and extent of likely impact

The Action is unlikely to have an impact on any National Heritage Places given that there is no real chance or possibility that it will cause:

- one or more of the National Heritage values to be lost;
- one or more of the National Heritage values to be degraded or damaged; or
- one or more of the National Heritage values to be notably altered, modified, obscured or diminished.

As such, the Action would not have, and is not likely to have, a significant impact on the National Heritage values of any National Heritage Places.

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

Description

No Ramsar wetlands are situated in the Action area. The closest Ramsar wetland to the Action is the Shoalwater and Corio Bays Area, located approximately 160 km north-east of the Action area on the QLD coastline.

Nature and extent of likely impact

The Shoalwater and Corio Bays Area are situated approximately 160 km north-east of the Action, and it is unlikely that the Shoalwater and Corio Bays Area would be affected by any potential direct or indirect effect of the Action. Secondary effects, such as the Action's contribution to global greenhouse gas emissions, would be relatively small.

The Action would not have a significant impact on the ecological character of the Shoalwater and Corio Bays Area Ramsar site as it would:

- not result in areas of the wetland being destroyed or substantially modified;
 - not result in a substantial and measurable change in the hydrological regime of the wetland;
 - not result in the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected;
 - not result in a substantial and measurable change in the water quality of the wetland; and
 - not result in an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.
-

3.1 (d) Listed threatened species and ecological communities

Description

The Action area and surrounds has been investigated during numerous previous surveys, investigations and assessments, including:

- Ecological Assessment Report for Bingegang Pipeline Relocation (Naturecall, 2014).
- Middlemount Coal Action, Stage 2 Terrestrial Ecological Impact Assessment (Parsons Brinckerhoff, 2010).
- Various monitoring reports and investigations undertaken at the Middlemount Coal Mine.

Threatened Flora Species

Naturecall (2016) conducted detailed flora surveys across the Action area over five days from 12 to 16 October 2015. The surveys aimed to verify and field-validate the type, distribution and remnant status of vegetation communities and regional ecosystems, develop an inventory of flora species present on site, identify and describe any Matters of National Environmental Significance (MNES) and to collect sufficient data to conduct a terrestrial habitat quality assessment. Targeted searches for conservation significant flora were also undertaken.

A list of threatened flora species under the EPBC Act that have the potential to occur in the Action area was generated from database searches (including the EPBC Protected Matters Search Tool) of a 10 x 10 km search area centred on the Action (DotE, 2016c).

King Blue-grass (*Dichanthium queenslandicum*) is the only threatened flora species listed under the EPBC Act which has the potential to occur in the Action area. However, the King Blue-grass was not recorded during the surveys undertaken in the Action area, and has not been recorded during targeted surveys in the immediate surrounds (Parsons Brinckerhoff, 2010). It is further noted that Naturecall (2016) considers that this species is unlikely to occur within the Action area on the basis that no cracking clay soils were identified in the Action area or surrounds and given the highly disturbed nature of the Action area.

Vegetation mapping (i.e. ground-truthed regional ecosystems) within the Action area is presented on Figure 5.

Threatened Fauna Species

Naturecall (2016) conducted detailed fauna surveys across the Action area over five days from 12 to 16 October 2015. The surveys aimed to develop an inventory of fauna species present on site and to identify and describe any MNES. The field surveys were undertaken in accordance with relevant guidelines. General survey techniques included transects, opportunistic records, habitat assessments, spot lighting, call playback, herpetofauna surveys, diurnal bird surveys, passive infrared camera stations, and scat, track and secondary evidence searches. Targeted searches for conservation significant fauna were also undertaken.

A list of threatened fauna species under the EPBC Act that have the potential to occur in the Action area was generated from database searches (including the EPBC Protected Matters Search Tool and the Wildlife Online database) of a 10 x 10 km search area centred on the Action (DotE, 2016c; DEHP, 2016a), and is presented in Table 2 below. No amphibian species listed as threatened under the EPBC Act have the potential to occur within the Action area and surrounds (Table 2).

Table 2
Threatened Fauna Species with Potential to Occur

Species	Status ¹	Source of Record		Distribution/Habitat in relation to the Action ⁴	Likelihood of Occurrence within Action Area and Immediate Surrounds ⁴
		EPBC Protected Matters Search ²	Wildlife Online ³		
Reptiles					
Collared Delma (<i>Delma torquate</i>)	V	●	-	No suitable habitat occurs in the Action area or surrounds (DotE, 2016d).	Unlikely
Ornamental Snake (<i>Denisonia maculate</i>)	V	●	●	Recorded about 4.5km to the south of the Action area, however not found in the Action area during this or previous surveys despite targeted searches. The site does not contain defined habitat requirements for this species such as Brigalow habitats, wetlands and clay soils and has been disturbed as a result of cattle grazing and weed invasion. Suitable habitat does however occur within 1km of the site. Low chance of occurrence.	Low
Yakka Skink (<i>Egernia rugosa</i>)	V	●	-	Action area contains broadly suitable vegetation associations and habitat components for this species however it has not been recorded on MCPL lands during previous surveys. Low chance of occurrence.	Low

Table 2 (Continued)
Threatened Fauna Species with Potential to Occur

Species	Status ¹	Source of Record		Distribution/Habitat in relation to the Action ⁴	Likelihood of Occurrence within Action Area and Immediate Surrounds ⁴
		EPBC Protected Matters Search ²	Wildlife Online ³		
Reptiles (Continued)					
Southern Snapping Turtle, White-throated Snapping Turtle (<i>Elseya albagula</i>)	CE	●	-	No suitable habitat occurs in the Action area or surrounds. Unlikely to occur.	Unlikely
Dunmall's Snake (<i>Furina dunmalli</i>)	V	●	-	No preferred Brigalow habitats for this species occur in the Action area, and the Action area and general area has been highly modified as a result of past and current activities. No local records and not recorded on MCPL lands to date. Unlikely to occur.	Unlikely
Allan's Lerista, Retro Slider (<i>Lerista allanae</i>)	E	●	-	No suitable habitat occurs in the Action area or surrounds. Unlikely to occur.	Unlikely
Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver (<i>Rheodytes leukops</i>)	V	●	-	No suitable habitat occurs in the Action area or surrounds. Unlikely to occur.	Unlikely
Birds					
Red Goshawk (<i>Erythrotriorchis radiates</i>)	V	●	-	Action area and general area comprises low quality foraging habitat due to lack of permanent waterways. No local or regional records. Unlikely to occur.	Unlikely
Squatter Pigeon (southern) (<i>Geophaps scripta scripta</i>)	V	●	-	Not recorded within the Action area despite targeted searches, however has been recorded outside of the Action area during previous surveys. Action area contains potential habitat for this species, however exotic groundcover over most of the Action area is a limitation. High chance of occurrence given suitable habitat within the Action area.	High
Star Finch (eastern), Star Finch (southern) (<i>Neochmia ruficauda ruficauda</i>)	E	●	-	Action area represents poor potential habitat for this species due to lack of permanent water and disturbance history. No local records. Unlikely to occur.	Unlikely
Black-throated Finch (southern) (<i>Poephila cincta cincta</i>)	E	●	-	Action area represents poor potential habitat for this species. No local records and Action area occurs beyond known distribution. Unlikely to occur.	Unlikely
Australian Painted Snipe (<i>Rostratula australis</i>)	E	●	-	No wetlands or waterways occur on Action area, hence this species is unlikely to occur.	Unlikely

Table 2 (Continued)
Threatened Fauna Species with Potential to Occur

Species	Status ¹	Source of Record		Distribution/Habitat in relation to the Action ⁴	Likelihood of Occurrence within Action Area and Immediate Surrounds ⁴
		EPBC Protected Matters Search ²	Wildlife Online ³		
Mammals					
Northern Quoll (<i>Dasyurus hallucatus</i>)	E	●	-	Action area may provide generic foraging and denning habitat, however disturbance history of Action area and general area, presence of feral predators, coupled with lack of records would significantly reduce potential. Unlikely to occur.	Unlikely
Ghost Bat (<i>Macroderma gigas</i>)	V	●	-	Action area may provide suitable habitat (DEHP, 2016b), however there is a lack of records in the vicinity of the Action area and surrounds, and the species was not detected during surveys. Unlikely to occur.	Unlikely
Corben's Long-eared Bat, South-eastern Long-eared Bat (<i>Nyctophilus corbeni</i>)	V	●	-	Action area contains generic foraging habitat as part of the larger area. Not recorded in the locality or during previous surveys on MCPL land. Fair chance of occurrence.	Moderate
Greater Glider (<i>Petauroides volans</i>)	V	●	-	Action area may provide suitable habitat (Threatened Species Scientific Committee, 2016), however there is a lack of records in the vicinity of the Action area and surrounds, and the species was not detected during surveys. Unlikely to occur.	Unlikely
Koala (<i>Phascolarctos cinereus</i>)	V	●	●	Recorded within approximately 5km of the Action area to the south-west by previous surveys. Preferred browse trees are however very rare in the Action area and soils are low nutrient. Further, no evidence of the Koala was recorded during the survey. As such, Koalas are unlikely to occupy the site. The Action area forms part of larger area of habitat hence there is a low chance Koalas moving through the site between preferred habitats or as dispersing males during the breeding season.	Low
Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>)	V	●	-	Action area contains a generic nectar foraging resource, however no potential roosting habitat occurs in the Action area or adjacent. No local records and not recorded on MCPL lands to date. Unlikely to occur.	Unlikely

¹ Conservation Status under the EPBC Act (current as at 20 May 2016). CE – critically endangered, E – endangered, V – vulnerable.

² DotE (2016c).

³ DEHP (2016a).

⁴ Naturecall (2016).

As described in Table 2, a total of 18 species listed under the EPBC Act have been considered for their potential to occur within the Action area or surrounds. The habitat requirements for each of the fauna species listed in Table 2 were reviewed using species profiles provided on the DEHP and DotE websites, and other material referenced in Table 2. This information was compared with the habitats identified within the Action area by contemporary surveys and an assessment was made of the likelihood of suitable habitat for each species being present. Threatened species whose habitats do not occur within the Action area are considered to have an 'unlikely' likelihood of occurrence (Naturecall, 2016).

The habitat filtering identified three EPBC Act listed species that are considered to have a low likelihood of occurring with the Action area (Table 2), Ornamental Snake (*Denisonia maculata*), Yakka Skink (*Egernia rugosa*) and Koala (*Phascolarctos cinereus*). One EPBC Act listed species is considered to have a moderate likelihood of occurring within the Action area (Table 2), Corben's Long-eared Bat (*Nyctophilus corbeni*). One EPBC Act listed species is considered to have a high likelihood of occurring within the Action area (Table 2), Squatter Pigeon (southern) (*Geophaps scripta scripta*).

These five species (along with all the other species) were specifically targeted during the field surveys conducted in the Action area. No EPBC Act listed threatened species were recorded during the 2015 surveys in the Action area (Naturecall, 2016). Further details on the Squatter Pigeon (southern), which is considered to have a high potential for occurring in the Action area, are provided below.

Squatter Pigeon (Southern)

The Squatter Pigeon (southern) has not been recorded in Action area or immediate surrounds, however it has also been conservatively assumed that there is a high chance of the species would use the habitat in the Action area from time to time given the species has been recorded in the wider landscape.

The Squatter Pigeon (southern) has a known distribution extending from the Burdekin-Lynd divide in Central QLD, west to Hughenden, Longreach and Charleville, east to the coastline between Townsville and Port Curtis (near Gladstone), south to scattered sites throughout south-eastern QLD and the Border Rivers region of northern NSW (DotE, 2016e).

Natural foraging habitat for the Squatter Pigeon (southern) comprises any remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by Eucalyptus, Corymbia, Acacia or Callitris species, on sandy or gravelly soils, within 3 km of a suitable, permanent or seasonal waterbody (Squatter Pigeon Workshop, 2011). Breeding habitat occurs on stony rises occurring on sandy or gravelly soils, within 1 km of a suitable, permanent waterbody (Squatter Pigeon Workshop, 2011).

Threatened Ecological Communities

Despite targeted searches during the flora survey conducted by Naturecall (2016), no threatened ecological communities were identified within the Action area, and none have been previously identified in the immediate surrounds.

A single regional ecosystem was ground-truthed within the Action area, namely RE 11.5.3 (*Eucalyptus populnea* ± *E. melanophloia* ± *Corymbia clarksoniana* on Cainozoic sand plains and/or remnant surfaces) along with small areas of a sub-type of this community comprising RE 11.5.3b (*E. populnea* woodland on closed depressions in sandplains).

Nature and extent of likely impact

This section assesses the potential impacts on threatened species or threatened ecological communities under the EPBC Act as a result of the Action, and identifies the nature and extent of any likely impacts in accordance with DotE (2013a) EPBC Act Policy Statement – Matters of National Environmental Significance – Significant Impact Guidelines 1.1.

The Action would require clearance of the following regional ecosystems in the approximate areas listed below:

- RE 11.5.3 (*Eucalyptus populnea* ± *E. melanophloia* ± *Corymbia clarksoniana* on Cainozoic sand plains and/or remnant surfaces) – 171 ha.
- RE 11.5.3b (*E. populnea* woodland on closed depressions in sandplains) – 3 ha.

Non-native and non-vegetative areas are excluded from the lists above, including cleared areas, plantings and existing infrastructure.

Threatened Flora Species

The Action is not likely to impact any EPBC Act listed flora species given the absence of records in or near the Action area.

Threatened Fauna Species

Table 3 evaluates the likelihood and nature of impacts of the Action on each individual threatened fauna species described in the above sections.

Table 3
Potential Impacts on Fauna Species and their Habitats

Species	Status ¹	Nature and Extent of Likely Impact ²
Ornamental Snake (<i>Denisonia maculata</i>)	V	Due to the lack of records within the Action area and surrounds, and the abundance of potential habitat surrounding it, it is unlikely that the Action would have a significant impact on this species.
Yakka Skink (<i>Egernia rugosa</i>)	V	Due to the lack of records within the Action area and surrounds, and the abundance of potential habitat surrounding it, it is unlikely that the Action would have a significant impact on this species.
Squatter Pigeon (southern) (<i>Geophaps scripta scripta</i>)	V	Due to the lack of records within the Action area and immediate surrounds, and the abundance of suitable habitat surrounding the Action area, it is unlikely that the Action would have a significant impact on this species. Further details provided below.
Corben's Long-eared Bat, South-eastern Long-eared Bat (<i>Nyctophilus corbeni</i>)	V	Due to the lack of records within the Action area and surrounds, and the abundance of potential habitat surrounding it, it is unlikely that the Action would have a significant impact on this species.
Koala (<i>Phascolarctos cinereus</i>)	V	Due to the lack of records within the Action area and surrounds, and the abundance of potential habitat surrounding it, it is unlikely that the Action would have a significant impact on this species.

¹ Conservation Status under the EPBC Act (current as at 20 May 2016). CE – critically endangered, E – endangered, V – vulnerable.

² Naturecall (2016).

Squatter Pigeon (Southern)

The removal of the potential habitat for the Squatter Pigeon in the Action area is highly unlikely to reduce the availability of habitat for the Squatter Pigeon in the immediate landscape, region or through-out the species range in Australia. This is because:

- Areas of remnant woodland on Land Zones 3, 4, 5, 7 and 10 are abundant in the landscape.
- The Action would result in the clearance of approximately 0.3% of the potential habitat for the Squatter Pigeon in the wider landscape.
- There are 20 records of the Squatter Pigeon in the wider landscape (Figure 6), and none within the Action area, despite targeted searches. The closest record is approximately 1.4 km south-east of the Action area.

- The Action area is approximately 240 km north of Carnarvon Ranges in Central Queensland, and therefore any potential occurrence of the Squatter Pigeon in the proposed extension area is not likely to be part of the sub-populations which are considered to be important sub-populations of the subspecies (DotE, 2016e).

The potential habitat for the Squatter Pigeon in the Action area is not likely to be necessary for the species movement in the immediate landscape, region or through-out the species range in Australia. This is because the potential habitat for the Squatter Pigeon in the Action area is connected to other habitat by potential habitat approximately 0.3 km wide and that connection would still exist after clearance for the Action.

Further, it is noted that the patches of RE 11.5.3b mapped within the Action area are not associated with palustrine wetlands, despite RE 11.5.3b generally being associated with wetlands (according to the Queensland RE database). Naturecall (2016) mapped RE 11.5.3b in Action area in areas of poorly-draining soils (slight clay depressions) and these areas are only capable of holding water for short periods of time after heavy rain (in the wet season). Naturecall (2016) specifically state that no wetlands were identified in the proposed extension area and there is no surface water present which may be used by the Squatter Pigeon.

Other Fauna Species

The Action is not likely to impact any of the other individual fauna species listed in Table 3.

Threatened Ecological Communities

The Action is not likely to impact any EPBC Act listed threatened ecological communities within the Action area or immediate surrounds.

3.1 (e) Listed migratory species

Description

Migratory species are identified as those species which migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations (DotE, 2016f). Table 4 provides a full list of migratory species, listed under the EPBC Act, that have been identified as occurring or having the potential to occur within the Action area and the area surrounding the Action. These were identified by the EPBC Act Protected Matters Search (DotE, 2016c) and recent fauna surveys in the Action area (Naturecall, 2016).

As described in Section 3.1(d) above, the patches of RE 11.5.3b mapped within the Action area are not associated with palustrine wetlands. These areas are only capable of holding water for short periods of time after heavy rain (in the wet season), and there is no surface water present which may be used by migratory species.

Only one migratory species listed under the EPBC Act was recorded within the Action area during the recent survey by Naturecall (2016), namely the Rainbow Bee-eater (*Merops ornatus*) (Table 4) (Figure 5).

Table 4
Migratory Species with Potential to Occur

Species	Status ¹	Source of Record		Distribution/Habitat in relation to the Action ⁴	Likelihood of Occurrence within Action Area and Immediate Surrounds ⁴
		EPBC Protected Matters Search ²	Wildlife Online ³		
Fork-tailed Swift (<i>Apus pacificus</i>)	M	•	-	Fair potential, as transient, between October-April.	Moderate
Oriental Cuckoo, Horsfield's Cuckoo (<i>Cuculus optatus</i>)	M	•	-	Broadly suitable habitat occurs in the Action area. Low chance of occurrence.	Low
Rainbow Bee-eater (<i>Merops ornatus</i>)	M	•	-	Recorded on site during field surveys.	Known to Occur
Black-faced Monarch (<i>Monarcha melanopsis</i>)	M	•	-	Broadly suitable habitat occurs in the Action area. Low chance of occurrence.	Low
Yellow Wagtail (<i>Motacilla flava</i>)	M	•	-	No suitable habitat occurs in the Action area or surrounds. Unlikely to occur.	Unlikely
Satin Flycatcher (<i>Myiagra cyanoleuca</i>)	M	•	-	Broadly suitable habitat occurs in the Action area. Low chance of occurrence.	Low
Rufous Fantail (<i>Rhipidura rufifrons</i>)	M	•	-	No suitable habitat occurs in the Action area or surrounds. Unlikely to occur.	Unlikely
Great Egret, White Egret (<i>Ardea alba</i>)	M	•	-	No suitable habitat occurs in the Action area or surrounds. Unlikely to occur.	Unlikely
Cattle Egret (<i>Ardea ibis</i>)	M	•	-	Suitable habitat occurs in the Action area and surrounds. Moderate chance of occurrence.	Moderate
Latham's Snipe, Japanese Snipe (<i>Gallinago hardwickii</i>)	M	•	-	No suitable habitat occurs in the Action area or surrounds. Unlikely to occur.	Unlikely
Osprey (<i>Pandion haliaetus</i>)	M	•	-	No suitable habitat occurs in the Action area or surrounds. Unlikely to occur.	Unlikely

¹ Conservation Status under the EPBC Act (current as at 20 May 2016). M - migratory.

² DoE (2016c).

³ DEHP (2016a).

⁴ Naturecall (2016).

Nature and extent of likely impact

The Action is not likely to have a significant impact on migratory species listed under the EPBC Act as it is unlikely that the Action would:

- substantially modify, destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

This is because:

- None of the species are considered to be at the limit of their known migratory ranges.
- Each of these species is highly mobile and foraging and territorial ranges far exceed the Action area.
- The Action area is not considered to contain limiting foraging or breeding habitat for these species.
- The Action area does not constitute an area of important habitat for any of these species.

The proposed action is unlikely to disrupt the lifecycle of any of these species.

3.1 (f) Commonwealth marine area

Description

There are no Commonwealth Marine Areas located within the vicinity of the Action. The Commonwealth Marine Area generally stretches from 3 to 200 nautical miles from the Australian coast (DotE, 2016g). As the Action is not situated within a Commonwealth Marine Area, it is not expected to impact marine species within a Commonwealth Marine Area.

Nature and extent of likely impact

The Action is unlikely to have an impact any Commonwealth Marine Areas, and as a result is not expected to impact any marine species within a Commonwealth Marine Area.

3.1 (g) Commonwealth land

Description

The Action would not take place on Commonwealth land and no Commonwealth lands are located in the area surrounding the Action.

Nature and extent of likely impact

The Action would not affect any Commonwealth land.

3.1 (h) The Great Barrier Reef Marine Park

Description

The Action is not located within the Great Barrier Reef Marine Park, or the catchment area of the Great Barrier Reef Marine Park.

Nature and extent of likely impact

The Action would not impact the Great Barrier Reef Marine Park.

3.1 (i) A water resource, in relation to coal seam gas development and large coal mining development

Description

Surface Water

Locally, the Action is located within the Roper Creek catchment, which forms part of the Mackenzie North-western Tributaries sub-catchment, within the Mackenzie River Sub-basin of the greater Fitzroy Basin.

No watercourses or drainage lines are located within the proposed Action area. One drainage line, an unnamed ephemeral tributary of Roper Creek, is located approximately 4 km south-east of the Action. It is poorly defined in some areas upstream of Dysart Middlemount Road, with a channel depth of less than 0.5 m in some locations (WRM Water & Environment [WRM], 2015a). Flow is interrupted at two locations by farm dams and the channel is not apparent on aerial photographs and survey about 185 m upstream of Dysart Middlemount Road. The drainage line reappears at Dysart Middlemount Road where it discharges under the road via several box culverts.

The QLD Department of Natural Resources and Mines (DNRM) confirmed that within ML 70417 (and therefore upstream of ML 70417), this drainage line is not a watercourse, rather a drainage feature defined under the *Water Act, 2000* that facilitates overland flow (DNRM, 2014). Any flow in the drainage feature was determined to be of an insufficient volume to sustain basic ecological processes and maintain biodiversity. Accordingly, no watercourses are located within or adjacent to the Action area.

It is noted that the Queensland Government's Environmentally Sensitive Areas (ESA) Mapping Tool does not map any Category B Environmentally Sensitive Areas along the drainage feature beyond the approved extent of the Middlemount Coal Mine (Middlemount, 2016).

Water quality in the vicinity of the Middlemount Coal Mine is considered to be highly turbid, with moderate and variable electrical conductivity (EC), low nutrient levels and low dissolved oxygen levels at times. The concentrations of some metals are also elevated above the water quality objectives for the area (WRM, 2015b).

Groundwater

Groundwater aquifers in the vicinity of the Action area are present in three general geological units, namely the alluvium (generally <5 m thick), the Tertiary unit and the coal measures. Alluvium is limited to narrow, shallow bands along watercourses, namely Thirteen Mile Gully and Roper Creek and their tributaries. No alluvium is located within the Action area.

Shallow groundwater flow and recharge is expected to be limited by significant clay deposits within the Alluvium and Tertiary units, however sand layers are likely to contain local aquifers, with groundwater considered to be brackish to saline (MCPL, 2011). Similarly, groundwater within the Permian strata is brackish to saline.

Groundwater use in the vicinity of the Action is limited, with the closest landholder bores located to the north of Middlemount township. Low yields and relatively high salinity are reported in nearby registered groundwater bores. A census of nearby landholder bores, the closest being approximately 4 km from the open cut mining extent, generally found that groundwater is used on rare occasions for stock watering. The groundwater level in registered and census bores was found to be approximately 15 to 40 m below ground level (MCPL, 2011).

The Action lies within the "Mackenzie Groundwaters" zone. The following environmental values for groundwater relevant to the Action have been identified:

- Aquatic ecosystems.
- Farm supply/use.
- Stock water.
- Cultural and spiritual values.

As no irrigation, recreation or industrial activities rely on groundwater in the vicinity of the Action, these values are not considered relevant. Similarly, there is no reliance on groundwater in the vicinity of the Action for drinking water, and as such, this is not considered a relevant environmental value.

Nature and extent of likely impact

A Water Management Plan for the Middlemount Coal Mine (WRM, 2015b) has been prepared in accordance with the EA conditions. The Water Management Plan includes a study of potential contaminants, a water balance model, a description of the site water management system, measures to manage and prevent saline and acid rock drainage, contingency procedures for emergencies and a monitoring and review program for the effectiveness of the water management plan. The Water Management Plan would be revised to incorporate the Action.

Surface Water

Surface water runoff from the disturbed Action catchment (i.e. the out-of-pit waste rock emplacement, prior to its rehabilitation) could potentially contain sediments, dissolved solids and salts. This runoff would be managed as sediment laden runoff, in accordance with the ESCP (WRM, 2015c).

Sediment laden runoff may have suspended sediment loads, but is not expected to have high salt loads or other contaminants (e.g. dissolved metals or hydrocarbons) that could adversely affect water quality, because the overburden material has a negligible to low acid forming potential. The dispersive nature of the material would be managed with the erosion and sediment control measures, with less dispersive material used as capping material.

The Action would increase the footprint of the East Dump by approximately 189 ha. Runoff from the Action area would report to Sediment Dam 7 via a new drainage channel, constructed in accordance with the ESCP to provide effective separation of clean and sediment laden water for a 100 year ARI 24-hour design event.

An extensive surface water monitoring network has been established at the Middlemount Coal Mine which includes upstream and downstream monitoring points and monitoring points on all licensed discharge points. Monitoring of water in sediment dams is also conducted. MCPL would continue to monitor surface water in accordance with the Water Management Plan.

With the monitoring, management and mitigation measures detailed above, it is predicted that water discharging from the site would continue to comply with the EA conditions. The monitoring and reporting requirements detailed in the Water Management Site Practice would continue to be implemented to monitor compliance with the EA and allow early identification of potential issues with the site water management systems.

Groundwater

Geochemical assessment (RGS, 2013) of overburden material identified that the majority of coal and mining waste materials are classified as non-acid forming, have excess acid buffering capacity and a high factor of safety with respect to potential for acid generation.

Heavy metal concentrations in all overburden samples tested for the Middlemount Coal Mine Stage 2 Environmental Impact Statement (MCPL, 2011) were below environmental investigation levels. The excavation and dumping of overburden was predicted to have a low risk of producing heavy metal contamination from leachate seepage or surface runoff from the overburden dumps.

The Action would not affect the potential risk of groundwater contamination via seepage at the Middlemount Coal Mine as the excavation and dumping of overburden would continue to have a low risk of producing heavy metal contamination from leachate seepage or surface runoff and no connective aquifers (i.e. Alluvial aquifers) are located in the Action area.

Groundwater monitoring at the locations specified within the EA would continue to be undertaken quarterly by a suitably qualified person in accordance with the methods prescribed in the latest edition of the administering authority's Monitoring and Sampling Manual 2009 (DEHP, 2010).

Groundwater monitoring includes standing water level and water quality of tertiary and alluvial aquifers. Standing water levels would continue to be monitored in coal seam aquifers. The existing management, monitoring and mitigation measures detailed in the Water Management Plan and the Water Management Site Practice would continue to be implemented for the Action to monitor compliance with the existing EA.

Conclusion

Considering the *Significant impact guidelines 1.3: Coal seam gas and large coal mining developments - impacts on water resources* (DotE, 2013b), MCPL considered, that beyond the existing approved impacts associated with the Middlemount Coal Mine, the Action is:

- unlikely to directly or indirectly result in a substantial change in the hydrology of water resources; and
- unlikely to directly or indirectly result in a substantial change in water quality of water resources.

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

3.2 (a)	Is the proposed action a nuclear action?	✓	No
			Yes (provide details below)
If yes, nature & extent of likely impact on the whole environment			
3.2 (b)	Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?	✓	No
			Yes (provide details below)
If yes, nature & extent of likely impact on the whole environment			
3.2 (c)	Is the proposed action to be taken in a Commonwealth marine area?	✓	No
			Yes (provide details below)
If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(f))			
3.2 (d)	Is the proposed action to be taken on Commonwealth land?	✓	No
			Yes (provide details below)
If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(g))			
3.2 (e)	Is the proposed action to be taken in the Great Barrier Reef Marine Park?	✓	No
			Yes (provide details below)
If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))			

3.3 Other important features of the environment

3.3 (a) Flora and fauna

Threatened flora and fauna species that are known to occur or could potentially occur within the Action area are summarised in Section 3.1(d). The general kinds of flora and fauna that occur in the Action area and surrounds are summarised below, as well as a description of the regional and local setting of the Action.

Regional and Local Setting

The Action is located within the Brigalow Belt North Bioregion, in the Isaac-Comet Downs subregion (Naturecall, 2016). The Brigalow Belt North Bioregion covers an area of approximately 59,824 square kilometres (Thackway & Cresswell, 1995) and has been largely cleared for dryland farming, grazing and mining, with remaining vegetation being highly fragmented and primarily limited to linear strips and isolated remnants (Naturecall, 2016).

Flora

Vegetation communities mapped within the Action area are shown on Figure 5.

As detailed in Section 3.1 (d), flora surveys in the Action area and surrounds have been undertaken by Naturecall (2016). During the 2015 surveys by Naturecall, a total of 62 terrestrial flora species were recorded within the Action area, consisting of 54 native species and eight introduced species.

Weed cover was generally low across the Action area with weed presence generally limited to pasture species such as *Cenchrus ciliaris* (Buffel Grass), *Urochloa mosambicensis* (Sabi Grass), *Stylosanthes* sp. and *Opuntia stricta* (Prickly Pear). *Chloris gayana* (Rhodes Grass) and *Heteropogon contortus* (Black Speargrass) and *Cenchrus ciliaris* (Buffel Grass) have also been previously recorded in the Action area and surrounds (Naturecall, 2014).

Fauna

As detailed in Section 3.1 (d), fauna surveys in the Action area and surrounds have been undertaken by Naturecall (2016). A total of 61 fauna species were identified within the Action area comprising 14 bird species, 12 mammal species and eight reptile species. No amphibian species were detected during the field surveys.

A number of pest species were recorded within the Action area, including domestic dog, feral cat, European fox and European rabbit (Naturecall, 2016).

3.3 (b) Hydrology, including water flows

The Action is located within the Roper Creek catchment, which forms part of the Mackenzie North-western Tributaries sub-catchment, within the Mackenzie River Sub-basin of the greater Fitzroy Basin (MCPL, 2016).

The underlying geology of the Action area is comprised of early tertiary mudstone, sandstone, conglomerate, siltstone, oil shale, lignite and basalt.

No watercourses or drainage lines are located within the Action area. One drainage line, an unnamed ephemeral tributary of Roper Creek, is located approximately 500 m east of the Action area. The DNRM confirmed that within ML 70417 (and therefore upstream of ML 70417), this drainage line is not a watercourse, rather a drainage feature defined under the *QLD Water Act 2000* that facilitates overland flow (DNRM, 2014). Any flow in the drainage feature was determined to be of an insufficient volume to sustain basic ecological processes and maintain biodiversity. Accordingly, no watercourses are located within or adjacent to the Action area.

Water resources in proximity to the Action are considered in further detail in Section 3.1(i).

3.3 (c) Soil and Vegetation characteristics

A single regional ecosystem was ground-truthed within the Action area, namely RE 11.5.3 (*Eucalyptus populnea* ± *E. melanophloia* ± *Corymbia clarksoniana* on Cainozoic sand plains and/or remnant surfaces) along with small areas of a sub-type of this community comprising RE 11.5.3b (*E. populnea* woodland on closed depressions in sandplains).

The single regional system (and associated sub-type) recorded within the Action area (i.e. RE 11.5.3/11.5.3b) is not listed as Endangered or Of Concern under the *QLD Vegetation Management Act, 1999*. The field validated regional ecosystem mapping is presented in Figure 5.

The land within the Action area is considered to be agricultural land “Class C”, which represents pasture land (i.e. land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production) (MCPL, 2011). No Strategic Cropping Land is mapped within, or in the vicinity of the Action (DNRM, 2014).

The environmental values relevant to land were identified using the DEHP Guideline *Application Requirements for Activities with Impacts to Land*. The following environmental values for land relevant to the Action have been identified:

- The existing land uses of low intensity cattle grazing on unimproved pasture, remnant and regrowth vegetation and mining and petroleum exploration activities.
- The intrinsic soil health, function and suitability (i.e. the ability for the soil to sustain growth of native vegetation and grasses for cattle grazing).
- The natural interaction of the land with other ecosystems.
- The cultural and spiritual values of the land.
- The qualities of the land that are conducive to human health and well being.
- The qualities of the land that are conducive to protecting the aesthetics of the environment.

3.3 (d) Outstanding natural features

No outstanding natural features have been identified within the Action area, and there are no environmentally sensitive areas within or in close proximity to the Action area.

3.3 (e) Remnant native vegetation

Refer to Sections 3.1(d), 3.3(a) and 3.3(c) above and Figure 5.

3.3 (f) Gradient (or depth range if action is to be taken in a marine area)

The existing land uses within the Action area include low intensity cattle grazing on unimproved pasture, remnant and regrowth vegetation and mining and petroleum exploration activities.

The natural topography within the Action area is relatively flat, with an elevation typically ranging from approximately 160 to 170 m AHD. Approximately 1.5 km to the east of the Action area, Middle Mountain rises to an elevation of approximately 280 m AHD.

3.3 (g) Current state of the environment

The Action is located on freehold land owned by MCPL which is currently used for low intensity cattle grazing under an agistment agreement. Lot 3 on SP210524, within which the Action is located, is listed on the Environmental Management Register as having livestock dips and mine wastes, however an inspection of the land and DEHP records did not identify any potentially contaminated sites such as livestock dips or rubbish dumps.

Introduced fauna species and weed species are discussed in Section 3.3(a).

3.3 (h) Commonwealth Heritage Places or other places recognised as having heritage values

As described in Section 3.1(b), no National Heritage Places are situated within the Action area or immediate surrounds.

3.3 (i) Indigenous heritage values

As described in Section 2.4, MCPL has approved CHMPs in place with the Barada Barna People and BBKY #4 native title claimants.

The plan provides for the engagement of the Indigenous groups prior to the commencement of any disturbance works, which allows for an assessment of the cultural heritage values within the proposed area of disturbance, and for the development of appropriate management strategies.

3.3 (j) Other important or unique values of the environment

No national parks, conservation reserves or wetlands of national significance occur within the Action area or the area surrounding the Action.

3.3 (k) Tenure of the action area (eg freehold, leasehold)

As described in Section 1.6, the Action would involve development within MLA 700014 (Figure 3), on freehold land owned by MCPL (Lot 3 SP210524).

3.3 (l) Existing land/marine uses of area

Existing land uses in the Action area and surrounds are described in Section 3.3(g).

3.3 (m) Any proposed land/marine uses of area

The Action would be rehabilitated consistent with the existing rehabilitation landform design criteria and post mining land use at the Middlemount Coal Mine. As required by the EA, the post mining land use for waste rock emplacements at the Middlemount Coal Mine is a native ecosystem with recreated Regional Ecosystem 11.5.3 (*Eucalyptus populnea* ± *E. Melanophloia* ± *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces).

4 Environmental outcomes

The following environmental outcomes, relevant to Matters of National Environmental Significance, would be achieved as a result of the proposed Action:

- No impacts to the World Heritage values of a declared World Heritage property.
- No impacts to the National Heritage values of a National Heritage Place.
- No impacts to the ecological character of a declared Ramsar wetland.
- No significant impacts to listed threatened species or ecological communities or their habitat.
- No significant impacts to listed migratory species.
- No impacts to the environment in a Commonwealth marine area.
- No impacts to the environment on Commonwealth land.
- No impacts to the Great Barrier Reef Marine Park.
- No significant impacts to a water resource, in relation to coal seam gas development and large coal mining development.

5 Measures to avoid or reduce impacts

Environmental management measures, monitoring programmes and reporting procedures are undertaken at the Middlemount Coal Mine in accordance with the existing Environmental Authority EPML00716913 and the approved environmental management plans.

The approved environmental management plans would be updated to incorporate the Project where necessary.

MCPL does not consider that the Action would have a significant impact on MNES and hence a commonwealth offset under the EPBC Act is not considered to be warranted. Notwithstanding, it is noted that an offset for the Squatter Pigeon (southern) is proposed for the Action under the Queensland *Environmental Offset Act, 2014*. This offset is proposed to be located to the west of the Middlemount Coal Mine, immediately south of the existing approved commonwealth offset areas.

6 Conclusion on the likelihood of significant impacts

6.1 Do you THINK your proposed action is a controlled action?

- | | |
|--|---------------------------|
| ☒ | No, complete section 5.2 |
| ☐ | Yes, complete section 5.3 |

6.2 Proposed action IS NOT a controlled action.

On the basis of the reasons provided in Section 3, the Action is not considered to be a Controlled Action as it is not likely to have a significant impact on:

- the World Heritage values of a declared World Heritage property;
- the National Heritage values of a National Heritage Place;
- the ecological character of a declared Ramsar wetland;
- a listed threatened species, threatened ecological community, or their habitat;
- a listed migratory species;
- the environment in a Commonwealth marine area;
- the environment on Commonwealth land;
- the Great Barrier Reef Marine Park; or
- a water resource, in relation to coal seam gas development and large coal mining development.

6.3 Proposed action IS a controlled action

Matters likely to be impacted

☐	World Heritage values (sections 12 and 15A)
☐	National Heritage places (sections 15B and 15C)
☐	Wetlands of international importance (sections 16 and 17B)
☐	Listed threatened species and communities (sections 18 and 18A)
☐	Listed migratory species (sections 20 and 20A)
☐	Protection of the environment from nuclear actions (sections 21 and 22A)
☐	Commonwealth marine environment (sections 23 and 24A)
☐	Great Barrier Reef Marine Park (sections 24B and 24C)
☐	A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E)
☐	Protection of the environment from actions involving Commonwealth land (sections 26 and 27A)
☐	Protection of the environment from Commonwealth actions (section 28)
☐	Commonwealth Heritage places overseas (sections 27B and 27C)

7 Environmental record of the responsible party

	Yes	No
7.1 Does the party taking the action have a satisfactory record of responsible environmental management? Provide details MCPL has a strong record of compliance with its environmental obligations under Environmental Authority EPML00716913 (as modified). MCPL has established and is committed to continuing open and constructive dialogue with the local community and stakeholders regarding environmental management as part of their operations.	✓	
7.2 Has either (a) the party proposing to take the action, or (b) if a permit has been applied for in relation to the action, the person making the application - ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources? If yes, provide details		✓
7.3 If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework? If yes, provide details of environmental policy and planning framework Our Aim At Middlemount Coal, we are committed to maintaining a sustainable balance between economic development and the protection of the natural environment. Our goal is to not only meet our environmental and cultural heritage obligations, but strive to exceed in all facets, therefore ensuring the protection of our environmental values within the Middlemount Mine as well as our surrounding communities. Our Objectives Our Environment and Cultural Heritage Management System includes but is not limited to: • Planning work activities so as to meet all environmental, sustainability and cultural heritage legislation and guidelines • Operating an environmentally sound and cultural aware business • Reporting and recording environmental practices, including greenhouse gas emissions, as part of our environmental and quality management system • Reviewing and auditing our environmental procedures to enable continual improvement.	✓	

Our Commitment

Middlemount Coal is committed to:

- Comply with legislation concerned with the production, minimisation and disposal of waste and the control of hazardous substances, dust and industrial noise
- Comply with government acts and requirements for the protection of our cultural heritage
- Comply with legislation and regulations concerned with energy efficiency and greenhouse gas emissions
- Act with due regard for the requirements and expectations of our of all our key stakeholders
- Encourage employee education and participation in improving environmental awareness and practice
- Encourage employee education in cultural heritage awareness
- Implement an environmental audit and reporting system, to continually improve our environmental management system
- Minimise waste generation and dispose of waste responsibly
- Identify opportunities to reduce energy use and greenhouse gas emissions and the subsequent implementation of operational changes in response to opportunities that have been identified
- Rehabilitate areas no longer required for mining processes.

A copy of the Middlemount Coal Mine Environment and Cultural Heritage Policy is available on the Middlemount Coal Mine website.

7.4 Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?

Provide name of proposal and EPBC reference number (if known)

Stage 2 of the Middlemount Coal Action was referred to the then Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now DotE) in 2005 and was determined to be a Controlled Action (EPBC 2010/5394).

✓

8 Information sources and attachments

(For the information provided above)

8.1 References

Department of Environment and Heritage Protection (2010) *Monitoring and Sampling Manual 2009*.

Department of Environment and Heritage Protection (2016a) Wildlife Online Extract. Website:
<https://environment.ehp.qld.gov.au/report-request/species-list/>. Report generated 9 May 2016.

Department of Environment and Heritage Protection (2016b) *Ghost Bat*. Website:
http://www.ehp.qld.gov.au/wildlife/animals-az/micro-bats/ghost_bat.html Accessed: May 2016.

Department of the Environment (2013a) *EPBC Act Policy Statement – Matters of National Environmental Significance – Significant Impact Guidelines*.

Department of the Environment (2013b) *Significant impact guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources*. December 2013.

Department of the Environment (2016a) *Australia's World Heritage List*. Website:
<http://www.environment.gov.au/heritage/places/world-heritage-list>. Accessed: May 2016.

Department of the Environment (2016b) *Australia's National Heritage List*. Website:
<https://www.environment.gov.au/heritage/places/national-heritage-list>. Accessed: May 2016.

Department of the Environment (2016c) *EPBC Act Protected Matters Report*. Report created 19 May 2016.

Department of the Environment (2016d) *Delma torquata – Collared Delma*. Website:
http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1656. Accessed: May 2016.

Department of the Environment (2016e) *Geophaps scripta scripta – Squatter Pigeon (southern)*. Website:
http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64440 Accessed: May 2016.

Department of the Environment (2016f) *EPBC Migratory Species Lists*. Website:
<http://www.environment.gov.au/cgi-bin/sprat/public/publicshowmigratory.pl> Accessed: May 2016.

Department of the Environment (2016g) *Commonwealth marine areas*. Website:
<http://www.environment.gov.au/epbc/what-is-protected/commonwealth-marine-areas>. Accessed: May 2016.

Department of Natural Resources and Mines (2014) *Statement of Reasons: Watercourse determination for mining lease for Middlemount Mine*. Unpublished advice to Middlemount Coal Pty Ltd.

Middlemount Coal Pty Ltd (2011) *Middlemount Coal Action Stage 2 Environmental Impact Statement*.

Middlemount Coal Pty Ltd (2013) *Mining By-Products Management Plan*.

Middlemount Coal Pty Ltd (2016) *Middlemount Coal North-eastern Extension Environmental Assessment Report*. April 2016.

Naturecall (2014) *Ecological Assessment Report for Bingegang Pipeline Relocation, Middlemount Coal Mine*. Report prepared for Middlemount Coal Pty Ltd.

Naturecall (2016) *EPBC Act 1999 – MNES Self Assessment, North-eastern Extension, Middlemount Coal Mine, Middlemount*. Report prepared for Middlemount Coal Pty Ltd. April 2016.

Parsons Brinckerhoff (2010) *Middlemount Coal Action, Stage 2 Terrestrial Ecological Impact Assessment*. Report prepared for Middlemount Coal Pty Ltd.

RGS Environmental Pty Ltd (2013) *Middlemount Coal Action Geochemical Assessment of Coal and Mining Waste Materials*. Report prepared for Middlemount Coal Pty Ltd.

Squatter Pigeon Workshop (2011). *Proceedings from the workshop for the Squatter Pigeon (southern)*. 14-15 December 2011. Toowoomba Office of the Queensland Parks and Wildlife Service.

Thackway, R. and Cresswell, I.D. (1995) *An interim biogeographic regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program, Version 4.0*.

Threatened Species Scientific Committee (2016) *Conservation Advice Petauroides volans*.

WRM Water & Environment (2015a) *Middlemount Coal North-eastern Extension Surface Water Assessment*. Report prepared for Middlemount Coal Pty Ltd. December 2015.

WRM Water & Environment (2015b) *Middlemount Coal Mine – Water Management Plan*.

WRM Water & Environment (2015c) *Middlemount Coal Mine – Erosion and Sediment Control Plan*.

8.2 Reliability and date of information

Information in Section 3 was sourced from previous and current surveys/assessments undertaken for the Action and the approved Middlemount Coal Mine. Information in this referral was compiled using assessments current as at May 2016 and included:

- MCPL project team (project information);
- baseline terrestrial flora and fauna surveys;
- database searches within and surrounding the Action area; and
- assessments prepared for the Action including by Naturecall (2016).

Minimal uncertainty regarding the information used in Section 3 is expected given:

- the comprehensive nature of the studies;
- the consultation process undertaken to date with key stakeholders; and
- the mitigation measures incorporated into the Action, including the implementation of an adaptive management approach.

8.3 Attachments

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the project locality (section 1)	✓	Attachment A - Geographic Information System (GIS) data supply guidelines
	GIS file delineating the boundary of the referral area (section 1)		Figure 1 – Regional Location Figure 3 – General Arrangement of the Middlemount Coal Mine Incorporating the Action
	figures, maps or aerial photographs showing the location of the project in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	Figure 1 – Regional Location Figure 2 – Currently Approved Middlemount Coal Mine General Arrangement Figure 3 – General Arrangement of the Middlemount Coal Mine Incorporating the Action Figure 4 – Relevant Land Tenure Information Figure 5 – Ground-truthed Regional Ecosystem Mapping and Recorded EPBC Act Listed Fauna Species in the Action Area Figure 6 – Potential Squatter Pigeon Habitat
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)		
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.6)		
	copies of any flora and fauna investigations and surveys (section 3)		
	technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3 and 4)		
	report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)		

9 Contacts, signatures and declarations

Action title: MIDDLEMOUNT COAL NORTH-EASTERN EXTENSION

9.1 Person proposing to take action

1. Name and Title: Mr Gerrie Jordaan – Chief Executive Officer

2. Organisation: Middlemount Coal Pty Ltd

3. EPBC Referral Number: -

4. ACN / ABN: ABN 49 122 348 412

5. Postal address: Middlemount Coal Pty Ltd, GPO Box 241, Brisbane, QLD 4001

6. Telephone: (07) 3179 2000

7. Email: gjordaan@middlemountcoal.com.au

8. Name of proposed proponent (if not the same person at item 1 above): Middlemount Coal Pty Ltd

9. ACN/ABN of proposed proponent (if not the same person named at item 1 above): -

I qualify for exemption from fees under section 520(4C)(e)(v) of the EPBC Act because I am:

- ☒ an individual; OR
- ☐ a small business entity (within the meaning given by section 328-110 (other than subsection 328-119(4)) of the *Income Tax Assessment Act 1997*); OR

If you are small business entity you must provide the Date/Income Year that you became a small business entity:

I would like to apply for a waiver of full or partial fees under Schedule 1, 5.21A of the EPBC Regulations. Under sub regulation 5.21A(5), you must include information about the applicant (if not you) the grounds on which the waiver is sought and the reasons why it should be made:

Declaration I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct.

I understand that giving false or misleading information is a serious offence.

I agree to be the proponent for this action.

I declare that I am not taking the action on behalf of or for the benefit of any other person or entity.

Signature

Date 31/5/2016

9.2 Person preparing the referral information (if different from 8.1)

Name

Title

Organisation

Organisation name should match entity identified in ABN/ACN search

ACN / ABN (if applicable)

Postal address

Telephone

Email

Declaration

I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct.

I understand that giving false or misleading information is a serious offence.

Signature

Date

REFERRAL CHECKLIST

HAVE YOU:

- ☒ Completed all required sections of the referral form?
- ☒ Included accurate coordinates (to allow the location of the proposed action to be mapped)?
- ☒ Provided a map showing the location and approximate boundaries of the project area?
- ☒ Provided a map/plan showing the location of the action in relation to any matters of NES?
- ☒ Provided a digital file (preferably ArcGIS shapefile, refer to guidelines at [Attachment A](#)) delineating the boundaries of the referral area?
- ☒ Provided complete contact details and signed the form?
- ☒ Provided copies of any documents referenced in the referral form?
- ☒ Ensured that all attachments are less than three megabytes (3mb)?
- ☒ Sent the referral to the Department (electronic and hard copy preferred)?

Geographic Information System (GIS) data supply guidelines

If the area is less than 5 hectares, provide the location as a point layer. If the area greater than 5 hectares, please provide as a polygon layer. If the proposed action is linear (eg. a road or pipeline) please provide a polyline layer.

GIS data needs to be provided to the Department in the following manner:

- Point, Line or Polygon data types: ESRI file geodatabase feature class (preferred) or as an ESRI shapefile (.shp) zipped and attached with appropriate title
- Raster data types: Raw satellite imagery should be supplied in the vendor specific format.
- Actionion as GDA94 coordinate system.

Processed products should be provided as follows:

- For data, uncompressed or lossless compressed formats is required - GeoTIFF or Imagine IMG is the first preference, then JPEG2000 lossless and other simple binary+header formats (ERS, ENVI or BIL).
- For natural/false/pseudo colour RGB imagery:
 - o If the imagery is already mosaiced and is ready for display then lossy compression is suitable (JPEG2000 lossy/ECW/MrSID). Prefer 10% compression, up to 20% is acceptable.
 - o If the imagery requires any sort of processing prior to display (i.e. mosaicing/colour balancing/etc) then an uncompressed or lossless compressed format is required.

Metadata or 'information about data' will be produced for all spatial data and will be compliant with ANZLIC Metadata Profile. (http://www.anzlic.org.au/policies_guidelines#guidelines).

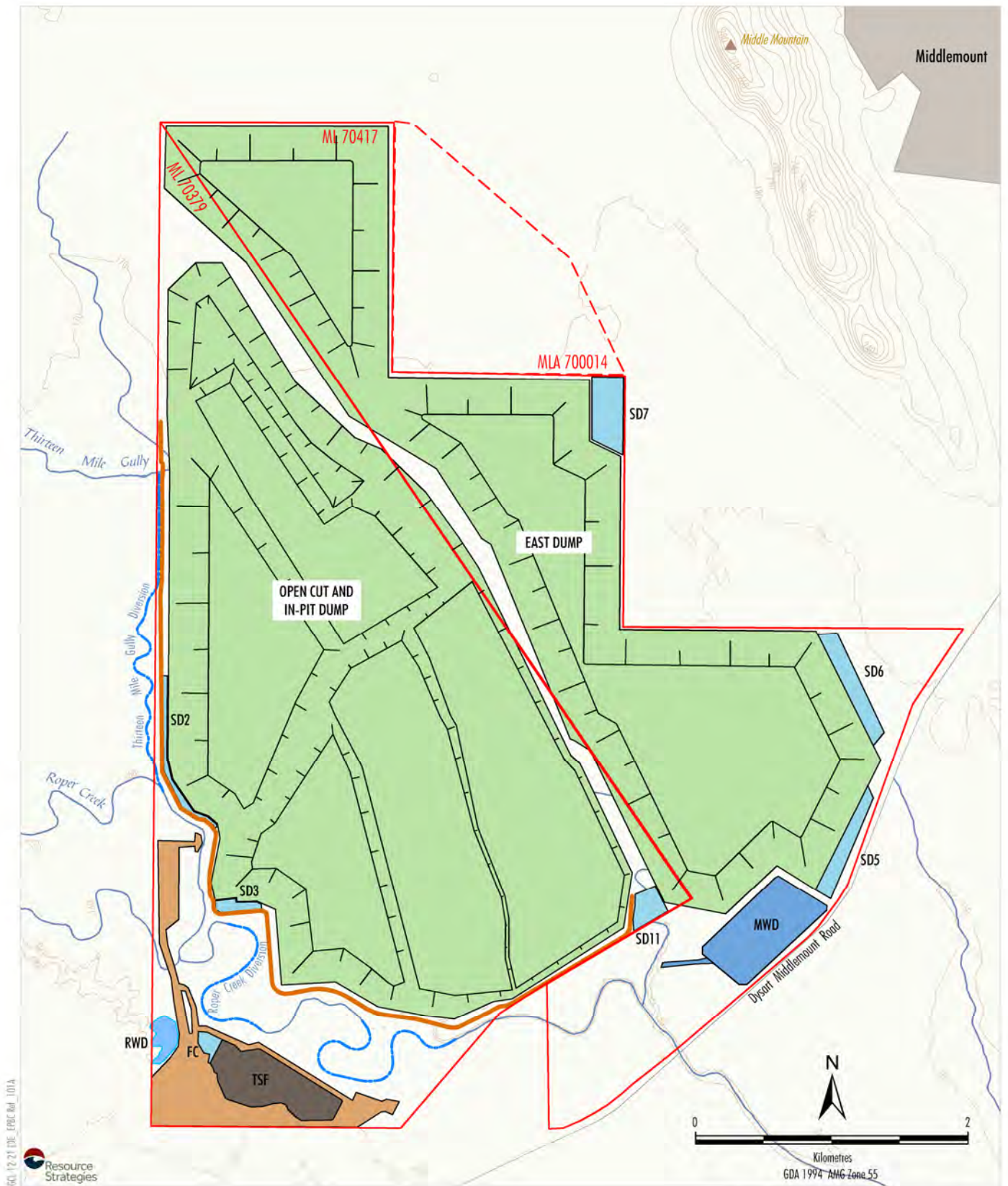
The Department's preferred method is using ANZMet Lite, however the Department's Service Provider may use any compliant system to generate metadata.

All data will be provide under a Creative Commons license (<http://creativecommons.org/licenses/by/3.0/au/>)

FIGURES



Figure 1



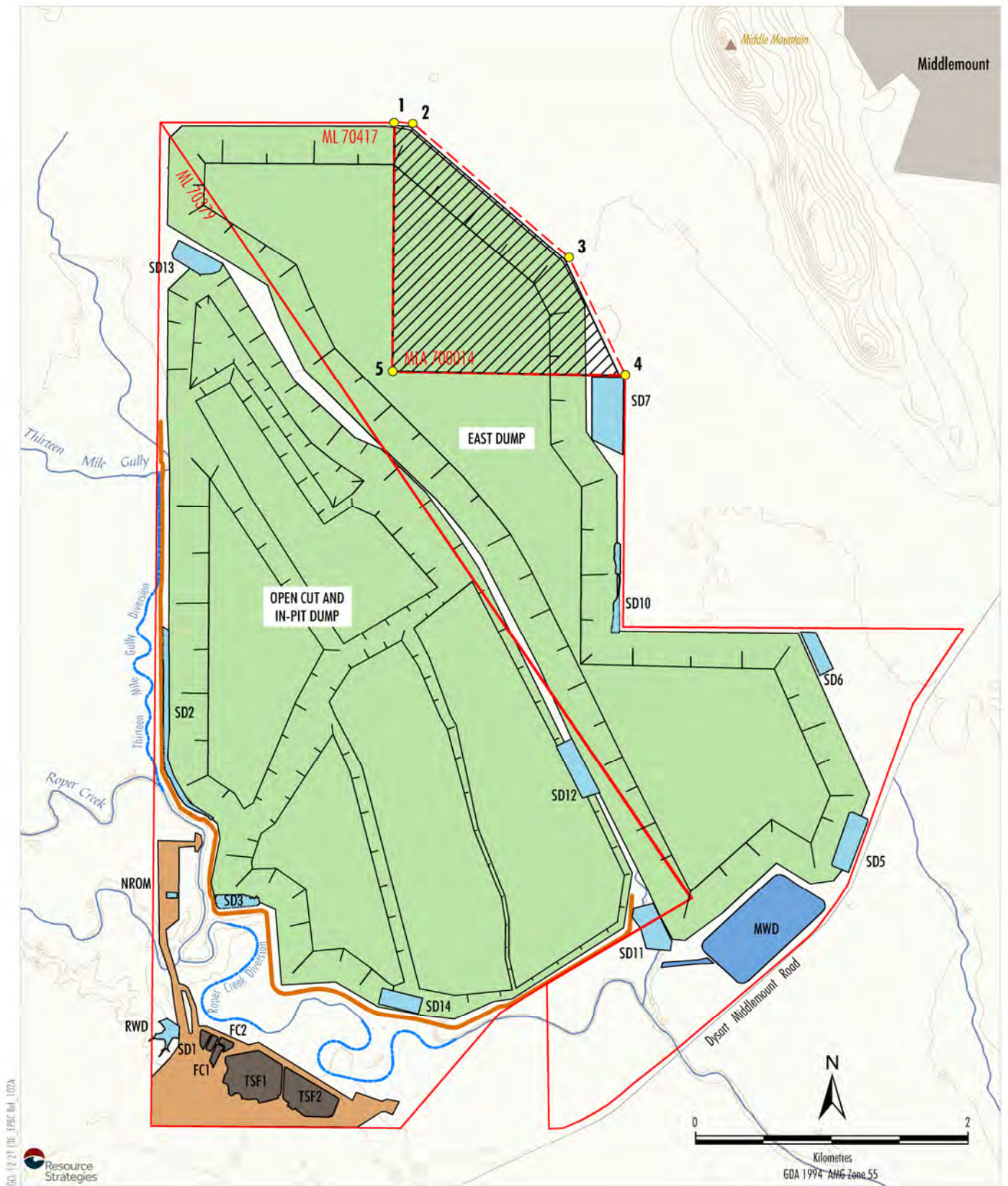
600 12 21 DEC. EPBC Ref. 101A



Source: Environmental Authority EPML00716913 - Middlemount Coal Mine

middlemount coal
NORTH-EASTERN EXTENSION
Middlemount Coal Mine
General Arrangement

Figure 2

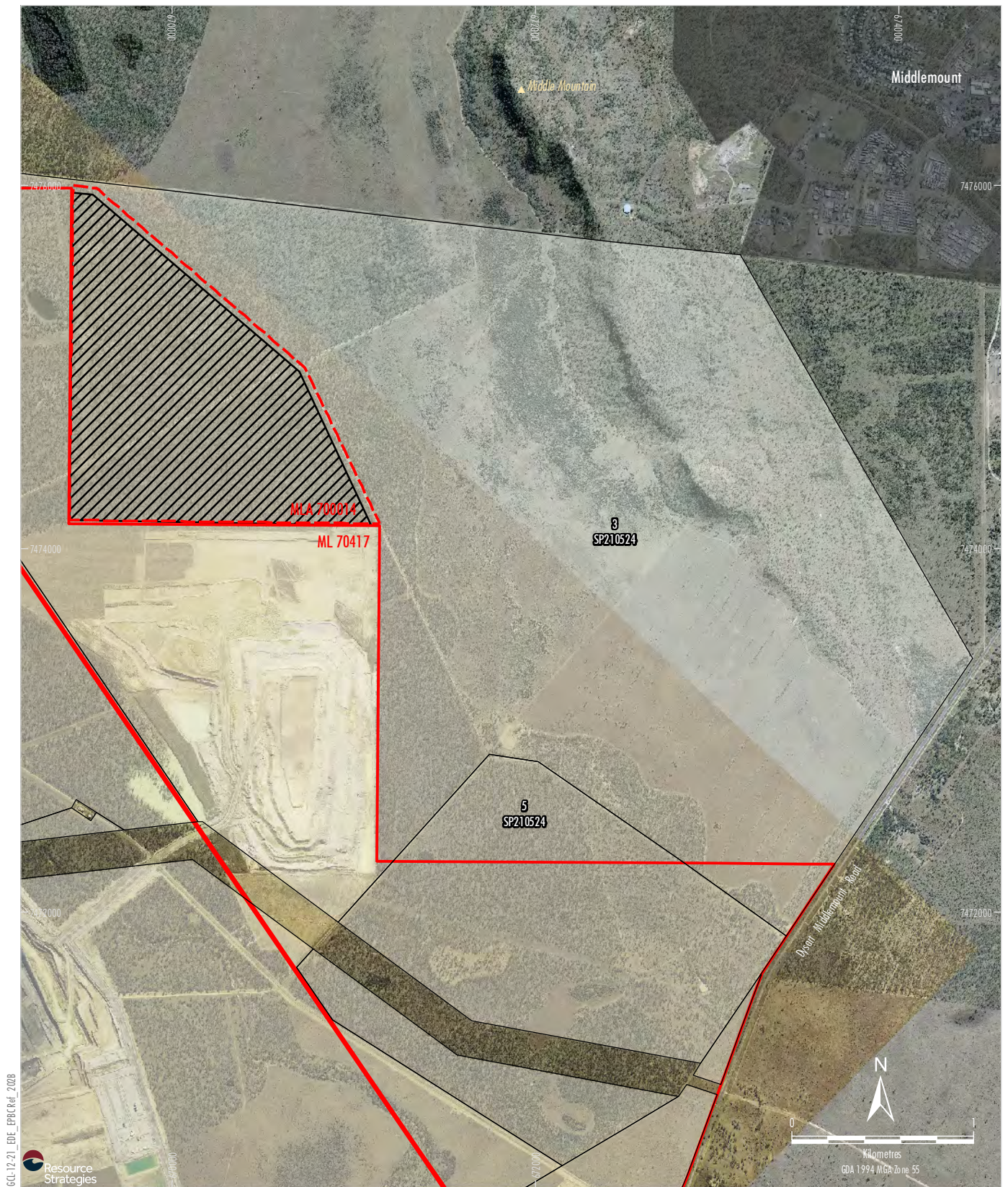


middlemount coal

NORTH-EASTERN EXTENSION

General Arrangement of the
Middlemount Coal Mine
Incorporating the Action

Figure 3



LEGEND

- Mining Lease
- Mining Lease Application Boundary
- MCPL Owned Land
- Approximate Extent of North-eastern Extension (the Action)

Source: MCPL (2016)
Orthophoto: MCPL (2014, 2012)



NORTH-EASTERN EXTENSION Relevant Land Tenure Information

Figure 4



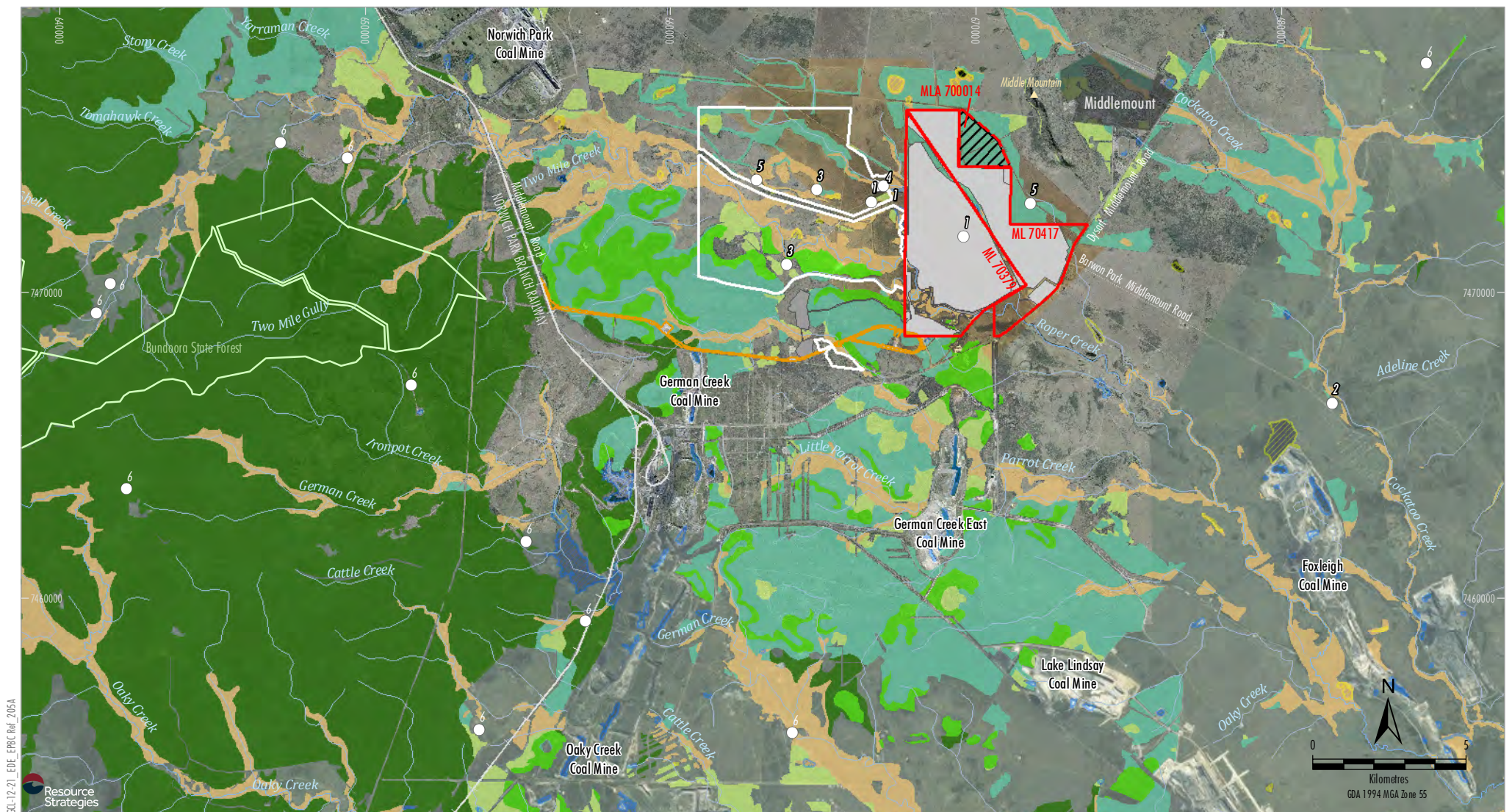
- LEGEND**
- Mining Lease Boundary
 - Mining Lease Application Boundary
 - Approved Disturbance Footprint
 - Approximate Extent of North-eastern Extension (the Action)
 - Regional Ecosystem Mapping
 - 11.5.3 (Of Least Concern)
 - 11.5.3b (Of Least Concern)
 - Recorded Fauna Species
 - △ Rainbow Bee-eater (Migratory)

Source: MCPL (2014); Department of Natural Resources and Mines (2016); Naturecall (2015)
Orthophoto: MCPL (2014, 2012)



NORTH-EASTERN EXTENSION
Ground-truthed Regional Ecosystem Mapping
and Recorded EPBC Act Listed Fauna Species
in the Action Area and Immediate Surrounds

Figure 5



GL-12-21_EDE_EPBC Ref. 2054

- LEGEND**
- Mining Lease
 - Mining Lease Application Boundary
 - Approved Disturbance Footprint
 - Approximate Extent of North-eastern Extension
 - Parrot Quarry
 - Existing Offset Area

- Regional Ecosystem Land Zone**
- 3
 - 4
 - 5
 - 7
 - 10
- Regional Wetland Mapping**
- Lacustrine System
 - Palustrine System

- Squatter Pigeon Record
- Reference:**
- 1 Parsons Brinckerhoff (2009-2010)
 - 2 Ecology and Heritage Partners (2012)
 - 3 Naturecall Environmental (2013)
 - 4 Naturecall Environmental (2014)
 - 5 Atlas of Living Australia (2016)
- Source:** MCPL (2014); Department of Natural Resources and Mines (2015); State of Queensland (Department of National Parks, Sport and Racing) (2016) Department of Environment and Heritage Protection (2016)
- Orthophoto:** MCPL (2014, 2012); Esri Basemap



NORTH-EASTERN EXTENSION

Potential Squatter Pigeon Habitat
and Records in the Surrounding Region

Figure 6

**MIDDLEMOUNT COAL MINE
NORTH-EASTERN EXTENSION (EPBC 2016/7717)
EPBC Act Preliminary Assessment Documentation**

Attachment B

Request for Preliminary Documentation





Australian Government

Department of the Environment and Energy

EPBC Ref: 2016/7717

Mr Gerrie Jordaan
Chief Executive Officer
Middlemount Coal Pty Ltd
GPO Box 241
BRISBANE QLD 4001

Dear Mr Jordaan

**ADDITIONAL INFORMATION REQUIRED FOR PRELIMINARY DOCUMENTATION
MIDDLEMOUNT COAL MINE, NORTH-EASTERN EXTENSION, BOWEN BASIN, QLD
(EPBC 2016/7717)**

I am writing to you in relation to your proposal to extend the existing East Dump (overburden placement) site at Middlemount Coal Mine, 2.4 km west of Middlemount, Queensland.

On 7 July 2016, the Minister's delegate decided that the proposed action is a controlled action and that it will be assessed by preliminary documentation. Further information will be required to assess the relevant impacts of the proposed action.

Details outlining the further information required are at Attachment A.

In the letter of 7 July 2016, you were informed that your project is likely to be suitable for the application of outcomes-based conditions in the event that your action is approved with conditions. The requirements of the Department Outcomes-based conditions Policy 2016 are reflected in Attachment A. You may wish to provide the information in Attachment A and discuss this matter further with the Department if you wish to have outcomes-based conditions fully considered for your proposal.

If you have any questions about the assessment process of the further information required, please contact the project officer, Justin Keast, by email to justin.keast@environment.gov.au, or telephone 02 6275 9953.

Yours sincerely

James Barker
Assistant Secretary
Assessments (Qld, Tas, Vic) and Sea Dumping Branch

28 July 2016

1. Listed Threatened Species and Communities

The Department considers that insufficient details have been provided to determine whether a significant impact is likely to occur upon the following four protected matters:

- a. Koala (*Phascolarctos cinereus*) – vulnerable;
- b. South-eastern long eared bat (*Nyctophilus corbeni*) - vulnerable;
- c. Ghost bat (*Macroderma gigas*) – vulnerable; and
- d. Yakka skink (*Egernia rugosa*) – vulnerable.

Please provide further information regarding survey methods employed and their adequacy in assessing impacts on the above listed matters including, but not limited to:

- a. An explanation about how surveys for koalas were conducted including, but not limited to, methodology used, maps showing transects/trail searched and why those transects were considered to be appropriate;
- a. Justification for figures used in koala assessment table, as per the *Referral Guidelines for the Koala* (2014);
- b. Justification for not returning to conduct bat surveys using working equipment; or
- c. Results of a recent ANABAT survey and/or survey results for nocturnal flying species using mist nets;
- d. Appraisal of habitat appropriateness within the project for each of the above four species; and
- e. Whether based on this new information a significant impact is likely and if so, what offsets are proposed (using the information requested below for the squatter pigeon as a guideline).

Please also provide a more detailed assessment of direct and indirect impacts for the above listed threatened species, including, but not limited to:

- f. a description of proposed avoidance and mitigation measures to deal with any relevant impacts of the action, including mitigation measures proposed to be taken by the Queensland Government and local governments;
- g. assessment of the expected or predicted effectiveness of the avoidance and mitigation measures for each species, including the scale and intensity of impacts of the proposed action and the on-ground benefits to be gained through each of these measures. Where an impact on a species is avoided this should be stated;
 - i. any statutory or policy basis for the mitigation measures;
 - ii. the cost of the mitigation measures.
 - iii. survey effort and methodology;
 - iv. amount and type of habitat to be impacted;
 - v. indirect impacts (for example weed invasion or fragmentation); and
 - vi. maps depicting habitat to be impacted.
- h. Address how the proposed action is not inconsistent with relevant conservation advice, recovery plans and threat abatement plans;

Based on the information provided in the referral and pre-referral, the Department has a view that a significant impact on the vulnerable squatter pigeon (southern)(*Geophaps scripta scripta*) is likely should the project proceed. In the event that impacts upon the squatter pigeon cannot be avoided or mitigated, please provide details for offsets for loss of squatter pigeon habitat, including:

- a. The type of offsets proposed (direct/indirect);

- b. The location (including a geo-referenced map) and suitability of proposed direct offsets for squatter pigeons;
- c. Conservation gain to be achieved by the offset, ie, positive management strategies that will improve the site or avert future loss and degradation or damage to the protected matter;
- d. Current habitat quality scores of the project site and the offset site;
- e. Target habitat quality scores at the proposed offset site;
- f. Time it will take to achieve the proposed conservation gain;
- g. Level of certainty that the proposed offset will be successful;
- h. Current land tenure of any proposed offset and the method of securing enduring protection of the offset site and managing the offset for the life of the impact;
- i. How the proposed offset is consistent with the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (October 2012); and
- j. How the proposed offset will address the relevant conservation advice and threat abatement plans related to the squatter pigeon.

Please note that all figures used to determine the suitability of offsets including habitat quality scores at the project site must be derived using a suitably robust and repeatable framework. Details about each framework must also be provided.

2. Economic and Social Matters

Please provide details on the social and economic costs and/or benefits of undertaking the proposed action, including the:

- a. Basis for any estimations of costs and/or benefits;
- b. Potential employment opportunities expected to be generated during development and operation of the proposed action;
- c. If economic benefits and employment opportunities are in addition to what would have been expected if the action were not to take place; and
- d. Details of any public stakeholder consultation activities, including the outcomes.

3. Ecologically Sustainable Development

Please provide a description of the proposed action in relation the principles of ecologically sustainable development, as defined in section 3A of the EPBC Act.

4. Outcomes Based Conditions

If you wish to pursue outcomes-based conditions in the event that the action is approved with conditions, the preliminary documentation should provide information on the outcomes that will be achieved for matters of national environmental significance.

Outcomes need to be specific, measurable and achievable, and should be based on robust baseline data. Outcomes should be developed in consideration of the *Department's Outcomes-based Conditions Policy* (2016) and *Outcomes-based Conditions Guidance* (2016), with suitable justification for considerations identified in the policy and guidance.

To allow application of the outcomes-based conditions, the preliminary documentation should include:

- a. The specific environmental outcomes to be achieved, and reasoning for these in reference to relevant statutory recovery plans, conservation advices and threat abatement plans.

- b. For each proposed environmental outcome:
 - i. The risks associated with achieving the outcome;
 - ii. The measurability of the outcome, including all suitable performance measures;
 - iii. Appropriate baseline data upon which the outcome has been defined and justified;
 - iv. The likely impacts that the proposed outcome will address;
 - v. Demonstrated willingness and capability of achieving the outcome;
 - vi. The level of knowledge about the protected matter or its surrogate, upon which outcomes were based;
 - vii. Commitments to independent and periodic audits of performance towards achieving outcomes;
 - viii. Assessment of the likely level of control that the proponent will have over achieving the outcome;
 - ix. Discussion of the appropriateness of any surrogates for protected matter outcomes; and
 - x. Details of proposed management measures to achieve the outcome, including, but not limited to performance indicators, periodic milestones, proposed monitoring and adaptive management, and record keeping, publication and reporting procedures.

Once you have provided the Department with the information requested in this letter, you will then be issued with a direction to publish including details on what you are required to publish and for how long.

5. Presentation

Preliminary documentation should be bound in a single volume and must be accompanied by an index identifying what documents are included. Information must be presented using language that is intelligible to the general reader, and accompanied by maps, figures, tables, etc where appropriate.



Mr Gerrie Jordaan
Chief Executive Officer
Middlemount Coal Pty Ltd
GPO Box 241
BRISBANE QLD 4001

Dear Mr Jordaan

ASSESSMENT OF DRAFT PRELIMINARY DOCUMENTATION - MIDDLEMOUNT COAL MINE, NORTH-EASTERN EXTENSION, BOWEN BASIN, QLD (EPBC 2016/7717)

Thank you for submitting the draft preliminary documentation on 5 October 2016 for the above proposal in response to the Department's additional information request dated 28 July 2016.

The Department has reviewed the draft preliminary documentation and considers that it does not meet the requirements of the additional information request. In particular, further information is required regarding offsets for the squatter pigeon (*Geophaps scripta scripta*), survey methods for koalas (*Phascolarctos cinereus*) and potential impacts upon threatened bats within the project site.

I have attached a table at [Appendix A](#) that further describes what information is required. Following submission of the updated draft preliminary documentation, the Department will reassess the information and, if adequate, will issue a direction to publish the document/s for public comment. Please note that as the Stage 2 cost recovery fee has been paid, review of any revised document will commence on submission.

If you have any questions, please contact the project manager, Justin Keast, by phone 02 6275 9953 or by email justin.keast@environment.gov.au for further details.

Yours sincerely

James Barker
Assistant Secretary
Assessments and Sea Dumping Branch

26 October 2016

#	Relevant Matter	Comment
1	Offsets for the squatter pigeon	In order to assess the suitability of the proposed offset, the draft preliminary documentation should include an offset proposal supported by an EBPC Act Environmental Offset Guide, as well as an Offset Management Plan. The information request dated 28 July 2016 outlines what information should be included in these documents and requires that figures quoted in the EBPC Act Environmental Offset Guide must be supported by a robust and repeatable framework. The Queensland Government's 'Guide to determining terrestrial habitat quality (DEHP, 2014)' is an example of an acceptable framework.
2	Koalas	I note that the draft preliminary documentation includes a description of what survey methods were used targeting koalas. However, there is little detail regarding the location of surveys or duration of effort.
3	Threatened bats	The information provided in the draft preliminary documentation provides some discussion regarding the presence or absence of the ghost bat and south-eastern long-eared bat. However, the survey information provided is from 2009 and from an adjacent property. Please provide more recent and site-specific information. While suitable breeding (inferred by the presence of tree hollows), roosting and foraging habitat have been identified for the south-eastern long-eared bat, the documents claim that no habitat critical to the survival of the species exists with the action area. Further information needs to be provided to explain and justify this statement.

MIDDLEMOUNT COAL MINE NORTH-EASTERN EXTENSION (EPBC 2016/7717) EPBC Act Preliminary Assessment Documentation

Attachment C

Middlemount Coal Mine North-eastern Extension
Offset Proposal



MIDDLEMOUNT COAL MINE
NORTH-EASTERN EXTENSION
OFFSET PROPOSAL



DECEMBER 2016
Project No. GCL-12-21
Document No. 00815668

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EXECUTIVE SUMMARY

The Middlemount Coal Mine is an existing open cut coal mine located approximately 7 kilometres to the south-west of the Middlemount township within the Isaac Regional Local Government Area, Queensland.

On 31 May 2016, Middlemount Coal Pty Ltd, an incorporated joint venture between Peabody Energy Australia Pty Ltd and Yancoal Australia Ltd, lodged a referral with the Commonwealth Department of the Environment and Energy for the extension of the currently approved East Dump beyond part of the eastern extent of Mining Lease 70417 (the Action [North-eastern Extension]) using the same overburden emplacement methodology currently employed at the Middlemount Coal Mine.

On 7 July 2016, a delegate of the Commonwealth Minister declared the Action to be a controlled action for the purposes of the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) due to likely impacts on listed threatened species and communities (sections 18 and 18A) which is a controlling provision under Part 3 of the EPBC Act. The delegate of the Commonwealth Minister also determined that the Action is to be assessed by Preliminary Documentation and further information was requested on 29 July and 26 October 2016 pursuant to section 95(A) of the EPBC Act.

The biodiversity offset package has been developed in accordance with the Commonwealth *EPBC Act Environmental Offsets Policy* (and the *EPBC Act Offsets Assessment Guide*) via a land-based offset which would compensate for the loss of approximately 181 hectares of potential habitat for the Squatter Pigeon (southern) (*Geophaps scripta scripta*), Koala (*Phascolarctos cinereus*) and South-eastern Long-eared Bat (*Nyctophilus corbeni*).

1 INTRODUCTION

1.1 BACKGROUND

The Middlemount Coal Mine is an existing open cut coal mine located approximately 7 kilometres (km) to the south-west of the Middlemount township within the Isaac Regional Local Government Area, Queensland (QLD) (Figure 1).

On 31 May 2016, Middlemount Coal Pty Ltd (MCPL), an incorporated joint venture between Peabody Energy Australia Pty Ltd and Yancoal Australia Ltd, lodged a referral with the Commonwealth Department of the Environment and Energy (DEE) for the extension of the currently approved East Dump beyond part of the eastern extent of Mining Lease 70417 (the Action [North-eastern Extension]) using the same overburden emplacement methodology currently employed at the Middlemount Coal Mine.

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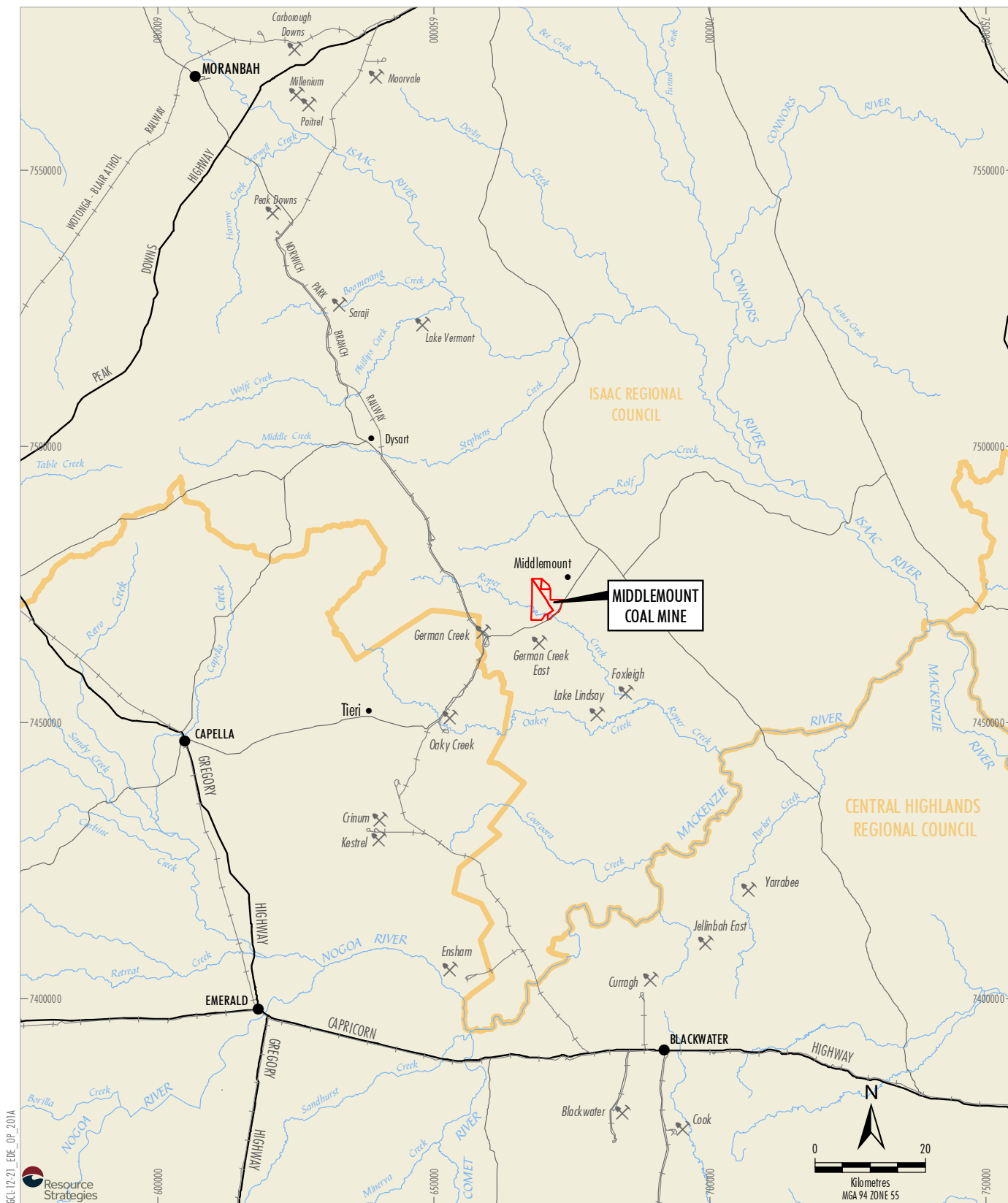
The North-eastern Extension was approved by the QLD Department of Environment and Heritage Protection (DEHP) on 23 September 2016. The general arrangement of the Middlemount Coal Mine is presented on Figure 2, while the general arrangement incorporating the North-eastern Extension (i.e. the Action) is presented on Figure 3.

1.2 OTHER MIDDLEMOUNT COAL MINE OFFSET AREAS

MCPL has existing State and Commonwealth approved offset areas which were established for various components of the Middlemount Coal Mine, including the following:

- Middlemount Coal (Stage 2) Project (EPBC 2010/5394) (Declared Area Map 2013/003919).
- Middlemount Coal Mine Rail Loop and Spur (Declared Area Map 2013/003919).
- Parrot Quarry (Declared Area Map 2013/003919).
- Thirteen Mile Gully Diversion (Declared Area Map 2013/003919).

It is noted that in addition to the above, Condition F30 of Environmental Authority EPML0071693 requires an environmental offset for the prescribed environmental matter “connectivity area” for clearance of Regional Ecosystem (RE) 11.5.3 (Figure 4). The land being proposed for this offset by MCPL is located within the extent of the proposed offset area described in this document for the Squatter Pigeon (Southern) (*Geophaps scripta scripta*). MCPL would seek to secure both offsets under a Voluntary Declaration (VDec) under the *QLD Vegetation Management Act, 1999* (or similar).



LEGEND

 Mining Lease Boundary

 Local Government Area Boundary

 Operating Coal Mine

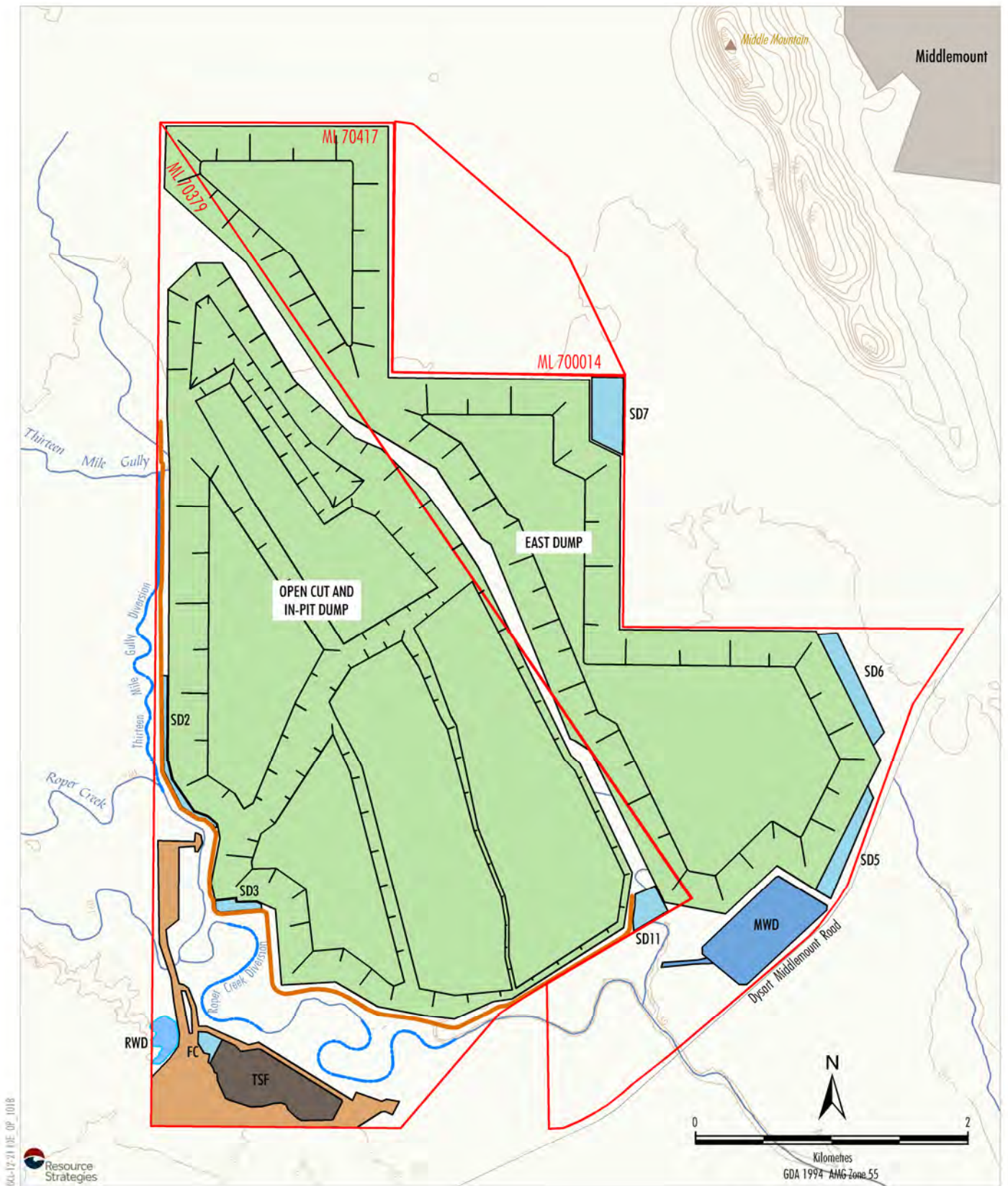
Source: Department of Natural Resource and Mines (2016); Geoscience (2011)



middlemount
coal PTY LTD

NORTH-EASTERN EXTENSION

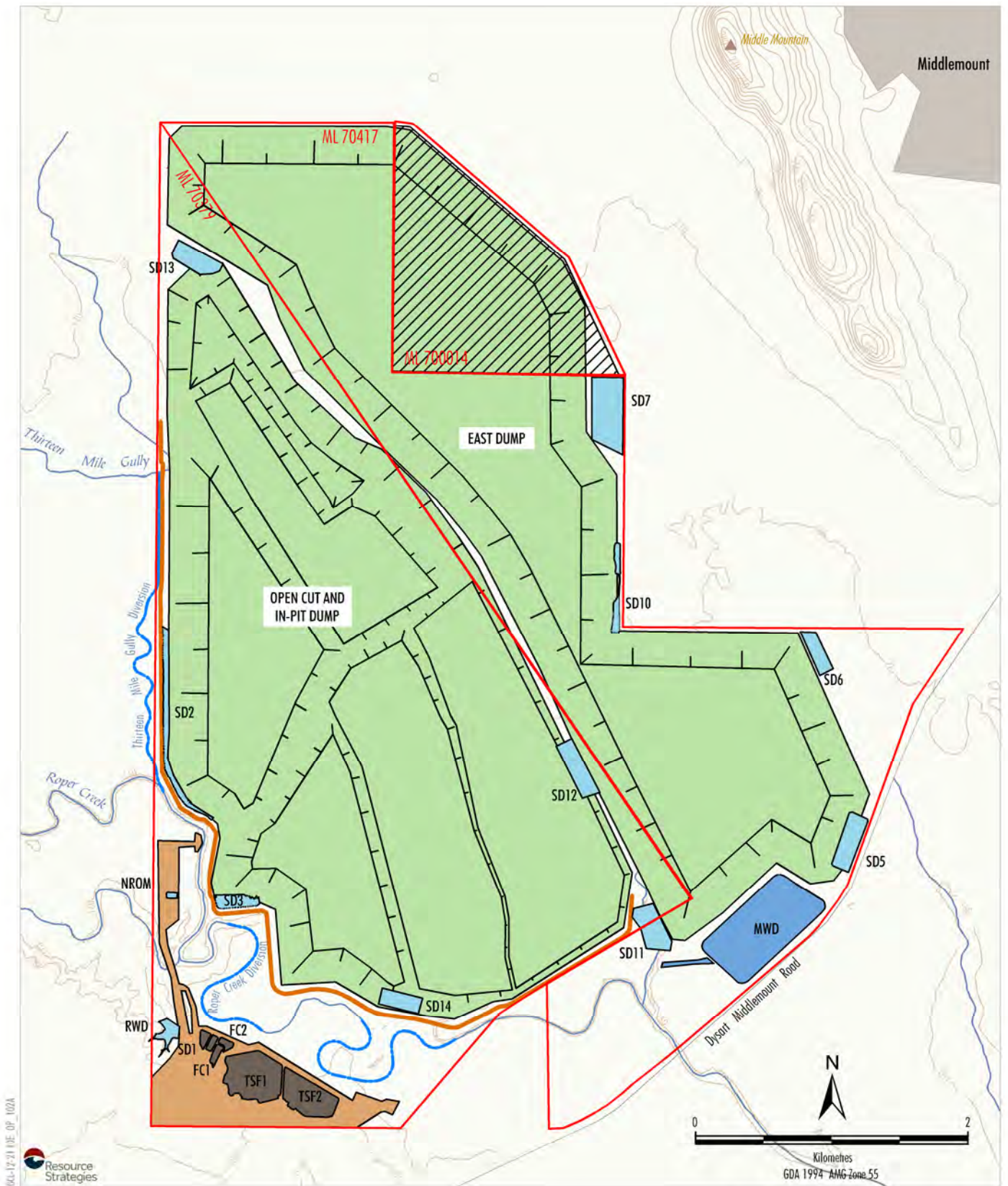
Figure 1



Source: Environmental Authority EPML00716913 - Middlemount Coal Mine

middlemount
coal
NORTH-EASTERN EXTENSION
Middlemount Coal Mine
General Arrangement

Figure 2



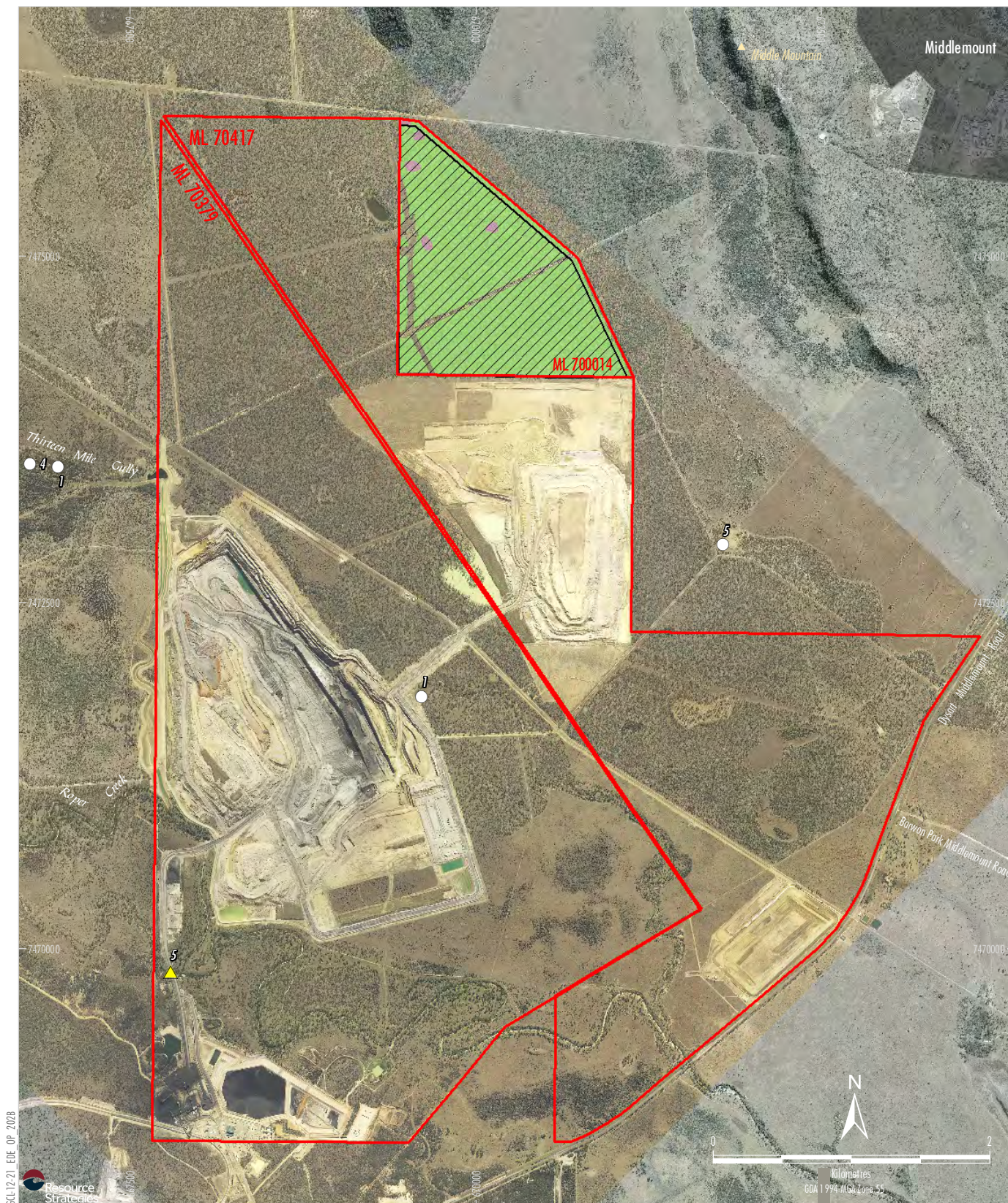
BA-12-21 UE OP 102A



Source: Environmental Authority EPML00716913 - Middlemount Coal Mine

- LEGEND**
- Mining Lease Boundary
 - Approximate Extent of North-eastern Extension (the Action)
 - Mining Pit and Spoil
 - Mine Infrastructure Area
 - Mine Water Dam
 - Sediment Dam
 - Tailings Storage Facility
 - Watercourse
 - Watercourse Diversion
 - Levee
 - Contours


NORTH-EASTERN EXTENSION
 General Arrangement of the
 Middlemount Coal Mine
 Incorporating the Action
Figure 3



- LEGEND**
- Mining Lease Boundary
 - Approximate Extent of North-eastern Extension (the Action)
 - Regional Ecosystem Mapping
 - 11.5.3 (Of Least Concern)
 - 11.5.3b (Of Least Concern)
 - Threatened Species Records
 - ▲ Koala
 - Squatter Pigeon

Reference: 1 Parsons Brinckerhoff (2009-2010)

4 Naturecall Environmental (2013)

5 Naturecall Environmental (2014)

Note: There are no references 2 and 3 on this figure.

Source: MCPL (2014); Department of Natural Resources and Mines (2016); Naturecall (2015)

Orthophoto: MCPL (2014, 2012)



NORTH-EASTERN EXTENSION

Ground-truthed Regional Ecosystem Mapping
and Recorded EPBC Act Listed Fauna Species
in the Action Area and Immediate Surrounds

Figure 4

2 OFFSET PROPOSAL

2.1 RELEVANT MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

A biodiversity offset package addressing the potential significant impact on the Squatter Pigeon (southern) is described in this section. In addition, the proposed offset area would provide suitable habitat resources for the Koala (*Phascolarctos cinereus*) and South-eastern Long-eared Bat (*Nyctophilus corbeni*).

Table 1 identifies the Matters of National Environmental Significance (MNES) relevant to the biodiversity offset package along with the area of potential habitat to be cleared by the Action.

Table 1
MNES Relevant to the Biodiversity Offset Package

Common Name	Scientific Name	Conservation Status under the EPBC Act ¹	Habitat Clearance (ha)
Squatter Pigeon (southern)	<i>Geophaps scripta scripta</i>	V	181
Koala	<i>Phascolarctos cinereus</i>	V	181
South-eastern Long-eared Bat	<i>Nyctophilus corbeni</i>	V	181

¹ Threatened species status under the EPBC Act (current at August 2016).

V – Vulnerable.

ha – hectares.

The biodiversity offset package for the Action is described in the following subsections.

2.2 TYPE OF OFFSET PROPOSED

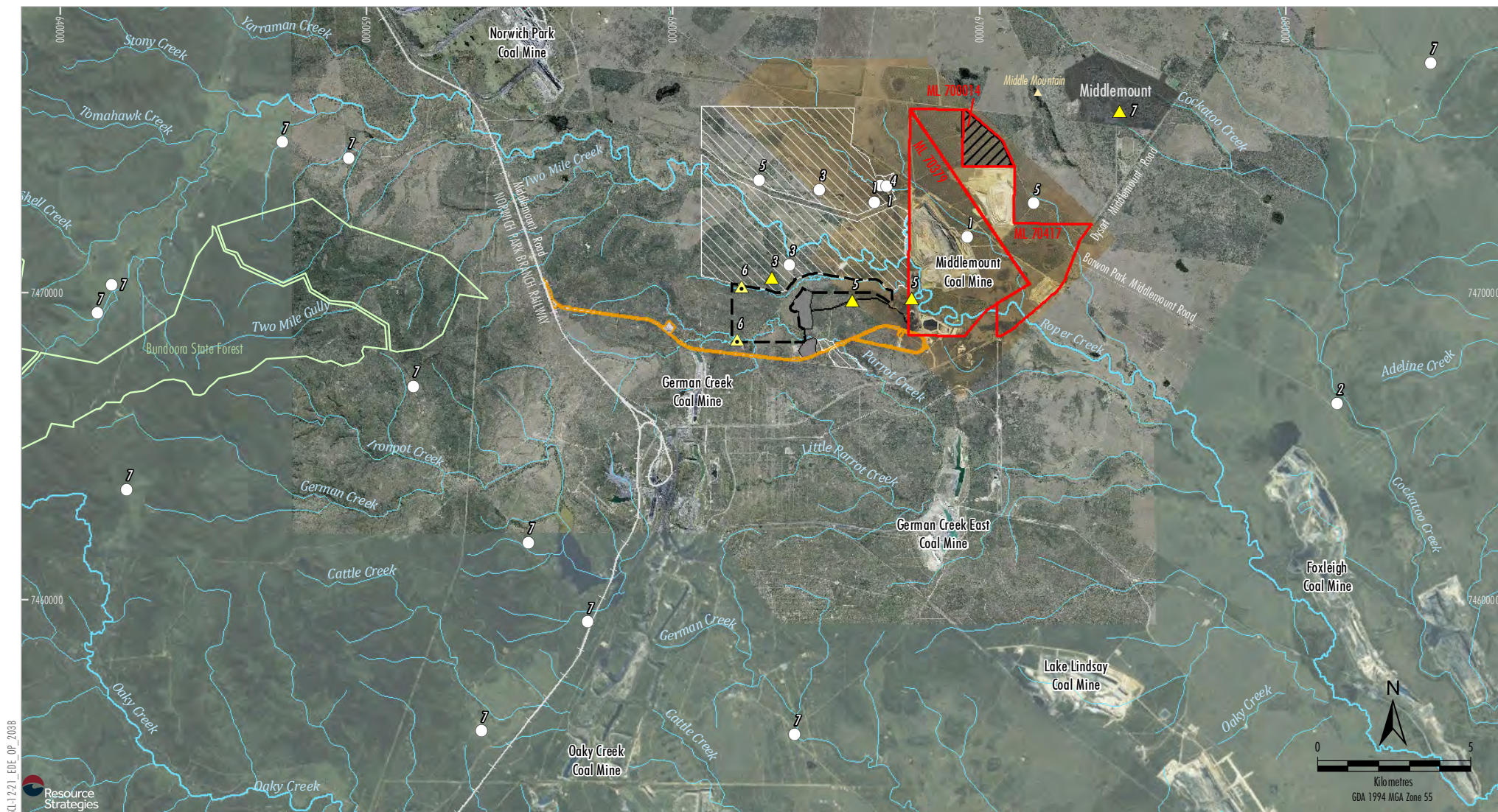
The proposed offset area for the Action is a proponent-driven land-based offset on freehold land owned by MCPL.

2.3 LOCATION AND SUITABILITY OF OFFSET

The proposed offset area is located approximately 7 km south-west of the Middlemount township (Figure 5). It falls within in the Isaac-Comet Downs subregion of the North Brigalow Belt Bioregion, within the Fitzroy catchment and is adjacent to two existing offset areas secured for previous stages of the Middlemount Coal Mine (Figure 5).

The proposed offset area is located on freehold land owned by MCPL (Lot 2, SP248577 – Booroondarra Station). The proposed offset area has a history of clearing and cattle grazing and has been grazed by the Baker family for generations. The property was purchased by MCPL and the Baker family leases the property from MCPL.

The proposed offset area includes a combination of forested/woodland areas along with cleared grazing land. A total of 11 remnant REs have been mapped within the offset area by Naturecall (2016a). These REs are described in Table 2 and are presented on Figure 6.



GLC-1221_EDE_OP_2038



- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Approximate Extent of North-eastern Extension
 - Existing Offset Area
 - Proposed Offset Area
 - Threatened Species Records**
 - ▲ Koala
 - ▲ Koala Scratches/Scats
 - Squatter Pigeon

- Reference:**
- 1 Parsons Brinckerhoff (2009-2010)
 - 2 Ecological (2009-2010)
 - 3 Ecology and Heritage Partners (2012)
 - 4 Naturecall Environmental (2013)
 - 5 Naturecall Environmental (2014)
 - 6 Naturecall Environmental (2016)
 - 7 Atlas of Living Australia (2016)

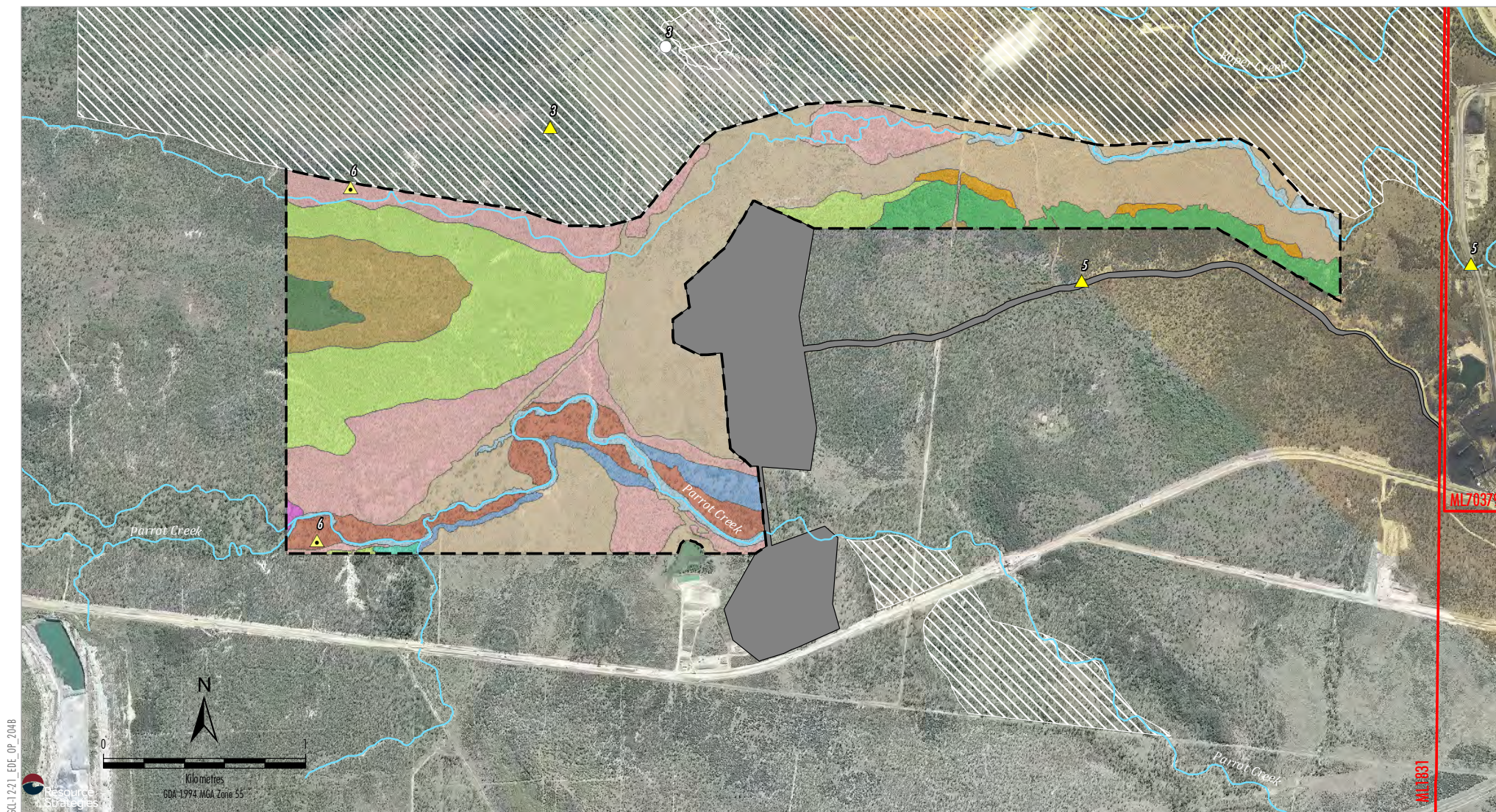
Source: MCPL (2014); Department of Natural Resources and Mines (2016);
State of Queensland (Department of National Parks, Sport and Racing) (2016)
Department of Environment and Heritage Protection (2016)
Orthophoto: MCPL (2014, 2012); Esri Basemap



NORTH-EASTERN EXTENSION

Location of the Proposed Offset Area

Figure 5



GL-1221 EDE DP 2048



GDA 1994 MGA Zone 55

- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Existing Offset Area
 - Proposed Offset Area
 - Threatened Species Records
 - ▲ Koala
 - ▲ Koala Scratches/Scats
 - Squatter Pigeon

Regional Ecosystem Mapping			
	11.3.2		11.5.2a
	11.3.25		11.5.3
	11.3.4		11.5.9
	11.3.4a		11.7.2
	11.4.8		11.7.4
	11.5.18		Non-remnant

Reference: 3 Ecology and Heritage Partners (2012)
 5 Naturecall Environmental (2014)
 6 Naturecall Environmental (2016)

Note: There are no references 1, 2 and 4 on this figure.

Source: Naturecall (2016); MCPL (2014);
 Department of Natural Resources and Mines (2016)
 Orthophoto: MCPL (2014, 2012)



NORTH-EASTERN EXTENSION
 Ground-truthed Regional Ecosystem Mapping and
 Recorded EPBC Act Listed Fauna Species in the
 Proposed Offset Area and Immediate Surrounds

Figure 6

Table 2
Regional Ecosystems Mapped within the Proposed Offset Area

Regional Ecosystem Number	Regional Ecosystem Name	Area Mapped within Proposed Offset Area (ha) ¹
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains.	12.5
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines.	18.5
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains.	28.0
11.3.4a	Floodplain (other than floodplain wetlands). <i>Corymbia tessellaris</i> woodland. On alluvial sand ridges to elevated levees and level terraces adjacent to larger stream channels which are irregularly flooded or possibly relict.	0.5
11.4.8	<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains.	1.0
11.5.18	<i>Micromyrtus capricornia</i> shrubland on Cainozoic sand plains/remnant surfaces.	6.5
11.5.2a	<i>Allocasuarina luehmannii</i> low tree layer with or without emergent woodland.	98.0
11.5.3	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces.	108.0
11.5.9	<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and/or remnant surfaces.	34.5
11.7.2	<i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone.	26.5
11.7.4	<i>Eucalyptus decorticans</i> and/or <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> woodland on Cainozoic lateritic duricrust.	5.0
Total		339
-	Non-remnant Vegetation	193

¹ Refer to Figure 6 for ground-truthed RE mapping within the proposed offset area.

The biodiversity offset package is consistent with the principles of the *EPBC Act Environmental Offsets Policy* (Commonwealth Department of Sustainability, Environment, Water, Population and Communities [SEWPaC], 2012a), and the *EPBC Act Offsets Assessment Guide* (SEWPaC, 2012b) was used to determine the appropriate size of the proposed offset area in order to exceed 100% of the offset requirement (Section 2.7).

The suitability of the proposed offset area for the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat is provided Sections 2.3.1 to 2.3.3 below.

2.3.1 Squatter Pigeon (Southern) (*Geophaps scripta scripta*)

The Squatter Pigeon (southern) was not recorded within the proposed offset area, however it has been previously recorded on a number of occasions in the wider area (Figure 5), and suitable habitat is present. As identified in Naturecall (2016a) a number of habitat attributes which would provide suitable habitat for the Squatter Pigeon (southern) are present within the proposed offset area. These include a number of native grass species, permanent water resources and a mosaic of open sandy areas.

As identified by DEE (2016), the Squatter Pigeon (southern) is known to utilise habitat located on land zones 3, 4, 5 and 7. Within the proposed offset area, this consists of RE 11.3.2, RE 11.3.4, RE 11.3.4a, RE 11.3.25, RE 11.4.8, RE 11.5.2a, RE 11.5.3, RE 11.5.9, RE 11.5.18, RE 11.7.2, RE 11.7.4 equating to approximately 339 ha of potential Squatter Pigeon (southern) habitat.

These REs provide good quality habitat for the Squatter Pigeon (southern) as they contain a number of native grass species which would provide a potential food resource. In addition there are a number of permanent water bodies within the study site which would provide a suitable water source.

2.3.2 Koala (*Phascolarctos cinereus*)

Koala scats were recorded under an Ironbark in the north-west of the proposed offset area in the Eucalypt woodland habitat type (Figure 6). The estimated age of the scat from visual identifiers was 6-8 months old (Naturecall, 2016a). In addition, trunk scratches attributed to the Koala were recorded on a Moreton Bay Ash growing in the riparian habitat near Parrot Creek in the south-west of the offset area (Figure 6).

Koalas have also been recorded on adjacent land to the north by Ecology and Heritage Partners (2012) and adjacent to Parrot Quarry Road by Naturecall (2014) (Figure 6).

Koala food trees (as defined in the *EPBC Act Referral Guidelines for the Vulnerable Koala* [DotE, 2014] and *Nature Conservation [Koala] Conservation Plan 2006 and Management Program 2006 – 2016* [EPA, 2006]) are present within the proposed offset area, in particular Queensland Blue Gum (identified as an important food species for the Koala [Van Dyck and Strahan, 2008; Land for Wildlife, 2014]), Moreton Bay Ash, Poplar Box, Forest Red Gum and Narrow-leaved Ironbark (Naturecall, 2016a).

A large portion of the REs mapped within the proposed offset area would provide potential habitat for the Koala based on the occurrence of potential Koala food trees. This includes RE 11.3.2, RE 11.3.4, RE 11.3.4a, RE 11.3.25, RE 11.4.8, RE 11.5.2a, RE 11.5.3, RE 11.5.9 and RE 11.7.4 equating to approximately 306 ha of potential Koala habitat.

These REs are in good condition, however as described in Naturecall (2016a), there are areas within the proposed offset area that have been subject to thinning and grazing. In addition, the habitat within the proposed offset area would provide beneficial movement corridors (i.e. connectivity) for the Koala throughout the landscape, particularly along Parrot Creek (Naturecall, 2016a).

2.3.3 South-eastern Long-eared Bat (*Nyctophilus corbeni*)

Suitable habitat for the South-eastern Long-eared Bat is present within the proposed offset area. The Eucalypt Woodland, Micromyrtus shrubland and *Acacia harpophylla* woodland/forest all contain hollow-bearing trees which would provide suitable roosting habitat for the South-eastern Long-eared Bat (Naturecall, 2016a). In addition, a number of flora species present would provide suitable habitat for insect species which the South-eastern Long-eared Bat could forage upon.

All of the woodland communities located within the offset area (i.e. approximately 339 ha) would provide suitable foraging and breeding habitat for the South-eastern Long-eared Bat. Tree hollows were identified within the Eucalypt Woodland, Micromyrtus shrubland and *Acacia harpophylla* woodland/forest. In addition, the South-eastern Long-eared Bat could forage over the non-remnant (regrowth/derived grassland) habitat from time to time (Naturecall, 2016a).

2.3.4 Other Values

In addition to the matters described in Sections 2.3.1 to 2.3.3 above, the proposed offset area also contains other values, such as:

- The proposed offset area is an extension of existing offset areas (i.e. for the Middlemount Coal [Stage 2] Project [EPBC 2010/5394], Middlemount Coal Mine Rail Loop and Spur, Parrot Quarry and Thirteen Mile Gully Diversion) thus creating a larger conserved area. The proposed offset area contains a portion of Parrot Creek, as well as several other unnamed creeks and tributaries.
- The proposed offset area contains other conservation significant species (including *Cerbera dumicola*, listed as 'Near Threatened' under the Queensland [QLD] *Nature Conservation Act, 1992*).
- The proposed offset area contains the following conservation significant vegetation communities:
 - Approximately 1 hectare (ha) of Brigalow (*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains) listed as 'Endangered' under the QLD *Vegetation Management Act, 1999* (VM Act) and the EPBC Act.
 - Approximately 12.5 ha of *Eucalyptus populnea* woodland on alluvial plains listed as 'Of Concern' under the VM Act and EPBC Act.
 - Approximately 18.5 ha of *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines listed as 'Of Concern' under the EPBC Act.
 - Approximately 28.5 ha of *Eucalyptus tereticornis* and/or *Eucalyptus spp.* woodland on alluvial plains listed as 'Of Concern' under the VM Act and EPBC Act.
 - Approximately 6.5 ha of *Micromyrtus capricornia* shrubland on Cainozoic sand plains/remnant surfaces listed as 'Of Concern' under the VM Act and EPBC Act.

The non-remnant vegetation areas are included in the proposed offset area as the Environmental Authority amendment for the North-eastern Extension (approved by the DEHP on 23 September 2016) requires an environmental offset for 'connectivity', which must be non-remnant vegetation.

The inclusion of the non-remnant vegetation (regrowth) areas in the offset has the following benefits:

- provides an opportunity to increase the amount of woodland habitat; and
- provides an opportunity to increase the connectivity of existing woodland habitat and habitat features (e.g. Parrot Creek).

2.4 CONSERVATION GAIN

The proposed offset area would result in a net conservation gain for the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat. This conservation gain would be achieved through the implementation of environmental management strategies that would improve the site and avert future loss/degradation to habitat features utilised by each of these MNES.

A key step to achieving this conservation gain would be through an arrangement for the enduring protection and management of the proposed offset area (Section 2.5). Once this arrangement is in place, it is highly unlikely that the habitat features relevant to the Squatter Pigeon (southern), Koala or South-eastern Long-eared Bat would be lost with the proposed offset area.

Consistent with MCPL's existing approved Offset Management Plan/Vegetation Management Plan (MCPL, 2013) for the existing offset areas, a number of measures would be implemented by MCPL to allow for this conservation gain to occur. These measures are summarised in Table 3.

Within the next 20 years, without the proposed offset, it is considered that there is a risk that the ecological values relevant to the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat will be lost.

Table 3
Management Measures to be Implemented in the Proposed Offset Area

Management Measure	Description
Management of livestock in the offset area ¹	Livestock grazing will be strategically used in the proposed offset area. Rotational livestock grazing may be used as a method of managing Buffel Grass and reducing fuel loads in the proposed offset area. It is intended that the regeneration areas progressively change from a grassland dominated system to woodland/forest. Livestock will be excluded from the offset areas once it is no longer required for strategic management of weed species.
Management of weeds	The spread and introduction of weeds/declared plants to and within the proposed offset area would be minimised by restricting vehicles to designated access tracks. The introduction, establishment and spread of non-native weeds will be minimised through regular monitoring and treatment activities.
Control of feral animal populations	Appropriately qualified persons will be engaged to undertake pest animal control. Control measures would consider the relevant guidelines and legislation. Control methods will target feral pigs, wild dogs, European Rabbits, Feral Cats and European Fox.
Setting up the proposed offset area on the ground	After protection of the proposed offset area has been established, the area will be set-up on the ground by: - identifying/establishing fire trails/access tracks required for fire management or other management purposes; - fencing the perimeter of the proposed offset area to manage grazing livestock; - installing locks on gates; and - installing signage along main access roads which recognised that the area is protected for conservation purposes to deter third party access into the area.
Fire management	Fire management activities will be undertaken including identifying/establishing fire trails, consultation with local fire wardens and development of fire awareness and response procedures. Ground fuel loads may be controlled through the strategic rotational grazing of cattle to prevent thick grass biomass from accumulating over time.
Erosion and sediment control	Erosion potential in the proposed offset area will be reduced by grazing management, restricting vehicle access to the proposed offset area and control of animal pests. Selective plantings/direct seeding of local endemic species may be undertaken to stabilise the soil and or the use of surface water management structures.
Restrictions to access	Access into the proposed offset area will be restricted to authorised personnel. Locks will be installed on gates into the proposed offset area. Vehicles will be restricted to designated access tracks.

¹ Naturecall has undertaken monitoring in the existing Middlemount Coal Mine offset areas since 2013 and report (Naturecall, 2016c) "The positive effects of rotational grazing have been noted at the photo monitoring points and Biocondition transects which have shown increases in groundcover density percentages across 8 BioCondition transects (of the 11)".

2.5 LAND TENURE AND PROPOSED OFFSET SECURITY MECHANISM

The proposed offset area is located entirely on freehold land owned by MCPL. The land tenure information is shown on Figure 7.

MCPL would secure the proposed offset area through a legally binding mechanism such as a voluntary declaration of an area of high nature conservation value (VDec) under the *QLD Vegetation Management Act, 1999* or by providing DEHP with a *Request for Environmental Offset Protection Area Declaration* in accordance with section 30 of the *Environmental Offsets Act, 2014*.

2.6 DETAILS OF MONITORING AND AUDITING

A programme will be undertaken to monitor and report the effectiveness of the measures and the performance of the regeneration in the biodiversity offset area, with summary reporting to be carried out annually. The monitoring will be undertaken by a suitably qualified person(s).

2.6.1 Objectives and Desired Outcome (Management Intent)

The desired outcome of the offset area established for the North-eastern Extension is that the extent and condition of the habitat values of threatened species and communities within the offset area are protected and enhanced. The land in the offset area is to be enhanced so that the currently degraded areas reach remnant status through increasing the structural integrity and extent of vegetation in the area. The purpose of the offset area is to offset clearing associated with the North-eastern Extension.

2.6.2 Performance Criteria (Performance Indicators)

The performance of the offset will be monitored against the performance criteria provided in Table 4 for each monitoring period. The performance criteria have been developed to meet the objectives for the offset.. If performance criteria are not being met, the contingency measures will be considered.

Table 4
Performance Criteria

Criteria	Management Type	Timeframe
Enduring protection has been provided for the offset area.	Enduring Protection	June 2017 to June 2018
Operational review of road and fire trail construction has been completed.	Setup	
Additional access tracks have been constructed/repared.	Setup	
Signage of the offset area has been provided.	Setup	
Appropriate fencing of the offset areas has been provided.	Setup	
Excess fencing inside of the offset area has been removed.	Setup	
Gates with locks have been installed to restrict entry into the offset area.	Setup	
Access tracks not necessary for management purposes have been ripped and revegetated.	Setup	
Access tracks across drainage lines in the offset area have been repaired and stabilised.	Setup	
Initial pest animal study has been undertaken.	Management	
Initial mapping of declared weeds and Buffel Grass infestations for management purposes has been undertaken.	Management	
Erosion areas have been identified.	Management	
Monitoring and reporting has been undertaken as per Management Schedule.	Monitoring/Reporting	June 2018 to June 2019
Maintenance of all access tracks, fences and gates have been undertaken as required.	Management	

Table 4 (Continued)
Performance Criteria

Criteria	Management Type	Timeframe
Weed control has been initiated.	Management	
Animal pest control has been initiated.	Management	
Fire management activities have been undertaken as required.	Management	
Restoration thinning has been undertaken if required.	Management	
Monitoring and reporting has been undertaken as per Management Schedule.	Monitoring/Reporting	
Maintenance of all access tracks, fences and gates have been undertaken as required.	Management	Annually from November 2019 until the completion criteria are met.
Weed control has been undertaken as required.	Management	
Animal pest control has been undertaken as required.	Management	
Fire management activities have been undertaken as required.	Management	
Monitoring and reporting has been undertaken as per Management Schedule.	Monitoring/Reporting	

2.6.3 Monitoring Programme

2.6.3.1 Ecological Surveys - Monitoring the Effectiveness of Regeneration in the Offset Area

Monitoring activities are linked to the performance criteria defined in Section 2.6.2. They measure the progression of the offset area towards achieving those outcomes. Monitoring is to be undertaken following the first year of approval of this plan (i.e. assuming approval by 30 June 2017, monitoring would be undertaken before 30 June 2018) and each subsequent year.

Permanent Photo Monitoring

Permanent photo monitoring across representative REs and cleared areas are to be installed within the offset area. Photos will be taken in a consistent direction, location (at global positioning system [GPS] points), height above the ground and time of day. These aspects and the date will be recorded for each photo taken (north, south, east and west). Photos will be taken on a biannual basis, during the wet and dry seasons. After the photographic monitoring event the photos will be compared to the photos from the previous monitoring periods. Natural regeneration of native understorey and overstorey species, the occurrence of habitat complexity (e.g. logs, litter), plant establishment and the status of weeds will all be noted. Aerial photographs may also be used to show enhancement of vegetation connectivity.

Permanent Transect Monitoring

Permanent transect monitoring is to be installed within the offset area across representative REs and cleared areas (i.e. Regeneration Areas). Transect monitoring is to be undertaken within representative areas to assess the effectiveness of restoration and to assess performance, focusing on:

- canopy cover;
- average stem diameter at breast height (DBH) of canopy species (existing trees over 20 centimetres DBH cannot be utilised for this assessment);
- signs of canopy and shrub layer recruitment present outside a minimum 40 m from adjacent vegetation;

- average height (and species composition) of each vegetation stratum;
- native plant species richness for four life-forms (trees, shrubs, grasses, forbs/other);
- native sub-canopy species encountered within one meter of the transect;
- non-native (weed) cover;
- recruitment of woody perennial species; and
- correct labelling with date, location, GPS points for end points of transect and any other observations.

2.6.3.2 Ecological Surveys - Usage of the Offset Area by Fauna

Fauna usage of the offset area will be documented over time. Fauna surveys will be conducted before the second year after approval of this plan and every three years thereafter. The surveys will occur across representative REs and cleared areas (i.e. Regeneration Areas) to assess the success of the offset in providing habitat for a range of vertebrate fauna. The surveys will include an assessment of habitat complexity and species richness and abundance. The monitoring results from each monitoring period are to be compared as part of the reporting.

2.6.3.3 Ecological Surveys - Effectiveness of the Weed Control

Weed control will be undertaken within the offset area. Follow-up inspections will be undertaken to assess the effectiveness of the weed management measures implemented and the requirement for any additional management measures.

2.6.3.4 Ecological Surveys - Effectiveness of the Exotic Animal Control

Pest animal control will be undertaken within the offset area. Monitoring of pest animals is to be undertaken every three years by a suitably qualified practitioner.

2.6.3.5 Visual Inspections

The offset area is to be inspected with relevant comments provided for the following:

- performance of the offset area against performance criteria;
- risks to achieving the management outcomes;
- implementation difficulties;
- weed control success;
- requirements for pest animal control;
- current fire fuel loads and the risk they present to the offset;
- erosion or sedimentation as an impediment to meeting offset area's objectives;
- effectiveness of erosion or sediment control (if used);
- fencing and track maintenance;
- uncontrolled presence of livestock in the offset area;
- illegal access and vandalism;

- effects of flood and fire events if they occur; and
- general notes regarding enhancing success and reducing failure.

2.6.3.6 Assessment of the Requirement for Restoration Thinning

An assessment of the regrowth and the requirement for restoration thinning will be made by a suitably qualified ecologist in the first year and after 3 years. The assessment will consider:

- tree density; and
- species diversity.

If thinning is to occur, secondary suckering will be monitored and controlled.

2.6.3.7 Impacts of Grazing on Management Objectives

In accordance with the DEHP *Vegetation Management Plan Template*, where an offset area contains grazing, monitoring must be undertaken to assess the impacts of grazing on achieving management outcomes. The outcomes of the ecological surveys and visual inspections will be used to assess the impacts of grazing on achieving management outcomes.

2.6.4 Potential Risks and Contingency Measures

Table 5 outlines risks to successful management of the offset area and a description of possible contingency measures that could be implemented to mitigate the risk. Risk management has been built into management specifications, but some unforeseen events may still restrict prescribed management outcomes.

Table 5
Potential Risks and Contingency Measures

Risk	Contingency
Unplanned fires	• The QLD Rural Fire Service will be called for assistance if a significant bushfire was to occur within or move towards the offset area. • Inspect and remedy issues with fences, gates or access.
Inappropriate grazing regimes	• Modify fencing. • Incorporate electric fencing. • Inspect and remedy issues. • Modify rotational grazing regime.
Illegal access and potential vandalism	• Inspect and remedy issues.
Natural regeneration not occurring	• Further active revegetation.
Lock regrowth in Brigalow	• Restoration thinning.
Poor access for management/monitoring	• Wait until access is possible.

2.6.4.1 Active Seeding/Planting

Active seeding/planting is also a contingency measure in the event that natural regeneration is not readily occurring. Active revegetation will be undertaken using appropriate plantings or seeding of local seed sources. The procedure is provided in Table 6.

**Table 6
Revegetation Methods**

Method	Description
Seed Collection	A key aim of seed collection is to collect local provenance seed stock for propagation purposes. Required approvals are identified, sought and obtained from relevant authorities. All seed collection is to be conducted under the framework of the 'Florabank Guidelines'. This includes best practice in collection activities, cleaning, data collection, germination testing and storage.
Site Preparation	Site preparation involves stabilising and preparing the surface of the rehabilitation area so that it can absorb water and nutrients. A large proportion of weeds are also removed during site preparation to allow space for new seedlings and plantings. Weed removal may have to occur more than once to reduce the weed management measures needed during implementation of the revegetation programme.
Revegetation Method	The revegetation method will change site to site depending on the structure and floristic characteristics of each site. A combination of tubestock and seeding may be used, depending on the circumstances.
Timing	Revegetation will be undertaken during suitable climatic conditions, such as during and immediately after sufficient rainfall.

2.6.5 Roles and Responsibilities

MCPL will be responsible for management measures. The MCPL Senior Environmental Advisor (or relevant equivalent) will be responsible for the monitoring, reviewing and implementation of this Offset Management Plan/Vegetation Management Plan. The MCPL Senior Environmental Advisor will be responsible for the implementation of any revisions of this Offset Management Plan/Vegetation Management Plan in consultation with the DEE.

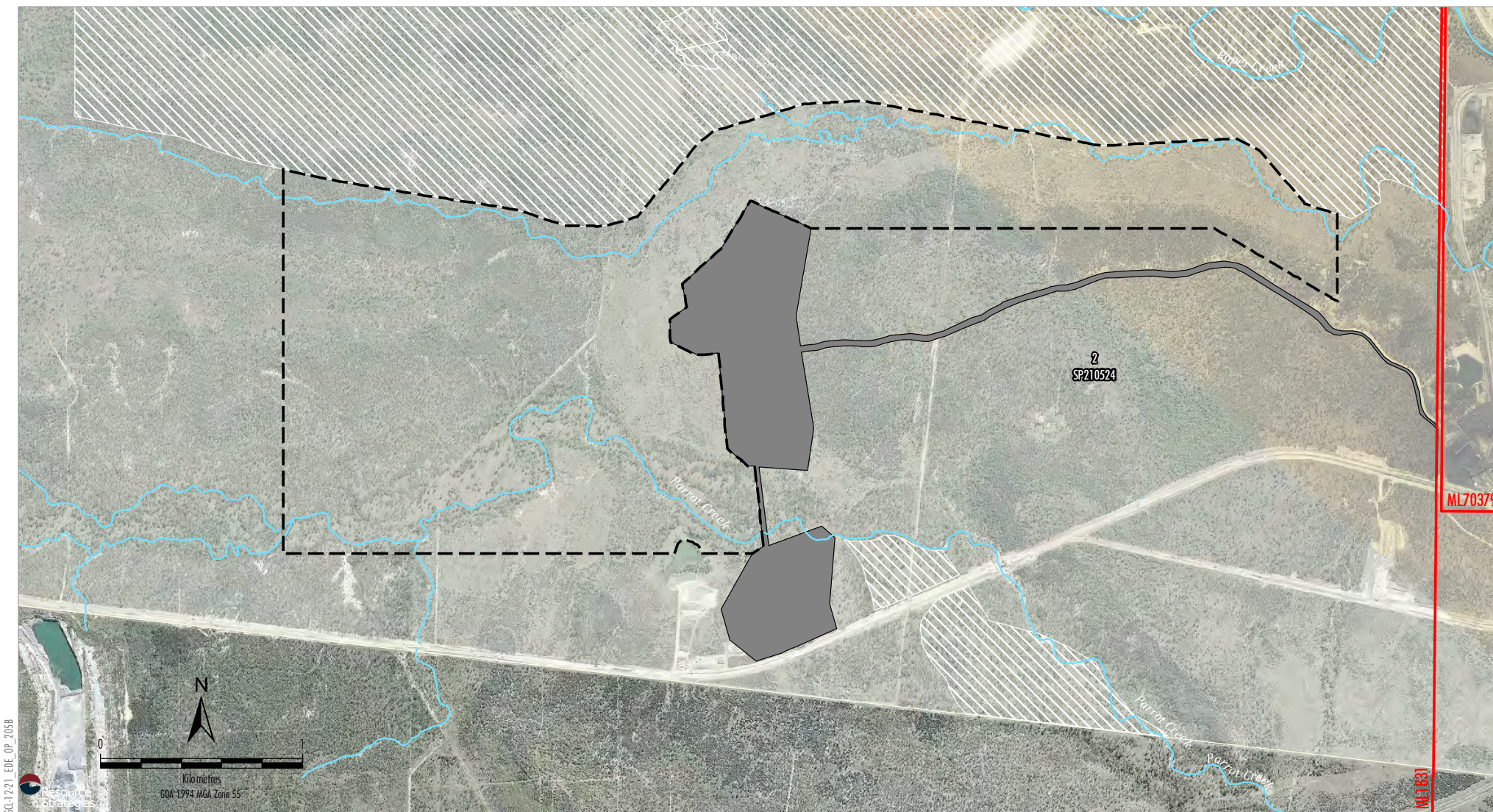
2.7 COMMONWEALTH OFFSET CALCULATOR

The Commonwealth offset calculator (i.e. the EPBC Act *Offset Assessments Guide*) was run to determine the size of the proposed offset area required to satisfy 100% of the offset requirement for all relevant MNES. The Commonwealth offset calculator relies on the following information to determine the offset suitability:

- size (in hectares) of the proposed offset area;
- current and future quality of the habitat within the proposed offset area;
- risk of loss with and without the proposed offset;
- time until conservation gain is achieved; and
- level of certainty of success.

Justification for these inputs to the Commonwealth offset calculator is provided in Appendices A and B and Section 2.7.1.

The output of the Commonwealth offset calculator is summarised in Table 7. The outputs of the Commonwealth offset calculator indicate that the proposed biodiversity offset package for the Action satisfies greater than 100% of the offset requirement for all relevant MNES.



- LEGEND
- Mining Lease Boundary
 - Parrot Quarry
 - Existing Offset Area
 - Proposed Offset Area
 - MCPL Owned Land

Source: MCPL (2014);
 Department of Natural Resources and Mines (2016)
 Orthophoto: MCPL (2014, 2012)



NORTH-EASTERN EXTENSION
 Proposed Offset Area
 Land Tenure

Figure 7

Table 7
Habitat for MNES Known or Considered Likely to Occur in the Action Area and
Proposed Offset Area and Summary of Percentage Offset Requirements Met

MNES	Conservation Status ¹	Area of Habitat to be Impacted (ha) ²	Total Area of Existing Habitat in Offset Area (ha) ³		Recorded in Offset Area	Percent Offset by Commonwealth Offset Areas
			Remnant Vegetation	Non-Remnant Vegetation		
Squatter Pigeon (southern) (<i>Geophaps scripta scripta</i>)	V	181	339	193	No	139.03%
Koala (<i>Phascolarctos cinereus</i>)	V	181	306	193	Yes	128.11%
South-eastern Long-eared Bat (<i>Nyctophilus corbeni</i>)	V	181	339	193	No	114.36%

¹ Threatened species status under the EPBC Act (current as at August 2016).

² Area based on vegetation mapped by Naturecall (2016b).

³ Area based on vegetation mapped by Naturecall (2016a).

V = Vulnerable.

2.7.1 Terrestrial Habitat Quality Assessment

As requested by DEE (26 October 2016), an assessment of the terrestrial habitat quality in the North-eastern Extension (i.e. the Action area) and proposed offset area was undertaken by Naturecall (2016a, 2016b) based on the methodology outlined in the *Guide to Determining Terrestrial Habitat Quality Version 1.1* (DEHP, 2014). As requested by DEE, the QLD Habitat Quality Scoring Template was used to derive the following inputs into the Commonwealth Offsets Assessment Guide:

- 'Habitat Quality' of the impact area;
- 'Start Habitat Quality' of the proposed offset area; and
- 'Future Quality with Offset' of the proposed offset area.

A description of the methods is provided below.

2.7.1.1 North-eastern Extension Area

The field survey for the North-eastern Extension was undertaken by Naturecall from the 12 to 16 October 2015 as described in *Middlemount Coal North-eastern Extension Terrestrial Ecology Impact Assessment* (Naturecall, 2016b).

Site Condition Assessment

The North-eastern Extension area was identified as a single vegetation type (RE 11.5.3¹) and therefore a single assessment unit (AU1) was established (Figure 8). Site condition assessments were conducted at four sites throughout the assessment unit. The following information was recorded at each of the assessment sites, using a combination of measured plots (100 x 50 metres [m]) and transects (100 m):

- RE map unit.
- Recruitment of woody perennial species (i.e. proportion of dominant layer regenerating).
- Native plant species richness (as a percentage) in each layer (trees, shrubs, grasses and forbs).
- Tree canopy height and percentage cover.
- Shrub percentage cover.
- Native perennial grass cover.
- Organic litter groundcover composition.
- Number of large tree located within a 100 m x 50 m plot.
- Coarse woody debris within a 50 m x 20 m plot.
- Non-native plant cover percentage.
- Photographic record of vegetation.

Further details on the methodology are provided in the *Guide to Determining Terrestrial Habitat Quality Version 1.1* (DEHP, 2014) and Eyre *et al* (2015).

¹ Small areas of RE 11.5.3b variant were not large enough for a separate assessment unit.

Site Context Assessment

Site context information (patch size, connectedness, context and ecological corridors) was calculated in accordance with the site context scoring guide outlined in the *Guide to Determining Terrestrial Habitat Quality Version 1.1* (DEHP, 2014).

Fauna Species Habitat Assessment

Targeted habitat assessments for relevant MNES were undertaken by Naturecall (2016b). The species habitat indices (as per the DEHP, 2014) were specifically evaluated:

- threats to species (score of 1, 7 or 15);
- quality and availability of foraging habitat (score of 1, 5 or 10);
- quality and availability of shelter (score of 1, 5 or 10);
- species mobility capacity (score of 1, 4, 7 or 10); and
- role of the site location to species overall population in the state (score of 1, 4 or 5).

2.7.1.2 Proposed Offset Area

Field surveys were undertaken throughout the proposed offset area by Naturecall from 9 to 15 June 2016 as described in the *Vegetation Validation and Terrestrial Habitat Assessment* (Naturecall, 2016a) (Appendix C).

Site Condition Assessments

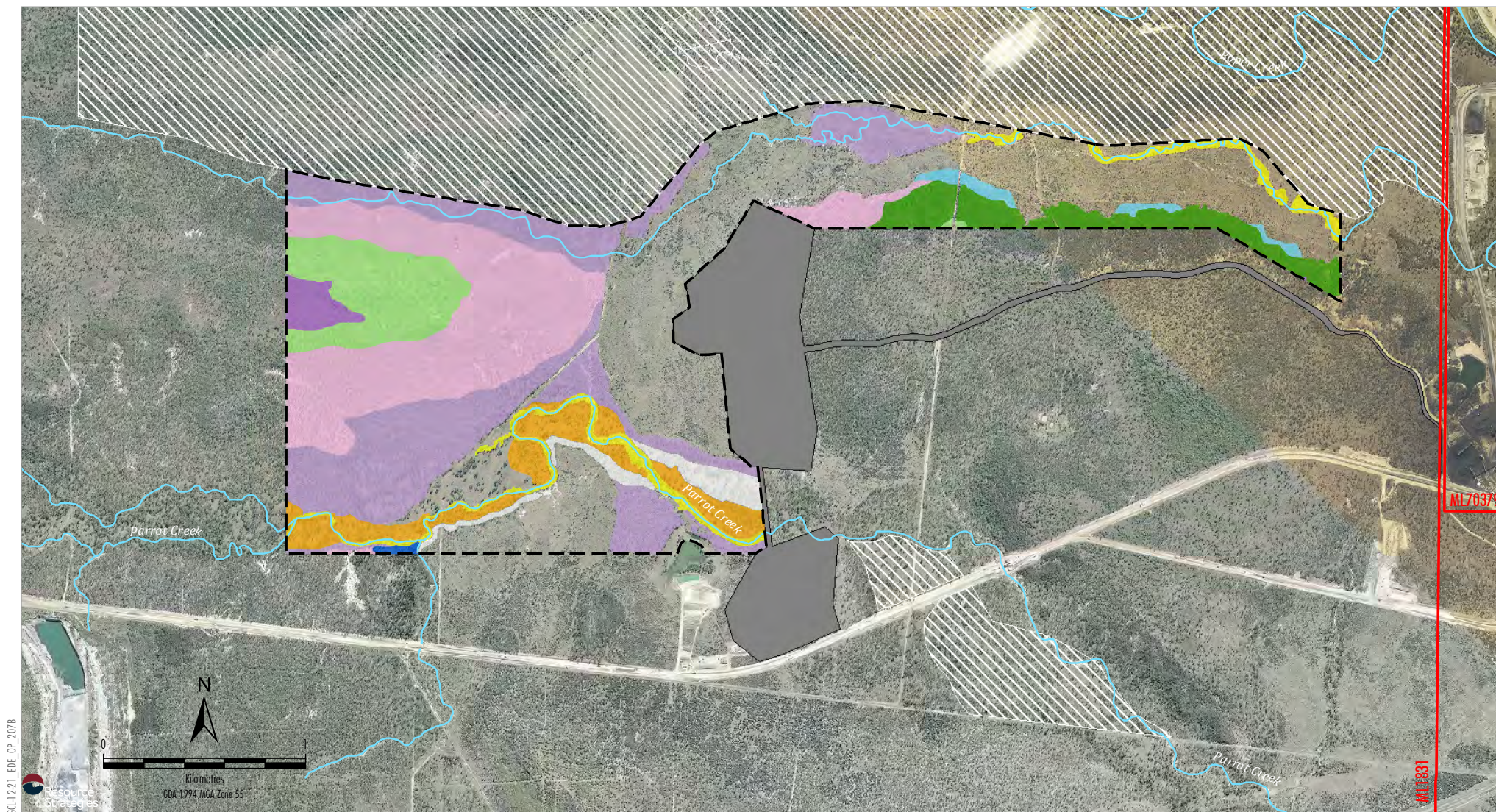
Existing DEHP RE mapping of the proposed offset area, as well as previous mapping on adjoining land (Parsons Brinckerhoff, 2010; Ecology and Heritage Partners, 2012) was obtained and used in conjunction with satellite imagery to identify the broad vegetation types present.

A total of 11 REs in similar condition were identified in the proposed offset area and each RE therefore represented an assessment unit (AU1 to AU10) (Figure 9). Note that one of the RE communities was determined to be a subtype of an existing community, and hence were amalgamated into a single assessment unit.

A total of 11 site condition assessments were undertaken (T2, T14, T15, T18, T19, T20, T23, T24, T25 and T28) and the survey locations are presented on Figure 10. The site condition information listed above (from DEHP, 2014) was recorded within each assessment site (AU1 to AU10).

Additional Sites

A total of 17 additional quaternary survey sites were inspected across the area to supplement the site condition assessments (i.e. the terrestrial habitat quality assessment sites described above). This allowed accurate mapping of REs, development of a more comprehensive species list, and validation of vegetation status (i.e. remnant or non-remnant).



- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Existing Offset Area
 - Proposed Offset Area

- Assessment Units**
- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10

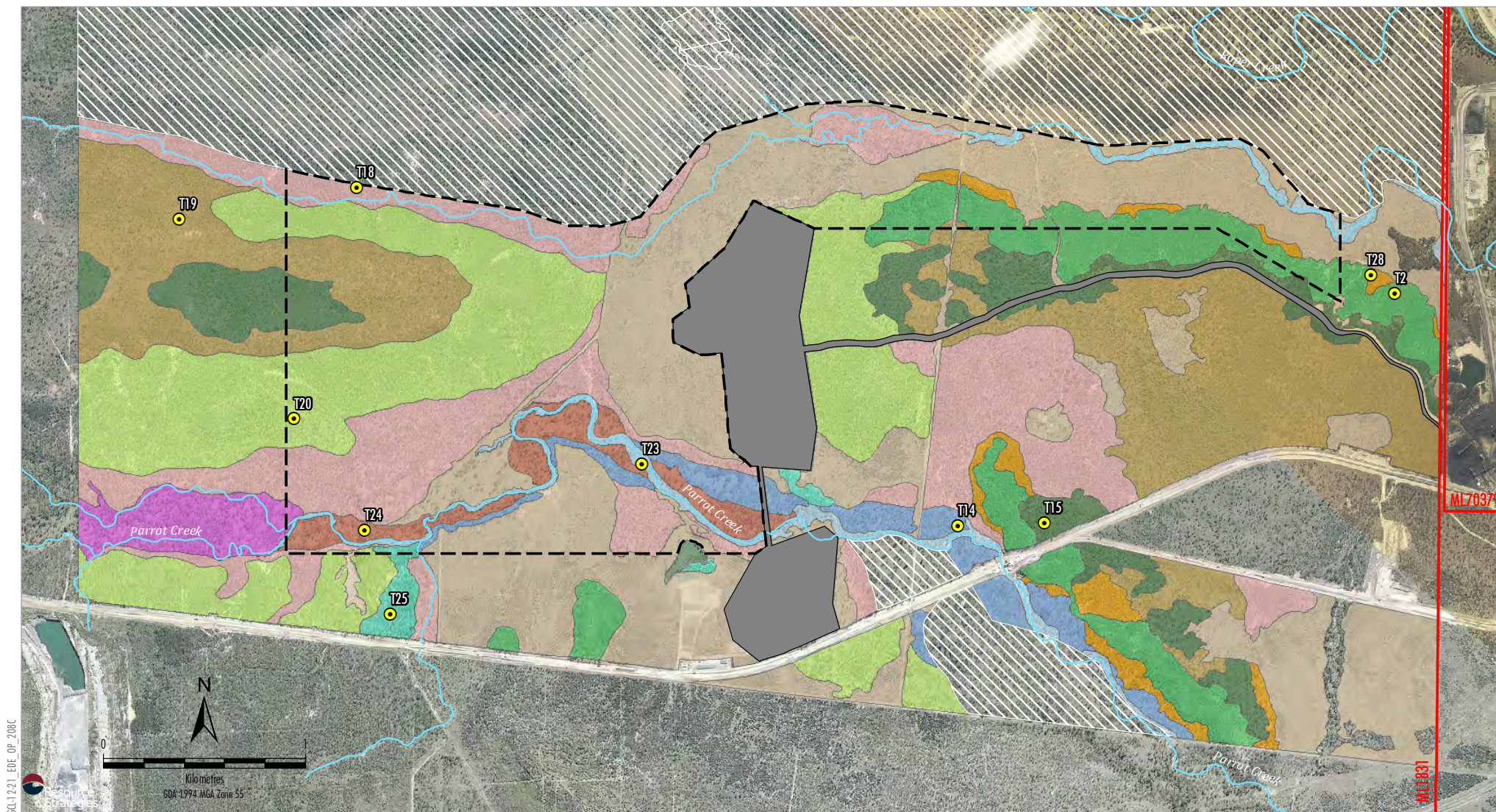
Source: Naturecall (2016); MCPL (2014);
Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (2014, 2012)



NORTH-EASTERN EXTENSION

Assessment Units
in the Proposed Offset Area

Figure 9



- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Existing Offset Area
 - Proposed Offset Area
 - Site Condition Assessment Location

Ground-truthed Regional Ecosystem Mapping

 11.3.2	 11.5.2a
 11.3.25	 11.5.3
 11.3.4	 11.5.9
 11.3.4a	 11.7.2
 11.4.8	 11.7.4
 11.5.18	 Non-remnant

Source: Naturecall (2016); MCPL (2014);
Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (2014, 2012)

**middlemount
coal**
NORTH-EASTERN EXTENSION
Survey Effort
in the Proposed Offset Area

Figure 10

Reference Sites

Two reference sites were created by Naturecall within the proposed offset area to establish a local benchmark for RE 11.5.2a, as no benchmark had been established by the Queensland Herbarium and no local benchmark is known to have been established by previous surveys in the area. These reference sites were created in accordance with the *Methodology for the Establishment and Survey of Reference Sites for BioCondition* (Eyre et al, 2015).

Site Context Assessment

Site context information was calculated as described for the North-eastern Extension (above).

Fauna Species Habitat Assessment

Targeted habitat assessments for relevant MNES were undertaken by Naturecall (2016b).

2.7.1.3 Final Habitat Quality Score

The inputs obtained during the surveys were used to determine the final habitat quality score for the North-eastern Extension area (i.e. the Action area) and the proposed offset area using the Habitat Quality Scoring Template available on the DEHP Environmental Offsets website (<https://www.qld.gov.au/environment/pollution/management/offsets/>).

A copy of the inputs is provided in Appendix B.

2.8 RECONCILIATION AGAINST EPBC ACT OFFSET POLICY

2.8.1 Commonwealth Offset Principles

A reconciliation of the proposed biodiversity offset package against the Commonwealth offset principles is presented in Table 8.

Table 8
Reconciliation of the Proposed Biodiversity Offset Package
against the Commonwealth Offset Principles

Offset Principles ¹	Elements of the Proposed Biodiversity Offset Package that Address these Requirements
<i>Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environmental law and affected by the action.</i>	The proposed offset area is specifically tailored to the relevant protected matters (i.e. Squatter Pigeon [southern], Koala and South-eastern Long-eared Bat) and to deliver an overall conservation outcome that improves or maintains the viability of each protected matter.
<i>Be built around direct offsets but may include other compensatory measures.</i>	The <i>EPBC Act Offsets Assessment Guide</i> (SEWPaC, 2012b) was used to assess the proposed offset areas against the Commonwealth biodiversity offset requirements. The offset areas are direct offsets which satisfies 100% of the offset requirements under the EPBC Act. The proposed offset area is owned by MCPL. MCPL intends to reach an agreement with the Commonwealth Government for the enduring protection and management of the proposed offset area.

Table 5 (Continued)
Reconciliation of the Proposed Biodiversity Offset Package
against the Commonwealth Offset Principles

Offset Principles ¹	Elements of the Proposed Biodiversity Offset Package that Address these Requirements
<i>Be in proportion to the level of statutory protection that applies to protected matters.</i>	The <i>EPBC Act Offsets Assessment Guide</i> (SEWPaC, 2012b), which was used for the Action, accounts for the level of statutory protection (vulnerable to critically endangered) of the relevant protected matters in calculating the offset requirement.
<i>Be of a size and scale proportionate to the impacts on the protected matter.</i>	The size and scale of the proposed offset was determined using the <i>EPBC Act Offsets Assessment Guide</i> (SEWPaC, 2012b). The following was considered: - the level of statutory protection (vulnerable to critically endangered); - specific attributes of the relevant protected matters and its habitat; - the quality and importance of the habitat; - the level of risk to the habitat in the offset area without the Action (e.g. grazing); - the time it would likely take for a conservation gain for each relevant protected matter; and - the risk of the conservation gain not occurring. With reference to the <i>EPBC Act Environmental Offsets Policy</i> (SEWPaC, 2012a), the impacts of the Action are conservatively assumed to be permanent for the purpose of the offset requirement, but in reality the Action area would be rehabilitated and revegetated.
<i>Effectively account for and manage the risks of the offset not succeeding.</i>	The Action would result in residual impacts on the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat (through the loss of habitat). The potential impacts on the protected matters have been evaluated and it is concluded that none of the protected matters are likely to be significantly impacted. However, the proposed offset area would compensate for the impacts on the protected matters and help maintain the viability of the protected matters. The <i>EPBC Act Offsets Assessment Guide</i> (SEWPaC, 2012b), which was used for the Action, accounts for the risks of the offset area not succeeding in calculating the offset requirement.
<i>Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs.</i>	The proposed offset area is beyond existing requirements, in that it is not part of any private conservation reserve system. The proposed offset area is new and additional under duty of care or any environmental planning laws.
<i>Be efficient, effective, transparent, proportionate, scientifically robust and reasonable.</i>	The proposed offset area would efficiently and effectively compensate for the impacts on the protected matters and help maintain the viability of the protected matters. Flora and fauna surveys of the proposed offset area were undertaken by Naturecall (2016a).
<i>Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.</i>	MCPL intends to reach an agreement with the Commonwealth Government for the enduring protection and management of the proposed offset area.

¹ SEWPaC, 2012a.

3 REFERENCES

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APPENDIX A

**JUSTIFICATION FOR THE INPUTS TO THE COMMONWEALTH OFFSET
CALCULATOR**

Table A-1
Calculator Inputs and Output – Squatter Pigeon (Southern) (Remnant Vegetation Offset)

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	181 ha	Habitat area defined by Naturecall (2016a) during field surveys.
Quality (0 to 10)	6	In consideration of the site condition and context, a quality value of 6 is considered appropriate for the Squatter Pigeon (southern) because: - this species has not been recorded within the Action area despite targeted survey work. - the Action area contains a large proportion of introduced pasture species within the groundcover layer. - the Action area does not contain any sources of permanent water. The 'habitat quality score' is 6.03 using the QLD <i>Habitat Quality Site Analysis Data Sheets</i>.
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	5 years	Areas of habitat within the offset areas are considered to contain a number of native grass species which provide a potential food resource for the Squatter Pigeon (southern). Some areas also have a mosaic of open sandy areas and native grasses which is preferred habitat for this species. Natural regeneration is likely to further increase the extent of habitat over time. Management of the offset areas is expected to improve the quality, composition and extent of patches of habitat for the Squatter Pigeon (southern). As a minimum, management of the offset areas would include: - weed control; - feral animal control; and - management of livestock. It is considered that the ecological benefit is likely to conservatively occur within 5 years.
Start area (ha) (Size of the offset)	339 ha	Area defined during field survey, consisting of 339 ha of woodland habitat mapped by Naturecall (2016b).
Start Quality (0 to 10)	7	Areas of habitat within the offset areas are considered to have a similar starting quality as the habitat in the impact area however the presence of permanent water (in the form of dams) slightly increases the quality value for the Squatter Pigeon (southern). The 'habitat quality score' is 7.14 using the QLD <i>Habitat Quality Site Analysis Data Sheets</i>.

Table A-1 (Continued)
Calculator Inputs and Output – Squatter Pigeon (Southern) (Remnant Vegetation Offset)

Aspect	Input	Justification
Risk of loss (%) without offset	5%	Within the next 20 years, without the offset, it is considered that there is a 5% risk that the ecological values relevant to the Squatter Pigeon (southern) will be lost. A 5% risk of loss is considered appropriate since there are no conservation protection measures in place (which there otherwise would be, as a result of the offset). There are no known pending development applications over the proposed offset areas.
Future quality without offset (scale of 0-10)	5	A decrease in the quality is possible due to ongoing threatening processes (e.g. grazing, weeds, and feral animals) as there are no long-term conservation measures in place (which otherwise will be, as a result of the offset areas).
Risk of loss (%) with offset	1%	It is anticipated that management and enhancement measures will effectively increase the extent of potential habitat for the Squatter Pigeon (southern) in these areas. It is highly unlikely that the habitat would be lost with the offset area because an arrangement would be made for the enduring protection and management of the offset area.
Future quality with offset (scale of 0-10)	8	An increase in quality is anticipated with natural regeneration and protection of existing vegetation. A quality value of 8 is considered appropriate because: - the starting quality is 7; - weeds would be managed; - livestock would be managed; and - feral animals would be controlled. The 'habitat quality score' is 8.19 using the <i>QLD Habitat Quality Site Analysis Data Sheets</i>.
Confidence in the result	80%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. There is a high level of confidence that the management measures (e.g. weed control, feral animal control and management of livestock grazing) would effectively improve the habitat quality for the Squatter Pigeon (southern). MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the QLD Vegetation Management Act, 1999. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the restriction of vegetation clearance activities, the limitation and control of grazing activities and the general access and use of the land.
Calculator Output - % of Impact Offset		78.14%

Table A-2
Calculator Inputs and Output – Squatter Pigeon (Southern) (Non-remnant Vegetation Offset)

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	181 ha	See Table A2
Quality (0 to 10)	6	See Table A2
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	5 years	Areas of habitat within the offset areas are considered to contain a number of native grass species which provide a potential food resource for the Squatter Pigeon (southern). Some areas also have a mosaic of open sandy areas and native grasses which is preferred habitat for this species. Natural regeneration is likely to further increase the extent of habitat over time. Management of the offset areas is expected to improve the quality, composition and extent of patches of habitat for the Squatter Pigeon (southern). As a minimum, management of the offset areas would include: • weed control; • feral animal control; and • management of livestock grazing. It is considered that the ecological benefit is likely to conservatively occur within 5 years.
Start area (ha) (Size of the offset)	193 ha	Area defined during field survey, consisting of 193 ha of non-remnant vegetation mapped by Naturecall (2016b).
Start Quality (0 to 10)	2	Dominant ground cover composition within the non-remnant vegetation is exotic grasses with native grasses and herbs being less common. The areas with a higher percentage of native grass species would provide some potential food resources for the Squatter Pigeon (southern).
Risk of loss (%) without offset	5%	Within the next 20 years, without the offset, it is considered that there is a 5% risk that the ecological values relevant to the Squatter Pigeon (southern) will be lost. A 5% risk of loss is considered appropriate since there are no conservation protection measures in place (which there otherwise would be, as a result of the offset). There are no known pending development applications over the proposed offset areas.
Future quality without offset (scale of 0-10)	0	A decrease in the quality is possible due to ongoing threatening processes (e.g. grazing, weeds, and feral animals) as there are no long-term conservation measures in place (which otherwise will be, as a result of the offset areas).
Risk of loss (%) with offset	1%	It is anticipated that management and enhancement measures will effectively increase the extent of potential habitat for the Squatter Pigeon (southern) in these areas. It is highly unlikely that the habitat would be lost with the offset area because an arrangement would be made for the enduring protection and management of the offset area.

Table A-2 (Continued)
Calculator Inputs and Output – Squatter Pigeon (Southern) (Non-remnant Vegetation Offset)

Aspect	Input	Justification
Future quality with offset (scale of 0-10)	5	An increase in quality is anticipated with protection of existing vegetation and implementation of weed control measures and active seeding/planting (as required).
Confidence in the result	70%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. There is a high level of confidence that the management measures (e.g. weed control, feral animal control and management of livestock grazing) would effectively improve the habitat quality for the Squatter Pigeon (southern). MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i>. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the restriction of vegetation clearance activities, the limitation and control of grazing activities and the general access and use of the land.
Calculator Output - % of Impact Offset		60.89%

Table A-3
Calculator Inputs and Output – Koala (Remnant Vegetation Offset)

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	181 ha	See Table A2
Quality (0 to 10)	5	In consideration of the site condition and context, a quality value of 5 is considered appropriate for the Koala because: • this species has not been recorded within 5 km of the Action area despite targeted survey work; • no critical habitat would be disturbed by the Action; • important food species (Van Dyck and Strahan, 2008; Land for Wildlife, 2014) for the Koala are rare within the Action area with only one patch of 5 small Queensland Blue Gum trees being recorded by Naturecall (2016a); and • the soil quality within the Action area is poor. The 'habitat quality score' is 5.32 using the QLD <i>Habitat Quality Site Analysis Data Sheets</i>.
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	5 years	Areas of habitat within the offset areas contain important food trees for the Koala. Natural regeneration is likely to further increase the extent of potential habitat over time. Management of the offset areas is expected to improve the quality, composition and extent of patches of habitat for the Koala. As a minimum, management of the offset areas would include: • weed control; • feral animal control; and • management of livestock grazing. It is considered that the ecological benefit is likely to conservatively occur within 5 years.
Start area (ha) (Size of the offset)	306 ha	Area defined during field survey, consisting of 306 ha of woodland habitat mapped by Naturecall (2016b).
Start Quality (0 to 10)	7	Areas of habitat within the offset areas are considered to have a similar starting quality as the habitat in the impact area however the presence of important food trees and records of the Koala within the offset area increases the start quality. The 'habitat quality score' is 7.26 using the QLD <i>Habitat Quality Site Analysis Data Sheets</i>.

Table A-3 (Continued)
Calculator Inputs and Output – Koala (Remnant Vegetation Offset)

Aspect	Input	Justification
Risk of loss (%) without offset	5%	Within the next 20 years, without the offset, it is considered that there is a 5% risk that the ecological values relevant to the Koala will be lost. A 5% risk of loss is considered appropriate since there are no conservation protection measures in place (which there otherwise would be, as a result of the offset). There are no known pending development applications over the proposed offset areas.
Future quality without offset (scale of 0-10)	5	A decrease in the quality is possible due to ongoing threatening processes (e.g. grazing, weeds, and feral animals) as there are no long-term conservation measures in place (which otherwise will be, as a result of the offset areas).
Risk of loss (%) with offset	1%	It is anticipated that management and enhancement measures will effectively increase the extent of potential habitat for the Koala in these areas. It is highly unlikely that the habitat would be lost with the offset area because an arrangement would be made for the enduring protection and management of the offset area.
Future quality with offset (scale of 0-10)	8	An increase in quality is anticipated with natural regeneration and protection of existing vegetation. A quality value of 8 is considered appropriate because: - the starting quality is 7; - livestock would be managed; - weeds would be managed; and - feral animals would be controlled. The 'habitat quality score' is 7.95 using the QLD <i>Habitat Quality Site Analysis Data Sheets</i>.
Confidence in the result	80%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. There is a high level of confidence that the management measures (e.g. weed control, feral animal control and management of livestock grazing) would effectively improve the habitat quality for the Koala. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the QLD <i>Vegetation Management Act, 1999</i>. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the restriction of vegetation clearance activities, the limitation and control of grazing activities and the general access and use of the land.
Calculator Output - % of Impact Offset		84.64%

Table A-4
Calculator Inputs and Output – Koala (Non-remnant Vegetation Offset)

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	181 ha	See Table A2
Quality (0 to 10)	5	See Table A4
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	10 years	Natural regeneration is likely to further increase the extent of potential habitat over time. Management of the offset areas is expected to improve the quality, composition and extent of patches of habitat for the Koala. As a minimum, management of the offset areas would include: • weed control; • feral animal control; and • management of livestock grazing. It is considered that the ecological benefit is likely to conservatively occur within 5 years.
Start area (ha) (Size of the offset)	193 ha	Area defined during field survey, consisting of 193 ha of non-remnant vegetation mapped by Naturecall (2016b).
Start Quality (0 to 10)	0	Dominant ground cover composition within the non-remnant vegetation is exotic grasses with native grasses and herbs being less common. This would not provide habitat resources for the Koala.
Risk of loss (%) without offset	0%	As it stands there are no ecological values relevant to the Koala that could be lost.
Future quality without offset (scale of 0-10)	0	It is unlikely that there would be any change in quality of the non-remnant vegetation without an offset being secured.
Risk of loss (%) with offset	1%	It is anticipated that management and enhancement measures will effectively increase the extent of potential habitat for the Koala in these areas. It is highly unlikely that the habitat would be lost with the offset area because an arrangement would be made for the enduring protection and management of the offset area.

Table A-4 (Continued)
Calculator Inputs and Output – Koala (Non-remnant Vegetation Offset)

Aspect	Input	Justification
Future quality with offset (scale of 0-10)	3	An increase in quality is anticipated with natural regeneration and protection of existing vegetation. A quality value of 3 is considered appropriate because: - the starting quality is 0; - livestock would be managed; - weeds would be managed; - feral animals would be controlled; and - active seeding/planting (as required).
Confidence in the result	70%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. There is a high level of confidence that the management measures (e.g. weed control, feral animal control and management of livestock grazing) would effectively improve the habitat quality for the Koala. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i>. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the restriction of vegetation clearance activities, the limitation and control of grazing activities and the general access and use of the land.
Calculator Output - % of Impact Offset		43.47%

Table A-5
Calculator Inputs and Output – South-eastern Long-eared Bat (Remnant Vegetation Offset)

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	181 ha	See Table A2
Quality (0 to 10)	6	In consideration of the site condition and context, a quality value of 6 is considered appropriate for the South-eastern Long-eared Bat because: • this species has not been confirmed to occur within 250 km of the Action area despite targeted survey work; • much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging). The 'habitat quality score' is 6.28 using the QLD <i>Habitat Quality Site Analysis Data Sheets</i>.
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	5 years	Areas of habitat within the offset areas contain potential foraging and roosting habitat for the South-eastern Long-eared Bat. Natural regeneration is likely to further increase the extent of potential habitat over time. Management of the offset areas is expected to improve the quality, composition and extent of patches of habitat for the South-eastern Long-eared Bat. As a minimum, management of the offset areas would include: • weed control; • feral animal control; and • management of livestock grazing. It is considered that the ecological benefit is likely to conservatively occur within 5 years.
Start area (ha) (Size of the offset)	339 ha	Area defined during field survey, consisting of 339 ha of woodland habitat mapped by Naturecall (2016b).
Start Quality (0 to 10)	7	Areas of habitat within the offset areas are considered to have a similar starting quality as the habitat in the impact area. The 'habitat quality score' is 6.91 using the QLD <i>Habitat Quality Site Analysis Data Sheets</i>.
Risk of loss (%) without offset	5%	Within the next 20 years, without the offset, it is considered that there is a 5% risk that the ecological values relevant to the Koala will be lost. A 5% risk of loss is considered appropriate since there are no conservation protection measures in place (which there otherwise would be, as a result of the offset). There are no known pending development applications over the proposed offset areas.
Future quality without offset (scale of 0-10)	5	A decrease in the quality is possible due to ongoing threatening processes (e.g. grazing, weeds, and feral animals) as there are no long-term conservation measures in place (which otherwise will be, as a result of the offset areas).

Table A-5 (Continued)
Calculator Inputs and Output – South-eastern Long-eared Bat (Remnant Vegetation Offset)

Aspect	Input	Justification
Risk of loss (%) with offset	1%	It is anticipated that management and enhancement measures will effectively increase the extent of potential habitat for the South-eastern Long-eared Bat in these areas. It is highly unlikely that the habitat would be lost with the offset area because an arrangement would be made for the enduring protection and management of the offset area.
Future quality with offset (scale of 0-10)	8	An increase in quality is anticipated with natural regeneration and protection of existing vegetation. A quality value of 8 is considered appropriate because: - the starting quality is 7; - livestock would be excluded (i.e. removal of grazing pressures); - weeds would be managed; and - feral animals would be controlled. The 'habitat quality score' is 8.16 using the <i>QLD Habitat Quality Site Analysis Data Sheets</i>.
Confidence in the result	80%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. There is a high level of confidence that the management measures (e.g. weed control, feral animal control and removal of livestock grazing) would effectively improve the habitat quality for the South-eastern Long-eared Bat. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i>. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the restriction of vegetation clearance activities, the limitation and control of grazing activities and the general access and use of the land.
Calculator Output - % of Impact Offset		78.14%

Table A-6
Calculator Inputs and Output – South-eastern Long-eared Bat (Non-remnant Vegetation Offset)

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	181 ha	See Table A2.
Quality (0 to 10)	6	See Table A6.
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	10 years	Natural regeneration is likely to further increase the extent of potential habitat over time. Management of the offset areas is expected to improve the quality, composition and extent of patches of habitat for the South-eastern Long-eared Bat. As a minimum, management of the offset areas would include: • weed control; • feral animal control; and • removal of livestock grazing. It is considered that the ecological benefit is likely to conservatively occur within 5 years.
Start area (ha) (Size of the offset)	193 ha	Area defined during field survey, consisting of 193 ha of non-remnant vegetation mapped by Naturecall (2016b).
Start Quality (0 to 10)	0	Dominant ground cover composition within the non-remnant vegetation is exotic grasses with native grasses and herbs being less common. This would not provide habitat resources for the South-eastern Long-eared Bat.
Risk of loss (%) without offset	0%	As it stands there are no ecological values relevant to the South-eastern Long-eared Bat that could be lost.
Future quality without offset (scale of 0-10)	0	It is unlikely that there would be any change in quality of the non-remnant vegetation without an offset being secured.
Risk of loss (%) with offset	1%	It is anticipated that management and enhancement measures will effectively increase the extent of potential habitat for the South-eastern Long-eared Bat in these areas. It is highly unlikely that the habitat would be lost with the offset area because an arrangement would be made for the enduring protection and management of the offset area.

Table A-6 (Continued)
Calculator Inputs and Output – South-eastern Long-eared Bat (Non-remnant Vegetation Offset)

Aspect	Input	Justification
Future quality with offset (scale of 0-10)	3	An increase in quality is anticipated with natural regeneration and protection of existing vegetation. A quality value of 3 is considered appropriate because: - the starting quality is 0; - livestock would be excluded (i.e. removal of grazing pressures); - weeds would be managed; - feral animals would be controlled; and - active seeding/planting (as required).
Confidence in the result	70%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. There is a high level of confidence that the management measures (e.g. weed control, feral animal control and removal of livestock grazing) would effectively improve the habitat quality for the South-eastern Long-eared Bat. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i>. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the restriction of vegetation clearance activities, the limitation and control of grazing activities and the general access and use of the land.
Calculator Output - % of Impact Offset		36.22%

APPENDIX B

TERRESTRIAL HABITAT QUALITY DATA

Tuesday, 13th December 2016

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To whom it may concern,

**Re: Terrestrial Habitat Quality Data for Northeast Extension
and Proposed Offset Site, Middlemount QLD**

A terrestrial habitat quality assessment was undertaken by Naturecall in the Middlemount Coal Mine North-eastern Extension and a proposed offset area (south-west of the mine) based on the methodology in the *Guide to Determining Terrestrial Habitat Quality Version 1.1* (Department of Environment and Heritage Protection, 2014).

Please find attached data collected during the surveys undertaken from 12 to 16 October 2015 (Attachment A) and 9 to 15 June 2016 (Attachment B) for use in the Qld Habitat Quality Scoring Template.

Overall, the data supports our view that the terrestrial habitat quality of the proposed offset area exceeds the terrestrial habitat quality of the habitat proposed to be cleared for the North-eastern Extension.

The predicted future habitat quality with the offset is also provided in Attachment C. In summary, it is predicted that there would be an:

- an increase in connectedness;
- a decrease in threats to species;
- an increase in the quality and availability of foraging habitat;
- an increase in the quality and availability of shelter;
- reduced non-native plant cover; and
- an increase in the importance of the habitat to the species.

Yours faithfully,



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ATTACHMENT A

TERRESTRIAL HABITAT QUALITY DATA – NORTH-EASTERN EXTENSION AREA

Table A1
Terrestrial Habitat Quality Data – North-eastern Extension Area¹

Assessment Unit ²	AU1 – RE 11.5.3								
Survey Site	T1			T2			T3		
Attribute	Benchmark	Value	Score	Benchmark	Value	Score	Benchmark	Value	Score
Site Condition									
Recruitment of woody perennial species in EDL (%)	100	5	-	100	5	-	66	3	-
Native plant species richness- trees	8	5	-	10	5	-	6	5	-
Native plant species richness- shrubs	2	3	-	5	3	-	0	2.5	-
Native plant species richness- grasses	4	3	-	1	2.5	-	5	3	-
Native plant species richness- forbs	2	2.5	-	4	3	-	2	2.5	-
Tree canopy height	17	5	-	17	5	-	17	5	-
Tree canopy cover (%)	19.4	5	-	26.2	5	-	34.5	5	-
Shrub canopy cover (%)	0	0	-	1.7	5	-	1	3	-
Native perennial grass cover (%)	21	5	-	6	1	-	15	3	-
Organic litter cover (%)	21	5	-	23	5	-	17	5	-
Large Trees	13	15	-	3	5	-	4	5	-
Coarse woody debris (m per ha)	415	5	-	432	5	-	502	5	-
Non-native plant cover (%)	40%	3	-	20%	3	-	10%	5	-
Site Context									
Size of patch	-	>200ha	10	-	>200ha	10	-	>200ha	10
Connectedness	-	50-75%	4	-	50-75%	4	-	50-75%	4
Context	-	>30-75%	4	-	>30-75%	4	-	>30-75%	4
Ecological corridors	-	within	6	-	within	6	-	within	6

Table A1
Terrestrial Habitat Quality Data – North-eastern Extension Area¹

Assessment Unit ²	AU1 – RE 11.5.3								
Survey Site	T1			T2			T3		
Attribute	Benchmark	Value	Score	Benchmark	Value	Score	Benchmark	Value	Score
Species Habitat Assessment (Squatter Pigeon [southern])									
Threats to species	-	moderate	7	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	moderate	5	-	moderate	5	-	moderate	5
Quality and availability of shelter	-	moderate	5	-	moderate	5	-	moderate	5
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	6.03	-	-	6.03	-	-	6.03
Species Habitat Assessment (Koala)									
Threats to species	-	moderate	7	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	poor	1	-	poor	1	-	poor	1
Quality and availability of shelter	-	poor	1	-	poor	1	-	poor	1
Species mobility category	-	Moderately restricted	7	-	Moderately restricted	7	-	Moderately restricted	7
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	5.32	-	-	5.32	-	-	5.32
Species Habitat Assessment (South-eastern Long-eared Bat)									
Threats to species	-	low	15	-	low	15	-	low	15
Quality and availability of foraging habitat	-	poor	1	-	poor	1	-	poor	1
Quality and availability of shelter	-	moderate	5	-	moderate	5	-	moderate	5
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	6.28	-	-	6.28	-	-	6.28

Table A1 (Continued)
Terrestrial Habitat Quality Data – North-eastern Extension Area¹

Assessment Unit ²	AU1 – RE 11.5.3 (Continued)		
Survey Site	T4		
Attribute	Benchmark	Value	Score
Site Condition			
Recruitment of woody perennial species in EDL (%)	75	3	-
Native plant species richness- trees	8	5	-
Native plant species richness- shrubs	3	3	-
Native plant species richness- grasses	5	3	-
Native plant species richness- forbs	3	3	-
Tree canopy height	17.5	5	-
Tree canopy cover (%)	56.2	3	-
Shrub canopy cover (%)	0.7	3	-
Native perennial grass cover (%)	14	3	-
Organic litter cover (%)	22	5	-
Large Trees	6	10	-
Coarse woody debris (m per ha)	439	5	-
Non-native plant cover (%)	25%	5	-
Site Context			
Size of patch	-	>200ha	10
Connectedness	-	50-75%	4
Context	-	>30-75%	4
Ecological corridors	-	within	6

Table A1 (Continued)
Terrestrial Habitat Quality Data – North-eastern Extension Area¹

Assessment Unit ²	AU1 – RE 11.5.3 (Continued)		
Survey Site	T4		
Attribute	Benchmark	Value	Score
Species Habitat Assessment (Squatter Pigeon [southern])			
Threats to species	-	moderate	7
Quality and availability of foraging habitat	-	moderate	5
Quality and availability of shelter	-	moderate	5
Species mobility category	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1
Score Total	-	-	6.03
Species Habitat Assessment (Koala)			
Threats to species	-	moderate	7
Quality and availability of foraging habitat	-	poor	1
Quality and availability of shelter	-	poor	1
Species mobility category	-	Moderately restricted	7
Role of the site location to species overall population in the state	-	not critical	1
Score Total	-	-	5.32
Species Habitat Assessment (South-eastern Long-eared Bat)			
Threats to species	-	low	15
Quality and availability of foraging habitat	-	poor	1
Quality and availability of shelter	-	moderate	5
Species mobility category	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1
Score Total	-	-	6.28

¹ The total area of vegetation clearance associated with the North-eastern Extension is approximately 181 ha.

² Assessment unit area is 181 ha.



Plate 1 AU1 – RE 11.5.3 Site T1



Plate 2 AU1 – RE 11.5.3 Site T2



Plate 3 AU1 – RE 11.5.3 Site T3



Plate 4 AU1 – RE 11.5.3 Site T4

ATTACHMENT B

TERRESTRIAL HABITAT QUALITY DATA – PROPOSED OFFSET AREA

Table B1
Terrestrial Habitat Quality Data – Proposed Offset Area¹

Assessment Unit	AU1 - RE 11.3.2			AU2 - RE 11.3.25			AU3 - RE 11.3.4/11.3.4a		
Assessment Unit Area (ha)	12.5			18.5			28.5		
Survey Site	T14			T23			T24		
Attribute	Benchmark	Value	Score	Benchmark	Value	Score	Benchmark	Value	Score
Site Condition									
Recruitment of woody perennial species in EDL (%)	100	75	-	100	66	-	100	75	-
Native plant species richness- trees	2	13	-	4	8	-	4	7	-
Native plant species richness- shrubs	2	3	-	2	2	-	2	1	-
Native plant species richness- grasses	9	6	-	8	5	-	7	4	-
Native plant species richness- forbs	17	3	-	12	7	-	10	4	-
Tree canopy height	18	17	-	23	20	-	22	25	-
Tree canopy cover (%)	40	34.3	-	22	77.5	-	17	17.5	-
Shrub canopy cover (%)	2	3.4	-	1	10.2	-	5	6.5	-
Native perennial grass cover (%)	35	8	-	12	18	-	43	30	-
Organic litter cover (%)	30	32	-	15	29	-	20	23	-
Large Trees	22	12	-	21	8	-	35	16	-
Coarse woody debris (m per ha)	307	648	-	375	154	-	384	160	-
Non-native plant cover (%)	0	75	-	0	50	-	0	20	-
Site Context									
Size of patch	-	>200ha	10	-	>200ha	10	-	>200ha	10
Connectedness	-	50-75%	4	-	50-75%	4	-	>75%	5
Context	-	>30-75%	4	-	>30-75%	4	-	>75%	5
Ecological corridors	-	within	6	-	within	6	-	within	6

Table B1 (Continued)
Terrestrial Habitat Quality Data – Proposed Offset Area¹

Assessment Unit	AU1 - RE 11.3.2			AU2 - RE 11.3.25			AU3 - RE 11.3.4/11.3.4a		
Assessment Unit Area (ha)	12.5			18.5			28.5		
Survey Site	T14			T23			T24		
Attribute	Benchmark	Value	Score	Benchmark	Value	Score	Benchmark	Value	Score
Species Habitat Assessment (Squatter Pigeon [southern])									
Threats to species	-	moderate	7	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	moderate	5	-	moderate	5	-	moderate	5
Quality and availability of shelter	-	moderate	5	-	moderate	5	-	moderate	5
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	7.14	-	-	7.14	-	-	7.14
Species Habitat Assessment (Koala)									
Threats to species	-	moderate	7	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	high	10	-	high	10	-	high	10
Quality and availability of shelter	-	high	10	-	high	10	-	high	10
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	7.26	-	-	7.26	-	-	7.26
Species Habitat Assessment (South-eastern Long-eared Bat)									
Threats to species	-	moderate	7	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	moderate	5	-	moderate	5	-	moderate	5
Quality and availability of shelter	-	moderate	5	-	moderate	5	-	moderate	5
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	6.91	-	-	6.91	-	-	6.91

Table B1 (Continued)
Terrestrial Habitat Quality Data – Proposed Offset Area¹

Assessment Unit	AU4 - RE 11.5.2a			AU5 - RE 11.5.3			AU6 - RE 11.5.9		
Assessment Unit Area (ha)	98.0			108.0			34.5		
Survey Site	T20			T18			T19		
Attribute	Benchmark	Value	Score	Benchmark	Value	Score	Benchmark	Value	Score
Site Condition									
Recruitment of woody perennial species in EDL (%)	100	25	-	100	75	-	100	75	-
Native plant species richness- trees	8.5	6	-	6	11	-	3	8	-
Native plant species richness- shrubs	2.5	0	-	6	5	-	6	3	-
Native plant species richness- grasses	6	6	-	6	7	-	9	7	-
Native plant species richness- forbs	5.5	5	-	10	4	-	11	5	-
Tree canopy height	13	10	-	16	16	-	17	20	-
Tree canopy cover (%)	53.65	57.8	-	20	23.7	-	25	13.5	-
Shrub canopy cover (%)	11.85	0	-	3	10.4	-	10	8.2	-
Native perennial grass cover (%)	23.5	19	-	19	19	-	26	12	-
Organic litter cover (%)	37.5	27	-	20	41	-	30	80	-
Large Trees	31	58	-	10	2	-	20	2	-
Coarse woody debris (m per ha)	106.4	519	-	314	893	-	342	94.8	-
Non-native plant cover (%)	0	5	-	0	5	-	0	5	-
Site Context									
Size of patch	-	>200ha	10	-	>200ha	10	-	>200ha	10
Connectedness	-	>75%	5	-	50-75%	4	-	>75%	5
Context	-	>75%	5	-	>75%	5	-	>75%	5
Ecological corridors	-	within	6	-	within	6	-	within	6

Table B1 (Continued)
Terrestrial Habitat Quality Data – Proposed Offset Area¹

Assessment Unit	AU4 - RE 11.5.2a			AU5 - RE 11.5.3			AU6 - RE 11.5.9		
Assessment Unit Area (ha)	98.0			108.0			34.5		
Survey Site	T20			T18			T19		
Attribute	Benchmark	Value	Score	Benchmark	Value	Score	Benchmark	Value	Score
Species Habitat Assessment (Squatter Pigeon [southern])									
Threats to species	-	moderate	7	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	high	10	-	high	10	-	high	10
Quality and availability of shelter	-	moderate	5	-	moderate	5	-	moderate	5
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	7.14	-	-	7.14	-	-	7.14
Species Habitat Assessment (Koala)									
Threats to species	-	moderate	7	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	moderate	5	-	moderate	5	-	moderate	5
Quality and availability of shelter	-	high	10	-	high	10	-	high	10
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	7.26	-	-	7.26	-	-	7.26
Species Habitat Assessment (South-eastern Long-eared Bat)									
Threats to species	-	moderate	7	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	moderate	5	-	moderate	5	-	moderate	5
Quality and availability of shelter	-	moderate	5	-	moderate	5	-	moderate	5
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	6.91	-	-	6.91	-	-	6.91

Table B1 (Continued)
Terrestrial Habitat Quality Data – Proposed Offset Area¹

Assessment Unit	AU7 - RE 11.7.2			AU8 - RE 11.7.4		
Assessment Unit Area (ha)	26.5			5.0		
Survey Site	T2			T28		
Attribute	Benchmark	Value	Score	Benchmark ²	Value	Score
Site Condition						
Recruitment of woody perennial species in EDL (%)	100	50	-	100	100	-
Native plant species richness- trees	3	6	-	17	17	-
Native plant species richness- shrubs	4	5	-	3	3	-
Native plant species richness- grasses	5	3	-	8	8	-
Native plant species richness- forbs	5	2	-	5	5	-
Tree canopy height	15	15	-	18	18	-
Tree canopy cover (%)	40	51.7	-	34.9	34.9	-
Shrub canopy cover (%)	4	5.1	-	12.6	12.6	-
Native perennial grass cover (%)	15	17	-	38	38	-
Organic litter cover (%)	20	42	-	27	27	-
Large Trees	36	8	-	22	22	-
Coarse woody debris (m per ha)	1214	1785	-	206	206	-
Non-native plant cover	0	5	-	20	20	-
Site Context						
Size of patch	-	>200ha	10	-	>200ha	10
Connectedness	-	50-75%	4	-	>10-<50%	2
Context	-	>30-75%	4	-	>30-75%	4
Ecological corridors	-	within	6	-	within	6

Table B1 (Continued)
Terrestrial Habitat Quality Data – Proposed Offset Area¹

Assessment Unit	AU7 - RE 11.7.2			AU8 - RE 11.7.4		
Assessment Unit Area (ha)	26.5			5.0		
Survey Site	T2			T28		
Attribute	Benchmark	Value	Score	Benchmark ²	Value	Score
Species Habitat Assessment (Squatter Pigeon [southern])						
Threats to species	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	moderate	5	-	moderate	5
Quality and availability of shelter	-	moderate	5	-	moderate	5
Species mobility category	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1
Score Total	-	-	7.14	-	-	7.14
Species Habitat Assessment (Koala)						
Threats to species	-	-	-	-	moderate	7
Quality and availability of foraging habitat	-	-	-	-	moderate	5
Quality and availability of shelter	-	-	-	-	moderate	5
Species mobility category	-	-	-	-	minor restriction	10
Role of the site location to species overall population in the state	-	-	-	-	not critical	1
Score Total	-	-	7.26	-	-	7.26
Species Habitat Assessment (South-eastern Long-eared Bat)						
Threats to species	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	moderate	5	-	moderate	5
Quality and availability of shelter	-	moderate	5	-	moderate	5
Species mobility category	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1
Score Total	-	-	6.91	-	-	6.91

Table B1 (Continued)
Terrestrial Habitat Quality Data – Proposed Offset Area¹

Assessment Unit	AU9 - RE 11.4.8			AU10 - RE 11.5.18		
Assessment Unit Area (ha)	1.0			6.5		
Survey Site	T25			T15		
Attribute	Benchmark	Value	Score	Benchmark ³	Value	Score
Site Condition						
Recruitment of woody perennial species in EDL (%)	100	100	-	100	100	-
Native plant species richness- trees	4	6	-	9	9	-
Native plant species richness- shrubs	7	5	-	1	1	-
Native plant species richness- grasses	6	6	-	10	10	-
Native plant species richness- forbs	8	5	-	2	2	-
Tree canopy height	14.5	10	-	3	3	-
Tree canopy cover (%)	48	61.5	-	41.3	41.3	-
Shrub canopy cover (%)	4.2	25.6	-	0.1	0.1	-
Native perennial grass cover (%)	43.6	14	-	43	43	-
Organic litter cover (%)	30.3	66	-	24	24	-
Large Trees	8.25	4	-	32	32	-
Coarse woody debris (m per ha)	831.2	1100	-	346	346	-
Non-native plant cover	0	5	-	5	5	-
Site Context						
Size of patch	-	>200 ha	10	-	>200 ha	10
Connectedness	-	>75%	5	-	>75%	5
Context	-	>30-75%	4	-	>30-75%	4
Ecological corridors	-	within	6	-	within	6

Table B1 (Continued)
Terrestrial Habitat Quality Data – Proposed Offset Area¹

Assessment Unit	AU9 - RE 11.4.8			AU10 - RE 11.5.18		
Assessment Unit Area (ha)	1.0			6.5		
Survey Site	T25			T15		
Attribute	Benchmark	Value	Score	Benchmark ³	Value	Score
Species Habitat Assessment (Squatter Pigeon [southern])						
Threats to species	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	Poor	1	-	Moderate	5
Quality and availability of shelter	-	Poor	1	-	Moderate	5
Species mobility category	-	Minor restriction	10	-	Minor restriction	10
Role of the site location to species overall population in the state	-	Unlikely to be critical	1	-	Unlikely to be critical	1
Score Total	-	-	7.14	-	-	7.14
Species Habitat Assessment (Koala)						
Threats to species	-	moderate	7	-	-	-
Quality and availability of foraging habitat	-	Poor	1	-	-	-
Quality and availability of shelter	-	Poor	1	-	-	-
Species mobility category	-	Severely restricted	10	-	-	-
Role of the site location to species overall population in the state	-	Unlikely to be critical	1	-	-	-
Score Total	-	-	7.26	-	-	7.26
Species Habitat Assessment (South-eastern Long-eared Bat)						
Threats to species	-	moderate	7	-	moderate	7
Quality and availability of foraging habitat	-	Poor	1	-	Moderate	5
Quality and availability of shelter	-	Poor	1	-	Moderate	5
Species mobility category	-	Severely restricted	10	-	Minor restriction	10
Role of the site location to species overall population in the state	-	Unlikely to be critical	1	-	Unlikely to be critical	1
Score Total	-	-	6.91	-	-	6.91

1 Total offset area is 532 ha.

2 No benchmark available for RE 11.7.4. This assessment has therefore assumed that the data obtained is comparative with the benchmark.

3 No benchmark available for RE 11.5.18. This assessment has therefore assumed that the data obtained is comparative with the benchmark.



Plate 1 AU1 – RE 11.3.2 Site T14



Plate 2 AU2 – RE 11.3.25 Site T23



Plate 3 AU3 – RE 11.3.4/11.3.4a Site T24



Plate 4 AU4 – RE 11.5.2a Site T20



Plate 5 AU5 – RE 11.5.3 Site T18



Plate 6 AU6 – RE 11.5.9 Site T19



Plate 7 AU7 – RE 11.7.2 Site T2



Plate 8 AU8 – RE 11.7.4 Site T28



Plate 9 AU9 – RE 11.4.8 Site T25



Plate 10 AU10 – RE 11.5.18 Site T15

ATTACHMENT C

**TERRESTRIAL HABITAT QUALITY DATA – PROPOSED OFFSET AREA – PREDICTED FUTURE QUALITY
WITH OFFSET**

Table C1
Terrestrial Habitat Quality Data Proposed Offset Area - Predicted Future Quality With Offset¹

Assessment Unit	AU1 - RE 11.3.2			AU2 - RE 11.3.25			AU3 - RE 11.3.4/11.3.4a		
Assessment Unit Area (ha)	12.5			18.5			28.5		
Survey Site	T14			T23			T24		
Attribute	Benchmark	Value	Score	Benchmark	Value	Score	Benchmark	Value	Score
Site Condition									
Recruitment of woody perennial species in EDL (%)	100	80	-	100	80	-	100	80	-
Native plant species richness- trees	2	13	-	4	8	-	4	7	-
Native plant species richness- shrubs	2	3	-	2	2	-	2	1	-
Native plant species richness- grasses	9	6	-	8	5	-	7	4	-
Native plant species richness- forbs	17	3	-	12	7	-	10	4	-
Tree canopy height	18	17	-	23	20	-	22	25	-
Tree canopy cover (%)	40	34.3	-	22	77.5	-	17	17.5	-
Shrub canopy cover (%)	2	3.4	-	1	10.2	-	5	6.5	-
Native perennial grass cover (%)	35	8	-	12	18	-	43	30	-
Organic litter cover (%)	30	32	-	15	29	-	20	23	-
Large Trees	22	12	-	21	8	-	35	16	-
Coarse woody debris (m per ha)	307	648	-	375	154	-	384	160	-
Non-native plant cover (%)	0	20	-	0	20	-	0	20	-
Site Context									
Size of patch	-	>200ha	10	-	>200ha	10	-	>200ha	10
Connectedness	-	>75%	5	-	>75%	5	-	>75%	5
Context	-	>30-75%	4	-	>30-75%	4	-	>75%	5
Ecological corridors	-	within	6	-	within	6	-	within	6

Table C1 (Continued)
Terrestrial Habitat Quality Data Proposed Offset Area - Predicted Future Quality With Offset¹

Assessment Unit	AU1 - RE 11.3.2			AU2 - RE 11.3.25			AU3 - RE 11.3.4/11.3.4a		
Assessment Unit Area (ha)	12.5			18.5			28.5		
Survey Site	T14			T23			T24		
Attribute	Benchmark	Value	Score	Benchmark	Value	Score	Benchmark	Value	Score
Species Habitat Assessment (Squatter Pigeon [southern])									
Threats to species	-	low	15	-	low	15	-	low	15
Quality and availability of foraging habitat	-	high	10	-	high	10	-	high	10
Quality and availability of shelter	-	high	10	-	high	10	-	high	10
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	8.19	-	-	8.19	-	-	8.19
Species Habitat Assessment (Koala)									
Threats to species	-	low	15	-	low	15	-	low	15
Quality and availability of foraging habitat	-	high	10	-	high	10	-	high	10
Quality and availability of shelter	-	high	10	-	high	10	-	high	10
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	7.95	-	-	7.95	-	-	7.95
Species Habitat Assessment (South-eastern Long-eared Bat)									
Threats to species	-	low	15	-	low	15	-	low	15
Quality and availability of foraging habitat	-	high	10	-	high	10	-	high	10
Quality and availability of shelter	-	high	10	-	high	10	-	high	10
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	8.16	-	-	8.16	-	-	8.16

Table C1 (Continued)
Terrestrial Habitat Quality Data Proposed Offset Area - Predicted Future Quality With Offset¹

Assessment Unit	AU4 - RE 11.5.2a			AU5 - RE 11.5.3			AU6 - RE 11.5.9		
Assessment Unit Area (ha)	98.0			108.0			34.5		
Survey Site	T20			T18			T19		
Attribute	Benchmark	Value	Score	Benchmark	Value	Score	Benchmark	Value	Score
Site Condition									
Recruitment of woody perennial species in EDL (%)	100	80	-	100	80	-	100	80	-
Native plant species richness- trees	8.5	6	-	6	11	-	3	8	-
Native plant species richness- shrubs	2.5	0	-	6	5	-	6	3	-
Native plant species richness- grasses	6	6	-	6	7	-	9	7	-
Native plant species richness- forbs	5.5	5	-	10	4	-	11	5	-
Tree canopy height	13	10	-	16	16	-	17	20	-
Tree canopy cover (%)	53.65	57.8	-	20	23.7	-	25	13.5	-
Shrub canopy cover (%)	11.85	0	-	3	10.4	-	10	8.2	-
Native perennial grass cover (%)	23.5	19	-	19	19	-	26	12	-
Organic litter cover (%)	37.5	27	-	20	41	-	30	80	-
Large Trees	31	58	-	10	2	-	20	2	-
Coarse woody debris (m per ha)	106.4	519	-	314	893	-	342	94.8	-
Non-native plant cover (%)	0	5	-	0	5	-	0	5	-
Site Context									
Size of patch	-	>200ha	10	-	>200ha	10	-	>200ha	10
Connectedness	-	>75%	5	-	>75%	5	-	>75%	5
Context	-	>75%	5	-	>75%	5	-	>75%	5
Ecological corridors	-	within	6	-	within	6	-	within	6

Table C1 (Continued)
Terrestrial Habitat Quality Data Proposed Offset Area - Predicted Future Quality With Offset¹

Assessment Unit	AU4 - RE 11.5.2a			AU5 - RE 11.5.3			AU6 - RE 11.5.9		
Assessment Unit Area (ha)	98.0			108.0			34.5		
Survey Site	T20			T18			T19		
Attribute	Benchmark	Value	Score	Benchmark	Value	Score	Benchmark	Value	Score
Species Habitat Assessment (Squatter Pigeon [southern])									
Threats to species	-	low	15	-	low	15	-	low	15
Quality and availability of foraging habitat	-	high	10	-	high	10	-	high	10
Quality and availability of shelter	-	high	10	-	high	10	-	high	10
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	8.19	-	-	8.19	-	-	8.19
Species Habitat Assessment (Koala)									
Threats to species	-	low	15	-	low	15	-	low	15
Quality and availability of foraging habitat	-	moderate	5	-	moderate	5	-	moderate	5
Quality and availability of shelter	-	high	10	-	high	10	-	high	10
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	7.95	-	-	7.95	-	-	7.95
Species Habitat Assessment (South-eastern Long-eared Bat)									
Threats to species	-	low	15	-	low	15	-	low	15
Quality and availability of foraging habitat	-	high	10	-	high	10	-	high	10
Quality and availability of shelter	-	high	10	-	high	10	-	high	10
Species mobility category	-	minor restriction	10	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1	-	not critical	1
Score Total	-	-	8.16	-	-	8.16	-	-	8.16

Table C1 (Continued)
Terrestrial Habitat Quality Data Proposed Offset Area - Predicted Future Quality With Offset¹

Assessment Unit	AU7 - RE 11.7.2			AU8 - RE 11.7.4		
Assessment Unit Area (ha)	26.5			5.0		
Survey Site	T2			T28		
Attribute	Benchmark	Value	Score	Benchmark ²	Value	Score
Site Condition						
Recruitment of woody perennial species in EDL (%)	100	80	-	100	100	-
Native plant species richness- trees	3	6	-	17	17	-
Native plant species richness- shrubs	4	5	-	3	3	-
Native plant species richness- grasses	5	3	-	8	8	-
Native plant species richness- forbs	5	2	-	5	5	-
Tree canopy height	15	15	-	18	18	-
Tree canopy cover (%)	40	51.7	-	34.9	34.9	-
Shrub canopy cover (%)	4	5.1	-	12.6	12.6	-
Native perennial grass cover (%)	15	17	-	38	38	-
Organic litter cover (%)	20	42	-	27	27	-
Large Trees	36	8	-	22	22	-
Coarse woody debris (m per ha)	1214	1785	-	206	206	-
Non-native plant cover (%)	0	5	-	20	20	-
Site Context						
Size of patch	-	>200ha	10	-	>200ha	10
Connectedness	-	>75%	5	-	>75%	5
Context	-	>30-75%	4	-	>30-75%	4
Ecological corridors	-	within	6	-	within	6

Table C1 (Continued)
Terrestrial Habitat Quality Data Proposed Offset Area - Predicted Future Quality With Offset¹

Assessment Unit	AU7 - RE 11.7.2			AU8 - RE 11.7.4		
Assessment Unit Area (ha)	26.5			5.0		
Survey Site	T2			T28		
Attribute	Benchmark	Value	Score	Benchmark ²	Value	Score
Species Habitat Assessment (Squatter Pigeon [southern])						
Threats to species	-	low	15	-	low	15
Quality and availability of foraging habitat	-	high	10	-	high	10
Quality and availability of shelter	-	high	10	-	high	10
Species mobility category	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1
Score Total	-	-	8.19	-	-	8.19
Species Habitat Assessment (Koala)						
Threats to species	-	-	-	-	low	15
Quality and availability of foraging habitat	-	-	-	-	high	10
Quality and availability of shelter	-	-	-	-	high	10
Species mobility category	-	-	-	-	minor restriction	10
Role of the site location to species overall population in the state	-	-	-	-	not critical	1
Score Total	-	-	7.95	-	-	7.95
Species Habitat Assessment (South-eastern Long-eared Bat)						
Threats to species	-	low	15	-	low	15
Quality and availability of foraging habitat	-	moderate	5	-	high	10
Quality and availability of shelter	-	moderate	5	-	high	10
Species mobility category	-	minor restriction	10	-	minor restriction	10
Role of the site location to species overall population in the state	-	not critical	1	-	not critical	1
Score Total	-	-	8.16	-	-	8.16

Table C1 (Continued)
Terrestrial Habitat Quality Data – Proposed Offset Area¹

Assessment Unit	AU9 - RE 11.4.8			AU10 - RE 11.5.18		
Assessment Unit Area (ha)	1.0			6.5		
Survey Site	T25			T15		
Attribute	Benchmark	Value	Score	Benchmark ³	Value	Score
Site Condition						
Recruitment of woody perennial species in EDL (%)	100	100	-	100	100	-
Native plant species richness- trees	4	6	-	9	9	-
Native plant species richness- shrubs	7	5	-	1	1	-
Native plant species richness- grasses	6	6	-	10	10	-
Native plant species richness- forbs	8	5	-	2	2	-
Tree canopy height	14.5	10	-	3	3	-
Tree canopy cover (%)	48	61.5	-	41.3	41.3	-
Shrub canopy cover (%)	4.2	25.6	-	0.1	0.1	-
Native perennial grass cover (%)	43.6	14	-	43	43	-
Organic litter cover (%)	30.3	66	-	24	24	-
Large Trees	8.25	4	-	32	32	-
Coarse woody debris (m per ha)	831.2	1100	-	346	346	-
Non-native plant cover	0	5	-	5	5	-
Site Context						
Size of patch	-	>200 ha	10	-	>200 ha	10
Connectedness	-	50-75%	4	-	>75%	5
Context	-	>75%	5	-	>75%	5
Ecological corridors	-	within	6	-	within	6

Table C1 (Continued)
Terrestrial Habitat Quality Data – Proposed Offset Area¹

Assessment Unit	AU9 - RE 11.4.8			AU10 - RE 11.5.18		
Assessment Unit Area (ha)	1.0			6.5		
Survey Site	T25			T15		
Attribute	Benchmark	Value	Score	Benchmark ³	Value	Score
Species Habitat Assessment (Squatter Pigeon [southern])						
Threats to species	-	High	1	-	High	1
Quality and availability of foraging habitat	-	Poor	1	-	Moderate	5
Quality and availability of shelter	-	Poor	1	-	Moderate	5
Species mobility category	-	Minor restriction	10	-	Minor restriction	10
Role of the site location to species overall population in the state	-	Unlikely to be critical	1	-	Unlikely to be critical	1
Score Total	-	-	8.19	-	-	8.19
Species Habitat Assessment (Koala)						
Threats to species	-	low	15	-	-	-
Quality and availability of foraging habitat	-	Poor	1	-	-	-
Quality and availability of shelter	-	Poor	1	-	-	-
Species mobility category	-	Severely restricted	10	-	-	-
Role of the site location to species overall population in the state	-	Unlikely to be critical	1	-	-	-
Score Total	-	-	7.95	-	-	7.95
Species Habitat Assessment (South-eastern Long-eared Bat)						
Threats to species	-	moderate	17	-	low	15
Quality and availability of foraging habitat	-	Poor	1	-	Moderate	5
Quality and availability of shelter	-	Poor	1	-	Moderate	5
Species mobility category	-	Severely restricted	10	-	Minor restriction	10
Role of the site location to species overall population in the state	-	Unlikely to be critical	1	-	Unlikely to be critical	1
Score Total	-	-	8.16	-	-	8.16

1 Total offset area is 532 ha.

2 No benchmark available for RE 11.7.4. This assessment has therefore assumed that the data obtained is comparative with the benchmark.

3 No benchmark available for RE 11.5.18. This assessment has therefore assumed that the data obtained is comparative with the benchmark.

APPENDIX C

VEGETATION VALIDATION AND TERRESTRIAL HABITAT ASSESSMENT (NATURECALL, 2016a)

Vegetation Validation and Terrestrial Habitat Assessment

Client:

Middlemount Coal Pty Ltd

August 2016



Document Status

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Executive Summary

Biodiversity Australia Pty Ltd trading as Naturecall Environmental (hereafter referred to as 'Naturecall') has been requested by Middlemount Coal Pty Ltd (MCPL) to undertake vegetation validation and terrestrial habitat quality assessments on land owned by MCPL.

The study site is located approximately 270 kilometres (km) north-west of Rockhampton and 9 km south-west of the Middlemount township. The study site comprises freehold land owned by MCPL and is approximately 1,487 hectares in area. It includes a combination of forested/woodland areas along with cleared grazing land.

The primary objectives for this study were to:

- verify and ground truth existing Regional Ecosystem mapping of the study site;
- undertake terrestrial habitat quality surveys over the study site;
- determine the suitability of the site to provide habitat for locally occurring threatened species; and
- determine connectivity values of the study site.

A desktop study (including comprehensive literature review) was carried out prior to the field survey to gather relevant information and data. Existing Department of Environment and Heritage Regional Ecosystem mapping of the study site, as well as previous mapping on adjoining land was obtained and used in conjunction with satellite imagery to identify the broad vegetation types present on the study site.

Flora and fauna surveys were undertaken throughout the study site from 9 to 15 June 2016. A total of 28 terrestrial habitat quality assessment sites and 17 quaternary vegetation plots were carried out across the study site. The fauna surveys comprised habitat suitability assessment, targeted surveys for threatened species, track, scat and secondary evidence searches as well as opportunistic fauna observations.

The recently concluded field surveys allow more precise assessments of regional ecosystem identities and boundaries than was previously possible. Ground-truthed regional ecosystems generally follow the broad patterns of mapped regional ecosystem distributions, but this study has refined and resolved some mixed polygons, shifted boundaries and identified new occurrences of a number of regional ecosystems.

A total of 13 distinct regional ecosystems were ground-truthed over the site. Three of these are listed as Endangered and four listed as Of Concern under the Queensland *Vegetation Management Act, 1999* Brigalow communities within the study site are also considered analogous to the *Environment Protection and Biodiversity Conservation Act 1999* listed Threatened Ecological Community *Brigalow (Acacia harpophylla dominant and co-dominant)*.



The study site was categorised into six broad fauna habitat types (i.e. eucalypt woodland/forest, *Micromyrtus* shrubland, riparian habitat, *Acacia shirleyi* forest, *Acacia harpophylla* woodland/forest, and regrowth/derived grassland). Eucalypt woodland was the most common habitat type on the study site. A number of habitat features were well represented in eucalypt woodlands such as hollow-bearing trees, coarse woody debris, nectar sources and native groundcover.

It is considered that the various habitat types present on site would provide suitable habitat for a range of conservation significant fauna species including the Squatter Pigeon, Koala (*Phascolarctos cinereus*) and South-eastern Long-eared Bat (*Nyctophilus corbeni*).

Cerbera dumicola, listed as 'Near Threatened' under the Queensland *Nature Conservation Act, 1992* was identified at four locations during the field survey. In addition, the Koala was recorded via secondary evidence (i.e. scats and scratches) at two locations in the study site.



1.0 Introduction

Biodiversity Australia Pty Ltd trading as Naturecall Environmental (hereafter referred to as 'Naturecall') has been requested by Middlemount Coal Pty Ltd (MCPL) to undertake vegetation validation and terrestrial habitat quality assessments on land owned by MCPL.

The survey was undertaken in consideration of the following:

- *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (Eyre et al 2014);
- the *Guide to Determining Terrestrial Habitat Quality Version 1.1* (Department of Environment and Heritage Protection [DEHP] 2014);
- the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner et al. 2012); and
- *Survey Guidelines for Australia's Threatened Birds* (Department of the Environment, Water, Heritage and the Arts [DEWHA], 2010).
- Habitat requirements for potentially occurring threatened species.



2.0 Background Information

2.1. Location of the Study Site

The study site is located approximately 270 kilometres (km) north-west of Rockhampton and 9 km south-west of the Middlemount township (Figure 1). It falls within in the Isaac-Comet Downs sub-region of the North Brigalow Belt Bioregion, within the Fitzroy catchment.

The study site comprises freehold land owned by MCPL and is approximately 1,487 hectares (ha) in area. It includes a combination of forested/woodland areas along with cleared grazing land. The study area is adjacent to three existing offset areas (Figure 2).

2.2. Study Objectives

The primary objectives for this study were to:

- verify and ground truth existing Regional Ecosystem (RE) mapping of the study site;
- undertake terrestrial habitat quality surveys over the study site;
- determine the suitability of the site to provide habitat for locally occurring threatened species; and
- determine connectivity values of the study site.



Figure 1: Location of the Study Site

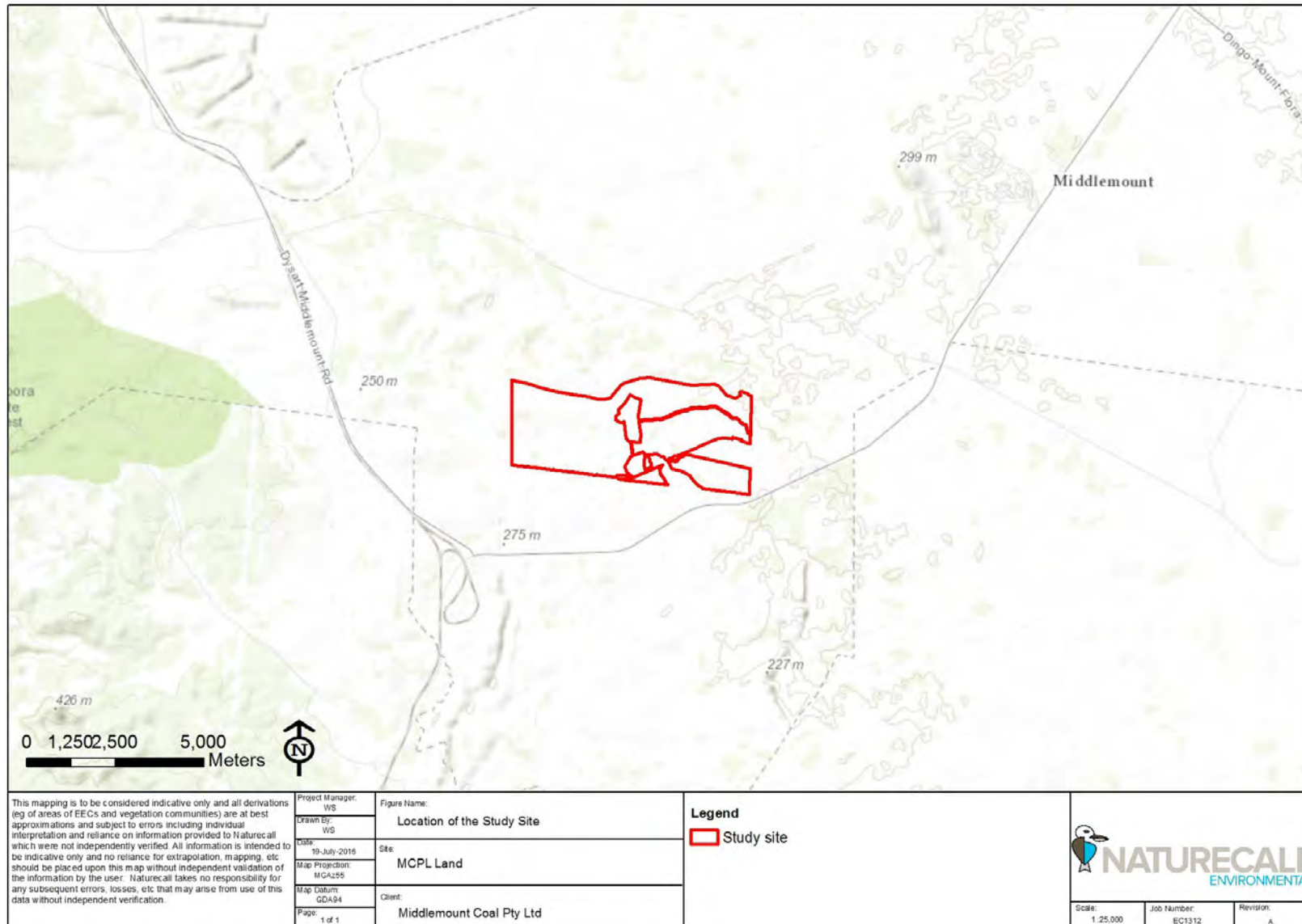
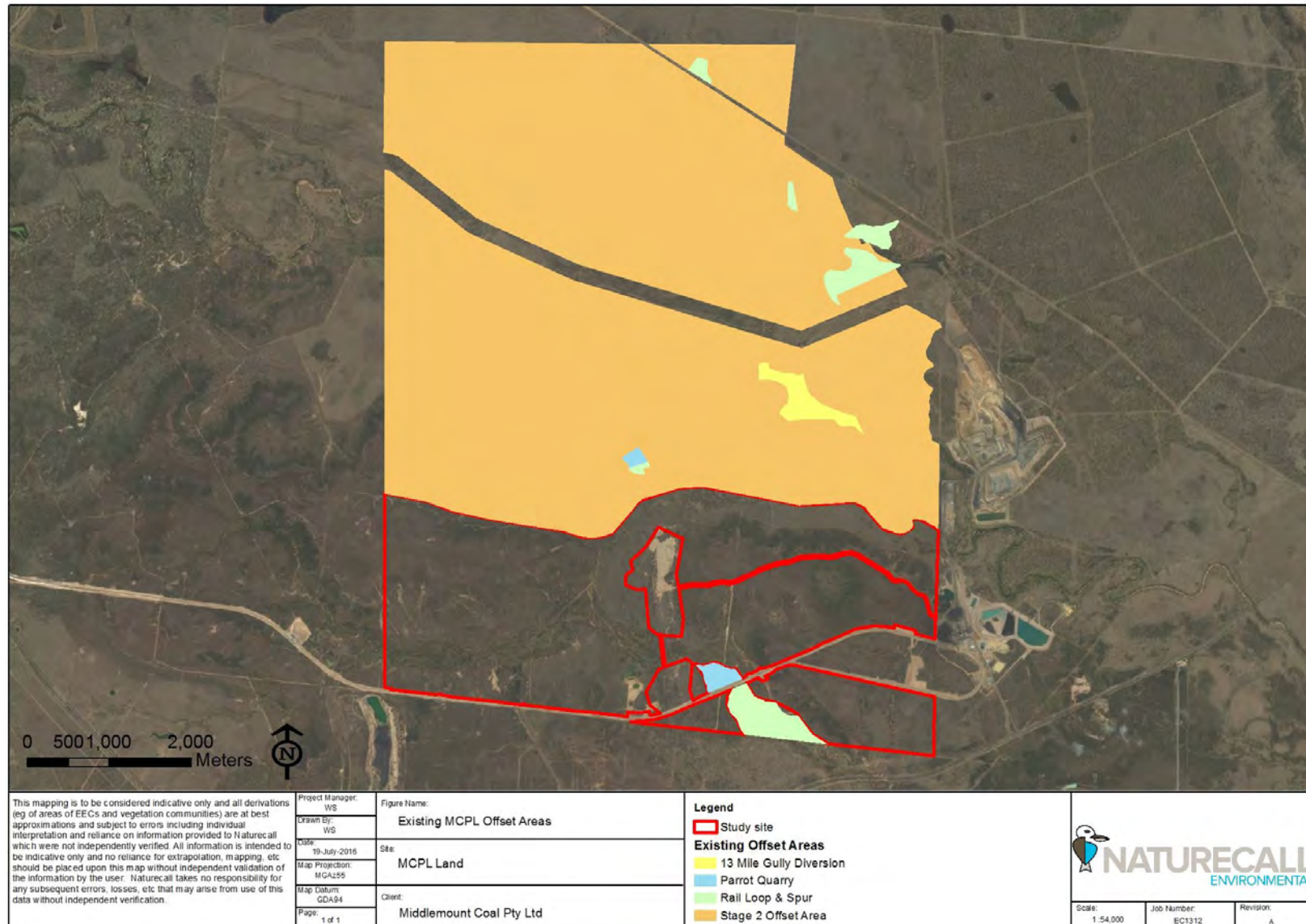




Figure 2: Existing MCPL Offset Areas





3.0 Existing Environment

3.1. Soils, Topography and Geology

The general topography of the study site is gently undulating lowlands with slopes ranging from <5 to 30 degrees. Elevated areas generally occur in the east and west of the site with level and low lying areas occurring in the centre and north-east of the site and along an alluvial plain associated with Parrot Creek (Figure 3).

Scarp retreat zones occur in the north-east and south-east of the site. These areas are characterised by skeletal soils with exposed rocky outcrops and deeply incised gullies.

Surface geology of the site comprises several formations as shown in Figure 3. The dominant underlying geology is the Duaringa Formation which is made up of sedimentary rocks including mudstone, sandstone, siltstone and conglomerate (Department of Natural Resources and Mines [DNRM] 2015). The St Lawrence formation bisects the centre of the site and comprises volcanics (intrusive rhyolite, trachyte and microsyenite) while the Parrot Creek floodplain comprises quaternary alluvium comprising clay, silt, sand and gravel (DNRM 2015).

Soil types within the study site vary widely depending on the topographic location and underlying geology. The most prevalent soil type within the study site is silty to sandy loams and clays.

A total of six land zones were mapped over the study site (Wilson and Taylor 2012, DEHP 2015a), comprising:

- Land Zone 3: Recent Quaternary alluvial systems.
- Land Zone 4: Tertiary-early Quaternary clay plains.
- Land Zone 5: Tertiary-early Quaternary loamy and sandy plains and plateaus.
- Land Zone 7: Cainozoic duricrusts.
- Land Zone 9: Fine grained sedimentary rocks.

3.2. Regional Ecosystems

Existing DEHP Regional Ecosystem mapping of the study site indicates that 15 Regional Ecosystems occur within the study site (Table 1; Figure 4). This study includes field verification of the DEHP mapped Regional Ecosystems, described in detail in Section 5.2.2.



Figure 3: Geology and Drainage

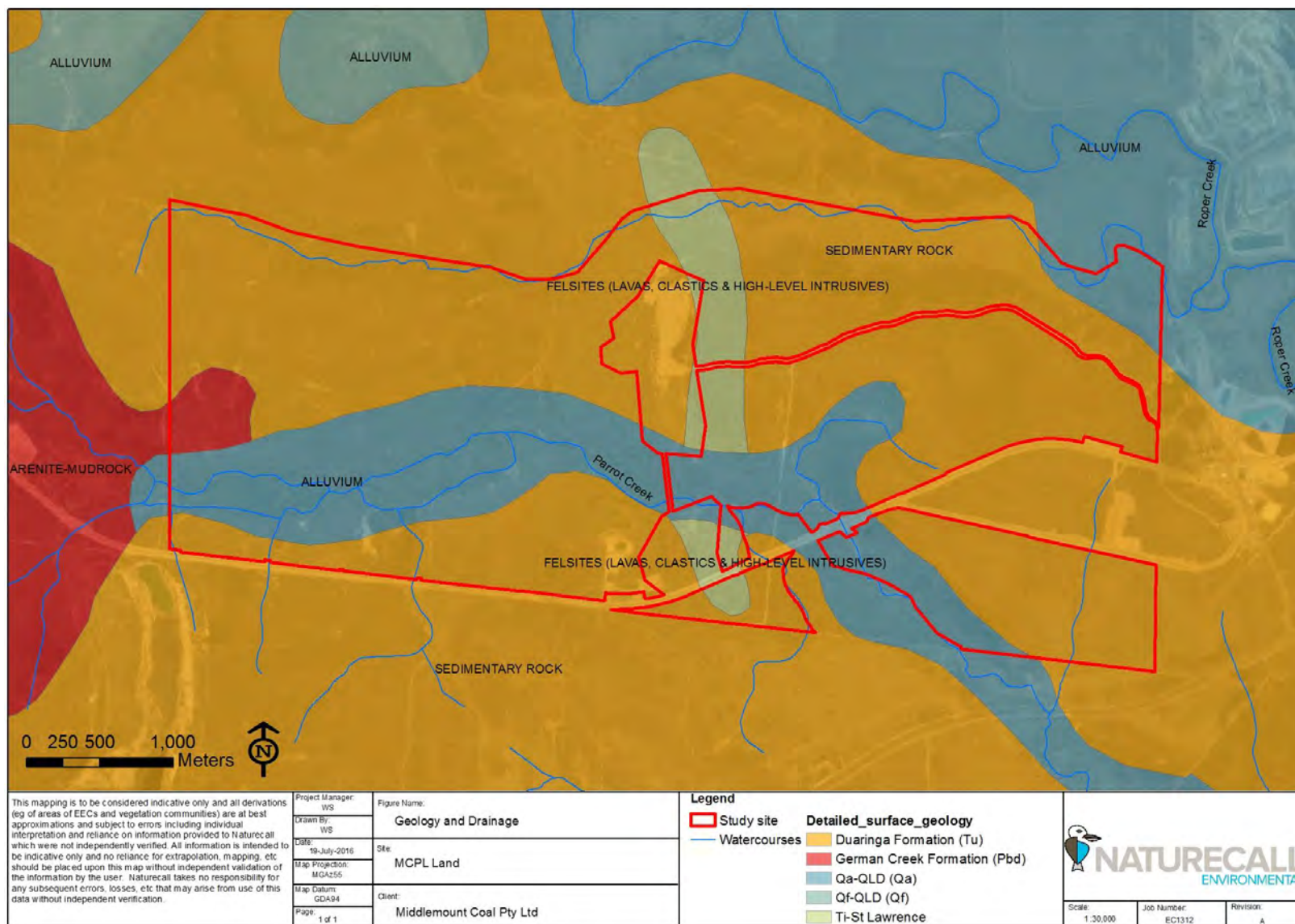




Table 1: Mapped Regional Ecosystems located within the Study Site

Regional Ecosystem	Short Description	DEHP Mapped Area (ha)	VMA Status	BD Status	EPBC Status
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains.	15.5	OC	OC	-
11.3.2/11.3.7	<i>Eucalyptus populnea</i> woodland on alluvial plains and <i>Corymbia</i> spp. woodland on alluvial plains. sandy soils.	5.0	OC/LC	OC/OC	-
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines.	5.1	LC	OC	-
11.3.4/11.3.25	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains and <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	120.3	OC/LC	OC/OC	-
11.4.8	<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains.	35.8	E	E	E
11.4.9/11.4.8	<i>Acacia harpophylla</i> shrubby open forest to woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains and <i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	9.0	E/E	E/E	E
11.5.2	<i>Eucalyptus crebra</i> , <i>Corymbia</i> spp., with <i>E. moluccana</i> on lower slopes of Cainozoic sand plains/remnant surfaces.	9.7	LC	NC	-
11.5.2/11.5.2a	<i>Eucalyptus crebra</i> , <i>Corymbia</i> spp., with <i>E. moluccana</i> on lower slopes of Cainozoic sand plains/remnant surfaces: and <i>Allocasuarina luehmannii</i> low tree layer with or without emergent woodland.	420.3	LC/LC	NC/NC	-
11.5.2/11.5.3	<i>Eucalyptus crebra</i> , <i>Corymbia</i> spp., with <i>E. moluccana</i> on lower slopes of Cainozoic sand plains/remnant surfaces and <i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces	6.1	LC/LC	NC/NC	-
11.5.3	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces	23.8	LC	NC	-



Regional Ecosystem	Short Description	DEHP Mapped Area (ha)	VMA Status	BD Status	EPBC Status
11.5.9b/11.5.18	<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and remnant surfaces and <i>Micromyrtus capricornia</i> shrubland on Cainozoic sand plains and/or remnant surfaces	207.7	LC/OC	NC/OC	-
11.5.9b/11.5.3	<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and remnant surfaces and <i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces	116.3	LC/LC	NC/NC	-
11.7.2/11.7.1	<i>Acacia</i> spp. woodland and or on Cainozoic lateritic duricrust. Scarp retreat zone/ <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> and <i>Eucalyptus thozetiana</i> or <i>E. microcarpa</i> woodland on lower scarp slopes on Cainozoic lateritic duricrust	87.9	LC/LC	NC/OC	-
11.7.2/11.7.4	<i>Acacia</i> spp. woodland on lateritic duricrust. Scarp retreat zone and <i>Eucalyptus decorticans</i> and <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> on lateritic duricrust.	40.7	LC/LC	NC/NC	-
11.9.5/11.9.1	<i>Acacia harpophylla-Eucalyptus cambageana</i> open forest to woodland on fine-grained sedimentary rocks and <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks	1.5	E/E	E/E	E/E

E – Endangered, OC – Of Concern, NC – No Concern at present, LC – Least Concern, VMA – Vegetation Management Act, EPBC –Environmental Protection & Biodiversity Conservation Act, BD Status –Biodiversity Status (according to the Queensland Government).



Source: DEHP 2015a





3.3. Drainage Features

The site is located in the Fitzroy River Basin which drains an area of approximately 150,000km² (DNRM 2015). The main drainage feature of the study site is Parrot Creek which passes through the southern half of the site (Figure 3). Parrot Creek was found to be dry during the field surveys (Photo 1). A number of other smaller tributaries and drainage lines flow through the study site into Parrot Creek from the south (Figure 3).

A tributary to Roper Creek also runs along the site's northern boundary (adjacent the existing Middlemount Stage 2 Project offset area) and joins Roper Creek just to the north-east of the study site.

These watercourses are all ephemeral (i.e. flow is restricted to periods after rainfall), so while these watercourses were not flowing during the field surveys, recent rainfall events resulted in a number of temporary waterholes within these watercourses (Photo 2).

Permanent water sources were located within the study site, including two large dams in the central-south of the study site which were excavated for railway fill (Photo 3). These water sources would provide a permanent water source for native fauna and habitat for a range of bird species.

Photo 1: Section of Parrot Creek in the south of the study site (terrestrial habitat quality site 3)





Photo 2: Waterhole located in the Parrot Creek floodplain within the study area (west of terrestrial habitat site 24)



Photo 3: Artificial dam in the south of the study site (southern extent of the study area)





3.4. Landuse and Disturbance History

The study site does not contain any developed areas such as dwellings or farm infrastructure. The primary landuse at present is beef cattle grazing, most of which occurs along Parrot Creek and over cleared areas in the centre and north-east of the site. No other agricultural activities occur within the study site.

Historically, the main disturbance activities within the study site were related to land clearing (to promote cattle grazing) which has occurred extensively in low-lying areas including creek flats, and clay plains. These areas were most likely dominated by Brigalow prior to land clearing activities. Grazing and trampling by cattle has suppressed regeneration over some cleared areas, however natural regeneration is occurring extensively throughout the study site.

Vegetation thinning also appears to have been a common practice throughout the study site and has occurred more commonly in woodland areas in the east of the site, with the forested areas in the west of the site appearing to remain largely undisturbed.

3.5. Summary of Previous Threatened Species Recorded

A number of flora and fauna surveys have been undertaken on lands surrounding the study site (Parsons Brinckerhoff 2010, Ecology & Heritage Partners [E&HP] 2012, EHP 2013a, 2013b, 2013c, Naturecall 2013, 2014a, 2014b, 2014c, 2015, GHD 2012). These surveys have resulted in the detection of a number of flora and fauna species listed under the *Nature Conservation Act, 1992* (NC Act) and/or *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) which include:

- *Cerbera dumicola* (listed as 'Near Threatened' under the NC Act) (Parsons Brinckerhoff 2010, EHP 2012, Naturecall 2013).
- Koala (*Phascolarctos cinereus*) (listed as 'Vulnerable' under the NC Act and EPBC Act) (Parsons Brinckerhoff 2010, Naturecall 2014b, EHP 2012).
- Greater Glider (*Petauroides volans*) (listed as 'Vulnerable' under the EPBC Act) (Naturecall 2014b).
- Squatter Pigeon (*Geophaps scripta scripta*) (listed as 'Vulnerable' under the NC Act and EPBC Act) (Parsons Brinckerhoff 2010, EHP 2012, Naturecall 2013, 2014a, 2014c).
- Ornamental Snake (*Denisonia maculata*) (listed as 'Vulnerable' under the NC Act and EPBC Act) (Parsons Brinckerhoff 2010).



4.0 Methodology

4.1. Desktop Study and Literature Review

A desktop study was carried out prior to the field survey to gather relevant information and data. The following databases and Geographic Information System (GIS) layers were searched/obtained:

- Department of the Environment and Energy (DEE) Protected Matters Search Tool (DEE 2016a).
- DEHP Wildlife Online database (DEHP 2016a).
- DEHP Certified Regional Ecosystems Mapping digital data layer (DEHP 2015a).
- Pre-clearing Regional Ecosystems digital data layer (DEHP 2015b).

In addition to the desktop searches, the following literature was reviewed:

- E&HP (2012). *Ecological Investigations within the Offset Area for Stage 2 of the Middelmount Coal Mine, Queensland, Australia*. Middelmount Coal Pty Ltd.
- E&HP (2013a). *Vegetation Offsets for Middelmount Rail Spur and Loop*.
- E&HP (2013b). *Vegetation Offsets for Parrot Quarry*.
- E&HP (2013c). *Vegetation Offsets for Middelmount Coal Mine Thirteen Mile Gully Diversion*.
- GHD (2012) *Rail Spur Environmental Offset Package*.
- MCPL (2013a) Middelmount Coal Mine Rail Loop and Spur Vegetation Offset Proposal.
- MCPL (2013b) Parrot Quarry Vegetation Offset Proposal.
- MCPL (2013c) Thirteen Mile Gully Diversion Vegetation Offset Proposal.
- MCPL (2013c). *Middelmount Coal Mine Offset Management Plan/Vegetation Management Plan. Queensland, Australia*. Middelmount Coal Pty Ltd.
- Naturecall (2013). *Ecological Monitoring for Offset Area*. Unpublished report to Middelmount Coal Pty Ltd.
- Naturecall Environmental (2014a). *Ecological Assessment Report for Bingegang Pipeline Relocation*, Middelmount Coal Mine.
- Naturecall (2014b). *Ecological Monitoring for Offset Area: Use of the Offset Area by Fauna*. Unpublished report to Middelmount Coal Pty Ltd.
- Naturecall (2014c). *Ecological Monitoring for Offset Area Year 2*. Unpublished report to Middelmount Coal Pty Ltd.
- Naturecall (2015). *Terrestrial Ecology Impact Assessment: North-eastern Extension, Middelmount Coal Mine*. Unpublished report to Middelmount Coal Pty Ltd.
- Parsons Brinckerhoff (2010). *Middelmount Coal Project (Stage 2) Terrestrial Ecological Impact Assessment*.



Existing DEHP Regional Ecosystem mapping of the study site (Section 3.2), as well as previous mapping on adjoining land (Parsons Brinckerhoff 2010, E&HP 2012) was obtained and used in conjunction with satellite imagery to identify the broad vegetation types present on the study site. This preliminary mapping assisted with survey design and allowed comparison to the floristic data collected during the survey.

4.2. Flora Survey

Flora surveys were undertaken throughout the study site by Senior Ecologist Will Steggall and Ecologist Bonnie Lawson from 9 to 15 June 2016. The primary aims of the flora survey were to verify DEHP Regional Ecosystem mapping for the study site.

4.2.1. Survey Methodology

Site condition assessments and quaternary plots were used to verify Regional Ecosystems across the study site as described below. Site selection aimed to sample a representative coverage of the site vegetation.

Site Condition Assessments

Site condition assessments were conducted throughout the study site in accordance with the *Guide to Determining Terrestrial Habitat Quality Version 1.1* (DEHP 2014) to verify the DEHP Regional Ecosystem mapping and conduct terrestrial habitat quality assessments (Photos 4 and 5). The following information was recorded at each of the 28 terrestrial habitat quality assessment sites using a combination of measured plots and transects:

- Observer, location and date.
- Regional Ecosystem map unit.
- Photographic record of vegetation.
- Habitat description (e.g. presence of habitat resources for native fauna).
- Canopy and subcanopy height (measured using stick method).
- Canopy and subcanopy percentage cover.
- Native plant species richness (as a percentage) in each layer.
- Number of large trees located within a 100m x 50m plot.
- Recruitment of woody perennial species (i.e. proportion of dominant layer regenerating).
- Coarse woody debris within a 50m x 20m plot.
- Non-native plant cover percentage.
- Groundcover composition.

The locations of the 28 terrestrial habitat quality assessment sites are shown on Figure 5.



Quaternary Sites

A total of 17 quaternary survey sites were carried out across the study site to supplement the site condition assessments (i.e. the terrestrial habitat quality assessment sites). This allowed accurate mapping of Regional Ecosystems, a more comprehensive species list of the study site (Appendix 1), and validation of vegetation status (i.e. remnant/non-remnant).

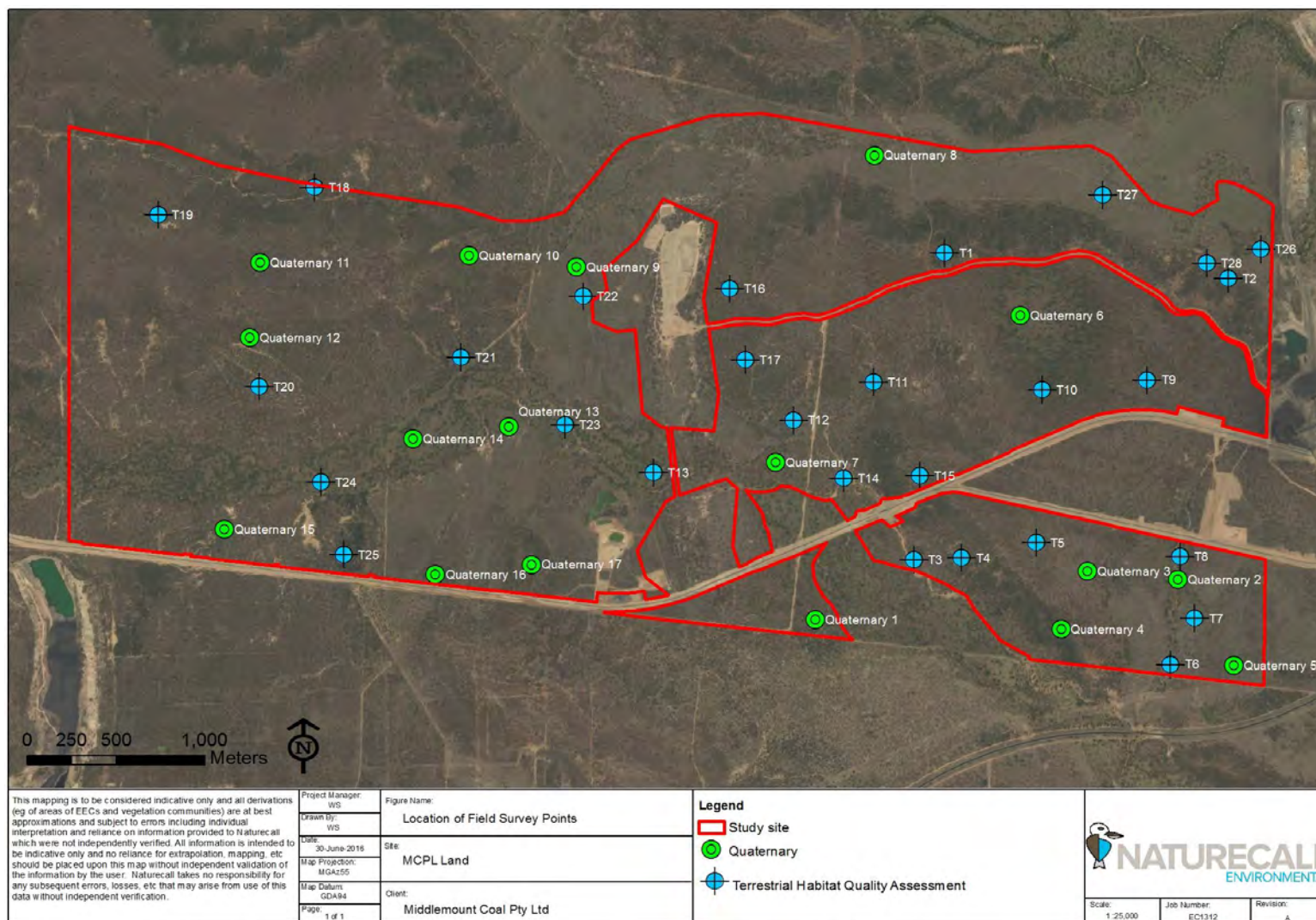
The following information was recorded at each quaternary survey site:

- Date.
- Structural Code.
- Ecologically Dominant Layer (EDL) Height.
- EDL Cover.
- Land Zone.
- Regional Ecosystem Map Unit.
- Collector/s.
- X/Y Coordinate.
- Remnant Vegetation Cover.
- Species Present.

The locations of the 17 quaternary surveys are shown in Figure 5.



Figure 5: Location of survey sites





Reference Sites

Two reference sites were created within the study site to establish a local benchmark for RE 11.5.2a, as no benchmark has been established by the Queensland Herbarium and no local benchmark is known to have been established by previous surveys in the area.

These reference sites were created in accordance with the *Methodology for the Establishment and Survey of Reference Sites for BioCondition* (Department of Environment & Resource Management 2011).

4.2.2. Vegetation Community Description and Mapping

The mapping of vegetation across the study site was based on the regional ecosystem framework (Sattler and Williams 1999). Regional Ecosystems are coded with a three part number consisting of the following:

- 1) Bioregion.
- 2) Land zone.
- 3) Ecosystem number.

Desktop mapping was undertaken in ArcGIS 10.2.2 (© ESRI 1995-2015) using the data collected in the field, existing Regional Ecosystems mapping and high resolution satellite imagery.

4.2.3. Conservation Status Assessment

Vegetation communities identified during the surveys were assessed for their conservation status under the EPBC Act, *Vegetation Management Act 1999* (VM Act) and DEHP Biodiversity Status.

The 'Biodiversity Status' is not listed under the VM Act but is used for a range of planning and management applications including the Biodiversity Planning Assessments and to determine environmentally sensitive areas.



Photo 4: Assessing groundcover using quadrat



Photo 5: Measuring tree diameter





4.3. Fauna Surveys

Fauna surveys were undertaken throughout the study site during the flora surveys (9 to 15 June 2016). The fauna surveys comprised the following:

- Habitat suitability assessment.
- Diurnal bird surveys.
- Track, scat and secondary evidence searches.
- Koala food trees.
- Opportunistic fauna observations.

Further detail is provided in Section 4.3.1 to 4.3.4.

4.3.1. Habitat Suitability Assessment

Broad fauna habitat types on the study site were categorised and mapped using the same classifications as Parsons Brinckerhoff (2010). The condition and features (e.g. hollows, fallen logs, leaf litter) of the various habitat types within the study site were recorded during the field surveys and any permanent and non-permanent water sources were also recorded and photographed.

Detailed data on habitat parameters such as groundcover density and composition, vegetation structure, coarse woody debris and weed cover was collected as part of the site condition assessment (Section 4.2.1).

Potential foraging/roosting habitat suitability for threatened bat species was also determined based on the presence of food sources (e.g. feed trees), hollow-bearing trees, caves (or cave-like structures).

The site was inspected during winter which is not conducive to recording bat species via other survey techniques (as they hibernate). However, bat surveys have been undertaken in the adjoining offset areas in accordance with the Commonwealth *Survey Guidelines for Australia's Threatened Bats* (DEWHA 2010) (Naturecall, 2014, 2014b, 2014c; 2015) and a number of native bat species have been recorded (e.g. Little Pied Bat, Eastern Cave Bat, Eastern Bentwing-bat, etc). Given the wide range of the potentially occurring threatened bat species (e.g. South-eastern Long-eared Bat [*Nyctophilus corbeni*]) and the continuity of habitats between the study site and the existing offset area, the surveys in the offset area are considered to provide a good indication of the presence (or likelihood of occurrence) of threatened bat species within the study site.



4.3.2. Diurnal Bird Surveys

The diurnal bird surveys consisted of specific censuses of at least 30 minutes duration and were undertaken twice a day in the morning and afternoon at each site. Bird species were generally surveyed by detecting calls and searching by binoculars at point positions or along a walking transect. The surveys targeted permanent water sources, roads/tracks and other areas of suitable habitat for the Squatter Pigeon.

Diurnal bird surveys targeting the Squatter Pigeon were undertaken in accordance with the *Commonwealth Survey Guidelines for Australia's Threatened Birds* (DEWHA 2010).

The locations of the diurnal bird surveys are shown in Figure 6.

4.3.3. Track, Scat and Secondary Evidence Searches

Searches for scats and tracks were undertaken opportunistically throughout the study site in conjunction with other surveys and when traversing between vegetation survey sites. A total of approximately 5 hours was spent on this activity.

The sandy roads within and around the study site provided ideal locations for track searches, and any tracks found were photographed and identified using Triggs (1996). Predator scats were collected and analysed in order to identify cryptic fauna species which may occur in the study site.

Physical habitat searches of the site involved:

- Lifting up of debris to search for reptiles and frogs.
- Inspection of dense vegetation for bird nests.
- Observation of likely basking sites for reptiles and frogs.
- Searches for scats, tracks, digging and scratches across the study site as they could indicate the presence of numerous native species (e.g. Koala).

4.3.4. Koala Food Trees

The suitability of the study site to provide habitat for the Koala was determined by assessing the presence of Koala food trees as defined by the *EPBC Act Referral Guidelines for the Vulnerable Koala* (DEE 2014) and *Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006 – 2016* (Environmental Protection Agency [EPA], 2006).

The presence of Koala food trees throughout the study site was determined using the results of the flora surveys (and subsequent Regional Ecosystem mapping). The presence of Koala food trees is discussed in Section 5.4.1.

4.4. Weather Conditions During the Survey

Weather conditions were generally fine and sunny, with overcast conditions and very light rain experienced on 13th June. During the field survey, temperatures ranged from 9.6°C to 24.6°C (Bureau of Meteorology [BoM], 2016).

Heavy rains (>30mm recorded) were experienced during the week prior to the field survey. Rainfall recorded at Middlemount Coal Mine for the months of May and June is shown in Figure 7.



Figure 6: Location of diurnal bird surveys

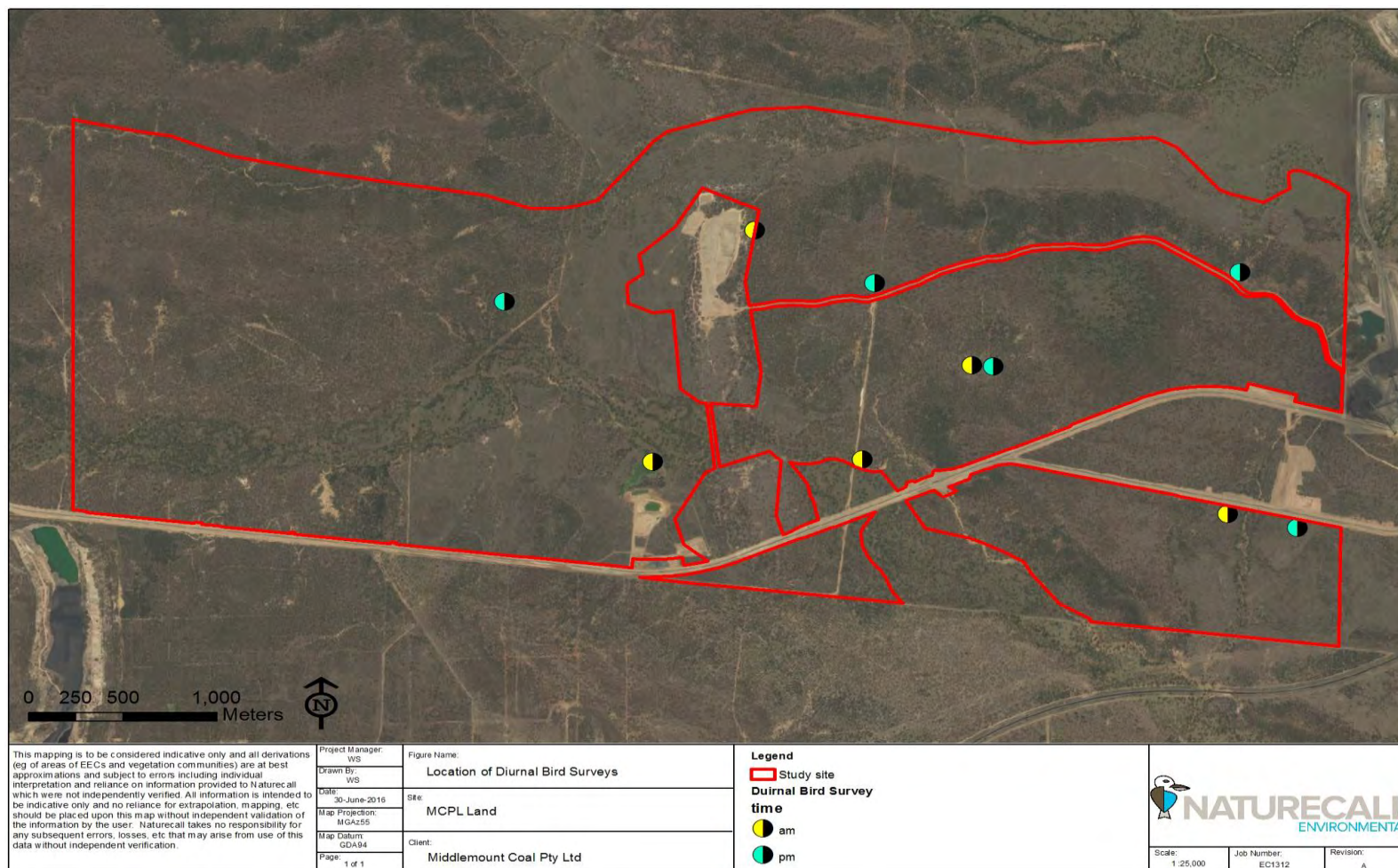
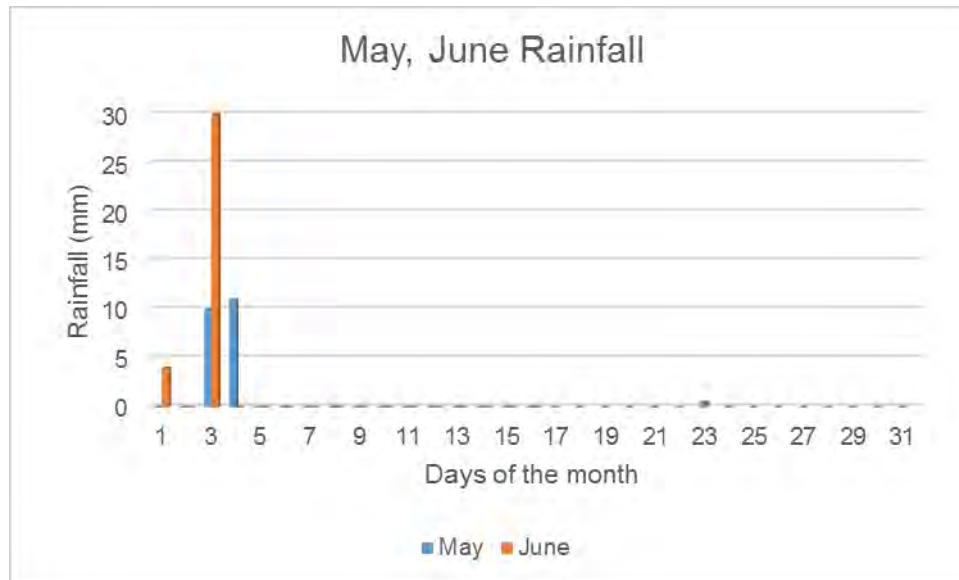




Figure 7: Rainfall at Middlemount Coal Mine for the month of May and June 2016

Source: MCPL 2016





5.0 Results

5.1. Desktop Search Results

5.1.1. Threatened Species (NC Act and EPBC Act)

The database and literature searches indicated that 19 fauna species and two flora species listed under the NC Act and/or EPBC Act have the potential to occur within 10km of the study site (Table 2). Of these, one threatened flora and four threatened flora species have been recorded during previous surveys within 10km of the study site, namely *Cerbera dumicola*, Ornamental Snake, Squatter Pigeon (southern subspecies), Greater Glider and Koala (Table 2).

Table 2: Locally recorded and potentially occurring threatened species

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Source
Flora				
-	<i>Cerbera dumicola</i>	NT	-	DEHP 2016, Parsons Brinckerhoff 2010, DEHP 2016
Blue King Grass	<i>Dichanthium queenslandicum</i>	V	E	DEE 2016a
Fauna				
Fitzroy River Turtle	<i>Rheodytes leukops</i>	V	V	DEE 2016a
Southern Snapping Turtle	<i>Elseya albagula</i>	LC	CE	DEE 2016a
Ornamental Snake	<i>Denisonia maculata</i>	V	V	Parsons Brinckerhoff 2010
Collared Delma	<i>Delma torquata</i>	V	V	DEE 2016a
Yakka Skink	<i>Egernia rugosa</i>	V	V	DEE 2016a
Dunmall's Snake	<i>Furina dunmali</i>	V	V	DEE 2016a
Retro Slider	<i>Lerista allanae</i>	E	E	DEE 2016a
Australian Painted Snipe	<i>Rostratula australis</i>	V	E	DEE 2016a
Red Goshawk	<i>Erythroriorchis radiatus</i>	E	V	DEE 2016a
Painted Honeyeater	<i>Grantiella picta</i>	V	V	DEE 2016a
Squatter Pigeon (southern subspecies)	<i>Geophaps scripta scripta</i>	V	V	Parsons Brinckerhoff 2010, DEHP 2012, Naturecall 2013, 2014a, 2015, DEHP 2016, DEE 2016a
Southern Black-throated Finch	<i>Poephila cincta cincta</i>	E	E	DEE 2016a
Star Finch	<i>Neochmia ruficauda ruficauda</i>	E	E	DEE 2016a



Common Name	Scientific Name	NC Act Status	EPBC Act Status	Source
Greater Glider	<i>Petauroides volans</i>	-	V	Naturecall 2014b, DEE 2016a
Koala	<i>Phascolarctos cinereus</i>	V	V	DEHP 2012, Naturecall 2014b, Parsons Brinckerhoff 2010, DEE 2016a
Northern Quoll	<i>Dasyurus hallucatus</i>	-	E	DEE 2016a
Grey Headed Flying Fox	<i>Pteropus poliocephalus</i>	LC	V	DEE 2016a
Ghost Bat	<i>Macroderma gigas</i>	V	V	DEE 2016a
South-eastern Long-eared Bat	<i>Nyctophilus corbeni</i>	V	V	DEE 2016a

Key: CE – Critically Endangered.

E – Endangered.

V – Vulnerable.

NT – Near Threatened.

LC – Least Concern.

5.1.2. Endangered and Of Concern Regional Ecosystems

The existing DEHP Regional Ecosystem mapping of the study site described in Section 4.1, shows that the following Endangered and of Concern Regional Ecosystems are mapped within the study site (Table 3) (DEHP 2016).

Table 3: Endangered and Of Concern Regional Ecosystems

Regional Ecosystem	Code	VMA Status	Biodiversity Status	EPBC Act Status
<i>Eucalyptus populnea</i> woodland on alluvial plains.	11.3.2	OC	OC	-
<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains.	11.3.4	OC	OC	-
<i>Corymbia clarksoniana</i> , <i>C. tessellaris</i> and <i>C. dallachiana</i> tall woodland with <i>Acacia salicina</i> , <i>Lysiphyllum hookeri</i> or <i>Grevillea striata</i> on Quaternary alluvial soils.	11.3.7	LC	OC	-
<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines.	11.3.25	LC	OC	-
<i>Micromyrtus capricornia</i> shrubland on Cainozoic sand plains/remnant surfaces.	11.5.18	OC	OC	-
<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains.	11.4.8	E	E	E
<i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains.	11.4.9	E	E	E



Regional Ecosystem	Code	VMA Status	Biodiversity Status	EPBC Act Status
<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> and <i>Eucalyptus thozetiana</i> or <i>E. microcarpa</i> woodland on lower scarp slopes on Cainozoic lateritic duricrust.	11.7.1	LC	OC	-
<i>Acacia harpophylla-Eucalyptus cambageana</i> woodland to open forest on fine-grained sedimentary rocks.	11.9.1	E	E	E
<i>Acacia harpophylla-Eucalyptus cambageana</i> woodland to open forest on fine-grained sedimentary rocks.	11.9.5	E	E	E

Key: E – Endangered.
 LC – Least Concern.
 OC – Of Concern.

5.2. Vegetation Survey Results

5.2.1. Floristics

The site was found to have reasonable floristic diversity, however weeds and naturalised pasture species such as Buffel Grass are present over large areas of the site. The comprehensive flora list for the study site is provided in Appendix 1.

A total of 145 flora species were recorded during the survey, including 15 exotic species (Appendix 1). The highest diversity was found at less disturbed sites which had an intact ground layer and less evidence of disturbance from cattle grazing.

Regional Ecosystem descriptions are provided below and details on threatened flora species recorded is provided in Section 5.2.4.

5.2.2. Regional Ecosystems

The Regional Ecosystem valuation process identified a total of 13 distinct regional ecosystems across the study site. Approximately 74% of the site or 1,096.5ha qualified as remnant vegetation¹, with the remaining 390.5ha (26%) was determined to be non-remnant.

The recently concluded field surveys allow more precise assessments of regional ecosystem identities and boundaries than was previously possible. Ground-truthed regional ecosystems generally follow the broad patterns of mapped regional ecosystem distributions, but this study has refined and resolved some mixed polygons, shifted boundaries and identified new occurrences of a number of regional ecosystems. The DEHP mapped regional ecosystems are shown in Figure 4 and updated ground-truthed regional ecosystem mapping for the study site is shown in Figure 8.

The areas of the DEHP mapped regional ecosystems and the ground-truthed regional ecosystems is provided in Table 4.

Photos 6 to 9 illustrate some of the different regional ecosystems present within the study site.

¹ As defined by (Accad and Neldner 2015)



Figure 8: Field Verified Regional Ecosystems

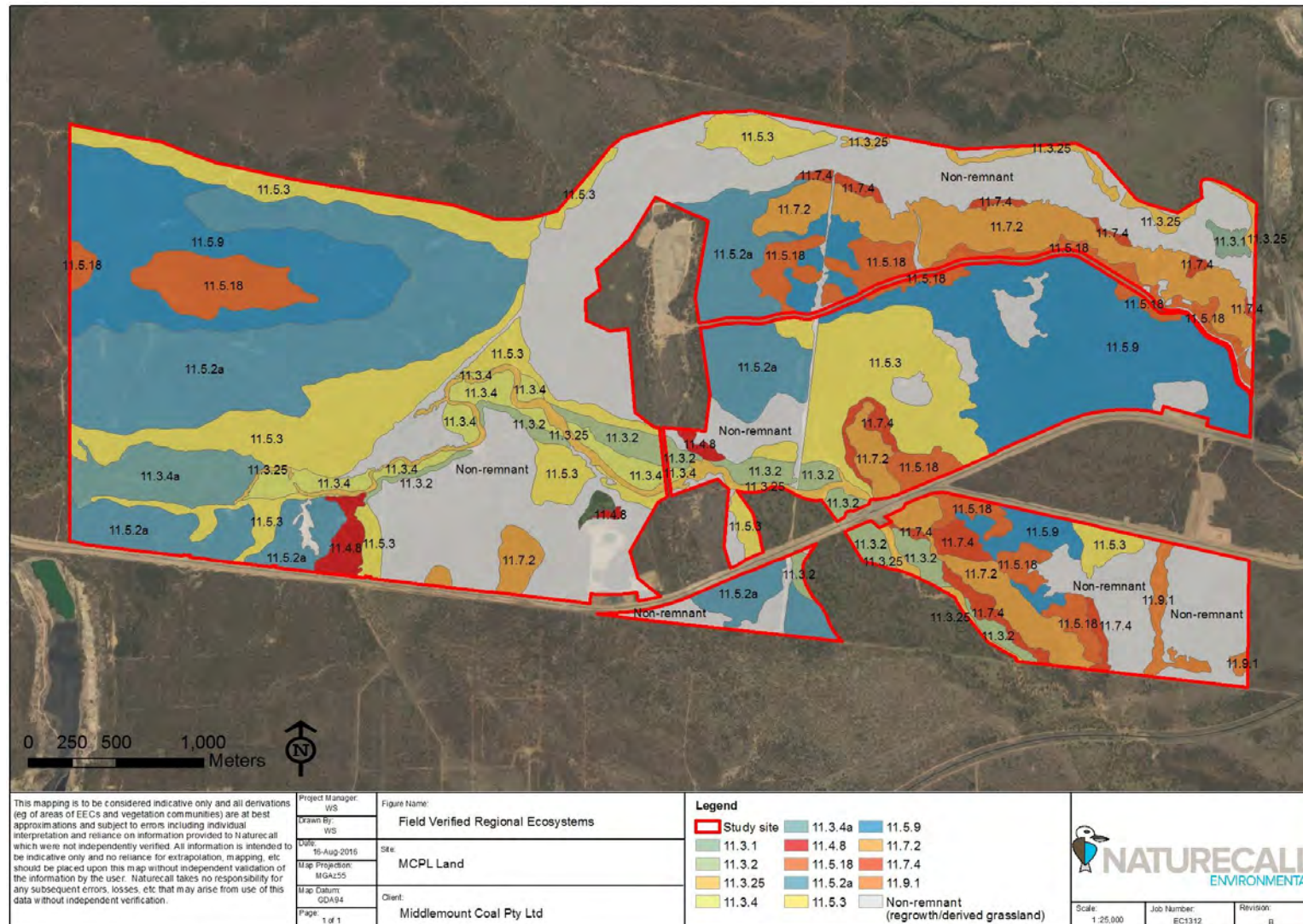




Table 4: Mapped Regional Ecosystems and Ground-truthed Regional Ecosystems located within the Study Site

Regional Ecosystem	Short Description	DEHP Mapped Area (ha)	Field Verified Area (ha)	VMA Status	BD Status	EPBC Status
Land Zone 3: Recent Quaternary alluvial systems						
11.3.1	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains.	0	3.1	E	E	E
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains.	15.5	39.4	OC	OC	-
11.3.2/11.3.7	<i>Eucalyptus populnea</i> woodland on alluvial plains and <i>Corymbia</i> spp. woodland on alluvial plains. Sandy soils.	5.0	0	OC/LC	OC/OC	-
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains.	0	29.3	OC	OC	-
11.3.4a	Floodplain (other than floodplain wetlands). <i>Corymbia tessellaris</i> woodland. On alluvial sand ridges to elevated levees and level terraces adjacent to larger stream channels which are irregularly flooded or possibly relict.	0	29.7	OC	OC	-
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines.	5.1	32.5	LC	OC	-
11.3.4/11.3.25	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains and <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines.	120.3	0	OC/LC	OC/OC	-
Land Zone 4: Tertiary - early Quaternary clay plains						
11.4.8	<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains.	35.8	10.4	E	E	E
11.4.9/11.4.8	<i>Acacia harpophylla</i> shrubby open forest to woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains and <i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains.	9.0	0	E/E	E/E	E



Regional Ecosystem	Short Description	DEHP Mapped Area (ha)	Field Verified Area (ha)	VMA Status	BD Status	EPBC Status
Land Zone 5: Tertiary – early Quaternary loamy and sandy plains and plateaus						
11.5.2	<i>Eucalyptus crebra</i> , <i>Corymbia</i> spp., with <i>E. moluccana</i> on lower slopes of Cainozoic sand plains/remnant surfaces.	9.7	0	LC	NC	-
11.5.2a	<i>Allocasuarina luehmannii</i> low tree layer with or without emergent woodland.	0	262.6	LC	NC	-
11.5.2/11.5.2a	<i>Eucalyptus crebra</i> , <i>Corymbia</i> spp., with <i>E. moluccana</i> on lower slopes of Cainozoic sand plains/remnant surfaces: and <i>Allocasuarina luehmannii</i> low tree layer with or without emergent woodland.	420.3	0	LC/LC	NC/NC	-
11.5.2/11.5.3	<i>Eucalyptus crebra</i> , <i>Corymbia</i> spp., with <i>E. moluccana</i> on lower slopes of Cainozoic sand plains/remnant surfaces and <i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces.	6.1	0	LC/LC	NC/NC	-
11.5.3	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces.	23.8	226.5	LC	NC	-
11.5.9	<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and/or remnant surfaces.	0	242.1	LC	NC	-
11.5.9b/11.5.18	<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and remnant surfaces and <i>Micromyrtus capricornia</i> shrubland on Cainozoic sand plains and/or remnant surfaces.	207.7	0	LC/OC	NC/OC	-
11.5.9b/11.5.3	<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and remnant surfaces and <i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces.	116.3	0	LC/LC	NC/NC	-
11.5.18	<i>Micromyrtus capricornia</i> shrubland on Cainozoic sand plains/remnant surfaces.	0	87.4	OC	OC	-



Regional Ecosystem	Short Description	DEHP Mapped Area (ha)	Field Verified Area (ha)	VMA Status	BD Status	EPBC Status
Land Zone 7: Cainozoic duricrusts						
11.7.2/11.7.1	Acacia spp. woodland and or on Cainozoic lateritic duricrust. Scarp retreat zone/ <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> and <i>Eucalyptus thozetiana</i> or <i>E. microcarpa</i> woodland on lower scarp slopes on Cainozoic lateritic duricrust.	87.9	0	LC/LC	NC/OC	-
11.7.2	Acacia spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone.	0	100.6	LC	NC	-
11.7.4	<i>Eucalyptus decorticans</i> and/or <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> woodland on Cainozoic lateritic duricrust.	0	24.7	LC	NC	-
11.7.2/11.7.4	Acacia spp. woodland on lateritic duricrust. Scarp retreat zone and <i>Eucalyptus decorticans</i> and <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> on lateritic duricrust.	40.7	0	LC/LC	NC/NC	-
Land Zone 9: Fine grained sedimentary rocks						
11.9.5/11.9.1	<i>Acacia harpophylla-Eucalyptus cambageana</i> open forest to woodland on fine-grained sedimentary rocks and <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks.	1.5	0	E/E	E/E	E/E
11.9.1	<i>Acacia harpophylla-Eucalyptus cambageana</i> open forest to woodland on fine-grained sedimentary rocks.	0	8.2	E	E	E

E – Endangered, OC - Of Concern, NC – No Concern at present, LC- Least Concern.



Photo 6: RE 11.4.8 *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains.



Photo 7: RE 11.3.2 *Eucalyptus populnea* woodland on alluvial plains





Photo 8: RE 11.5.18 *Micromyrtus capricornia* shrubland on Cainozoic sand plains/remnant surfaces

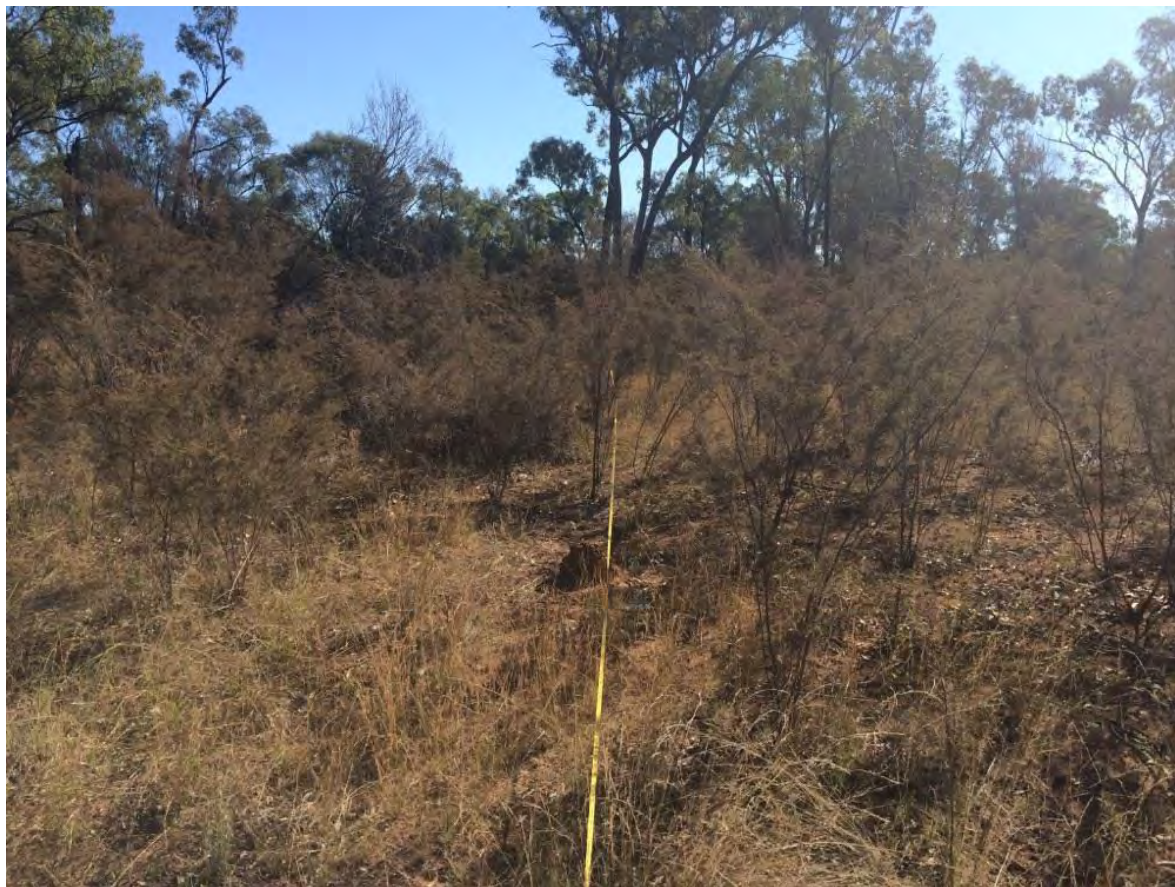


Photo 9: RE 11.3.5 *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines





5.2.3. Vegetation Condition

The vegetation throughout the study site is in good condition overall. Large areas of vegetation in the west of the study site and the regional ecosystems occurring on Land Zone 7 showed minimal signs of disturbance.

Remnant vegetation communities covered 1,096.5ha (74%) of the study site. The less disturbed remnant areas (e.g. in the west of the study site) are within published benchmarks for a range of attributes such as tree height and cover, species diversity and coarse woody debris. Some remnant areas in the east of the site, especially RE 11.5.9, which have been subject to thinning and cattle grazing did not meet benchmarks particularly percentage of native groundcover, canopy cover and species diversity.

There are several areas in the central, north-east and south-east of the study site that have been previously cleared and are grazed by cattle, shown as non-remnant (regrowth/derived grassland) on Figure 8. These areas all displayed high levels of weed invasion, however the majority of weeds were naturalized pasture grasses. Many of these non-remnant areas recorded positive signs of native tree recruitment and natural regeneration.

5.2.4. Threatened Flora

A single threatened flora species was identified on the study site during the survey, namely *Cerbera dumicola* (Photo 10), which is listed as Near Threatened under the NC Act.

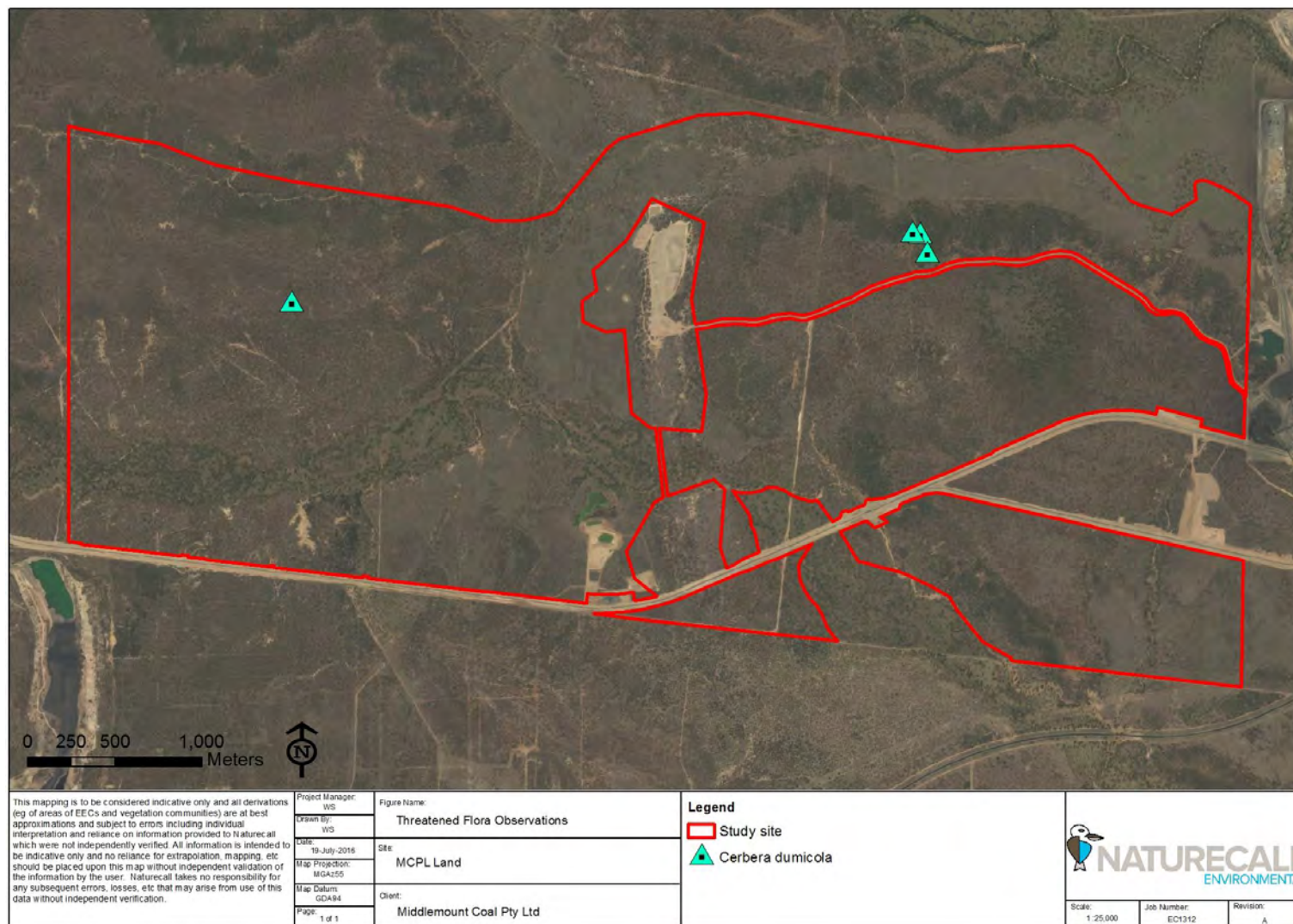
The species was identified at four locations (three of which were very close together) within the study site (Figure 9). It occurred in isolated patches in moderate to high density in RE 11.7.2 east of Parrot Quarry and in RE 11.5.18 in the west of the study site.

Photo 10: Photo of *Cerbera dumicola* within the study site





Figure 9: Threatened Flora Observations





5.3. Endangered and Of Concern Regional Ecosystems

5.3.1. Queensland Vegetation Management Act Status

Under the VM Act, the following Endangered and Of Concern Regional Ecosystems were identified and ground-truthed within the study site:

Endangered Regional Ecosystems:

- RE 11.3.1 - *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains.
- RE 11.4.8 - *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains.
- RE 11.9.1 - *Acacia harpophylla*-*Eucalyptus cambageana* open forest to woodland on fine-grained sedimentary rocks.

Of Concern Regional Ecosystems:

- RE 11.3.2 - *Eucalyptus populnea* woodland on alluvial plains.
- RE 11.3.4 - *Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains.
- RE 11.3.4a - *Corymbia tessellaris* woodland. On alluvial sand ridges to elevated levees and level terraces adjacent to larger stream channels which are irregularly flooded or possibly relict.
- RE 11.5.18 - *Micromyrtus capricornia* shrubland on Cainozoic sand plains/remnant surfaces.

The area, in ha, of each of these communities is provided in Table 4 and their extent and location within the study site is illustrated in Figure 10.

5.3.2. Environmental Protection and Biodiversity Conservation Act Status

The three Brigalow communities identified on the site (REs 11.3.1, 11.4.8 and 11.9.1) qualified as the Threatened Ecological Community (TEC) *Brigalow (Acacia harpophylla dominant and co-dominant)* listed as 'Endangered' under the EPBC Act.

An assessment of each individual patch of these communities against the threshold criteria outlined in the *Approved Conservation Advice for the Brigalow (Acacia harpophylla dominant and co-dominant) ecological community* (Threatened Species Scientific Committee 2013) was undertaken. It was concluded that each of these regional ecosystems met the area and condition thresholds (i.e. not cleared within the last 15 years, >0.5ha in area and have less than 50% weed cover) for them to be included as the TEC under the EPBC Act.

Regional ecosystem 11.4.8 comprises three patches, 11.9.1 consisted of one linear patch in the south-east of the study site, and 11.3.1 comprised one patch in the north-east as seen in Figure 11. The total ground-truthed area of remnant Brigalow TEC within the study site is 21.6ha.



Figure 10: Endangered and Of Concern Regional Ecosystems listed under the VM Act

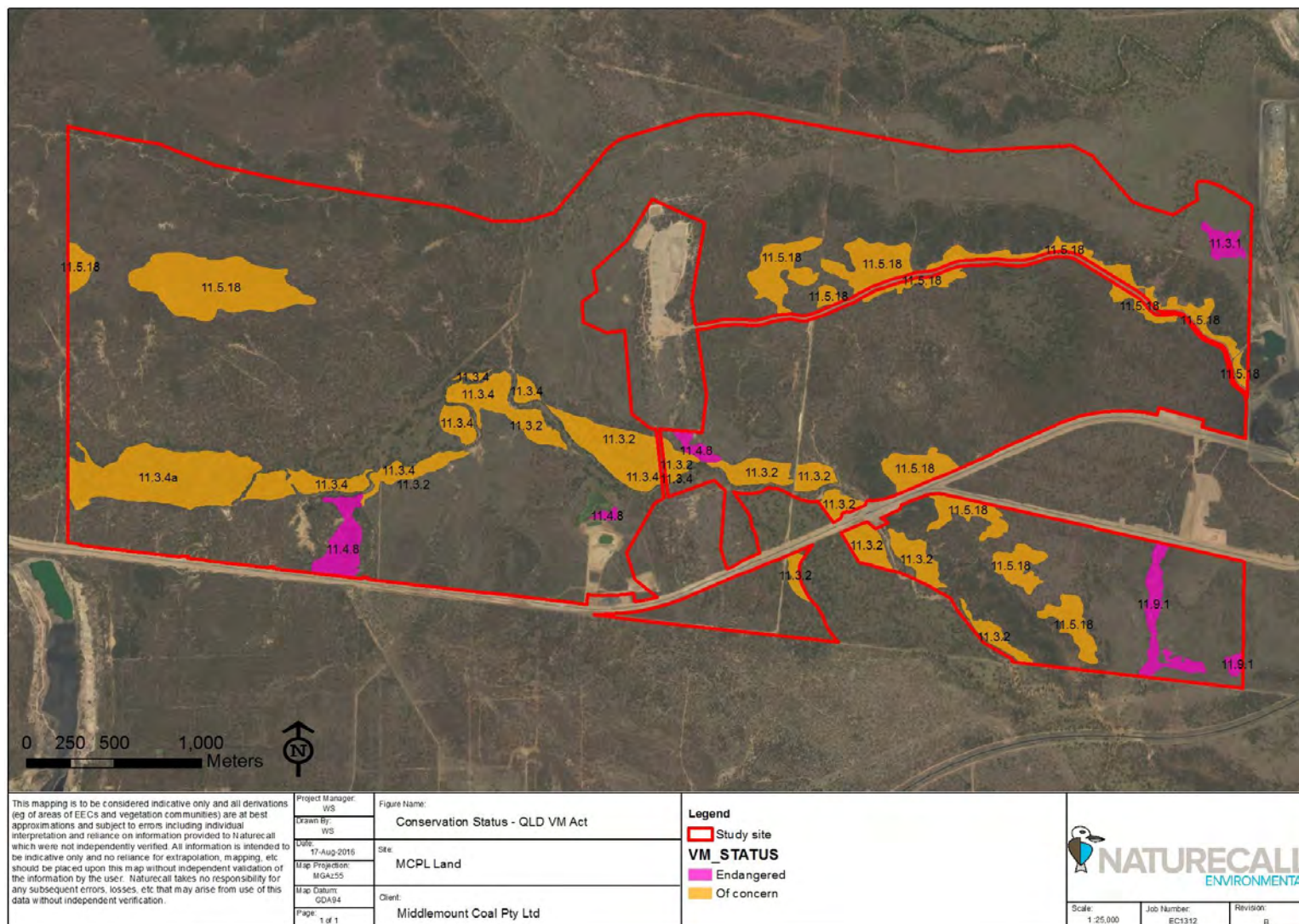
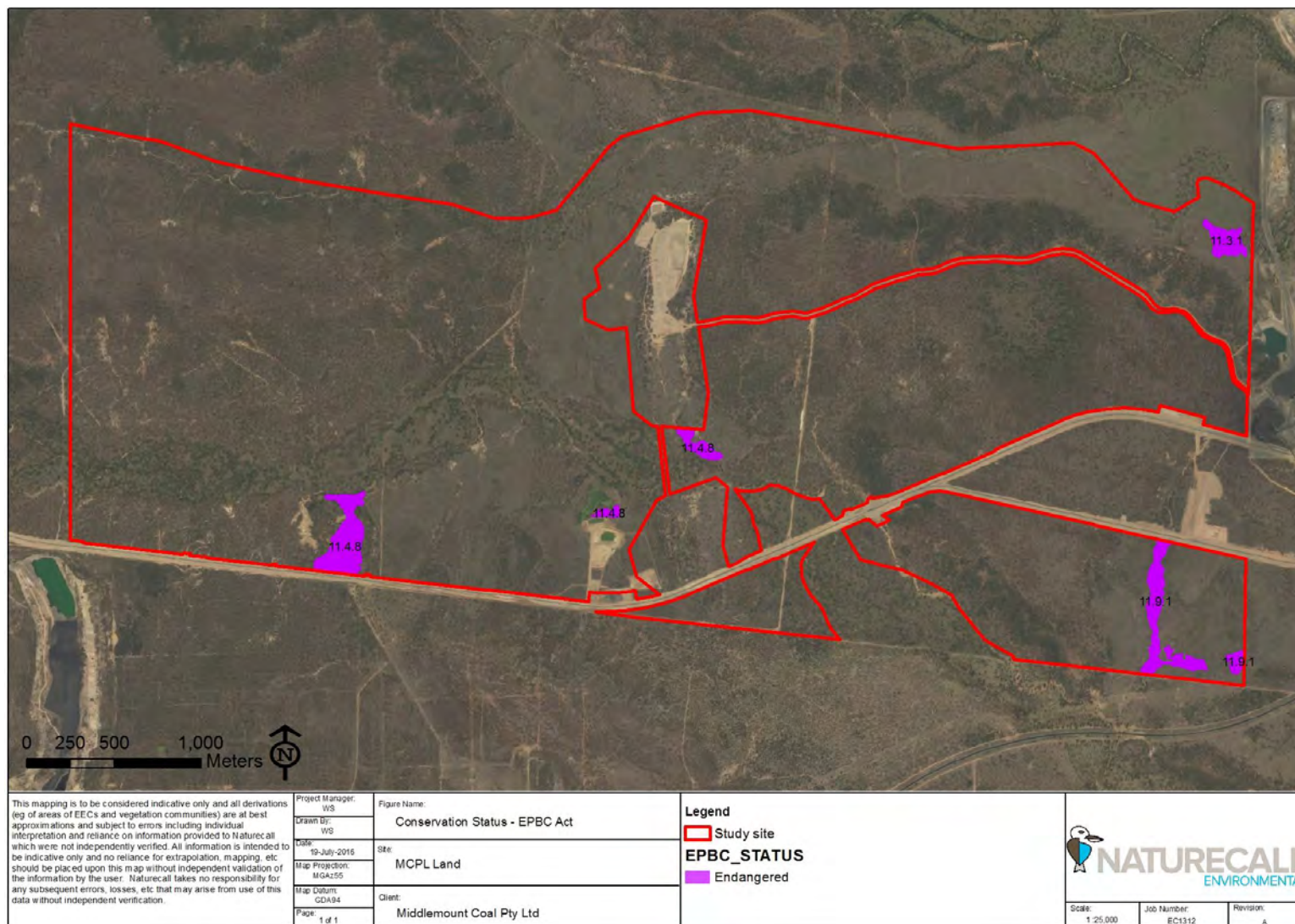




Figure 11: Threatened Ecological Communities listed under the EPBC Act





5.3.3. Exotic Flora Species

As detailed in Section 5.2.1, a total of 15 exotic flora species were recorded within the study site. Weed invasion is common throughout the study site, especially in disturbed areas, however it is largely limited to the groundcover stratum. Naturalised introduced pasture species such as Buffel Grass (*Cenchrus ciliaris*), Sabi Grass (*Urochloa mosambicensis*) and Red Natal Grass (*Melinis repens*) along with herbs including *Sida* spp. Cobblers Pegs (*Bidens pilosa*), Gomphrena Weed (*Gomphrena celosioides*) and Stylo (*Stylosanthes scabra*) were the main weeds encountered. These species dominated the ground layer in the derived grassland habitats, and incursion of these species into adjacent eucalypt woodlands was common.

Table 5 lists the noxious weeds declared under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) recorded within the study site. Occasional Prickly Pear (*Opuntia stricta*) Harrisia Cactus (*Harissa martini*) and Rats Tail Grass (*Sporobolus* sp.) were recorded, however, the noxious weed distribution was patchy and not identified to pose a significant risk to the ecological integrity of the study site due to their low density.

Table 5: Noxious weeds recorded within the study site

Scientific Name	Common name	LP Act Category	Weed of National Significance	Abundance
<i>Opuntia stricta</i>	Prickly Pear	Class 2	Yes	Low
<i>Harrisia martini</i>	Harrisia Cactus	Class 1	No	Low
<i>Sporobolus</i> sp.	Rats Tail Grass	Class 2	No	Low

5.4. Fauna Survey Results

5.4.1. Fauna Habitat Types

Broad fauna habitats within the study site were categorized and mapped into six broad habitat types using the same classifications as Parsons Brinckerhoff (2010). The broad fauna habitat types include (Figure 12):

- Eucalypt woodland/forest.
- Micromyrtus shrubland.
- Riparian habitat.
- *Acacia shirleyi* forest.
- *Acacia harpophylla* woodland/forest.
- Regrowth/derived grassland.



Table 6 details the regional ecosystems which make up each broad fauna habitat type along with the area (in ha) of each.

Table 6: Broad fauna habitat types

Number	Broad Fauna Habitat Type	Regional Ecosystem	Field Verified Area (ha)
1	Eucalypt Woodland	11.3.2	39.4
		11.3.4	29.3
		11.3.4a	29.7
		11.5.2a	262.6
		11.5.3	226.5
		11.5.9	242.1
		11.7.4	24.7
	Subtotal (Eucalypt Woodland)		854.3
2	Micromyrtus shrubland	11.5.18	87.4
3	Riparian habitat	11.3.25	32.5
4	<i>Acacia shirleyi</i> forest	11.7.2	100.6
5	<i>Acacia harpophylla</i> woodland/forest	11.3.1	3.1
		11.4.8	10.4
		11.9.1	8.2
	Subtotal (<i>Acacia harpophylla</i> woodland/forest)		21.7
6	Regrowth	-	390.5
	Total		1,487

Table 7 describes the habitat values per category, with focus on habitat value and suitability for foraging, nesting, roosting, and breeding requirements for potentially occurring threatened species listed under the NC Act and EPBC Act. Photos 11 to 16 illustrate some the habitat features located within the study site.



Table 7: Fauna habitat assessment

Habitat Attribute/Category	Site Values					
	1. Eucalypt Woodland	2. Micromyrtus shrubland	3. Riparian habitat	4. <i>Acacia shirleyi</i> forest	5. <i>Acacia harpophylla</i> woodland/forest	6. Regrowth/derived grassland
Groundcover	Variable density and composition depending on disturbance history e.g. rotational grazing regime. Some areas feature a moderately dense cover of exotic grasses while some are more open and dominated by native grasses and shrubs. A number of native grass species provide a potential food resource for the Squatter Pigeon. Some areas also have a mosaic of open sandy areas and native grasses which is preferred habitat for this species.	Comprises open grassy groundcover (mostly native grasses) and areas of bare ground. A number of native grass species provide potential food resources for the Squatter Pigeon.	Generally a good cover of native grasses, sedges and herbs. Some areas dominated by Buffel Grass.	Sparse to open ground cover of native grasses, with areas of bare ground.	Sparse to open ground cover of mostly native grasses, with areas of bare ground. Provides potential shelter and prey habitat for threatened reptiles.	Dominant ground cover composition of exotic grasses and herbs being less common. Areas with a higher percentage of native grass species would provide food resources for the Squatter Pigeon.
Leaf Litter	High under canopy trees, and scattered throughout the mixed grass undergrowth.	Overall low density of leaf litter present due to the lack of canopy trees.	Generally thin leaf litter throughout due to open canopy.	Density of leaf litter was low overall with some small accumulations noted.	Mature Brigalow habitats contained dense accumulations of leaf litter which would provide shelter and prey habitat for a range of small reptiles.	Sparse leaf litter.



Habitat Attribute/Category	Site Values					
	1. Eucalypt Woodland	2. <i>Micromyrtus</i> shrubland	3. Riparian habitat	4. <i>Acacia shirleyi</i> forest	5. <i>Acacia harpophylla</i> woodland/forest	6. Regrowth/derived grassland
Logs and Debris	Reasonable abundance of hollow logs and debris present due to the nature of <i>Eucalyptus</i> shedding limbs. Larger logs provide shelter and prey habitat for ground dwelling reptiles.	Low density of coarse woody debris in the form of small fallen timber at the base of scattered canopy eucalypts. Marginal potential habitat values for threatened fauna overall.	Some accumulations of coarse woody debris and logs under canopy trees. Marginal potential habitat values for threatened fauna overall.	High density of coarse woody debris, which is typical of this habitat type.	High density of coarse woody debris, which is typical of this habitat type.	Very few logs observed. Some log and debris piles as a result of past clearing occur.
Rocky outcrops	Only some small to medium surface rock present.	Some small surface rock present.	Absent	Rocky outcrops are very common in this habitat type. Provide potential shelter, basking sites and prey habitat for a range of common reptiles and small mammals.	Absent	Absent
Aquatic habitat	Aquatic habitats in this habitat type were largely limited to small ephemeral creeks and soaks that would only hold water for short periods.	Absent	Some sections of the ephemeral creeks and drainage lines had temporary flows recorded. The recent rainfall events prior to the survey increased the quantity of water within the riparian areas.	Absent	Brigalow habitats contain small depressions and melon holes that would hold water during the wet season.	A few large dunes were located within non-remnant areas. One large dam in the south of the site contained established aquatic vegetation, while others that had been excavated more recently were devoid of aquatic vegetation.



Habitat Attribute/Category	Site Values					
	1. Eucalypt Woodland	2. <i>Micromyrtus</i> shrubland	3. Riparian habitat	4. <i>Acacia shirleyi</i> forest	5. <i>Acacia harpophylla</i> woodland/forest	6. Regrowth/derived grassland
			Semi-permanent billabongs and pools in the creek bed would provide water sources for the Squatter Pigeon.			Dams on site attracted a range of wetland birds and provided permanent water sources for a range of fauna including the Squatter Pigeon.
Hollows	Hollow-bearing trees and stags were common within this habitat type. A range of hollow-sizes are present i.e. <5cm to >20cm diameter cavities. Hollows provide nesting/denning/roosting habitat for a number of threatened fauna species such as the South-eastern Long-eared bat.	Scattered eucalyptus and corymbias in this habitat type contained hollows. Hollows that are present would provide potential roosting habitat for threatened bat species such as the South-eastern Long-eared Bat.	Hollow-bearing trees were generally uncommon in this habitat type and would largely be occupied by common birds such as Galahs and Lorikeets.	Absent.	Low occurrence of tree hollows in occasional eucalyptus species present. Hollows that are present would provide potential roosting habitat for threatened bat species such as the South-eastern Long-eared Bat.	No hollow bearing trees present due to previous clearing history.
Nectar sources	Woodland habitats contains a range of nectar producing species e.g. eucalypts, acacias and grevilleas. Narrow-leaved ironbark was one of the main flowing species recorded during the field survey (Photo 15).	Low nectar source overall. Flowering <i>Micromyrtus</i> shrubs would be an insect attractant for the South-eastern Long-eared Bat.	Nectar sources in riparian habitats include eucalypts and Melaleucas, some of which were flowering during the survey.	<i>Acacia shirleyi</i> is the primary nectar source and would provide foraging resources for fauna when in flower.	<i>Acacia harpophylla</i> is the primary nectar source and would provide foraging resources for fauna when in flower.	This habitat type does not provide a significant nectar source due to the lack of mature trees.



Habitat Attribute/Category	Site Values					
	1. Eucalypt Woodland	2. <i>Micromyrtus</i> shrubland	3. Riparian habitat	4. <i>Acacia shirleyi</i> forest	5. <i>Acacia harpophylla</i> woodland/forest	6. Regrowth/derived grassland
Koala food trees	Moreton Bay Ash, Poplar Box and Narrow-leaved Ironbark are the main Koala browse species in this community (DEE 2014). Koala was recorded in this habitat type via scats (Photo 12).	Absent aside from a few Narrow-leaved Ironbark.	This community is dominated by Queensland Blue Gum which is a preferred browse species for Koalas. Koala was recorded in a riparian community via indicative trunk scratches (Photo 11).	Absent	<i>Eucalyptus cambageana</i> is located within this habitat type and, although a less common food source for the Koala, meets the definition of a Koala food tree DEE (2014).	Absent aside from occasional areas of regrowth eucalypts and corymbias.
Connectivity values	Provides strong habitat links and connectivity values across the site, especially north-south connections with adjacent habitat in the east and west of the site. Some areas of woodland are fragmented by roads and cleared areas. This habitat type would benefit the local movements of a range of fauna species, including arboreal species such as the Koala.	The shrubland habitats would complement the connectivity values of other habitat types and provide shelter and cover for small terrestrial species and passerine birds.	Riparian habitats provide connectivity along Parrot Creek. Due to the open nature of this habitat type, it is only likely to be used by mobile species capable of crossing open ground. Important connectivity values for the Koala.	This habitat type is generally surrounded by woodland habitats and would provide similar connectivity values. Rocky scarp habitats are likely to assist local movements of reptiles and small mammals.	The small patches of Brigalow habitats would contribute to the connectivity values of the other site habitats, however it is generally isolated, and would not provide any specific connectivity values for fauna.	Continued regeneration of non-remnant areas over time would help re-establish linkages for flora and fauna across the site and broader landscape.



Figure 12: Broad fauna habitat types present on the study site

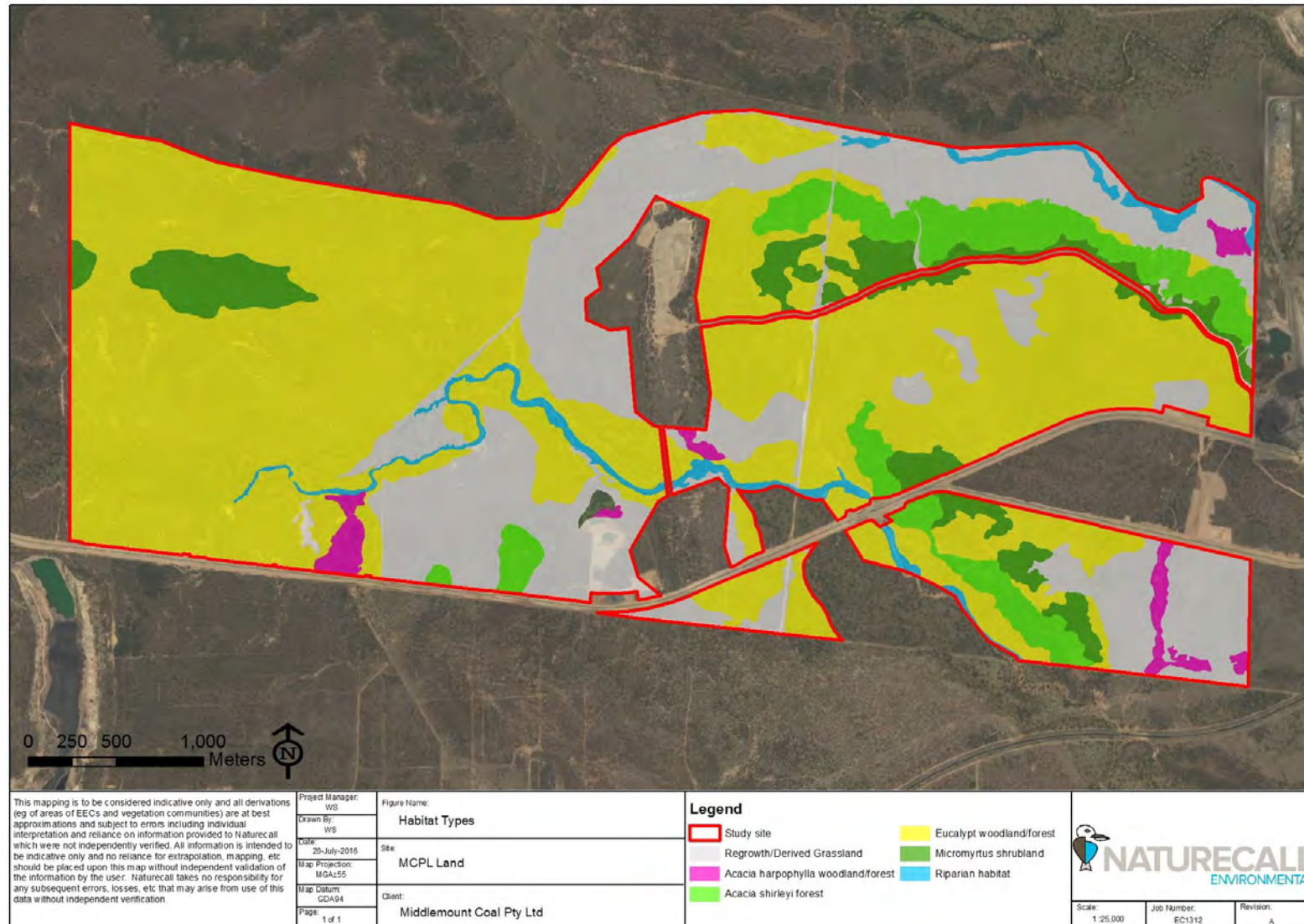




Photo 11: Likely Koala scratches in the south of the study site (Figure 13)



Photo 12: Koala scats in the northwest of the study site (Figure 13)





Figure 13: Koala records within the study site

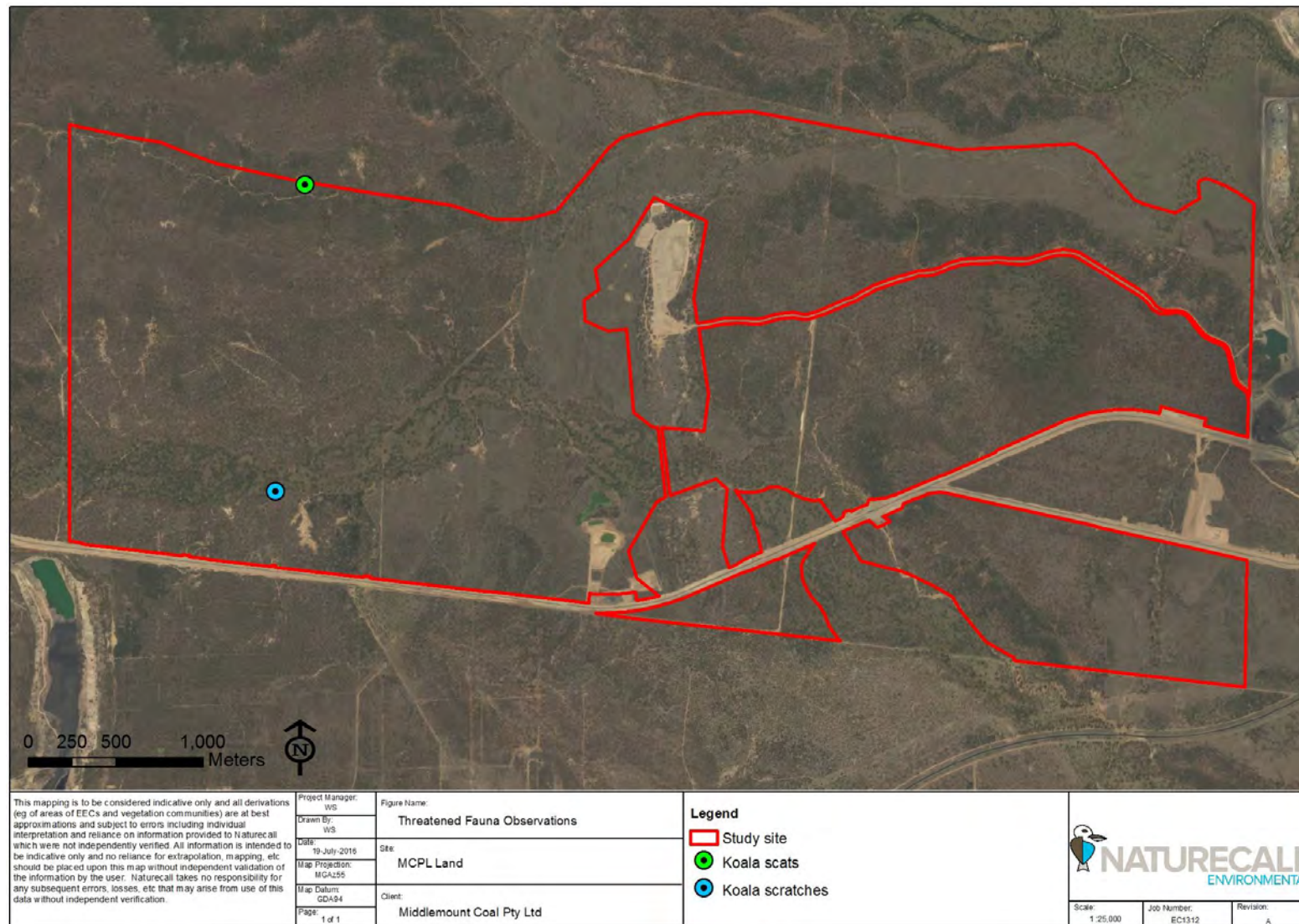




Photo 13: Potential Squatter Pigeon habitat in Eucalypt woodland/forest



Photo 14: Regrowth/derived grassland habitat





Photo 15: Narrow-leaved Ironbark in flower in the Eucalypt woodland



Photo 16: Leaf litter in *Acacia harpophylla* woodland/forest





5.4.2. Fauna Species Detected

A total of 72 fauna species were detected during the survey either opportunistically or during specific survey methods. Birds were the most common fauna group observed with a total of 60 species detected. One amphibian, nine mammals (including four introduced species), and two reptiles were also detected (Appendix 2).

A list of fauna species detected is provided in Appendix 2.

The species assemblage on the study site is considered typical for the area based on results of previous surveys on adjacent and nearby lands (e.g. Parsons Brinckerhoff 2010, E&HP 2012, Naturecall 2013, 2014b, 2015).

5.4.3. Threatened Fauna Species

The only threatened fauna species detected during the survey was the Koala (*Phascolarctos cinereus*), which is listed as Vulnerable under the NC Act and EPBC Act. The Koala was detected within the study site via secondary evidence (i.e. scats and scratches).

Koala (*Phascolarctos cinereus*)

Koala scats were recorded under an Ironbark in the north-west of the study site in the Eucalypt woodland habitat type (Figure 12; Photo 12). The estimated age of the scat from visual identifiers was 6-8 months old. In addition, trunk scratches attributed to the Koala were recorded on a Moreton Bay Ash growing in the riparian habitat near Parrot Creek in the south-west of the study site (Photo 11).

Koalas have also been recorded on adjacent land to the north by Ecology and Heritage Partners (2012) and adjacent to Parrot Quarry Road by Naturecall (2014b).

Koala food trees (as defined in the *EPBC Act Referral Guidelines for the Vulnerable Koala* [DEE, 2014] and *Nature Conservation [Koala] Conservation Plan 2006 and Management Program 2006 – 2016* [EPA, 2006]) are present within the study site, in particular Queensland Blue Gum (identified as an important food species for the Koala [Van Dyck and Strahan, 2008; Land for Wildlife, 2014]), Moreton Bay Ash, Poplar Box, Forest Red Gum and Narrow-leaved Ironbark.

A large portion of the Regional Ecosystems mapped within the study site would provide potential habitat for the Koala based on the occurrence of potential Koala food trees. This includes RE 11.3.2, RE 11.3.4, RE 11.3.4a, RE 11.3.25, RE 11.4.8, RE 11.5.2a, RE 11.5.3, RE 11.5.9, RE 11.7.4 and RE 11.9.1, equating to approximately 905.5 ha of potential Koala habitat.

These Regional Ecosystems are in good condition, however as described in Section 5.2.3, there are areas within the study site that have been subject to thinning and grazing. In addition, these areas would provide beneficial movement corridors (i.e. connectivity) for the Koala throughout the landscape, particularly along Parrot creek.



Squatter Pigeon (*Geophaps scripta scripta*)

The Squatter Pigeon was not recorded within the study site, however it has been previously recorded in the locality and suitable habitat is present. As identified in Table 7 a number of habitat attributes which would provide suitable habitat for the Squatter Pigeon are present. These include a number of native grass species, permanent water resources and a mosaic of open sandy areas.

As identified by DEE (2016b), the Squatter Pigeon is known to utilize habitat located on land zones 3, 4, 5 and 7. Within the study site, this consists of RE 11.3.1, RE 11.3.2, RE 11.3.4, RE 11.3.4a, RE 11.3.25, RE 11.4.8, RE 11.5.2a, RE 11.5.3, RE 11.5.9, RE 11.5.18, RE 11.7.2, RE 11.7.4 equating to approximately 1,088.4ha of potential Squatter Pigeon habitat.

These regional ecosystems provide good quality habitat for the Squatter Pigeon as they contain a number of native grass species which would provide a potential food resource. In addition there a number of permanent water bodies within the study site which would provide a suitable water source.

South-eastern Long-eared Bat (*Nyctophilus corbeni*)

Suitable habitat for the South-eastern Long-eared Bat is present within the study site. As identified in Table 7 the Eucalypt Woodland, *Micromyrtus* shrubland and *Acacia harpophylla* woodland/forest all contain hollow-bearing trees which would provide suitable roosting habitat for the South-eastern Long-eared Bat. In addition, a number of flora species present would provide suitable habitat for insect species which the South-eastern Long-eared Bat could forage in.

All of the woodland communities located within the study site (i.e. 1,096.6ha) would provide suitable foraging and breeding habitat for the South-eastern Long-eared Bat Tree hollows were identified within the Eucalypt Woodland, *Micromyrtus* shrubland and *Acacia harpophylla* woodland/forest. In addition, the South-eastern Long-eared Bat could forage over the non-remnant (regrowth/derived grassland) habitat from time to time.

5.4.4. Migratory Fauna Species

The Rainbow Bee-eater (*Merops ornatus*) was the only EPBC Act listed migratory fauna species observed within the study area. It was observed and heard calling on three separate occasions over woodland and open habitats in the central and south-eastern parts of the site.

5.4.5. Exotic Fauna Species

During the field survey two Wild Dogs were directly observed in the south-west of the site. A large number of wild dog tracks were also recorded across the study site on tracks and in dry creek beds (Photo 17). Other exotic species detected on site were the Fox, European rabbit and feral cat which were also recorded via tracks. Very few tracks of the latter species were found, indicating a low abundance.



Photo 17: Wild dog tracks observed in dry creek bed





6.0 Conclusion

The study site is located approximately 270 km north-west of Rockhampton and 9 km south-west of the Middlemount township. The study site comprises freehold land owned by MCPL and is approximately 1,487 ha in area. It includes a combination of forested/woodland areas along with cleared grazing land.

A desktop study (including comprehensive literature review) was carried out prior to the field survey to gather relevant information and data. Existing Department of Environment and Heritage Regional Ecosystem mapping of the study site, as well as previous mapping on adjoining land was obtained and used in conjunction with satellite imagery to identify the broad vegetation types present on the study site.

Flora and fauna surveys were undertaken throughout the study site from 9 to 15 June 2016. A total of 28 terrestrial habitat quality assessment sites and 17 quaternary vegetation plots were carried out across the study site. The fauna surveys comprised habitat suitability assessment, targeted surveys for threatened species, track, scat and secondary evidence searches as well as opportunistic fauna observations.

The recently concluded field surveys allow more precise assessments of regional ecosystem identities and boundaries than was previously possible. Ground-truthed regional ecosystems generally follow the broad patterns of mapped regional ecosystem distributions, but this study has refined and resolved some mixed polygons, shifted boundaries and identified new occurrences of a number of regional ecosystems.

The study site was categorised into six broad fauna habitat types (i.e. eucalypt woodland/forest, *Micromyrtus* shrubland, riparian habitat, *Acacia shirleyi* forest, *Acacia harpophylla* woodland/forest, and regrowth/derived grassland). Eucalypt woodland was the most common habitat type on the study site. A number of habitat features were well represented in eucalypt woodlands such as hollow-bearing trees, coarse woody debris, nectar sources and native groundcover. It is considered that the various habitat types present on site would provide suitable habitat for a range of conservation significant fauna species including the Squatter Pigeon, Koala and South-eastern Long-eared Bat.

Cerbera dumicola, listed as 'Near Threatened' under the Queensland Nature Conservation Act, 1992 was identified at four locations during the field survey. In addition, the Koala was recorded via secondary evidence (i.e. scats and scratches) at two locations in the study site.



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Appendix 1: Site Flora Species List

Scientific name	Common name	NC Act Status
Canopy Trees		
Ironwood	<i>Acacia excelsa</i>	LC
Brigalow	<i>Acacia harpophylla</i>	LC
Inland Rosewood	<i>Acacia rhodoxylon</i>	LC
Lancewood	<i>Acacia shirleyi</i>	LC
Clarkson's Bloodwood	<i>Corymbia clarksoniana</i>	LC
Dallachy's Gum	<i>Corymbia dallachyana</i>	LC
Moreton Bay Ash	<i>Corymbia tessellaris</i>	LC
Dawson's Gum	<i>Eucalyptus cambageana</i>	LC
Narrow-leaved Ironbark	<i>Eucalyptus crebra</i>	LC
Peppermint	<i>Eucalyptus exserta</i>	LC
Silver-leaved Ironbark	<i>Eucalyptus melanophloia</i>	LC
Poplar Box	<i>Eucalyptus populnea</i>	LC
Queensland Blue Gum	<i>Eucalyptus tereticornis</i>	LC
Weeping Paperbark	<i>Melaleuca leucadendra</i>	LC
Understorey Trees and Shrubs		
Bendee	<i>Acacia catenulata</i>	LC
-	<i>Acacia cretata</i>	LC
Black Wattle	<i>Acacia leiocalyx</i>	LC
Native Willow	<i>Acacia salicina</i>	LC
Bull Oak	<i>Allocasuarina luehmannii</i>	LC
Red Ash	<i>Alphitonia excelsa</i>	LC
Dead Finish	<i>Archidendropsis basaltica</i>	LC
Whitewood	<i>Atalaya hemiglauca</i>	LC
Coffee Bush	<i>Breynia oblongifolia</i>	LC
Wild Orange	<i>Capparis canescens</i>	LC
Currant Bush	<i>Carissa ovata</i>	LC
Leichhardt Bean	<i>Cassia brewsteri</i>	LC
Belah	<i>Casuarina cristata</i>	LC
River Oak	<i>Casuarina cunninghamiana</i>	LC
-	<i>Cerbera dumicola</i>	NT
Lolly Bush	<i>Clerodendrum floribundum</i>	LC
-	<i>Denhamia cunninghamii</i>	LC
Native Ebony	<i>Diospyros humilis</i>	LC
Hop Bush	<i>Dodonaea viscosa</i>	LC
Turkey Bush	<i>Eremophila deserti</i>	LC
Harrisia Cactus	<i>Harrisia martini*</i>	-
False Sandalwood	<i>Eremophila mitchellii</i>	LC
Cocaine Tree	<i>Erythroxylum australe</i>	LC
Sandpaper Fig	<i>Ficus opposita</i>	LC
Scrub Leopardwood	<i>Flindersia dissosperma</i>	LC
Wilga	<i>Geijera parviflora</i>	LC



Scientific name	Common name	NC Act Status
Silver Oak	<i>Grevillea parallela</i>	LC
Beefwood	<i>Grevillea striata</i>	LC
Dysentery Bush	<i>Grewia latifolia</i>	LC
Bootlace Oak	<i>Hakea lorea</i>	LC
Native Gardenia	<i>Larsenaikia ochreatea</i>	LC
-	<i>Melaleuca nervosa</i>	LC
-	<i>Micromyrtus capricornia</i>	LC
Boobialla	<i>Myoporum montanum</i>	LC
Native Olive	<i>Notelaea microcarpa</i>	LC
Prickly Pear	<i>Opuntia stricta</i> *	-
Gooya	<i>Owenia acidula</i>	LC
Quinine Tree	<i>Petalostigma pubescens</i>	LC
-	<i>Prostanthera cryptandroides</i> subsp. <i>euphrasioides</i>	LC
-	<i>Psyrax attenuata</i>	LC
-	<i>Solanum parvifolium</i>	LC
Vine Tree	<i>Ventilago viminalis</i>	LC
Grasses		
Cockatoo Grass	<i>Alloteropsis semialata</i>	LC
Dark Wiregrass	<i>Aristida calycina</i>	LC
Many-headed Wiregrass	<i>Aristida caput-medusae</i>	LC
Jericho Wiregrass	<i>Aristida jerichoensis</i>	LC
Feathertop Wiregrass	<i>Aristida latifolia</i>	LC
White Speargrass	<i>Aristida leptopoda</i>	LC
Pitted Bluegrass	<i>Bothriochloa decipiens</i>	LC
Buffel Grass	<i>Cenchrus ciliaris</i> *	-
Slender Chloris	<i>Chloris divaricata</i>	LC
Rhodes Grass	<i>Chloris gayana</i> *	-
Windmill Grass	<i>Chloris truncata</i>	LC
Hairy Chloris	<i>Chloris virgata</i>	LC
Golden Beard Grass	<i>Chrysopogon fallax</i>	LC
Barbed Wire Grass	<i>Cymbopogon refractus</i>	LC
Couch Grass	<i>Cynodon dactylon</i>	LC
Queensland Bluegrass	<i>Dichanthium sericeum</i>	LC
-	<i>Digitaria brownii</i>	LC
Spreading Umbrella Grass	<i>Digitaria divaricatissima</i>	LC
Wiry Panic	<i>Entolasia stricta</i>	LC
Brown's Lovegrass	<i>Eragrostis brownii</i>	LC
Clustered Lovegrass	<i>Eragrostis elongata</i>	LC
Purple Lovegrass	<i>Eragrostis lacunaria</i>	LC
Woodland Lovegrass	<i>Eragrostis sororia</i>	LC
Black Speargrass	<i>Heteropogon contortus</i>	LC
Blady Grass	<i>Imperata cylindrica</i>	LC



Scientific name	Common name	NC Act Status
Red Natal Grass	<i>Melinis repens</i> *	-
-	<i>Ottochloa gracillima</i>	LC
Native Millet	<i>Panicum decompositum</i>	LC
Hairy Panic	<i>Panicum effusum</i>	LC
Brigalow Grass	<i>Paspalidium caespitosum</i>	LC
-	<i>Paspalidium distans</i>	LC
Freshwater Couch	<i>Paspalum distichum</i>	LC
Comet Grass	<i>Perotis rara</i>	LC
-	<i>Sorgum sp.*</i>	-
Rats Tail Grass	<i>Sporobolus sp.*</i>	-
-	<i>Themeda avenacea</i>	LC
Kangaroo Grass	<i>Themeda triandra</i>	LC
Sabi Grass	<i>Urochloa mosambicensis</i> *	-
Groundcovers		
Creeping Saltbush	<i>Atriplex semibaccata</i>	LC
Cobbler's Pegs	<i>Bidens pilosa</i> *	-
Purple Trumpet	<i>Brunoniella australis</i>	LC
Rock Fern	<i>Cheilanthes sieberi</i>	LC
Yellow Buttons	<i>Chrysocephalum apiculatum</i>	LC
Native Wandering Jew	<i>Commelina cyanea</i>	LC
Yellow Rattlepod	<i>Crotalaria mitchellii</i>	LC
Blue Flax-lily	<i>Dianella longifolia</i>	LC
Ruby Saltbush	<i>Enchylaena tomentosa</i>	LC
Gomphrena Weed	<i>Gomphrena celosioides</i> *	-
-	<i>Goodenia heteromera</i>	LC
-	<i>Goodenia rotundifolia</i>	LC
Small-flowered Mallow	<i>Malva parvifolia</i> *	-
Spiked Malvastrum	<i>Malvastrum americanum</i> *	-
Common Yellow Woodsorrel	<i>Oxalis perennans</i>	LC
-	<i>Phyllanthus maderaspatensis</i>	LC
Pigweed	<i>Portulaca oleracea</i>	LC
Hairy Pigweed	<i>Portulaca pilosa</i>	LC
Soft Roly-poly	<i>Salsola kali</i>	LC
-	<i>Sauropus hirtellus</i>	LC
Sesbania Pea	<i>Sesbania cannabina</i>	LC
Flannel Weed	<i>Sida cordifolia</i> *	-
Fine Sida	<i>Sida filiformis</i>	LC
Paddy's Lucerne	<i>Sida rhombifolia</i> *	-
Spiked Sida	<i>Sida subspicata</i>	LC
Hairy Sida	<i>Sida trichopoda</i>	LC
Stylo	<i>Stylosanthes scabra</i> *	-
Bluebell	<i>Wahlenbergia gracilis</i>	LC



Scientific name	Common name	NC Act Status
Sedges, Rushes and Aquatics		
-	<i>Bulbostylis barbata</i>	LC
Tall Sedge	<i>Carex appressa</i>	LC
Tassel Sedge	<i>Carex fascicularis</i>	LC
-	<i>Cyperus difformis</i>	LC
-	<i>Cyperus gracilis</i>	LC
Nutgrass	<i>Cyperus rotundus</i>	LC
Saw Sedge	<i>Gahnia aspera</i>	LC
Common Rush	<i>Juncus usitatus</i>	LC
Wattle Matrush	<i>Lomandra filiformis</i>	LC
Spiny-headed Matrush	<i>Lomandra longifolia</i>	LC
-	<i>Lomandra sp.</i>	LC
-	<i>Ludwigia octovalvis</i>	LC
Nardoo	<i>Marsilea hirsuta</i>	LC
Water Snowflake	<i>Nymphoides indica</i>	LC
-	<i>Persicaria attenuata</i>	LC
Narrow-leaved Cumbungi	<i>Typha domingensis</i>	LC
Lianas, Scramblers and Twiners		
Nepine	<i>Capparis lasiantha</i>	LC
-	<i>Desmodium macrocarpum</i>	LC
-	<i>Glycine clandestina</i>	LC
-	<i>Marsdenia sp.</i>	LC
Wonga Wonga Vine	<i>Pandorea pandorana</i>	LC
Rough Silkpod	<i>Parsonsia lanceolata</i>	LC
Orchids and Epiphytes		
Tiger Orchid	<i>Cymbidium canaliculatum</i>	LC

* Denotes an introduced species



Appendix 2: Site Fauna Species List

Common Name	Scientific Name	Detection Method ¹
Amphibians		
Scarlet-sided Pobblebonk	<i>Limnodynastes terraereginae</i>	OBS
Birds		
Grey Teal	<i>Anas gracilis</i>	OBS
Pacific Black Duck	<i>Anas superciliosa</i>	OBS, HC
Australasian Darter	<i>Anhinga novaehollandiae</i>	OBS
Richards Pipit	<i>Anthus novaeseelandiae</i>	OBS
Red-winged Parrot	<i>Aprosmictus erythropterus</i>	OBS
Wedge-tailed Eagle	<i>Aquila audax</i>	OBS
Great Egret	<i>Ardea alba</i>	OBS
White-necked Heron	<i>Ardea pacifica</i>	OBS
Australian Bustard	<i>Ardeotis australis</i>	OBS
Hardhead	<i>Aythya australis</i>	OBS
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	OBS, HC
Australian Magpie	<i>Caracticus tibicen</i>	OBS, HC
Pheasant Coucal	<i>Centropus phasianinus</i>	OBS
Red-capped Plover	<i>Charadrius ruficapillus</i>	OBS
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	OBS
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	OBS, HC
Torresian Crow	<i>Corvus orru</i>	HC
Brown Quail	<i>Coturnix ypsilophora</i>	OBS
Pied Butcherbird	<i>Cracticus nigrogularis</i>	HC
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	OBS, HC
White-faced Heron	<i>Egretta novaehollandiae</i>	OBS
Black-fronted Dotterel	<i>Elsayornis melanops</i>	OBS
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>	OBS
Eurasian Coot	<i>Fulica atra</i>	OBS
Bar-shouldered Dove	<i>Geopelia humeralis</i>	OBS
Peaceful Dove	<i>Geopelia placida</i>	OBS, HC
White-throated Gerygone	<i>Gerygone albogularis</i>	OBS, HC
Brown Gerygone	<i>Gerygone mouki</i>	HC
Magpie-lark	<i>Grallina cyanoleuca</i>	OBS
Australian Magpie	<i>Gymnorhina tibicen</i>	OBS, HC
Whistling Kite	<i>Haliastur sphenurus</i>	OBS, HC
Black-winged Stilt	<i>Himantopus himantopus</i>	OBS
Welcome Swallow	<i>Hirundo neoxena</i>	OBS
Comb Crested Jacana	<i>Irediparra gallinacean</i>	OBS
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	OBS
Red-backed Fairy-wren	<i>Malurus melanocephalus</i>	OBS
Noisy Miner	<i>Manorina melanocephala</i>	OBS, HC



Common Name	Scientific Name	Detection Method ¹
Rainbow Bee-eater [#]	<i>Merops ornatus</i>	HC
Black Kite	<i>Milvus migrans</i>	OBS
Restless Flycatcher	<i>Myiagra inquieta</i>	OBS
Crested Pigeon	<i>Ocyphaps lophotes</i>	OBS
Rufous Whistler	<i>Pachycephala rufiventris</i>	OBS, HC
Striated Pardalote	<i>Pardalotus striatus</i>	OBS, HC
Pied Cormorant	<i>Phalacrocorax varius</i>	OBS
Common Bronzewing	<i>Phaps chalcoptera</i>	OBS
Little Friarbird	<i>Philemon citreogularis</i>	OBS, HC
Noisy Friarbird	<i>Philemon corniculatus</i>	OBS, HC
Pale-headed Rosella	<i>Platycercus adscitus</i>	OBS, HC
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	OBS
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	OBS, HC
Grey Fantail	<i>Rhipidura albiscarpa</i>	OBS
Willie Wagtail	<i>Rhipidura leucophrys</i>	OBS
Apostlebird	<i>Struthidea cinerea</i>	OBS
Australian Grebe	<i>Tachybaptus novaehollandiae</i>	OBS
Double-barred Finch	<i>Taeniopygia bichenovii</i>	OBS
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	OBS
Forest Kingfisher	<i>Todiramphus macleayi</i>	OBS
Scaly-breasted Lorikeet	<i>Trichoglossus chlorolepidotus</i>	OBS
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	HC
Masked Lapwing	<i>Vanellus miles</i>	OBS
Mammals		
Dog	<i>Canis lupus familiaris</i> *	TRA
Feral Cat	<i>Felis catus</i> *	TRA
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	OBS, SC, TRA
Common Wallaroo	<i>Macropus robustus</i>	OBS
European Rabbit	<i>Oryctolagus cuniculus</i> *	SC
Koala ^{+,^}	<i>Phascolarctos cinereus</i>	SC
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>	TRA
European Fox	<i>Vulpes vulpes</i> *	TRA
Swamp Wallaby	<i>Wallabia bicolor</i>	OBS
Reptiles		
Open Litter Rainbow Skink	<i>Carlia pectoralis</i>	OBS
Wall Skink	<i>Cryptoblepharus virgatus</i>	OBS
¹ Codes: Direct Observation (OBS), Heard Call (HC), Tracks (TRA), Scat (SC) * Denotes exotic species ^ Vulnerable EPBC Act + Vulnerable NC Act # Migratory EPBC Act		

MIDDLEMOUNT COAL MINE NORTH-EASTERN EXTENSION (EPBC 2016/7717) EPBC Act Preliminary Assessment Documentation

Attachment D

Middlemount Coal Mine North-eastern Extension
Offset Management Plan/Vegetation Management Plan



MIDDLEMOUNT COAL MINE
NORTH-EASTERN EXTENSION

OFFSET MANAGEMENT PLAN/
VEGETATION MANAGEMENT PLAN



November 2016
Project No. GCL-12-21
Document No. 00810684

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EXECUTIVE SUMMARY

This Offset Management Plan/Vegetation Management Plan has been prepared to describe how Middlemount Coal Pty Ltd (MCPL) will manage an offset area established for the North-eastern Extension.

The Middlemount Coal Mine is located in the central Bowen Basin approximately 270 kilometres (km) north-west of Rockhampton and approximately 7 km to the south-west of the Middlemount township within the Isaac Regional Local Government Area, Queensland.

The offset area for the North-eastern Extension is located immediately west of the existing Middlemount Coal Mine on freehold land owned by MCPL. The land is currently used for grazing livestock.

The offset area will be secured for enduring conservation purposes through a legally binding mechanism.

This Offset Management Plan/Vegetation Management Plan provides details of management measures including regeneration, weed management, pest animal management, fire management, erosion and sediment control, and management of livestock. The management measures will be implemented by suitability qualified person(s) in accordance with relevant licences where required.

A monitoring plan is included and will be used to assess the success of the management measures against identified performance criteria. The performance criteria and monitoring requirements will conclude once the completion criteria have been achieved.

This Offset Management Plan/Vegetation Management Plan provides a description of the potential risks to successful management of the offset area, and a description of the contingency measures that will be implemented to mitigate those risks.

This Offset Management Plan/Vegetation Management Plan has been prepared as a draft for inclusion in the Middlemount Coal Mine North-eastern Extension (EPBC 2016/7717) Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* Preliminary Assessment documentation. The contents of this document may change through consultation with the Commonwealth Department of the Environment and Energy and the Queensland Department of Environment and Heritage Protection.

1 INTRODUCTION

1.1 BACKGROUND

The Middlemount Coal Mine, which has been operating since 2009, is located in the central Bowen Basin approximately 270 kilometres (km) north-west of Rockhampton and approximately 7 km south-west of the Middlemount township within the Isaac Regional Local Government Area, Queensland (QLD) (Figures 1 and 2). The offset area is located immediately west of the existing Middlemount Coal Mine (Figure 3) on freehold land owned by Middlemount Coal Pty Ltd (MCPL).

In April 2016 MCPL lodged an amendment application to the Middlemount Coal Mine Environmental Authority EPML00716913 in accordance with section 224 of the *QLD Environmental Protection Act, 1994* (EP Act) to approve the extension of the East Dump at the Middlemount Coal Mine (the North-eastern Extension). The North-eastern Extension was approved by the QLD Department of Environment and Heritage Protection (DEHP) on 23 September 2016. The general arrangement of the Middlemount Coal Mine incorporating the North-eastern Extension is presented on Figure 2.

This Offset Management Plan/Vegetation Management Plan has been prepared to describe how MCPL will manage an offset area established for the North-eastern Extension.

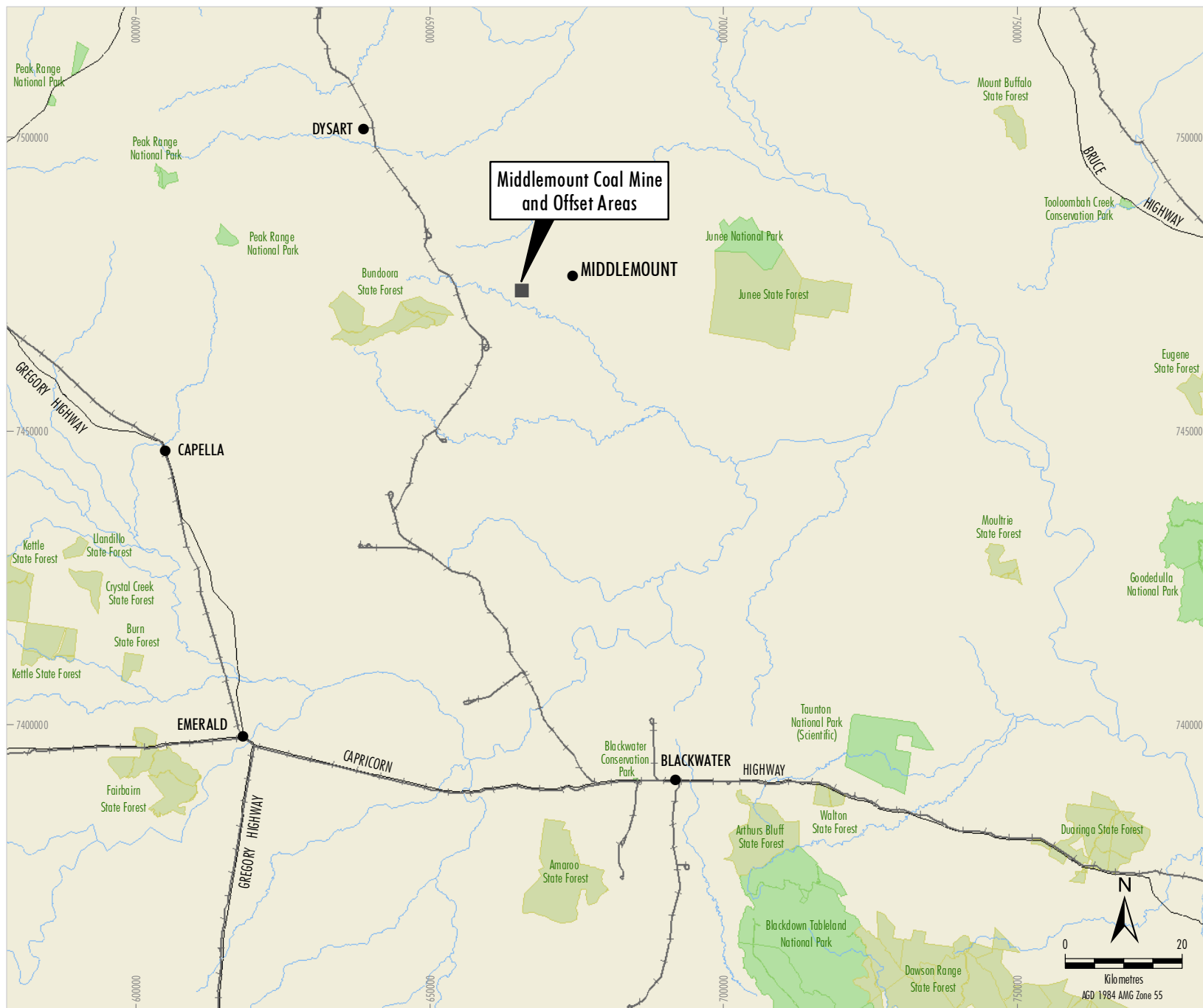
In accordance with Environmental Authority EPML0071691, an environmental offset is required for the prescribed environmental matter “connectivity area” for clearance of Regional Ecosystem (RE) 11.5.3. The offset area to which this management plan pertains also addresses the potential significant impact on the Squatter Pigeon (southern) (*Geophaps scripta scripta*). In addition, the offset area would provide suitable habitat resources for the Koala (*Phascolarctos cinereus*) and South-eastern Long-eared Bat (*Nyctophilus corbeni*).

This Offset Management Plan/Vegetation Management Plan has been prepared as a draft for inclusion in the Middlemount Coal Mine North-eastern Extension (EPBC 2016/7717) Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) Preliminary Assessment documentation. The contents of this document may change through consultation with the Commonwealth Department of the Environment and Energy (DEE) and the QLD Department of Environment and Heritage Protection (DEHP).

MCPL has existing State and Commonwealth approved offset areas which were established for various components of the Middlemount Coal Mine, including the following:

- Middlemount Coal (Stage 2) Project (EPBC 2010/5394) (Declared Area Map 2013/003919).
- Middlemount Coal Mine Rail Loop and Spur (Declared Area Map 2013/003919).
- Parrot Quarry (Declared Area Map 2013/003919).
- Thirteen Mile Gully Diversion (Declared Area Map 2013/003919).

The offset areas established for the above are managed under a separate management plan titled *Middlemount Coal Mine Offset Management Plan/Vegetation Management Plan* (dated November 2013) (MCPL, 2013).



LEGEND

- National Park/Conservation Area
- State Forest
- Railway
- Major Road

Source: Geoscience Australia - Topographical Data 250K (2006)

middlemount coal

OFFSET MANAGEMENT PLAN

Regional Location

Figure 1

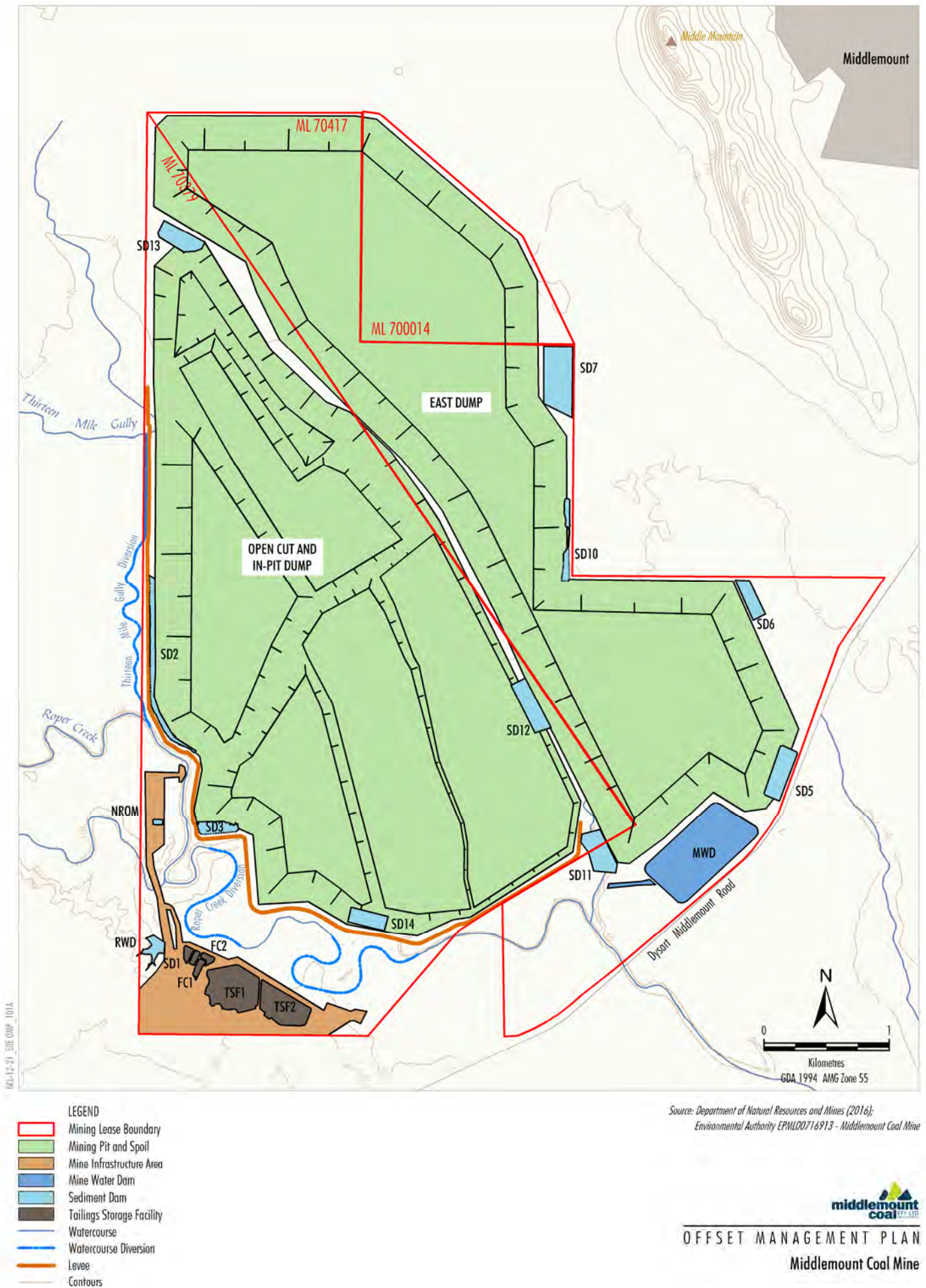
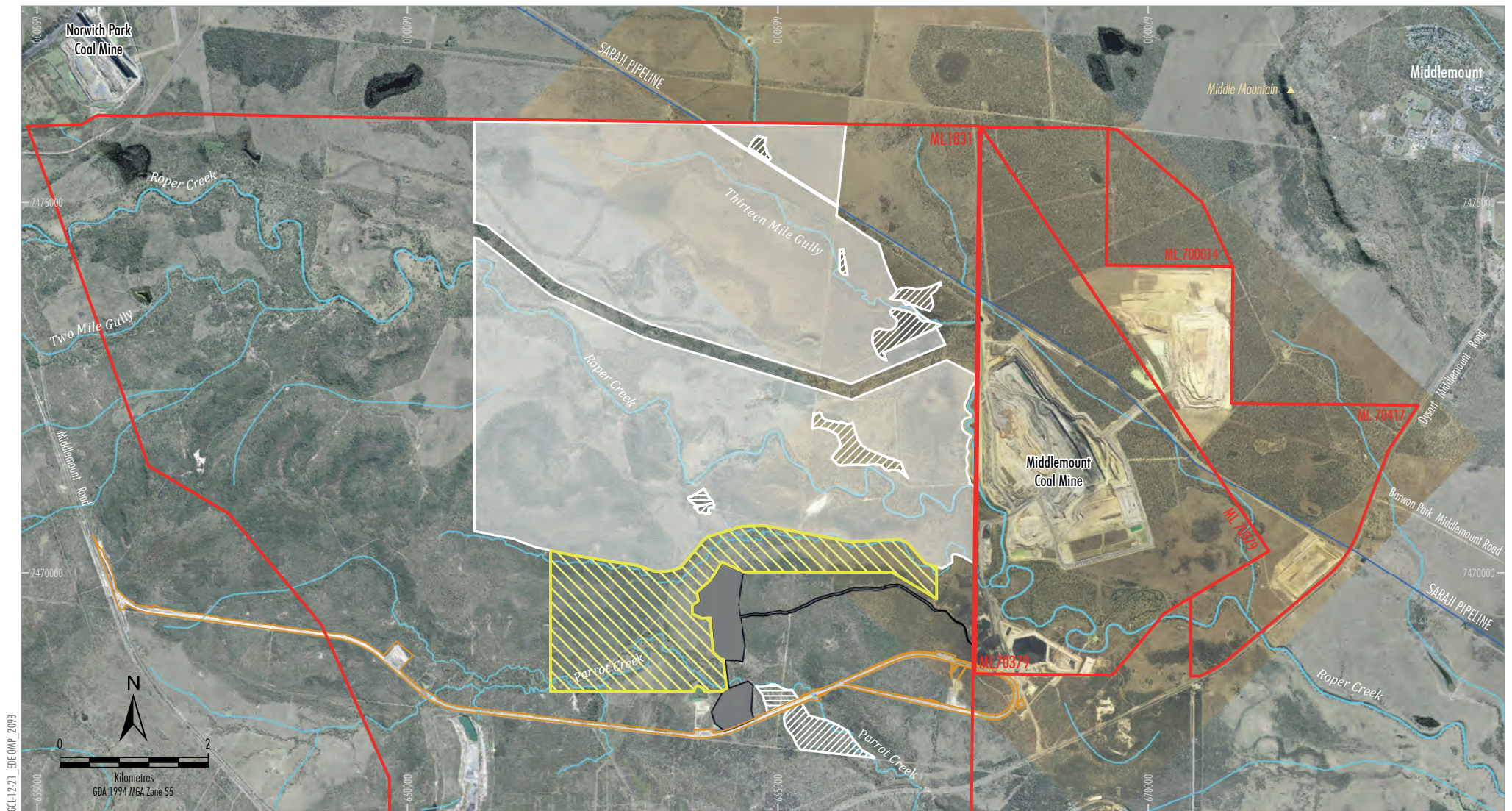


Figure 2



GCL12-21 EDCOMP 2098

- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Middlemount Rail Spur and Loop
 - Existing Offset Area - Stage 2 Project (EPBC 2010/5394) (Declared Area Map 2013/003919)
 - Existing Offset Area - Thirteen Mile Gully Project (Declared Area Map 2013/003919)
 - Existing Offset Area - Rail (Declared Area Map 2013/003919)
 - Existing Offset Area - Parrot Quarry (Declared Area Map 2013/003919)
 - Proposed Offset Area (EPBC 2016/7717)

Source: MCPL (2014); Department of Natural Resources
and Mines (2016)
Orthophoto: MCPL (2014, 2012)

**middlemount
coal**
offset management plan
Offset Location

Figure 3

1.2 OBJECTIVES AND DESIRED OUTCOMES (MANAGEMENT INTENT)

The desired outcome of the offset area established for the North-eastern Extension is that the extent and condition of the habitat values of threatened species and communities within the offset area are protected and enhanced. The land in the offset area is to be enhanced so that the currently degraded areas reach remnant status through increasing the structural integrity and extent of vegetation in the area. The purpose of the offset area is to offset clearing associated with the North-eastern Extension.

1.3 ENDURING PROTECTION OF THE OFFSET AREA - VOLUNTARY DECLARATION

The offset area is located on freehold land owned by MCPL (Lot 2, SP248577). The offset area will be secured through a legally binding mechanism such as a voluntary declaration of an area of high nature conservation value (VDec) under the *QLD Vegetation Management Act, 1999* (VM Act).

The *Guide to Voluntary Declarations under the Queensland Vegetation Management Act, 1999* (Department of Natural Resources and Mines [DNRM], 2016a) provides requirements for Vegetation Management Plans under a VDec. Table 1 provides the relevant requirements and the corresponding sections of this plan that meet such requirements.

Table 1
Vegetation Management Plan Requirements from the *Guide to Voluntary Declarations*

Requirement	Relevant Section that Addresses the Requirement
<i>The management plan must be signed by the proponent.</i>	Following the table of contents ¹
<i>The management plan must include sufficient information to allow DNRM to map the boundary of the stated area.</i>	Figures 5 to 11
<i>The management plan must state the proponent's management intent and proposed outcomes for the conservation of the high nature conservation value of the area or the prevention of land degradation in the area.</i>	Section 1.2
<i>The management plan must state the activities that the proponent intends to carry out or refrain from carrying out to achieve the management outcomes for the conservation of the high nature conservation value of the area or the prevention of land degradation in the area.</i>	Section 3
<i>The management plan must state the restrictions, if any, to be imposed on the use of, or access to, the area by other persons to achieve the management outcomes for the conservation of high nature conservation value of the area or the prevention of land degradation in the area.</i>	Section 3.9

¹ To be inserted following finalisation of the plan.

1.4 REPORT STRUCTURE

The structure of this plan is as follows:

Section 2	Existing environment of the offset area.
Section 3	Management of the offset area.
Section 4	Performance and completion criteria.
Section 5	Monitoring, reporting and reviewing.
Section 6	Contingency measures.
Section 7	Timing and responsibilities.
Section 8	References cited in this Offset Management Plan/Vegetation Management Plan.

The following appendices are attached to this plan:

Appendix A Weed Management Guide for Buffel Grass.

Appendix B Department of Environment and Heritage Protection - Fire Management Guidelines
for Regional Ecosystems in the Offset Area.

2 EXISTING ENVIRONMENT

2.1 LOCATION

The offset area (Figure 5) is located in the Isaac Regional Council area of the Brigalow Belt Bioregion. The closest reserves are Bundorra State Forest located approximately 10 km south-west and June National Park located approximately 20 km north-east (Figure 1).

2.2 PROPERTY AND OWNERSHIP DETAILS AND REGISTERED INTERESTS

The offset area is located on freehold land owned by MCPL (Lot 2, SP248577 – Booroondarra Station). There are no other registered interest holders under the QLD *Land Act 1994* or QLD *Land Title Act 1994*.

2.3 LAND USES

The offset area has a history of clearing and cattle grazing. There is no Strategic Cropping Land mapped in the vicinity of the offset area (DNRM, 2016c). MCPL own the property bordering all sides of the offset area. The land outside of the offset area is currently agisted and will be subject to grazing.

The offset area overlies Mining Lease (ML) 1831 held by Anglo Coal (German Creek) Pty Ltd (Anglo), however there is no current proposal to mine (underground or open cut) within the offset area. Anglo does not hold surface rights over the part of ML 1831 where the offset area is located. Anglo's ML 1831 is for sub-surface rights only in the vicinity of the offset area. Any future mining proposals from Anglo will need to account for the impacts to the offset area (Section 6.2).

2.4 CLIMATE

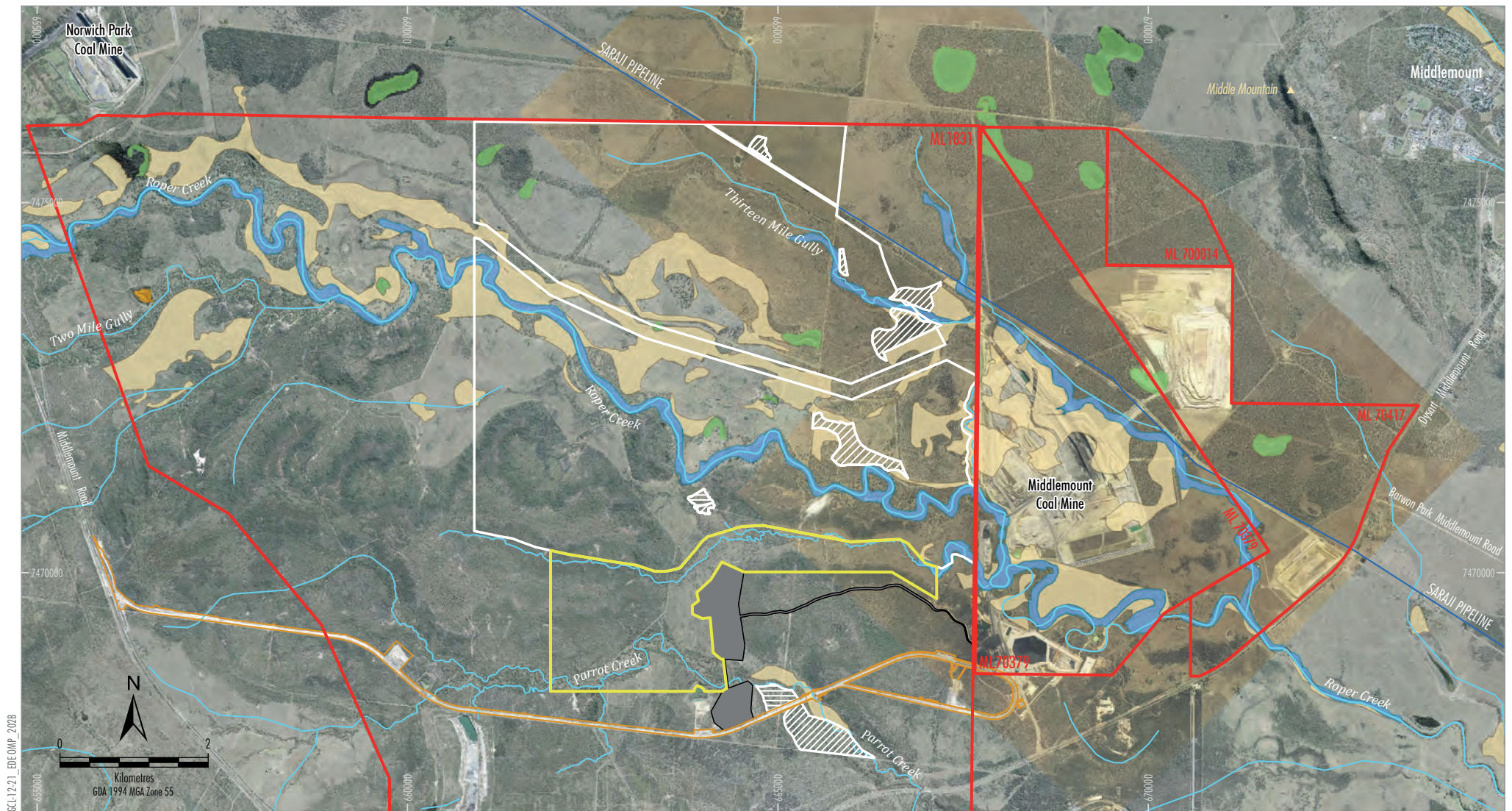
Climate can influence restoration programmes, however the offset area is in a relatively high rainfall area located approximately 120 km inland from the QLD coast. The closest Commonwealth Bureau of Meteorology (BoM) weather station to the offset area is the Emerald Post Office (035027). Mean maximum temperature at the offset area ranges from 22.4 degrees Celsius (°C) in July to 34.8°C in December (BoM, 2016). Mean minimum temperature ranges from 6.9°C in July to 21.4°C in January (BoM, 2016). Mean rainfall is approximately 640.3 millimetres (mm), with the most rain occurring in January (mean rainfall 103.4 mm) and the least amount of rainfall occurring in August (mean rainfall 20.7 mm) (BoM, 2016).

2.5 HYDROLOGY

The site is located in the Fitzroy River Basin which drains an area of approximately 150,000 square kilometers (DNRM, 2016b). The main drainage feature of the offset area is Parrot Creek which passes through the southern portion of the offset area (Figure 4). A number of other smaller tributaries and drainage lines flow through the offset area into Parrot Creek from the south (Figure 4).

A tributary to Roper Creek also runs along the offset area's northern boundary (adjacent the existing Middlemount Stage 2 Project offset area) and joins Roper Creek just to the north-east of the offset area.

These watercourses are both ephemeral (i.e. flow is restricted to periods after rainfall), so while these watercourses were not flowing during the field surveys, recent rainfall events resulted in a number of temporary waterholes along these watercourses.



GCL12-21 EDCOMP 2028

- | | |
|---|---|
| LEGEND | Regional Wetland Mapping |
| Mining Lease Boundary | Palustrine System |
| Parrot Quarry | Lacustrine System |
| Middlemount Rail Spur and Loop | Riverine System |
| Existing Offset Area - Stage 2 Project (EPBC 2010/5394) | Remnant Regional Ecosystem (51-80% Wetland) |
| Existing Offset Area - Thirteen Mile Gully Project | |
| Existing Offset Area - Rail | |
| Existing Offset Area - Parrot Quarry | |
| Proposed Offset Area (EPBC 2016/7717) | |

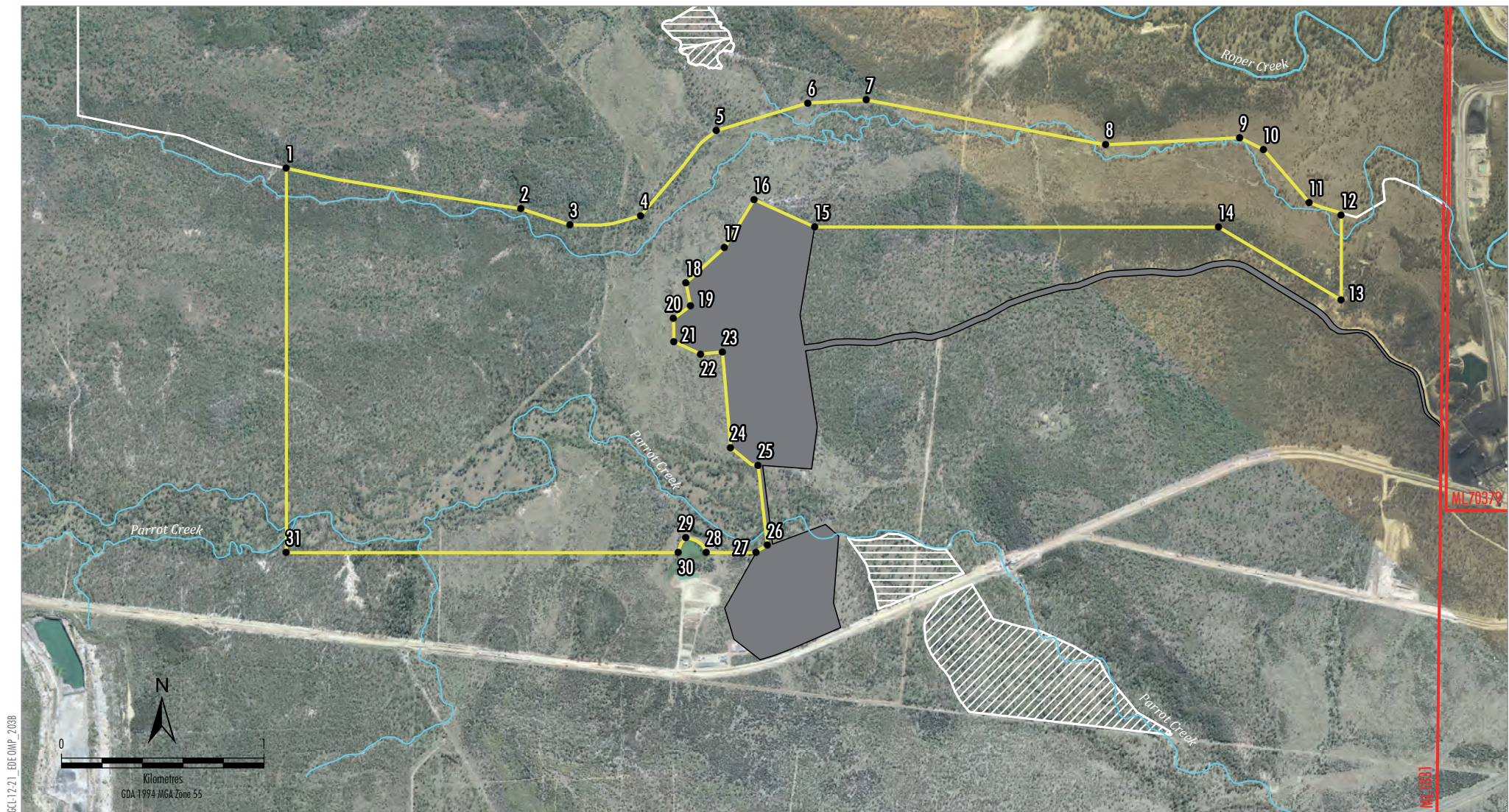
Source: MCPL (2014); Naturecall (2012);
Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (2014, 2012)



OFFSET MANAGEMENT PLAN

Regional Wetland Mapping

Figure 4



GCL12-21 EDE CMP 2038

- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Existing Offset Area - Stage 2 Project (EPBC 2010/5394)
 - Existing Offset Area - Rail
 - Existing Offset Area - Parrot Quarry
 - Proposed Offset Area (EPBC 2016/7717)
 - Reference Point

POINT	EASTING	NORTHING	POINT	EASTING	NORTHING	POINT	EASTING	NORTHING
1	661930.56	7470300.06	11	666983.91	7470131.89	21	663845.41	7469443.23
2	663089.58	7470100.53	12	667142.22	7470068.59	22	663977.42	7469381.83
3	663331.95	7470019.78	13	667142.22	7469648.51	23	664084.84	7469392.32
4	663680.82	7470065.61	14	666536.86	7470008.87	24	664125.88	7468919.60
5	664055.29	7470486.68	15	664541.16	7470009.46	25	664261.18	7468831.59
6	664507.77	7470623.14	16	664241.62	7470145.08	26	664307.50	7468435.82
7	664795.80	7470638.70	17	664095.43	7469907.59	27	664251.90	7468399.59
8	665978.33	7470416.50	18	663904.73	7469733.70	28	664005.49	7468399.59
9	666640.65	7470451.59	19	663928.04	7469619.22	29	663904.32	7468472.61
10	666757.67	7470393.11	20	663843.29	7469557.71	30	663867.06	7468399.59
						31	661930.56	7468399.59

Source: MCPL (2014); Department of Natural Resources and Mines (2016)
 Orthophoto: MCPL (2014, 2012); Esri Basemap


OFFSET MANAGEMENT PLAN
 Aerial Photograph
 with Reference Points

Figure 5

2.6 VEGETATION

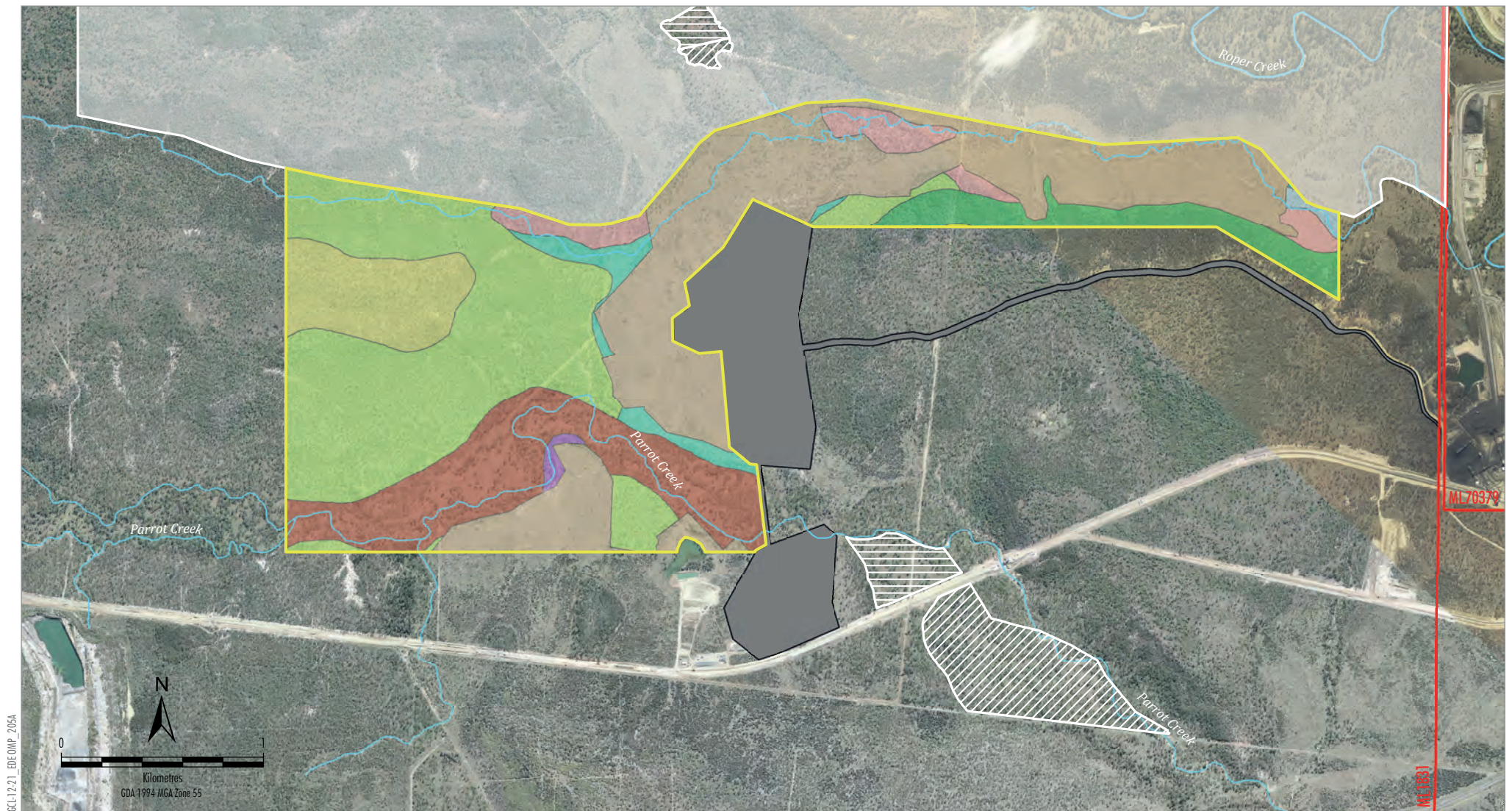
Field surveys in the offset area were undertaken by Naturecall Environmental (Naturecall) (2016) to ground-truth the available DEHP RE mapping (shown on Figure 6), including refining the boundaries and extent of non-remnant vegetation. The ground-truthed RE mapping in the offset area is presented in Figure 7. An example of the woodland/forest areas encountered during the surveys is provided in Plate 1.



Plate 1 - Examples of Woodland/Forest Areas

A single patch of Brigalow (*Acacia harpophylla* dominant and co-dominant) (RE 11.4.8), a threatened ecological community listed under the EPBC Act (RE 11.4.8), occurs in the south-western extent of the offset area (Figure 7) (Section 2.10). Brigalow is present as a component of a number of Endangered and Of Concern REs listed under the VM Act.

The non-remnant vegetation (as defined by the RE mapping system), comprises land which has been cleared in the past and is now at various stages of regeneration (Plate 2). Weed invasion is common throughout the non-remnant vegetation, however it is largely limited to the groundcover stratum. Buffel Grass (*Cenchrus ciliaris*), Sabi Grass (*Urochloa mosambicensis*) and Red Natal Grass (*Melinis repens*) are dominant in the ground layer in the non-remnant vegetation, and incursion of these species into adjacent woodlands was common (Naturecall, 2016).

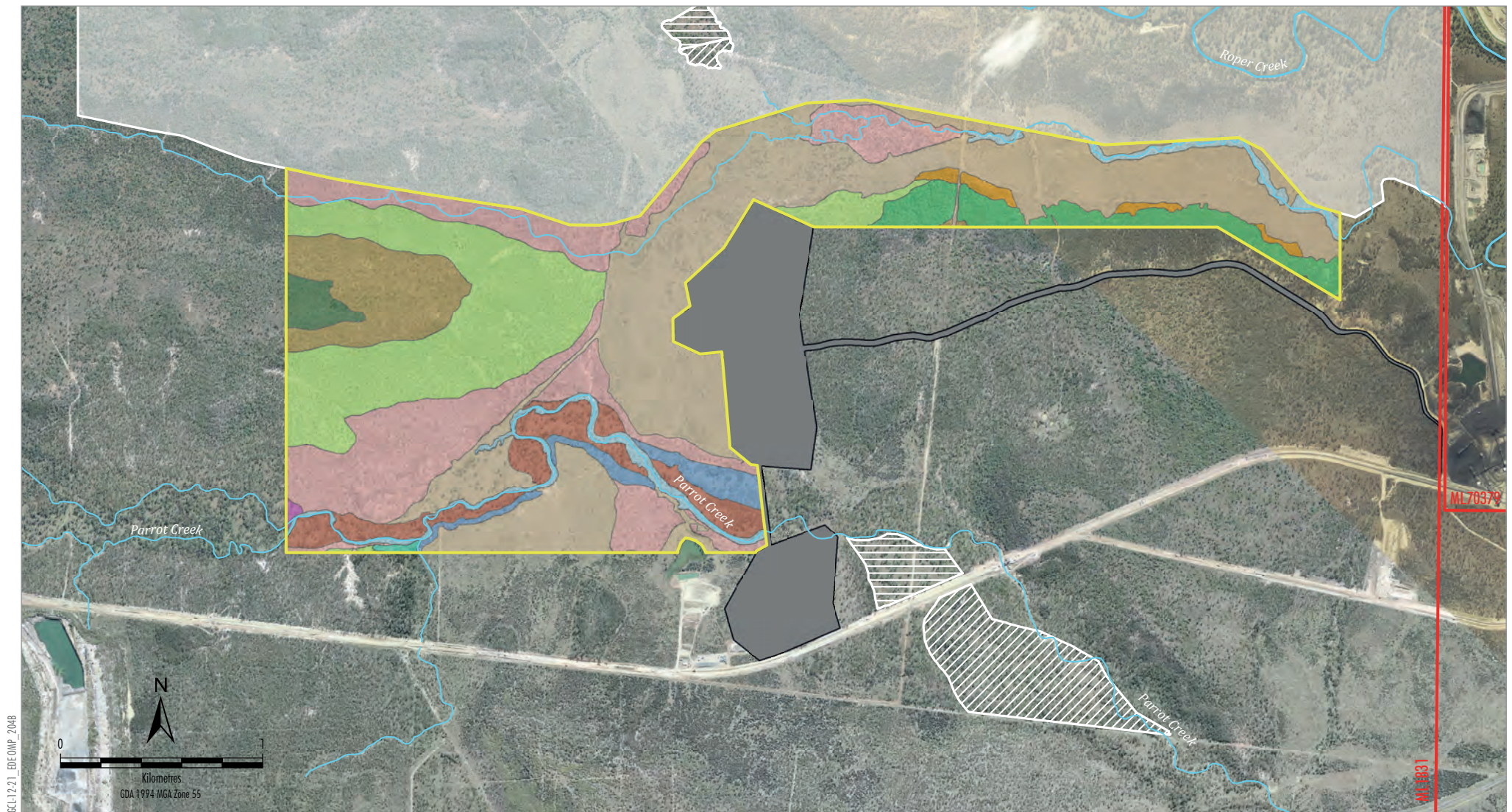


LEGEND	
	Mining Lease Boundary
	Parrot Quarry
	Existing Offset Area - Stage 2 Project (EPBC 2010/5394)
	Existing Offset Area - Rail
	Existing Offset Area - Parrot Quarry
	Proposed Offset Area (EPBC 2016/7717)

Certified Regional Ecosystem Mapping			
	11.3.2/11.3.7		11.5.3
	11.3.25		11.5.9/11.5.18
	11.3.4/11.3.25		11.5.9/11.5.3
	11.4.8		11.7.2/11.7.1
	11.4.9/11.4.8		Non-remnant
	11.5.2		

Source: MCPL (2014); Department of Natural Resources and Mines (2016); Department of Science, Information Technology and Innovation (2015)
Orthophoto: MCPL (2014, 2012)

Figure 6



- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Existing Offset Area - Stage 2 Project (EPBC 2010/5394)
 - Existing Offset Area - Rail
 - Existing Offset Area - Parrot Quarry
 - Proposed Offset Area (EPBC 2016/7717)

Ground-truthed Regional Ecosystem Mapping

 11.3.2	 11.5.2a
 11.3.25	 11.5.3
 11.3.4	 11.5.9
 11.3.4a	 11.7.2
 11.4.8	 11.7.4
 11.5.18	 Non-remnant

Source: Naturecall (2016); MCPL (2014); Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (2014, 2012)


OFFSET MANAGEMENT PLAN
Ground-truthed
Regional Ecosystem Mapping

Figure 7



Plate 2 - Examples of Previously Cleared Areas that are Regenerating

A total of 11 REs were recorded within the offset area (Figure 7; Table 2).

**Table 2
Regional Ecosystems Mapped within the Offset Area**

RE Number	RE Name	Status ¹			Area Mapped within Offset Area (ha)
		VM Act	Biodiversity Status	EPBC Act	
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains.	OC	OC	-	12.5
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines.	LC	OC	-	18.5
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains.	OC	OC	-	28.0
11.3.4a	Floodplain (other than floodplain wetlands). <i>Corymbia tessellaris</i> woodland. On alluvial sand ridges to elevated levees and level terraces adjacent to larger stream channels which are irregularly flooded or possibly relict.	OC	OC	-	0.5
11.4.8	<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains.	E	E	E	1.0
11.5.18	<i>Micromyrtus capricornia</i> shrubland on Cainozoic sand plains/remnant surfaces.	OC	OC	-	6.5
11.5.2a	<i>Allocasuarina luehmannii</i> low tree layer with or without emergent woodland.	LC	NC	-	98.0

Table 2 (Continued)
Regional Ecosystems Mapped within the Offset Area

Regional Ecosystem Number	Regional Ecosystem Name	Status ¹			Area Mapped within Offset Area (ha)
		VM Act	Biodiversity Status	EPBC Act	
11.5.3	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces.	LC	NC	-	108.0
11.5.9	<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and/or remnant surfaces.	LC	NC	-	34.5
11.7.2	<i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone.	LC	NC	-	26.5
11.7.4	<i>Eucalyptus decorticans</i> and/or <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> woodland on Cainozoic lateritic duricrust.	LC	NC	-	5.0
Total					339
-	Non-remnant Vegetation	-	-	-	193

Source: After Naturecall (2016).

Refer to Figure 8 for conservation significant vegetation mapping.

1 Conservation status of REs listed under the VM Act and/or EPBC Act (current at November 2016).

E = Endangered, OC = Of Concern, LC = Least Concern, NC = No Concern at Present, ha = hectares.

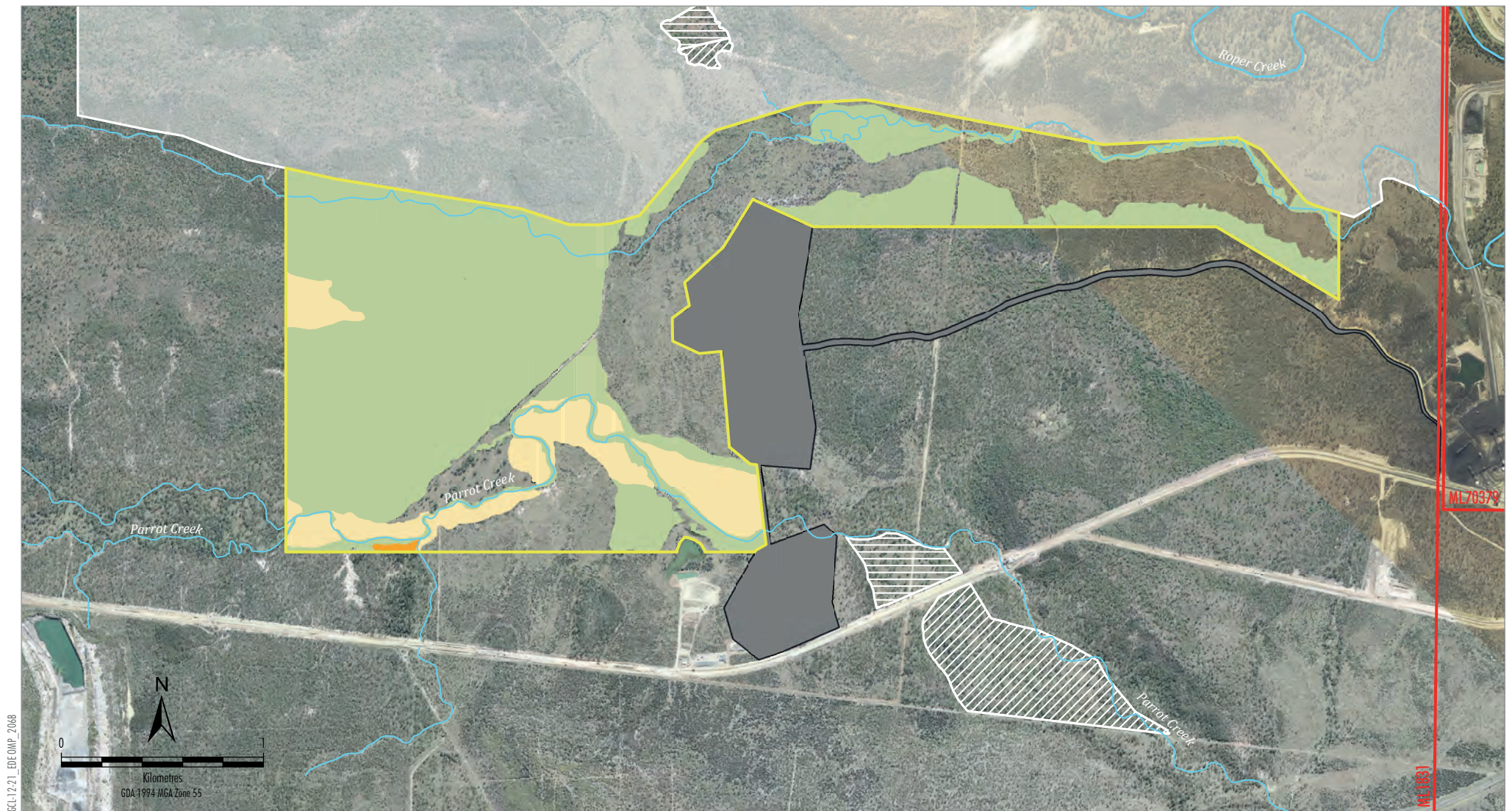
2.7 RESTRICTED MATTERS (WEEDS)

Restricted matters are listed under the QLD *Biosecurity Act, 2014* (Biosecurity Act) and are targeted for control because they have a significant impact on human health, social amenity, the economy or the environment. There are seven categories of restricted matters, of which Categories 1 and 2 restricted matters have specific reporting requirements.

Naturecall (2016) recorded three restricted weeds in the offset area:

- Harrisia Cactus (*Eriocereus martinii*) is a perennial plant with spiny, fleshy-jointed stems that grow to around 0.5 metres (m) high. This species forms dense infestations that chokes out other species if left unchecked (Department of Agriculture, Fisheries and Forestry, 2016).
- Prickly Pear (*Opuntia stricta*) is a perennial, leafless, succulent shrub, that grows to around 50-100 centimetres tall. This species is vigorous in hot, dry conditions, causing other plants to lose vigour or die (Department of Agriculture, Fisheries and Forestry, 2016).
- Rats Tail Grass (*Sporobolus* sp.) is a robust, tufted, perennial grass which grows up to 2 m tall. This species quickly dominates environments, particularly after overgrazing or soil disturbance (Department of Agriculture, Fisheries and Forestry, 2016).

Occasional Prickly Pear, Harrisia Cactus and Rats Tail Grass were recorded, however, their distribution was patchy and not identified to pose a significant risk to the ecological integrity of the offset area due to their low density (Naturecall, 2016).



- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Existing Offset Area - Stage 2 Project (EPBC 2010/5394)
 - Existing Offset Area - Rail
 - Existing Offset Area - Parrot Quarry
 - Proposed Offset Area (EPBC 2016/7717)

- Conservation Status**
- Endangered
 - Of Concern
 - Least Concern

Source: Naturecall (2016); MCPL (2014); Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (2014, 2012)

middlemount coal
OFFSET MANAGEMENT PLAN
Conservation Status of Vegetation

Figure 8

During nearby surveys of the mine site and surrounding offset areas, Parsons Brinckerhoff (2010) and Ecology and Heritage Partners (2012) recorded four restricted weed species listed under the Biosecurity Act not recorded during the recent surveys conducted within the offset area:

- Parthenium (*Parthenium hysterophorus*);
- Velvety Tree Pear (*Opuntia tormentosa*);
- Prickly Acacia (*Acacia nilotica*); and
- Tiger Pear (*Opuntia aurantiaca*).

These species all have the potential to occur in the offset area.

2.8 FAUNA HABITAT

Six broad fauna habitat types were recorded by Naturecall (2016) as occurring within the offset area. These comprised: eucalypt woodlands; non-remnant grasslands; riparian habitat; Brigalow woodland; *Acacia shirleyi* forest; and *Micromyrtus* shrubland (Figure 9). A summary of the habitat types are provided below.

The most common fauna habitat type within the offset area is the eucalypt woodlands which is dominated by Poplar Box (*Eucalyptus populnea*) and Silver Leaved Ironbark (*Eucalyptus melanophloia*). Ground debris, particularly hollow logs, and debris was common throughout this habitat type. The non-remnant grasslands habitat type comprises land which has been cleared in the past and is now at various stages of regeneration (Plate 2).

Riparian habitat generally occurred as open riparian woodlands dominated by Queensland Blue Gum (*Eucalyptus tereticornis*) along Parrot Creek and the un-named watercourse within the northern extent of the offset area. Hollow-bearing trees were generally uncommon within this habitat type and the ground layer contained a good coverage of native grasses, sedges and herbs. Some accumulations of coarse woody debris and logs were present under canopy trees, however leaf litter was thin due to the open canopy.

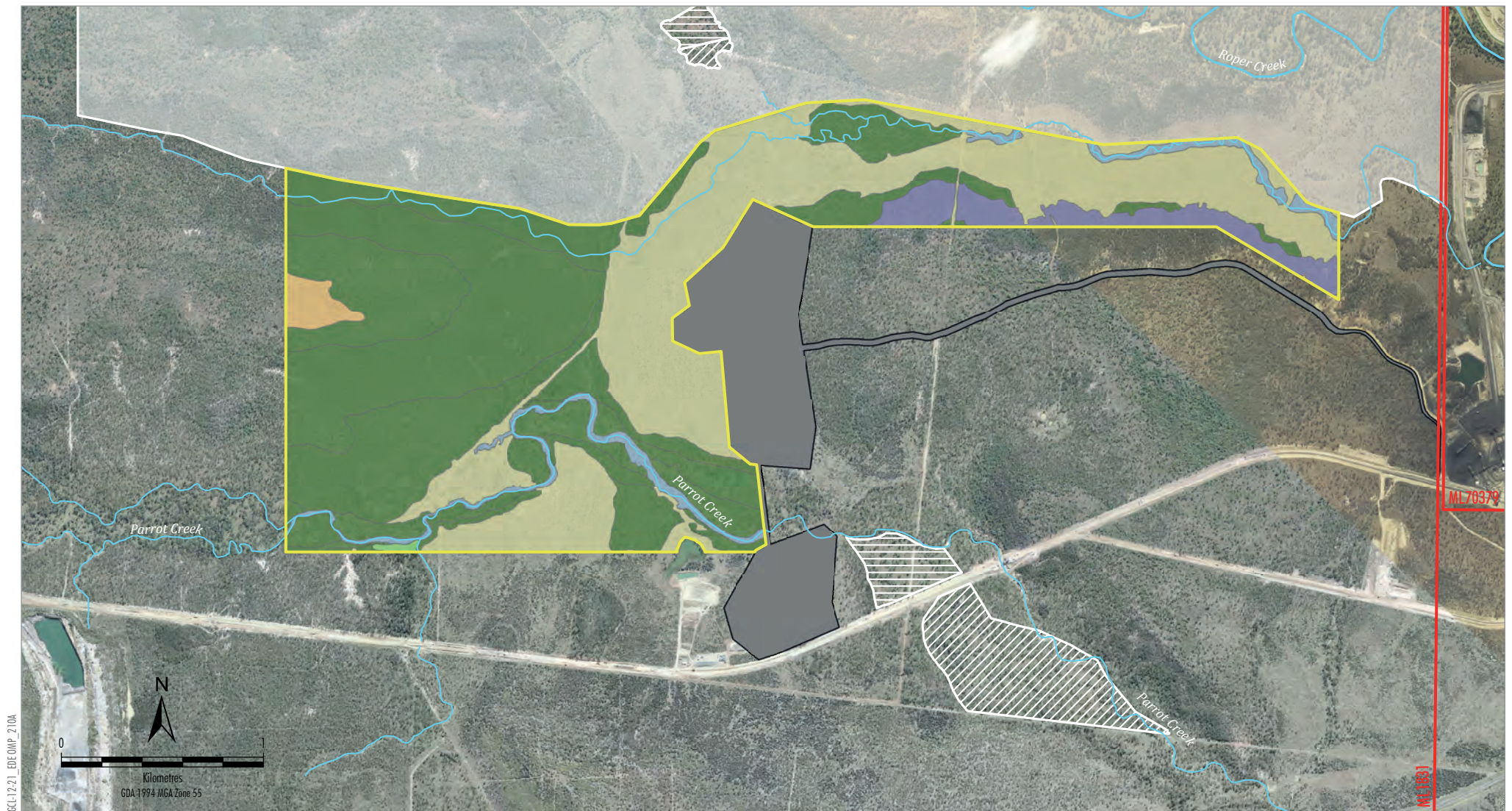
Brigalow woodlands contained dense accumulations of leaf litter and a high density of coarse woody debris, however tree hollows were not common. The ground layer was dominated by native grasses, with some areas of bare ground. Few weeds occurred within this habitat type.

Acacia shirleyi forest consisted of a moderately dense, tall canopy dominated by Lancewood (*Acacia shirleyi*). Hollows-bearing trees were absent, however there was a high density of coarse woody debris and rocky outcrops. Groundcover was dominated by native grasses and leaf litter was predominantly absent.

Micromyrtus shrubland contained a reasonable abundance of hollow logs and debris, with hollow-bearing trees and stags being common throughout this habitat type. The groundcover was dominated by native grasses and leaf litter was common under the canopy trees. This habitat type also contained some small to medium surface rocks.

2.9 RESTRICTED MATTERS (PESTS)

As detailed in Section 2.7, restricted matters are listed under the Biosecurity Act and are targeted for control because they have a significant impact on human health, social amenity, the economy or the environment. There are seven categories of restricted matters, of which Categories 1 and 2 restricted matters have specific reporting requirements.



- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Existing Offset Area - Stage 2 Project (EPBC 2010/5394)
 - Existing Offset Area - Rail
 - Existing Offset Area - Parrot Quarry
 - Proposed Offset Area (EPBC 2016/7717)

- Habitat Type**
- Acacia harpophylla* Woodland/Forest
 - Acacia shirleyi* Forest
 - Eucalypt Woodland/Forest
 - Micromyrtus* Shrubland
 - Regrowth/Derived Grassland
 - Riparian

Source: Naturecall (2016); MCPL (2014); Department of Natural Resources and Mines (2016)
 Orthophoto: MCPL (2014, 2012)



OFFSET MANAGEMENT PLAN Fauna Habitat Types

Figure 9

Naturecall (2016) recorded four restricted fauna species within the offset area listed under the Biosecurity Act:

- Wild Dog (*Canis lupus familiaris*);
- European Fox (*Vulpes vulpes*);
- European Rabbit (*Oryctolagus cuniculus*); and
- Feral Cat (*Felis catus*).

During nearby surveys of the mine site and surrounding offset areas, Parsons Brinckerhoff (2010) and Ecology and Heritage Partners (2012) recorded the Pig (*Sus scrofa*). This species also has the potential to occur in the offset area.

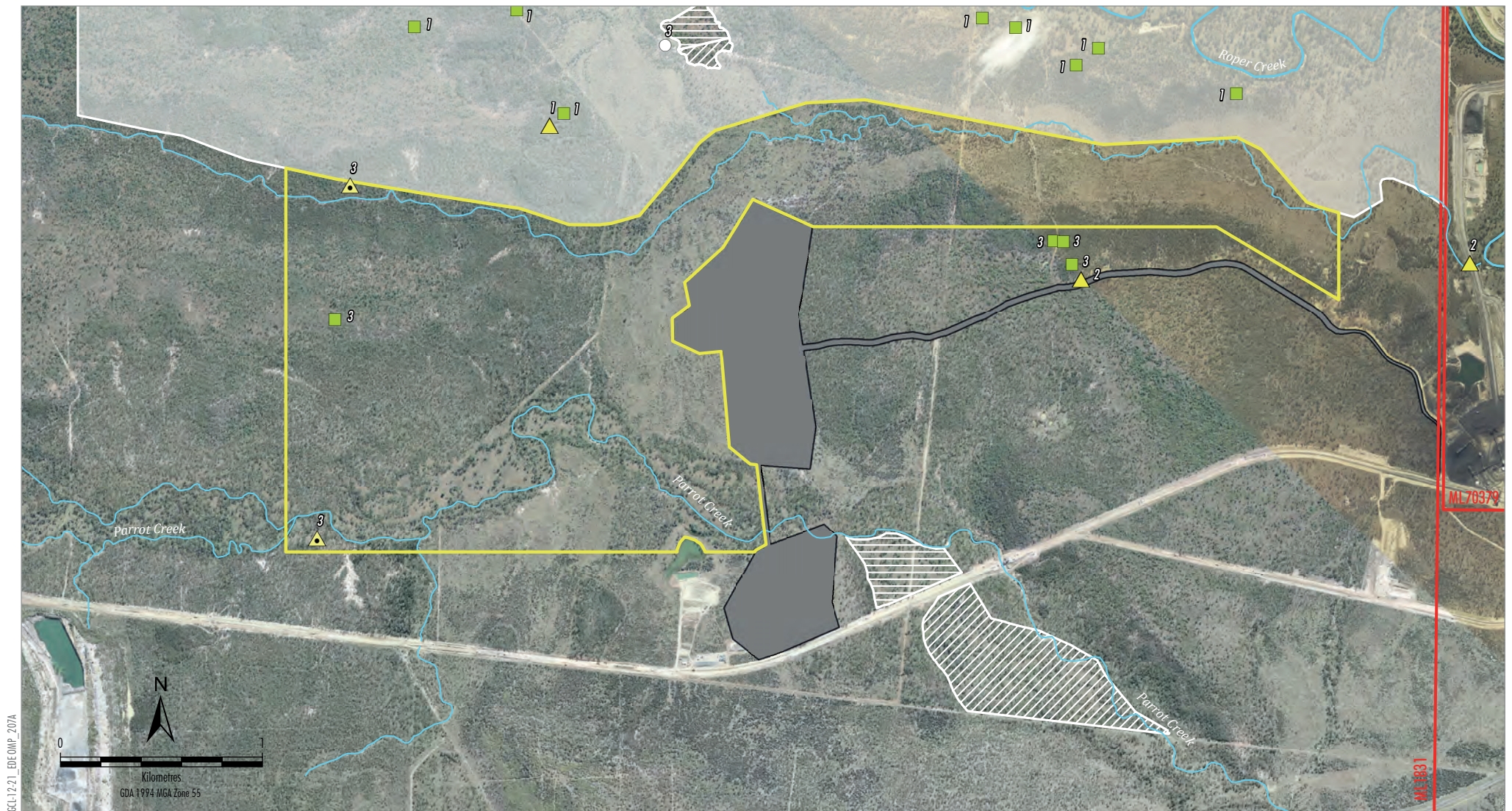
Other potentially occurring pests (i.e. fauna that are not restricted matters) include the House Mouse (*Mus musculus*) and Cane Toad (*Bufo marinus*).

2.10 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Naturecall (2016) ground-truthed areas of threatened ecological communities listed under the EPBC Act and mapped potential habitat for the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat within the offset area. Matters of National Environmental Significance relevant to the offset area are listed in Table 3.

Table 3
Matters of National Environmental Significance

Scientific Name	Common Name	EPBC Act Status ¹	Current Extent and Condition
Threatened Ecological Community			
Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) community		E	Approximately 1 ha of Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) community occurs within the south-western extent of the offset area (Figure 7). Naturecall (2016) determined that the Brigalow community within the offset area meets the area and condition thresholds for it to be included as a Threatened Ecological Community under the EPBC Act.
Fauna			
<i>Geophaps scripta scripta</i>	Squatter Pigeon (southern race)	V	This species occurs mainly in dry grassy eucalypt woodlands and open forests in sandy areas near a source of permanent water (Curtis <i>et al.</i> , 2012). This species has also been recorded in sown grasslands with scattered remnant trees, disturbed habitats (such as stockyards, roads, railways, settlements, etc.), scrub, Acacia growth and heavily-grazed country (DEE, 2016). The Squatter Pigeon (southern) was not recorded within the offset area, however it has been previously recorded on a number of occasions in the wider area (Figure 10), and suitable habitat is present.
<i>Phascolarctos cinereus</i>	Koala	V	The most important habitat characteristics for this species is the type and presence of Eucalyptus tree species and the extent of tree cover (Curtis <i>et al.</i> , 2012). This species inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities (DEE, 2016). The distribution of this species is also affected by soil fertility, water regimes, altitude (limited to <800 m Australian Height Datum), temperature and leaf moisture (Curtis <i>et al.</i> , 2012; DEE, 2016). Locations where this species has been recorded are shown on Figure 10. Koala scats were recorded under an Ironbark in the north-west of the offset area in the Eucalypt woodland habitat type (Naturecall, 2016).



- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Existing Offset Area - Stage 2 Project (EPBC 2010/5394)
 - Existing Offset Area - Rail
 - Existing Offset Area - Parrot Quarry
 - Proposed Offset Area (EPBC 2016/7717)
- Threatened Species Records**
- ▲ Koala
 - ▲ Koala Scratches/Scats
 - Squatter Pigeon (Southern)
 - Native Frangipani (*Cerbera dumicola*)
- Reference:**
- 1 Ecology and Heritage Partners (2012)
 - 2 Naturecall Environmental (2014)
 - 3 Naturecall Environmental (2016)

Source: Naturecall (2016); MCPL (2014);
Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (2014, 2012)

middlemount coal
OFFSET MANAGEMENT PLAN
Threatened Species Records

Figure 10

Table 3 (Continued)
Matters of National Environmental Significance

Scientific Name	Common Name	EPBC Act Status ¹	Current Extent and Condition
<i>Nyctophilus corbeni</i>	South-eastern Long-eared Bat	V	The South-eastern Long-eared Bat occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodlands. The species also occurs in Buloke woodland, Brigalow woodland, Belah woodland, Smooth-barked Apple (<i>Angophora leiocarpa</i>), woodland; River Red Gum, forests lining watercourses and lakes, Black Box (<i>Eucalyptus largiflorens</i>) woodland, and dry sclerophyll forest (DEE, 2016). Suitable habitat for the South-eastern Long-eared Bat is present within the offset area.

¹ Conservation status under the EPBC Act (current at November 2016).

V = Vulnerable, E = Endangered.

The offset area also provides potential habitat for a number of other threatened species listed under the EPBC Act, such as the Yakka Skink (*Egernia rugosa*). These species may occur in the offset area.

2.11 CURRENT THREATS

Current threats in the offset area are as follows:

- weeds;
- pest animals;
- uncontrolled wild fire;
- land degradation;
- over grazing; and
- barbed wire on fences.

The management of these threats are described in Section 3.

3 MANAGEMENT ACTIONS

Management measures applicable to the offset area are listed in Table 4.

Table 4
Management Measures

Management Measures	Section
Management of EPBC Act listed threatened species	Section 3.1
Setting up the offset area on the ground	Section 3.2
Regeneration	Section 3.3
Weed management strategy	Section 3.4
Pest animal management strategy	Section 3.5
Fire management	Section 3.6
Erosion and sediment control	Section 3.7
Management of livestock	Section 3.8
Restrictions to access	Section 3.9
Removal of barbed wire	Section 3.10
Education	Section 3.11
Management schedule	Section 3.12

3.1 MANAGEMENT OF EPBC ACT LISTED THREATENED SPECIES

Table 5 provides management measures relevant to Matters of National Environmental Significance as described in this Offset Management Plan/Vegetation Management Plan. The section of this Offset Management Plan/Vegetation Management Plan that addresses the management measure is also provided.

The management measures provided in this Offset Management Plan/Vegetation Management Plan consider the threat abatement and recovery information on the DEE (2016) website.

Table 5
Specific Management Measures Relevant to Matters of National Environmental Significance

MNES	Conservation Status ¹	Management Measures	Section
Squatter Pigeon (southern) (<i>Geophaps scripta scripta</i>)	V	Livestock will be managed in the offset area.	Section 3.8
		A pest animal management strategy will be developed to control pest animals (such as rabbits, cats, pigs, dogs and foxes).	Section 3.5
		Regeneration of already cleared land will be allowed by preventing regrowth clearing, minimising fire and by managing grazing in the offset area.	Section 3.3
Koala (<i>Phascolarctos cinereus</i>)	V	A pest animal management strategy will be developed to control pest animals (such as cats, dogs and foxes).	Section 3.5
		Regeneration of already cleared land will be allowed by preventing regrowth clearing, minimising fire and by managing grazing in the offset area.	Section 3.3
		Access restrictions (such as speed limits and restriction of vehicles to access tracks).	Section 3.9

Table 5 (Continued)
Specific Management Measures Relevant to Matters of National Environmental Significance

MNES	Conservation Status ¹	Management Measures	Section
South-eastern Long-eared Bat (<i>Nyctophilus corbeni</i>)	V	A pest animal management strategy will be developed to control pest animals (such as cats, dogs and foxes).	Section 3.5
		Regeneration of already cleared land will be allowed by preventing regrowth clearing, minimising fire and by managing grazing in the offset area.	Section 3.3
		Fire Management.	Section 3.6

¹ Conservation status under the EPBC Act.

MNES – Matters of National Environmental Significance.

3.2 SETTING UP THE OFFSET AREA

After enduring protection of the offset area has been established (Section 1.3), the offset area will be set-up on the ground by:

- identifying/establishing fire trails/access tracks required for fire management or other management purposes (Sections 3.6 and 3.9, Figure 11);
- fencing the perimeter of the offset area to manage grazing livestock in the offset area (Section 3.8);
- installing locks on gates (Section 3.9); and
- installing signage along main access roads which recognised that the area is protected for conservation purposes to deter third party access into the area (Section 3.9).

An operational review of road and fire trail construction is to be completed in order to set up the offset area. Access into the offset area is currently limited. The main access is along an access track associated with the Parrot Creek Quarry. The design of any new tracks will consider the location of conservation significant vegetation and flora (Figures 8 and 10).

Any existing access tracks not necessary for management purposes will be ripped and revegetated (Section 3.3). Excess fencing inside of the offset area which is not required will be removed and recycled where practicable. Access tracks across drainage lines in the offset area will be repaired and stabilised.

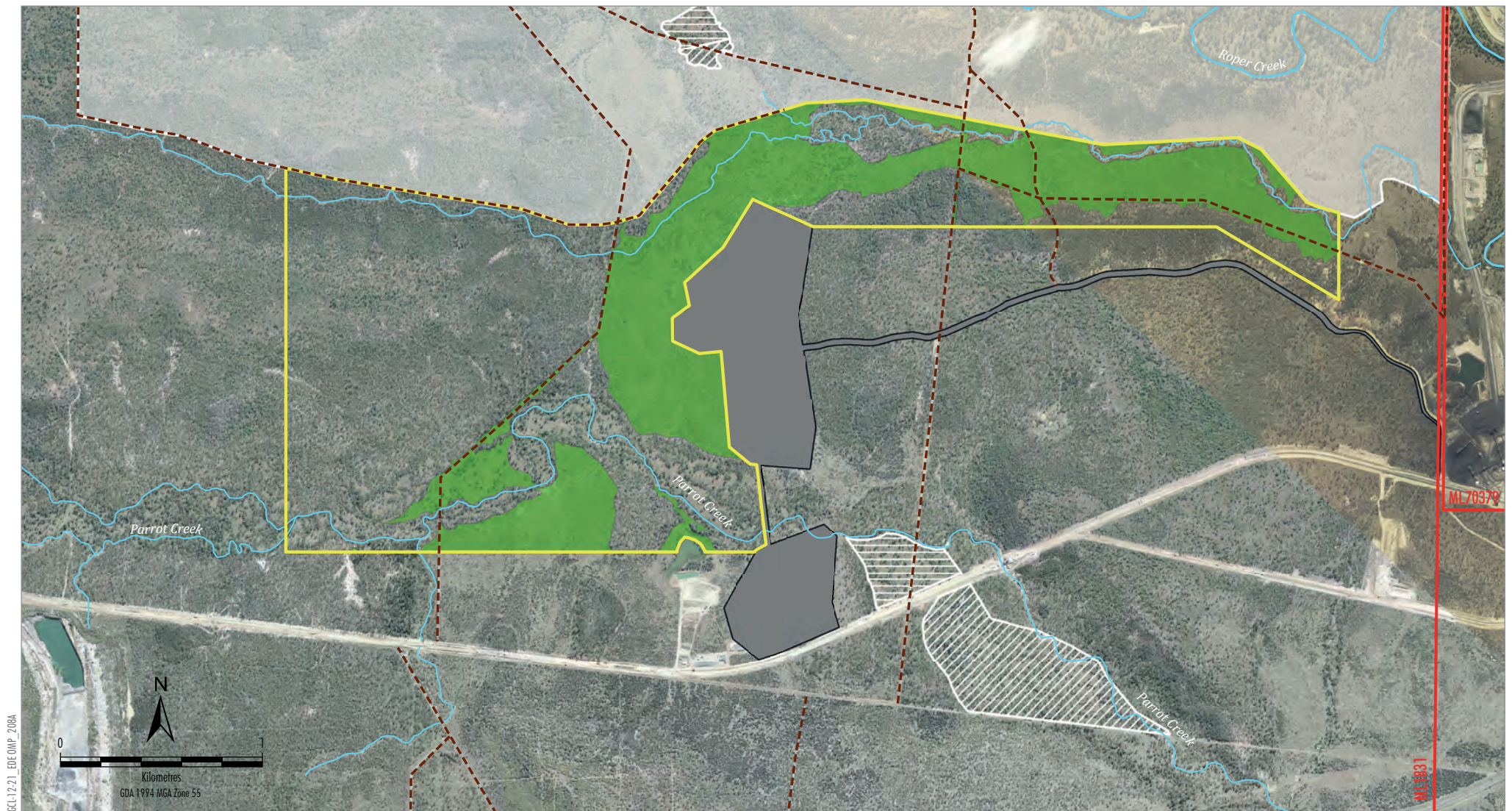
3.3 REGENERATION

Two main types of management areas are relevant to the offset area, namely, Enhancement Areas and Regeneration Areas (Figure 11¹). The management areas are described in Table 6.

Table 6
Management Areas

Management Area	Description
Enhancement Areas	Approximately 339 ha of existing woodland/forest habitats will be managed to improve its condition.
Regeneration Areas	Approximately 193 ha of cleared land will be allowed to regenerate.

¹ Enhancement areas are areas of the offset which are not mapped as Regeneration Areas.



- LEGEND**
- Mining Lease Boundary
 - Parrot Quarry
 - Existing Offset Area - Stage 2 Project (EPBC 2010/5394)
 - Existing Offset Area - Rail
 - Existing Offset Area - Parrot Quarry
 - Proposed Offset Area (EPBC 2016/7717)
 - Regeneration Area
 - Track

Source: Naturecall (2016); MCPL (2014);
Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (2014, 2012)


OFFSET MANAGEMENT PLAN
 Regeneration Areas

Figure 11

The Enhancement Areas comprise existing woodland/forest habitats and will not need specific revegetation measures. On the other hand, the Regeneration Areas comprise land which has been cleared in the past (Plate 2, Section 2.6).

The land is considered to have moderate to high resilience despite the past disturbance, evidenced by regrowth of trees and native understorey. Therefore, the primary method for regenerating the offset area will be through management of threatening processes that inhibit natural regeneration (e.g. weeds [Section 3.4], pest animals [Section 3.5], erosion [Section 3.7] and grazing livestock [Section 3.8]). Specific monitoring of these areas are described in Section 5.1.

Access tracks not necessary for management purposes will be ripped and revegetated according to the method in Section 6.1.1. Areas of excessive erosion will be treated according to the method outlined in Section 3.7.

In the unlikely event that natural regeneration is not readily occurring or species composition is poor, contingency measures are described in Section 6.1, including further active seeding/planting or disturbance to reduce competition.

3.4 WEED MANAGEMENT STRATEGY

The purpose of the weed management strategy is to improve the condition of the habitat by reducing the presence of weeds/declared plants.

3.4.1 Weed Prevention

The spread and introduction of weeds/declared plants to and within the offset area can be minimised by restricting vehicles to designated access tracks. The implementation of measures that favour the restoration of healthy native vegetation is also an effective method of weed management. The introduction, establishment and spread of non-native weeds will be minimised through regular monitoring and treatment activities.

3.4.2 Weed Control

The presence of weeds/declared plants will be identified via monitoring (Section 5.1.3) and regular site inspections (Section 5.1.5). In regard to weed management measures, physical removal and chemical application are the main weed control methods available. Appropriately qualified persons will be engaged to undertake weed control.

Control methods will target the following species listed as restricted matters under the Biosecurity Act:

- Cactus (*Harrisia* sp.) (Category 3);
- Rats Tail Grass (*Sporobolus* sp.) (Category 3);
- Parthenium (*Parthenium hysterophorus*) (Category 3);
- Velvety Tree Pear (*Opuntia tormentosa*) (Category 3);
- Prickly Acacia (*Acacia nilotica*) (Category 3);
- Tiger Pear (*Opuntia aurantiaca*) (Category 3); and
- Prickly Pear (*Opuntia stricta*) (Category 3).

Category descriptions are as follows:

- **Category 3** – includes weeds, pest animals and noxious fish (e.g. gambusia, dingoes, yellow crazy ants). You must not distribute this restricted matter unless the distribution or disposal is authorised in a regulation or under a permit.

Specific weed control methods will be in accordance with those specified by the Department of Agriculture, Fisheries and Forestry (2016).

As described in Section 2.7, *Harrisia* Cactus, Prickly Pear and Rats Tail Grass were found to have a patchy distribution across the offset area (Naturecall, 2016). On 12 August 2013, DNRM requested weed control methods for Cactus, Parthenium and Velvety Tree Pear to be outlined in this plan. These species will be controlled in accordance with Department of Agriculture, Fisheries and Forestry (2016) weed control specifications (Table 7).

Table 7
Weed Control Methods

Species	Control Methods ¹
Cactus (<i>Harrisia</i> sp.)	• Mechanical control to dig out plants (including tubers) and destroy. • Herbicide control with chemicals and application rates in accordance with the <i>Harrisia</i> Cactus fact sheet.
Parthenium	• Herbicide control with chemicals and application rates in accordance with the Parthenium fact sheet. • Spray in a time of year before Parthenium sets seed. • Herbicide control will involve a knockdown herbicide to kill plants that are present and a residual herbicide to control future germinations. • Repeated spraying may be required even within a single growing season to prevent further seed production.
Velvety Tree Pear	• Herbicide control with chemicals and application rates in accordance with the prickly pear identification and control fact sheet.

¹ Source: Department of Agriculture, Fisheries and Forestry (2016).

One or multiple combination of treatments may be applied. The selected treatments employed will be documented and monitored. Any clearing of native vegetation to control non-native weeds will be conducted in a way that prevents soils erosion, and maintains bank stability if clearing is associated with a watercourse.

3.4.3 Buffel Grass Management

Buffel Grass is a widespread introduced pasture species which is dominant over large areas of remnant and non-remnant vegetation in the offset area and surrounds. Buffel Grass is readily spread by the wind, overland water flow, animals and human activities. Buffel Grass has an extensive root system that enables the grass to bind soil particles to reduce erosion and dust generation. Uncontrolled Buffel Grass growth suppresses regrowth of native plant species (Franks, 2002; Grice *et al.*, 2012; Marshall *et al.*, 2012; Appendix A) which can hinder the performance of the Regeneration Areas. The objective of the Regeneration Areas is that they progressively change from a grassland dominated system to woodland/forest.

Buffel Grass can also present a significant fire risk as studies have shown the wildfires through overgrown Buffel Grass are more intense and can damage native vegetation communities (such as the Brigalow [*Acacia harpophylla* dominant and co-dominant] community) (Franks, 2002; Butler and Fairfax, 2003; Butler, 2007; Miller *et al.*, 2010; Appendix A).

For this reason, the interaction between Buffel Grass and fire has been identified as an important target for management (Butler and Fairfax, 2003). Further information on Buffel Grass can be found in the Cooperative Research Centre for Australian Weed Management (CRC Weed Management) (2008) *Weed Management Guide for Buffel Grass* (Appendix A).

Buffel Grass in the offset area will be managed to suppress its dominance and reduce the fire risk posed by high fuel loads. Buffel Grass growth in the offset areas can be managed by the following options:

- Encouraging growth of overstorey vegetation (to form a canopy and shade-out Buffel Grass).
- Mapping Buffel Grass infestations for management purposes (extent and approximate ground cover).
- Segmentation of the offset area into Buffel Grass management zones where appropriate with different treatments trailed in different areas.

Possible treatments include:

- Strategic grazing in the offset area to control biomass and reduce fuel load (Section 3.8).
- Mosaic fire management to reduce Buffel Grass cover/old growth fuel load.

These possible treatments are further discussed below. One or multiple combination of treatments may be applied. The selected treatments employed will be documented and monitored.

Strategic Grazing

Rotational livestock grazing may be used as a method of managing Buffel Grass and reducing fuel loads in the offset management area. It is noted that inappropriate livestock grazing can pose a risk to native vegetation, though strategic grazing is likely to be an effective method of reducing Buffel Grass fuel loads over large areas (Butler and Fairfax, 2003). Further information on livestock grazing in the offset area is described in Section 3.8.

Mosaic Fire Management

Buffel Grass is also relatively resilient to fire, however a cool fire may provide a safe and useful means of fuel reduction and could be achieved when moisture levels are relatively high (Butler and Fairfax, 2003). Marshall, *et al.* (2012) described that burning followed by the application of herbicides and sowing of native grasses has been highly effective at suppressing Buffel Grass while promoting the regeneration of other flora.

Fires in pastures (i.e. the Regeneration Areas) should be generally prevented from escaping into adjacent areas of native vegetation woodland/forest as they can open them up to Buffel Grass invasion (Appendix A). Fire management guidelines for each of the REs recorded within the offset area are provided in Appendix B as sourced from the Queensland Herbarium (2014).

3.4.4 Weed Monitoring and Reporting

The control techniques used will be documented and areas subject to weed control will be mapped for follow-up inspection and management. Follow-up site inspections will occur to determine the effectiveness of weed control. Weed management and monitoring results will be reported annually. Weed monitoring is described in Section 5.1.3 and reporting requirements are outlined in Section 5.2.

3.5 PEST ANIMAL MANAGEMENT STRATEGY

The purpose of the pest animal management strategy is to improve the condition of the habitat by reducing the presence of pest animals. The European Fox (*Vulpes vulpes*), European Rabbit (*Oryctolagus cuniculus*) and Feral Cats (*Felis catus*) are threats to the Squatter Pigeon (southern) (Curtis *et al.*, 2012). Multiple pest animals can degrade occurrences of the Brigalow (*Acacia harpophylla* dominant and co-dominant) community.

3.5.1 Pest Animal Prevention

Removing available feed and maintaining a clean, rubbish-free environment in order to discourage scavenging and reduce the potential for colonisation of these areas by non-endemic fauna (e.g. introduced rodents, predators and birds) will be undertaken.

3.5.2 Pest Animal Control

Appropriately qualified persons will be engaged to undertake pest animal control. Control measures will consider the guidelines found on the Department of Agriculture, Fisheries and Forestry website. A control programme is to be implemented according to relevant legislation.

Control methods will target the following species listed under the Biosecurity Act:

- Feral Pigs (*Sus scrofa*) (Categories 3, 4 and 6);
- Wild Dogs (*Canis lupus familiaris*) (Categories 3, 4 and 6);
- European Rabbit (*Oryctolagus cuniculus*) (Categories 3, 4, 5 and 6);
- Feral Cats (*Felis catus*) (Categories 3, 4 and 6); and
- European Fox (*Vulpes vulpes*) (Categories 3, 4, 5 and 6).

Category descriptions are as follows:

- **Category 3** – includes weeds, pest animals and noxious fish (e.g. gambusia, dingoes, yellow crazy ants). You must not distribute this restricted matter unless the distribution or disposal is authorised in a regulation or under a permit.
- **Category 4** – includes specific weeds, pest animals and noxious fish such as the bitou bush, feral pig or giant cichlid. You must not move this restricted matter to ensure that it does not spread into other areas of the state.
- **Category 5** – includes weeds, pest animals and noxious fish such as Mexican feather grass, rabbits and carp. You must not possess or keep this restricted matter under your control without a permit under the Biosecurity Act 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. You must not feed this category of restricted matter.

The Cane Toad is not a restricted matter under the Biosecurity Act (presumably because there are no cost-effective, broad scale control measures available), but it will be controlled if encountered in the offset area. The *biological effects, including lethal toxic ingestion, caused by Cane Toads (Bufo marinus)* is a key threatening process listed under the EPBC Act.

3.5.3 Pest Animal Monitoring and Reporting

Monitoring of pest animals is to be undertaken every 3 years by a suitably qualified practitioner (Section 5.1.4). If the results of these surveys indicate that a control programme is necessary, such a control programme is to be implemented and monitored according to relevant legislation.

Follow-up site inspections will occur to determine the effectiveness of pest animal control (Section 5.1.4). Pest animal management and monitoring results will be reported annually.

3.6 FIRE MANAGEMENT

Inappropriate fire regimes has been recognised as presenting a threat to the habitat of several threatened species including the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat (DEE, 2016). Fire would also impact the grass nests and the grass habitat of the Squatter Pigeon. Brigalow regrowth is often killed by fire and intense fires can alter the structure of Brigalow vegetation (Butler and Fairfax, 2003).

After enduring protection of the offset area has been established (Section 1.3), the offset area will be set-up on the ground by identifying/establishing fire trails required for fire management. Fire management guidelines for each of the REs recorded within the offset area are provided in Appendix B as sourced from the Queensland Herbarium (2014).

Ground fuel loads may be controlled through the strategic rotational grazing of cattle to prevent thick grass biomass from accumulating over time. It is anticipated that growth of overstorey vegetation will gradually shade-out/reduce Buffel Grass in the offset area. As stated in Section 3.8, livestock will be excluded from the offset area once it is no longer required for strategic management of Buffel Grass.

Bushfire preventative measures will include:

- Educating employees and contractors on general fire awareness and response procedures (Section 3.11).
- Fire track maintenance for fire control.
- Ground fuel loads may be controlled through the strategic rotational grazing of cattle to prevent thick grass biomass from accumulating over time. Reducing the fuel load will minimise the impact of uncontrolled fires (e.g. from lightning strike), which could cause damage to Brigalow regeneration and enhancement areas, plus also impact the ground dwelling Squatter Pigeon (southern).
- When necessary, fuel management (e.g. hazard reduction burns) will be undertaken in consultation with the QLD Rural Fire Service.
- Local fire wardens will be consulted and fire permits will be obtained prior to hazard reduction burns.
- Land managers adjacent to the offset area are to be contacted annually to discuss fire issues and burning programmes on adjacent land.

In the event of a wild fire occurring within the offset management area, back burning from the established fire breaks will be undertaken to prevent the spread of the wild fire. If the established fire breaks do not provide effective suppression of the wild fire then additional fire management lines will be installed to control the wild fire. Proposed locations of the established fire breaks/tracks are provided in Figure 11.

The QLD Rural Fire Service will be called for assistance if a significant bushfire was to occur within or move towards the offset area.

The known locations of Native Frangipani (*Cerbera dumicola*) (Figure 10) will be protected from hazard reduction burns where practicable.

3.7 EROSION AND SEDIMENT CONTROL

Erosion potential in the offset area will be reduced by grazing management (Section 3.8), restricting vehicle access to the offset area (Section 3.9) and control of animal pests (such as the European Rabbit) (Section 3.5).

Erosion control may be required in areas observed to be displaying relevant characteristics (e.g. gullying), through visual monitoring (Section 5.1.5). Visual observations will focus on drainage areas and disturbed areas (e.g. access tracks including creek crossings).

The following measures may be used to control erosion within the offset area:

- selective plantings/direct seeding of local endemic species to stabilise the soil; and/or
- surface water management structures (e.g. contour banks and temporary sediment traps [such as hay bales]).

3.8 MANAGEMENT OF LIVESTOCK

Extended periods of Intense grazing of livestock can suppress regeneration of native plant species which can hinder the performance of the Regeneration Areas. Long-term Intense grazing of livestock is a recognised threat to Brigalow (*Acacia harpophylla* dominant and co-dominant) community (DEE, 2016).

The perimeter of the offset area will be fenced so that grazing activities can be managed in the offset area. Ultimately, it is intended to exclude grazing from the offset area in the long-term, however in the interim, strategic grazing may be used to manage Buffel Grass fuel load in the offset management area.

Strategic Grazing

Livestock grazing will be strategically used in the offset area. Rotational livestock grazing may be used as a method of managing Buffel Grass and reducing fuel loads in the offset management area. Rotational grazing is where a period of grazing is followed by an extended period of rest which, depending on pasture growth and season conditions, may be up to a few months (Department of Environment and Reserve Management [DERM], 2011). Rotating livestock will provide periods throughout the year when there will be no grazing pressure in selected areas.

It is intended that the Regeneration Areas progressively change from a grassland dominated system to woodland/forest. Grazing would be used in a way to still enable regeneration of native plant species in the Regeneration Areas. This would be achieved by maintaining high ground cover (i.e. greater than 60% [or as dictated by future monitoring]).

The rotation of stock will be undertaken in association with the livestock owner and will be dependent upon seasonal conditions, maintaining ground cover above 60%.

Ground cover above 60% is considered “high cover”, which minimises soil loss from erosion and prevents declines in land condition (Fitzroy Basin Association, 2006). Maintaining ground cover above 60% will prevent the offset area from being overgrazed, which is a known threat to the habitat of the Squatter Pigeon (southern).

Fencing and appropriate stock water would need to be in place to enable areas to be strategically grazed (e.g. short duration, heavy grazing of Buffel Grass). Excess fencing inside of the offset area which is not required will be removed and recycled where practicable.

The areas grazed would be mapped annually and the intensity of grazing (number of cattle and duration) would be recorded. Regeneration Areas would be monitored as described in Section 5 and the grazing regime revised as necessary.

Stocking rates in the offset area will be highly dependent upon seasonal conditions and will fluctuate from year to year, so a precise set stocking rate cannot be established. Publically available literature indicates set stocking rates may not be the best tool for managing grazing pressure, due to the variability in seasonal conditions. During years with above average rainfall in the offset area, higher stocking rates will be required for Buffel Grass and fire fuel load management. Conversely, lower stocking rates will be utilised during years with below average rainfall when buffel pasture growth has been limited (e.g. grazing a sustainable/safe level of pasture utilisation). At no time will stocking rates exceed 1 adult equivalent animal per 10 acres (annualised) and the stocking rate will be dependent upon maintaining the ground cover above 60%, the Fitzroy Basin Association recommendations (Fitzroy Basin Association, 2006).

Exclusion of Grazing

As described above, it is intended that the Regeneration Areas progressively change from a grassland dominated system to woodland/forest. Livestock will be excluded from the offset areas once it is no longer required for strategic management of Buffel Grass.

3.9 RESTRICTIONS TO ACCESS

Access into the offset area will be restricted to authorised personnel. Locks will be installed on gates into the offset area.

Vehicles will be restricted to designated access tracks. Access tracks through the offset area will be maintained for fire management. Speed limits of 60 km per hour will be imposed on vehicles using access tracks.

Signage will be installed along main access roads which recognised that the area is protected for conservation purposes. The signs will describe:

- the area is a conservation area;
- access is restricted to authorised personnel only; and
- contact details for MCPL (Senior Environmental Advisor [or relevant equivalent]).

3.10 REMOVAL OF BARBED WIRE

Barbed wire use in fencing is a recognised threat to a range of fauna (e.g. bats), and is particularly hazardous when used in new fences and across fauna movement paths. Barbed wire fencing within the offset area will be removed upon exclusion of grazing.

Where practical, the top two wires will be replaced with plain wire. Visual inspections of the fencing would be undertaken and any breaches rectified. If livestock from outside the offset area are found to be eluding the fence, the design of the fence would be modified as required.

3.11 EDUCATION

MCPL own the property bordering all sides of the offset area. MCPL will consult with the leaseholder regarding the rotational grazing livestock in the offset area.

Contractors/MCPL staff entering the offset area will receive an induction in regard to:

- threatened and near threatened species present and their conservation value;
- requirement of vehicles to stay on designated tracks;
- fire awareness and response procedures; and
- prohibition of smoking in the offset area (fire risk).

3.12 MANAGEMENT SCHEDULE

A management schedule is provided in Table 8.

**Table 8
Management Schedule**

Action	Management Type	Section	Timeframe
Enduring protection to be provided for the offset area.	Enduring Protection	1.3	June 2017 to June 2018
Operational review of road and fire trail construction to be completed.	Setup	3.2	
Additional access tracks to be constructed/repaired.	Setup	3.2	
Signage of the offset area to be provided.	Setup	3.2 and 3.9	
Appropriate fencing of the offset area to be provided.	Setup	3.2 and 3.8	
Excess fencing inside of the offset area to be removed.	Setup	3.2 and 3.8	
Gates with locks to be installed to restrict entry into the offset area.	Setup	3.2 and 3.9	
Access tracks not necessary for management purposes to be ripped and revegetated.	Setup	3.2 and 3.3	
Access tracks across drainage lines in the offset area to be repaired and stabilised.	Setup	3.2	
Barbed wire to be removed where practicable.	Management	3.10	
Initial pest animal study to be undertaken.	Management	3.5	
Initial mapping of declared weeds and Buffel Grass infestations for management purposes.	Management	3.4.4	
Erosion areas to be identified.	Management	3.7	
Baseline monitoring to measure the effectiveness of the regeneration and reporting to be undertaken.	Monitoring/Reporting	5.1.1 and 5.2	June 2018 to June 2019
Visual inspection and reporting to be undertaken.	Monitoring/Reporting	5.1.5 and 5.2	
An inspection for bushfire control requirements.	Monitoring	3.6	
Assessment of the requirement for restoration thinning to be undertaken.	Monitoring	5.1.6	
Maintenance of all access tracks, fences and gates to be undertaken as required.	Management	3.6, 3.8 and 3.9	
Weed control initiated.	Management	3.4	

Table 8 (Continued)
Management Schedule

Action	Management Type	Section	Timeframe
Animal pest control initiated.	Management	3.5	June 2018 to June 2019
Fire management activities to be undertaken as required.	Management	3.6	
Restoration thinning to be undertaken if required.	Management	5.1.6	
Monitoring the effectiveness of the regeneration and reporting to be undertaken.	Monitoring	5.1.1 and 5.2	
Monitoring the usage of the offset area by fauna and reporting to be undertaken.	Monitoring	5.1.2 and 5.2	
Monitoring and reporting to be undertaken to evaluate the effectiveness of weed control.	Monitoring	5.1.3 and 5.2	
Monitoring and reporting to be undertaken to evaluate the effectiveness of pest control.	Monitoring	5.1.4 and 5.2	
Visual inspection and reporting to be undertaken.	Monitoring	5.1.5 and 5.2	
An inspection for bushfire control requirements.	Monitoring	3.6	
Maintenance of all access tracks, fences and gates to be undertaken as required.	Management	3.6, 3.8 and 3.9	Annually from November 2019 until the completion criteria are met.
Weed control to be undertaken as required.	Management	3.4	
Animal pest control to be undertaken as required.	Management	3.5	
Fire management activities to be undertaken as required.	Management	3.6	
Monitoring the effectiveness of the regeneration and reporting to be undertaken.	Monitoring	5.1.1 and 5.2	
Monitoring and reporting to be undertaken to evaluate the effectiveness of weed control.	Monitoring	5.1.3 and 5.2	
Monitoring and reporting to be undertaken to evaluate the effectiveness of pest control.	Monitoring	5.1.4 and 5.2	
Visual inspection and reporting to be undertaken.	Monitoring	5.1.5 and 5.2	
An inspection for bushfire control requirements.	Monitoring	3.6	
Assessment of the requirement for restoration thinning to be undertaken.	Monitoring	5.1.6	

The following activities will be undertaken on an ongoing basis as required:

- weed prevention (Section 3.4.1);
- animal pest prevention (Section 3.5.1);
- bushfire prevention (Section 3.6);
- restricting access (Section 3.9); and
- education (Section 3.11).

A management activities schedule is provided in Table 9 as outlined in the DEHP *Vegetation Management Plan Template*.

Table 9
Management Activities Schedule

Management Activity	How the Activity will be Undertaken	Where the Activity will be Undertaken	When the Activity will be Undertaken	Who will Undertake the Activity
Control of non-native weeds	Physical removal, chemical application	Within the offset area as required	Annual	MCPL
Control of pest animals	As required, depending on pest animal, in consideration with animal ethics. Control methods are available at: http://www.daff.qld.gov.au/4790_8262.htm	Within the offset area as required	Annual	MCPL
Fire management	Section 3.6	Within the offset area as required	Annual	MCPL
Erosion and sediment control	Section 3.7	Within the offset area as required	Annual	MCPL

4 PERFORMANCE AND COMPLETION CRITERIA

4.1 PERFORMANCE CRITERIA

The performance of the offset will be monitored against the performance criteria provided in Table 10 for each monitoring period. The performance criteria have been developed to meet the objectives for the offset (Section 1.2). All criteria link to management measures listed in Section 3 and monitoring/reporting specifications in Section 5. If performance criteria are not being met, the contingency measures in Section 6 will be considered.

Table 10
Performance Criteria

Criteria	Management Type	Section	Timeframe
Enduring protection has been provided for the offset area.	Enduring Protection	1.3	June 2017 to June 2018
Operational review of road and fire trail construction has been completed.	Setup	3.2	
Additional access tracks have been constructed/repared.	Setup	3.2	
Signage of the offset area has been provided.	Setup	3.2 and 3.9	
Appropriate fencing of the offset areas has been provided.	Setup	3.2 and 3.8	
Excess fencing inside of the offset area has been removed.	Setup	3.2 and 3.8	
Gates with locks have been installed to restrict entry into the offset area.	Setup	3.2 and 3.9	
Access tracks not necessary for management purposes have been ripped and revegetated.	Setup	3.2 and 3.3	
Access tracks across drainage lines in the offset area have been repaired and stabilised.	Setup	3.2	
Initial pest animal study has been undertaken.	Management	3.5	
Initial mapping of declared weeds and Buffel Grass infestations for management purposes has been undertaken.	Management	3.4.2 and 3.4.3	
Erosion areas have been identified.	Management	3.7	
Monitoring and reporting has been undertaken as per Management Schedule.	Monitoring/Reporting	Table 8	
Maintenance of all access tracks, fences and gates have been undertaken as required.	Management	3.6, 3.8 and 3.9	June 2018 to June 2019
Weed control has been initiated.	Management	3.4	
Animal pest control has been initiated.	Management	3.5	
Fire management activities have been undertaken as required.	Management	3.6	
Restoration thinning has been undertaken if required.	Management	5.1.6	
Monitoring and reporting has been undertaken as per Management Schedule.	Monitoring/Reporting	Table 8	
Maintenance of all access tracks, fences and gates have been undertaken as required.	Management	3.6, 3.8 and 3.9	Annually from November 2019 until the completion criteria are met.
Weed control has been undertaken as required.	Management	3.4	
Animal pest control has been undertaken as required.	Management	3.5	
Fire management activities have been undertaken as required.	Management	3.6	
Monitoring and reporting has been undertaken as per Management Schedule.	Monitoring/Reporting	Table 8	

4.2 COMPLETION CRITERIA

Once approved by the QLD Government, this management plan will be binding on current and future owners and occupiers, under the terms of the VDec. The management plan will continue to have effect until the objectives have been achieved. The management plan and monitoring requirements would conclude once the completion criteria in Table 11 have been achieved.

Table 11
Completion Criteria

Aspect	Criteria
Enduring Security	Enduring protection for the offset area would be provided as described in Section 1.3.
Regeneration Areas (Non-remnant Areas) (Figure 11)	Non-remnant areas have achieved RE remnant status ¹ .

¹ For non-remnant vegetation to achieve woody vegetation remnant status the dominant canopy must have greater than 70% of the height and greater than 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 (DEHP, 2016).

As described in Section 1.2, the desired outcome of the offset is that the land in the offset area is to be enhanced so that the currently degraded areas reach remnant status through increasing the structural integrity and extent of vegetation in the area. It is estimated that the offset management objectives and outcomes could be achieved in 20 years.

Once the requirements of the development approval (if applicable), legally binding mechanism and offset area management plan have been achieved, the offset area would be mapped by the QLD administering authority as remnant vegetation on a region map.

5 MONITORING, REPORTING AND REVIEWING

A programme will be undertaken to monitor and report the effectiveness of the measures and the performance of the regeneration in the biodiversity offset area, with summary reporting to be carried out annually. The monitoring will be undertaken by a suitably qualified person(s).

5.1 MONITORING PLAN

5.1.1 Ecological Surveys - Monitoring the Effectiveness of Regeneration in the Offset Area

Monitoring activities are linked to the performance criteria defined in Section 4.1. They measure the progression of the offset area towards achieving those outcomes. Monitoring is to be undertaken following the first year of approval of this plan (i.e. assuming approval by 30 June 2017, monitoring would be undertaken before 30 June 2018) and each subsequent year.

Permanent Photo Monitoring

Permanent photo monitoring across representative REs and cleared areas are to be installed within the offset area. Photos will be taken in a consistent direction, location (at global positioning system [GPS] points), height above the ground and time of day. These aspects and the date will be recorded for each photo taken (north, south, east and west). Photos will be taken on a biannual basis, during the wet and dry seasons. After the photographic monitoring event the photos will be compared to the photos from the previous monitoring periods. Natural regeneration of native understorey and overstorey species, the occurrence of habitat complexity (e.g. logs, litter), plant establishment and the status of weeds will all be noted. Aerial photographs may also be used to show enhancement of vegetation connectivity.

Permanent Transect Monitoring

Permanent transect monitoring is to be installed within the offset area across representative REs and cleared areas (i.e. Regeneration Areas). Transect monitoring is to be undertaken within representative areas to assess the effectiveness of restoration and to assess performance, focusing on:

- canopy cover;
- average stem diameter at breast height (DBH) of canopy species (existing trees over 20 centimetres DBH cannot be utilised for this assessment);
- signs of canopy and shrub layer recruitment present outside a minimum 40 m from adjacent vegetation;
- average height (and species composition) of each vegetation stratum;
- native plant species richness for four life-forms (trees, shrubs, grasses, forbs/other);
- native sub-canopy species encountered within one meter of the transect;
- non-native (weed) cover;
- recruitment of woody perennial species; and
- correct labelling with date, location, GPS points for end points of transect and any other observations.

5.1.2 Ecological Surveys - Usage of the Offset Area by Fauna

Fauna usage of the offset area will be documented over time. Fauna surveys will be conducted before the second year after approval of this plan and every three years thereafter. The surveys will occur across representative REs and cleared areas (i.e. Regeneration Areas) to assess the success of the offset in providing habitat for a range of vertebrate fauna. The surveys will include an assessment of habitat complexity and species richness and abundance. The monitoring results from each monitoring period are to be compared as part of the reporting.

5.1.3 Ecological Surveys - Effectiveness of the Weed Control

Weed control will be undertaken within the offset area (Section 3.4). Follow-up inspections will be undertaken to assess the effectiveness of the weed management measures implemented and the requirement for any additional management measures.

5.1.4 Ecological Surveys - Effectiveness of the Exotic Animal Control

Pest animal control will be undertaken within the offset area (Section 3.5). Monitoring of pest animals is to be undertaken every three years by a suitably qualified practitioner.

5.1.5 Visual Inspections

The offset area is to be inspected with relevant comments provided for the following:

- performance of the offset area against performance criteria;
- risks to achieving the management outcomes;
- implementation difficulties;
- weed control success (also covered by Section 5.1.3);
- requirements for pest animal control (also covered by Section 5.1.4);
- current fire fuel loads and the risk they present to the offset;
- erosion or sedimentation as an impediment to meeting offset area's objectives;
- effectiveness of erosion or sediment control (if used);
- fencing and track maintenance;
- uncontrolled presence of livestock in the offset area;
- illegal access and vandalism;
- effects of flood and fire events if they occur; and
- general notes regarding enhancing success and reducing failure.

5.1.6 Assessment of the Requirement for Restoration Thinning

An assessment of the regrowth and the requirement for restoration thinning will be made by a suitably qualified ecologist in the first year and after 3 years. The assessment will consider:

- tree density; and
- species diversity.

If thinning is to occur, secondary suckering will be monitored and controlled.

5.1.7 Impacts of Grazing on Management Objectives

In accordance with the DEHP *Vegetation Management Plan Template*, where an offset area contains grazing, monitoring must be undertaken to assess the impacts of grazing on achieving management outcomes. The outcomes of the ecological surveys and visual inspections will be used to assess the impacts of grazing on achieving management outcomes.

5.2 REPORTING

5.2.1 Commonwealth

MCPL will undertake reporting as required by DEE.

Monitoring reports for the offset area should contain, at a minimum:

- Name and contact details of company/persons undertaking management activities.
- Name and contact details of company/persons undertaking monitoring activities.
- Results of monitoring the effectiveness of the regeneration in the offset area as outlined in Section 5.1.
- An analysis of the monitoring data over time (Section 5.1).
- Data collected from monitoring (Section 5.1). All data should be correctly labelled with date, location, GPS points for end points of transect and any other observations.
- An overview of the progress of achieving the performance criteria (Section 4).
- An indication of any risks or potential threats that have become apparent, and activities to be undertaken to manage these threats and/or risks.
- Identification of any need for improved management.

5.2.2 State

In accordance with the DEHP *Vegetation Management Plan Template*, a monitoring report for the offset area will be provided annually to DNRM (Rockhampton) for the first 5 years. After 5 years, reports will be provided every 2 years until the completion criteria have been met. These monitoring reports will contain, at a minimum:

- Name and contact details of landholder. If someone other than the landholder is undertaking management activities (i.e. a contractor) then their details must also be provided.
- eLVAS case number [if known].
- Lot on Plan property description and postal address.
- Photo monitoring results.
- If transects required, revegetation/restoration data collected from transects, outlining species present, average canopy cover and height of vegetation. All data should be correctly labelled with date, location, GPS points for end points of transect and any other observations.
- Annexure A - Management Activities Schedule with the progress section completed.

- An overview of the progress of the management area in achieving the management outcomes and how any risks or threats have impacted on the area.
- An indication of any risks or potential threats that have become apparent to the management area since the development of the management plan, and activities to be undertaken to manage these threats and/or risks.
- Where the proponent is proposing that the management outcomes have been achieved and the report is being submitted as the final report, the proponent must provide evidence that all management outcomes have been achieved in full.

The monitoring report required under Section 5.2.1 can be the same report required under Section 5.2.2, if both requirements are met.

5.3 REVIEW/REVISION OF THIS PLAN

Once a VDec is established over the offset area, any amendments to this Offset Management Plan/Vegetation Management Plan are to be made by agreement between MCPL and the chief executive of DERM (now DNRM). The *Guide to Voluntary Declarations under the Vegetation Management Act, 1999* (DNRM, 2016a) states:

To maintain flexibility and ensure that the plan remains up to date, the management plan can be changed...The amendment provision provides flexibility and ensures the management plan remains up to date and relevant to achieving the purpose of the VDec.

6 CONTINGENCY MEASURES

6.1 POTENTIAL RISKS AND CONTINGENCY MEASURES

Table 12 outlines risks to successful management of the offset area and a description of possible contingency measures that could be implemented to mitigate the risk. Risk management has been built into management specifications, but some unforeseen events may still restrict prescribed management outcomes.

Table 12
Potential Risks and Contingency Measures

Risk	Contingency
Unplanned fires	- The QLD Rural Fire Service will be called for assistance if a significant bushfire was to occur within or move towards the offset area. - Inspect and remedy issues with fences, gates or access.
Inappropriate grazing regimes	- Modify fencing. - Incorporate electric fencing. - Inspect and remedy issues. - Modify rotational grazing regime.
Illegal access and potential vandalism	Inspect and remedy issues.
Natural regeneration not occurring	Further active revegetation (Section 6.1.1).
Lock regrowth in Brigalow	Restoration thinning.
Poor access for management/monitoring	Wait until access is possible.

6.1.1 Active Seeding/Planting

Active seeding/planting is also a contingency measure in the event that natural regeneration is not readily occurring. Active revegetation will be undertaken using appropriate plantings or seeding of local seed sources. The procedure is provided in Table 13.

Table 13
Revegetation Methods

Method	Description
Seed Collection	A key aim of seed collection is to collect local provenance seed stock for propagation purposes. Required approvals are identified, sought and obtained from relevant authorities. All seed collection is to be conducted under the framework of the 'Florabank Guidelines'. This includes best practice in collection activities, cleaning, data collection, germination testing and storage.
Site Preparation	Site preparation involves stabilising and preparing the surface of the rehabilitation area so that it can absorb water and nutrients. A large proportion of weeds are also removed during site preparation to allow space for new seedlings and plantings. Weed removal may have to occur more than once to reduce the weed management measures needed during implementation of the revegetation programme.
Revegetation Method	The revegetation method will change site to site depending on the structure and floristic characteristics of each site. A combination of tubestock and seeding may be used, depending on the circumstances.
Timing	Revegetation will be undertaken during suitable climactic conditions, such as during and immediately after sufficient rainfall.

6.2 IMPACTS FROM A THIRD PARTY

The offset area will be fenced (Section 3.8), locks will be installed on the gates and signage will be installed along main access roads (Section 3.9). These provisions will deter third party access into the offset area.

In the event that a third party impacts the offset area, MCPL will notify DEE with the following details (where known):

- who has impacted the offset area;
- the nature and extent of the impact;
- when the impact occurred;
- why the impact occurred; and
- if there is a proposal from the third party to remedy the impact.

The offset area overlies ML 1831 held by Anglo. There is no current proposal to mine (underground or open cut) within the offset area. Any future mining proposals within the offset area will need to account for the impacts to the offset area.

7 TIMING AND RESPONSIBILITIES

A schedule of timing for the offset and the relevant responsible party is provided in Table 14.

Table 14
Timing of the Offset

Aspect	Section	Timing	Responsibilities
Enduring protection of the offset area	1.3	The offset area will be secured through a legally binding mechanism, in a timeframe required by the State and/or Commonwealth Governments.	MCPL
Commencement of active management	3	The active management of the offset area will commence, in a timeframe required by the State and/or Commonwealth Governments.	MCPL
Implementing the management measures	3 and 4	Refer to the timing in the management schedule (Section 3.12).	MCPL
Monitoring the effectiveness of regeneration	5.1.1	Annually.	MCPL
Monitoring the fauna usage of the offset area	5.1.2	Twice in a year (in different seasons) every 3 years.	MCPL
Monitoring the effectiveness of weed control	5.1.3	Annually.	MCPL
Monitoring the effectiveness of pest control	5.1.4	Annually.	MCPL
Visual monitoring	5.1.5	Annually and as required.	MCPL

MCPL will be responsible for management measures (Table 14). The MCPL Senior Environmental Advisor (or relevant equivalent) will be responsible for the monitoring, reviewing and implementation of this Offset Management Plan/Vegetation Management Plan. The MCPL Senior Environmental Advisor will be responsible for the implementation of any revisions of this Offset Management Plan/Vegetation Management Plan in consultation with the DEE.

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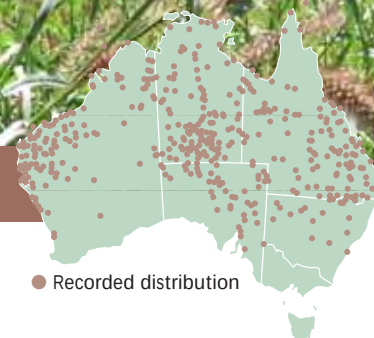
APPENDIX A

WEED MANAGEMENT GUIDE FOR BUFFEL GRASS

(SOURCE: CRC WEED MANAGEMENT, 2008)

Weed Management Guide

Managing weeds for biodiversity



Buffel grass (*Cenchrus ciliaris*)

The problem

Buffel grass (*Cenchrus ciliaris*) is an introduced, perennial pasture grass that is found across much of the Australian continent, including arid and semi-arid regions. For many decades it has been widely planted for livestock production and land rehabilitation. Its palatability is moderate but it is well regarded as pasture because it grows rapidly under warm, moist conditions and persists under heavy grazing and drought. Buffel grass has spread well beyond planted areas and dominates the ground layer in many native plant communities. It reduces native plant diversity and can affect vegetation structure by changing fire regimes. In arid Australia, buffel grass invades some of the wetter, more

fertile parts of the landscape, important for the survival of native plant and animal populations in this highly variable climate. Although it was planted for dust control in central Australia, it also imposes economic costs through the need to manage fire risks and to protect biodiversity assets and infrastructure. Some pastoralists are also concerned that productivity of buffel grass-dominated pastures can decline in the longer term.

Buffel grass has been identified as a major threat to biodiversity in regional natural resource management strategies across Australia (SA Arid Lands, Rangelands (WA), Fitzroy (Qld) and the NT). It is becoming recognised that new policies are needed to

address the problem of weeds that are also considered useful.

Buffel grass is just one of many perennial grasses invading Australia's native vegetation, particularly grassy plant communities, rangelands and coastal areas. Grasses introduced as pastures, such as gamba grass (*Andropogon gayanus*), mission grass (*Pennisetum polystachion*) and Birdwood grass (*Cenchrus setiger*) are a particular threat to tropical savannas in northern Australia.

Key points

- Buffel grass is widespread in central and northern Australia and has invaded a range of native plant communities.
- It can dominate the ground layer, displacing native grasses and other plants.
- Its rapid regrowth and high biomass may alter the intensity, frequency and extent of fires, changing vegetation structure and composition.
- Buffel grass is still spreading, assisted by continued planting and new cultivars.
- Its seed is readily dispersed by wind, water and animals.
- Control measures can reduce impacts at sites of high conservation significance.
- Mature plants are difficult to remove physically. Herbicide can be effective if applied when plants are actively growing and follow-up action is undertaken. Correct timing is essential.
- The value of buffel grass as a pasture species is well recognised and it is not a declared weed. Public policy issues arising from its positive and negative aspects need to be resolved.



Buffel grass (*Cenchrus ciliaris*) can dominate the understorey in arid regions. Central Australia, NT.
Photo: R. Davies

The weed

Numerous forms of buffel grass have been imported to Australia from across its native range. They differ in their drought, temperature and soil tolerance, growth form, palatability, and in quantity and timing of seed production. Eleven have been registered as cultivars in Australia. Two closely related species, *Cenchrus pennisetiformis* (Cloncurry grass) and *C. setiger* (Birdwood grass), have also been planted as pastures in Australia and are naturalised. Their range is similar, but they are less common than *C. ciliaris*.

The most common uses of buffel grass in Australia are:

- as a pasture for livestock production in semi-arid and arid lands (where sowing often follows native vegetation clearing)
- to stabilise areas disturbed by mining, infrastructure development or overgrazing.

Buffel grass is a long-lived tussock grass with a deep, tough root system. While some cultivars can grow up to



Birdwood grass (*Cenchrus setiger*) seed head lacks long, fine bristles.
Photo: Jose Hernandez @ USDA-NRCS PLANTS Database

1.5 m tall, others are less than 1 m tall. Some have rhizomes up to 0.5 m long. The tough, branched stalks have swollen bases and produce leaves at the basal and higher nodes. Leaves are rough-textured downwards, hairless or with fairly sparse, long hairs. Leaf blades have prominent midribs and leaf sheaths are keeled. The ligule at the junction of the leaf blade and sheath is a row of hairs, 0.2–2 mm long.

The flower head is cylindrical, erect, dense, spike-like, 2.5–15 cm long and varies in colour from straw-coloured to purple. It consists of bristly burrs borne on a zigzag central axis. The burr has whorls of flexible bristles, a thin outer whorl and a ciliate (hairy) inner whorl

with one longer bristle, 8–16 mm long. The bristles are joined at the very base into a disc. Mature burrs contain a small seed (<2 mm long) and are dispersed by wind, water, animals, clothing, boots and vehicles.

Advantages, disadvantages and broader impacts of buffel grass

Buffel grass has proved useful for pasture and soil retention in a wide range of environments due to its drought tolerance, high biomass, deep roots, rapid response to summer rains, relative palatability and resistance to overgrazing. It produces viable seed so that stands can be self-replacing and pastures may not need to be reseeded. These same characteristics also make it an environmental weed.

Like any pasture species, buffel grass has limitations, such as:

- Through competition with native species, it reduces diversity of pasture including native grasses that are highly valued fodder after rain. The effect may be exacerbated by selective grazing of more palatable species.
- The initial increase in productivity when buffel grass pasture is established is not always maintained, and pastures may run down over time (10 years or less in some soils), especially where environmental conditions do not favour legumes. This problem is difficult to address in a cost-effective manner, especially on less productive lands.
- Once buffel grass has been established as the dominant ground cover, conversion to an alternative pasture would be prohibitively expensive.
- Some cultivars are more palatable than others. The less palatable forms may gradually become dominant in grazing lands through selective grazing.

Buffel grass (*Cenchrus ciliaris*)



Flowering head.
Image: M.Robertson



Shedding seed head, with zigzag axis.
Image: M.Robertson



Burr.
Image: M.Robertson



Ligule at the junction of leaf blade and sheath is a fringe of hairs, 0.2–2 mm long.
Image: M.Robertson

- Old leaves and stalks may persist for several years and are of no value to stock but may restrict their access to fresh growth.

Broader environmental impacts of buffel grass include the following:

- Dry buffel grass foliage forms a relatively continuous flammable ground layer that can carry extensive and intense fires. It recovers its biomass very rapidly when moisture is sufficient and can burn when partly green. Therefore it can carry fire at much shorter intervals than native understorey. More frequent hot fires alter native plant community structure because established trees and shrubs can be killed and young ones destroyed before they have produced seed.
- Patch burning is needed in some native vegetation types such as hummock (*Triodia*) grasslands to maintain biodiversity and bush food resources, and to reduce the risk of large wildfires. It becomes more difficult to manage after buffel grass has invaded the landscape.
- Food sources and habitat for native fauna may be altered. In particular, native grass seed that is eaten by granivorous birds can be depleted, and habitat patchiness and diversity of invertebrates reduced. Loss of trees and shrubs to fire reduces habitat diversity.
- Native plants affected by invasion of buffel grass provide a diminished resource for traditional indigenous livelihoods including bush food, timber and medicine.
- Where buffel grass pasture occurs adjacent to fire-sensitive native vegetation, it can burn hot enough to carry fire into the remnants, opening up the canopy. The edges are then more prone to degradation, including by weed invasion. In this way, the area and integrity of habitat can be progressively reduced.



Mature buffel grass (*Cenchrus ciliaris*) tussocks grow rapidly after summer rains. Uluru NT. Photo: R. Davies

- Restoration of native vegetation on previously cleared lands may be needed for recovery of threatened species or ecological communities. Buffel grass can be a major constraint to such efforts.

Weed identification and similar native species

A number of grasses in the genus *Cenchrus* and the closely related genus *Pennisetum* occur in Australia, including native and introduced, annual and perennial species. Most have flower heads that are spike-like, consisting of a central axis bearing numerous hairy, bristly or spiny burrs that are actually very short floral branches.

How to identify *Cenchrus* species

The introduced perennial pasture species, buffel grass (*Cenchrus ciliaris*), Birdwood grass (*C. setiger*) and Cloncurry, white or slender buffel grass (*C. pennisetiformis*) have burrs that lack sharp, rigid spines. They are closely related—in fact *C. pennisetiformis* and *C. ciliaris* are sometimes considered to be the same species. Alternative species names for the buffel grasses are *Pennisetum ciliare*, *P. setigerum* and



Mossman River grass (*Cenchrus echinatus*) is a spiny annual weed in both northern and southern Australia. Photo: C. Wilson

P. pennisetiforme. Burrs of buffel grass and Cloncurry buffel grass have soft, ciliate bristles but these are lacking in Birdwood grass. Other *Cenchrus* species in Australia are native perennials and introduced annuals.

Annual *Cenchrus* species with spiny burrs can be a nuisance and are often declared noxious. Mossman River grass (*C. echinatus*) is the most widespread in Australia. Innocent weed or gentle Annie (*C. longispinus*) is most prevalent in the south, especially along the Murray River. Indian sandburr or Gallon's curse (*C. biflorus*) is naturalised in northern Australia. *C. brownii* occurs along the northern coast and offshore islands and spiny burr-grass (*C. incertus*) occurs mainly in eastern Australia.



Native species: black bottle-washers
(*Enneapogon nigricans*).
Photo: T. Reynolds

Similar native species

The native *Cenchrus* species (*C. elymoides*, *C. robustus* and *C. caliculatus*) are perennial, with various burrs, but lacking the long flexible bristles of buffel grasses and most *Pennisetum* species. *C. elymoides* is confined to the tropics of northern Australia (Kimberley, northern NT and Cape York regions). *C. robustus* and *C. caliculatus* mainly occur in the eastern districts of Qld and NSW. The flower head of *C. caliculatus* is loosely packed, 4–24 cm long; its burrs have rigid inner bristles (4–11 mm long) and are often dark purplish. *C. robustus* has 45–60 rigid, 9–13 mm long bristles in a single whorl.

Other native grasses with spike-like heads include annual and perennial nine-awn grasses or bottle-washers (*Enneapogon* species), smaller grasses that have florets crowned with a ring of nine hairy awns.

How it spreads

Buffel grass has been spread throughout the dry tropics, subtropics and arid lands of the world by human activities. It is thought to have been introduced inadvertently to Australia in the 1870s in camel harness from western Asia. Camel trains were major means of transport through inland Australia and it is likely that buffel grass became

locally established along their routes. Some of its early spread may have been deliberate. From 1910 buffel grass was actively distributed for planting as pasture, initially in WA, then more widely. Introductions of new forms from Africa began in the 1920s and were evaluated by government agencies, mainly in NSW and Qld. From the 1940s seed was imported from around the world for trials. There is evidence that buffel grass had been planted in central Australia before systematic planting for land rehabilitation began there in the 1960s. Prior to 1972, nine introduced forms had been registered as cultivars in Australia and their seed produced commercially. Buffel grass pastures have been sown in a range of environments across Australia, on land cleared for the purpose, or into native vegetation.

Buffel grass spreads through dispersal of its fluffy burrs by wind, water and animals, particularly along drainage lines and roads. Its spread along roads can also be assisted by vehicle draughts and movement of soil by graders and other vehicles. Buffel grass may be slow to establish initially but it may then spread readily beyond planted areas under favourable seasonal conditions. In the arid zone, it has spread extensively during infrequent episodes when summer rainfall was well above average for several years. This has been documented in the Ashburton River catchment in WA, from 1978 to 2002.

Where it grows

Buffel grass is native to Africa, the Middle East and Asia and naturalised elsewhere, including the USA and Mexico where it is planted for cattle pasture. In Arizona it invades fire-sensitive plant communities and the increased risk of fire poses a threat to the distinctive Saguaro cactus communities.

Buffel grass can survive in areas with average rainfall of more than 200 mm annually (or 170 mm in summer). It occurs naturally in regions having up to 1000 mm annual rainfall. Under higher rainfall, tropical conditions or in regions with winter rainfall of 400 mm or more, buffel grass is less competitive with other plant species, including perennial grasses.

In northern and central Australia buffel grass occurs mainly in the semi-arid to arid zone. In arid regions it is most common along ephemeral watercourses, on alluvial plains, other run-on sites and calcareous rises. It thrives in sandy loam but may be slow to establish on heavy clay and prefers neutral to alkaline soils. It is not highly tolerant of severe frost or prolonged water logging.

At the local scale, studies in central Australia have found that buffel grass is most likely to be found nearer to drainages and tracks, in less rugged terrain, with lower hummock grass cover and on soils with greater clay content than rocky slopes or sand plains. Drainage lines and tracks provide opportunities for dispersal and also favourable sites for establishment (disturbed or bare ground, higher fertility, moisture and lack of plant competition). In fragmented landscapes, small or narrow remnants of native vegetation are more vulnerable to buffel grass invasion than larger patches with an intact canopy.

Native plant communities invaded by buffel grass include:

- Poplar box (*Eucalyptus populnea*) and silver-leaved ironbark (*E. melanophloia*) woodlands in Qld.
- Mountain coolabah (*Eucalyptus orgadophila*) woodlands in Qld.
- Brigalow (*Acacia harpophylla* dominant and subdominant) listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

- Gidyea / gidgee (*Acacia cambagei*) shrublands in central west Qld.
- Riparian and floodplain woodlands throughout the semi-arid and arid zones, eg river red gum (*Eucalyptus camaldulensis*) and teatree (*Melaleuca* species) woodlands on ephemeral rivers in central Australia.
- Vegetation on alluvial plains and other sites of relatively fertile soils in central Australia (eg *Acacia* woodlands and ghost gum (*Corymbia aparrerinja*) and bloodwood (*Corymbia opaca*) open woodlands).
- Coastal vegetation and islands off the Pilbara coast (WA), riparian zones and wetlands, alluvial plains; tussock grasslands, eucalypt woodlands, chenopod shrublands and overgrazed hummock grasslands.
- Mulga (*Acacia aneura*) open / woodlands and shrublands are sometimes invaded at sites of higher moisture and soil fertility.
- Dry rainforest or 'softwood scrub' remnants dominated by species such as bottle tree *Brachychiton rupestris*, belah *Casuarina cristata*, vines etc can be invaded along edges adjacent to pasture if burnt, including semi-evergreen vine-thickets listed as Endangered under the EPBC Act.

Potential distribution

Buffel grass is still spreading within and between regions, unassisted and through planting. Modelling based on climatic and soil requirements has predicted that 25% of Australia is potentially 'highly suitable and 43% suitable for buffel grass growth'.

Extensive areas were mapped as suitable or highly suitable, where buffel grass has not yet been recorded or records are sparse. These included northern SA and adjoining areas. Soil and climate data were classified at a broad scale for the continental mapping. Modelling at finer spatial scales is needed to predict with more certainty where areas of high biodiversity value are under threat.

Mapping of current buffel grass distribution is largely based on accumulated records, particularly herbarium specimens, though the collection of such records has not been comprehensive in space or time. Field surveys are needed to determine how accurately existing records represent the current limits of distribution.

Genetic studies suggest that forms of buffel grass that are not genetically

identical to the main cultivars are naturalised in central Australia. Forms other than registered cultivars may have been introduced to the region or new types may be arising in the field. Research is also underway into breeding new types to extend its use as pasture in heavier soils and cooler regions. New forms of buffel grass may have potential to invade a wider range of habitats.

There is inherent uncertainty in predicting the potential limits of distribution due to the wide range of conditions in which buffel grass already occurs; imprecise knowledge of the current range, genetic variation, breeding system and ecology of naturalised populations; and the unknown effects of factors such as future land management changes, cultivar development programs and long-term climatic variation.

Growth cycle

Buffel grass is summer-active. Established plants can respond rapidly to small rains in spring to autumn but make little growth during winter in the inland non-tropics. Seeds germinate rapidly, but will not germinate on light falls of rain. Generally, at least 20–25 mm of rain is required for germination and establishment, as buffel grass seeds need to be moist for about 3–5 days in order to germinate. Plants can germinate from seed, mature and flower within 6 weeks of a significant rainfall event.

Buffel grass seed may survive for up to an estimated 4 years in the soil, but plants can live for many years (possibly up to about 20 years). In drier locations, moisture levels sufficient for high seed production, or for widespread germination and plant establishment, may occur infrequently. The variable climate may result in a dynamic distribution of buffel grass across the landscape, with drier sites being recolonised from moist refuges after prolonged drought.



Buffel grass (*Cenchrus ciliaris*) infestation on calcareous loamy soil along a creek in Karijini NP, WA. Photo: S. van Leeuwen



Buffel grass (*Cenchrus ciliaris*) burnt butts resprouting after summer rain. Uluru, NT.
Photo: R. Davies

What to do about it

There is potential for buffel grass to spread within and beyond its current range. In regions where its distribution is limited, it may be feasible to contain its further spread through early intervention. Management options that would significantly reduce the abundance of buffel grass on a broad scale are yet to be developed. To minimise existing and potential threats to biodiversity, a range of strategies is needed.

- **Regional planning:** in many regions, buffel grass is both a pasture plant and a major weed of native ecosystems. Processes are needed to resolve policy issues and enable a co-ordinated approach to vegetation management including weed control. Priority areas for control measures should be identified across the region. These include sites of significance for biodiversity and areas where buffel grass is just starting to invade. Long distance dispersal along roadsides into susceptible habitats is probably assisted by road grading and slashing operations. Strategies will be needed to prevent further spread

along and from roadsides and other infrastructure corridors.

- **Fire:** the rapid build-up of buffel grass after favourable seasonal conditions can fuel fires of increased extent, frequency and / or intensity, which threaten biodiversity. Clumps of buffel grass under trees and shrubs can also increase localised fire intensity and flame height, damaging woody species. Strategies are needed to prevent more frequent, extensive wildfires. Areas dominated by buffel grass may need to be slashed or grazed to reduce buffel grass biomass where other values would not be at risk. Where fire has removed old buffel grass foliage, there is an opportunity to target fresh regrowth with control measures such as herbicides after significant rainfall.
- **Buffel grass pastures:** native vegetation adjacent to pastures is at risk from buffel grass invasion. To contain buffel grass within the pasture, grazing needs to be managed to minimise seed production and dispersal. A buffer zone with intact vegetation provides competition to buffel grass seedlings. It should be monitored and colonising plants

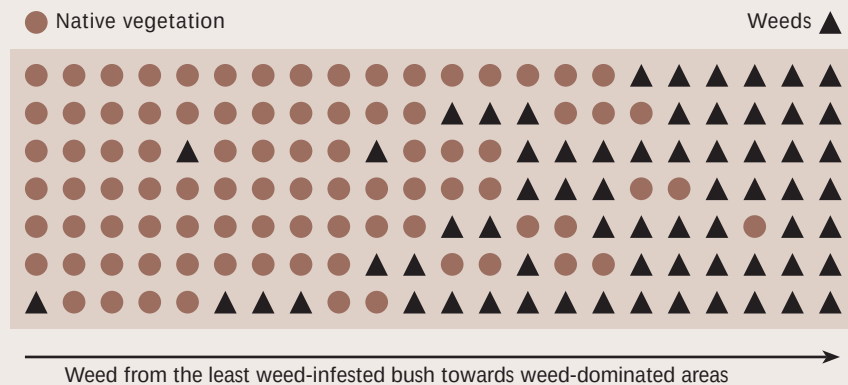
removed. Fires in pastures should be prevented from escaping into native vegetation remnants as they can open them up to buffel grass invasion.

- **Native rangelands containing buffel grass:** it is beneficial for both pastoral and conservation purposes to maintain plant diversity in the long term. Paddocks need to be spelled from grazing to allow native grasses to set seed following rainfall.
- **Areas managed for conservation:** buffel grass is easily the most significant weed in many arid and semi-arid areas of high value for biodiversity conservation. Strategic management is needed to minimise its further spread while mitigating adverse impacts on fire regime, habitat quality, ecosystem processes and plant community restoration. The first step in planning such an approach is often to acquire adequate knowledge about buffel grass distribution patterns and the biodiversity values under threat.
- **Soil stabilisation / rehabilitation:** once buffel grass is established, it persists and may exclude other plant species, prevent recovery of complex vegetation structure in the long term and become an on-going fuel hazard. There are alternative pioneer species and methods for rehabilitation.

Prevent buffel grass spreading

At regional and local levels, a high priority should be to monitor and control buffel grass in locations where the species is absent or sparse. This requires understanding local seasonal conditions that trigger abundant seedling establishment and local dispersal patterns. Spread is most likely soon after adequate warm season rainfall, especially following drought conditions or fire when other ground cover is sparse. Most resources will be needed at this time.

Strategic weeding in native vegetation



- Locate and remove small, isolated infestations before they seed. Particular vigilance is needed along dispersal routes such as roadsides and drainage lines.
- Practise weed hygiene during slashing and road grading:
 - where possible, slash before seeds develop
 - slash into rather than away from patches of buffel grass
 - clean vehicles and clothing before moving to uninfested areas.

Reduce established infestations

Where buffel grass occurs in native vegetation a planned, strategic approach is essential to ensure that, after treatment, buffel grass is replaced by desirable plant cover rather than buffel grass regrowth, seedlings or other weeds. Sites of high biodiversity value should be identified and targeted first. As well as information on buffel grass biology and control methods, a plan should be based on specific knowledge about the site, including the distribution of other major weeds. It requires assessment of the need for revegetation following removal of buffel grass.

Steps to develop and implement a long-term weed management plan are:

1. Investigate the site

- Identify native plants (including grasses) and weeds.

- Map weed infestations: indicate buffel grass density across the site; identify major sources of seed from which re-invasion can occur.
- Map native vegetation condition: assess its capacity for recovery after buffel grass is removed and identify sites of high biodiversity values, such as habitats of rare flora and fauna.
- Values and risks: identify high risk sites for erosion and other factors.

2. Develop the site action plan

- Identify goals and priorities based on the site information.
- Define priority areas for control by overlaying maps of buffel grass density, native vegetation, site values and risks.
- Plan to weed strategically:
 - protect the better quality native vegetation first and consider the needs of rare fauna and flora
 - work from isolated buffel grass plants towards core infestations
 - control plants from upslope to downslope.
- Work in stages. The area targeted at each stage should be of a manageable size so that thorough follow up is possible.
- Include control of other weeds so that they do not establish where buffel grass has been removed.
- Select the most suitable control method for each buffel grass growth stage in each area to

avoid damage to native vegetation. Plan appropriate disposal of weed material.

- Plan a rapid response to seasonal changes to maximise the effectiveness of control activities.

3. Implement the action plan

- Remove buffel grass from the least infested areas before tackling more infested areas. Ensure that activities do not spread the seeds into clean areas or disturb native ground cover. Adapt to local seasonal conditions to prevent seedlings maturing and seeding.
- Follow up by treating buffel grass regrowth in areas previously treated before moving to new areas of infestation.
- Seek mechanisms for managing spread from adjacent lands into weed-free or treated areas.

4. Monitor and evaluate outcomes and adapt the plan accordingly

Include monitoring of native plant regeneration. In weed management programs there is often a tendency to focus on the removal of weeds as a goal, but at the site level the ultimate goal is restoration of native vegetation. It is important to monitor native plant regeneration and respond appropriately.

Control methods

Mature buffel grass plants are difficult to kill because they have a tough base and extensive root system and regrow after cutting, grazing or burning. Herbicide treatment is effective only on actively growing foliage. In arid or semi-arid regions the period of active growth may be short and unpredictable. Old, dry growth can shield growing leaves from contact with herbicide and a single application may not be sufficient to kill the plant. Spot spraying or grubbing individual tussocks minimises

chemical wastage and risk of damage to other species. Large-scale mechanical removal favours re-establishment of buffel grass and slashing needs to be combined with other methods to have significant, lasting impact. A combination of physical and chemical treatments may be most effective. Because buffel grass is a valuable forage species, biological control is not an option, but existing organisms affect seed production in some regions.

Physical removal of small or sparse infestations

Small, isolated plants can be dug out from key sites, but mature buffel grass plants have a very tough crown and deep roots. The butt can be more than 30 cm across. Remove the weeds before seeding if possible. Follow up within weeks after rain to check for regrowth and for seedlings.

Foliar spray

To be effective, spraying should be undertaken when the growth rate is



The edge of Mazeppa NP, central Queensland 5 years after a hot fire fuelled by buffel grass damaged the tree canopy, promoting further invasion.
Photo: D. Butler



Buffel grass invasion of intact gidgee / brigalow in Mazeppa NP, central Queensland.
Photo: D. Butler

high (leaves are bright green and glossy), and the herbicide applied to as much green foliage as possible. The period when conditions are suitable may be short. Spot spray using hand-held equipment (handgun and hose or knapsack) to avoid off-target damage. Persistent dry foliage may shield fresh growth. Follow up is essential using the same or other treatment methods.

Combined treatment of extensive infestations

Initial slashing of old foliage followed by spraying after effective rainfall can be very effective. It may be desirable to leave slashed material on the ground to protect the soil from erosive rainfall. Follow up with further spraying or grubbing of surviving plants and seedlings when actively growing.

Contacts

State / Territory	Department	Phone	Email	Website
NSW	Dept of Primary Industries	1800 680 244 or 131555	weeds@dpi.nsw.gov.au	www.dpi.nsw.gov.au/weeds
	Dept of Environment and Climate Change		info@environment.nsw.gov.au	www.environment.nsw.gov.au
NT	Dept of Natural Resources, Environment and the Arts	(08) 8999 4567	weedinfo.nreta@nt.gov.au	www.nt.gov.au/nreta/natres/weeds/index.html
Qld	Environment Protection Authority	1300 130 372	csc@epa.qld.gov.au	www.epa.qld.gov.au
SA	Dept of Water, Land and Biodiversity Conservation	(08) 8303 9620	N/A	www.dwlbc.sa.gov.au
WA	Dept of Agriculture and Food	(08) 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au
	Dept of Environment and Conservation	(08) 6467 5000	info@dec.wa.gov.au	www.naturebase.net/
Australia-wide	Australian Pesticides and Veterinary Medicines Authority (APVMA)	(02) 6210 4700	N/A	www.apvma.gov.au

Contact details for state and territory agencies with responsibility for weeds are listed above, along with the Australian Pesticides and Veterinary Medicines Authority (APVMA). The APVMA website hosts the PUBCRIS database which contains information on all herbicides that are registered in each Australian state and territory, including minor use permits.

Consult your local natural resource management organisation or council to find local contacts on managing weeds for biodiversity, including community groups working on buffel grass.

Refer to the CRC for Australian Weed Management website (www.weedsrc.org.au) for weed management guides in this series, as well as guides for Weeds of National Significance and Alert List species. The Introductory Weed Management Manual (also available from this website) may assist in developing a plan tailored to your situation.

Success managing buffel grass at Alice Springs Desert Park

Alice Springs Desert Park introduces visitors to central Australia's diversity of habitats, plants and animals and to cultural knowledge and use of the environment. The exhibits and infrastructure occupy a core area of 54 hectares within a wider park area of 1300 hectares of natural vegetation, extensively invaded by buffel grass. The park is situated on the lower slopes of the MacDonnell Ranges and the adjacent plain. Throughout the district, buffel grass typically dominates such habitats, where it has largely replaced native grasses and other herbaceous plants.

A buffel grass control program has been conducted in the park since its inception in 1996. The first goal was to eradicate it from the core area, to enable visitors to see and understand more of the native ecosystem. A further goal is to reduce the level of buffel grass fuel in the wider park area to reduce the risk to biodiversity assets and infrastructure from wildfire.

Early control methods employed in the core area included grubbing out individual plants and following up with herbicide spot spraying whenever green shoots appeared after rain. The project is labour intensive and much assistance has been received from volunteers and community work programs. Follow-up work could be needed more than once a year, but the number of work hours decreased greatly over the first two years, both in dense and light infestations. A large proportion of the core area has now been cleared of buffel grass, in spite of unusually wet conditions in 2000 and 2001 which delayed this achievement.

At the start of the program, it was not known whether removal of buffel grass could be achieved. Also unknown was the likely vegetation response to its removal. In fact, there has been



Chipping individual buffel grass (*Cenchrus ciliaris*) tussocks in Alice Springs Desert Park, NT.
Photo: G. Dinham

a transformation from an understorey consisting almost entirely of buffel grass to a remarkable diversity of native grasses and other herbaceous plants, occurring through natural regeneration. These results suggest that even where buffel grass has become dominant, native plants persist in the seedbank for a number of years and can germinate readily after rain, once the weed is removed. Some resilience of the native understorey is not unexpected, given its adaptation to long periods of little rain, but the maximum longevity of the native seedbank is not known. Much of the spread of buffel grass in central Australia has occurred in the past four decades.

Ongoing monitoring will be needed to prevent buffel grass reinvasion of the core area, especially where soil is disturbed or native understorey is very sparse. Since 2005 buffel grass in the wider park has been sprayed or chipped at strategic locations, with larger areas

on relatively flat ground being slashed by machinery. Whipper snippers were used around the base of trees and shrubs. Where possible, the slashing was timed to prevent seed set and the viable seedbank is expected to diminish over time. There has been little recent buffel grass seedling recruitment due to dry conditions.

The slashing has been successful in reducing fuel loads and the threat of wild fire. The reduction in the amount of buffel grass has allowed native plants to grow between the slashed clumps. Slashing has been followed up with spot spraying and grubbing. Slashed clumps are easier to grub when dry and easier to spray after rain events.

The park managers emphasise that there is no point to any treatment unless you have the capacity to do the follow-up spraying after rain events as the buffel grass will return and you will have wasted your time.

Herbicides

Herbicides, including grass-selective chemicals, are registered on labels for controlling buffel grass only in certain crop situations in Australia. A 'Permit to allow minor use of an AGVET chemical product' may be issued to allow registered products to be used for a purpose or in a manner that is not included on the approved label. Permits that include treatment of environmental weeds, including perennial grasses with glyphosate in some non-crop situations exist in NSW, Qld, SA and WA. The Australian Pesticides and Veterinary Medicines Authority website includes the relevant permit for each state. Glyphosate is a non-residual, systemic chemical and affects both broad-leaved plants and grasses. Glyphosate herbicide formulated for aquatic situations has been effective on buffel grass when applied to actively growing foliage and regrowth.

Trials to control buffel grass in non-crop situations with systemic herbicides, both grass-selective and non-selective, have indicated that a range of factors are critical to successful control of both seedlings and regrowth. These include:

- The plants' condition at the time of treatment will determine its effectiveness. They must be actively growing with no sign of senescence and may be flowering but should not be seeding. If timed well, it may be possible to spray both resprouting mature plants and seedlings at the same time when seedlings are sufficiently developed after heavy summer rain.
- Herbicide should be applied to as much of the green leaf as possible. This is best achieved by spot spraying. Reduced contact in the spray shadow may be unavoidable, necessitating repeated treatment. Treatment that combines slashing followed by spraying may be most effective.

- An assessment should be made of native plants and their susceptibility to different herbicides in order to minimise off-target damage. In some situations, grass-selective and non-selective herbicides may be suitable during different phases of the control program.
- Follow up treatment, using the same or different methods, should be applied to actively growing plants and to seedlings.

To address these critical factors, forward planning is needed. A treatment program should be carefully tailored to each situation and responsive to rainfall events. Unpredictable variation in seasonal conditions may reduce treatment effectiveness at times. Perseverance is vital to maintain buffel grass at low density.

When using herbicides, always read the label and follow instructions carefully. Operators should have formal training in the safe storage, handling, preparation and use of the chosen herbicides. Particular care should be taken to ensure that rainfall runoff will not carry herbicide into waterways.

Legislation

Buffel grasses (*Cenchrus ciliaris*, *C. pennisetiformis* and *C. setiger*) are not proclaimed under any Australian weeds legislation. Buffel grass is a prohibited noxious weed in Arizona, USA, due to the threat to the environment and the fire hazard it creates.

Cenchrus species that are declared in one or more Australian states are: *C. biflorus* (Gallon's curse); *C. brownii* (fine-bristled burr grass); *C. echinatus* (Mossman River grass); *C. incertus*, synonym *C. pauciflorus* (spiny burrgrass); and *C. longispinus* (spiny burrgrass or gentle Annie). These species may also be known as innocent weed or hedgehog grass.



Buffel grass (*Cenchrus ciliaris*) plants have extensive roots.
Photo: M. Robertson

Invasion of native plant communities by exotic perennial grasses has been listed as a key threatening process under the NSW *Threatened Species Conservation Act 1995*. Buffel grass is one of the species of special concern. In WA, buffel grass was identified in the 2007 State of the Environment report among the top five environmental weeds in two of the four major biogeographic regions of the state.

Under the Commonwealth EPBC Act, three ecological communities threatened by buffel grass are listed as endangered:

1. Brigalow (*Acacia harpophylla* dominant and co-dominant)
2. Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions
3. Bluegrass (*Dichanthium* species) dominant grasslands of the Brigalow Belt Bioregions (North and South).

In most of Australia the clearance of native vegetation for establishment of improved pastures is now regulated. Sowing of non-native pasture species in native vegetation may not be defined as clearance but may be regulated on leasehold land. Introduction of non-native species to pastoral leases has been widely encouraged by some government agencies. However, in South Australia the Pastoral Board's permission would be required. Much of the area under threat from buffel grass is pastoral leasehold, conservation reserve, Aboriginal land or vacant crown land. Containing unwanted buffel grass invasion and rehabilitating key areas where it dominates is becoming a major issue for land managers.



A drainage line in buffel grass (*Cenchrus ciliaris*) pasture on heavy clay alluvium near Springsure, central Queensland.
Photo: D. Butler

Knowledge gaps

Relatively few resources have been directed at assessing the long-term consequences for biodiversity, pastoralism and the human population from buffel grass invasion of vast areas of Australia. Maps of current distribution often lack sufficient detail for planning local or regional management. Knowledge of the long-term sustainability of buffel grass pastures in various climates and soils is lacking. Where buffel grass is already widely established, methods to minimise its spread, and to maintain diversity of native understorey and overstorey plant species and vegetation structure, are required. In vegetation where buffel grass is dominant, the nature of its impacts on native fauna (including invertebrates) and on soil nutrient cycles is largely unknown. Its potential distributional limits and the susceptibility of various native vegetation types to invasion under specific management regimes and future climate change are poorly understood.

The possibility that buffel grass roots exude chemicals that inhibit growth of other plant species needs to be investigated.

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Map: Australia's Virtual Herbarium, (*Cenchrus ciliaris*), via Royal Botanic Gardens Melbourne, Council of Heads of Australian Herbaria. www.rbv.vic.gov.au/cgi-bin/avhpublic/avh.cgi.

Case study: G. Dinham, Alice Springs Desert Park.

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Strategic management of buffel grass

Regional / local status of buffel grass	Not yet established	Small, isolated outbreaks	Widely established
Management goals	Prevent establishment	Eradicate	Contain infestations and mitigate threat
Strategies required	Maintain native vegetation cover and integrity Regulate planting—define zones at greatest risk Practise weed hygiene Monitor, detect and identify new infestations especially drainage lines, floodouts, calcareous rises, roadsides and bare soil areas Where rainfall is variable, extra vigilance will be needed during a sequence of wetter than average summers	Physical removal or herbicide, or combined treatment Follow up is essential Prevent re-establishment or invasion by other weeds through passive or active site restoration	Native vegetation: Identify high priority biodiversity assets under threat from buffel grass and protect them through implementing long-term site management plans Native / buffel pasture: Manage grazing and fire to maintain diversity, eg allow native plants to recruit seedlings and set seed in good seasons Cleared / improved pasture: Manage seed production and minimise spread into adjacent areas, remove seedlings from outside planted area. Prevent fires spreading from pastures. Roadsides and other infrastructure corridors: Map infestations, practise weed hygiene and remove new outbreaks to prevent spread

Apply herbicides during periods of active growth

Herbicide should only be applied when plants are green, leafy and actively growing, generally soon after significant warm season rainfall. In semi-arid and arid climates, the period when spraying can be effective may be quite limited. Plan ahead to take advantage of these times. Follow instructions on the herbicide labels.

Follow up

It is essential to follow up physical or chemical treatment after the next significant rainfall. This will require advance resource planning. Spot spray regrowth from butts while still growing. Consider both physical and chemical treatments as combining them may

increase their effectiveness and minimise off-target damage.

Prevent buffel grass re-establishment

Once mature plants have been killed, the focus is on preventing re-establishment from seeds in the soil seedbank or brought in by wind, water or animals. Buffel grass seeds may retain viability for up to 4 years or so and young plants can set seeds in their first season of growth.

1. Identify patterns of invasion and dispersal agents and manage major seed sources. Slashing can be done at any time but, if undertaken before seed set, it will minimise additions to the buffel grass seedbank.
2. Monitor weed-free areas after wet seasons to detect and remove



Buffel grass (*Cenchrus ciliaris*) along the highway near the Flinders Ranges, SA.
Photo: D. Powell

seedlings before they establish deep roots and produce seed.

3. Restore ground-cover vegetation to areas from which buffel grass has been removed.
4. Avoid large-scale disturbance that would create extensive areas of bare soil and favour buffel grass invasion, such as too-frequent fire or overgrazing.

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APPENDIX B

**DEPARTMENT OF ENVIRONMENT AND HERITAGE PROTECTION –
FIRE MANAGEMENT GUIDELINES FOR REGIONAL ECOSYSTEMS
IN THE OFFSET AREA**

(SOURCE: QUEENSLAND HERBARIUM, 2014)

Table B1
Department of Environment and Heritage Protection - Fire Management Guidelines for Regional Ecosystems in the Offset Area

Regional Ecosystem	Season	Intensity	Interval	Strategy	Issue
11.3.2	Late wet to early dry season when there is good soil moisture. Early storm season or after good spring rains.	Low to moderate.	6-10 years (shorter in BBN: 2-7 years).	Restrict to less than 30% in any year. Burn under conditions of good soil moisture and when plants are actively growing. Sometimes a small amount of wind may move the fire front quickly so that burn intensity is not too severe to destroy habitat trees.	Burn interval for conservation purposes will differ from that for grazing purposes; the latter being much shorter. Management of this vegetation type should be based on maintaining vegetation composition, structural diversity, fauna habitats (in particular hollow-bearing trees and logs) and preventing extensive wildfire. Maintaining a fire mosaic will help ensure protection of habitat and mitigate against wildfires. Fire can control shrub invasives (e.g., <i>Eremophila</i> spp. and <i>A. stenophylla</i> in the red soil country in particular). Fire will also control cypress. Low to moderate intensity burns with good soil moisture are necessary to minimise loss of hollow trees. Avoid burning riparian communities as these can be critical habitat for some species. Culturally significant (scar) trees may need protection, such as rake removal of ground fuels. Planned burns have traditionally been carried out in the winter dry season; further research required.
11.3.25	Primarily early dry season.	Low.	3 - 5 years.	Protection relies on broad-scale management of surrounding country with numerous small fires throughout the year so that wildfires will be very limited in extent. c-g: Depending on position in the landscape, protection depends on broad-scale management of surrounding country, with numerous small fires throughout the year so that wildfires will be very limited in extent.	Fringing communities are critical habitat. In some situations it may be best not to burn. Intense and extensive fires degrade vegetation structure and destroy fauna habitats. Restrict the extent and intensity of fires. Hollow trees are critical habitat. Green panic may be an issue and an intensive grazing regime for very short periods, may be necessary to limit potential of wildfire. c-g: If burning is to occur then implement when water level is deep enough to protect the bases of aquatic plants. Sedges are disadvantaged by repeated fires. Impact of fire on rare and threatened plants associated with mound springs that include <i>Arthraxon hispidus</i> and <i>Dimeria</i> sp. (Salvator Rosa R.J.Fensham RJF3643) should be considered. Boggomosses/springs can bounce back following fire but care should be taken where a dry peat layer has developed (particularly in degraded situations). Fire is an option for control of weeds (possibly in ungrazed situations). If riparian areas need to be burnt to reduce fuel loads then burning should occur when there is good soil moisture and active growth.

Table B1 (Continued)
Department of Environment and Heritage Protection - Fire Management Guidelines for Regional Ecosystems in the Offset Area

Regional Ecosystem	Season	Intensity	Interval	Strategy	Issue
11.3.4	Late wet to early dry season when there is good soil moisture. Early storm season or after good spring rains.	Low to moderate.	6-10 years (shorter in BBN: 2 - 7 years).	Restrict to less than 30% in any year. Burn under conditions of good soil moisture and when plants are actively growing. Sometimes a small amount of wind may move the fire front quickly so that burn intensity is not too severe to destroy habitat trees.	Burn interval for conservation purposes will differ from that for grazing purposes; the latter being much shorter. Management of this vegetation type should be based on maintaining vegetation composition, structural diversity, fauna habitats (in particular hollow-bearing trees and logs) and preventing extensive wildfire. Maintaining a fire mosaic will help ensure protection of habitat and mitigate against wildfires. Fire can control shrub invasives (e.g., <i>Eremophila</i> spp. and <i>A. stenophylla</i> in the red soil country in particular). Fire will also control cypress. Low to moderate intensity burns with good soil moisture are necessary to minimise loss of hollow trees. Avoid burning riparian communities as these can be critical habitat for some species. Culturally significant (scar) trees may need protection, such as rake removal of ground fuels. Planned burns have traditionally been carried out in the winter dry season; further research required.
11.4.8	-	-	-	Maintain fire management of surrounding country so that wildfires will be very limited in extent. Frequent fire at the edge of this RE keeps fuel loads low. Protection from fire is necessary.	<i>Casuarina cristata</i> is fire sensitive, although germination can be good in bare areas. Brigalow is soft-seeded, so germination is not promoted by fire. Buffel grass invasion will increase risk from fire. High intensity fires will cause damage to overstorey. Grazing may be an option for reducing fuel loads where exotic grass such as buffel have invaded.
11.5.18	Spring to summer after rain, with good soil moisture.	Moderate to high.	6-15 years.	This RE will burn when ready with adjacent vegetation. Burn small patches where possible (most are naturally small). Burn when sufficient soil moisture and according to seasonal condition.	This heathland requires long enough fire intervals to allow regrowth to a mature structure. Ensure mature shrubland structure persists for many years in between fire events.

Table B1 (Continued)
Department of Environment and Heritage Protection - Fire Management Guidelines for Regional Ecosystems in the Offset Area

Regional Ecosystem	Season	Intensity	Interval	Strategy	Issue
11.5.2	Late wet to early dry season when there is good soil moisture. Early storm season or after good spring rains.	Low to moderate.	6-10 years.	Restrict to less than 30% in any year. Burn under conditions of good soil moisture and when plants are actively growing. Sometimes a small amount of wind may move the fire front quickly so that burn intensity is not too severe to destroy habitat trees. a: Restrict to less than 30-60% in any year. Rotate burns in mosaic patches. Maintain fire management of surrounding country so that wildfires will be very limited in extent. Burn under conditions of good soil moisture and when plants are actively growing.	Burn interval for conservation purposes will differ from that for grazing purposes; the latter being much shorter. Management of this vegetation type should be based on maintaining vegetation composition, structural diversity, fauna habitats (in particular hollow-bearing trees and logs) and preventing extensive wildfire. Maintaining a fire mosaic will help ensure protection of habitat and mitigate against wildfires. Fire can control shrub invasives (e.g., <i>Eremophila</i> spp. and <i>A. stenophylla</i> in the red soil country in particular). Fire will also control cypress. Low to moderate intensity burns with good soil moisture are necessary to minimise loss of hollow trees. Avoid burning riparian communities as these can be critical habitat for some species. Culturally significant (scar) trees may need protection, such as rake removal of ground fuels. Planned burns have traditionally been carried out in the winter dry season; further research required. a: Maintaining a fire mosaic will ensure protection of fauna habitats (such as dense stands of <i>A. luehmannii</i>) and mitigate against wildfires. <i>Allocasuarina luehmannii</i> (bull oak) can be both killed by fire and regenerate from seed following fire. Bull oak thickening/creation of whipstick communities may be controlled with planned low intensity burns. Drought index will help deliver required guideline. Jewel butterfly is significant in this community, but the jewel butterfly needs thick leaf litter/mature bull oak; so high intensity fire (or fire that removes the litter layer) could be detrimental to survival. <i>Allocasuarina</i> is also an important food source for glossy-black cockatoo.

Table B1 (Continued)
Department of Environment and Heritage Protection - Fire Management Guidelines for Regional Ecosystems in the Offset Area

Regional Ecosystem	Season	Intensity	Interval	Strategy	Issue
11.5.3	Late wet to early dry season when there is good soil moisture. Early storm season or after good spring rains.	Various.	6-15 years (shorter intervals in BBN: 5-10 years). No shrubby woodlands should receive two consecutive burns at intervals of < 6 years.	Once boundaries of the planned burning area are secure, ignite across the landscape in a patchwork, rather than continuous ignition strips. Use topographical features to help create a patchily burnt landscape. Where shrubby woodlands occur within a broader grassy landscape, attempt to burn the shrubby woodland during every second fire rotation in the grassy woodland, by burning early breaks around the shrubby areas. In sites with a history of wildfires recurring within 5 years, patchy burning in a few small strategic locations at 3 or 4 year intervals may reduce the incidence of extensive wildfires, while ensuring most shrubby woodland areas remain unburnt for > 5 years. b: Burn under mild conditions and primarily away from the edge into surrounding vegetation. Low intensity burning may be of benefit within the forests with native grasses and where Para grass density requires management.	Shrubby woodlands require longer fire intervals than grassy woodlands, because of the presence of fire-killed shrubs and the time required for post-fire regrowth to return to a mature structure. The seedlings of many fire-killed shrubs (such as some wattles) require 5 years or more before they mature. The creation of a fine-scale patchy mosaic can be more difficult to achieve in shrubby compared to grassy woodlands. Ensure seedlings of fire-killed shrubs mature and persist in the woodland; ensure several years of mature shrubby woodland structure before the subsequent fire. b: Care is needed to ensure a low intensity fire, as high intensity fires can damage trees, e.g. Melaleuca spp. and Brigalow. Native grasses (e.g. Imperata cylindrica, Sporobolus virginicus) and sedges (e.g. Fimbristylis spp) will benefit from occasional burning. Fire, coupled with herbicide spraying, is important for managing exotic wetland plants, such as Olive Hymenachne and Para grass. Burning temporarily opens gaps within exotic grass patches, allowing native flora to establish. Ensure native grass diversity is maintained and native trees are not damaged by fires.
11.5.9	Late wet to early dry season when there is good soil moisture. Early storm season or after good spring rains.	Various.	6-15 years (shorter intervals in BBN: 5-10 years). No shrubby woodlands should receive two consecutive burns at intervals of < 6 years.	Once boundaries of the planned burning area are secure, ignite across the landscape in a patchwork, rather than continuous ignition strips. Use topographical features to help create a patchily burnt landscape. Where shrubby woodlands occur within a broader grassy landscape, attempt to burn the shrubby woodland during every second fire rotation in the grassy woodland, by burning early breaks around the shrubby areas. In sites with a history of wildfires recurring within 5 years, patchy burning in a few small strategic locations at 3 or 4 year intervals may reduce the incidence of extensive wildfires, while ensuring most shrubby woodland areas remain unburnt for > 5 years.	Shrubby woodlands require longer fire intervals than grassy woodlands, because of the presence of fire-killed shrubs and the time required for post-fire regrowth to return to a mature structure. The seedlings of many fire-killed shrubs (such as some wattles) require 5 years or more before they mature. The creation of a fine-scale patchy mosaic can be more difficult to achieve in shrubby compared to grassy woodlands. Ensure seedlings of fire-killed shrubs mature and persist in the woodland. Ensure several years of mature shrubby woodland structure before the subsequent fire.

Table B1 (Continued)
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Regional Ecosystem	Season	Intensity	Interval	Strategy	Issue
11.7.2	-	-	-	Maintain fire management of surrounding country so that wildfires will be very limited in extent and do not penetrate Lancewood forests.	Although fire promotes the germination of Lancewood seedlings, trees are killed by all but the lowest intensity fires. Lancewood trees require approximately 20 years before seedlings mature. Often the lack of grass layer inhibits fire spread into these forests, and they will regenerate after occasional wildfires. Damaged by repeated fires < 20 years. Manage surrounding woodlands so that wildfires do not burn large areas of Lancewood forest in a single event. Ensure no damage to Lancewood trees from fires; extra protection required to ensure no two fires penetrate Lancewood forests within 20 years.
11.7.4	-	-	-	Manage surrounding country. Burn surrounding country only under conditions of good soil moisture and when plants are actively growing. Will be difficult to burn owing to a lack of ground fuel that normally occurs in this RE.	-

Source: Queensland Herbarium (2014) Regional Ecosystem Fire Guidelines (September 2014) (Queensland Department of Science, Information Technology, Innovation and the Arts: Brisbane) Website: <https://publications.qld.gov.au/dataset/redd/resource/c77196df-7af9-4c09-ac88-256867c39806>. Date Accessed: November 2016.