Appendix K
Ecological Assessment

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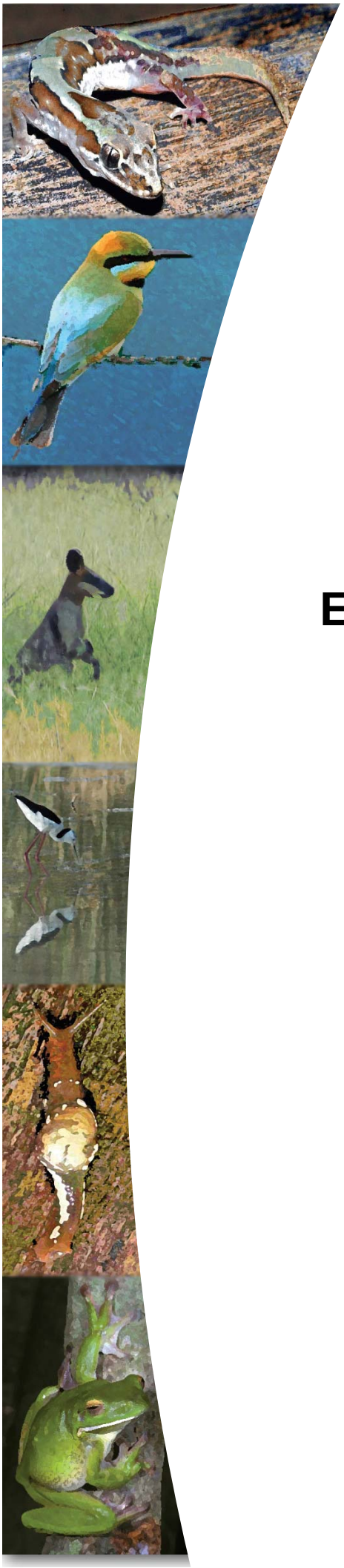

Caval Ridge Coal Mine Project

ECOLOGICAL ASSESSMENT

Report prepared
for
URS Australia

Biodiversity Assessment AND MANAGEMENT PTY LTD

FAUNA AND HABITAT SPECIALISTS

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Project Author/s: Terry Reis, Dr Chris Schell, Adam Abbott, Paul Grimshaw, Paulette Jones, Jedd Appleton

Project Summary: An assessment of potential impacts on flora and terrestrial vertebrate and aquatic fauna due to proposed coal mining activities within the Caval Ridge Baseline EIS project site, situated near Moranbah in Central Queensland, based on a baseline assessment of ecological values.

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Signed on behalf of Date: 28 May 2009

Biodiversity Assessment and Management Pty Ltd

Managing Director

ECOLOGICAL ASSESSMENT

Caval Ridge Coal Mine Project

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List of Abbreviations

BAAM	-	Biodiversity Assessment and Management Pty Ltd
BBN	-	Brigalow Belt North (Bioregion)
BMA	-	BHP Billiton Mitsubishi Alliance
CHPP	-	Coal Handling and Preparation Plant
DEWHA	-	Commonwealth Department of Environment, Water, Heritage and the Arts
DPIF	-	Queensland Department of Primary Industries and Fisheries
EPA	-	Queensland Environmental Protection Agency
EPBC Act	-	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EVR	-	Endangered, Vulnerable or Rare
IPA	-	Queensland *Integrated Planning Act 1997*
LGA	-	Local Government Area
LP Act	-	Queensland *Lands Protection (Pest and Stock Route Management) Act 2002*
MNES	-	Matters of National Environmental Significance
NC Act	-	Queensland *Nature Conservation Act 1992*
NRW	-	Queensland Department of Natural Resources and Water
QMR Act		Queensland Mineral Resources Act 1989
RE	-	Regional Ecosystem
REDD		Regional Ecosystem Description Database
ROM	-	Run-of-Mine coal stockpiles
VM Act	-	Queensland *Vegetation Management Act 1999*

1.0 INTRODUCTION

1.1 PURPOSE OF THE REPORT

This report has been prepared for URS Australia for the purpose of providing an independent and comprehensive baseline assessment of the flora and terrestrial vertebrate and aquatic fauna and associated habitat values of the site of the Caval Ridge Coal Mine Project (the 'project site'), located near Moranbah in Central Queensland (**Figure 1.1**), and a subsequent assessment of potential ecological impacts from the proposed mining activities.

The specific aims of the Baseline Assessment component are to provide:

- an account of the vegetation types present within the project site, including significance status under Queensland's *Vegetation Management Act 1999* (VM Act), site-specific Regional Ecosystem (RE) mapping and, if necessary, recommendations for alterations to current Queensland Department of Natural Resources and Water (NRW) certified RE mapping;
- an account of the flora, terrestrial vertebrate and aquatic fauna present on, or that may utilise, the project site, including species lists and significance status under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Queensland's *Nature Conservation Act 1992* (NC Act);
- an evaluation and comment on the presence or absence of any at-risk, migratory or otherwise significant species of flora and fauna of the area;
- an assessment and comment on any significant habitats within the project site, including their contribution to faunal movement corridors; and
- an account of the general distribution and abundance of pest plants and animals within the project site, including mapping of locations of significant infestations.

The specific aims of the Impact Assessment component are to:

- describe the potential environmental harm to the ecological values of the area affected by the construction and operation of the Project;
- describe measures to mitigate and/or offset the environmental harm to habitat or the inhibition of ecological processes, including strategies for protecting significant species and controlling exotic species, and any specific obligations imposed by Local, State or Commonwealth legislation.

All following observations and recommendations are based on site investigations undertaken by Terry Reis and Adam Abbott (fauna) and Dr Chris Schell and Paul Grimshaw (flora) from 31 March to 4 April 2008 (inclusive), and by Terry Reis (fauna) and Dr Chris Schell (flora) from 5 to 8 August 2008 (inclusive), following a review of available literature and relevant Project information.

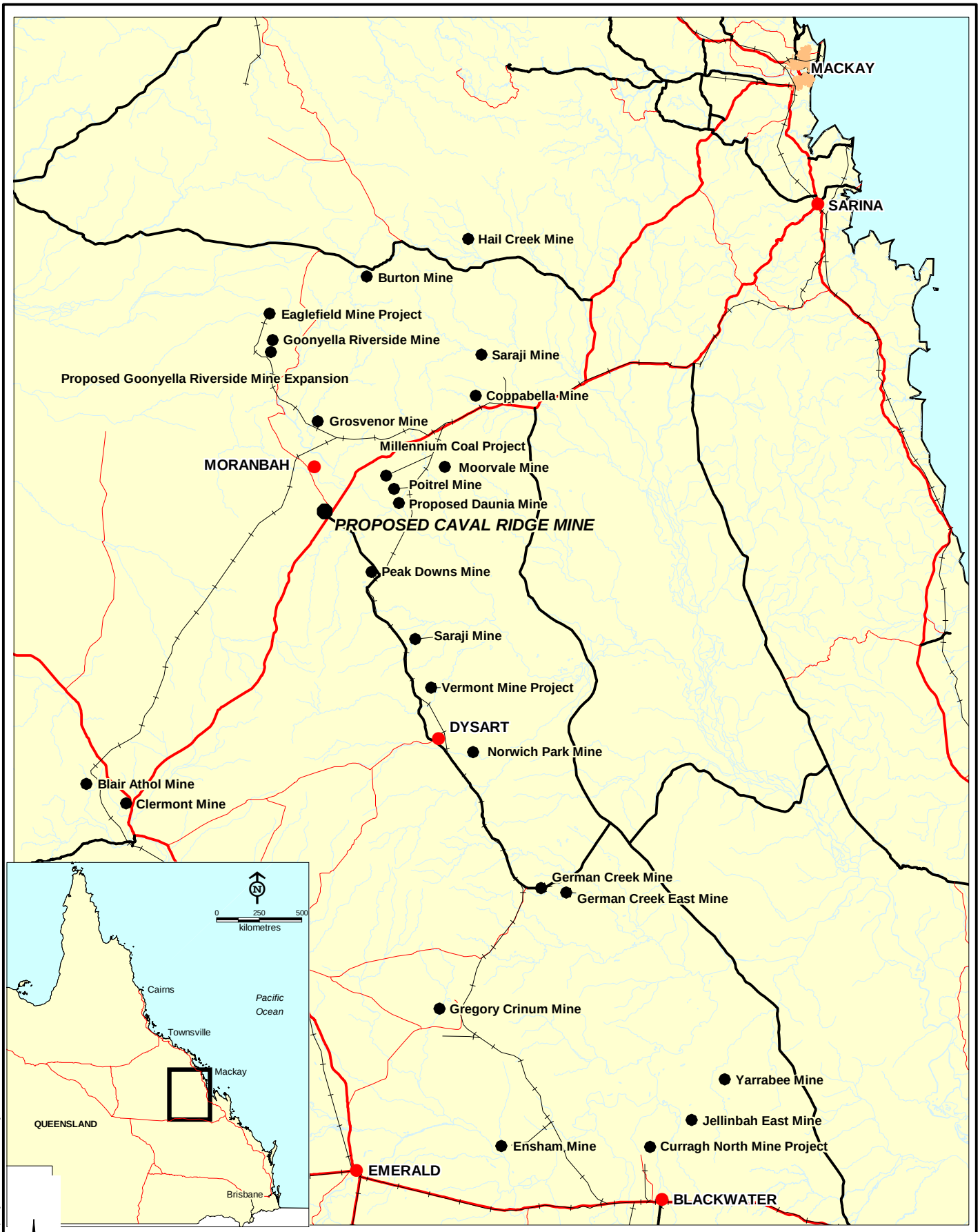
The Report structure is:

- Background;
- Methodology;
- Baseline Assessment; and
- Impacts and Mitigation Measures

1.2 PROJECT DESCRIPTION

As part of their Bowen Basin Coal Growth Project, the alliance between BHP Billiton and Mitsubishi Corporation (known as the 'BHP Billiton Mitsubishi Alliance' or 'BMA') is proposing the development of a new coal mining operation, known as Caval Ridge Mine, and associated mine infrastructure. The Project is located immediately north of Harrow Creek and the existing Peak Downs Mine in the northern Bowen Basin south-east of Moranbah in Central Queensland. It is anticipated that the proposed mine will produce 5.5 million tonnes of high quality, hard coking coal in order to help meet export demand.

The project has been declared a "significant project" under the provisions of the *State Development and Public Works Organisation Act 1971*.



Client: URS	Project: ECOLOGICAL ASSESSMENT - CAVAL RIDGE COAL MINE PROJECT	Title: **PROJECT SITE LOCALITY**
Biodiversity Assessment and Management Pty Ltd	Drawn: VH; Approved: BAAM; Date: 08-12-2008	Figure: **1.1**
	Job No: **4262 6158**; File No: 42626158-g-122.wor	Rev:A; **A4**

Key Project elements include:

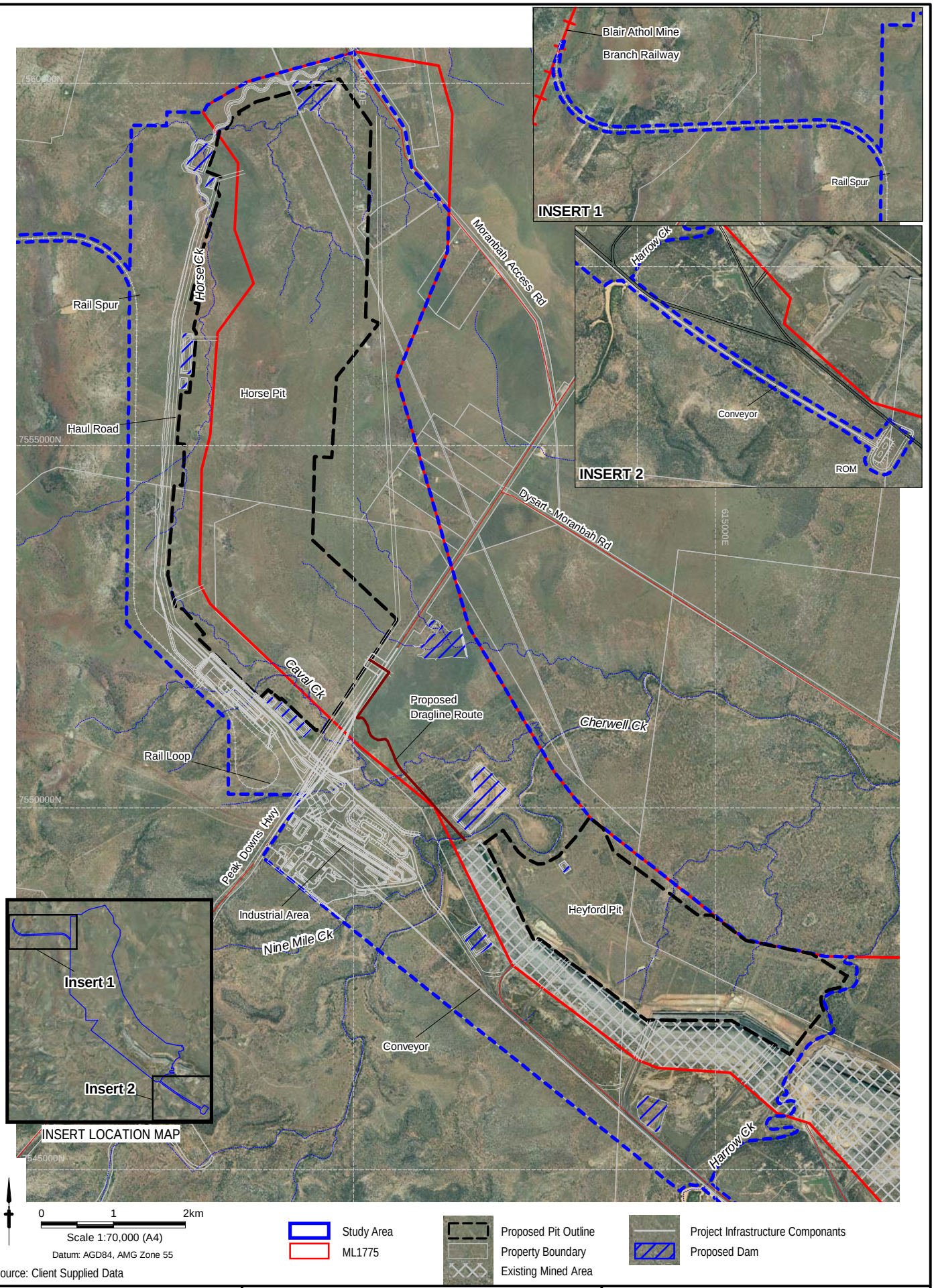
- A 24 month construction phase, including the establishment of:
  - the initial box cut, ramps and out of pit waste dump areas;
  - Run-of-Mine (ROM) coal stockpiles and associated overland conveyor;
  - an onsite Coal Handling and Preparation Plant (CHPP) and associated loading facilities;
  - necessary transport facilities and corridors, including a new rail line and spur with associated coal loading facilities, an all weather access road from the Peak Downs Highway, Haul Road, access roads and an overpass to allow for the transportation of material under the Highway using heavy and light vehicles;
  - necessary utilities, including power supply from the existing network and a new water supply off take pipeline from existing bulk pipelines;
  - a mine water management system, including clean water diversion, disturbed area runoff collection and treatment, pit water management, water reuse and water disposal if there is surplus water at anytime;
  - sewage and wastewater treatment by packaged sewage treatment plant; and
  - site offices, ablution and bathhouse facilities, workshops and stores area, including storage for diesel, tyres and other consumable materials.
- A 30-year, 7 days per week open-cut dragline and truck shovel operation involving:
  - progressively clearing of any vegetation occurring on areas required for the operation and stockpiling topsoil from disturbed areas for storage and use in future rehabilitation of the site;
  - prestripping/excavation of unconsolidated/soft overburden waste using excavators and trucks, and dumping over previously stripped dragline spoil;
  - drill and blasting of upper competent overburden waste;
  - removal of waste rock using a combination of dozers, excavators and trucks; and dumping over previously stripped dragline spoil;
  - coal mining of upper seams using a combination of dozers, excavators, loaders and trucks;
  - drill and blasting of lower competent overburden waste and side casting of lower overburden into the previously mined strip using a dragline;
  - in pit waste dump;
  - coal mining of lower seams using a combination of dozers, excavators, loaders and trucks; and
  - rehabilitation of the site by re-shaping the waste rock dumps, topsoiling and revegetation using native vegetation.

Figure 1.2 shows the proposed mining footprint. Approximately 3,900 ha will be disturbed over the life of the proposed mine, as indicated by the proposed pits, dams, transport routes and other infrastructure.

1.3 EPBC ACT REFERRAL

On 26 August 2008, BMA referred the Project to the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) for a decision as to whether approval for the mine and associated infrastructure is required under the EPBC Act.

On 23 September 2008, DEWHA made the decision that the project is a controlled action (and therefore requires assessment and approval) as it is likely to have a significant impact on listed threatened species and communities, and that the assessment would be under a bilateral agreement with the Queensland Government.



Client: URS

Biodiversity Assessment and Management Pty Ltd

Project: ECOLOGICAL ASSESSMENT - CAVAL RIDGE COAL MINE PROJECT

Title: **PROPOSED MINING AND INFRASTRUCTURE FOOTPRINT**

Drawn: VH	Approved: BAAM	Date: 05-03-2009
Job No: **4262 6158**	File No: 42626158-g-123e.wor	

Figure: **1.2**

Rev:E

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1.4 THE PROJECT SITE

The project site is located adjacent to, and to the north of, the northern extent of the existing Peak Downs Coal Mine, approximately 6 km south-east of Moranbah in Central Queensland (**Figure 1.1**).

The total area of the project site is 6,477 ha, most of which has been previously cleared for grazing activity and has since suffered significant weed infestation. Occasional patches of remnant vegetation persist, predominantly along the banks of Cherwell Creek. Harrow Creek forms the southern boundary of the project site, and while several other drainage lines also occur, these are largely ephemeral and would be dry for most of the year. Occasional 'jump-ups' occur as a result of the underlying duricrust substrate, although the vast majority of the project site is relatively flat.

2.0 ECOLOGICAL LEGISLATION AND PLANNING INSTRUMENTS RELEVANT TO THE STUDY AREA

The project has been declared a "significant project" under the provisions of the *State Development and Public Works Organisation Act 1971*. Ecological legislation relevant to the project site includes both Commonwealth and State Acts. In addition, planning for this area should have regard for the intent of regional planning instruments (i.e. Biodiversity Planning Assessment). Ecologically relevant legislation and planning instruments are discussed below.

2.1 COMMONWEALTH LEGISLATION

2.1.1 The Commonwealth Environment Protection and Biodiversity Conservation Act 1999

At the Commonwealth level, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) identifies species and ecosystems of conservation significance that may be present in the project site. One or more species and/or ecosystems having conservation significance may require specific management regimes dependant upon the level of impacts from any future proposed works.

In planning for the Project, there was a requirement for a referral to the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) as per the EPBC Act Policy Statement 1.1: Significant Impact Guidelines, Matters of National Environmental Significance (DEH 2006) for assessment against the EPBC Act. The outcomes of this referral process are outlined in **Section 1.3**.

2.2 STATE LEGISLATION

On 18 July 2008 the Coordinator-General declared the project a 'significant project' for which an Environmental Impact Statement (EIS) is required in accordance with Part 4 of the *State Development and Public Works Organisation Act 1971* (Queensland).

2.2.1 The Queensland Mineral Resource Act (1989)

The object of this Act is to provide a framework to regulate tenure and royalty issues associated with exploration and mining for minerals on land in Queensland. However, the environmental impacts of mining are now regulated under the Environmental Protection Act (1994). Mining is exempt development under the Integrated Planning Act (1997) and it is not intended to integrate the approval processes for mining into the Integrated Development Assessment System.

2.2.2 The Queensland Environmental Protection Act (1994)

The Queensland Environmental Protection Act is directly relevant to this project. The object of this Act is to protect Queensland's environment while allowing for 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 (''ecologically sustainable development'').

An environmental activity may be prescribed by regulation as an environmentally relevant activity and may be ascribed a level 1 or level 2 environmentally relevant activity depending on the risk of environmental harm. All Environmentally Relevant Activities (ERAs) are to be licensed by the EPA (Queensland Environmental Protection Agency). This can be achieved under an Integrated Environmental Management System (IEMS).

2.2.3 The Queensland Nature Conservation Act 1992

Although this legislation is not subordinate to the Queensland *Mineral Resource Act 1989* (QMR Act) and is therefore not triggered as part of the application process, it is indirectly relevant to determine the environmental values of the project site. One of the aims of the Queensland Environmental Protection Act (1994) is to minimise environmental harm. Therefore, planning for the project site must consider the guidelines and provisions of Queensland's *Nature Conservation Act 1992* (NC Act), which lists species of significance at a state level.

The NC Act (Section 68) states that:

> 'Protected wildlife is to be managed to—
>
> (a) conserve the wildlife and its values and, in particular to—
>
> (i) ensure the survival and natural development of the wildlife in the wild; and
>
> (ii) conserve the biological diversity of the wildlife to the greatest possible extent; and
>
> (iii) identify, and reduce or remove, the effects of threatening processes relating to the wildlife; and
>
> (iv) identify the wildlife's critical habitat and conserve it to the greatest possible extent; and …'.

Protected wildlife is also linked to the VM Act (below) through the mapping of Remnant Vegetation and associated Essential Habitat contained therein.

2.2.4 The Queensland Vegetation Management Act 1999

The purpose of the *Vegetation Management Act 1999* (VM Act) is to regulate the clearing of native vegetation (i.e. remnant vegetation mapped as Regional Ecosystems (REs) that are: Endangered, Of Concern and Not of Concern) to maintain ecological processes, ensure there is no loss of biodiversity or increase in land degradation from vegetation clearing and manage the effects of clearing. In addition, some areas of remnant vegetation are further classified as Essential Habitat under the VM Act with specific reference to conservation significant species listed under the NC Act.

The VM Act is implemented through the Queensland Department of Natural Resources and Water (NRW) certified mapping of Remnant Vegetation and Essential Habitat. Clearing of native vegetation mapped as REs and/or Essential Habitat is subject to assessment by NRW against the Regional Vegetation Management Codes.

Although this legislation is not subordinate to the QMR Act and is therefore not triggered as part of the application process, it is indirectly relevant to determine the environmental values of the project site. In addition, areas categorised as having an Endangered management status under the provisions of the VM Act are subject to certain restrictions under the Environmental Protection Act and Regional Ecosystems that are analogous to Nationally Listed Threatened Ecological Communities as listed under the provisions of the EPBC Act must be considered and protected.

2.2.5 The Queensland Lands Protection (Pest and Stock Route Management) Act 2002

The main purpose of the *Lands Protection (Pest and Stock Route Management) Act 2002* (LP Act) is to provide pest management for agricultural lands. The LP Act lists several species of flora and fauna that are considered Class 1, 2 or 3 pests under the Act. In addition, there may be environmental weeds present within the project site that are not listed under the LP Act.

Future planning in the project site should incorporate appropriate weed and pest management.

2.3 THE EPA'S REGIONAL BIODIVERSITY PLANNING ASSESSMENT

The Biodiversity Planning Assessment (BPA) (EPA 2003a,b) process uses the Biodiversity and Mapping Methodology (EPA 2002) to determine the biodiversity significance of habitats and landscapes for the various bioregions in Queensland.

The project site is located within the Brigalow Belt North (BBN) bioregion and as such is part of the BBN BPA. The BPA affords significance to the remnant vegetation and associated wildlife corridors of the project site.

3.0 STUDY METHODOLOGY

The following methodologies were employed for the Ecological Assessment.

3.1 DESK TOP

An initial ecological literature review and gap analysis undertaken by URS (**Appendix 1**) identified the need for an additional, comprehensive ecological baseline survey of the project site for the purpose of providing suitable baseline information for future impact assessment.

Prior to the field survey component for the baseline assessment, public databases were searched in order to provide background information regarding flora and fauna species and communities known from the region and local area. This included searches of the Commonwealth's EPBC Act Online Protected Matters Search Tool, the EPA's WildNet database, Birds Australia's Atlas database, and the Queensland Museum's fauna database for the project site and surrounds (**Appendix 2**). Information gained from this phase of the assessment was used to:

- ensure that survey methods were designed to detect species of significance known from the region; and
- determine which species/communities are most likely to occur if suitable habitat was located within the project site. Those species that are known from recent, nearby records are considered more likely to occur if suitable habitat is located.

Other relevant baseline information relating to the Project, project site and the surveys was also reviewed, where available. This included the results of any preliminary or previous comprehensive surveys of the project site and/or surrounds (i.e. the adjacent Peak Downs Mine), including:

- WBM (1998),
- GHD (2004),
- Ecoserve and LAMR (2005),
- Ecoserve (2006a, b, c) and
- Ecoserve and Ecoteam (2006),

as well as aerial photography, mapping of vegetation and other physical features, and relevant planning documentation/mapping administered by the Queensland Government.

For the subsequent Impact Assessment component, all relevant Project design, construction and operational details were reviewed with regard to the ecological values determined on the project site during the baseline assessment.

3.2 FLORA SURVEYS

The general approach for the flora surveys was to traverse each of the major landscape elements and associated vegetation communities within the project site. Vegetation data were collected in accordance with general Queensland Herbarium methodologies in order to provide a detailed structural and botanical description of each community type, and to validate the current NRW certified Regional Ecosystem mapping or to justify changes to the mapping. This involved the establishment of Secondary and Quaternary survey plots within representative areas for each community (based on a review of aerial photography and existing RE mapping) and spread across the lease to acquire data within communities that may be affected by any future operations.

Descriptive site information recorded at each Secondary survey site included:

- GPS Location;
- Time encoded photographs;
- Landform and soil types;
- Height class of each stratum (T1: canopy, T2: mid, S1: shrub, G1: ground) within the 50 x 10 m plot obtained with a laser hypsometer, clinometer or by ocular estimation;
- Crown cover of T1 and T2 strata intercepted along the 50 m transect centre line;
- Foliage projection cover (FPC %) of all ground cover species within five 1 x 1 m quadrats along the transect tape;
- Relative abundance of all species present within the 50 x 10 m plot;
- The relative dominance of characteristic species within each stratum; and
- Basal prism sweep and count of all T1 and T2 species.

Descriptive site information recorded at each Quaternary survey site included:

- GPS Location
- Time encoded photographs;
- Landform and soil types;
- Height class of each stratum (T1: canopy, T2: mid, S1: shrub, G1: ground) within the 100 x 5 m plot obtained with a laser hypsometer, clinometer or by ocular estimation;
- Crown cover of T1 and T2 strata intercepted along the 100 m transect centre line; and
- Relative abundance of Canopy and mid-stratum species present within the 100 x 5 m plot.

A total of ten secondary and five quaternary survey plots were established during the survey of the project site from 31 March to 4 April 2008 (inclusive), while an additional seven secondary and two quaternary survey plots were established during the supplementary survey of the areas of the proposed Coal Handling and Preparation Plant (CHPP), rail infrastructure, Run-Of-Mine coal stockpiles (ROM) and associated road and conveyor from 5 to 8 August 2008 (inclusive) (**Figure 3.1**).

Following assessment of each plot, an area of approximately 1 ha surrounding each plot was searched utilising a random meander technique, with care taken to avoid sampling in different vegetation types to those of the plots. Meander searches were employed to:

- Identify additional, less abundant species not recorded within survey plots;
- Identify any potential significant species not identified within the survey plot;
- Confirm the representativeness of plot locations; and
- Confirm boundaries and ecotonal areas between vegetation communities.

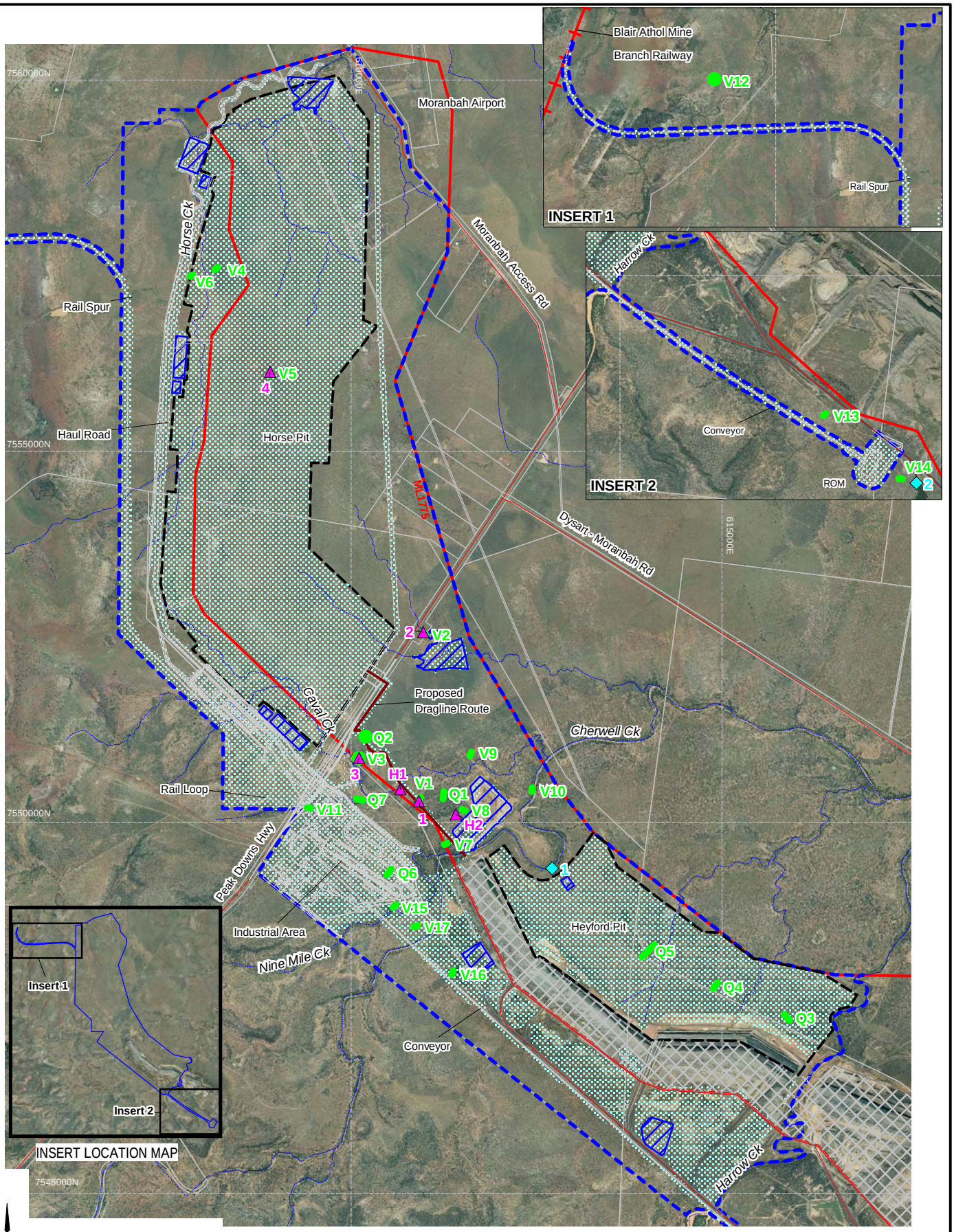
Significant species and/or communities identified as part of the desktop studies were targeted during the survey and their locations recorded by GPS, where encountered, for subsequent mapping, along with the general location and extent of declared pest species.

The locations of the vegetation survey transects eventually established in the field are listed in **Table 3.1** and shown on **Figure 3.1**.

TABLE 3.1. Vegetation survey transect locations (Datum: GDA, Decimal Degrees)

Transect No.	Survey Effort	Start Location*		End Location*	
		Latitude	Longitude	Latitude	Longitude
V1	Secondary	S22.14736	E148.07668	S22.14697	E148.07691
V2	Secondary	S22.12681	E148.07713	S22.12713	E148.07746
V3	Secondary	S22.14221	E148.06886	S22.14102	E148.06982
V4	Secondary	S22.08291	E148.04958	S22.08261	E148.04993
V5	Secondary	S22.09525	E148.05691	S22.09568	E148.05695
V6	Secondary	S22.08370	E148.04634	S22.08353	E148.04671
V7	Secondary	S22.15250	E148.08043	S22.15266	E148.08008
V8	Secondary	S22.14854	E148.08274	S22.14837	E148.08235
V9	Secondary	S22.14181	E148.08333	S22.14142	E148.08346
V10	Secondary	S22.14613	E148.09144	S22.14570	E148.09145
V11#	Secondary	S22.14831	E148.06208	S22.14835	E148.06256
V12#	Secondary	S22.07280	E148.00976	S22.07250	E148.00938
V13#	Secondary	S22.21308	E148.14627	S22.21335	E148.14591
V14#	Secondary	S22.22169	E148.15727	S22.22165	E148.15678
V15#	Secondary	S22.16003	E148.07380	S22.16035	E148.07340
V16#	Secondary	S22.16844	E148.08117	S22.16802	E148.08134
V17#	Secondary	S22.16270	E148.07615	S22.16255	E148.07661
Q1	Quaternary	S22.14621	E148.07995	S22.14710	E148.07988
Q2	Quaternary	S22.13961	E148.06969	S22.13947	E148.07070
Q3	Quaternary	S22.17369	E148.12531	S22.17302	E148.12468
Q4	Quaternary	S22.16994	E148.11531	S22.16924	E148.11591
Q5	Quaternary	S22.16615	E148.10600	S22.16538	E148.10541
Q6#	Quaternary	S22.15642	E148.07257	S22.15569	E148.07312
Q7#	Quaternary	S22.14718	E148.06851	S22.14735	E148.06940

* Note: Locations recorded on Garmin handheld GPS. # Data obtained August 2008.



Client: URS

Biodiversity Assessment and Management Pty Ltd

Project: ECOLOGICAL ASSESSMENT - CAVAL RIDGE COAL MINE PROJECT

Title: **LOCATION OF SYSTEMATIC SURVEY SITES - FLORA, FAUNA AND AQUATIC**

Drawn: VH	Approved: BAAM	Date: 05-03-2009
Job No: **4262 6158**	File No: 42626158-g-124e.wor	

Figure: **3.1**

Rev:E

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3.3 TERRESTRIAL VERTEBRATE SURVEYS

3.3.1 Survey Effort and Site Selection

The general approach for the terrestrial vertebrate survey of the project site in autumn (31 March to 4 April 2008 inclusive) was to establish representative, systematic survey transects within each of the major habitat types occurring within the project site, supported by targeted habitat assessment and opportunistic observations during general traverses throughout the survey period. This included a standard trap/release program and passive recording conducted over five days and four nights, in accordance with the EPA's *Guidelines for Flora and Fauna Surveys* (1999), and BAAM's Queensland Parks and Wildlife Service's Scientific Purposes Permit No. WISP02791605 and Queensland Department of Primary Industries and Fisheries' (DPIF) Animal Ethics Committee Certification No. CA 2005/10/81.

In order to represent each of the basic vegetation/habitat types within the project site, a total of four terrestrial trapping sites were established, as follows:

Site 1: Site 1 was established in Open Forest/Woodland (Vegetation Community 7 – **Section 4.2.2**) with a canopy dominated by Dawson Gum (*Eucalyptus cambageana*), Poplar Box (*E. populnea*), and Brigalow (*Acacia harpophylla*) and a ground cover which included Wiregrass (*Aristida gracilis*), Windmill Grass (*Enteropogon unispiceus*) and Hooky Grass (*Ancistrachne uncinulata*). The canopy was sparse, there was little understorey and the groundcover was particularly dense (**Photo 1**).

Photo 1

Reasonable quantities of fallen timber were present and the site had undergone historical clearing, was subject to some tree death due to drought and is subject to on-going grazing.

Site 2: Site 2 was established in Open Forest/Woodland (Vegetation Community 14 – **Section 4.2.2**) with a canopy dominated by Brigalow, Yellowwood (*Terminalia oblongata*), and Scrub Boonaree (*Alectryon diversifolia*). The ground cover included Buffel Grass (*Pennisetum ciliare*), Red Natal Grass (*Melinis repens*) and Parthenium (*Parthenium hysterophorus*) (see **Photo 2**).

Photo 2

The canopy was low and sparse and the groundcover dense. The area was low-lying and somewhat swampy with a dam and windmill nearby. The area had previously been cleared and is subject to on-going grazing. Nearby areas, around the dam, are particularly degraded due to cattle and the site suffers some disturbance, such as noise, dust and potential mortality by vehicle strike, from the very close proximity of Peak Downs Highway.

Site 3: Site 3 was established in Open/Closed Grassland with Isolated Trees (Vegetation Community 1 – **Section 4.2.2**) with a very sparse canopy and mid-stratum dominated by Whitewood (*Atalaya hemiglauca*) and False Sandalwood (*Eremophila mitchellii*) with a ground cover of Buffel Grass and Harrisia Cactus (*Eriocerис martini*) (**Photo 3**). The site was flanked by a small patch of Brigalow regrowth and a large area infested with Parthenium. The area had previously been cleared and is subject to on-going grazing.

Photo 3

Site 4: Site 4 was established in Open Shrubland on a jump-up (mesa) (Vegetation Community 13 – **Section 4.2.2**) with a canopy and mid-stratum dominated by Burrow's Wattle (*Acacia burrowii*), Red Ash (*Alphitonia excelsa*), and Dogwood (*Erythroxylon australe*) with a ground cover of Wiregrass (*Aristida*) species and Pigweed (*Portulaca oleracea*) (see **Photo 4**). The jump-up was mainly bare earth and rock (duricrust) and had substantial amounts of fallen timber. It was surrounded by pasture.

Photo 4

Due to clearing and degradation, the vegetation of the project site north of Cherwell Creek presented little by way of flight paths to act as focal points for microbat foraging activities. Nonetheless, two sites were targeted for microbats, H1 (Harp Trap site 1) and H2 (Harp Trap site 2), and a harp trap was deployed overnight at each location. The trap at H1 was situated in a creekline with pools of water. The surrounding vegetation was Open Woodland with Poplar Box, Blue Gum (*E. tereticornis*) and Long-fruited Bloodwood (*Corymbia clarksoniana*) and Buffel Grass as ground cover. The trap at H2 was situated on a narrow track within Open Forest/Woodland with a canopy dominated by Dawson Gum, Poplar Box, and Brigalow and a ground cover which included Wiregrass and Windmill Grass.

Given the time of year (i.e. winter) and the level of investigation already undertaken within the project site, it was considered that a specific, comprehensive trap and release survey was unnecessary for the supplementary flora investigation undertaken between 5 and 8 August 2008 (inclusive). As such, this component primarily involved a non-invasive evaluation of important terrestrial and aquatic features that contribute to fauna habitat values within areas potentially affected by the proposed activities, focusing on those habitats potentially supporting species of conservation significance.

The locations of all terrestrial vertebrate survey transects and targeted sites are listed in **Table 3.2** and shown on **Figure 3.1**. In addition to the project site, the areas abutting were opportunistically searched for scheduled species, but no trapping was undertaken.

Weather conditions during the autumn (trapping) survey were mild, though still sufficiently warm for reasonable levels of reptile activity. Conditions were not suitable for substantial frog activity although the project site was subjected to flooding about a month prior.

TABLE 3.2. Terrestrial vertebrate survey transect locations (Datum: GDA, Decimal Degrees)

Transect No.	Location*	
	Latitude	Longitude
1	S22.14736	E148.07668
2	S22.12681	E148.07713
3	S22.14221	E148.06886
4	S22.09525	E148.05691
H1	S22.14598	E148.07425
H2	S22.148961	E148.081555

Note: Locations recorded on Garmin handheld GPS.

3.3.2 Survey Techniques

The following specific techniques were employed during the terrestrial vertebrate survey of the project site (autumn 2008):

Box Traps

A total of 22 Elliot type 'A' traps, two Elliot type 'B' traps, and two large cage traps were set over four nights along three systematic survey transects for the sampling of arboreal/terrestrial mammals.

Traps are placed on the ground (or, occasionally, in trees if habitat is suitable), 5-10 m apart using a variety of baits (rolled oats, peanut butter, oil and vanilla +/- salami or chicken). These traps are cleared each morning in accordance with animal ethics requirements and reset in late afternoon. Trap placement is influenced by vegetation diversity, the size and shape of habitat patches and by naturally occurring features such as logs, rock outcrops, tree bases and clumping vegetation.

A fourth systematic survey site was established on the second survey day, meaning that it was trapped for three, rather than four, nights. The location, a jump-up set within an expanse of intensively grazed land, was not identifiable from RE mapping (as per the usual method for site selection) and was not located until the second day. It was, however, considered appropriate for a systematic survey site.

Pitfall Traps

A pitfall trap line was established adjacent to each systematic survey transect and left open for five days and four nights for the sampling of frogs, reptiles and small mammals. Each line comprised up to four 20 L containers with a 20 m drift fence between the traps. Pitfall traps are cleared early morning and late afternoon in accordance with Animal Ethics requirements.

The fourth systematic site, established on a jump-up, was not pit-trapped due to the nature of its substrate, i.e. a duricrust. At one systematic survey site ant activity within the buckets resulted in partial, and then full, closure of the pitfall line, as dictated by BAAM's animal ethics certification obligations. As such, a total of nine trap nights were completed for the project site rather than the intended sixteen (a trap night = one pitfall trap line open at a site per night). This precaution prevented any trap deaths.

Harp Traps

Harp traps are designed specifically to target microbats (species belonging to the suborder Microchiroptera; typically small, insectivorous bats that use echolocation). The success of harp traps is largely dependent on the availability of suitable locations for microbat activity, usually flights paths routinely used by individual microbats as foraging and/or drinking zones. Systematic survey transects do not necessarily contain flight paths and harp trap installation is often at locations other than those targeted for box and pitfall traps. Harp traps were used where two suitable flight paths were identified (**Section 3.3.1**).

Diurnal Active Searching

This involved intensive investigation of ground layer (under logs, rocks and leaf litter), low vegetation (under bark and in tree stumps) and rock crevices for frogs, reptiles, bats and animal signs (e.g. scats, owl pellets, orts (bird feeding remnants), remains and tracks). Each systematic survey transect (and adjacent habitat) is searched for approximately 30 minutes during the warmer parts of each day.

Diurnal Bird Surveys

Birds were surveyed using a timed transect technique, whereby each systematic survey transect is surveyed for approximately 30 minutes in the early morning by pausing at each fifth box trap for six minutes. Birds were identified from either direct observation or their characteristic vocalisations.

Nocturnal Surveys

A combination of high-powered spotlights and head torches were used to sample nocturnal mammals (flying, arboreal and terrestrial), birds (owls and nightjars), reptiles and frogs. Each systematic survey transect (and adjacent habitat) is searched for a total of up to two hours during the survey period. During the spotlighting, species-specific work was assisted by the use of call playback surveys undertaken for nocturnal birds and nocturnal mammals, as required.

Microbats were also surveyed along each systematic survey transect using an ANABAT II

detector and associated ZCAIM unit. Anabat recording was conducted at each systematic survey site during spotlighting and call playback events.

Anabat recording was also conducted at the two sites targeted for microbats by the use of harp traps (**Section 3.3.1**). The site considered of the higher habitat quality for microbats was sampled throughout one entire night, ensuring sampling of peak nocturnal activity periods.

Targeted Habitat Assessments

Where significant habitat areas exist, but the establishment of systematic survey transects is not possible (e.g. waterbody/wetland) or feasible (e.g. due to the small size of the area or the representation of similar habitat by an already established transect elsewhere in the project site), targeted assessments were undertaken during the survey period to ensure such areas are duly represented within the assessment results. This includes diurnal and nocturnal searching and bird surveys.

Incidental (Opportunistic) Observations

During the survey, fauna observations are continuous and species records are obtained outside of the systematic methodology of the survey. All results were included within the overall species list for the project site.

Throughout all aspects of the survey, special effort was made to confirm the presence or absence of any species of special conservation significance known or considered likely to occur in the area. Where such species were detected, GPS coordinates were recorded for future reference.

Winter 2008 Survey

During the survey of additional areas for specific infrastructure, important ecological features that were evaluated included, but were not limited to:

- Vegetation structure (including age/successional phase), cover (such as canopy connectivity), density, etc;
- Presence or absence of habitat trees;
- Abundance of hollows and other nesting sites;
- Abundance of foraging resources;
- Suitability of microhabitats;
- Quality and type of ground cover;
- Quality and type of aquatic habitats;
- Habitat substrate characteristics;
- Water sources;
- Evidence of clearing, fire, erosion, sedimentation and other disturbances;
- The homogeneity or heterogeneity of habitats; and
- Important habitat linkages.

This was supplemented by targeted diurnal active searching for significant species (or evidence of such) identified as part of the desktop studies, along with opportunistic observations.

3.4 AQUATIC FAUNA SURVEY

Throughout the autumn 2008 survey period, potential aquatic survey locations were assessed. When identified as suitable, standard small fish traps were baited with vegemite and bread and positioned by members of the survey team.

The traps were checked regularly during each day, after which any trapped aquatic vertebrates were identified and released at point of capture.

In terms of aquatic macro invertebrates, replicate sampling points could not be identified due to the ephemeral nature of Cherwell Creek and other creeks and drainage lines identified throughout the project site. Therefore, macro invertebrate sampling and subsequent SIGNAL analysis was not undertaken.

As a result of the general condition and ephemeral nature of Cherwell Creek and other creeks and drainage lines identify throughout the project site, a single sampling location was assessed during autumn. During winter 2008 a second suitable trap site was identified in 4 North Dam, to the west of the existing mining activities and south of the proposed ROM site. The location of these sampling sites is shown on **Figure 3.1** and provided in **Table 3.3**. Sampling site selection was based on an assessment of the environments of each main water body within the project site, taking into account the need to include a variety of microhabitats in the survey.

TABLE 3.3. Aquatic sampling site location (Datum: GDA, Decimal Degrees)

Site No.	Location*	
	Latitude	Longitude
1	S22.155475	E148.094166
2	S22.222217	E148.159288

* Note: Locations recorded on Garmin handheld GPS.

As noted for the winter 2008 terrestrial vertebrate survey, the assessment of aquatic fauna undertaken during the winter survey of additional areas for specific infrastructure was generally limited (with the exception of the opportunistic establishment of a second fish trapping site) to an evaluation of important habitat features, including vegetation, foraging resources, microhabitats, substrate, variability and complexity, as well as any notable disturbances.

3.5 IMPACT ASSESSMENT

An assessment of potential short term, long term, direct and indirect ecological impacts from the Project, and necessary strategies for their avoidance, mitigation or (in the case of positive impacts) enhancement was undertaken in accordance with the draft Bowen Basin Coal Growth Project Terms of Reference (9 August 2008). Particular focus was placed on:

- Potential impacts from the clearing, salvaging or removal of vegetation and the indirect effects on vegetation not cleared, as well as the potential environmental harm on flora and fauna of any alterations to the local surface and ground water environment, particularly on riparian vegetation or other sensitive vegetation communities;
- Measures to protect and/or enhance, or mitigate and/or offset the environmental harm to, habitat or the inhibition of ecological processes, particularly strategies for protecting significant species and communities and associated habitat and preventing or minimising the inhibition of normal movement, propagation or feeding patterns, and change to food chains. This includes the re-establishment of Regional Ecosystems and rehabilitation of disturbed areas using local provenance native species and provision of nest hollows and ground litter, where appropriate;
- Strategies for controlling the spread or introduction of weeds and feral animal species; and
- Any specific obligations imposed by Local, State or Commonwealth legislation, including a specific assessment of impacts on Matters of National Environmental Significance (MNES) under the EPBC Act, in accordance with DEWHA's Significant Impact Guidelines.

It was also understood that any departure from 'no net loss of ecological values' should be described, and that consideration should be given to securing other areas of endangered ecosystems of State and regional significance if disturbed Regional Ecosystems cannot be re-established.

Further details on the impact assessment methodology are provided in **Section 5.0**.

4.0 BASELINE ASSESSMENT RESULTS

4.1 BIODIVERSITY PLANNING ASSESSMENT

The project site is located within the Brigalow Belt North (BBN) bioregion. For those criteria relating to the project site, mapping results (BPA Version 1.2) (EPA 2003a,b) are provided in **Table 4.1** together with a description of the mapping, the value allocated and the areas to which they are relevant. Maps produced as part of the assessment of the BPA are provided in **Appendix 8**.

Table 4.1: BPA Results and Expert Panel Information (EPA 2003a,b)

Criteria	Description of Mapping	Mapping Value	Area affected by the mapping
A Rating Habitat for EVR Taxa	This criterion clarifies areas according to their significance based on the presences of Endangered, Vulnerable and/or Rare (EVR) Taxa. These taxa are protected under the provisions of the NC Act 1992 and/or the EPBC Act 1999.	Low	All REs on site
B1 Rating State Ecosystem Value	This criterion is based on the Biodiversity status of each RE, or the presence of intertidal or nationally important wetlands or the presence of poorly conserved REs.	Very High	Endangered REs – Associated with Brigalow woodland on the flood plain of Cherwell Creek and its tributaries in the central portion of the site, and Harrow Creek in the southern portion of the site
		High	Of Concern REs – associated with Cherwell Creek in the central portion of the site, and with the Bluegrass (*Dichanthium* spp.) dominant grassland in the central north of the site
		Medium	Not of Concern REs or Subdominant Endangered or Of Concern REs – northern, central and southern portions of the site
B2 Rating Regional Ecosystem Value	This criterion primarily classifies Remnant units according to their biodiversity status as determined for a particular bioregion.	High	Central and southern portions of the site
		Medium	Poorly conserved REs within the BBN bioregion – most REs on the site
C Rating Tract Size	The size of any tract is a major indicator of ecological significance, and is also strongly correlated with the long-term viability of biodiversity values. Larger tracts are less susceptible to ecological edge effects and are more likely to sustain viable populations of native flora and fauna than smaller tracts.	Low	Bluegrass (*Dichanthium* spp.) dominant grassland in the central north of the site
		High	All REs located in the central and southern portions of the site
E Rating Condition	The quality of remnant units is judged by the extent to which each resembles its natural condition. In the absence of a consistent assessment of vegetation condition across a bioregion, REs mapped by the Queensland Herbarium are taken to represent areas of vegetation in their natural state.	Very High	All mapped REs within the site
F Rating Ecosystem Diversity	Rated using Simpson's Diversity Index – a measure that incorporates both species richness (number) and evenness (relative abundance).	Very High	A Simpson's Diversity index of greater than 75% - REs associated with Cherwell and Harrow Creeks
		High	A Simpson's Diversity index between 50% and 75% - Woodlands in the central northern, south eastern and southern portions of the site
		Medium	A Simpson's Diversity index between 25% to 50% - REs in northern and central portions of the site

Criteria	Description of Mapping	Mapping Value	Area affected by the mapping
G Rating Context and Connection	Connected remnant units are more representative of biodiversity, contribute more to a habitat network and have greater resilience to the effects of disturbance than small isolated remnants.	Very High	REs that adjoin other REs along 75% of their perimeter or borders a water body or waterway – northern, central and southern portions of the site
		High	REs that adjoin other REs along 50% to 70% of their perimeter or borders a water body or waterway – northern, central and southern portions of the site
		Medium	REs that adjoin other REs less than 50% of their perimeter or borders a water body or waterway – northern, central and southern portions of the site
Bio_Sig Biodiversity Significance	The Biodiversity Significance rating of REs as to their State, Regional or Local significance is based on a combination of results from the diagnostic criteria.	State	Central and southern portions of the site
		Regional	Northern and central portions of the site
		Local	Northern, central and southern portions of the site

4.2 FLORA RESULTS

4.2.1 Desk Top

Regional Context

The project site is situated in the Queensland Pastoral District of Leichhardt within the Isaac - Comet Downs subregion of the BBN bioregion. It is described as a largely undulating 'sub-region' dominated by Tertiary and other Cainozoic deposits. Where they have not been cleared, tablelands and dissected remnants of the upper Tertiary surfaces carry Narrow-leaved Ironbark (*Eucalyptus crebra*) woodland on the earths of undulating plateaus, and Bendee Wattle (*Acacia catenulate*) or Lancewood (*A. shirleyi*) on the rocky hills and mesas. The lower parts of the Tertiary surface are dominated by Brigalow and Dawson Gum communities on undulating clay or texture contrast soils, although these lower areas have been subject to broad scale clearing, and less than 10% of the original vegetation cover remains (EPA 2005).

Typically, the alluvial soils carry Brigalow or Coolabah (*Eucalyptus coolabah)* woodlands. Fine-grained Permian sediments are exposed in some areas, giving rise to grasslands, open woodlands and areas of Brigalow.

Database Searches

A search of the Queensland Herbarium's records (EPA 2008a) indicate that one terrestrial plant species of special conservation significance, *Bertya pedicellata* (a shrub with no common name listed as Rare under the NC Act), occurs within the locality of the project site.

The EPBC Act Online Protected Matters Search Tool results indicate that two ecological communities and two species of special conservation significance may occur within the vicinity of the project site, as follows:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) communities - Endangered EPBC Act;
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* – Endangered EPBC Act;
- *Dichanthium queenslandicum* King Blue-grass - Vulnerable EPBC Act, Vulnerable NC Act; and
- *Digitaria porrecta* Finger Panic Grass - Endangered EPBC Act, Rare NC Act.

*Note: this recently designated community was formally encompassed within the Bluegrass (*Dichanthium* spp.) dominant grasslands of the Brigalow Belt bioregions (North and South) community, which is no longer recognised under the EPBC Act.

A previous ecological assessment undertaken for the Peak Downs mining lease (including southern sections of the current project site) by Ecoserve and LAMR (2005) also indicated that, although not recorded during surveys, King Blue-grass and Queensland Blue-grass *Dichanthium setosum* (Vulnerable EPBC Act, Rare NC Act) both have a "reasonable probability of occurrence on the site in either Regional Ecosystems 11.8.5 or 11.8.11."

Mapped Remnant Vegetation and Essential Habitat

The existing 1:100,000 NRW certified RE mapping (EPA 2008b) for the project site (**Figure 4.1**) obtained from the EPA (sourced on-line) indicates that twelve REs are currently mapped as occurring within the project site, as listed in **Table 4.2**. The REs mapped are contained within both homogeneous and heterogeneous polygons. Six of these REs have a Not of Concern management status, three have an Of Concern management status and three have an Endangered management status under the provisions of the VM Act, and five of the REs are analogous to ecological communities listed as Endangered under the EPBC Act.

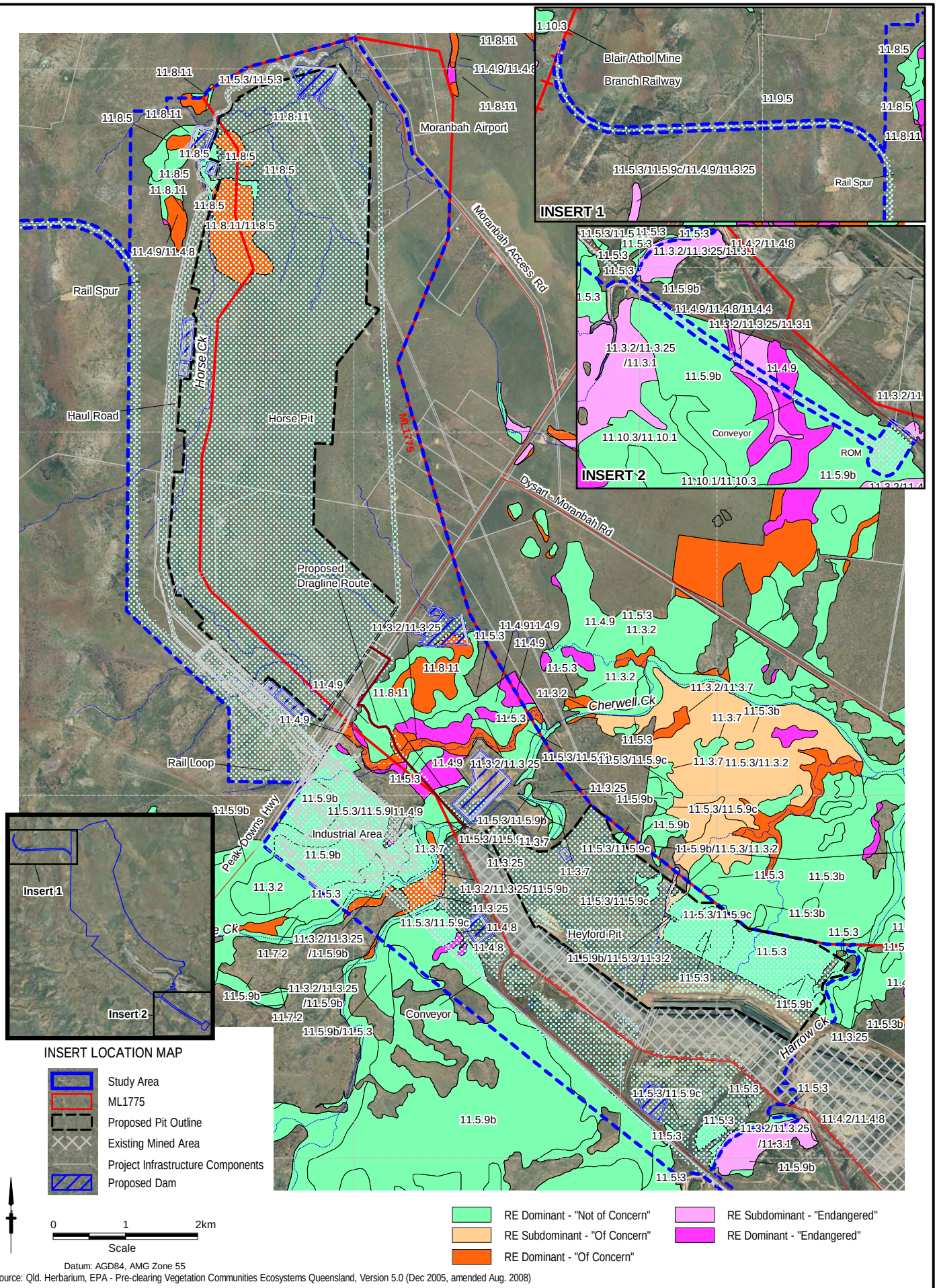
The RE mapping also indicates that the project site supports no areas designated as Essential Habitat for species listed as threatened under the provisions of the NC Act.

Table 4.2. Regional Ecosystems (REs) within the project site identified on the current 1:100,000 RE map

Regional Ecosystem[1]	Management Status	Description (REDD[2])
11.3.1	Endangered (VM Act and EPBC Act)	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains
11.3.2	Of Concern (VM Act)	*Eucalyptus populnea* woodland on alluvial plains
11.3.25	Not Of Concern (VM Act)	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines
11.3.7	Not Of Concern (VM Act)	*Corymbia* spp. woodland on alluvial plains sandy soils
11.4.2	Of Concern (VM Act),	*Eucalyptus* spp. and/or *Corymbia* spp. grassy or shrubby woodland on Cainozoic clay plains
11.4.4	Not Of Concern (VM Act) Endangered (EPBC Act)	*Dichanthium spp*., *Astrebla spp*. grassland on Cainozoic clay plains
11.4.8	Endangered (VM Act and EPBC Act)	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains
11.4.9	Endangered (VM Act and EPBC Act)	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains
11.5.3	Not Of Concern (VM Act)	*Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces
11.5.9	Not Of Concern (VM Act)	*Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains/remnant surfaces
11.8.5	Not Of Concern (VM Act)	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks
11.8.11	Of Concern (VM Act), Endangered (EPBC Act)	*Dichanthium sericeum* grassland on Cainozoic igneous rocks

[1] An additional RE (11.9.5) (listed as Endangered under the provisions of the VM Act) was recorded during the current ground-truthing exercise (**Table 4.3**). This community is analogous to the Nationally listed (Endangered under the provisions of the EPBC Act) Brigalow (*Acacia harpophylla* dominant and co-dominant) communities and is discussed in **Section 4.2.4**.

[2] REDD = EPA's Regional Ecosystem Description Database v5.0.



Source: Qld. Herbarium, EPA - Pre-clearing Vegetation Communities Ecosystems Queensland, Version 5.0 (Dec 2005, amended Aug. 2008)

Client: URS

Biodiversity Assessment and Management Pty Ltd

Project: ECOLOGICAL ASSESSMENT - CAVAL RIDGE COAL MINE PROJECT

Title: **CURRENT NRW CERTIFIED REGIONAL ECOSYSTEM MAP FOR THE STUDY AREA**

Drawn: VH	Approved: BAAM	Date: 05-03-2009	Figure: **4.1**	Rev:E
Job No: **4262 6158**	File No: 42626158-g-125e.wor			**A4**

4.2.2 Recorded Flora Communities

Nineteen distinct vegetation communities were identified within the project site, as shown on **Figure 4.2**. Fourteen of these communities are currently mapped as remnant under the provisions of the VM Act and an additional community (vegetation community 14) is analogous to RE 11.9.5. A description of each vegetation community and a photographic representation is provided in **Table 4.3**.

Figure 4.2a shows the ground-truthed vegetation communities in relation to existing Surface Area Approvals under the *Mineral Resources Act 1989*. These are discussed further in **Section 5.1.1**.

Vegetation communities show some deviation from the current NRW certified RE mapping for the area. Of particular note is the absence of community 4 (south of Cherwell Creek) and community 14 from the RE Mapping. Revised RE mapping of the project site is shown on **Figure 4.3**.

4.2.3 Recorded Flora Species

A total of 176 flora species were recorded of which 157 (89.2%) were native and 19 (10.8%) were exotic. The complete list of flora species recorded during the vegetation survey is provided in **Appendix 3**. This list includes species recorded during formal survey transects, as well as incidental records from across the project site.

4.2.4 Species/Communities of Special Conservation Significance

No flora species listed as significant under the provisions of the NC Act and/or the EPBC Act was recorded within the project site. However, the following two ecological communities listed as Endangered under the provisions of the EPBC Act were recorded on site:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) communities - (analogous to REs 11.4.8, 11.4.9 and 11.9.5).
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin – (analogous to RE 11.8.11).

These communities are analogous to Vegetation Communities 2 (Natural Grassland), 4 (Brigalow), 14 (Brigalow), 16 (Brigalow) and 18 (Brigalow) and their distribution on site is indicated on **Figure 4.4**.

4.2.5 Declared Weeds

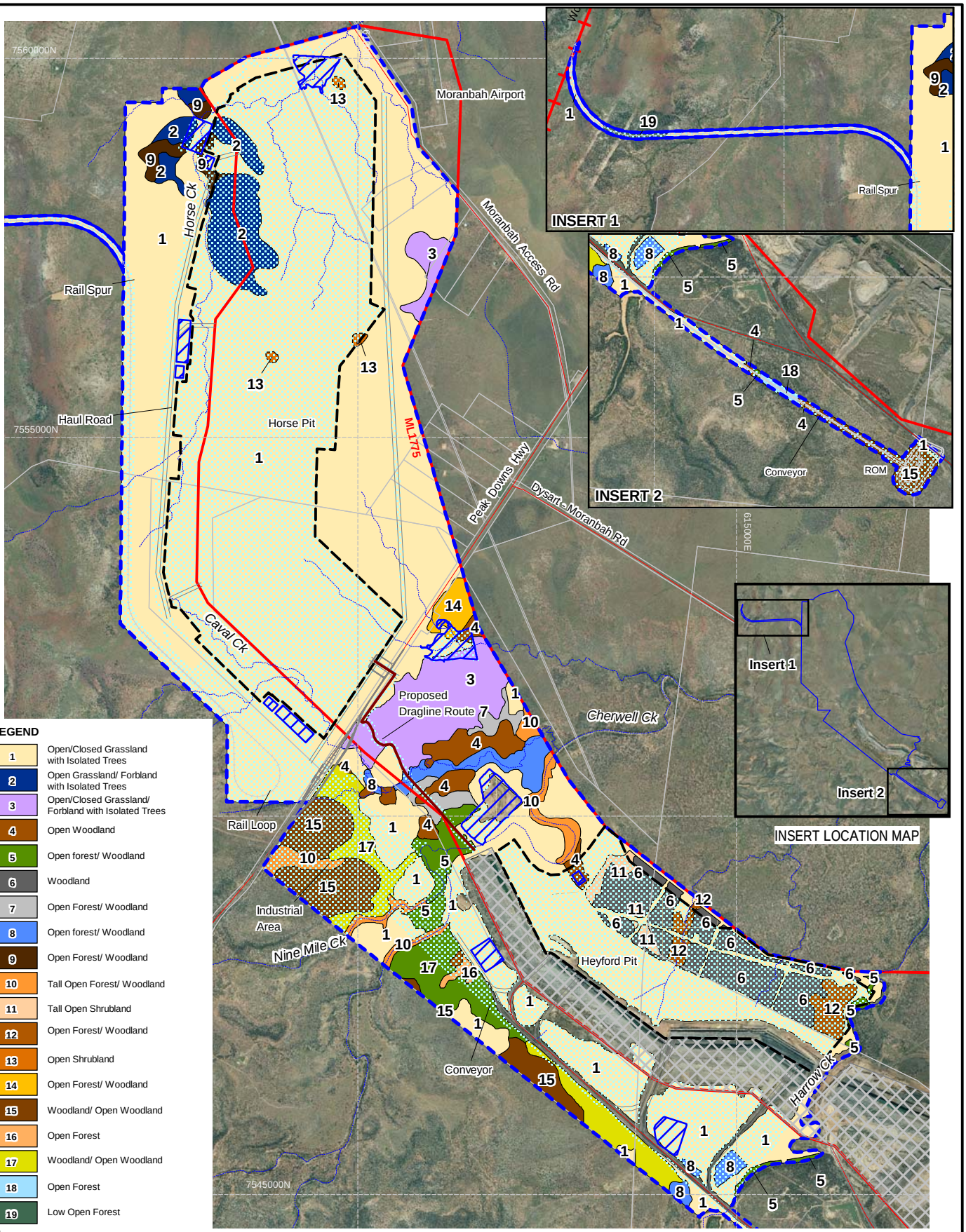
Five flora species listed as significant under the provisions of the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) were recorded from the project site, as follows:

- Lantana (*Lantana camara*);
- Mother of Millions (*Bryophyllum delagoense*);
- Harrisia Cactus (*Eriocereus martini*);
- Velvet Tree-pear (*Opuntia tomentose*); and
- Parthenium (*Parthenium hysterophorus*).

Lantana is currently listed as a Class 3 weed and the remaining species are listed as Class 2 weeds under the provisions of the LP Act.

Under the LP Act, a Class 2 weed is one that has already spread over substantial areas of Queensland, but its impact is so serious that control of the species is required to avoid further spread of the species onto properties that are not infested. By law, all landholders must try to keep their properties free of Class 2 weeds.

Of these species, Harrisia Cactus, Mother of Millions and Velvet Tree-pear were distributed throughout the entire site, particularly within Vegetation Communities 1 and 7 (**Figure 4.2**). Conversely, Parthenium was generally restricted to areas overlying basalt and therefore was generally restricted to Vegetation Communities 2 and 3 (**Figure 4.2**). Infestation of Parthenium within these areas was very high, resulting in suppression of native species, particularly grasses.



LEGEND

1	Open/Closed Grassland with Isolated Trees
2	Open Grassland/ Forbland with Isolated Trees
3	Open/Closed Grassland/ Forbland with Isolated Trees
4	Open Woodland
5	Open forest/ Woodland
6	Woodland
7	Open Forest/ Woodland
8	Open forest/ Woodland
9	Open Forest/ Woodland
10	Tall Open Forest/ Woodland
11	Tall Open Shrubland
12	Open Forest/ Woodland
13	Open Shrubland
14	Open Forest/ Woodland
15	Woodland/ Open Woodland
16	Open Forest
17	Woodland/ Open Woodland
18	Open Forest
19	Low Open Forest

0 1 2km

Scale

Datum: AGD84, AMG Zone 55

Source: Client Supplied Data

Study Area

ML1775

Proposed Pit Outline

Existing Mined Area

Project Infrastructure Components

Proposed Area of Clearing

Proposed Dam

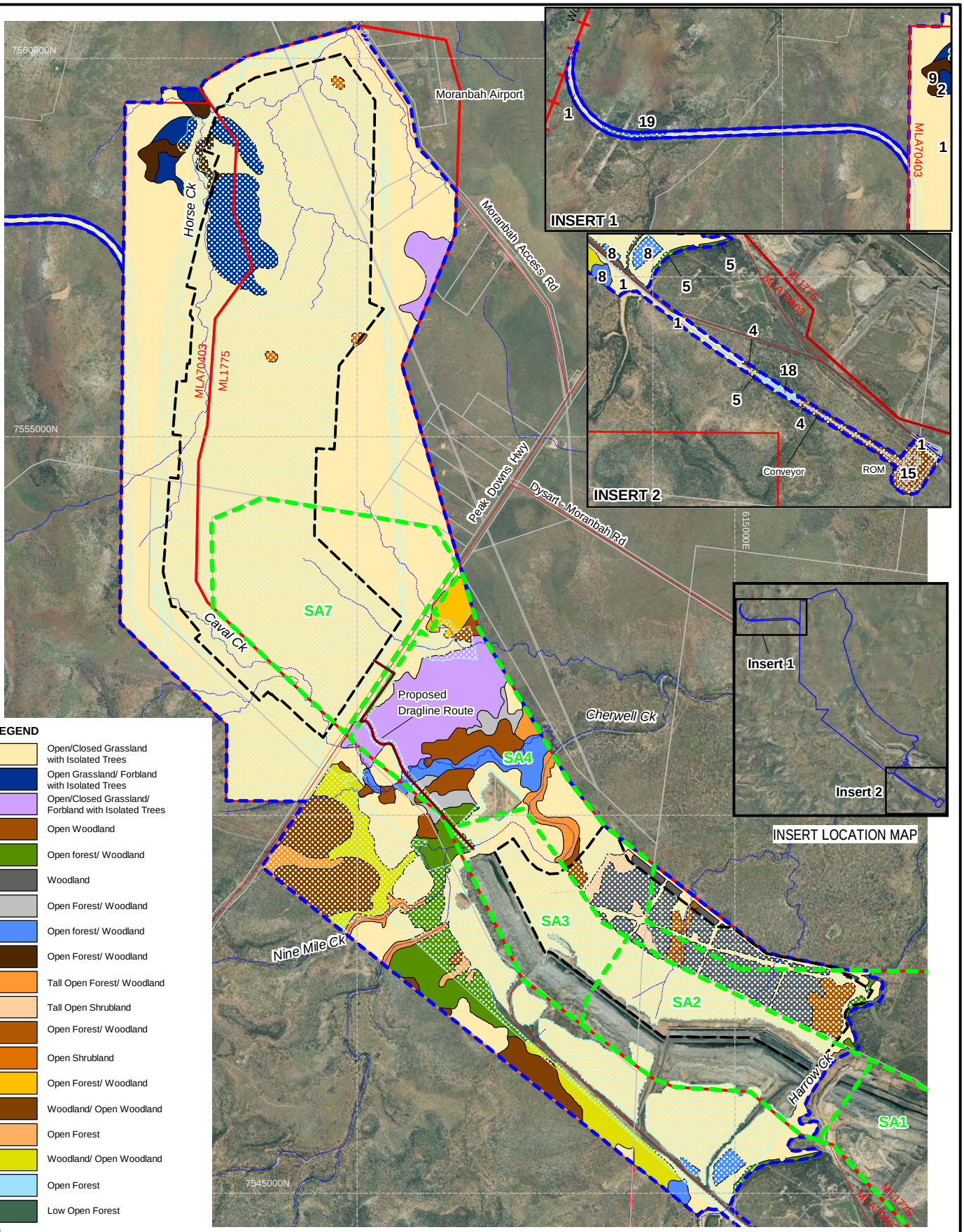
Client: URS

Biodiversity Assessment and Management Pty Ltd

Project: ECOLOGICAL ASSESSMENT - CAVAL RIDGE COAL MINE PROJECT

Title: **GROUND-TRUTHED VEGETATION MAP OF THE STUDY AREA**

Drawn: VH	Approved: BAAM	Date: 05-03-2009	Figure: **4.2**
Job No: **4262 6158**	File No: 42626158-g-126e.wor		Rev:E A4



Source: Client Supplied Data

Client: URS

Biodiversity Assessment AND MANAGEMENT PTY LTD

Project: ECOLOGICAL ASSESSMENT - CAVAL RIDGE COAL MINE PROJECT

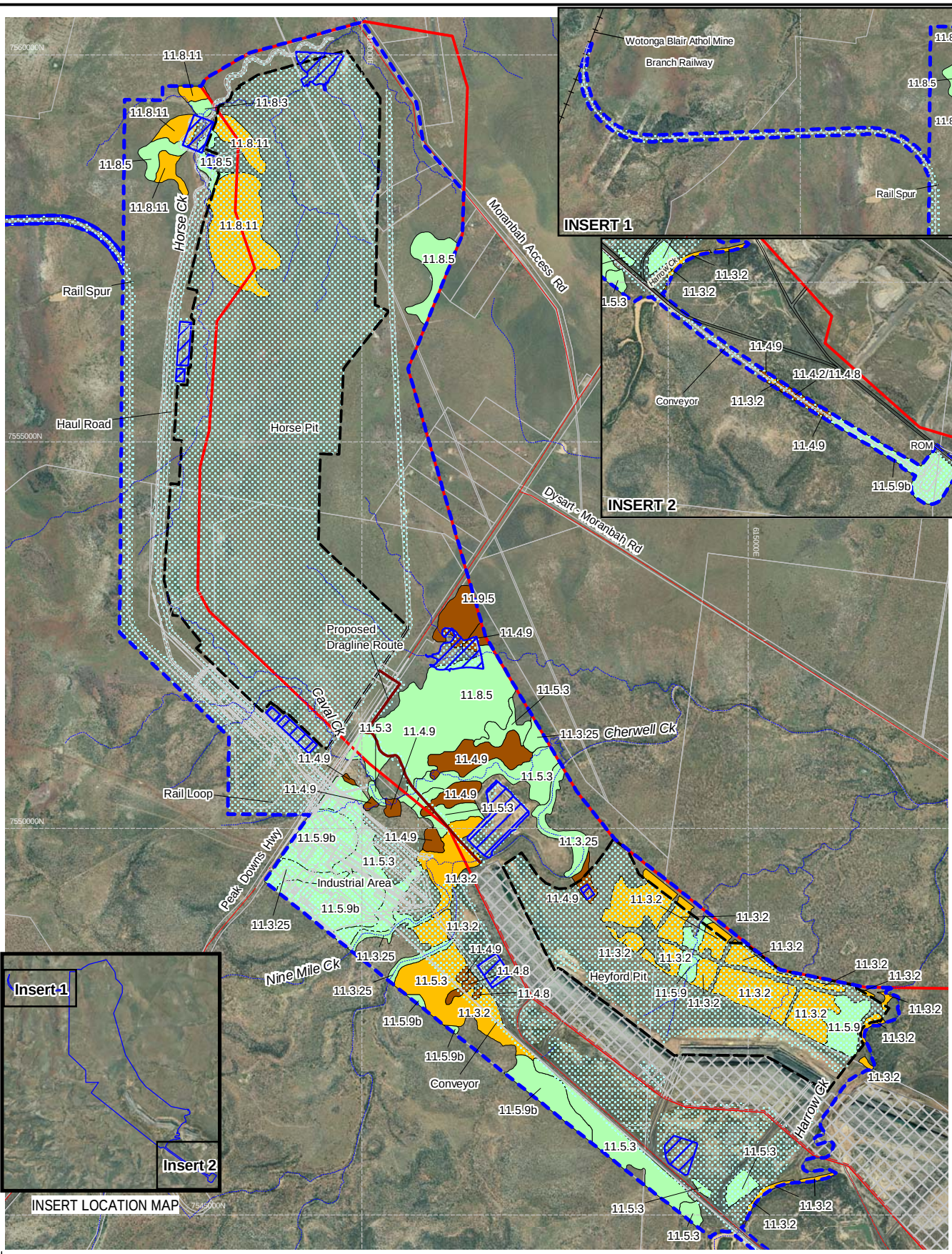
Title: **GROUND-TRUTHED VEGETATION MAP OF THE STUDY AREA (INCLUDING EXISTING pre2000 SURFACE AREA APPLICATIONS)**

Drawn: VH	Approved: BAAM	Date: 23-02-2009
Job No: **4262 6158**	File No: 42626158-g-177.wor	

Figure: **4.2a**

Rev:A

A4



Source: BAAM, Sept 2008.

Client	Project	Title
URS	ECOLOGICAL ASSESSMENT - CAVAL RIDGE COAL MINE PROJECT	**GROUND-TRUTHED REGIONAL ECOSYSTEM MAP**
Biodiversity Assessment AND MANAGEMENT PTY LTD		

Drawn: VH	Approved: BAAM	Date: 05-03-2009	Figure: **4.3**	Rev:E
Job No: **4262 6158**	File No: 42626158-g-128e.wor			**A4**

Table 4.3. Vegetation communities recorded across the project site

Vegetation Community	Description	Analogous RE and Management Status	Dominant Species	Site Photograph
1	Open/Closed Grassland with Isolated Trees (Height 0.5- 1.5 m)	Non-remnant *N/A*	Canopy / Mid-stratum: *Atalaya hemiglauca, Eremophila mitchellii, Leucaena leucocephala, Lysiphyllum carronii* Ground Stratum: *Pennisetum ciliare, Erioceris martinii*	
2	Open Grassland/ Forbland with Isolated Trees (Height: 0.2 – 1.0 m)	RE 11.8.11 *Of Concern* (VM Act) Analogous to Nationally Endangered Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (EPBC Act)	Canopy / Mid-stratum: *Absent* Ground Stratum: *Parthenium hysterophorus, Iseilema vaginiflorum, Salsola kali, Neptunia* sp., *Hibiscus meraukensis, Panicum decompositum, Indigofera linifolia, Sida acuta, Enneapogon pallidus*	
3	Open/Closed Grassland/ Forbland with Isolated Trees (Height: 0.5 -12 m)	RE 11.8.5 *Not of Concern* (VM Act) Note: portions currently mapped by the EPA as RE 11.8.11 (*Of Concern* - VM Act)	Canopy / Mid-stratum: *Eucalyptus orgadophila, Atalaya hemiglauca, Corymbia erythrophloia* Ground Stratum: *Dactyloctenium radulans, Dichanthium sericeum, Iseilema vaginiflorum, Parthenium hysterophorus*	

Vegetation Community	Description	Analogous RE and Management Status	Dominant Species	Site Photograph
4	Open Woodland (Height 8-14 m)	RE 11.4.9 *Endangered* (VM Act) Analogous to Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community (EPBC Act)	Canopy / Mid-stratum: *Acacia harpophylla, Eucalyptus populnea, Canthium buxifolia, Eremophila mitchellii, Citriobatus spinescens* Ground Stratum: *Pennisetum ciliare, Melinis repens, Sida subspicata, Sida fibulifera, Sida rohlenae*	
5	Open forest/ Woodland (Height: 15-18 m)	RE 11.3.2 *Of Concern* (VM Act)	Canopy / Mid-stratum: *Eucalyptus populnea, Corymbia clarksoniana, Acacia salicina, Alphitonia excelsa, Capparis lasiantha* Ground Stratum: *Pennisetum ciliare, Themeda triandra, Sida cordifolia, Melinis repens, Sida spinosa, Sida subspicata, Eremophila debilis, Phyllanthus virgatus*	
6	Woodland (Height: 15-18 m)	RE 11.3.2 *Of Concern* (VM Act)	Canopy / Mid-stratum: *Eucalyptus populnea, Atalaya hemiglauca, Cassia brewsteri, Maytenus cunning, Ehretia membranifolia, Grevillea striata* Ground Stratum: *Pennisetum ciliare, Archidendropsis basaltica, Sida species, Erioceris martinii, Themeda triandra*	

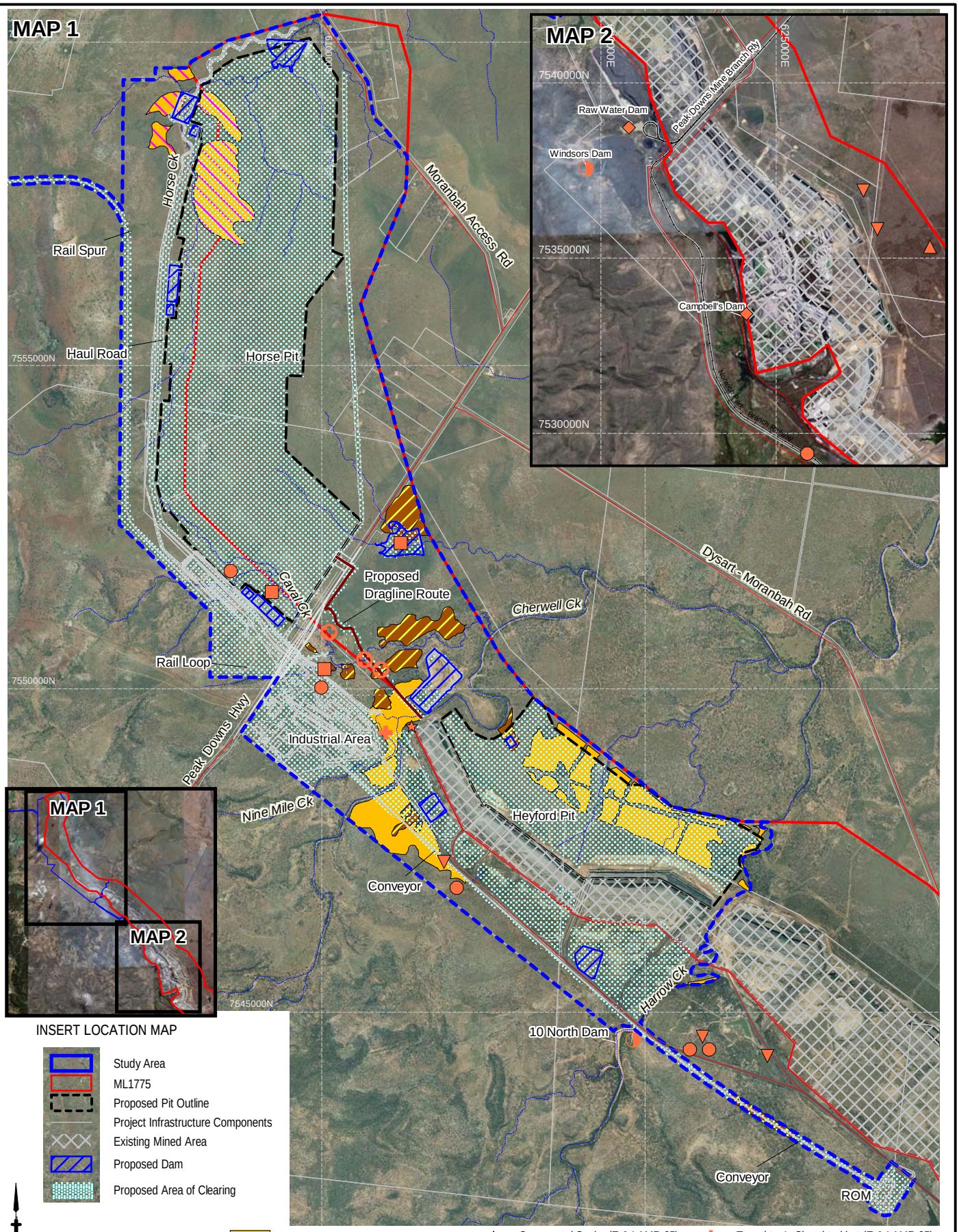
Vegetation Community	Description	Analogous RE and Management Status	Dominant Species	Site Photograph
7	Open Forest/ Woodland (Height: 18-25 m)	RE 11.5.3 *Not of Concern* (VM Act)	Canopy / Mid-stratum: *Eucalyptus cambageana, Eucalyptus populnea, Acacia salicina, Acacia harpophylla, Eremophila mitchellii, Flindersia dissosperma Canthium buxifolium, Dodonaea viscosa, Carissa ovata, Breynia oblongifolia* Ground Stratum: *Aristida gracilis, Enteropogon unispiceus, Ancistrachne uncinulata, Bothriochloa decipiens, Cymbopogon refractus, Melinis repens*	
8		RE 11.5.3 *Not of Concern* (VM Act)	Canopy / Mid-stratum: *Eucalyptus populnea, Corymbia clarksoniana, Eucalyptus tereticornis* Ground Stratum: *Pennisetum ciliare*	
9	Open Forest/ Woodland (Height: 15-18 m)	RE 11.8.5 *Not of Concern* (VM Act)	Canopy / Mid-stratum *Eucalyptus orgadophila, Atalaya hemiglauca, Corymbia erythrophloia* Ground Stratum: *Dactyloctenium radulans, Dichanthium sericeum, Iseilema vaginiflorum, Parthenium hysterophorus*	*No Photograph available*

Vegetation Community	Description	Analogous RE and Management Status	Dominant Species	Site Photograph
10	Tall Open Forest/ Woodland (Height: 25-30 m)	RE 11.3.25 *Not of Concern* (VM Act)	Canopy / Mid-stratum: *Eucalyptus tereticornis, Corymbia tessellaris, Acacia salicina, Lysiphyllum hookeri* Ground Stratum: *Megathyrsus maximum*, *Pennisetum ciliare, Grewia retusifolia, Sida cordifolia*	
11	Tall Open Shrubland (Height: 6-8 m)	Non-remnant *N/A*	Canopy / Mid-stratum: *Terminalia oblongata, Atalaya hemiglauca, Acacia harpophylla, Citriobatus spinescens, Acacia salicina* Ground Stratum: *Pennisetum ciliare*	
12 (site 14)	Open Forest/ Woodland (Height: 15-18 m)	RE 11.5.9 *Not of Concern* (VM Act)	Canopy / Mid-stratum: *Eucalyptus crebra, Eucalyptus melanophloia, Corymbia citriodora, Corymbia clarksoniana, Corymbia dallachiana* Ground Stratum: *Pennisetum ciliare*	

Vegetation Community	Description	Analogous RE and Management Status	Dominant Species	Site Photograph
13	Open Shrubland (Height: 1-8 m)	Non-remnant *N/A*	Canopy / Mid-stratum: *Acacia burrowii, Alphitonia excelsa, Erythroxylon australe, Jasminum racemosum, Cassia brewsteri, Clerodendron floribunda, Eucalyptus thozetiana* Ground Stratum*: Aristida calycina, Aristida caput-medusae, Portulaca oleracea, Sida subspicata*	
14	Open Forest/ Woodland (Height: 4-6 m)	RE 11.9.5 *Endangered* (VM Act) and analogous to the Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community (EPBC Act) Note: currently mapped by the EPA as Non-remnant	Canopy / Mid-stratum: *Acacia harpophylla, Terminalia oblongata, Alectryon diversifolia, Owenia acidula, Sesbania cannabina, Diplocyclos palmatus* Ground Stratum: *Pennisetum ciliare, Melinis repens Parthenium hysterophorus, Eriocereus martinii, Sida spinosa, Desmodium sp., Glycine sp., Echinochloa colona, Dactyloctenium radulans*	
15	Woodland/ Open Woodland (Height: 15-18 m)	RE 11.5.9b *Not of Concern* (VM Act)	Canopy / Mid-stratum: *Corymbia clarksoniana, Eucalyptus crebra, Petalostigma pubescence, Acacia sparsiflora, Grevillea parralella* Ground Stratum: *Melinis repens, Eragrostis brownii, Aristida calycina, Sida subspicata*	

Vegetation Community	Description	Analogous RE and Management Status	Dominant Species	Site Photograph
16	Open Forest (Height 8-14 m)	RE 11.4.8 *Endangered* (VM Act) Analogous to Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community (EPBC Act)	Canopy / Mid-stratum: *Eucalyptus cambageana, Acacia harpophylla, Carissa ovata, Geijera parviflora* Ground Stratum: *Pennisetum ciliare, Parthenium hysterophorus, Sida cordifolia*	
17	Woodland/ Open Woodland (Height 14-23 m)	RE 11.5.3 *Not of Concern* (VM Act)	Canopy / Mid-stratum*: Eucalyptus populnea, Eucalyptus melanophloia, Corymbia clarksoniana, Corymbia dallachiana, Eucalyptus crebra, Eremophilia michellii, Geijera parviflora, Archidendropsis basaltica* Ground Stratum *Pennisetum ciliare, Melinis repens, Eragrostis brownii, Aristida calycina, Sida subspicata, Grewia retusifolia, Sida cordifolia*	
18		11.4.2 / 11.4.8 *Of Concern / Endangered* (VM Act) RE 11.4.8 is analogous to the Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community (EPBC Act)	Canopy / Mid-stratum: *Eucalyptus populnea, Eucalyptus melanophloia, Corymbia dallachiana, Corymbia tessellaris, Eucalyptus crebra, Eucalyptus platyphylla, Carissa ovata* Ground Stratum: *Pennisetum ciliare, Melinis repens, Eragrostis brownii*	*No Photograph available*

Vegetation Community	Description	Analogous RE and Management Status	Dominant Species	Site Photograph
19	Low Open Forest (Height 3-6 m)	Non-remnant *N/A*	Canopy / Mid-stratum *Acacia shirleyi, Dodonaea lanceolata* Ground Stratum: *Arastida caput-medusae, Arastida calycina*	



Client: URS

Biodiversity Assessment and Management Pty Ltd

Project: ECOLOGICAL ASSESSMENT - CAVAL RIDGE COAL MINE PROJECT

Title: **LOCATION OF SIGNIFICANT COMMUNITIES AND EVR SPECIES WITHIN AND AROUND THE STUDY AREA**

Drawn: VH	Approved: BAAM	Date: 31-03-2009	Figure: **4.4**	Rev:G
Job No: **4262 6158**	File No: 42626158-g-127g.wor			**A4**

4.3 TERRESTRIAL VERTEBRATE RESULTS

4.3.1 Database Searches

Species records obtained from the EPA WildNet database (EPA 2008a), Birds Australia Atlas database, Queensland Museum database, and EPBC Online Protected Matters Search Tool are provided in **Appendix 2**. These searches are based on a larger area than the project site to capture as many records as possible for the local area.

Species of special conservation significance obtained from the database searches but not detected during the current survey, or in earlier surveys, are detailed in **Appendix 5**. It should be noted that database records are unlikely to have been obtained from the actual project site and, following the field-based site assessment and consideration of the habitats present within the project site and the known ranges of the terrestrial vertebrates (see 'Comments' in **Appendix 5**), only some of those species listed are considered likely to occur. These are discussed in further detail in **Sections 4.3.3 – 4.3.6**.

Database records listed in **Appendix 2** are provided using the nomenclature of the source. There is a lack of uniformity in nomenclature across the organisations that maintain the databases. In an effort to simplify nomenclature this report follows the CSIRO List of Australian Vertebrates (Clayton *et al*. 2006) as it provides a single point of reference for all terrestrial vertebrate groups. Any notable variations in common and/or scientific names of conservation significant species are identified in the text and where taxonomic revision affects the conservation status of a species the possible consequences are addressed within the species profiles provided.

4.3.2 Recorded Terrestrial Vertebrate Species

All terrestrial vertebrate species recorded during the surveys are listed in **Appendix 4**. In total, 153 terrestrial vertebrate species were recorded from the project site or nearby, including 20 species of mammal, 113 birds, 10 reptiles and 10 amphibians (**Table 4.4**).

Appendix 4 also includes the results of previous surveys undertaken on the Peak Downs mining lease, including southern sections of the current project site (**Section 3.1**), which indicate that an additional 136 terrestrial vertebrate species also occur, resulting in an overall total of up to 289 terrestrial vertebrate species for the project site and surrounds (**Table 4.4**).

Table 4.4. Terrestrial vertebrate species diversity from survey

Site	Number of Species Recorded				Total[1]
	Mammals	Birds	Reptiles	Amphibians	
1	4	21	4	4	**33**
2	2	18	6	4	**32**
3	4	21	0	4	**29**
4	3	14	0	1	**18**
H1	5	13	0	0	**19**
H2	3	0	0	0	**3**
Incidental	5	69	3	3	**80**
TOTAL Diversity (2008 surveys)	**20**	**113**	**10**	**10**	**153**
Previous Surveys[2]	44	176	42	16	**278**
TOTAL Diversity (all surveys)	**46**	**182**	**45**	**16**	**289**

Note:

1. Totals for specific sites and surveys may include a number of the same species as those for other sites and surveys. As such, totals for the 'current survey' and 'all surveys' are derived from the summation of adjacent cells within the same row, not the summation of totals in preceding rows. Incidental records refer only to species not recorded from a formal survey site.
2. Includes data from reports cited in **Section 3.1**, which may or may not have been recorded on the current project site.

The majority of the terrestrial vertebrate species recorded from the current and previous surveys are currently listed in Queensland's NC Act as 'Least Concern' wildlife (i.e. native animals that are not currently listed as 'Presumed Extinct, Endangered, Vulnerable or Rare', although are still prescribed as protected wildlife). However, 20 are recognised as species of special conservation significance under the Commonwealth (EPBC Act) and/or Queensland Government (NC Act) legislations, as listed in **Table 4.5**.

The location(s) of EVR species recorded during the current and previous surveys are shown on **Figure 4.4**.

All of the species listed in **Table 4.5** are discussed further in **Sections 4.3.3** and **4.3.4**.

TABLE 4.5. Terrestrial vertebrate species of special conservation significance detected within the project site and surrounds during the 2008 and previous surveys[1]

Zoological Name	Common Name	2008 Survey Record	Previous Survey Record	NC Act Status	EPBC Act Status
Reptiles					
Denisonia maculata	Ornamental Snake		X	V	V
Birds					
Nettapus coromandelianus albipennis	(Australian) Cotton Pygmy-goose		X	R	M
Ardea alba	Great Egret	X	X	S	M
Haliaeetus leucogaster	White-bellied Sea-Eagle		X	S	M
Tringa stagnatilis	Marsh Sandpiper		X	S	M
Actitis hypoleucos	Common Sandpiper		X	S	M
Calidris ruficollis	Red-necked Stint		X	S	M
Calidris acuminata	Sharp-tailed Sandpiper		X	S	M
Sterna caspia	Caspian Tern		X	S	M
Geophaps scripta scripta	Squatter Pigeon (southern subspecies)	X	X	V	V
Hirundapus caudacutus	White-throated Needletail		X	S	M
Apus pacificus	Fork-tailed Swift		X	S	M
Merops ornatus	Rainbow Bee-eater	X	X	S	M
Rhipidura rufifrons	Rufous Fantail		X	S	M
Myiagra cyanoleuca	Satin Flycatcher		X	S	M
Acrocephalus australis	Australian Reed-Warbler	X	X	S	M
Mammals					
Tachyglossus aculeatus	Short-beaked Echidna	X	X	CS	
Phascolarctos cinereus	Koala		X	CS	
Taphozous troughtoni	Troughton's Sheathtail-bat		X	E	
Chalinolobus picatus	Little Pied Bat	X	X	R	

Note:
1. Special Status abbreviations are as follows:
   - **Queensland's *Nature Conservation Act 1992* (NC Act Status)**: **E** = Endangered, **V** = Vulnerable, **R** = Rare, **S** = Special Least Concern (Migratory), **CS** = Special Cultural Significance, **C** = Least Concern wildlife.
   - **Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act Status)**: **E** = Endangered, **V** = Vulnerable, **M** = Migratory Species.

4.3.3 Species of National Conservation Significance Detected During the 2008 and Previous Surveys

Ornamental Snake (*Denisonia maculata*)

Status: EPBC Act Vulnerable; NC Act Vulnerable.

Two Ornamental Snakes were recorded on the adjacent Peak Downs Mine during a nocturnal search as part of a previous fauna survey (**Figure 4.4**). The location included known habitat characteristics for this species of inundated gilgais and Brigalow on deep-cracking clays.

Targeted searches failed to locate any more individuals or suitable habitat (Ecoserve and LAMR 2005). An area of Brigalow possibly suitable for this species based on substrate and proximity to a creekline, Site V16 (**Figure 3.1**), was identified during the winter 2008 survey. This area is outside of the area of proposed disturbance and, as only part of the patch has substrate suitable for Ornamental Snake, may be insufficient in size to maintain a population.

Ecology and Habitat: The Ornamental Snake occurs in low-lying areas with deep-cracking clay soils that are subject to seasonal flooding, and in adjacent areas of clay and sandy loams. The species is found in woodlands and shrublands, such as Brigalow, and in riverine habitats, and lives in soil cracks and under fallen timber. It is a secretive and nocturnal species and feeds almost entirely on frogs, though lizards may very occasionally be eaten (Ehmann 1992; Wilson 2005; Wilson and Swan 2008).

Distribution: The Ornamental Snake is found in the Dawson and Fitzroy River Drainages of central coastal Queensland (Ehmann 1992).

Sensitivity to Change: Threats to this species are uncertain. It is likely to be susceptible to habitat destruction, habitat degradation through overgrazing and inappropriate fire regimes, poisoning by attempted predation on Cane Toads, predation by feral predators, and a decline in prey abundance (McFarland *et al*. 1999).

Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta*)

Status: EPBC Act Vulnerable; NC Act Vulnerable.

During the recent 2008 surveys Squatter Pigeons were observed on a number of occasions, usually as singletons and never more than three individuals, though two pairs were recorded in very close proximity. Most observations were at the same location, near a creek (**Figure 4.4**), and may have been of the same individual. All individuals were observed in areas of active grazing and substantial habitat degradation and their occurrence may reflect the nearby presence of water rather than food resources, or be simply a result of increased visibility improving the likelihood of detection.

Earlier surveys of the project site and adjacent Peak Downs Mine recorded Squatter Pigeons in groups of up to seven individuals (Ecoserve and LAMR 2005). Habitat details are not available for most of these records, though the report authors state that the species is likely to occur anywhere within the area that has grassland. The Squatter Pigeon, despite substantial declines and even local extinctions in the southernmost parts of its range, remains common locally, even in areas heavily degraded by cattle.

The species has been known to recover from declines driven by drought and then increase in abundance on active grazing properties (e.g. Woinarski and Catterall 2004). What is uncertain is the extent to which such populations are dependent on less disturbed patches of habitat within the landscape.

Ecology and Habitat: Squatter Pigeons are terrestrial, foraging and breeding on the ground. The species occurs in open dry sclerophyll woodland with grassy understorey, nearly always near permanent water. Birds may occasionally feed in sown grasslands and pastures. Squatter Pigeons eat mainly seeds, including those of exotic pasture plants, and some insects (Crome and Shields 1992; Higgins and Davies 1996).

Distribution and Breeding: This species was historically found from Cape York Peninsula in Queensland south to the Dubbo region in New South Wales. There have been no official records in New South Wales since the 1970s

and the species has declined greatly in southern Queensland (Higgins and Davies 1996; NPWS 2003).

Breeding is poorly known but does appear to be greatly influenced by rainfall. The nest is a shallow depression on the ground (Frith 1982; Higgins and Davies 1996).

Sensitivity to Change: Much of the original habitat in Queensland has been replaced with pasture for livestock (Higgins and Davies 1996). Existing populations are susceptible to clearing and fragmentation of habitat, overgrazing by livestock and feral herbivores, trampling of nests by livestock and feral animals, predation by cats and foxes, and illegal shooting (NPWS 2003). Squatter Pigeons appear more susceptible to the effects of grazing by sheep compared to cattle, which may explain the more severe declines in the southern parts of their range (Frith 1982).

Migratory Birds

Status: EPBC Act Migratory.

A total of 14 Migratory species have been identified within the project site and immediate surrounds as detailed in **Table 4.5**. One of these species, Cotton-Pygmy-goose, is listed as Rare under the NC Act. The remaining species are considered of Special Least Concern under the NC Act.

For the convenience of this report, Migratory bird species have been assigned to one of two groups: those that occur in terrestrial habitats and those that are associated with wetland/aquatic habitats.

Terrestrial Species

- Fork-tailed Swift (*Apus pacificus*);
- White-throated Needletail (*Hirundapus caudacutus*);
- Rainbow Bee-eater (*Merops ornatus*);
- Rufous Fantail (*Rhipidura rufifrons*) and
- Satin Flycatcher (*Myiagra cyanoleuca*).

Fork-tailed Swift and White-throated Needletail are aerial species that may at times fly over the project site. They are non-breeding summer visitors and forage over a wide variety of habitats, including highly modified areas such as pasture and those dominated by human infrastructure.

Sensitivity to change: These two species are susceptible to collisions with infrastructure such as overhead wires, windows and lighthouses (Higgins 1999).

Rainbow Bee-eater is a common, widespread species that occurs in a wide variety of habitats, including highly modified land such as pasture. The majority of the survey records from the project site are from wooded or rehabilitated habitats (WBM 1998; Ecoserve/LAMR 2005, 2006a, b) but the species is likely to utilise almost any habitat present, particularly during migration. Potential breeding habitat is present on the exposed banks of Cherwell Creek though breeding was no recorded during any surveys. The species was present during winter 2008 and is likely to be present year-round. Such individuals are either migrants from southern Australia or over-wintering birds.

Sensitivity to change: Threats are minimal, although cane toads have been found to prey on the eggs and nestlings of Rainbow Bee-eaters (Boland 2004).

Rufous Fantail and Satin Flycatcher are both species largely restricted to wetter, more dense habitats, particularly riparian vegetation. Although a number of fauna surveys have been conducted in the project site there has been only one survey record of each species, both in 1996 (WBM 1998). Neither species is likely to be a regular visitor to the area, even on passage, due to a lack of suitable habitat in the local landscape.

Sensitivity to change: These species are sensitive to loss and fragmentation of moist forest breeding habitat and of migration corridors (Higgins *et al*. 2006a).

Wetland Species

- (Australian) Cotton Pygmy-Goose (*Nettapus coromandelianus albipennis*);
- Great Egret (*Ardea alba*);
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*);
- Marsh Sandpiper (*Tringa stagnatilis*);
- Common Sandpiper (*Actitis hypoleucos*);
- Red-necked Stint (*Calidris ruficollis*);

- Sharp-tailed Sandpiper (*Calidris acuminata*);
- Caspian Tern (*Sterna caspia*); and
- Australian Reed-Warbler (*Acrocephalus australis*).

The Cotton Pygmy-goose is almost entirely aquatic, spending much less time out of the water than most other Australian duck species, and prefers freshwater wetlands with abundant floating and submerged aquatic vegetation, interspersed with patches of open water. It feeds almost entirely on aquatic vegetation, including flowers and seeds. Breeding is little known in Australia but all known nests have been in hollows in dead trees in or next to deep swamps (Marchant and Higgins 1990) and suitable artificial waterbodies (Beruldsen 2006).

There are survey records for this species for Campbell's and Raw Water Dams (**Figure 4.4**) and it is also likely to occur under suitable conditions on Boomerang Dam, the wetlands adjacent to 7 South fill point and Windsor's Dam (Ecoserve and LAMR 2005). Waterbodies such as 4 North Dam have suitable trees with hollows for breeding but the species does require aquatic vegetation, which was not present during the winter 2008 survey.

Sensitivity to Change: The species is sensitive to drainage of wetlands; invasion of wetlands by weeds (especially water hyacinth *Eichhornia crassipes* and ponded-pasture species); grazing of wetlands by livestock; removal of standing dead trees; and the use of herbicides and insecticides near wetlands (Garnett and Crowley 2000; NPWS 2003).

Great Egrets (also known as Eastern Great Egret *Ardea modesta*) utilise modified habitats, including pasture, and are common and widespread. Those previous survey records of the species on the project site for which habitat details are available (six of eight records) are all from artificial waterbodies (WBM 1998). The species was also recorded in winter 2008 on Four North Dam.

Sensitivity to change: Great Egret is threatened by destruction and modification of freshwater habitats by drainage, grazing, clearing, burning, increased salinity, groundwater extraction and weed invasions (Marchant and Higgins 1990).

White-bellied Sea-Eagles are mainly found in maritime habitats, terrestrial wetlands and coastal areas and offshore islands. The species does also range inland over large rivers and wetlands and forages over wetlands including freshwater swamps, lakes, reservoirs and billabongs. There is one survey record for the general project site of a breeding pair from nearby One Mile Dam at Saraji Mine, which is south of Peak Downs Mine (Ecoserve/LAMR 2006b).

Sensitivity to change: The species remains fairly common throughout its range and has undergone some localised increases due to the creation of artificial waterbodies and the introduction of fish (Olsen 1998). Localised decreases are likely to be due to clearing of forests and the consequent loss of optimal breeding sites (Marchant and Higgins 1993; Olsen 1998).

The four sandpiper species recorded for the project site, Marsh, Common and Sharp-tailed Sandpipers and Red-necked Stint, are species all regularly recorded at freshwater habitats. They will all forage on artificial waterbodies but prefer those with shallow water margins. Only limited suitable habitat is present in the project site for sandpipers, though groups of up to eight individuals were observed for both Red-necked Stints and Sharp-tailed Sandpipers at Boomerang Dam 21 on Peak Downs Mine (Ecoserve and LAMR 2005).

Sensitivity to change: Sandpipers are susceptible to loss of wetlands through drainage and reclamation, loss of inflows to floodplains due to damming of rivers and water extraction, loss of high tide roosts, destruction of mangroves, pollution, harvesting of prey items such as yabbies (*Trypaea australiensis*), disturbance such as recreational use of habitat including beaches and foredunes, and global warming (Geering *et al*. 2007).

Caspian Terns mostly occur in coastal habitats but also on inland wetlands, especially lakes, reservoirs and rivers. The species usually forages on open water, preferring shallow water near margins. There are two survey records of Caspian Tern from the project site, one observation being from Raw Water Dam on Peak Downs Mine (WBM 1998).

Sensitivity to change: Caspian Terns are susceptible to loss of eggs by trampling by cattle and chick predation by cats.

Occasionally they are entangled in fishing nets (Higgins and Davies 1996).

The Australian Reed-Warbler was, until recently, considered conspecific with Clamorous Reed-Warbler (*A. stentoreus*) and is as such listed as a Migratory species under the EPBC Act. Now regarded as a separate species, the Australian Reed-Warbler is most likely restricted to Australia. Possible extralimital breeding populations in Wallacea and New Guinea are most likely a subspecies of Clamorous Reed-Warbler and are resident in any case (Higgins *et al*. 2006b). Nonetheless, the species will be treated as a Migratory species under the EPBC Act when discussing potential project impacts in **Section 5.0**.

There are three survey records of Australian Reed-Warbler for the project site, from both a Peak Downs Mine rehabilitation area and Peak Downs Mine Dam 1 North (WBM 1998). The species was also present at Dam 1 North in winter 2008. The species is likely to occur in any patch of suitable habitat, such as dense, low, aquatic or riparian vegetation including reeds, rushes and sedges. It regularly occurs on artificial waterbodies should they have suitable fringing vegetation and may breed in the project site.

Sensitivity to change: The major threat to Australian Reed-Warblers is loss of habitat due to coastal development in natural habitat areas (Higgins *et al*. 2006b).

4.3.4 Species of State (Queensland) Conservation Significance Detected during the 2008 and Previous Surveys

In addition to those species described in Section 4.3.3 that have both National and State significance, the following sections describe species listed solely under the NC Act.

Troughton's Sheathtail-bat (*Taphozous troughtoni*)

Status: NC Act Endangered.

Survey records of Troughton's Sheathtail-bat are shown on **Figure 4.4**. All records are Anabat records (Ecoserve and LAMR 2005, 2006) and no details are available other than that the species was recorded at Cherwell Creek.

Ecology and Habitat: Troughton's Sheathtail-bat roosts in caves and abandoned mines. The species has been recorded from hills with open woodland and spinifex. Almost nothing is known of its behaviour (Churchill 1998; Menkhorst and Knight 2004), though members of the genus are typically swift, high-flying species that forage above canopy height (Thomson *et al*. 2002). It is known to prey on a species of large, high-flying grasshopper (Hall 2008).

Distribution and Breeding: The species is known from three locations near Mount Isa and was considered to be restricted to this area. More recently, however, the species has been found to occur throughout much of south-eastern and central Queensland (DEWHA 2007). Recent genetic studies indicate that the classification of *T. australis*, *T. georgianus* and *T. troughtoni* needs revision. The validity of the species requires investigation (Hall 2008). This taxonomic uncertainty is compounded by questions as to the reliability of Anabat as a means of identification of *Taphozous* to the species level (C. Corben Pers. Comm.).

Nothing is known of its breeding biology (Churchill 1998; Menkhorst and Knight 2004; Hall 2008).

Sensitivity to Change: The species is threatened by destruction and disturbance of roost and maternity sites. The presence of feral predators such as Cats may also disrupt roost and maternity sites (Thomson *et al*. 2002).

Little Pied Bat (*Chalinolobus picatus*)

Status: NC Act Rare

There are Anabat survey records of Little Pied Bat from the Windsor's Dam site, wetlands adjacent to 10 North Fill Point, and within the Brigalow remnant adjacent to the boundary of Peak Downs Mine with Saraji mine (Ecoserve and LAMR 2005). During the autumn 2008 survey there were records (also Anabat) from three locations, all in or near woodland with Brigalow (**Figure 4.4**). There were 'probable' records from another three locations, including

a Jump-up (Site 4) set within a large expanse of pasture.

These survey records support the opinion of an earlier study (Ecoserve and LAMR 2005) that the species may occur within many habitats on the current mining leases.

Ecology and Habitat: Little Pied Bats are typically found in dry habitats including open forests, woodland, mulga woodlands, chenopod scrublands, *Callitris* forest and mallee (Churchill 1998). However, recent surveys have also located the species in notophyll vine forest gullies (Eyre *et al* 1997). The species has broad habitat preferences (Ford *et al*. 2008). The species was originally thought to roost almost exclusively in caves, tunnels and similar subterranean structures (Hall and Richards 1979), although has now been identified roosting in alternatives such as hollow-bearing trees and even abandoned buildings. Unlike many other microchiropteran bats, Little Pied Bats do not seem to roost in large numbers. Rather, most roosts contain ten or less individuals (Ford *et al*. 2008).

Distribution and Breeding: The species occurs north from the mallee region of South Australia/Victoria to the tropic of Capricorn and is most common west of the Great Dividing Range in semi-arid regions, although individuals have also been located in areas closer to the coast. Young are born in spring (Menkhorst and Knight 2004).

Sensitivity to Change: Threats to the Little Pied Bat include habitat clearance, fragmentation and loss of potentially important roosting locations such as tunnels, mine shafts or caves.

Culturally Significant Species

The NC Act lists both Short-beaked Echidna and Koala as a 'Special Least Concern' species. This listing states "*the proposed management intent for each special least concern animal includes ensuring each person exercising a power or carrying out a function for a State government agency has regard to, when exercising the power or carrying out the function-*

> *(a) the special cultural significance of the animal; and*
>
> *(b) the need to conserve existing populations of the animal*."

Short-beaked Echidna (*Tachyglossus aculeatus)*

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

Short-beaked Echidna has been recorded six times for all surveys combined. This species is typically encountered opportunistically, often when crossing roads or as road-killed individuals. The number of records for this often difficult to observe species suggest that it is reasonably common in the project site and surrounds.

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

Distribution and Breeding: This species occurs throughout Australia and is found from alpine areas to deserts. Mating takes place in July and August with juveniles seen from September (Augee 2008).

Sensitivity to change: The Short-beaked Echidna is sensitive to habitat loss and individuals are killed by dingoes/dogs and motor vehicles and young are also taken by large goannas. The species remains ubiquitous and common except in the more arid parts of its range (Maxwell *et al*. 1996; Augee 2008).

Koala (*Phascolarctos cinereus*)

Koala was not recorded in the 2008 surveys but there are over 100 records of the species from previous surveys, indicating that there is a substantial population present, presumably in the areas of more suitable habitat south of Cherwell Creek (see **Section 4.3.8**).

Ecology and Habitat: In the bioregion Koala is generally associated with large *Eucalyptus*

tereticornis, an important food tree in northern parts of its distribution (Martin *et al*. 2008).

Koalas have a distinct association with eucalypt woodland and forest habitat types containing suitable food trees, although they are not necessarily restricted to bushland and remnant areas and are known to exist and breed within farmland and the urban environment. Similarly, movement is not confined to vegetated corridors, as they also move across cleared rural land and even through suburbs.

They use a variety of trees, including many non-eucalypts, for feeding, shelter and breeding purposes. They can, however, have distinct, localised preferences throughout their range, selecting some species in preference to others, and are even known to have favourite individual trees due possibly to high leaf moisture content, high leaf nitrogen content and low formylated phloroglucinol compounds, which are produced by eucalypts to resist herbivory (Pahl and Hume 1990; Hume and Esson 1993; Pass *et al*. 1998; Lawler *et al*. 1998, 2000; Moore and Foley 2000).

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

Distribution and Breeding: Koalas occur throughout north-east, central and south-east Queensland, extending south through Victoria into South Australia and to Kangaroo Island. They breed in spring and summer and healthy females can produce one young per year (Martin *et al*. 2008).

Sensitivity to Change: Koalas are threatened by habitat destruction and fragmentation, bushfire and disease. Populations around urban areas are also at increased risk of mortality due to dog attack and road strike (Maxwell *et al.* 1996).

4.3.5 Species of National Conservation Significance Not Detected During Recent Surveys but Which May Occur

In addition to those species discussed in **Section 4.3.3**, the following species of National conservation significance that were not recorded on the project site or nearby during the current and previous surveys are predicted to occur or it is considered possible that they may occur (see 'Comments' in **Appendix 5**).

Brigalow Scaly-foot (*Paradelma orientalis)*

Status: EPBC Act Vulnerable; NC Act Vulnerable.

Ecology and Habitat: The Brigalow Scaly-foot was once thought to be confined to remnant Brigalow or sparse tussock grass vegetation on grey cracking soils (Shea 1987). Recent records, however, have found the species in additional habitats including Broad-leaved Hickory (*Acacia falciformis*) woodland, Gidgee (*A. cambagei*) woodland, Poplar Box open woodland, sandstone rises in dry sclerophyll forests, Spotted Gum (*Corymbia citriodora*) and Narrow-leaved Ironbark dominated forest and mixed open woodland with Buck Spinifex (*Triodia mitchelli*) (Schulz and Eyre 1997; Kutt *et al.* 2003).

Most records are from relatively undisturbed habitats but the species does also occur in young regrowth (two-three years old) and heavily grazed areas (Kutt *et al*. 2003). However, it is also suggested that the species needs litter on the ground and so, never occurs in disturbed habitats (EPA 2003a). Fragments of invertebrates such as spiders and crickets have been recorded from scats. However, sap, particularly from *Acacia* species, constitutes a significant proportion of this species diet (Tremul 2000).

Distribution and Breeding: The majority of records are from the BBN bioregion. However, records occur from 200 km south-west of Charters Towers south to Bendidee National Park and Eena State Forest (35 km north-west of Goondiwindi) (Schulz and Eyre 1997; Kutt *et al.* 2003). The species occurs east to Gladstone (Boyne Island) and west to around Morven (Eyre *et al.* 1997; Schulz and Eyre 1997; Tremul 2000). Breeding occurs in spring and summer (Tremul 2000).

Sensitivity to change: The Brigalow Scaly-foot is threatened by clearing and habitat fragmentation for agriculture and pastoral purposes. In addition, uncleared areas can be deleteriously altered by stock grazing and inappropriate fire regimes. Both these activities reduce horizontal ground layer complexity.

Likelihood of Occurrence: Ecoserve and LAMR (2005) report that Brigalow and eucalypt communities within the south-eastern area (of the adjacent Peak Downs lease) are most likely to provide suitable resources for Brigalow Scaly-foot. Based on the 2008 surveys, there is only limited habitat north of Cherwell Creek, all of which is south of Peak Downs Highway. Site V16 (**Figure 3.1**), south of Cherwell Creek, is a patch of Brigalow on a variety of substrates and, although some of the patch is infested with Buffel Grass, it retains areas of leaf litter and coarse woody debris and appears suitable for Brigalow Scaly-foot. This area is just outside of the area of proposed disturbance.

Yakka Skink (*Egernia rugosa*)

Status: EPBC Act Vulnerable; NC Act Vulnerable.

Ecology and Habitat: Yakka Skinks live in colonies, occupying communal burrows, often under dead timber or deep rock crevices. They eat invertebrates and soft plant material, particularly fruit. They are found in a variety of drier forests, woodlands and shrublands (usually on well drained, coarse gritty soils) including Poplar Box on alluvial soils, low ridges, cypress on sands, belah, mulga and *Eucalyptus intertexta* (Ehmann 1992; Cogger 2000; Drury 2001; Wilson 2005). They can also occur in highly degraded sites and where there are log piles and rabbit warrens. It has been suggested the species may be more common than previously thought (EPA 2003a).

Distribution and Breeding: The Yakka Skink is endemic to Queensland, occurring from Cape York Peninsula to the St. George area in the Southern Brigalow Belt (Drury 2001; Wilson 2005). The species lives in colonies (Ehmann 1992) but no breeding information is available.

Sensitivity to change: The species is threatened by loss of habitat, loss of shelter sites through agricultural practices, too-frequent fire, trampling of burrows by livestock, and predation by foxes and cats (Drury 2001).

Likelihood of Occurrence: The species was targeted in earlier surveys south of Cherwell Creek (Ecoserve and LAMR 2005) but was not located nor was it reported as likely to occur. During the winter 2008 habitat assessment small areas of potentially suitable habitat were identified very close to Site V16 (**Figure 3.1**), just outside of the area of proposed disturbance. The very small areas of apparently suitable habitat mean that its occurrence is questionable but cannot be discounted.

Australian Painted Snipe (*Rostratula australis*)

Status: EPBC Act Vulnerable; NC Act Vulnerable.

Painted Snipes in Australia have previously been considered a subspecies of *Rostratula benghalensis*, a species found in sub-Saharan Africa and Asia (Marchant and Higgins 1993). Most recently, the Australian birds have been considered to be an endemic species, *R. australis*, in which case *R. benghalensis* does not occur in Australia (Garnett and Crowley 2000; Geering *et al*. 2007).

Ecology and Habitat: The Australian Painted Snipe is a secretive, cryptic, crepuscular species that occurs in terrestrial shallow wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains. The species feeds on vegetation, seeds and invertebrates, including crustaceans and molluscs (Marchant and Higgins 1993).

Distribution and Breeding: The species is patchily distributed throughout Australia, with most records being in the south-east. Records are unpredictable, the species being absent from areas in some years and common in others.

Breeding occurs mainly in the Murray-Darling region, though is also recorded in other parts of Queensland, New South Wales and South Australia. Nests are on the ground in swamps and grassland and nesting occurs between May and February, depending on location (Marchant and Higgins 1993).

Sensitivity to change: The Australian Painted Snipe is threatened by drainage of wetlands, diversion of water from rivers, clearance of wetland vegetation, and overgrazing (Garnett and Crowley 2000).

Likelihood of Occurrence: Although there are no actual database records for the project site

or nearby (the EPBC Act Online Protected Matters Search Tool is a predictive database) the erratic nature of its movements and its willingness to use artificial waterbodies means that the species may occur on the project site at times.

Any such occurrences could be years apart and could easily be overlooked due to the secretive nature of the species. One North Dam (to the south of the project site) is one location that may provide suitable resources, though this will be dependent on water levels being such that the water's edge is near fringing vegetation.

The project site and immediate surrounds are not, however, likely to provide breeding resources and any occurrence is likely to be sporadic at best.

Greater Long-eared Bat (South-eastern) (*Nyctophilus timoriensis*)

Status: NC Act Vulnerable; EPBC Act Vulnerable.

The four geographically separate forms of this species are currently undergoing taxonomic revision. The form in question is the South-eastern Long-eared Bat (Turbill *et al*. 2008).

Ecology and Habitat: The Greater Long-eared Bat occurs in dry forest and woodland, mallee, Brigalow/Belah and other arid and semi-arid habitats. The species is most common in box/ironbark/cypress pine woodland on sandy soils (Turbill *et al*. 2008). It roosts in tree hollows or under bark (NPWS 2003). It is a little known species that is rarely caught (Churchill 1998).

Distribution and Breeding: This species occurs across southern Australia, including Tasmania, but avoids coastal regions on the south-eastern mainland (NPWS 2003). Mating occurs in autumn and a single litter is produced each year (Churchill 1998).

Sensitivity to change: The Greater Long-eared Bat is threatened by loss and fragmentation of habitat, loss of mature hollow-bearing trees, and the use of pesticides (NPWS 2003).

Likelihood of Occurrence: The genus *Nyctophilus* is readily identifiable by Anabat call analysis, though there are major difficulties in further resolution to species level. However, there are no Anabat records for any species of *Nyctophilus* for the project site. It is therefore unlikely that the Greater Long-eared Bat is present on the project site; however sporadic use of the project site by any individuals possibly present in the local area cannot be discounted.

Migratory Birds

Cattle Egret (*Bubulcus ibis*)

The species is also known as *Ardea ibis.*

Status: EPBC Act Migratory; NC Act Special Least Concern.

Ecology and Habitat: The Cattle Egret inhabits grasslands, wetlands and wooded lands, often foraging away from water in grassland, pasture and crops. The species is strongly associated with grazing animals in Australia, but also forages at garbage tips, follows machinery, and feeds independently of livestock. Cattle Egrets were one of the most successful of bird species during the 20th century. The species feeds on invertebrates, especially grasshoppers, and small vertebrates such as frogs, reptiles and mammals (Pringle 1985; Marchant and Higgins 1990).

Distribution and Breeding: The Cattle Egret was introduced to the Kimberley in Western Australia in 1933, though the current Australian population is likely to be a result of a worldwide expansion by the species. Indeed it is considered that Cattle Egrets were present in Australia as early as 1907 (Pringle 1985). Cattle Egrets breed between October and March, usually in the presence of other species of waterbird (Marchant and Higgins 1990).

Sensitivity to change: The species may be threatened by development near breeding colonies (Low 1995); though continued expansion indicates that the Australian population of this common bird is secure.

Likelihood of Occurrence: Cattle Egrets are likely to occur on the cleared and actively grazed areas of the project site at times. Such use is likely to be sporadic.

Painted Snipe (*Rostratula benghalensis s. lat.*)

Status: EPBC Act Vulnerable and Migratory; NC Act Vulnerable.

Rostratula benghalensis is no longer considered to occur in Australia and hence there is no migratory species of Painted Snipe in Australia (discussed above under Australian Painted Snipe). Nonetheless, the species will be treated as a Migratory species under the EPBC Act when discussing potential project impacts in **Section 5.2**.

Latham's Snipe (*Gallinago hardwickii*)

Status: EPBC Act Migratory; NC Act Special Least Concern.

Ecology and Habitat: Latham's Snipe, also known as Japanese Snipe, is a largely solitary wader, though loose flocks may form under ideal conditions or during migration. The species is mainly crepuscular, is shy and cryptic, and is often first seen only when flushed from dense vegetation. It occurs in swamp and marsh margins and in wet pasture, feeding mainly on earthworms and insect larvae (Pringle 1987).

Distribution and Breeding: Latham's Snipe breeds mainly in Japan, arriving in north-eastern Queensland during winter and then south through the coastal/sub-coastal areas of south-east Queensland, New South Wales, Victoria and Tasmania and around to the Eyre Peninsula in South Australia during spring and summer (Pringle 1987; Pizzey and Knight 2003).

Sensitivity to change: Latham's Snipe declined in numbers during the 20th Century due largely to hunting (Pringle 1987). Current threats within Australia include habitat/drainage modification due to development and mowing of grasslands (Garnett and Crowley 2000).

Likelihood of Occurrence: This species probably occurs sporadically, determined by rainfall patterns during spring and summer. Suitable habitats present include the shallow margins of wetlands adjacent to 7 South fill point and Windsor's Dam on Peak Downs Mine (Ecoserve and LAMR 2005) to the south of the project site.

Little Curlew (*Numenius minutus*)

Status: EPBC Act Migratory; NC Act Special Least Concern;

Ecology and Habitat: In Australia the Little Curlew occurs on short, dry grasslands and sedgelands, including artificial areas such as airfields, sporting fields, roadsides and lawns, and on the grassy edges of freshwater wetlands. Individuals and flocks are highly mobile and move unpredictably in response to conditions. The species is omnivorous, though feeding mainly on insects (Higgins and Davies 1996; Geering *et al*. 2007).

Distribution and Breeding: The species breeds in the northern hemisphere during the northern summer and most of the world population migrates to Australia. The majority of individuals in Australia are found on sub-coastal plains in northern Australia (Geering *et al*. 2007). In Queensland Little Curlews are widespread north of 20-21^{o}S, including in inland areas. Further south the species is widespread on the coast (Higgins and Davies 1996).

Sensitivity to change: In Australia threats are uncertain. Wetlands act as important stop-over sites during migration, particularly in the Northern Territory, and the condition of these wetlands are threatened by weed invasion, saltwater intrusion due to sea level rise, and damage by feral animals such as Pigs (*Sus scrofa)* and Swamp Buffalo (*Bubalus bubalus*) (Bellio *et al.* 2006). The species has probably benefited from creation of artificial watering points and of grassland by clearing for pasture (Higgins and Davies 1996).

Likelihood of Occurrence: The likelihood of this species occurring on the project site would be dependent on the provision of suitably expansive areas of short grass, combined with appropriate rainfall patterns. The habitats present indicate that any use of the project site by this species would be sporadic and probably short-term and is likely only in areas either of non-remnant vegetation and/or in areas heavily disturbed by livestock.

Black-faced Monarch (*Monarcha melanopsis*)

Status: EPBC Act Migratory; NC Act Special Least Concern.

Ecology and Habitat: Black- faced Monarchs occur in rainforests, wet sclerophyll forests, denser eucalypt forests, deep gullies, regrowth and mangroves. They forage for arthropods, mainly insects, at all heights from the canopy to near, or occasionally on, the ground.

Distribution and Breeding: The species is found on the east coast of Australia from Cape York to the Dandenong Ranges in Victoria from September to April. It breeds September to February - April in eastern Australia and over winters in New Guinea, although some birds may over-winter in eastern Queensland (Higgins *et al*. 2006b).

Sensitivity to change: This species has a widespread distribution and on a local level the clearing of rainforest, wet sclerophyll or denser eucalyptus forests would fragment and/or reduce habitat.

Likelihood of Occurrence: The Black-faced Monarch could occur on the project site on passage during migration. Any occurrence would most likely be in riparian vegetation and be of short duration.

4.3.6 Species of State (Queensland) Conservation Significance Not Detected During Recent Surveys But Which May Occur

In addition to those species discussed in **Sections 4.3.3**, **4.3.4** and **4.3.5**, the following species of State conservation significance that were not recorded on the project site or nearby during the current and previous surveys are predicted to occur or it is considered possible that they may occur (see 'Comments' in **Appendix 5**).

Black-necked Stork (*Ephippiorhynchus asiaticus*)

Status: NC Act Rare.

Ecology and Habitat: Black-necked Storks occur in terrestrial wetlands, estuaries, littoral habitats and, occasionally, grasslands. They occur in both fresh and saline waters but are most frequently recorded in open fresh waters such as shallow swamps, billabongs and pools on floodplains. They appear largely sedentary, though some birds move long distances and the species may be partially nomadic (Pringle 1985; Marchant and Higgins 1990).

The species feeds on a variety of aquatic prey items including insects, crustaceans, fish, amphibians and reptiles (Barker and Vestjens 1989; Marchant and Higgins 1990; Dorfman *et al* 2001).

Distribution and Breeding: The Black-necked Stork is found from Pakistan and India through south-east Asia to New Guinea and Australia. It is widespread in northern and eastern Australia and occurs through much of Queensland (Marchant and Higgins 1990).

The species is very sparsely distributed throughout its range and it appears that the maintenance of even one pair may require large areas of freshwater swamps (Pringle 1985). Breeding is very poorly known, although they nest in tall trees, both live and dead, in or near freshwater swamps (Marchant and Higgins 1990).

Sensitivity to change: The species is threatened by collision with powerlines, the use of herbicides, insecticides and other chemicals near wetlands, the loss of suitable nesting trees, disturbance by livestock, ingestion of cane toads, and loss of wetlands due to agriculture and development (Garnett and Crowley 2000; Dorfman *et al.* 2001; NPWS 2002).

Likelihood of Occurrence: Black-necked Storks probably occur occasionally on the project site. Such occurrences would be determined by rainfall patterns and evaporation rates and the resultant water levels of a number of water bodies. Potentially suitable habitat includes shallow margins of wetlands adjacent to 7 South fill point on Peak Downs Mine (Ecoserve and LAMR 2005). On a short-term basis the species also is known to utilise small dams, such as those that are scattered throughout the grazing land north of Cherwell Creek. Such waterbodies provide very limited resources for the species.

4.3.7 Feral Terrestrial Vertebrate Species

Feral species noted during the 2008 and previous surveys and database searches were:

- Cane Toad (*Bufo marinus*),
- House Sparrow (*Passer domesticus*),
- House Mouse (*Mus musculus*),
- Black Rat (*Rattus rattus*),
- Cat (*Felis catus*),
- Brown Hare (*Lepus capensis*),
- Rabbit (*Oryctolagus cuniculus*),
- Donkey (*Equus asinus*),
- Pig (*Sus scrofa*); and

- Goat (*Capra hircus*).

Of these, Cat, Rabbit and Pig are listed as Class 2 pests under the LP Act.

Under the LP Act "*A Class 2 pest is one that is established in Queensland and has, or could have a substantial adverse economic, environmental, or social impact. The management of these pests requires co-ordination and they are subject to local government-, community- or landowner-led programs. Landowners must take reasonable steps to keep land free from Class 2 pests.*"

None of these species is unexpected and all are commonly found in central Queensland. Provided that appropriate pest species management actions are employed (**Section 5.3**), no adverse ecological outcomes are expected from these species as a result of the project on the project site and surrounds.

4.3.8 Habitat Values for Terrestrial Vertebrate Species

The habitats within and immediately surrounding the project site can be assigned to five broad categories:

(i) Woodland and Open Forest;

(ii) Grasslands – both introduced pasture and native grasslands;

(iii) Jump-ups with shrubby vegetation;

(iv) Ephemeral creeks and drainage lines; and

(v) Dams and other artificial waterbodies.

The value of these broad habitat types is discussed individually hereunder. Unless otherwise noted, the habitats refer solely to areas north of Cherwell Creek. The area to the south adjacent to the active mine was subject only to habitat assessment, and is discussed separately. It was more extensively assessed in earlier surveys (e.g., Ecoserve and LAMR 2005; Ecoserve 2006a).

Reference to species of conservation significance in this section includes only those listed as Endangered, Vulnerable or Rare at the National or State level, unless otherwise noted. Migratory (EPBC Act) species are identified where appropriate.

Woodland and Open Forest

The project site supports a variety of Open Woodland, Woodland and Open Forest habitats. The canopy of these habitats is dominated, to varying degrees, by Dawson Gum, Narrow-leaved Ironbark, Mountain Coolibah (*Eucalyptus orgadophila*), Poplar Box and Brigalow. The woodlands and forests typically had very little understorey and had been severely affected by drought stress, with large numbers of standing dead trees. Ground cover was often highly disturbed by livestock and was dominated by a mixture of native and introduced grasses, such as *Aristida* species, Buffel Grass and some forbs (**Photos 5** and **6)**.

There was varying amounts of fallen timber potentially providing microhabitats for reptiles and small ground-dwelling mammals (e.g., Brown 2001; Kanowski *et al*. 2006), though generally the ground was somewhat smothered with grasses, reducing the suitability. Rocky areas, whether boulders, rock slabs or scree slopes also act as valuable microhabitat but were not a local component of the habitat type.

Photo 5

Photo 6

Disturbance at the time of survey was largely limited to active grazing and weed infestations. Human infrastructure and modifications consisted of vehicle tracks, fences, dams and windmills. There was evidence of some feral species. Black Rat was trapped at one woodland site, Cat was observed within the project site and would undoubtedly occur in woodland and open forest areas and Dog/Dingo tracks were recorded. Pig tracks were observed south of Cherwell Creek in winter 2008 and the species probably occurs throughout most of the project site, though presumably at low densities. Cane Toads were common throughout.

Frog activity was limited at the time of the autumn survey, most likely due to weather conditions, though dense grass cover substantially reduced visibility for active searching for terrestrial species and possibly reduced recording rates. Only four native species were recorded within woodland or forest, however all 15 species recorded in other habitats or during earlier surveys on the project site are likely to occur in this habitat type. None of these species is conservation significant and no unrecorded conservation significant species is expected to occur. The habitat is providing reasonable resources for frog species but these resources are possibly decreased in areas of weed infestation.

Eight species of reptile were observed in woodland and forest habitats during the current survey. This is undoubtedly a substantial under-representation of the actual species assemblage. Forty-seven species have been recorded for the project site during all surveys combined and only one of these, Macquarie Turtle (*Emydura macquarii*), would not occur in this habitat type.

One recorded species, Ornamental Snake, is listed as Vulnerable under both the EPBC and NC Acts, and is largely confined to woodland, especially Brigalow on cracking soils with gilgais. Two individuals were recorded from south of Cherwell Creek and that location appears to be the only area of particularly suitable habitat for this species other than a small Brigalow patch at Site V16 (**Figure 3.1)** (**Section 4.3.3**).

Despite a lack of survey or database records it is possible that the Brigalow Scaly-foot (listed as Vulnerable under both the EPBC and NC Acts) is also present in some areas of Brigalow (**Section 4.3.5**) and other woodland, particularly in areas with substantial leaf litter (e.g. **Photo 7**).

Photo 7

Generally, the woodlands and forests on the project site are providing reasonably good resources for reptiles, though weed infestations and degradation by livestock are likely to be having deleterious impacts (Adair and Groves 1998; Woinarski and Ash 2002). There is scant leaf litter in much of the habitat but reasonable quantities of fallen timber may be providing valuable resources.

One hundred and seventeen of the bird species recorded for the project site regularly occur in, or are dependent on, woodlands and forests. Despite the on-going disturbance and the loss of many individual trees due to drought death, the species assemblage included many small insectivorous species such as thornbills, whistlers and sittellas, and other birds that have declined in woodlands and forests in parts of eastern Australia, such as Grey-crowned Babbler (*Pomatostomus temporalis)* and Speckled Warbler (*Pyrrholaemus sagittatus*) (Ford *et al*. 2001; Woinarski and Catterall 2004). These species were, however, typically of low abundance. Livestock grazing and weed invasion both deleteriously affect some insectivorous birds, particularly species that forage on the ground (Maron and Lill 2005).

There were large numbers of so-called 'increaser' species (Landsberg *et al.* 1997; Moran *et al*. 2004), such as Pied Butcherbird (*Cracticus nigrogularis*), Pied Currawong (*Strepera graculina*) and Laughing Kookaburra (*Dacelo novaeguineae*). These large, aggressive species invade disturbed habitats and deleteriously affect many woodland and

forest bird species. Their presence reflects the degraded nature of much of this habitat (Recher 1999; Martin and McIntyre 2007).

Despite the degradation, the woodlands would be providing resources for Squatter Pigeon, which is listed as Vulnerable under both the EPBC and NC Acts. Although most individuals observed in 2008 were on dirt tracks or in open areas this probably is more related to their greater visibility in those locations than actual patterns of occurrence, though the species does like to dust-bathe (Frith 1982). The species, despite declines and local extinctions in the South East Queensland bioregion and northern New South Wales, remains locally common.

Very few mammals were recorded during the 2008 surveys. One individual each of two native rodent species were trapped in woodland habitats and Eastern Grey Kangaroos (*Macropus giganteus*) were observed in small numbers. No arboreal mammal or dasyurid was recorded. Of the two dasyurid species recorded by earlier surveys only Narrow-nosed Planigale (*Planigale tenuirostris*) appears to be common. The four native rodents recorded by all surveys would all occur in woodland and forest habitats but the small number of survey records suggest that population densities are low.

Previous surveys recorded four species of arboreal mammal. The thinning of the canopy due to tree death has probably caused a decline in arboreal mammals though numbers, as indicated by combined survey records, appear to have been low at least since the WBM surveys of the late 1990s (WBM 1998). Only Koala appears at all common on the project site and the relatively intact Poplar Box habitat south of Cherwell Creek may support a substantial population. A previous survey (Veary *et al*. 2006) found that Koala favoured Poplar Box, Blue Gum and Narrow-leaved Ironbark in the project site.

Seven macropod species have been recorded for the project site and surrounds, and some, such as Black-striped Wallaby (*Macropus dorsalis*) and Swamp Wallaby (*Wallabia bicolor*), are dependent on shrubby cover. The lack of understorey in the woodland and forest north of Cherwell Creek indicates that the habitat is of little value to these species and the single record for each species suggests that little suitable habitat exists anywhere on the project site. The small number of records (four) of other small and medium-sized macropods indicates that the project site is most suitable for larger species, particularly Eastern Grey Kangaroo.

A number of microbat species would forage, and perhaps roost, in the woodland and forest but in overall terms, despite a reasonable species assemblage, the degraded nature of the habitat appears to have comparatively poor resource values for native mammals. The Little Pied Bat, listed as Rare under the NC Act, appears to be widespread in woodlands on the project site based on Anabat records from the autumn 2008 and earlier surveys. This is not unexpected given the frequency with which this species has been recorded from a variety of woodland and open forest types in the Brigalow Belt South bioregion (McFarland *et al*. 1999).

Grasslands

The project site would have been dominated by Brigalow and *Eucalyptus cambageana* communities prior to broadscale clearing, which has left less than 10% of the original vegetation cover in the bioregion (EPA 2005). Much of this vegetation has been replaced by pasture. Native grasslands are also present, dominated by species such Queensland Blue-grass and Button Grass (*Dactyloctenium radulans*), but this habitat has been invaded, and in places replaced, by infestations of Parthenium (see **Photos 8** and **9**).

Photo 8

Photo 9

The grasslands, whether native or exotic, are also affected by livestock. Grazing alters vegetation structure and composition and trampling increases penetration resistance, which reduces both water infiltration and the buffer of the soil microclimate (Hobbs 2001). Nonetheless, the grasslands do provide resources for a number of native grassland fauna species, albeit at generally low densities.

Frogs within this habitat are either associated with waterbodies, both permanent and ephemeral, or are burrowing frogs such various *Cyclorana* species, which respond to rainfall. Native grasslands typically have a small frog species assemblage and infestations of Parthenium and the impacts of livestock have reduced the value of the grasslands to native frogs. Some resilient species, such as Striped Burrowing Frog (*Cyclorana alboguttata*) and Ornate Burrowing Frog (*Limnodynastes ornatus*), probably remain common despite on-going pressures.

The density of the ground cover during the 2008 surveys meant that reptiles were very difficult to record in grassland habitats. The vast majority of the species recorded for the project site and surrounds are more typically associated with woody vegetation and fallen timber and/or leaf litter. It is assumed that the reptile species assemblage would be small and comprised mainly of various snake and *Ctenotus* (skink) species. Grazing almost certainly has reduced both the diversity and abundance of species (Woinarski and Ash 2002; James 2003) and areas dominated by Buffel Grass typically have reduced species diversity, not just of reptiles, but for all terrestrial vertebrates (Hannah and Thurgate 2001).

Birds are a conspicuous component of the fauna assemblage of the grasslands. Larger species, such as Brolga (*Grus rubicunda*) and Australian Bustard (*Ardeotis australis*), use the habitat, though in small numbers and may be limited at times by both the density and height of the groundcover. Two small species, Horsfield's Bushlark (*Mirafra javanica*) and Australian Pipit (*Anthus australis*), were quite common, and other grassland species, such as Ground Cuckoo-shrike (*Coracina maxima*) and Red-chested Button-quail (*Turnix pyrrhothorax*), were present in small numbers during the 2008 surveys.

Many of the species that frequent grasslands, such as some Button-quail species, some Woodswallow species and Australian Bustard, respond to weather, season and/or food resources and would move in and out of the project site depending on local conditions. Despite the weed infestations and the effects of livestock the grassland bird species assemblage is quite good for the project site.

Other than microbat species that may forage above the grasslands but roost and breed elsewhere, the mammal assemblage is quite small. Native mammals recorded include Eastern Grey Kangaroo and Red Kangaroo (*Macropus rufus*), though there are only three records of the latter (including autumn and winter 2008), which is a species more typical of areas further west. Areas still dominated by native grasses are likely to have some native rodents and dasyurids such as Narrow-nosed Planigale.

Jump-ups

The project site incorporated a number of jump-ups, which form isolated components of the landscape within exotic pasture. The vegetation on these areas was dominated by Bendee (*Acacia catenulata*), Lancewood (*A. shirleyi*) and/or Mountain Yapunyah (*Eucalyptus thozetiana*) with a shrubby understorey of species such as Dogwood (*Erythroxylon australe*). Some jump-ups had large amounts of fallen timber and/or loose rock. All had a duricrust substrate in part (**Photos 10** and **11**).

The jump-ups were quite poor for fauna, with the exception of birds. This probably reflects their small total area within the local landscape, their small individual size, their

history of being cleared and their isolation within a heavily modified landscape.

Photo 10

Photo 11

Structurally the jump ups appeared likely to support a number of reptile species but none were recorded during active searches in autumn 2008, either diurnal or nocturnal. More cryptic species may have been present but the substrate precluded use of pitfall traps.

The habitat is not particularly suitable for frogs, though New Holland Frog (*Cyclorana novaehollandiae*) was observed. Of mammals other than microbats, only European Rabbit was recorded. The bird assemblage was a mixture of open country and/or generalist species, such as Australian Kestrel (*Falco cenchroides*) and Black Kite (*Milvus migrans*), and birds that frequented the shrubby understorey, namely Spotted Bowerbird (*Chlamydera maculata*), Zebra Finch (*Taeniopygia guttata*), and Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*).

Ephemeral Creeks and Drainage Lines

The project site included Cherwell Creek (**Photo 12**), which at the time of surveys was almost completely dry, though there appeared to be considerable subsurface flow through the sandy substrate, and a number of smaller creeks and drainage lines, typically highly degraded (**Photo 13)**.

Photo 12 Cherwell Creek

The creeks were not chosen for a systematic survey (i.e. trapping) though one was the site of a harp trap targeting microbats (**Figure 3.1**). Consequently terrestrial fauna data was collected somewhat opportunistically and is comprised largely of birds.

Although creeks will attract a number of frog species when in flow, none of the species recorded for the project site is a species restricted to, or dependent on, lotic waterbodies. Only one water-dependent reptile, Macquarie Turtle, has been recorded on the project site or surrounds (Ecoserve/LAMR 2006a). Other species may forage on the banks of creeks, for example Burns' Dragon (*Lophognathus burnsi*) was recorded at the water's edge of the creek shown in **Photo 13** (close to systematic survey site 2) in autumn 2008 but the species is not restricted to riparian habitats.

Photo 13

Creeks within the project site provide important watering sites for birds, but given their ephemeral nature locally are probably of less importance than artificial waterbodies, especially dams and troughs providing water for livestock. When in flow creeks may be the preferred option, however, due to water quality and a decreased likelihood for predation by goshawks and falcons. Squatter Pigeons were recorded a number of times in close proximity to creeks and may have been using them as watering points (**Figure 4.4**).

An important function of rivers and creeks is as corridors (Naiman *et al*. 1993), particularly in a degraded landscape, but riparian vegetation also allows some fauna species to extend their distributions into otherwise unsuitable areas (Woinarski *et al*. 2000). Riparian vegetation is usually more complex than adjacent plant communities (Hancock *et al*. 1996) and is often more susceptible to the impacts of grazing by livestock (e.g. Martin and McIntyre 2007) and weed invasion (Hancock *et al*. 1996) than other nearby habitats.

Riparian corridors may be the component within an ecosystem most sensitive to environmental change and effective management of the riparian zone may ameliorate many land use issues (Naiman *et al.* 1993). Although riparian vegetation in the project site is degraded and narrow it would still serve as route by which species traverse the landscape or as a stepping stone habitat for some Migratory bird species (under the EPBC Act) that require more dense vegetation such as Rufous Fantail and Satin Flycatcher.

Arboreal mammals probably use some of the larger trees on Cherwell Creek as habitat trees for shelter and breeding hollows. These species would also move along the creeklines. Macropods, such as Eastern Grey Kangaroo, probably drink from the creeks as well. Sections of creek with overhanging vegetation act as flyways for foraging microbats though activity patterns will vary with season and flying insect activity. Riparian zones are important foraging habitat for microbats, even ephemeral creeks (Seidman and Zabel 2001).

In autumn 2008 Gould's Wattled Bat (*Chalinolobus gouldii*) and an unidentified Broad-nosed Bat (either *Scotorepens greyii* or *S. sanborni* – both common species) were caught on a creekline at Harp Trap site 1. An additional three species were recorded by Anabat, including the Rare (NC Act) Little Pied Bat. In a landscape that has suffered the loss of many trees, due either to historical clearing or recent drought death, riparian vegetation is likely to be of increased importance for microbats.

Dams and other Artificial Waterbodies

There are a substantial number of artificial waterbodies, of varying sizes, within the project site. The larger and more valuable in terms of fauna of these are all located south of Cherwell Creek. North of Cherwell Creek the artificial waterbodies consist of small farm dams and watering points such as troughs. Brief surveys of waterbodies such as One North and Four North Dams in August 2008 found 14 species of waterbird, including Great Egret (Migratory under the EPBC Act), despite the on-going mine activity. Species such as Black Swan (*Cygnus atratus*) breed in close proximity to existing Peak Downs Mine infrastructure.

The northern waterbodies would act as watering points for macropods and birds and provide food and breeding resources for a number of waterbirds and frogs. Some snake species would also hunt for frogs and other vertebrates on their fringes. The bird species using these northern dams would be mainly non-migratory species such as Australasian Grebe (*Tachybaptus novaehollandiae*) and Plumed Whistling-Duck (*Dendrocygna eytoni*)

(which was observed in 2008 with non-flying young on the dam at aquatic sampling site 2 (**Figure 3.1**). Great Egret would also utilise these waterbodies and the Rare (NC Act) Black-necked Stork may also occur in the area sporadically.

The conservation significant waterbirds (including Migratory species) known to, and expected to, occur on the project site (**Sections 4.3.3** and **4.3.5**) are more likely to occur south of Cherwell Creek. Based on previous studies such as Ecoserve and LAMR (2005) and WBM (1998), Boomerang Dam, Raw Water Dam, Windsor's Dam and wetlands associated with 7 South fill point (all of which are on Peak Downs Mine south of the project site) all, at times, provide suitable resources for a number of such bird species.

Peak Downs Mine and surrounds south of Cherwell Creek

This area was subject to a habitat assessment on one day only, including spotlighting, in April 2008 and a number of brief incidental visits during a four day assessment of habitat in the vicinity of the proposed overland conveyor, the proposed ROM site and further west of the proposed pits in August 2008. This area has been extensively assessed in earlier surveys (e.g., Ecoserve and LAMR 2005; Ecoserve 2006a). The assessment hereunder is largely based on the one day visit in April.

The site was dominated by Poplar Box woodland of good quality. The habitat contains many large trees, both live and dead, with substantial hollows. Spotlighting, however, failed to locate any arboreal mammals, despite the habitat being good for Koala, a species that is known from the project site in some numbers. The habitat is of lesser value for other arboreal mammals.

There were large amounts of fallen timber due to clearing. The habitat was compromised, however, by the dense grassy understorey, dominated by Buffel Grass. No macropods, or any mammals for that matter, were observed during spotlighting. This may be as a result of population declines due to the drought but more probably reflects a lack of suitability of the Buffel Grass understorey. There were large numbers of Tawny Frogmouth (*Podargus strigoides*), suggesting that small vertebrates of some kind were present in reasonable numbers. Only frogs were observed.

The site also had some *Eucalyptus crebra* woodland which appeared to be well-established and capable of supporting a good range of fauna species. There was some Brigalow, either as mature but scattered trees, or as regrowth. A large number of more mature trees were dead, presumably from drought stress. The area also had a number of (presumed) dead Poplar Box. These are likely to have been poisoned at some time in the past (possibly decades ago). Buffel Grass and other pasture weeds were abundant throughout and may be suppressing native fauna assemblages.

Conclusions

Generally speaking, much of the habitat south of Cherwell Creek appeared to have higher fauna habitat values than other areas. The best habitat areas in the northern section of the project site were immediately north of Cherwell Creek with patches of Open Woodland with some substantial Dawson Gum and Poplar Box and scattered small Brigalow. There were good quantities of coarse woody debris and some areas had a diverse understorey and ground cover with many native species.

Habitat quality generally declined moving northwards, particularly in terms of Buffel Grass and Parthenium dominating the ground cover as dense swards. Dead trees, presumably as a result of drought stress were common, especially immediately south of Peak Downs Highway. The creeklines retained some native vegetation but had no real continuity of substantial vegetation. They also typically became more and more degraded to the north.

4.3.9 Habitat Protection for Significant Species

The value of habitats within the project site to conservation significant fauna has been discussed under broad headings, each of which encompasses a number of RE types (**Section 4.3.8**). These headings are intended to reflect structural aspects of habitat which determine likely use by particular species. Data provided by the EPA (2004) are used to indicate the

areas of habitat suitable for conservation significant species

In order to determine the areas of habitat for significant species that are currently protected, RE mapping has been used to provide some indication of the extent of suitable habitat within reserves, including National Parks.

The likelihood of a species occurring in an RE can be determined based on the description of the RE and the known distribution of the species in question. **Table 4.6** lists the REs which are found in Province 6 of the BBN bioregion (Young *et al*. 1999), which encompasses the project site, and which are most likely to provide appropriate resources of the conservation significant fauna species identified by surveys or by database searches (**Section 4.3**). The exclusion of an RE in relation to a particular species does not mean that it may not at times occur there, especially for migratory species. Rather, the REs have been chosen to represent the habitats of greatest likelihood of regular occurrence. Waterbirds and wetland species, such as those associated with rank vegetation fringing waterbodies, may use many REs beyond those listed should appropriate waterbodies exist within the area in question. The habitat requirements of White-throated Needletail, Rainbow Bee-eater and Short-beaked Echidna are so broad that they could occur in all REs.

It should also be noted that non-remnant vegetation may provide significant resources for many of the species listed.

Table 4.7 provides the total area of REs listed for each species listed in Table 4.6 and gives the land tenure, indicating the amount of habitat for conservation significant species that is currently conserved. This is, however, a broad scale approach as particular species do not occur in all available and apparently suitable habitat due to a variety of patch characteristics including connectivity and habitat condition.

An area mapped as remnant may be highly degraded, particularly in terms of its ground cover, and may not be suitable for ground-dwelling species, especially herpetofauna and ground-nesting birds. An actual habitat assessment is required to accurately identify the likelihood of a species occurring in a habitat patch.

EVR species (EPBC Act and NC Act)

Brigalow Scaly-foot, Yakka Skink and Ornamental Snake have 16,778; 20,032 and 3,675 ha of reserved habitat (i.e. within National Parks and Forest Reserves) respectively. These species are susceptible to disturbance and the loss of suitable ground cover such as coarse woody debris and leaf litter. Non-reserved remnant vegetation may be grazed or otherwise disturbed and is less likely to provide suitable resources for these species, though Yakka Skink can occupy degraded areas with log piles or rabbit warrens to provide shelter. Due to the possible consequences of grazing the extent of reserved land is of much greater importance for these species than for many other conservation significant species.

The Australian Painted Snipe is not particularly restricted to any RE types in the BBN bioregion. It requires terrestrial shallow wetlands and will use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains. Therefore the area of conserved REs for this species gives little indication of the amount of suitable habitat as this species is often recorded from non-remnant vegetation.

The Squatter Pigeon occurs in open woodlands with a grassy understorey with permanent water nearby. The 23,330 ha of reserved habitat would include some areas where the understorey is too dense for this species. Given a tolerance of low to medium intensity cattle grazing and a willingness to eat some pasture grasses much of the freehold and leasehold land and state forest may actually provide better resources. The species probably also benefits from artificial waterbodies in non-remnant vegetation.

The 6,869 ha of reserved habitat for Greater Long-eared Bat may be considerable under-estimation given that the species occurs in a variety of habitats. The lack of knowledge of its biology makes it difficult to make accurate assessments of its habitat use. It is likely, however, to require large, intact remnants (Turbill *et al*. 2008) and hence may be dependent on reserved lands.

Table 4.6. Conservation significant species known or predicted from the vicinity of the project site and surrounding lands – Regional Ecosystem use

Genus Species	Common Name	Regional Ecosystems *	NC Act	EPBC Act
Paradelma orientalis	Brigalow Scaly-foot	11.3.2, 11.3.4, 11.3.21, 11.4.9, 11.11.13, 11.11.19	V	V
Egernia rugosa	Yakka Skink	11.3.2, 11.3.4, 11.4.2, 11.4.9, 11.5.3, 11.11.13	V	V
Denisonia maculata	Ornamental Snake	11.3.21, 11.4.9	V	V
Nettapus coromandelianus	Cotton Pygmy-goose	11.3.27	R	M
Ephippiorhynchus asiaticus	Black-necked Stork	11.3.27	R	
Ardea alba	Great Egret	11.3.25, 11.3.27	S	M
Bubulcus ibis	Cattle Egret	11.3.21, 11.4.4, 11.11.17	S	M
Haliaeetus leucogaster	White-bellied Sea-Eagle	11.3.25, 11.3.27	S	M
Rostratula australis	Australian Painted Snipe	11.3.27	V	V
Gallinago hardwickii	Latham's Snipe	11.3.27	S	M
Numenius minutus	Little Curlew	11.3.27	S	M
Tringa stagnatilis	Marsh Sandpiper	11.3.27	S	M
Actitis hypoleucos	Common Sandpiper	11.3.27	S	M
Calidris ruficollis	Red-necked Stint	11.3.27	S	M
Calidris acuminata	Sharp-tailed Sandpiper	11.3.27	S	M
Sterna caspia	Caspian Tern	11.3.27	S	M
Geophaps scripta scripta	Squatter Pigeon (southern subspecies)	11.3.2, 11.3.4, 11.3.7, 11.3.9, 11.3.25, 11.3.36, 11.5.12, 11.8.11, 11.8.14, 11.9.12, 11.11.10, 11.11.17, 11.11.19	V	V
Hirundapus caudacutus	White-throated Needletail	all	S	M
Apus pacificus	Fork-tailed Swift	all	S	M
Merops ornatus	Rainbow Bee-eater	all	S	M
Rhipidura rufifrons	Rufous Fantail	11.3.25, 11.8.3, 11.8.13, 11.10.8, 11.11.18	S	M
Monarcha melanopsis	Black-faced Monarch	11.3.25, 11.8.3, 11.8.13, 11.10.8	S	M
Myiagra cyanoleuca	Satin Flycatcher	11.3.9, 11.3.25	S	M
Acrocephalus australis	Australian Reed-Warbler	11.3.27	S	M
Tachyglossus aculeatus	Short-beaked Echidna	all	CS	
Phascolarctos cinereus	Koala	11.3.2, 11.3.4, 11.3.7, 11.3.9, 11.3.25, 11.3.36, 11.4.2, 11.5.3, 11.5.9, 11.8.5, 11.8.14, 11.10.12, 11.11.1, 11.11.2, 11.11.10	CS	
Taphozous troughtoni	Troughton's Sheathtail-bat	unknown in this province	E	
Chalinolobus picatus	Little Pied Bat	11.3.2, 11.3.4, 11.3.7, 11.3.9, 11.3.21, 11.3.25, 11.3.36, 11.4.9, 11.5.3, 11.11.10, 11.11.13, 11.11.17, 11.11.19	R	
Nyctophilus timoriensis	Greater Long-eared Bat	11.4.9, 11.5.3, 11.10.12, 11.11.13	V	V

* Regional Ecosystems of Province 6 of the BBN bioregion
Status Abbreviations: Queensland's Nature Conservation Act 1992 (NC Act): E = Endangered, V = Vulnerable, R = Rare, S = Special Least Concern (Migratory), CS = Least Concern (Culturally Significant), C = Least Concern wildlife. Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act): E = Endangered, V = Vulnerable, M = Migratory Species

Table 4.7. Project site conservation significant fauna species – relevant Regional Ecosystem extent and tenure

Scientific Name	Common Name	Extent of habitat remaining and Land Tenure (ha) - Queensland*						Grand Total (ha)
		Forest Reserve	Freehold Land	Leasehold Land	National Park	Other	State Forest	
Paradelma orientalis	Brigalow Scaly-foot	199	355044	523789	16579	23375	54951	973937
Egernia rugosa	Yakka Skink	199	469684	777333	19833	26764	62160	1355973
Denisonia maculata	Ornamental Snake	0	71184	79440	3675	2834	851	157984
Nettapus coromandelianus	Cotton Pygmy-goose	1	9868	4886	704	2940	182	18581
Ephippiorhynchus asiaticus	Black-necked Stork	1	9868	4886	704	2940	182	18581
Ardea alba	Great Egret	12	234197	201054	8401	52636	20695	516995
Bubulcus ibis	Cattle Egret	0	42525	37042	152	449	43	80211
Haliaeetus leucogaster	White-bellied Sea-Eagle	12	234197	201054	8401	52636	20695	516995
Rostratula australis	Australian Painted Snipe	1	9868	4886	704	2940	182	18581
Gallinago hardwickii	Latham's Snipe	1	9868	4886	704	2940	182	18581
Numenius minutus	Little Curlew	1	9868	4886	704	2940	182	18581
Tringa stagnatilis	Marsh Sandpiper	1	9868	4886	704	2940	182	18581
Actitis hypoleucos	Common Sandpiper	1	9868	4886	704	2940	182	18581
Calidris ruficollis	Red-necked Stint	1	9868	4886	704	2940	182	18581
Calidris acuminata	Sharp-tailed Sandpiper	1	9868	4886	704	2940	182	18581
Sterna caspia	Caspian Tern	1	9868	4886	704	2940	182	18581
Geophaps scripta scripta	Squatter Pigeon (southern subsp.)	210	729955	808980	23120	85655	78558	1726478
Hirundapus caudacutus	White-throated Needeltail	211	1319344	1704780	73689	118755	162232	3379011
Apus pacificus	Fork-tailed Swift	211	1319344	1704780	73689	118755	162232	3379011
Merops ornatus	Rainbow Bee-eater	211	1319344	1704780	73689	118755	162232	3379011
Rhipidura rufifrons	Rufous Fantail	11	241358	214295	11348	49718	21684	538414
Monarcha melanopsis	Black-faced Monarch	11	241358	214295	11348	49718	21684	538414
Myiagra cyanoleuca	Satin Flycatcher	11	255472	219306	8004	58334	21538	562665
Acrocephalus australis	Australian Reed-Warbler	1	9868	4886	704	2940	182	18581
Tachyglossus aculeatus	Short-beaked Echidna	211	1319344	1704780	73689	118755	162232	3379011
Phascolarctos cinereus	Koala	210	1050149	1428697	64550	111767	159225	2814598
Chalinolobus picatus	Little Pied Bat	210	771919	1127065	29387	90672	85773	2105026
Nyctophilus timoriensis	Greater Long-eared Bat	0	182269	428263	6869	8554	10847	636802

*Data from EPA (2004).

EVR species (NC Act)

Cotton Pygmy-goose and Black-necked Stork are similar to Australian Painted Snipe in that their habitat requirements are not well reflected by REs.

Little Pied Bat occurs in a wide variety of habitats and, based on Anabat records, is often found in non-remnant, highly modified landscapes. It does require caves, tunnels, other similar subterranean structures or hollow-bearing trees as roosts, which may be just as common in non-reserved remnant vegetation as in forest reserves and National Parks. The sparseness of this species is not indicated by the amount of apparently suitable remnant vegetation in the BBN bioregion.

Non-EVR Migratory species (EPBC Act)

White-bellied Sea-eagle, Latham's Snipe, Marsh Sandpiper, Common Sandpiper, Red-necked Stint, Sharp-tailed Sandpiper Caspian Tern and, to a lesser degree, Great Egret and Little Curlew, are dependent on waterbodies, including artificial ones. Cattle Egret is an open country species that most often occurs in highly modified non-remnant habitats such as pasture. RE extent does not indicate the amount of suitable habitat for these species in the BBN bioregion.

Rufous Fantail and Black-faced Monarch prefer areas with intact mid-strata. This is more likely to be the case in reserved remnants not subject to grazing. The extent of reserved suitable habitats, <3% of the relevant REs in the BBN bioregion, is hence more significant than for many other conservation significant species. These species will appear in a much greater variety of habitats, including non-remnant vegetation, during passage.

4.3.10 Movement Opportunities for Terrestrial Vertebrate Species

No corridors are mapped for the project site at the state, regional or local levels under the BPA (EPA 2003b) (**Section 4.1**). The project site contains little by way of movement opportunities for terrestrial fauna. Cherwell Creek and Nine Mile Creek probably provide the only corridors of note, with arboreal mammals and birds, including some listed as Migratory under the EPBC Act, likely to use the riparian vegetation to traverse the local landscape. The degraded and thin nature of the riparian vegetation means that this function has lost much of its likely original value to fauna.

4.4 AQUATIC FAUNA RESULTS

4.4.1 Desk Top

All natural drainage lines, including creeks, occurring within the study area are ephemeral. However, artificial dams within or adjacent to Peak Downs Mine contain water throughout the year. The results of previous surveys of the aquatic fauna within these water bodies indicate that at least six fish species persist within the local catchment (**Table 4.8**), all of which are native, but none of which is listed under Commonwealth or State legislation, and all of which are considered to be common within the Fitzroy drainage system (WBM 1998; Ecoserve 2006c).

No feral species was recorded during either the 1998 or 2006 surveys, despite the occurrence of some such species within natural waterways throughout central Queensland.

TABLE 4.8. Freshwater fish species known to occur within the local catchment

Zoological Name	Common Name
Ambassis agassizii	Agassiz's Glassfish
Hypseleotris klunzingeri	Western Carp Gudgeon
Leiopotherapon unicolor	Spangled Perch
Melanotaenia splendida	Eastern Rainbowfish
Nematalosa erebi	Bony Bream
Neosilurus hyrtlii	Hyrtl's Catfish

4.4.2 Overview of Aquatic Habitats

Aquatic habitats within the project site consisted of natural creeks and drainage lines associated with the main channel of Cherwell Creek, which flows in the Isaac River approximately 20-30km downstream of the project site, and a number of artificial waterbodies in the form of mine and farm dams.

At the time of the autumn 2008 trapping survey, most of Cherwell Creek was dry with isolated shallow pools despite recent, heavy rainfall events. This creek is ephemeral in nature. This is supported by the deep sandy stream bed and absence of aquatic/riparian vegetation. In addition, during the winter survey (2008) there was no free-standing

water in Cherwell Creek, Horse Creek or Nine-mile Creek, and sampling was therefore restricted to 4 North Dam on Peak Downs Mine.

4.4.3 Macroinvertebrates and Stream Health

Due to the ephemeral nature of the creeks and natural drainage lines contained within the project site (e.g. Cherwell Creek, Nine-mile Creek, Harrow Creek and Horse Creek) and the scarcities of macrophytes, aquatic invertebrates were relatively sparse during the autumn 2008 and winter 2008 trapping survey. Therefore, aquatic macroinvertebrate sampling and associated SIGNAL analysis were not undertaken.

Macroinvertebrate data recorded in April 2008 from similar habitats within a similarly disturbed landscape as part of an aquatic assessment for the Daunia Coal Mine Project (also located within the Isaac River catchment, approximately 20km to the north-west of the Caval Ridge project site) indicates that local waterways are 'significantly' or 'severely impaired' when analysed under the AusRivAS model (BMA 2008). According to the model, this suggests fewer macroinvertebrate families were recorded than expected compared to the reference condition, due to impacts on water quality and/or habitat quality (BMA 2008).

4.4.4 Fish

Table 4.9 lists the fish present within Cherwell Creek during the autumn 2008 trapping survey and 4 North Dam during the winter 2008 survey.

In total, three species were caught. All species are native to the area and no feral species was observed. All species had been recorded by previous studies.

TABLE 4.9. Freshwater fish collected during the aquatic survey

Site	GPS Coordinates	Zoological Name	Common Name
1	S22.155475 E148.094166	*Hypseleotris klunzingeri*	Western Carp Gudgeon
1	S22.155475 E148.094166	*Leiopotherapon unicolor*	Spangled Perch
1	S22.155475 E148.094166	*Melanotaenia splendida*	Eastern Rainbowfish
2	S22.222217 E148.159288	*Hypseleotris klunzingeri*	Western Carp Gudgeon

The fish species recorded were not noteworthy apart from being typical of rivers of the Fitzroy drainage system. Seasonal factors contributed to the large numbers of pre-adult specimens observed.

4.4.5 Aquatic Habitat Values

The aquatic habitat values of Cherwell Creek, Horse Creek and Nine-mile Creek did not show any special significance in terms of their fauna. However, all of these creeks are ephemeral and were generally dry, or reduced to a series of isolated pools largely devoid of aquatic vegetation at the times of survey. Given the substrate of the creek bed, the frequency of flows within this section of Cherwell Creek is expected to be considerably reduced, and restricted to periods of heavy rainfall.

The ephemeral nature of many creeks and rivers in the semi-arid Brigalow Belt has implications for aquatic species sampling design in order to maximise catch. The continuation of many of the life cycles of the animals in these environments depends on opportunistic colonisation and this in turn is dependent on presence of breeding adults when these systems are active. Hence, the time between fill and sampling needs to be carefully judged. Conditions during the autumn and winter 2008 sampling periods may be seen to represent the prevailing conditions in this locality.

The comparative absence of macroinvertebrates found in the 2008 surveys can be ascribed to a number of factors including:

- the ephemeral nature of the creeks and other natural drainage systems within the project site;
- the relatively high density of fish within the remaining pools; and
- the relative absence of macrophytes and associated riparian vegetation.

5.0 POTENTIAL IMPACTS AND MITIGATION MEASURES

5.1 IMPACT MECHANISMS

This section sets out the impact mechanisms predicted to affect flora and fauna in the project site and surrounds. To a large degree impacts are assessed on the extent of REs in the project site (**Table 5.1**). Identified impacts have then been applied to the significant aspects of the flora and fauna in **Tables 5.2 to 5.5** (**Section 5.2**), from which needs for mitigation actions are identified. Recommended mitigation measures are set out in **Section 5.3**. Residual impacts and opportunities for positive impacts are discussed in **Sections 5.4 and 5.5**, respectively. For ease of reference, all potential impacts on ecological Matters of National Environmental Significance (MNES) are also discussed in a single section (**Section 5.6**).

In general, impacts on ecological values can be considered in terms of direct and indirect effects, both short-term and long-term. Direct impacts refer to the loss of vegetation and habitat, usually through land clearing, while indirect impacts are secondary effects such as weed invasion and increased sedimentation. The Project disturbance footprint is shown on **Figure 1.2**. It includes areas that will be cleared as part of open-cut mining operations, and areas cleared for the construction of associated infrastructure.

5.1.1 Clearing

During the construction phase, clearing will be required for a range of infrastructure within the project site (**Section 1.2**), along with a number of sediment basins, creek diversions, the initial open-cut mining pit(s), ramps and out of pit waste dump areas. Clearing will also occur progressively during mine operation for the extension of pits and spoil areas. Overall, it is understood that a total area of approximately 3,900 ha will be disturbed over the life of the project. This will incorporate the clearing of remnant vegetation as defined under the provisions of the VM Act as well as non-remnant vegetation. The approximate areas of each RE to be cleared (calculated via aerial photograph interpretation and subsequent GIS analysis), together with their description under the provisions of the VM Act, their bioregional extent, local extent and area contained in the project site is provided within **Table 5.1**.

These calculations have been undertaken for the purposes of determining the general scale/level of potential impact associated with vegetation removal, and should not be seen as exact areas by which on-ground activities are to be measured or assessed. Clearing of native vegetation primarily results in a reduction of the overall amount of habitat and populations of flora and fauna, and has the potential to result in isolation of habitats and populations, changes to remaining vegetation that cause the loss of food and shelter resources for fauna, and exposure to introduced species that are either competitors or predators (Bennett *et al*. 2000).

Removal of vegetation results in direct loss of plant species, and can result in the mortality of certain fauna present at the time of clearing. There may also be indirect impacts such as the loss of large, live and dead, trees suitable for nesting.

Secondary impacts are associated with:

- soil disturbance/exposure and altered water flow patterns, and subsequent erosion and sedimentation, which may expose tree roots, smother vegetation, and potentially alter the physical form, chemical processes and ecological health of downstream aquatic habitats; and
- increases in desiccation, light penetration, wind-throw, herbivory, weed invasion, nest predation, and parasitism for adjacent flora and fauna (Murcia 1995). In particular, introduced weeds can change vegetation community composition and in some cases increase the intensity of fire, leading to further community degradation.

While the majority of the area to be cleared consists of pasture and regrowth vegetation, the results of the proposed clearing have the potential to affect fauna movement and flora and fauna dispersal opportunities. These impacts will be greatest during the operational phase of the Project, when the open cut pits are progressively established (**Section 5.1.3**).

Table 5.1. Approximate current extent of ground-truthed REs within the Bioregion, Local Government Area and project site and extent to be disturbed by the Project

Analogous RE	Description (REDD)	Management Status	Total Extent (ha)			Extent to be Disturbed			
			Within BBN Bioregion[1]	Within Local Government Area[1]	Within project site[2]	Total Area (ha)[2]	% of Bioregional Extent	% of Local Extent	Area with Existing Approval (ha)[3]
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	Of Concern (VM Act)	545,265	30,830	351.8	248.56	0.05	0.81	140.26
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Not Of Concern (VM Act)	498,414	28,566	75.94	31.55	0.01	0.11	0
11.4.2	*Eucalyptus* spp. and/or *Corymbia* spp. grassy or shrubby woodland on Cainozoic clay plains	Of Concern (VM Act)	37,135	514	4.51[4]	4.51[4]	0.01	0.88	0
11.4.8	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	Endangered (VM Act and EPBC Act)	80,904	30,910	10.05[4]	8.24[4]	0.01	0.03	0
11.4.9	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains	Endangered (VM Act and EPBC Act)	105,656	39,723	92.14	17.82	0.02	0.04	3.1
11.5.3	*Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces	Not Of Concern (VM Act)	413,237	183,023	245.55	100	0.02	0.05	0.52
11.5.9	*Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains/remnant surfaces	Not Of Concern (VM Act)	251,427	31,532	259.43	217.34	0.09	0.69	37.93
11.8.5	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	Not Of Concern (VM Act)	348,697	39,976	255.01	25.06	0.01	0.06	6.79
11.8.11	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	Of Concern (VM Act), Endangered (EPBC Act)	188,169	37,194	153.12	124.58	0.07	0.33	0
11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on fine grained sedimentary rock.	Endangered (VM Act and EPBC Act)	149,368	499	31.69	3.93	0.003	0.79	3.93

Note:
1. Based on most recent data available from the EPA (2004).
2. Approximate areas calculated via aerial photograph interpretation and subsequent GIS analysis.
3. These areas are excluded from the subsequent considerations of proposed offsets under relevant legislation.
4. Based on an indicative breakdown of vegetation community 18 (**Section 4.2.2**) into 60% analogous RE 11.4.2 and 40% analogous RE 11.4.8.

Assessment of the cumulative impacts associated with clearing are taken into account in the assessment of ground-truthed REs (and associated habitat for significant fauna) relative to their local and bioregional significance status and extent in **Table 5.1** and **Section 5.2**.

It should be noted that much of the clearing associated with this project will occur on land subject to an existing mining lease (ML 1775), which in its entirety is the subject of an Environmental Authority granted pursuant to the *Environmental Protection Act 1994* for the carrying out of mining activities, and on which all but small areas have the necessary Surface Area Approvals under the *Mineral Resources Act 1989*. The approved areas would otherwise be cleared as the Peak Downs Mine continues its operation at its current rate. The clearing, disturbance and mining activities proposed as part of the Caval Ridge Mine brings this clearing forward in time.

Despite these approvals being in place, a full assessment of the environmental impacts on flora and fauna values of the site has been completed.

Figure 4.2a shows the surface area approvals granted prior to 16 July 2000 (i.e. SAs 1-9), which are consequently excluded from offset calculations in the following impact assessment, in accordance with Section 43A of the EPBC Act.

5.1.2 Construction Activities

In addition to clearing and the associated secondary impacts listed above, the construction phase has the potential to result in on-going disturbance from noise and dust within adjacent habitat due to ground disturbance, the operation and movement of machinery, traffic along haul roads, exposed stockpiles and blasting.

Working past daylight hours will require light pollution, which may affect behaviour of both nocturnal and diurnal fauna, both vertebrate and invertebrate; including interfering with birds that migrate at night; altering reproductive behaviour of frogs; disrupting communication between individual mammals and birds; focusing the foraging activities of insectivores; and increasing the likelihood of predation (Longcore and Rich 2004).

Another potential impact associated with fauna, particularly reptiles and small mammals, is becoming trapped in any trenches or other excavations that remain open for any period of time. This may lead to mortality either by exposure, starvation, thirst or predation by other species.

An increase in traffic, both heavy vehicles and construction workers in light vehicles, during the construction phase could contribute to increased animal/vehicle collisions on local roads.

Construction vehicles have the potential to introduce and/or spread weed species and plant pathogens such as root-rot fungus in disturbed soil, while general waste and land disturbance has the potential to attract highly competitive and/or predatory exotic fauna species.

Fuels and chemical spills from storage areas, and oils from heavy machinery can enter the environment, affecting habitats where the spill occurs, and potentially causing more widespread impact if contaminants reach waterways.

5.1.3 Mine Operation

In general, the potential impacts on flora and fauna during the construction phase of the Project are also applicable during mine operation as a result of progressive open cut mining and spoil dumps, stockpiling, coal transport and processing. In addition, the operation of the proposed mine has the potential to further disrupt natural ecological processes within the local area beyond initial clearing, in terms of both the spatial and temporal scale of impact. This includes:

- limiting the natural movement and dispersal of ground-dwelling and non-volant (flightless) arboreal fauna (i.e. for breeding and foraging purposes), which are unable to traverse the mined landscape, and/or have difficulty traversing other barriers such as roads. This also has the potential to limit the natural spread and regeneration of native flora that rely on such fauna for seed dispersal;
- altering the local surface and groundwater environment due to large-scale landform modification, creek diversions and the creation of dams, and subsequent impacts

on downstream ecosystems, particularly aquatic habitats, wetlands, riparian vegetation and other sensitive vegetation communities and dependent fauna. This includes alterations to base flows, as well as to the frequency and extent of flooding;

- creating long-term edge effects along the borders of the active area and adjacent habitat, as well as isolated habitat patches between disturbed areas; and
- altering behaviour and movement of fauna through light pollution at night.

5.1.4 Areas of Impact

Open Cut Pits

The vast majority of the area proposed to be mined is non-remnant vegetation and is currently grazed. The area north of Peak Downs Highway (Horse Pit) has two patches of Natural Grassland (RE 11.8.11) and a number of small jump-ups with species such as Lancewood and Mountain Yapunyah. The jump-ups were depauperate in fauna, with the exception of birds. This is most likely due to their small area, isolation and historical clearing. The grasslands, including areas of pasture, also provided resources mainly for birds, typically common and widespread species. Both Red and Eastern Grey Kangaroos were present.

One EVR species, Squatter Pigeon, was recorded in this area. Two pairs were observed in close proximity just north of the highway, but the species was more frequently sighted south of the highway and north of Cherwell Creek. This probably reflects increased tree cover and more suitable watering points, namely creeks as opposed to farm dams. When the ephemeral creeks are completely dry there are dams as alternative drinking locations. Some birds were close to human habitation and other infrastructure. This species is often found around cattle yards and other disturbed areas.

Generally speaking, the area north of the highway provides very poor resources for fauna, especially for conservation significant species and the dominance of Buffel Grass has led to a reduction of many native flora species. Buffel Grass is known to have a competitive advantage over native flora species (Jackson 2005). Once operating, the greatest impact of the open pit will be as a barrier to non-volant fauna.

From a flora perspective, the greatest impact of Horse Pit will be the removal of Natural Grassland currently recognised as an Endangered Ecological Community under the EPBC Act. Although this community within the project site is currently infested by Parthenium weed, the ecosystem is relatively rare within the BBN bioregion (between 10% and 30% of the preclearing extent currently remains) and approximately 20% of the remaining extent within the BBN bioregion is contained within the former Belyando Local Government Area (LGA) (EPA 2004).

The Heyford Pit, south of Cherwell Creek, supports a mosaic of habitats; some non-remnant regrowth vegetation (primarily *Acacia* spp, woody shrubs and native as well as exotic grasses and forbs), a small patch of Brigalow (currently mapped as non-remnant but analogous to RE 11.4.9), Poplar Box woodland (remnant *Of Concern*) and *Eucalyptus crebra* (ironbark) woodland (remnant *Not of Concern*). Habitat mosaics increase the resources available to some fauna species (Law and Dickman 1998). For example, microbats may roost in woodland and forage in open areas or along riparian zones. Similarly, macropods may shelter in cover during the day and feed in open areas at night.

Currently, less than 10% of the pre-clearing extent of Brigalow-dominated RE 11.4.9 remains and, of this, almost 38% is contained within the former Belyando LGA (EPA 2004). It is anticipated that the Heyford Pit will result in the removal of approximately 0.02% of the remaining extent of RE 11.4.9, calculated at the LGA level. This area may provide suitable resources for Brigalow Scaly-foot (Vulnerable under both EPBC and NC Acts).

The culturally significant Short-beaked Echidna and Koala are both likely to occur in the Ironbark and Poplar Box woodlands. The Ironbark woodland is good habitat for small nectivorous birds and, where coarse woody debris is reasonably common, often has a rich assemblage of reptile species. As with Horse Pit, the greatest impact of the Heyford Pit component of the operating mine will be as a barrier to non-volant fauna.

Roads and Dragline Transport Route

The haul road that will service the Horse Pit will pass almost entirely through non-remnant vegetation to the north of the Peak Downs Highway, the majority of which is currently highly disturbed grazing land dominated by Buffel Grass.

To the south of the Peak Downs Highway, the haul road will pass through a mosaic of remnants dominated by Poplar Box, Silver-leaved Ironbark, Queensland Blue Gum and Bloodwood communities. In addition, large areas currently supporting *Acacia* spp regrowth (dominated by an understorey of native and exotic grasses) will be disturbed.

In general, the proposed route for transporting the dragline between Horse and Heyford pits will minimise fragmentation of the large patch of remnant vegetation between the highway and Cherwell Creek, although will still require the clearing of native riparian vegetation and open woodland/grassland communities, including a small area of Brigalow (RE 11.4.9) listed as Endangered under the EPBC Act.

The construction and utilisation of these transport corridors has some potential to further spread weeds. Of particular concern is the potential spread of Buffel Grass, which has a competitive advantage over native flora species and is known to reduce the recruitment rates of endemic species (Jackson 2005).

The construction and operation of the haul road will also increase the likelihood of fauna coming into contact with the road thereby increasing likelihood of vehicle strike. This will especially be the case for slow-moving species such as Short-beaked Echidna, Koala and various reptiles and frogs.

The width of these transport corridors also acts as a barrier to movement for many non-volant species, limiting dispersal and reducing access to resources. Areas of habitat adjacent to all roads will also be altered both physically and chemically. Changes to the physical environment affect soil density and water content, temperature, light penetration, dust, surface waters, runoff patterns and sedimentation. Chemical changes include the addition of heavy metals, salts, ozone and nutrients to roadside habitats. These conditions are often favourable for the growth of weed species that may thrive and spread into adjacent habitat from roadside locations.

Roads, particularly narrow, little-used tracks, function as movement corridors for feral species such as foxes and cats, facilitating competition with, or predation of, native species (Trombulak and Frissell 2000).

Coal Handling and Preparation Plant

The CHPP will be located immediately to the south of the Peak Downs Highway. This location is characterised by woodland communities dominated by Ironbark, Bloodwood, Poplar Box, Moreton Bay Ash and Queensland Blue Gum and generally analogous to REs 11.3.25, 11.5.9b and 11.5.3. The understory is generally shrubby and dominated by *Acacia* spp., although exotic grasses including Buffel Grass and Red Natal Grass have extensively colonised much of the ground stratum. These ecosystems are well represented throughout the BBN bioregion and local area and it is not expected that clearing associated with the construction of the CHPP or reduced photosynthetic and transpiration rates and associated dieback/reduced recruitment of surrounding vegetation due to particulate emissions (e.g. coal dust) will represent a significant loss of these communities within the broader context.

There will be some loss of habitat and some exclusion from watering points for Squatter Pigeons due to construction of the CHPP and other infrastructure, but any impacts are expected to be minor given that there are a large number of watering sites, both natural and artificial, within the local landscape and the species, despite being listed as Vulnerable, is tolerant of human modification and habitat degradation.

Overland Conveyor

The overland conveyor will be located between the southern ROM and the CHPP. This will predominantly pass through areas supporting Poplar Box, Silver-leaved Ironbark and Bloodwood woodland. However, it will also pass directly through an area mapped as RE 11.4.2/11.4.8 (vegetation community 18) and will be directly adjacent to an area of RE

11.4.8 (vegetation community 16). A small area of RE 11.4.8 will be impacted by conveyor construction. This community is currently listed as Endangered under State and Commonwealth legislation as less than 10% of the pre-clearing extent currently remains. Of this, approximately 38% is contained within the former Belyando LGA. Impacts on this community will represent approximately 0.03% of the local extent.

Potential impacts associated with the operation of the overland conveyor are likely to be restricted to particulate emissions (e.g. coal dust) and their effect upon vegetation immediately adjacent to the overland conveyor (e.g. reduced photosynthetic and transpiration rates) and the adoption of standard dust suppression will minimise any such impacts. It is anticipated that operation of the overland conveyor would have limited deleterious impacts on native fauna.

Rail Spur and Loop

The rail spur and loop will be located to the north of the Peak Downs Highway primarily within non-remnant vegetation dominated by Buffel Grass and other exotic pasture species. It is therefore expected that the impacts associated with the construction and operation of the rail spur and loop will be negligible in terms of native flora.

While the rail link may act as a barrier to local movement for some fauna species, this should be at an insignificant level. However, the route does pass through a large stand of regrowth dominated by Lancewood, which contains a very large amount of coarse woody debris. This debris may be providing valuable resources for reptiles.

There may be some mortality from train strike if the reptile fauna have access to the rail line at this location.

Southern ROM

The southern ROM will be located primarily within vegetation community 15 (RE 11.5.9b), located to the south of Cherwell Creek. This area is dominated by Ironbark and Bloodwood woodland with a grassy and shrubby understorey. The eastern portion of the southern ROM is located within an area that is currently mapped as non-remnant under the provisions of the VM Act.

It is not expected that the clearing of these vegetation communities will cause a significant impact on the extent or persistence of RE 11.5.9b within the local context, and, providing that dust suppression methods are utilised, it is not anticipated that operation of the southern ROM will significantly impact upon fauna.

Sediment Basins, Dams and Creek Diversions

Several Creeks, drainage lines and dams are present within the project site. Key aquatic areas are:

- Horse Creek;
- Cherwell Creek;
- Nine-Mile Creek;
- Harrow Creek; and
- A number of mine and farm dams on the property (e.g. 4 North Dam).

The creeks and drainage lines, when containing water, are valuable watering points for Squatter Pigeons and other fauna species, and act as flight paths for foraging microbats such as Little Pied Bat.

With the exception of the artificial dams and the dammed section of Harrow Creek to the west of the haul road, all of these systems are ephemeral (Ecoserve 2006c). Impacts on Nine-Mile Creek and Harrow Creek are expected to be minimal as they are likely to be limited to disturbance for creek crossings for the overland conveyor, haul road and rail corridor.

Conversely, it is proposed that a section of Horse Creek and a section of Caval Creek will be diverted as they currently traverse areas that will be incorporated into Horse Pit. There will be some loss of habitat and some exclusion from watering points for Squatter Pigeons because of creek diversion, but any impacts are expected to be minor given that there are a large number of watering sites, both natural and artificial, within the local landscape and the species, despite being listed as Vulnerable, is tolerant of human modification and habitat degradation. The diversions should only be temporary disturbance.

There will also be the creation of additional dams during the project, which may provide additional watering points and habitat for a range of species, including Squatter Pigeon and a number of wetland bird species listed as Migratory under the EPBC Act. However, in combination with the proposed creek diversions, this will also require the clearing of remnant vegetation, including Brigalow (REs 11.4.9 and 11.9.5) and Natural Grassland (RE 11.8.11), both of which are listed as Endangered under the EPBC Act. Additional dams also have the potential to impact on downstream ecosystems through alterations to base flows and the frequency and extent of flooding;

The proposed route for transporting the dragline between Horse and Heyford pits will require the crossing of the main channels and Caval Creek and Cherwell Creek, with associated potential impacts on aquatic habitat due to direct disturbance, the introduction/spread of weeds and possible fuel spills during dragline transport. As these systems are ephemeral, any diversions and transporting of draglines undertaken during dry conditions will result in minimal impacts on aquatic species, provided disturbance and fuel spills are minimised and natural creek bank morphology is restored.

Furthermore, while reduced water quality may result from mine run-off (e.g. from processing plants or stockpiles), most of the aquatic species within the vicinity of the project site are wide ranging and capable of withstanding a wide range of aquatic conditions.

5.2 IMPACT ASSESSMENT METHODOLOGY

Impacts may be direct or indirect, varying in their potential to occur, intensity (scale) and duration. Impacts may be either positive or negative, and separate components of the Project may act synergistically to produce outcomes that may vary seasonally or with weather conditions, such as rainfall. These impacts and their species-specific consequences may be assessed both as unmitigated (preliminary) impacts and with consideration of certain mitigation actions or, where mitigation may not be possible or does not completely mitigate the impact, with appropriate and practical compensatory actions. Impacts subsequent to mitigation or compensatory measures are referred to here as 'residual impacts'.

The complexity of this task is addressed by concise and consistent summary within **Tables 5.2** to **5.5**, which set out each significant ecological element present in the project site, summarise the impact mechanisms and their potential effects on each element, provide appropriate mitigation measures (referencing sections that provide more detailed information for mitigation measures), and show the assessed residual impact. For the purposes of this assessment, significant ecological elements refer to those species, communities or processes that have the potential to constrain the proposed activities (e.g. species listed as significant under the provisions of the EPBC Act, NC Act, *Mineral Resource Act 1989* and/or the VM Act).

For flora, assessment of the nature and scale of impacts are based on the known distribution and rarity of the ecosystem and the proportion and absolute area affected, the presence or likely presence of significant species, and the likely environmental (physical, chemical, biological) changes resulting from construction and operational activities.

For fauna, assessment of the nature and scale of predicted impacts are based on known or likely occurrence, fecundity, dispersal abilities, home range, habitat specialisation, resilience to disturbance, and mobility.

The tables in **Appendix 6** further clarify the impact assessment process applied to **Tables 5.2** to **5.5**.

The terms used in **Tables 5.2** to **5.5** to describe impact types and scales are defined hereunder.

Impact Type

Direct impact: Any impact that affects a species/community directly, e.g. the actual removal of vegetation or the loss of foraging habitat for a species due to the project.

Indirect impact: Any impact that affects a species/community indirectly, which may be as a result of a direct impact on another species whose life history is interrelated with the

species in question (e.g. the loss of certain hollow-bearing trees directly reduces potential sheltering and breeding sites for arboreal mammals, which in turn reduces prey availability for a predator foraging over a large area).

Preliminary impact: The predicted impact without any mitigation measures in place. While mitigation would be in place should the project proceed, an assessment of unmitigated impact is necessary for the planning phase assessment.

Residual impact: The predicted remaining impact after mitigation measures are implemented. This represents the likely actual impact of the Project and should form the basis of discussions regarding compensations for offsets.

Preliminary and Residual Impact Assessment

Levels of impact are assessed in relation to the following three factors:

1. **Impact Likelihood:** The likelihood of an identified impact occurring has been rated as either Certain, Probable, Possible, Unlikely or Very Unlikely.
2. **Impact Consequence:** Each impact is categorised as Catastrophic, Significant, Moderate, Minor or Negligible in terms of its effect on the element in question, taking into account the geographic extent of impact (area), the duration and intensity of impacts, and the ability of the impacted element to recover (resilience).
    a. Catastrophic impacts would result in the extinction of a species.
    b. Significant impacts may be notably detrimental or beneficial to the species or community on a population scale. Significant negative impacts may result in local extinction or catastrophic declines and a consequent substantial decrease in abundance and population viability at larger scales. Significant negative impacts may also be determined by the conservation status of a species being affected (e.g. NC Act or EPBC Act – listed species. Significant positive impacts may result in substantial increases in local populations, increasing the overall abundance of a species, or in influxes, in the case of more mobile species, into the area from surrounding regions.
    c. Moderate negative impacts may result in a substantial change to a local population, though which would not lead to extinction at any level. Moderate positive impacts may produce an increase in the local population sufficient, for breeding species, for the local area to act as a source population for nearby areas. This may not necessarily lead to an overall increase in the species' abundance.
    d. Minor negative impacts may result in small decreases to a local population that would be overcome without mitigation. A minor positive impact may result in small increases that would not facilitate substantive species emigration from nearby areas. Any changes from minor impacts would fall within natural fluctuations of a local population, i.e. within the normal carrying capacity of the area.
    e. Negligible impacts are those that are likely to be undetectable.
3. **Impacts may be negative, neutral or positive.** All impacts listed in the tables should be considered as negative, unless otherwise stated.

Table 5.2. Flora Construction and Clearing[1] Impact Assessment

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type [3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
Endangered REs/Ecological Communities (State and/or Commonwealth legislation) Objective: Ensure no long term loss in project site.	RE 11.4.8	Endangered EPBC Act Endangered VM Act	Clearing associated with conveyor	Approximately 0.01% of bioregional extent and 0.03% of local extent	Direct – 1. Loss of vegetation, 2. Dust	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Offset vegetation loss through negotiation with DEWHA. Utilise standard dust suppression techniques to reduce dust leaving the construction area.	Negligible[5]
	RE 11.4.9	Endangered EPBC Act Endangered VM Act	Clearing associated with Heyford Pit, the CHPP, Catchment Dam South and the dragline transport route, and clearing/dust associated with the conveyor	Approximately 0.02% of bioregional extent and 0.04% of local extent	Direct – 1. Loss of vegetation, 2. Dust	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. For those areas not subject to an existing clearing approval (**Section 5.1.1**), offset vegetation loss through negotiation with DEWHA. Utilise standard dust suppression techniques to reduce dust leaving the construction area.	Minor [5]
	RE 11.8.11	Endangered EPBC Act Of Concern VM Act	Clearing associated with Horse Pit and Horse Creek diversion/Sed Dam N3	More than 100 ha (approximately 0.07% of bioregional extent and 0.33% of local extent)	Direct – Loss of vegetation	Certain	Significant	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Offset vegetation loss through negotiation with DEWHA.	Moderate[5]
	RE 11.9.5	Endangered EPBC Act Endangered VM Act	Clearing associated with Horse Pit and Catchment Dam South	Approximately 0.003% of bioregional extent and 0.79% of local extent	Direct – 1. Loss of vegetation, 2. Dust	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Utilise standard dust suppression techniques to reduce dust leaving the construction area.	Minor [5]
Other Remnant Vegetation (REs). Objective: Minimise loss of RE Type	RE 11.3.2	Dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and dominated by species characteristic of the vegetation's undisturbed canopy.	Clearing associated with Heyford Pit, the CHPP, Mine Water Dam 12 North and the dragline transport route, and clearing/dust associated with the conveyor	Approximately 0.05% of bioregional extent and 0.81% of local extent	Direct – 1. Loss of vegetation, 2. Dust	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Utilise standard dust suppression techniques to reduce dust leaving the construction area.	Minor
	RE 11.3.25		Clearing associated with the CHPP	Approximately 0.01% of bioregional extent and 0.11% of local extent	Direct – Loss of vegetation	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system.	Minor
	RE 11.4.2		Clearing and dust associated with the conveyor	Approximately 0.01% of bioregional extent and 0.88% of local extent	Direct – 1. Loss of vegetation, 2. Dust	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Utilise standard dust suppression techniques to reduce dust leaving the construction area.	Minor
	RE 11.5.3		Clearing associated with Heyford Pit, the CHPP, Mine Water Dam 12 North and the dragline transport route, and clearing/dust associated with the conveyor	Approximately 0.02% of bioregional extent and 0.05% of local extent	Direct – 1. Loss of vegetation, 2. Dust	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Utilise standard dust suppression techniques to reduce dust leaving the construction area.	Minor

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type [3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
	RE 11.5.9		Clearing associated with the ROM coal stockpile area.	Approximately 0.09% of bioregional extent and 0.69% of local extent	Direct – Loss of vegetation	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system.	Minor
	RE 11.8.5		Clearing of Horse Pit and clearing associated with Horse Creek diversion/Sed Dam N3, Mine Water Dam N3, Catchment Dam South and the dragline transport route**.**	Approximately 0.01% of bioregional extent and 0.06% of local extent	Direct – Loss of vegetation	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system.	Minor
Exotic Species of State Significance Objective: Manage existing weeds and prevent new introductions.	Mother-of-millions *Bryophyllum delagoense* Harrisia Cactus *Eriocereus martinii* Velvety Tree Pear *Opuntia tomentosa* Parthenium *Parthenium hysterophorus*	Declared Class 2 Pests under the LP Act	Clearing associated with pits will initially remove significant infestations of these species. Works have potential to introduce and spread weeds.	Pits, transport corridors and infrastructure areas	Direct – Destruction of significant weed infestations	Certain	Moderate (positive impact)	Strategies for managing pest and weed species will be maintained in the EM Plan.	Moderate (positive impact)
	Lantana *Lantana camara*	Declared Class 3 Pest under the LP Act			Direct – Potential for weed spread by mechanical means through seeds or propagules during clearing and earthworks.	Possible	Moderate	Strategies for managing pest and weed species will be maintained in the EM Plan.	Minor
Other Exotic Species Objective: Manage existing weeds and prevent new introductions.	Invasive Naturalised Plants in the northern Brigalow Belt E.g., Sesbania Pea *Sesbania cannabina* Captain Cook Tree *Thevetia peruviana* Noogoora Burr *Xanthium pungens* Purple Rubber Vine *Cryptostegia madagascariensis* Rattlepods *Crotalaria mitchellii*	Nebo Shire Council (2006)[6]	Clearing and associated pit construction will initially remove infestations of these species. Works have potential to introduce and spread weeds.	Pits, transport corridors and infrastructure areas	Direct – Destruction of significant weed infestations	Certain	Moderate (positive impact)		Moderate (positive impact)
					Direct – Potential for weed spread by mechanical means through seeds or propagules during clearing and earthworks.	Possible	Moderate	Strategies for managing pest and weed species will be maintained in the EM Plan.	Minor
Plant Pathogens Objective: Manage existing plant pathogens and prevent new introductions	*Phytophthora cinnamomi* (Root-rot fungus)	A root-rot fungus that infects some plant species.	Works have potential to introduce and spread the species via cars and/or earthmoving equipment.	Offset areas	Direct – Dieback of vegetation	Unlikely	Moderate	Strategies for managing pest and weed species will be maintained in the EM Plan.	Negligible
Vegetation adjacent to Disturbance Areas Objective: Minimise disturbance to potential habitat	All remnant and non-remnant vegetation types, including riparian vegetation	Integrity of vegetation influences biodiversity	Disturbance to adjacent habitat during construction	Vegetation edges and drainage lines	Direct – damage to adjacent vegetation during construction Indirect – alteration to environmental flows and water quality affecting riparian and instream ecosystem integrity	Certain	Moderate	Strategies for managing uncleared remnant vegetation will be maintained in the EM Plan. A specific Revegetation Plan will be developed for creek diversions subject to the *Water Act 2000*.	Minor

[1] Clearing refers to activities undertaken both during the construction and operational phases.

[2] Calculated via aerial photograph interpretation and subsequent GIS analysis.
[3] All impacts listed in the tables should be considered as negative, unless otherwise stated.
[4] Many of these measures will be prescribed within site management plans for construction and operation (**Section 5.3.2**).
[5] Based on a 1:1 offset scenario, excluding those areas subject to existing onsite clearing approval (**Section 5.1.1**).
[6] Queensland Herbarium has yet to distribute a list of invasive weeds for the Brigalow Belt. The Nebo Shire Pest Management Plan provides a list of plants that are locally significant pest species within Nebo shire and neighbouring shires.

Table 5.3. Flora Operation[1] Impact Assessment

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
Endangered REs/Ecological Communities (State and/or Commonwealth legislation) Objective: Ensure no long term loss in project site.	REs 11.4.8, 11.4.9 and 11.9.5	Endangered EPBC Act Endangered VM Act	Coal extraction, preparation and transport	Adjacent to the pits and infrastructure	Direct – Dust	Probable	Minor	Utilise standard dust suppression techniques to reduce dust leaving the preparation (ROM and CHPP) and transport (conveyor / rail corridor) areas. Strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover.	Negligible
	RE 11.8.11	Endangered EPBC Act Of Concern VM Act	Coal extraction, preparation and transport	Adjacent to the pits and infrastructure	Direct – Dust	Probable	Minor	Utilise standard dust suppression techniques to reduce dust leaving the preparation (ROM and CHPP) and transport (conveyor / rail corridor) areas. Strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover.	Negligible
Other Remnant Vegetation (REs) Objective: Minimise loss of RE Type	All other REs within project site	Dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and dominated by species characteristic of the vegetation's undisturbed canopy	Coal extraction, preparation and transport	Adjacent to the pits and infrastructure	Direct – Dust	Probable	Minor	Utilise standard dust suppression techniques to reduce dust leaving the preparation (ROM and CHPP) and transport (conveyor / rail corridor) areas. Strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover.	Negligible
Exotic Species of State Significance Objective: Manage existing weeds and prevent new introductions.	Mother-of-millions *Bryophyllum delagoense* Harrisia Cactus *Eriocereus martinii* Velvety Tree Pear *Opuntia tomentosa* Parthenium *Parthenium hysterophorus*	Declared Class 2 Pests under the LP Act	Mining Coal transport and vehicles have the potential to introduce and spread weeds.	Pit area and areas adjacent to the CHPP, rail corridor, roads, dragline transport route and infrastructure	Direct – Destruction of significant weed infestations	Certain	Moderate (positive impact)	Strategies for managing pest and weed species will be maintained in the EM Plan.	Moderate (positive impact)
					Direct – Weed spread by mechanical means through seeds or propagules through vehicle movement	Possible	Moderate	Strategies for managing pest and weed species will be maintained in the EM Plan.	Minor
	Lantana *Lantana camara*	Declared Class 3 Pest under the LP Act							
Other Exotic Species Objective: Manage existing weeds and prevent new introductions.	Invasive Naturalised Plants in the northern Brigalow Belt E.g., Sesbania Pea *Sesbania cannabina* Captain Cook Tree *Thevetia peruviana* Noogoora Burr *Xanthium pungens* Purple Rubber Vine *Cryptostegia madagascariensis* Rattlepods *Crotalaria mitchellii*	Nebo Shire Council (2006)[4]	Mining Coal transport and vehicles have the potential to introduce and spread weeds.	Pit area and areas adjacent to the CHPP, rail corridor, roads dragline transport route and infrastructure	Direct – Destruction of significant weed infestations.	Certain	Moderate (positive impact)		Moderate (positive impact)
					Direct – Weed spread by mechanical means through seeds or propagules through vehicle movement	Possible	Moderate	Strategies for managing pest and weed species will be maintained in the EM Plan.	Minor
Plant Diseases Objective: Manage existing plant diseases and prevent new introductions	*Phytophthora cinnamomi* (Root-rot fungus)	A root-rot fungus that infects some plant species.	Ongoing operational works have potential to introduce and spread the species through vehicle movement	Study area and adjacent lands	Direct – Dieback of vegetation	Unlikely	Minor	Strategies for managing pest and weed species will be maintained in the EM Plan.	Negligible

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
Vegetation adjacent to Pits, Infrastructure and Transport Corridors Objective: Minimise disturbance	All remnant and non-remnant vegetation types	Integrity of vegetation influences biodiversity	Disturbance to habitat adjacent to construction and dust associated with mining and preparation activities	Vegetation in proximity to pits, infrastructure and transport corridors	Direct – 1. Damage to adjacent vegetation, 2. Dust Indirect – alteration to environmental flows and water quality affects riparian and instream ecosystem integrity.	Certain	Moderate	Utilise standard dust suppression techniques to reduce dust leaving the processing (ROM and CHPP) and transport (conveyor / rail corridor) areas. Strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover. Strategies for managing uncleared remnant vegetation will be maintained in the EM Plan. A specific Revegetation Plan will be developed for creek diversions subject to the *Water Act 2000*.	Minor

[1] Clearing activities undertaken during the operational phases are assessed in Table 5.2.
[2]. All impacts listed in the tables should be considered as negative, unless otherwise stated.
[3]. Many of these measures will be prescribed within site management plans for construction and operation (**Section 5.3.2**).
[4]. Queensland Herbarium has yet to distribute a list of invasive weeds for the Brigalow Belt. The Nebo Shire Pest Management Plan provides a list of plants that are locally significant pest species within Nebo shire and neighbouring shires.

Table 5.4. Fauna Construction and Clearing[1] Impact Assessment

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
Nationally Significant Fauna (Endangered or Vulnerable) Objective: Minimise long term loss of habitat in project site.	Brigalow Scaly-foot (*Paradelma orientalis*) (species not recorded - reasonable possibility of occurrence in project site)	Vulnerable EPBC Act and NC Act	Pits	Direct – Loss of habitat	Possible	Minor	Fauna spotter/catcher during clearing of remnant woodland. Consideration of vegetation offset areas will take into account habitat for significant fauna species.	Minor
			Infrastructure [4]	Direct – Loss of habitat	Possible	Minor		Minor
	Yakka Skink (*Egernia rugosa)* (species not recorded - low possibility of occurrence in project site)		Pits	Direct – Loss of habitat	Very Unlikely	Negligible – marginal habitat	Fauna spotter/catcher during clearing of remnant woodland. Retention of log piles where practical.	Negligible
			Infrastructure [4]	Direct – Loss of habitat	Unlikely	Minor – marginal habitat		Negligible
	Ornamental Snake (*Denisonia maculata)* (species present)		Pits	Direct – Loss of habitat	Unlikely	Minor – marginal habitat	Fauna spotter/catcher during clearing of remnant woodland.	Negligible
			Infrastructure [4]	Direct – Loss of habitat	Possible	Negligible – marginal habitat		
	Australian Painted Snipe (*Rostratula australis*) (species not recorded, but predicted to occur occasionally)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of important foraging habitat and no loss of potential breeding habitat.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta)* (species present)		Pits	Direct – Loss of breeding habitat	Certain	Minor	Consideration of vegetation offset areas will take into account habitat for significant fauna species.	Minor
			Infrastructure [4]	Direct – Loss of breeding habitat	Certain	Minor	Consideration of vegetation offset areas will take into account habitat for significant fauna species.	Minor
	Greater Long-eared Bat (*Nyctophilus timoriensis*) (species not recorded – low possibility of occurrence in project site)		Pits	Direct – Loss of foraging and roosting habitat	Unlikely	Minor	Retention of hollow-bearing trees where practical.	Negligible
			Infrastructure [4]	Direct – Loss of foraging and roosting habitat	Unlikely	Negligible		Negligible
State Significant Fauna Objective: Minimise long term loss of habitat in project site.	Black-necked Stork *Ephippiorhynchus asiaticus* (species not recorded, but predicted to occur occasionally)	Rare NC Act	Pits	Direct – Loss of foraging habitat: farm dams and pasture (when inundated)	Certain	Negligible – marginal habitat	None provided – no loss of important foraging habitat and no loss of potential breeding habitat.	Negligible
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Short-beaked Echidna (*Tachyglossus aculeatus)* (species present)	Special Least Concern (Culturally Significant) NC Act	Pits	Direct – 1. Loss of habitat, 2. Predation by feral predators when fleeing disturbance, 3. Mortality from vehicle strike	1. Certain 2. Possible 3. Possible	Moderate	Fauna spotter/catcher during clearing of remnant woodland. Strategies for managing pest species will be maintained in the EM Plan. Appropriate speed limits for construction vehicles. Awareness of wildlife matters will be incorporated in the site induction.	Minor
			Infrastructure [4]	Direct – 1. Loss of habitat. 2. Predation by feral predators when fleeing disturbance	1. Certain 2. Possible	Minor		Negligible
	Koala (*Phascolarctos cinereus*) (species present)		Pits	Direct – 1. Loss of habitat, 2. Predation by feral predators when fleeing disturbance, 3. Mortality from vehicle strike	1. Certain 2. Possible 3. Possible	Minor	Fauna spotter/catcher during clearing of remnant woodland. Strategies for managing pest species will be maintained in the EM Plan. Appropriate speed limits for construction vehicles. Awareness of wildlife matters will be incorporated in the site induction.	Minor
			Infrastructure [4]	Direct – 1. Loss of habitat, 2. Predation by feral predators when fleeing disturbance, 3. Mortality from vehicle strike	1. Certain 2. Possible 3. Possible	Minor		Negligible
	Troughton's Sheathtail-bat (*Taphozous troughtoni)* (species present)	Endangered NC Act	Pits	Direct – Loss of foraging habitat	Possible	Not appropriate – there is uncertainty concerning the validity of this species and of the reliability of Anabat as a means of identification (see **Section 4.3.4**).	None provided.	Not applicable
			Infrastructure [4]	Direct – Loss of foraging habitat	Possible	Not appropriate		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
	Little Pied Bat *Chalinolobus picatus* (species present)	Rare NC Act	Pits	Direct - Loss of foraging habitat and potential roosting habitat	Certain	Moderate	Rehabilitation or restoration/enhancement of comparable woodland. Retention of hollow-bearing trees where practical.	Minor
			Infrastructure [4]	Direct – Loss of foraging habitat and potential roosting habitat	Certain	Minor		
Nationally Significant Fauna (Migratory) Objective: Minimise long term loss of habitat in project site.	Australian Cotton Pygmy-goose *(Nettapus coromandelianus albipennis)* Also listed as Rare under the NC Act (species present)	Migratory EPBC Act	Pits	None – No suitable habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of important foraging habitat and no loss of potential breeding habitat.	None
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Great Egret (*Ardea alba)* (species present)		Pits	Direct – Loss of foraging habitat: farm dams and pasture (when inundated)	Certain	Minor	None provided – no loss of important habitat and no constraints to movement across the landscape.	Minor
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Cattle Egret (*Bubulcus ibis)* (species not recorded, but predicted to occur sporadically)		Pits	Direct – Loss of foraging habitat: pasture and native grasslands	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	White-bellied Sea-eagle (*Haliaeetus leucogaster*) (species present)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Painted Snipe (*Rostratula benghalensis s. lat).* and Latham's Snipe (*Gallinago hardwickii*) (species not recorded, but predicted to occur occasionally)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Little Curlew (*Numenius minutus)* (non-breeding wader, not recorded but may occur sporadically)		Pits	Direct – Loss of foraging habitat: pasture and native grasslands	Unlikely	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Marsh Sandpiper (*Tringa stagnatilis)*, Common Sandpiper *(Actitis hypoleucos*), Red-necked Stint (*Calidris ruficollis)* and Sharp-tailed Sandpiper *(Calidris acuminata)* (non-breeding waders, species present)		Pits	Direct – Loss of foraging habitat: farm dams	Possible	Minor – marginal habitat	None provided – no loss of important habitat and no constraints to movement across the landscape.	Minor
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Caspian Tern (*Sterna caspia)* (species present)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	White-throated Needletail (*Hirundapus caudacutus)* and Fork-tailed Swift (*Apus pacificus*) (non-breeding aerial species – species present)		Pits	Indirect – Disturbance of flying invertebrates (prey)	Probable	Negligible (possibly positive – provision of foraging opportunity)	None provided – no loss of habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	Indirect – Disturbance of flying invertebrates (prey)	Probable	Negligible (possibly positive – provision of foraging opportunity)		
	Rainbow Bee-eater (*Merops ornatus*) (species present)		Pits	Direct – Loss of foraging habitat, loss of potential breeding habitat Indirect impact – disturbance of flying invertebrates (prey)	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	Direct – Loss of foraging habitat,	Certain	Negligible		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
				Indirect – Disturbance of flying invertebrates (prey)				
	Rufous Fantail (*Rhipidura rufifrons)* (breeding passerine – species present)		Pits	Direct – Loss of passage habitat	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – no habitat within area of disturbance	Not applicable	Negligible		
	Black-faced Monarch (*Monarcha melanopsis)* (breeding passerine – not recorded but predicted to occur occasionally)		Pits	Direct – Loss of passage habitat	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Satin Flycatcher (*Myiagra cyanoleuca)* (non-breeding passerine – species present)		Pits	Direct – Loss of passage habitat	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Australian Reed-Warbler (*Acrocephalus australis)* (breeding passerine – species present)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
Feral Species of State Significance Objective: Manage existing pests and prevent new introductions.	(feral) Cat (*Felis catus),* Dingo/dog (*Canis lupus dingo/familiaris)* (feral predators – species present)	Declared Class 2 Pest under the LP Act	Areas disturbed for Project infrastructure [4]	Direct – Predation on native fauna	Probable	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Red Fox (*Vulpes vulpes)* (feral predator – not recorded but predicted to occur sporadically)		Areas disturbed for Project infrastructure [4]	Direct – Predation on native fauna	Possible	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Rabbit (*Oryctolagus cuniculus*) (species present)		Areas disturbed for Project infrastructure [4]	Indirect – Destruction of native vegetation	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	(feral) Pig (*Sus scrofa*) (species present)		Areas disturbed for Project infrastructure [4]	Direct – Predation on native fauna. Indirect – 1. Destruction of native vegetation, 2. Disturbance of waterbodies	Probable	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	(feral) Goat (*Capra hircus)* (species present)		Areas disturbed for Project infrastructure [4]	Indirect – Destruction of native vegetation	Unlikely	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
Other Feral Species Objective: Manage existing pests and prevent new introductions.	Cane Toad (*Bufo marinus*) (species present)	Non-native animal	Areas disturbed for Project infrastructure [4]	Direct – 1. Predation of native fauna, 2. Competition with native fauna around waterbody edges	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	House Sparrow (*Passer domesticus)* (species present)		Areas disturbed for Project infrastructure [4]	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	House Mouse (*Mus musculus)* (species present)		Areas disturbed for Project infrastructure [4]	Direct – Competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	Black Rat (*Rattus rattus)* (species present)		Areas disturbed for Project infrastructure [4]	Direct – Competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Brown Hare (*Lepus capensis*) (species present)		Areas disturbed for Project infrastructure [4]	Direct – Competition with native fauna Indirect – Destruction of native vegetation	Possible	Negligible	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	(feral) Donkey (*Equus asinus)* (species present)		Areas disturbed for Project infrastructure [4]	Indirect – Destruction of native vegetation	Unlikely	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible

[1] Clearing refers to activities undertaken both during the construction and operational phases.
[2] All impacts listed in the tables should be considered as negative, unless otherwise stated.

[3]. Many of these measures will be prescribed within site management plans for construction and operation (**Section 5.3.2**).
[4]. During the construction phase all infrastructure, other than for the pits, is combined.

Table 5.5. Fauna Operation[1] Impact Assessment

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
Nationally Significant Fauna (Endangered or Vulnerable) Objective: Minimise fauna injury and disturbance to natural processes and behaviour.	Brigalow Scaly-foot (*Paradelma orientalis)* (species not recorded - reasonable possibility of occurrence in project site	Vulnerable EPBC Act and NC Act	Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Unlikely	Minor	Appropriate speed limits for vehicles. Awareness of wildlife matters will be incorporated in the site induction.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
	Yakka Skink (*Egernia rugosa)* (species not recorded - low possibility of occurrence in project site)		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Very Unlikely	Negligible	Appropriate speed limits for vehicles. Awareness of wildlife matters will be incorporated in the site induction.	Negligible
			Coal preparation infrastructure	None	Not applicable	Negligible		
			Transport infrastructure	None	Not applicable	Negligible		
	Ornamental Snake (*Denisonia maculata*) (species present)		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Very Unlikely	Negligible	Appropriate speed limits for vehicles. Awareness of wildlife matters will be incorporated in the site induction.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
	Australian Painted Snipe (*Rostratula australis*) (species not recorded, but predicted to occur occasionally)		Pits	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible	None provided.	Negligible
			Coal preparation infrastructure	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta)* (species present)		Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional watering points	Probable	Minor (positive impact)		Minor (positive impact)
	Greater Long-eared Bat (*Nyctophilus timoriensis)* (species not recorded – low possibility of occurrence in project site)		Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
State Significant Fauna Objective: Minimise fauna injury and disturbance to natural processes and behaviour.	Black-necked Stork (*Ephippiorhynchus asiaticus)* (species not recorded, but predicted to occur occasionally)	Rare NC Act	Pits	None	Not applicable	Not applicable		None
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Short-beaked Echidna (*Tachyglossus aculeatus*) (species present)	Special Least Concern (Culturally Significant) NC Act	Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike, 3. Noise, dust and light pollution (on individuals in adjacent habitats)	Probable	Moderate	Liaison with local Wildlife Carer for treatment of injured animals or young rescued from adults killed or injured by vehicles or activities associated with the Project.	Moderate

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	Direct – 1. Constraint to local movements (if rail corridor fenced), 2. Mortality from vehicle strike	Possible	Minor		
	Koala (*Phascolarctos cinereus*) (species present)		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike, 3. Noise, dust and light pollution (on individuals in adjacent habitats)	Probable	Minor	Liaison with local Wildlife Carer for treatment of injured animals or young rescued from adults killed or injured by vehicles or activities associated with the Project. Appropriate speed limits for vehicles. Awareness of wildlife matters will be incorporated in the site induction. Standard dust suppression techniques.	Minor
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	Direct – 1. Constraint to local movements (if rail corridor fenced), 2. mortality from vehicle strike	Possible	Minor		
	Troughton's Sheathtail-bat *(Taphozous troughtoni)* (species present)	Endangered NC Act	Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Not appropriate – there is uncertainty concerning the validity of this species and of the reliability of Anabat as a means of identification.		Not applicable
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Not appropriate		
			Transport infrastructure	None	Not applicable	Not appropriate		
	Little Pied Bat *(Chalinolobus picatus*) (species present)	Rare NC Act	Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Minor
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	None	Not applicable	Not applicable		
Nationally Significant Fauna (Migratory) Objective: Minimise fauna injury and disturbance to natural processes and behaviour.	Australian Cotton Pygmy-goose (*Nettapus coromandelianus albipennis)* Also listed as Rare under the NC Act (species present)	Migratory EPBC Act	Pits	None	Not applicable	Not applicable		None
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Great Egret (*Ardea alba)* (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Cattle Egret (*Bubulcus ibis*) (species not recorded, but predicted to occur sporadically)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	White-bellied Sea-eagle *(Haliaeetus leucogaster*) (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Painted Snipe *(Rostratula benghalensis s. lat.*) and Latham's Snipe (*Gallinago hardwickii*) (species not recorded, but predicted to occur occasionally)		Pits	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Little Curlew *Numenius minutus* (non-breeding wader, not recorded but may occur sporadically)		Pits	Direct impact – noise and dust pollution (on individuals in adjacent habitats).	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Marsh Sandpiper *Tringa stagnatilis*, Common Sandpiper *Actitis hypoleucos*, Red-necked Stint *Calidris ruficollis*, and Sharp-tailed Sandpiper *Calidris acuminata* (non-breeding waders, species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Caspian Tern *Sterna caspia* (species present)		Pits	None	Not applicable	Not applicable	None provided	None
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	White-throated Needletail *Hirundapus caudacutus* and Fork-tailed Swift *Apus pacificus* (non-breeding aerial species – species present)		Pits	Direct – Noise and dust pollution (on individuals foraging above and over adjacent habitats)	Probable	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals foraging above and over adjacent habitats)	Probable	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Rainbow Bee-eater *Merops ornatus* (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Probable	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Rufous Fantail *Rhipidura rufifrons* (breeding passerine – species present)		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Possible	Minor	Standard dust suppression techniques.	Minor
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Possible	Minor		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
			Transport infrastructure	None	Not applicable	Not applicable		
	Black-faced Monarch *Monarcha melanopsis* (breeding passerine – not recorded but predicted to occur occasionally)		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Satin Flycatcher *Myiagra cyanoleuca* (non-breeding passerine – species present)		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Australian Reed-Warbler *Acrocephalus australis* (breeding passerine – species present)		Pits	Direct impact – noise and dust pollution (on individuals in adjacent habitats).	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
Feral Species of State Significance Objective: Manage existing pests and prevent new introductions.	(feral) Cat *Felis catus*, Dingo/dog *Canis lupus dingo/familiaris* (feral predators – species present)	Declared Class 2 Pest under the LP Act	Roads and tracks	Direct – Increased access to surrounding vegetation and resultant predation on native fauna	Probable	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Red Fox *Vulpes vulpes* (feral predator – not recorded but predicted to occur sporadically)		Roads and tracks	Direct – Increased access to surrounding vegetation and resultant predation on native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Rabbit *Oryctolagus cuniculus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	(feral) Pig *Sus scrofa* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	(feral) Goat *Capra hircus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
Other Feral Species Objective: Manage existing pests and prevent new introductions.	Cane Toad *Bufo marinus* (species present)	Non-native animal	Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	House Sparrow *Passer domesticus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	House Mouse *Mus musculus* (species present)		Areas disturbed for Project infrastructure	Direct – Source area for dispersal into adjacent native vegetation and resultant competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	Black Rat *Rattus rattus* (species present)		Areas disturbed for Project infrastructure	Direct – Source area for dispersal into adjacent native vegetation and resultant competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	Brown Hare *Lepus capensis* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	(feral) Donkey *Equus asinus*		Areas disturbed for Project	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	(species present)		infrastructure					

[1] Clearing activities undertaken during the operational phases are assessed in Table 5.4.
[2] Many of these measures will be prescribed within site management plans for construction and operation (**Section 5.3.2**).

5.3 IMPACT MITIGATION

5.3.1 General Legislative Obligations

Remnant Vegetation

Ten REs were identified from ground truthing, of which three (i.e. REs 11.4.8, 11.4.9 and 11.9.5) have an Endangered status under the provisions of the VM Act and three (i.e. REs 11.3. 2, 11.4.2 and 11.8.11) have an Of Concern management status under the provisions of the VM Act. Of the ground truthed REs, nine have been previously mapped for the site, while one (RE 11.9.5 – vegetation community 14) is not currently mapped. In addition, the area of RE 11.4.9 south of Cherwell Creek (vegetation community 4) is not currently mapped. As such, a map amendment request will be submitted to NRW to reflect the ground truthed vegetation communities.

In order to comply with the *Code of Environmental Compliance for Mining Lease Projects* as part of the *Environmental Protection Act 1994* (EP Act), Condition 14 states that the holder of the environmental authority must not carry out activities "i*n, or within 1km of, a category B Environmentally Sensitive Area*".

As REs 11.4.8, 11.4.9 and 11.9.5 constitute Category B environmentally sensitive areas, and it is proposed to undertake activities (including clearing) in, or within 1 km of, these areas, the project will be assessed by the EPA as a Level 1 Mining Project. This requires the submission of an EM Plan that provides information on how the impacts on such areas will be managed. Relevant components are provided within the Draft Environmental Management Plan (Appendix R of EIS)

Significant Flora Species/Communities

No significant flora species was identified within the project site. However, five ground truthed vegetation communities (i.e. 2, 4, 14, 16 and 18) are analogous to either the EPBC Act listed Brigalow (*Acacia harpophylla* dominant and co-dominant) communities or the EPBC Act listed Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin. These communities are both listed as *Endangered* under the provisions of the EPBC Act.

As disturbance is proposed to these communities, the project is considered a controlled action that requires assessment and approval under the EPBC Act (**Section 1.3**). One of the BMA's key tasks in this respect is the determination of whether the listed communities will be significantly impacted with regard to a number of official assessment criteria. These criteria have been formally addressed in **Appendix 7** with key aspects discussed in **Section 5.6**.

Declared Pest Species

The project site has been extensively invaded by exotic weed species, four of which have been declared as Class 2 weeds and one as a Class 3 weed under the Provisions of the LP Act. There are also a number of pest animal species known or considered likely to be present.

By law, landholders are required to control Class 2 weed/pest species to prevent their further spread to surrounding land. The control of relatively small infestations of Lantana will also be undertaken before the species fully establishes within this locality.

Despite its value as a pasture species, the negative impacts of Buffel Grass upon native biota have been documented (Jackson 2005). This exotic, perennial grass species will be controlled within areas of ecological significance (e.g. areas currently mapped as remnant vegetation) to facilitate the recruitment of native flora.

Significant Terrestrial Vertebrate Species and Habitat

Two species listed as Vulnerable under the EPBC Act, Ornamental Snake and Squatter Pigeon (southern subspecies), have been recorded on the project site and/or the adjacent Peak Downs Mine, while another four, Brigalow Scaly-foot, Yakka Skink, Australian Painted Snipe, and Greater Long-eared Bat (south-eastern form), are predicted to occur or it is considered possible that they may occur. These species are considered as part of the assessment of significance of impacts for these and other Matters of National

Environmental Significance in **Appendix 7** with key aspects discussed in **Section 5.6**.

Fourteen bird species listed as Migratory under the EPBC Act, Cotton Pygmy-goose, Great Egret, White-bellied Sea-Eagle, Marsh Sandpiper, Common Sandpiper, Red-necked Stint, Sharp-tailed Sandpiper, Caspian Tern, Fork-tailed Swift, White-throated Needletail, Rainbow Bee-Eater, Rufous Fantail, Satin Flycatcher and Australian Reed-Warbler (listed as Clamorous Reed-Warbler) (**Section 4.3.3)**, have also been recorded. These species are considered as part of the assessment of significance of impacts for these and other Matters of National Environmental Significance in **Appendix 7** with key aspects discussed in **Section 5.6**.

Terrestrial Vertebrate Movement Corridors

No corridors are mapped for the project site at the State, Regional or Local levels under the BPA (EPA 2003b) (**Section 4.1**). No legislative constraints for any proposed activities are anticipated in regards to movement corridors.

Aquatic Fauna

No aquatic fauna of special conservation significance was recorded during current or previous surveys of the project site and immediate surrounds. The ephemeral nature of the natural drainage lines and their substrate within the project site mean that flows of any substance are likely to be restricted to periods of, and immediately after, heavy rainfall.

No legislative constraints are anticipated in regards to aquatic fauna based on the current or previous survey results.

5.3.2 Mitigation Requirements/Recommendations

Implementation of the following mitigation and compensatory measures is identified in **Tables 5.2 to 5.5** as necessary to reduce identified impacts on flora and fauna to levels that will not cause permanent harm to significant ecosystems or flora and fauna populations:

- As much as possible, only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system;;
- Utilise standard dust suppression techniques and strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover;
- Fauna spotter/catchers present during clearing activities in areas of high ecological value, such as remnant woodland;
- For affected ecosystems (e.g. vegetation communities listed as Endangered under the provisions of the VM Act and/or the EPBC Act) not subject to existing surface area approvals for clearing and significant species – offset vegetation loss through negotiation with DEWHA;
- Take into account habitat for significant fauna species when considering vegetation offset areas;
- Develop and implement the site Environmental Management Plan, including appropriate pest animal and weed management measures (such as cleaning vehicles) and contaminated land management measures;
- Interference with watercourses and flows will be in accordance with the *Water Act 2000*, including the development of a specific Revegetation Plan for creek diversions;
- Implement measures to reduce fauna mortality on roads and ensure appropriate treatment of injured/orphaned animals through liaison with local Wildlife Carers; and
- Retention (or provision in surrounding habitat), where practical, of important habitat features such as large hollow-bearing trees (live or dead), nest boxes and log piles.

A contractor's construction environmental management plan will manage potential habitat impacts during the construction phase, while the site environmental management plan will manage habitat impacts during operation and decommissioning.

Pest animal and weed management planning is an important component of habitat

management for each stage of the project, including measures to control weeds (e.g. Parthenium and Buffel Grass in remnant vegetation), as are measures to control grazing, site access, erosion and sedimentation and fire.

The maintenance of environmental flows within the project site's natural drainage systems is also significant for flora and fauna in that the riparian zone provides refuge habitat and facilitates movement throughout the local area. Many plant and animal species rely on these areas for survival within the predominantly dry landscape.

Key components are provided within relevant EM Plan elements in Chapter 21 of the EIS.

5.3.3 Ecological Monitoring

Monitoring is a vital component of environmental management, in that it provides feedback on the effectiveness of design, methods and management practices and provides information that allows designs, methods and management practices to be altered to improve their effectiveness.

For the Caval Ridge Mine Project, ecological monitoring will be undertaken during:

Pre-construction

To determine baseline condition, surveys designed to provide an accurate assessment of the ecological condition and flora and fauna community composition within the project site were carried out.

Standard survey techniques were applied that are replicable, and can be used as a basis for future monitoring. As such, data sets exist for:

- RE/vegetation community composition and condition;
- Fauna community composition for the main habitat types present;
- Fauna occupancy for the main habitat types present; and
- The locations of flora and fauna species of special conservation significance.

The results of previous surveys of the project site (**Section 3.1**) have also been incorporated into this report.

Construction Phase

Monitoring during this period will include:

- Mapping of the distribution of declared and environmental weeds, particularly adjacent to roadway construction;
- Occurrences of erosion and sedimentation influencing vegetation and stream health;
- Pest animal activity;
- Dust effects on native vegetation; and
- Native animal injuries during the construction phase.

Operational Phase

Monitoring during this period will include:

- The distribution of declared and environmental weeds around the perimeter of the open pits, CHPP, ROM, overland conveyor, rail route, new sediment basins, creek diversions and adjacent to new roadways and the dragline transport route;
- Habitat rehabilitation/restoration progress;
- Fauna use of rehabilitated areas;
- Downstream riparian habitat; and
- Pest animal activity.

The proponent should also undertake water quality and quantity monitoring upstream and downstream of mining operations.

5.4 RESIDUAL IMPACTS

Once appropriate mitigation measures and management plans are implemented, the impacts of the construction and operational phases of the mine and associated infrastructure on terrestrial and aquatic ecosystems are predicted to be predominantly minor or negligible (**Tables 5.2-5.5**), with moderate impact predicted to result from the loss of remnant vegetation in the form of approximately 125 ha of Endangered (EPBC Act) RE 11.8.11.

Critical to the predicted scale of residual impacts are restoration, enhancement or offset of Endangered vegetation communities,

including consideration of habitat for significant fauna species.

The noise, dust and light effects from the pits, roads, rail spur and loop, and CHPP will present a continual management requirement for vegetation and fauna in surrounding areas.

Riparian and in-channel ecological communities downstream of the diverted sections of Caval and Horse Creeks and additional site dams, and within the path of the proposed dragline transport route, may be affected by alterations in stream morphology, requiring monitoring and the implementation of management actions where required to ensure that the vegetation retains its current ecological function within the local landscape. Monitoring should include bank stability, over-bank flow, and water quality.

5.5 OPPORTUNITIES FOR POSITIVE IMPACTS

The EPA has developed a hierarchy of rehabilitation objectives specifically for mining projects (EPA 2008c). This hierarchy, in order of decreasing capacity to prevent or minimise environmental harm, is:

> *1. avoid disturbance that will require rehabilitation*
>
> *2. reinstate a 'natural' ecosystem as similar as possible to the original ecosystem*
>
> *3. develop an alternative outcome with a higher economic value than the previous land use*
>
> *4. reinstate previous land use (e.g. grazing or cropping)*
>
> *5. develop lower value land use*
>
> *6. leave the site in an unusable condition or with a potential to generate future pollution or adversely affect environmental values* (EPA 2008c: 5)

Rehabilitation of grazing land, as is the case with much of the project site, is sufficient to meet requirements. However, as stated above, a preferred option is reinstatement of habitat as close to the original ecosystem as possible. Details of original vegetation are obtainable from the Queensland Herbarium. Such rehabilitation is considered the preferred option as it would:

(a) reduce the likelihood of invasion by weeds, including Buffel Grass, into adjacent remnant vegetation;

(b) recreate habitat suitable for a number of EVR fauna species;

(c) improve the visual amenity of the rehabilitated area;

(d) improve fauna movement across a highly disturbed landscape by providing a 'stepping stone'; and

(e) reduce the greenhouse gas burden of the area.

5.6 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

5.6.1 Brigalow

Removal of areas mapped as vegetation communities 4, 14, 16 and 18 (**Figures 4.2** and **4.4**) will result in the loss of areas mapped during ground survey as REs 11.4.8, 11.4.9 and 11.9.5 that have been listed as Endangered under the provisions of the EPBC Act.

Figures 4.2, 4.3 and **4.4** show the areas of RE 11.4.8 (vegetation communities 16 and 18), RE 11.4.9 (vegetation community 4) and RE 11.9.5 (vegetation community 14) that would be subject to clearing as a result of the proposed activities.

Under the EPBC Act Administrative Guidelines on Significance (DEH 2006), an action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- reduce the extent of a community, or
- fragment or increase fragmentation of the community, or
- adversely affect habitat critical to the survival of an ecological community, or
- modify or destroy abiotic factors necessary for the community's survival, or
- cause a substantial change in the species composition of an occurrence of an ecological community, or

- cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, or
- interfere with the recovery of an ecological community.

These criteria have been addressed in **Appendix 7**.

Overall, it was found that much of the Brigalow in this location has been highly disturbed and is in poor condition due primarily to invasion by Buffel Grass and drought stress.

It is proposed that the loss of those areas of Endangered Brigalow communities associated with the proposed open pit and infrastructure that are not subject to existing surface area approvals for vegetation clearing (as shown on Figure 8.2a) will be offset, through negotiation with DEWHA. In addition, areas currently supporting Brigalow will be managed to control the extent of Buffel Grass and other weed species to ensure the continued persistence of the communities within the subject area.

5.6.2 Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

Removal of vegetation currently mapped as vegetation community 2 (**Figures 4.2** and **4.4**) will result in the loss of vegetation currently mapped as RE 11.8.11 which is listed as Endangered under the provisions of the EPBC Act.

Figures 4.2, 4.3 and **4.4** show the areas of RE 11.8.11 (vegetation community 2) that would be subject to clearing as a result of the proposed open pit.

Areas currently mapped as RE 11.8.11 were generally observed to be heavily infested by Parthenium weed. However, as this weed is an annual species, the RE is still considered to be recoverable and therefore meets the definition of remnant under the provisions of the VM Act.

EPBC Act Significant Impact Criteria have been addressed in **Appendix 7**.

It is proposed that the loss of those areas of the Endangered Natural Grassland community associated with the proposed pit that are not subject to existing surface area approvals for vegetation clearing (as shown on Figure 8.5) will be, through negotiation with DEWHA.

. In addition, areas currently supporting RE 11.8.11 will be managed to control the extent of exotic species (e.g. Parthenium) to ensure the continued persistence of this community within the subject area.

5.6.3 Vulnerable Species

Two species listed as Vulnerable under the EPBC Act, Ornamental Snake and Squatter Pigeon, have been recorded from the project site and/or adjacent Peak Downs Mine. The Ornamental Snake (2 records at the one location) was actually outside of the project site, while Squatter Pigeon was recorded at a number of locations within the project site, including highly modified areas.

Under the EPBC Act Administrative guidelines on significance (DEH 2006), an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

These criteria have been addressed in **Appendix 7**.

In summary, despite the proposed loss of habitat, mitigation through the establishment and management of vegetation offset areas to replace ecosystems and habitat lost, and the management of habitat remaining on-site to control pest species and fire, would ensure that significant ecosystems and habitat values for significant species are retained and enhanced within the local area.

5.6.4 Migratory Birds

Under the EPBC Act Administrative guidelines on significance (DEH 2006), an action is likely to have a significant impact on migratory species if there is a real chance or possibility that it will:

- substantially modify, destroy or isolate an area of important habitat of the migratory species, or
- result in invasive species that are harmful to the migratory species becoming established in an area of important habitat of the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

These criteria have been addressed in **Appendix 7**.

Overall, there is no evidence to suggest that the study area provides an area of important habitat for, or supports an ecologically significant proportion of a population of, any of the recorded migratory birds. Most are wetland species and the study area is surrounded by properties with many small dams for many kilometres. These, including the dams and other large waterbodies on the project site, form a multitude of isolated waterbodies that comprise a large, regional wetland resource for mobile species. These species will be moving throughout this larger 'wetland' and not just reliant on the waterbodies on the study area.

In the context of regional resources, including nearby farm dams and water storage areas associated with the existing Peak Downs Mine, the loss of the habitat is very unlikely to be significant. Most of the birds are using artificial waterbodies in the area and of the larger region of which the project site is a part and no long-term impacts on local populations of the observed migratory species are expected as a result of the Project. Overall, the creation of additional dams within the project site may provide a net increase in habitat for these species.

In terms of non-wetland migratory species, only Rainbow Bee-eater is likely to suffer any substantial loss of habitat. However, this species is not dependent specifically on habitat occurring on the site and utilises highly modified lands as well as remnant vegetation. Overall, the proposed action is not expected to detract from a safe future for Migratory Birds in the region.

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Appendix 1:
Peak Downs Mine – Literature Review and Recommendaitons for Further Ecological Studies for the Proposed Expansion EIS

FINAL REPORT

Peak Downs Mine -

Literature Review and Recommendations for Further Ecological Studies for the Proposed Expansion EIS





Prepared for

BMA

4 May 2007

42625926

URS

Project Manager:

Matthew Ames
Principal Environmental Engineer

URS Australia Pty Ltd

Level 3, 116 Miller Street
North Sydney
NSW 2060
Australia
Tel: 61 2 8925 5500
Fax: 61 2 9922 6977

Project Director:

Chris Pigott
Senior Principal

Date: 4 May 2007
Reference: 42625926 R001
Status: Final

Authors:

Dan Simmons
Senior Environmental Scientist

Keith Martin
Senior Environmental Scientist

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Section 1 Introduction

1.1 Background

URS Australia Pty Ltd (URS) were commissioned by BHP Billiton Mitsubishi Alliance BMA to undertake a literature review of a number of reports previously undertaken for the Peak Downs Mine. Existing literature on the terrestrial and aquatic ecology of the study area has been summarised through review of 15 key references.

1.2 Purpose of Review

URS were engaged to prepare an Environmental Impact Assessment (EIS) for the proposed Peak Downs Mine expansion project. A part of this study would be a description of the existing fauna diversity of the area, assessment of significant taxa and communities and habitat in the area, assessment of the impacts of the proposed project on terrestrial vascular flora and vertebrate fauna and design of an appropriate management or monitoring programs to minimise and monitor impacts.

This review provides information on the existing biodiversity data available for the subject area and examines the adequacy of that data for the EIS process. Any gaps in the data are identified and recommendations for closing those gaps are presented.

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2.1 Summary of Documents

Many of the reports reviewed were received by URS in draft format and are currently undated. In such cases the dates referenced below are based on timing of field work.

2.1.1 Ecoserve (2005a)

Ecoserve (2005a) *2005 Summer Season Flora and Fauna Surveys for Peak Downs Mine,* Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

- This report represents the results of a broad flora/fauna survey of the un-mined portions of the Peak Downs mining lease (90,000 ha), including the majority of the proposed currently expansion area. This flora survey does not cover the most south-westerly section of the proposed expansion area.
- The majority of survey coverage is in the area to the south of the proposed expansion (Figure 4.1 of the report). A small area in the south of the proposed expansion footprint has been covered by vegetation mapping in this survey.
- The flora component of this survey was undertaken by an experienced botanist during the overall eight day survey period undertaken for both flora and fauna studies in February 2005. The extent of the survey period for the flora survey is unclear.
- Review of existing information published for the study area included review of the current EPA certified Regional Ecosystem (RE) mapping version 4.0.
- Field methodology employed is not outlined in detail however it can be determined that methodology employed involved: random meander searches made in likely habitats of rare and threatened taxa known from the region; and assessment of REs using an undescribed transect methodology. It is assumed that the transect employed is something similar to Quaternary level transect methodology (Neldner, 2005) employed for assessment of dominant species in each strata for RE determination.
- An inventory of flora taxa was compiled during regional ecosystem mapping of the study site. Additional taxa observed in the nearby analogous vegetation were also made for comparative purposes.
- Field results include a description of the 13 REs observed during the study, including four 'Endangered' and two 'Of concern' REs as listed under the Queensland *Vegetation Management Act, 1999* at the time of survey.
- No taxa of conservation significance under either the *Nature Conservation (Wildlife) Regulation 1994* (of the *Nature Conservation Act 1992*), or the *Environment Protection and Biodiversity Conservation Act 1999* were observed during the survey period.
- It is noted that two taxa, *Dichanthium queenslandicum* and *D. setosum*, have a reasonable probability of occurring on the site in RE 11.8.5 or 11.8.11.
- Nine weed species as listed under the *Land Protection (Pest And Stock Route Management) Act 2002* were observed during the survey.

2.1.2 Ecoserve (2005b)

Ecoserve (2005b) *An Investigation of Flora, Fauna and Biodiversity Values associated with Brigalow Remnants along the Proposed Heyford Back Access Road,*
Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

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- This study is primarily a site visit comprising one day's field work by two persons in July 2005. The aim was to investigate the biodiversity significance of a stretch of about 1 km of new road at the Peak Downs site.
- Three REs were observed within the study area, one of which is listed as 'Endangered' and one of which is listed as 'Of concern' under the Queensland *Vegetation Management Act, 1999*.
- No taxa of conservation significance under either the *Nature Conservation (Wildlife) Regulation 1994* (of the *Nature Conservation Act 1992*), or the *Environment Protection and Biodiversity Conservation Act 1999* were observed or expected to occur in the study area.
- Three pest species as listed under the *Land Protection (Pest And Stock Route Management) Act 2002* were observed during the survey.
- A recommendation is made for further flora studies to be conducted to account for seasonal variation in the floristic assemblage.

2.1.3 Ecoserve (2006a)

Ecoserve (2006a) Draft - *Flora & Fauna Baseline Surveys for the BMA Isaac River Project*. Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

- This survey covers the area north of the Peak Downs Highway and the south-western section of the currently proposed expansion area not covered in Ecoserve (2005a). The report employs the same field methodology, and is in the same format as Ecoserve (2005a).
- The flora component of this survey was undertaken by an experienced botanist during the overall seven day flora/fauna survey period in February 2006. The extent of the survey period for the flora survey is unclear.
- Review of existing information published for the study area included review of previous Ecoserve reports for the region and review of the current EPA certified RE mapping version 5.0.
- Field methodology employed is not outlined in detail however it can be determined that methodology employed involved: random meander searches made in likely habitats of rare and threatened taxa known from the region; and assessment of REs using an undescribed transect methodology. It is assumed that the transect employed is something similar to Quaternary level transect methodology (Neldner, 2005) employed for assessment of dominant species in each strata for RE determination.
- An inventory of flora taxa was compiled during regional ecosystem mapping of the study site. Additional taxa observed in the nearby analogous vegetation were also made for comparative purposes.
- Field results include a description of the 15 REs observed during the study, including five 'Endangered' and two 'Of concern' REs as listed under the Queensland *Vegetation Management Act, 1999* at the time of survey.
- No taxa of conservation significance under either the *Nature Conservation (Wildlife) Regulation 1994* (of the *Nature Conservation Act 1992*), or the *Environment Protection and Biodiversity Conservation Act 1999* were observed during the survey period
- It is noted that three significant taxa, *Dichanthium queenslandicum D. setosum*, and *Desmodium macrocarpum* have a reasonable probability of occurring on the site.
- Ten weed species as listed under the *Land Protection (Pest And Stock Route Management) Act 2002* were observed during the survey.

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- A recommendation is made to undertake further detailed flora studies once the final location and footprint of the mine and associated infrastructure are finalised.

2.1.4 Ecoserve (2006b)

Ecoserve (2006b) Draft- *Preliminary Flora and Fauna Investigations – Land at Station Road, Moranbah* Prepared for Shaun Ferris, BMA Project Development by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

- The flora component of this field survey was conducted over two days in February 2006 by a qualified botanist.
- The study area is remote from the expansion project site.
- No survey data are presented in the report, however three REs are identified for the study area, one of which is listed as 'Of Concern' under the under the Queensland *Vegetation Management Act, 1999*.
- No taxa of conservation significance under either the *Nature Conservation (Wildlife) Regulation 1994* (under the *Nature Conservation Act 1992*), or the *Environment Protection and Biodiversity Conservation Act 1999* were observed or expected to occur in the study area.

2.1.5 Ecoserve (2007)

Ecoserve (2007) *A review of Habitat Values for Biodiversity Species of Conservation Significance - Peak Downs Mine*
Prepared for BMA Peak Downs Mine by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

- Objectives of this report were to revise RE mapping, review and revise flora/fauna data and habitat values in relation to threatened taxa, and produce a biodiversity map and database.
- Literature review includes all previous reports and a wide range of other regional assessments.
- Results identify 14 REs from review of all previous reports, including four 'Endangered' and two 'Of concern' REs as listed under the Queensland *Vegetation Management Act, 1999* at the time of reporting.
- No taxa of conservation significance under either the *Nature Conservation (Wildlife) Regulation 1994* (under the *Nature Conservation Act 1992*), or the *Environment Protection and Biodiversity Conservation Act 1999* were found to be occurring on site.
- It is noted that three significant taxa, *Dichanthium queenslandicum D. setosum*, and *Digitaria porrecta* have a reasonable probability of occurring on the site.
- Ten weed species as listed under the *Land Protection (Pest And Stock Route Management) Act 2002* were found to be occurring on site.

2.1.6 Emerton and Elsol (2007)

Emmerton and Elsol (2007) *Peak Downs Mine Rehabilitation Monitoring August September 2006,* prepared by B.R. Emmerton Pty Ltd and J & J Elsol.

- This report is presented in three sections: Section A details soil and spoil profile monitoring; Section B details results of vegetation monitoring for 2005 and 2006; and Section C details erosion monitoring results. This summary only pertains to Section B.

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- Nine permanent monitoring sites were established at Peak Downs Mine in 2005 for vegetation rehabilitation and erosion monitoring. Sites consisted of three unmined reference sites and six rehabilitated sites.
- Two additional unmined reference sites were subsequently added in 2006 during the monitoring period.
- Monitoring is proposed to be undertaken annually for six periods to ascertain rehabilitation condition.
- Vegetation monitoring results show that the older un-topsoiled rehabilitation sites are Buffel grass dominated (50 to 100%) and have moderate total cover levels of 70 to 78%. The newer topsoiled rehabilitation sites are dominated by Buffel grass and Rhodes grass with total cover levels between 70 and 92%. The unmined reference sites are generally not Buffel grass dominated but invasive pasture species are present with ground cover levels between 72 to 90%.

2.2 General Comments on Flora Reports

Some of these reports are in draft format and therefore may be different to the final product. Notes relating to these reports may not be applicable to final versions.

Of the reviewed studies, the two with the most direct relevance to the currently proposed expansion area are the '2005 Summer Season' survey (Ecoserve, 2005a) and the 'Flora and Fauna Baseline Surveys for the Isaac River Project' (Ecoserve, 2006a)

The reports detail standard sampling methodology and results in accordance with accepted practices and legislative requirements in Queensland and as such, provide some useful baseline information for environmental impact assessment.

2.3 Data Gaps

The primary objectives of the flora survey components of the most comprehensive and relevant of the Ecoserve 2005a and Ecoserve 2006a reports are to undertake rare and threatened species searches, ground truth RE mapping, and obtain some data on floral diversity. As such, rigorous transect methodology was not required for obtaining detailed structural and floristic data. An EIS-level impact assessment in keeping with typical EIS Terms of Reference (ToR) is highly likely to require more detailed studies to obtain more detailed baseline data on the floristics and structure of vegetation communities replicated (usually for a minimum of three transects) in every identified RE.

2.4 Recommendations for Additional Flora Studies

The main tasks required to prepare an EIS for the proposed expansion area would be to:

1) Consolidate survey baseline data;

2) Describe floral seasonal floral diversity; and

3) Prepare detailed vegetation mapping of significant communities (if not all communities).

Much of this work would be undertaken as desktop review. However, a field survey should be undertaken to obtain detailed floristic and structural data, at least targeting significant REs of the proposed expansion area.

2.4.1 Survey Outcomes

Key recommended outcomes from flora field investigations include:

- Baseline terrestrial flora mapping of the study area at a scale adequately refined to assist impact assessment and resource management;

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- Quantitative data on the structure and floristics of the significant vegetation communities of the study area; and
- Identification of the extent and diversity of weed species for the study area.

2.4.2 Survey Design

A flora field investigation is recommended to be undertaken to provide baseline data not currently available from previous studies that would be required for EIS-level studies, and to refine current vegetation mapping at a larger scale to better inform mine planning. Two possible survey approaches are proposed for the flora field investigation to fill gaps in the current information:

- A reduced-scale vascular flora study building on previous work, aimed at obtaining additional floristic data and refining mapping only for REs of significant conservation status; or
- A full-scale terrestrial vascular flora study for the proposed expansion area in keeping with methodology typical of EIS ToR.

The first survey approach is the preferred approach as it builds on previous work undertaken for the study area without requiring an extensive survey effort. It is recommended that negotiation should be undertaken with the Environmental Protection Authority (EPA) to gain approval for the reduced survey approach, as it is outside typical EIS ToR. Further detail of proposed survey methodology is provided below.

2.4.3 Survey Effort and Timing

The recommended survey period for the proposed reduced-scale flora survey targeting only conservation significant REs is expected to be between four and five days duration.

The recommended flora survey period for a full-scale survey that would adhere to methodology required to satisfy typical EIS ToR is between nine and ten days duration depending on the number of vegetation communities present within the study area requiring survey and other variable factors. A follow up survey may also be required to capture seasonal variation of diversity, depending on the seasonal timing of the initial study

2.4.4 Methodology

Reduced Survey

It is recommended that the proposed reduced survey effort primarily focus on the survey and delineation of conservation significant vegetation communities[1] of the site. Flora field surveys should employ an assessment of floral taxa and vegetation communities in keeping with the methodology used by the Queensland Herbarium for the survey of Regional Ecosystems and vegetation communities (Nelder *et al.,* 2004) and should be consistent with the EPA CORVEG proforma.

Preliminary identification of conservation significant vegetation communities of the project area should be conducted prior to the commencement of fieldwork. Preliminary identification should include vegetation community definition from previous survey data, current stereo image 1: 25 000 colour aerial photography and interpretation of 1:100 000 Regional Ecosystems mapping (version 5.0) for the region (EPA, 2005a).

Preliminary community definition should be used to identify locations for representative field survey sample plots to obtain floristic and structural data and ground truth conservation significant communities

[1] Of Concern, Endangered, Critically Endangered, or Vulnerable communities under the either Queensland *Vegetation Management Act, 1999* and the Commonwealth *Environmental Protection and Biodiversity Conservation Act, 1999*

to refine their delineation. Field surveys should involve a botanical assessment at a number of representative sites (three minimum) within each conservation significant vegetation community, employing a number of standard methods within primary sample plots (50 m x 10 m in extent), secondary sample plots and random meander search areas. A number of vehicle traverses of the study site should also be undertaken throughout the survey period to identify changes in landform and identify community boundaries. Random meander searches should also be undertaken across the entire study site in habitat of the conservation significant species[2] identified as potentially occurring within the study area

Community structural formation classes should be assessed according to Specht (1970). Regional Ecosystem classification of communities should be determined as per Young and Dillewaard (1999) in Sattler and Williams (1999), and in accordance with the Regional Ecosystems Description Database (REDD) (EPA, 2005b). Final vegetation mapping should be undertaken utilising field survey data and aerial photograph interpretation of stereo pair images at a scale of 1: 25,000 or better. .

Full Survey

A flora field survey undertaken in keeping with typical EIS ToR should sample all vegetation communities present within the study area employing an assessment of floral taxa in keeping with the methodology used by the Queensland Herbarium for the survey of Regional Ecosystems and vegetation communities (Nelder *et al.,* 2004) and should be consistent with the EPA CORVEG proforma.

Preliminary identification of the vegetation communities of the project areas should be conducted prior to the commencement of fieldwork. Preliminary identification should include vegetation community definition from previous survey data, stereo image 1: 25 000 colour aerial photography and interpretation of 1:100 000 Regional Ecosystems mapping (version 5.0) for the region (EPA, 2005a).

Preliminary community definition should be used to identify locations for representative field survey sample plots to obtain floristic and structural data and ground truth communities. Field surveys should involve a botanical assessment at a number of representative sites (three minimum) within each vegetation community, employing a number of standard methods within primary sample plots (50 m x 10 m in extent), secondary sample plots and random meander search areas. A number of vehicle traverses of the study site should also be undertaken throughout the survey period to identify changes in landform and identify community boundaries. Random meander searches should be undertaken in likely habitats of conservation significant species[1] identified as potentially occurring within the study area.

Community structural formation classes should be assessed according to Specht (1970). Regional Ecosystem classification of communities should be determined as per Young and Dillewaard (1999) in Sattler and Williams (1999), and in accordance with the Regional Ecosystems Description Database (REDD) (EPA, 2005b). Final vegetation mapping should be undertaken utilising field survey data and aerial photograph interpretation of stereo pair images at a scale of 1: 25,000 or better.

All field activities for the flora survey should be undertaken in accordance with the URS Peak Downs expansion project Health, Safety, Environment and Community (HSEC) Plan, with JSAs developed specifically for the ecological study to address specific potential hazards and identify control measures.

[2] Critically Endangered, Endangered, Vulnerable, Rare or Conservation Dependant species under either the Queensland *Nature Conservation (Wildlife) Regulation, 2006* and the Commonwealth *Environmental Protection and Biodiversity Conservation Act, 1999*

Section 3 Fauna Studies

3.1 Summary of Documents

Many of the reports discussed below were received by URS in draft format and are currently undated. In such cases the dates referenced below are based on timing of field work.

3.1.1 Ecoserve (2005a)

Ecoserve (2005a) *2005 Summer Season Flora and Fauna Surveys for Peak Downs Mine,* Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd

- The survey was undertaken by two personnel for an eight day period in February 2005
- This report represents the results of a broad flora/fauna survey of the unmined Peak Downs mining lease (90,000 ha), including some of the area of expansion.
- The majority of survey coverage is in the area to the south of the proposed expansion (see Figure 4.1 of the report). A small area in the south of the proposed expansion footprint has been covered by sampling sites in this survey.
- The survey highlights *Nature Conservation Act 1992* (NCA) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) listed species, and Jamba/Camba species. Regional Ecosystems are described in detail and mapped.
- Five sites surveyed systematically over five nights/six days. The fives site (Figure 4.1 of the report) are all close to the mined areas. Field survey methods comprised: Elliot trapping (50 A, 2 B 5 nights); pit trapping (5 nights); spotlighting; ground searches; and bird census.
- Other methods included: Anabat call detection; call playback; frog searches in wetlands; targeted searches for threatened species; and driving spotlighting.
- Limitations recognised in the survey include: potential for poor results due to several years of drought conditions; lack of flowering plants at time of survey; and the single sample period which meant personnel were unable to record data on migratory species or certain frogs at that time.
- The field investigation program provided records for 188 terrestrial vertebrate fauna species. The fauna assemblage was comprised of 29 mammal, 25 reptile, 14 frog and 120 bird species.
- Fourteen species recorded in the surveys are listed as rare, threatened, or otherwise significant under the provisions of the NCA and/or EPBC. Those are: Rare and Threatened species - Squatter Pigeon *Geophaps scripta scripta*, Little Pied Bat *Chalinolobus picatus* and Ornamental Snake *Denisonia maculate*; Culturally Significant species - Short-beaked Echidna *Tachyglossus aculeatus* and Koala *Phascolarctos cinereus*; Migratory species - Great Egret *Ardea alba*; Red-necked Stint *Calidris ruficollis*; Sharp-tailed Sandpiper *Calidris acuminata*; Marsh Sandpiper *Tringa stagnatilis*; White-throated Needletail *Hirundapus caudacutus*; Fork-tailed Swift *Apus pacificus*; Rainbow Bee-eater *Merops ornatus*; Dollarbird *Eurystomus orientalis*; and Restless Flycatcher *Myiagra inquieta*.
- Potentially richer fauna assemblages are likely to be linked to a number of factors including greater habitat structural diversity, higher floristic diversity, and an absence or low occurrence of introduced fauna (i.e. both competitors and predators). Areas that support such conditions and resources that are more favourable for the maintenance of a potentially richer fauna assemblage are the brigalow woodlands on cracking clay soils, the large remnant areas of poplar box woodlands (with more structurally complex understorey) in the south-eastern sector of the *study site*, and the riparian zone of the creek systems crossing the lease areas (e.g. *survey sites* 1, 3 and 4).
- Squatter pigeons were recorded from several sites. Little pied bat was recorded from Windsor Dam. Ornamental snake was recorded from Site 1 (two specimens).

- Survey recommendations are that future assessments are required to account for seasonal variations, and for adoption of a fauna monitoring program.
- The report includes a "database" of fauna records although this is actually a series of independent cross-tabulations for the various results and is not in a true database format.

3.1.2 Ecoserve (2005b)

Ecoserve (2005b) *An Investigation of Flora, Fauna and Biodiversity Values associated with Brigalow Remnants along the Proposed Heyford Back Access Road* Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

- This study is primarily a site visit comprising one day's field work by two persons in July 2005. The aim was to investigate the biodiversity significance of a stretch of about 1 km of new road at the Peak Downs site.
- No fauna records are given for the survey, but the surveyors report that, based on habitats present, it is unlikely that the area is important for any threatened species.

3.1.3 Ecoserve (2006a)

Ecoserve (2006a) *Flora & Fauna Baseline Surveys for the BMA Isaac River Project*. Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

- This survey covers the area of the proposed expansion. The report is in the same format as the others, and field survey methods are much the same as in Ecoserve (2005a).
- The survey was undertaken over a seven day period (including setup) in February 2006 by four researchers.
- Six systematic sampling sites were established (although seven figured in map). These sites are all fairly tightly grouped in the central part of the project area.
- Other targeted surveys using a variety of methods were conducted for threatened or significant species.
- Limitations of the survey were noted to include: dry conditions, which may have reduce the likelihood of detecting some species, especially some significant species; lack of flowering plants; and the single sample nature of the study.
- The field investigation program provided records for 187 terrestrial vertebrate fauna species. The fauna assemblage was comprised of 31 mammal, 36 reptile, 10 frog and 110 bird species.
- Significant fauna species recorded in the study include squatter pigeon, little pied bat, koala, echidna and some migratory birds.
- It is considered that potential exists for other significant species to be present, including ornamental snake and Brigalow scalyfoot.
- The report includes a "database" of fauna records although this is actually a series of independent cross-tabulations for the various results and is not in a true database format.
- The report concludes that areas south of the Peak Downs Highway support a wider variety of habitats and are less disturbed than areas to the north.

- The study concludes that "Further field investigations conducted under conditions different to those which prevailed during the recent survey period, may be required to provide more clarity on the occurrence on the study site of these taxa, particularly the 'Vulnerable' ornamental snake."

3.1.4 Ecoserve (2006b)

Ecoserve (2006b) Preliminary Flora and Fauna Investigations – Land at Station Road, Moranbah Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

- This field survey was conducted over three days in February 2006 by two researchers.
- The study area is remote from the expansion project site.
- No survey data are presented in the report, although the report states that it is unlikely that species of high conservation interest are resident on the site.

3.1.5 Ecoserve (2006c)

Ecoserve (2006c) *2006 Winter Vertebrate Fauna Survey of Remnant Habitats on Peak Downs Mine* Prepared for Shaun Ferris, BMA Project Development by Ecoserve Environmental Consultants.

- This survey targets 11 areas of vegetation both within and adjacent to the currently proposed expansion area. The report is in similar format as Ecoserve (2005a) and Ecoserve (2006a).
- Survey methodologies employed were observational (i.e. no trapping program), principally employed for surveying birds within targeted habitats to pick up any seasonal variation in the bird assemblage.
- The survey was undertaken over a six day period in May 2006 by two researchers.
- The field investigation program provided records for 152 terrestrial vertebrate fauna species. The fauna assemblage was comprised of 20 mammal, 8 reptile, 7 frog and 117 bird species.
- Fifteen records were new species not recorded in previous surveys on the site. This record included 2 reptile and 12 bird species.
- Eight species of conservation significance were recorded including: squatter pigeon; cotton pygmy goose; koala; short-beaked echidna; great egret; white-bellied sea-eagle; Caspian tern; and rainbow bee-eater.
- Field assessments suggest that habitat is present for other species of conservation significance not recorded
- The study concludes that it is important to continue assessing the noted seasonal variation in faunal assemblages and that it is recommended that Peak Downs Mine continues on-going fauna monitoring surveys of both remnant and rehabilitated communities.

3.1.6 Ecoserve (2006d)

Ecoserve (2006d) *2006 Aquatic Fauna Survey of Water Bodies on Peak Downs Mine* Prepared for Sara James and Lesley Chalkley, BMA Peak Downs Mine by Ecoserve Environmental Consultants.

- A five day survey of aquatic fauna of Peak Downs conducted by one researcher in May 2006.
- Review of previous literature included three previous WBM studies for the area.
- The field study concentrated on 10 artificial water bodies, primarily targeting fish species.

- Results include a description of water bodies and a water quality assessment. Five fish species were recorded.
- No conservation significant species were found.

3.1.7 Ecoserve (2006e)

Ecoserve (2006e) *Draft -2006 Baseline Fauna Survey of Post-mined Landscapes on Peak Downs Mine* Prepared for BMA Peak Downs Mine by Ecoserve Environmental Consultants.

- Literature review included assessment of previous reports for the study area and recent aerial photography flown in 2006.
- Field survey was undertaken over six day period in September 2006 by two researchers.
- Survey methodology employed standardised techniques at three systematic sites and observational techniques at a number of sites within rehabilitated habitat.
- Results yielded 97 terrestrial vertebrate fauna species, including 9 mammal, 5 frog, and 73 bird species. These results were preliminary, and excluded results from micro bat survey analysis.
- The report concludes the survey shows a variety of native fauna can be seen to be recolonising post-mine rehabilitation habitat, including conservation significant species.

3.1.8 Ecoserve (2006f)

Ecoserve (2006f) *Draft -Assessment of Koalas and Koala Habitat Use on Peak Downs Mine* Prepared for BMA Peak Downs Mine by Ecoserve Environmental Consultants and Ecoteam Environmental Scientific Services

- Literature review included assessment of previous reports for the study area and recent aerial photography flown in 2006.
- The field survey was undertaken over five days in September 2006 by three researchers.
- Survey methodology employed specific techniques for survey of koalas and/or evidence of their occurrence at 27 targeted survey sites.
- Diet analysis was undertaken for faecal pellets collected at six survey sites.
- The survey covered most of the proposed expansion area and adjacent habitat.
- Results revealed the presence of four observed koalas, and the presence of koala scats at 18 survey sites under five tree species across the survey area.
- An analysis was undertaken of preferred tree species, preferred REs and locations utilised by koalas within the study area.

3.1.9 Ecoserve (2006g)

Ecoserve (2006g) *Biodiversity and Threatened Species Action Plan for Peak Downs Mine* Prepared for BMA Peak Downs Mine by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

- Prepared in 2006, this report provides an overview of biodiversity values identified from previous reports for the study area.
- The report identifies threatened species, important habitats and introduced species.

- The report identifies “biodiversity management units”.
- The report provides an assessment of threats to biodiversity values of area and provides summaries of management actions, primarily for weed and feral animal control.

3.1.10 Ecoserve (2007)

Ecoserve (2006g) *A review of Habitat Values for Biodiversity Species of Conservation Significance - Peak Downs Mine*
Prepared for BMA Peak Downs Mine by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

- Objectives of this report were to revise RE mapping, review and revise flora/fauna data and habitat values in relation to threatened taxa, produce a biodiversity map and database.
- Literature review included all previous reports and a wide range of other regional assessments.
- Review of four previous reports (Ecoserve 2005a; WBM, 1996; WBM 1999; and GHD, 2004) revealed 234 terrestrial vertebrate fauna species, including 37 mammal, 29 reptile, 17 frog, and 151 bird species.
- Thirteen conservation significant fauna species are identified for the study area.
- Areas of high biodiversity value are identified.
- Threats to biodiversity, species and communities of significance are identified.

3.1.11 GHD (2004)

GHD (2004) *Peak Downs Mine Fauna Survey,* prepared for BMA December 2004.

- The report involved a three day survey of terrestrial vertebrates at three small sites to be cleared at Peak Downs.
- Literature review was limited to an EPBC website database search.
- Standard field survey techniques were employed including: Elliott trapping; spotlighting; active searches; bird observations; and Anabat detection.
- The surveys recorded one ‘Vulnerable’ bird species (Masked Owl, but this is in error), and one ‘Culturally Significant’ species (Koala).

3.1.12 WBM (1996)

WBM (1996) *Draft – Peak Downs Mine Aquatic and terrestrial Fauna Survey*, Prepared by WBM Oceanics Australia for BHP November 1996.

- Survey was undertaken in the late dry season October 1996 by four researchers.
- The aquatic survey was undertaken over a seven day period, sampling nine water bodies, resulting in seven fish species recorded.
- The terrestrial vertebrate survey was undertaken over a seven day period, sampling four systematic sites within differing habitat. Sites included both remnant and rehabilitated habitat.
- Methodology employed at systematic sites involved standard trapping and observational methods including: Elliot trapping; cage trapping; and pitfall lines. A nocturnal spotlighting survey and targeted waterbird survey were also undertaken.

- A four day targeted bat survey was undertaken across seven sites, involving harp trapping and observational searches.
- Results cited a total of 148 taxa including 10 frog species, 9 reptiles, 17 mammal and 112 bird species. Results are a compilation of the field survey data and previous collated data from other sources.
- No conservation significant terrestrial or aquatic fauna species were recorded.
- The report notes the significance of tall Eucalypt forest along Cherwell Creek, especially as potential habitat for Greater Glider.

3.1.13 WBM (1998)

WBM (1998) *Peak Downs Mine Aquatic and terrestrial Fauna Survey Wet and Dry Seasons*, Prepared by WBM Oceanics Australia for BHP November 1996.

- Report details the results from both the 1998 and 1996 studies.
- Survey undertaken in the wet season in January 1998.
- Methodology for the aquatic survey replicates that of the 1996 survey, sampling nine water bodies, resulting in six fish species recorded.
- Terrestrial vertebrate methodology employed replicates 1996 survey methodology, utilising standard trapping and observational methods including: Elliot trapping; cage trapping and pitfall lines. A nocturnal spotlighting survey and targeted waterbird survey were also undertaken.
- A comparison is made between 1996 and 1998 results.
- No conservation significant terrestrial or aquatic species were recorded.
- Management and monitoring options are presented in a general sense.

3.2 General Comments on Fauna Reports

Some of these reports are in draft format and therefore may be different to the final product. Notes relating to these reports may not be applicable to any submitted final versions not cited.

The reports are all written in a similar format, and due to the close proximity of the study sites, results are predictably similar in all cases.

Of the reviewed studies, the two with the most direct relevance to the proposed expansion are the “2005 Summer Season” survey (Ecoserve, 2005a) and the “Flora and Fauna Baseline Surveys for the Isaac River Project” (Ecoserve, 2006a).

The reports detail standard sampling methodology and results in accordance with accepted practices and legislative requirements in Queensland and as such, provide useful baseline information for environmental impact assessment.

The reports conclude that weather conditions at the time of the surveys (in particular the long dry period preceding) have hampered results for several fauna groups. All surveys have been conducted at the same time of year (February).

The surveys all highlight the presence of the same significant species in the area (squatter pigeon, little pied bat, ornamental snake and migratory waterbirds).

The reports summarise results in a series of “databases”. These are not really databases, but cross-tabulation presentations of the data. It is not known if the data collected have been entered into a true database for long term storage, addition and retrieval of fauna data.

Section 3 Fauna Studies

3.3 Data Gaps

The baseline fauna surveys described in the various reports represent a fairly comprehensive summary of the fauna of the study area. Most sections of the revised project area have been surveyed and all habitats have been sampled. Therefore, it is not considered necessary to undertake further baseline surveys for the EIS.

The baseline aquatic surveys cover only man-made habitats and only cover fishes. There are no data on macro-invertebrates, or on the ecology of natural watercourses. This is most likely due to the fact that no water was present in the natural watercourses during the sample periods. The lack of macro-invertebrate data may be an issue but since natural watercourses are non-perennial, the monitoring value for this group is limited.

Although there is a wealth of survey data presented in these reports, it is quite fragmented and difficult to access. It is not known if these data are available in a database format (eg. Microsoft Access). URS has been commissioned to prepare such a database based on exiting fauna survey data.

The Cherwell Creek area has been identified as a key fauna area, especially for riverine connectivity. If this area is planned for diversion, then some field assessments should be undertaken there.

Although there is a ”Biodiversity and Threatened Species Action Plan”, this document is mainly concerned with weeds and feral animal control. Biodiversity “management units” are mapped, but it is difficult to follow proposed actions for each unit as they relate to significant species. Threatened/migratory species are listed, but their distribution and key sites based on prior survey data is not mapped, and no management or monitoring program has been proposed for individual species or groups. For the EIS, a practical management and monitoring program for these species will need to be presented. Both desktop and some field work will be required to determine the potential impacts on these species, their habitats and locations, measures to reduce impacts, and to prepare a monitoring plan.

3.4 Recommendations for Additional Fauna Studies

The main tasks required to prepare the EIS for this study are to:

1) Consolidate survey baseline data;

2) Describe threatened fauna species, sites and habitats; and

3) Prepare management and monitoring plans for fauna and habitats, particularly threatened species.

Most of this work would be undertaken as desktop review. However, it is recommended that some field work targeting significant sites (e.g. Cherwell Creek) and threatened species would be necessary in developing the monitoring and management plans for fauna. It is expected that such work could be completed in four to five days on site. Timing is not critical, but warmer and wetter conditions would be beneficial. Further detail of proposed survey methodology is provided below.

3.4.1 Outcomes

Key outcomes recommended for fauna field studies should include:

- Compilation of all previous baseline and monitoring fauna studies undertaken for the study area. Baseline fauna habitat mapping of study area at an adequate scale to assist impact assessment and resource management; and
- Presentation of quantitative data for terrestrial and aquatic vertebrate fauna species assemblages.

3.4.2 Survey Design

The survey approach for fauna investigations does not require a significant level field study as it is recognised that relevant data from previous fauna surveys are readily available. The proposed approach for the fauna study involves the following components:

- Review and consolidation of previous baseline data;
- Description of faunal assemblages, threatened species sites and habitat;
- A site visit for familiarisation of landform and habitat; and
- An observational fauna survey targeting significant sites.

3.4.3 Survey Effort and Timing

Investigations for the fauna study should primarily comprise review and consolidation of previous data, however a supplementary fauna investigation at the study site is also proposed. A site visit would allow a zoology team familiarisation with site specific variables such as landform and habitat types, allowing for an appreciation of potential impacts. The field survey should also target significant habitat for assessment, including habitat of conservation significant species and habitat sensitive to particular impacts such as the riparian and aquatic ecosystems of Cherwell Creek. This will provide a basis for gauging future monitoring requirements and management recommendations. The fauna field investigation is recommended to be undertaken over a four to five day period depending on a number of variable factors.

3.4.4 Methodology

Methods for the proposed fauna field investigation should be based on observational techniques and habitat analysis. Proposed methodology should be in keeping with techniques used for forested habitats of central coastal Queensland, with a focus on methodologies that are compatible with the faunal assemblages of the brigalow belt bioregion.

Active diurnal and nocturnal searches for reptiles, amphibians and mammals may be employed involving searches for individuals active in targeted micro-habitat such as aquatic habitat, groundcover, trees/rock faces, fallen wood debris, decorticating bark and forest litter. Searches for tracks and signs would involve both active and opportunistic observations of scats, scratchings, diggings and other signs of fauna activity. Where possible predator scats should be collected for hair analysis for identification of prey species.

Nocturnal spotlighting, both on foot and from a moving vehicle should be employed to record nocturnal ground dwelling and arboreal fauna activity. Ultrasonic microbat bat call detection may also be employed to sample bat activity at selected sites. Nocturnal call playback sessions may be conducted including a listening period where both un-elicited and elicited calls from arboreal mammals and nocturnal bird species should be recorded. Additionally, all nocturnal species heard or seen while spotlighting should be recorded.

Habitat conditions should be recorded within targeted significant habitat types. Habitat features recorded should include dominant vegetation structure and floristics, level of fallen timber, hollow bearing trees, leaf litter, rocks, rank grasses or dense shrub layers, levels of disturbance and obvious signs of animal activity. Separate targeted significant species surveys may also be employed within specific habitat types to ascertain presence or absence of significant cryptic species (eg: brigalow scaly foot, ornamental snake) if critical habitat for these species is evident within the study area.

All field activities for the fauna survey should be undertaken in accordance with the URS Peak Downs expansion project Health, Safety, Environment and Community (HSEC) Plan, with JSAs developed specifically for the ecological study to address specific potential hazards and identify control measures.

Section 4 References

Ecoserve (2005a) *2005 Summer Season Flora and Fauna Surveys for Peak Downs Mine,* Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd

Ecoserve (2005b) *An Investigation of Flora, Fauna and Biodiversity Values associated with Brigalow Remnants along the Proposed Heyford Back Access Road* Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

Ecoserve (2006a) *Flora & Fauna Baseline Surveys for the BMA Isaac River Project*. Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

Ecoserve (2006b) Preliminary Flora and Fauna Investigations – Land at Station Road, Moranbah Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

Ecoserve (2006c) *2006 Winter Vertebrate Fauna Survey of Remnant Habitats on Peak Downs Mine* Prepared for Shaun Ferris, BMA Project Development by Ecoserve Environmental Consultants.

Ecoserve (2006d) *2006 Aquatic Fauna Survey of Water Bodies on Peak Downs Mine* Prepared for Sara James and Lesley Chalkley, BMA Peak Downs Mine by Ecoserve Environmental Consultants.

Ecoserve (2006e) *Draft -2006 Baseline Fauna Survey of Post-mined Landscapes on Peak Downs Mine* Prepared for BMA Peak Downs Mine by Ecoserve Environmental Consultants.

Ecoserve (2006f) *Draft -Assessment of Koalas and Koala Habitat Use on Peak Downs Mine* Prepared for BMA Peak Downs Mine by Ecoserve Environmental Consultants and Ecoteam Environmental Scientific Services

Ecoserve (2006g) *Biodiversity and Threatened Species Action Plan for Peak Downs Mine* Prepared for BMA Peak Downs Mine by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

Ecoserve (2006g) *A review of Habitat Values for Biodiversity Species of Conservation Significance - Peak Downs Mine* Prepared for BMA Peak Downs Mine by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd.

Emmerton and Elsol (2007) *Peak Downs mine rehabilitation monitoring August September 2006,* prepared by B.R. Emmerton Pty Ltd and J & J Elsol.

GHD (2004) *Peak Downs Mine Fauna Survey,* prepared for BMA December 2004

WBM (1996) *Draft – Peak Downs Mine Aquatic and terrestrial Fauna Survey*, Prepared by WBM Oceanics Australia for BHP November 1996.

WBM (1998) *Peak Downs Mine Aquatic and terrestrial Fauna Survey Wet and Dry Seasons*, Prepared by WBM Oceanics Australia for BHP November 1996.

WBM (1999) *Assessment of rehabilitation Enhancement works.* Prepared for BHP Coal Peak Downs Mine

Appendix 2:
Database Search Results

19 February 2009 15:10

EPBC Act Protected Matters Report

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

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

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

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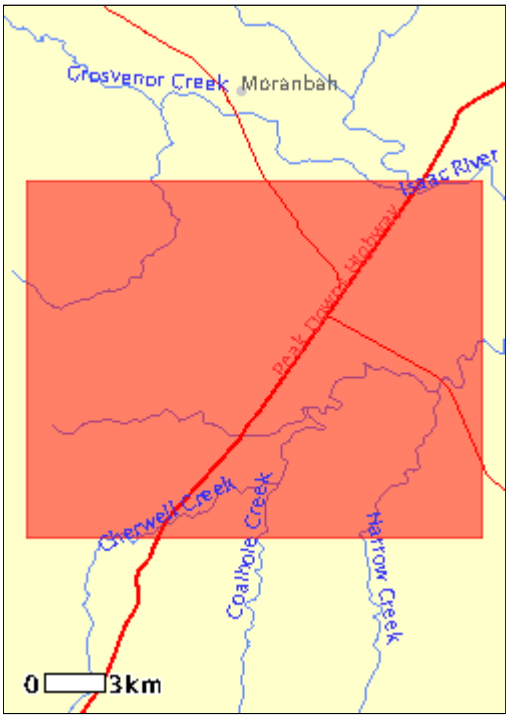

Search Type:	Area
Buffer:	0 km

Coordinates: -22.04549,147.94373, -22.21733,147.94373, -22.21733,148.16209, -22.0454,148.16209

Report Contents:

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance: (Ramsar Sites)	1
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	2
Threatened Species:	11
Migratory Species:	14

Other Matters Protected by the EPBC Act

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

significant impact on the environment anywhere.

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

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Places on the RNE:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

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

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

Details

Matters of National Environmental Significance

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

SHOALWATER AND CORIO BAYS AREA	Within same catchment as Ramsar site

Threatened Ecological Communities [Dataset Information]	Status	Type of Presence
Brigalow (*Acacia harpophylla* dominant and co-dominant)	Endangered	Community known to occur within area

Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	Endangered	Community likely to occur within area
Threatened Species [Dataset Information]	Status	Type of Presence
Birds		
Erythrotriorchis radiatus Red Goshawk	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern)	Vulnerable	Species or species habitat likely to occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern)	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Mammals		
Nyctophilus timoriensis (South-eastern form) Eastern Long-eared Bat	Vulnerable	Species or species habitat may occur within area
Reptiles		
Egernia rugosa Yakka Skink	Vulnerable	Species or species habitat likely to occur within area
Lerista allanae Allan's Lerista, Retro Slider	Endangered	Species or species habitat may occur within area
Paradelma orientalis Brigalow Scaly-foot	Vulnerable	Species or species habitat likely to occur within area
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle	Vulnerable	Species or species habitat may occur within area
Plants		
Dichanthium queenslandicum King Blue-grass	Vulnerable	Species or species habitat likely to occur within area
Digitaria porrecta Finger Panic Grass	Endangered	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Migratory	Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Species or species habitat likely to occur within area
Migratory Wetland Species		

Birds		
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Nettapus coromandelianus albipennis Australian Cotton Pygmy-goose	Migratory	Species or species habitat may occur within area
Numenius minutus Little Curlew, Little Whimbrel	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Anseranas semipalmata Magpie Goose	Listed - overfly marine area	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area

Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Listed - overfly marine area	Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Species or species habitat likely to occur within area
Nettapus coromandelianus albipennis Australian Cotton Pygmy-goose	Listed - overfly marine area	Species or species habitat may occur within area
Numenius minutus Little Curlew, Little Whimbrel	Listed - overfly marine area	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area

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Caveat

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

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

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

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened

ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

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

Only selected species covered by the migratory and marine provisions of the Act have been mapped.

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

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

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

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

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

Acknowledgments

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

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

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was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

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Department of the Environment, Water, Heritage and the Arts
GPO Box 787 Canberra ACT 2601 Australia
Telephone: +61 (0)2 6274 1111

EPA WildNet Database Search Results

Special Status abbreviations are as follows:

Queensland's *Nature Conservation Act 1992* (NCA Status): C = Least Concern species, R = species, **I** = exotic species

Kingdom	Class	Family	Scientific Name	Common Name	NCA	EPBC	Sighting Records	Specimen Records
animals	birds	Meliphagidae	*Acanthagenys rufogularis*	spiny-cheeked honeyeater	C		1	0
animals	birds	Anatidae	*Anas gracilis*	grey teal	C		1	0
animals	birds	Anatidae	*Anas superciliosa*	Pacific black duck	C		1	0
animals	birds	Otididae	*Ardeotis australis*	Australian bustard	C		1	0
animals	birds	Cacatuidae	*Cacatua galerita*	sulphur-crested cockatoo	C		2	0
animals	birds	Cacatuidae	*Cacatua roseicapilla*	galah	C		2	0
animals	birds	Anatidae	*Chenonetta jubata*	Australian wood duck	C		1	0
animals	birds	Campephagidae	*Coracina maxima*	ground cuckoo-shrike	C		1	0
animals	birds	Corvidae	*Corvus orru*	Torresian crow	C		4	0
animals	birds	Artamidae	*Cracticus torquatus*	grey butcherbird	C		1	0
animals	birds	Cuculidae	*Cuculus pallidus*	pallid cuckoo	C		1	0
animals	birds	Anatidae	*Dendrocygna eytoni*	plumed whistling-duck	C		1	0
animals	birds	Ardeidae	*Egretta novaehollandiae*	white-faced heron	C		1	0
animals	birds	Meliphagidae	*Entomyzon cyanotis*	blue-faced honeyeater	C		1	0
animals	birds	Ciconiidae	*Ephippiorhynchus asiaticus*	black-necked stork	R		1	0
animals	birds	Falconidae	*Falco berigora*	brown falcon	C		1	0
animals	birds	Pardalotidae	*Gerygone olivacea*	white-throated gerygone	C		1	0
animals	birds	Dicruridae	*Grallina cyanoleuca*	magpie-lark	C		2	0
animals	birds	Gruidae	*Grus rubicunda*	brolga	C		1	0
animals	birds	Accipitridae	*Haliastur sphenurus*	whistling kite	C		2	0
animals	birds	Hirundinidae	*Hirundo ariel*	fairy martin	C		1	0
animals	birds	Meliphagidae	*Lichmera indistincta*	brown honeyeater	C		2	0
animals	birds	Meliphagidae	*Manorina melanocephala*	noisy miner	C		1	0
animals	birds	Meropidae	*Merops ornatus*	rainbow bee-eater	C		1	0
animals	birds	Oriolidae	*Oriolus sagittatus*	olive-backed oriole	C		1	0

Kingdom	Class	Family	Scientific Name	Common Name	NCA	EPBC	Sighting Records	Specimen Records
animals	birds	Pardalotidae	*Pardalotus striatus*	striated pardalote	C		1	0
animals	birds	Pelecanidae	*Pelecanus conspicillatus*	Australian pelican	C		1	0
animals	birds	Meliphagidae	*Philemon citreogularis*	little friarbird	C		1	0
animals	birds	Meliphagidae	*Philemon corniculatus*	noisy friarbird	C		2	0
animals	birds	Dicruridae	*Rhipidura leucophrys*	willie wagtail	C		1	0
animals	birds	Pardalotidae	*Smicrornis brevirostris*	weebill	C		1	0
animals	birds	Halcyonidae	*Todiramphus macleayii*	forest kingfisher	C		1	0
animals	birds	Psittacidae	*Trichoglossus haematodus moluccanus*	rainbow lorikeet	C		3	0
animals	birds	Charadriidae	*Vanellus miles miles*	masked lapwing (northern subspecies)	C		1	0
plants	higher dicots	Malvaceae	*Abelmoschus ficulneus*	native rosella	C		1	1
plants	higher dicots	Mimosaceae	*Acacia bancroftiorum*		C		2	1
plants	higher dicots	Mimosaceae	*Acacia faucium*		C		1	1
plants	higher dicots	Mimosaceae	*Acacia leiocalyx*		C		1	0
plants	higher dicots	Rhamnaceae	*Alphitonia excelsa*	soap tree	C		1	0
plants	higher dicots	Euphorbiaceae	*Bertya pedicellata*		R		1	1
plants	higher dicots	Asteraceae	*Calotis cuneifolia*	burr daisy	C		1	0
plants	higher dicots	Myrtaceae	*Corymbia aureola*		C		3	3
plants	higher dicots	Fabaceae	*Crotalaria juncea*	sunhemp	I		1	1
plants	higher dicots	Asteraceae	*Epaltes australis*	spreading nutheads	C		2	1
plants	higher dicots	Apiaceae	*Eryngium plantagineum*	long eryngium	C		1	1
plants	higher dicots	Myrtaceae	*Eucalyptus crebra*	narrow-leaved red ironbark	C		1	0
plants	higher dicots	Myrtaceae	*Eucalyptus persistens*		C		1	0

Kingdom	Class	Family	Scientific Name	Common Name	NCA	EPBC	Sighting Records	Specimen Records
plants	higher dicots	Convolvulaceae	*Evolvulus alsinoides*		C		1	0
plants	higher dicots	Malvaceae	*Hibiscus meraukensis*	Merauke hibiscus	C		1	0
plants	higher dicots	Malvaceae	*Hibiscus sp. (Emerald S.L.Everist 2124)*		C		1	1
plants	higher dicots	Malvaceae	*Hibiscus trionum var. vesicarius*		C		1	1
plants	higher dicots	Violaceae	*Hybanthus stellarioides*		C		1	0
plants	higher dicots	Clusiaceae	*Hypericum gramineum*		C		1	0
plants	higher dicots	Convolvulaceae	*Ipomoea brownii*		C		1	1
plants	higher dicots	Convolvulaceae	*Ipomoea calobra*		C		1	1
plants	higher dicots	Myrtaceae	*Melaleuca nervosa subsp. nervosa*		C		1	1
plants	higher dicots	Loganiaceae	*Mitrasacme neldneri*		C		2	1
plants	higher dicots	Meliaceae	*Owenia x reliqua*		C		1	1
plants	higher dicots	Apocynaceae	*Parsonsia lanceolata*	northern silkpod	C		1	1
plants	higher dicots	Phyllanthaceae	*Phyllanthus carpentariae*		C		1	0
plants	higher dicots	Phyllanthaceae	*Phyllanthus virgatus*		C		1	0
plants	higher dicots	Lamiaceae	*Prostanthera collina*		C		1	1
plants	higher dicots	Malvaceae	*Sida rohlenae*		C		1	0
plants	higher dicots	Solanaceae	*Solanum ellipticum*	potato bush	C		1	0
plants	higher dicots	Rubiaceae	*Spermacoce brachystema*		C		1	0
plants	higher	Fabaceae	*Stylosanthes guianensis var. intermedia*		I		2	1

Kingdom	Class	Family	Scientific Name	Common Name	NCA	EPBC	Sighting Records	Specimen Records
	dicots							
plants	higher dicots	Byttneriaceae	*Waltheria indica*		C		1	0
plants	higher dicots	Asteraceae	*Wedelia spilanthoides*		C		2	2
plants	monocots	Poaceae	*Aristida latifolia*	feathertop wiregrass	C		2	2
plants	monocots	Poaceae	*Chrysopogon fallax*		C		1	0
plants	monocots	Poaceae	*Cleistochloa subjuncea*		C		1	0
plants	monocots	Cyperaceae	*Cyperus leiocaulon*		C		1	0
plants	monocots	Poaceae	*Dichanthium sericeum subsp. sericeum*		C		1	1
plants	monocots	Poaceae	*Digitaria brownii*		C		1	1
plants	monocots	Poaceae	*Eragrostis sororia*		C		1	0
plants	monocots	Poaceae	*Eriochloa crebra*	spring grass	C		1	1
plants	monocots	Poaceae	*Melinis repens*	red natal grass	I		1	0
plants	monocots	Poaceae	*Panicum decompositum var. decompositum*		C		1	1
plants	monocots	Poaceae	*Panicum effusum*		C		1	0
plants	monocots	Poaceae	*Pennisetum ciliare*		I		1	0
plants	monocots	Poaceae	*Pennisetum pennisetiforme*		I		2	1
plants	monocots	Poaceae	*Perotis rara*	comet grass	C		1	0
plants	monocots	Poaceae	*Setaria surgens*		C		1	0
plants	monocots	Poaceae	*Themeda triandra*	kangaroo grass	C		1	1

Birds Australia Atlas Database Search Results

Species order	Record Form#	Species	Common_name	Scientific_name	Location	Latdeg	Latmin	Latsec	Londeg	Lon min	Lons ec	Lat	Lon
729	144779	647	Richard's Pipit	Anthus novaeseelandiae	Devlin Creek, Fitzroy Developmental Road	22	6	50	148	34	7	-22.1139	148.569
379	5018051	280	Red-winged Parrot	Aprosmictus erythropterus	Roadside	22	16	0	148	33	5	-22.2667	148.551
181	144779	224	Wedge-tailed Eagle	Aquila audax	Devlin Creek, Fitzroy Developmental Road	22	6	50	148	34	7	-22.1139	148.569
362	5018051	273	Galah	Cacatua roseicapilla	Roadside	22	16	0	148	33	5	-22.2667	148.551
421	144779	349	Pheasant Coucal	Centropus phasianinus	Devlin Creek, Fitzroy Developmental Road	22	6	50	148	34	7	-22.1139	148.569
415	144780	344	Shining Bronze-Cuckoo	Chrysococcyx lucidus	Fitzroy Developmental Road	22	14	8	148	32	10	-22.2356	148.536
781	144779	525	Golden-headed Cisticola	Cisticola exilis	Devlin Creek, Fitzroy Developmental Road	22	6	50	148	34	7	-22.1139	148.569
681	5018051	424	Black-faced Cuckoo-Shrike	Coracina novaehollandiae	Roadside	22	16	0	148	33	5	-22.2667	148.551
683	144779	425	White-bellied Cuckoo-Shrike	Coracina papuensis	Devlin Creek, Fitzroy Developmental Road	22	6	50	148	34	7	-22.1139	148.569
713	5018051	692	Torresian Crow	Corvus orru	Roadside	22	16	0	148	33	5	-22.2667	148.551
700	5018051	700	Pied Butcherbird	Cracticus nigrogularis	Roadside	22	16	0	148	33	5	-22.2667	148.551
450	144779	322	Laughing	Dacelo	Devlin Creek,	22	6	50	148	34	7	-	148.569

Species order	Record Form#	Species	Common_name	Scientific_name	Location	Latdeg	Latmin	Latsec	Londeg	Lon min	Lons ec	Lat	Lon
			Kookaburra	novaeguineae	Fitzroy Developmental Road							22.1139	
551	144780	641	Blue-faced Honeyeater	Entomyzon cyanotis	Fitzroy Developmental Road	22	14	8	148	32	10	-22.2356	148.536
458	5018051	318	Dollarbird	Eurystomus orientalis	Roadside	22	16	0	148	33	5	-22.2667	148.551
183	144779	239	Brown Falcon	Falco berigora	Devlin Creek, Fitzroy Developmental Road	22	6	50	148	34	7	-22.1139	148.569
674	144778	415	Magpie-Lark	Grallina cyanoleuca	Fitzroy Developmental Road	22	4	7	148	34	50	-22.0686	148.581
701	5018051	705	Australian Magpie	Gymnorhina tibicen	Roadside	22	16	0	148	33	5	-22.2667	148.551
171	144779	228	Whistling Kite	Haliastur sphenurus	Devlin Creek, Fitzroy Developmental Road	22	6	50	148	34	7	-22.1139	148.569
476	144780	536	Variegated Fairy-wren	Malurus lamberti	Fitzroy Developmental Road	22	14	8	148	32	10	-22.2356	148.536
554	5018051	635	Yellow-throated Miner	Manorina flavigula	Roadside	22	16	0	148	33	5	-22.2667	148.551
553	144779	634	Noisy Miner	Manorina melanocephala	Devlin Creek, Fitzroy Developmental Road	22	6	50	148	34	7	-22.1139	148.569
170	144778	229	Black Kite	Milvus migrans	Fitzroy Developmental Road	22	4	7	148	34	50	-22.0686	148.581
670	144780	365	Leaden Flycatcher	Myiagra rubecula	Fitzroy Developmental Road	22	14	8	148	32	10	-22.2356	148.536
336	144779	43	Crested Pigeon	Ocyphaps	Devlin Creek,	22	6	50	148	34	7	-	148.569

Species order	Record Form#	Species	Common_name	Scientific_name	Location	Latdeg	Latmin	Latsec	Londeg	Lon min	Lons ec	Lat	Lon
				lophotes	Fitzroy Developmental Road							22.1139	
656	144780	401	Rufous Whistler	Pachycephala rufiventris	Fitzroy Developmental Road	22	14	8	148	32	10	-22.2356	148.536
496	5018051	976	Striated Pardalote	Pardalotus striatus	Roadside	22	16	0	148	33	5	-22.2667	148.551
549	5018051	646	Little Friarbird	Philemon citreogularis	Roadside	22	16	0	148	33	5	-22.2667	148.551
386	144779	286	Pale-headed Rosella	Platycercus adscitus	Devlin Creek, Fitzroy Developmental Road	22	6	50	148	34	7	-22.1139	148.569
545	5018051	585	Striped Honeyeater	Plectorhyncha lanceolata	Roadside	22	16	0	148	33	5	-22.2667	148.551
679	144778	364	Willie Wagtail	Rhipidura leucophrys	Fitzroy Developmental Road	22	4	7	148	34	50	-22.0686	148.581
516	5018051	465	Weebill	Smicrornis brevirostris	Roadside	22	16	0	148	33	5	-22.2667	148.551
716	5018051	675	Apostlebird	Struthidea cinerea	Roadside	22	16	0	148	33	5	-22.2667	148.551
369	144779	254	Rainbow Lorikeet	Trichoglossus haematodus	Devlin Creek, Fitzroy Developmental Road	22	6	50	148	34	7	-22.1139	148.569

Queensland Museum Database Search Results

COLLECTION	FAMILY	GENUS	SPECIES	LOCALITY	LAT	LONG	DATE
Frogs	HYLIDAE	Cyclorana	brevipes	Moranbah, 5km S	22.02	148.03	20 Dec 97-26 Apr 98
Frogs	MYOBATRACHIDAE	Limnodynastes	ornatus	Moranbah, 5km S	22.02	148.03	20 Dec 97-26 Apr 98
Frogs	HYLIDAE	Litoria	rubella	Moranbah, 6kms S	22.03	148.04	20 Dec 97-26 Apr 98
Frogs	MYOBATRACHIDAE	Notaden	bennettii	Moranbah, 6kms S	22.03	148.04	20 Dec 97-26 Apr 98
Mammals	Potoroidae	Aepyprymnus	rufescens	Blair Athol Coal Mine	22.07	147.55	11-Jul-97
Mammals	Peramelidae	Isoodon	macrourus	Blair Athol Coal Mine	22.07	147.55	4-Jul-97
Mammals	Petauridae	Petaurus	breviceps	Moranbah	22.01	148.06	Apr-82
Mammals	Muridae	Pseudomys	delicatulus	Moranbah, 5km S	22.02	148.03	25 Jun-20 Dec 1997
Mammals	Emballonuridae	Saccolaimus	flaviventris	Blair Athol Coal Mine	22.07	147.55	20-Nov-95
Reptiles	SCINCIDAE	Carlia	munda	Peak Downs Mine	22.15	148.12	18-Jan-98
Reptiles	SCINCIDAE	Carlia	pectoralis	Moranbah, 5km S	22.02	148.03	25/6-20/12/1997
Reptiles	SCINCIDAE	Cryptoblepharus	carnabyi	Moranbah, 5km S	22.02	148.03	25/6-20/12/1997
Reptiles	SCINCIDAE	Cryptoblepharus	plagiocephalus	5km South of Moranbah	22.02	148.03	20/12/97-26/4/98
Reptiles	SCINCIDAE	Cryptoblepharus	virgatus	Moranbah - Central highlands	21.59	148.03	4-Apr-96
Reptiles	SCINCIDAE	Ctenotus	strauchii	Peak Downs Mine	22.15	148.12	22-Jan-98
Reptiles	SCINCIDAE	Ctenotus	taeniolatus	Peak Downs Mine	22.15	148.12	21-Jan-98
Reptiles	GEKKONIDAE	Diplodactylus	conspicillatus	Moranbah, 5km S	22.02	148.03	20 Dec 97-26 Apr 98
Reptiles	GEKKONIDAE	Diplodactylus	steindachneri	Moranbah, 6km S	22.03	148.04	20 Dec 97-26 Apr 98
Reptiles	GEKKONIDAE	Diplodactylus	vittatus	5km South of Moranbah	22.02	148.03	25/6/97-20/12/97
Reptiles	GEKKONIDAE	Heteronotia	binoei	5km South of Moranbah	22.02	148.03	20/12/97-26/4/98
Reptiles	SCINCIDAE	Lampropholis	delicata	Moranbah	21.59	148.03	4-Apr-96
Reptiles	SCINCIDAE	Lerista	fragilis	Peak Downs Mine	22.15	148.12	21-Jan-98
Reptiles	SCINCIDAE	Menetia	greyii	Moranbah, 5km S	22.02	148.03	25/6-20/12/1997
Reptiles	SCINCIDAE	Morethia	boulengeri	Moranbah, 5km S	22.02	148.03	25/6-20/12/1997
Reptiles	GEKKONIDAE	Nephrurus	asper	Peak Downs Mine	22.09	148	6-Oct-96

Appendix 3:
Flora Species List

Special Status abbreviations are as follows:

Queensland's *Nature Conservation Act 1992* (NCA Status): C = Least Concern species, **I** = unprotected (e.g. exotic species)

Species listed as weeds under the provisions of the Queensland *Land Protection (Pest and Stock Route Management) Act* 2002 are shaded in yellow.

Family	Scientific Name	Common Name	NCA Status	EPBC Status
Acanthaceae	*Brunoniella australis*	Blue Trumpet	C	
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower	C	
Acanthaceae	*Rostellularia adscendens var. hispida*	Pink Tongues	C	
Adiantaceae	*Cheilanthes sieberi*	Mulga Fern	C	
Aizoaceae	*Zaleya galericulata*		C	
Amaranthaceae	*Achyranthes aspera*	Chaff Flower	C	
Amaranthaceae	*Gomphrena celosioides*	Gomphrena Weed	I	
Amaranthaceae	*Nyssanthes diffusa*	Barb-Wire Plant	C	
Apocynaceae	*Carissa ovata*	Currant Bush, Kunkerberry	C	
Asteraceae	*Calotis multicaulis*	Woolly-headed Burr-daisy	C	
Asteraceae	*Parthenium hysterophorus*	Parthenium Weed (Class 2 Weed)	I	
Asteraceae	*Pterocaulon sphacelatum*	Applebush	C	
Asteraceae	*Senecio lautus*	Fireweed	C	
Asteraceae	*Tridax procumbens*	Tridax Daisy	I	
Asteraceae	*Verbesina encelioides*	Crownbeard	I	
Bignoniaceae	*Pandorea doratoxylon*	Spear Vine	C	
Boraginaceae	*Ehretia membranifolia*	Weeping Koda	C	
Cactaceae	*Eriocereus martinii*	Harrisia Cactus (Class 2 Weed)	I	
Cactaceae	*Opuntia tomentosa*	Velvety Tree Pear (Class 2 Weed)	I	
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell	C	
Caesalpiniaceae	*Lysiphyllum carronii*	Bauhinia	C	
Caesalpiniaceae	*Lysiphyllum hookeri*	Pegunny	C	
Caesalpiniaceae	*Cassia brewsteri*	Brewster's Cassia	C	
Capparaceae	*Apophyllum anomolum*	Warrior Bush	C	
Capparaceae	*Capparis lasiantha*	Nipan, Split Jack	C	
Capparaceae	*Capparis spinosa*		C	
Casuarinaceae	*Allocasuarina luehmannii*	Bulloak	C	
Casuarinaceae	*Casuarina cristata*	Belah	C	
Celastraceae	*Denhamia oleaster*	Stiff Denhamia	C	
Celastraceae	*Denhamia oleaster*		C	
Chenopodiaceae	*Atriplex muelleri*	Mueller's Salt Bush	C	
Chenopodiaceae	*Enchylaena tomentosa*	Ruby Salt Bush	C	
Chenopodiaceae	*Salsola kali*	Soft Roly-Poly	C	
Combretaceae	*Terminalia oblongata subsp. oblongata*	Yellow Wood	C	
Convolvulaceae	*Evolvulus alsinoides*	Tropical Speedwell	C	
Convolvulaceae	*Ipomoea plebeia*	Bellvine	C	
Convolvulaceae	*Jacquemontia paniculata*		C	
Crassulaceae	*Bryophyllum delagoense*	Mother-Of-Millions (Class 2 Weed)	I	
Cyperaceae	*Cyperus bifax*	Western Nutgrass	C	
Cyperaceae	*Cyperus concinnus*		C	
Ebonaceae	*Diospyros humilis*	Small-Leaved Ebony	C	
Erythroxylaceae	*Erythroxylum australe*	Cocaine Tree	C	
Fabaceae	*Crotalaria medicaginea*	Trefoil Rattlepod	C	

Family	Scientific Name	Common Name	NCA Status	EPBC Status
Fabaceae	*Crotalaria mitchellii*	Mitchell's Rattlepod	C	
Fabaceae	*Crotalaria novae-hollandiae*	New Holland Rattlepod	C	
Fabaceae	*Desmodium* sp.		C	
Fabaceae	*Glycine latifolia*		C	
Fabaceae	*Indigofera linifolia*	Round Pod Indigo, Narrow-Leaved Indigo	C	
Fabaceae	*Rhynchosia minima*	Rhynchosia	C	
Fabaceae	*Sesbania* sp.		C	
Fabaceae	*Stylosanthes scabra*	Shrubby Stylo	I	
Lamiaceae	*Clerodendrum floribundum*	Lollie Bush	C	
Loranthaceae	*Amyema quandang*	Grey Mistletoe	C	
Malvaceae	*Abutilon otocarpum*	Desert Chinese Lantern	C	
Malvaceae	*Hibiscus meraukensis*	Merauke Hibiscus	C	
Malvaceae	*Hibiscus sp. (Emerald S.L.Everist 2124)*		C	
Malvaceae	*Hibiscus sturtii var. sturtii*	Hill Hibiscus	C	
Malvaceae	*Malvastrum americanum*	Malvastrum	I	
Malvaceae	*Sida acuta*	Spinyhead Sida	C	
Malvaceae	*Sida cordifolia*	Flannel Weed	C	
Malvaceae	*Sida corrugata*	Corrugated Sida	C	
Malvaceae	*Sida fibulifera*	Pin Sida	C	
Malvaceae	*Sida rohlenae*	Shrub Sida	C	
Malvaceae	*Sida sp. (Charters Towers)*		C	
Malvaceae	*Sida spinosa*	Spiny Sida	C	
Malvaceae	*Sida subspicata*	Spiked Sida	C	
Meliaceae	*Melia azedarach*	White Cedar	C	
Meliaceae	*Owenia acidula*	Emu Apple	C	
Mimosaceae	*Acacia crassa*		C	
Mimosaceae	*Acacia excelsa*	Ironwood	C	
Mimosaceae	*Acacia harpophylla*	Brigalow	C	
Mimosaceae	*Acacia salicina*	Sallow Wattle	C	
Mimosaceae	*Acacia sparsiflora*	Currawong	C	
Mimosaceae	*Acacia shirleii*	Lancewood	C	
Mimosaceae	*Archidendropsis basaltica*	Dead Finish	C	
Mimosaceae	*Leucaena leucocephala subsp. leucocephala*	Leucaena	I	
Mimosaceae	*Neptunia dimorphantha*	Sensitive Plant	C	
Mimosaceae	*Neptunia gracilis*	Sensitive Plant	C	
Mimosaceae	*Neptunia sp.*	Sensitive Plant	C	
Mimosaceae	*Acacia farnesiana*	Mimosa Bush	I	
Myoporaceae	*Eremophila debilis*	Creeping Boobiala	C	
Myoporaceae	*Eremophila mitchellii*	Budda Bush, False Sandalwood	C	
Myoporaceae	*Myoporum montanum*	Water Bush	C	
Myrtaceae	*Corymbia clarksoniana*	Clarkson's Bloodwood	C	
Myrtaceae	*Corymbia dallachiana*	Dallachy's Gum	C	
Myrtaceae	*Corymbia erythrophloia*	Gum-Topped Bloodwood	C	
Myrtaceae	*Corymbia tessellaris*	Moreton Bay Ash	C	
Myrtaceae	*Eucalyptus cambageana*	Dawson Gum	C	
Myrtaceae	*Eucalyptus crebra*	Narrow-Leaved Ironbark	C	
Myrtaceae	*Eucalyptus melanophloia*	Silver-Leaved Ironbark	C	
Myrtaceae	*Eucalyptus orgadophila*	Mountain Coolibah	C	
Myrtaceae	*Eucalyptus platyphylla*	Poplar Gum	C	
Myrtaceae	*Eucalyptus populnea*	Poplar Box	C	

Family	Scientific Name	Common Name	NCA Status	EPBC Status
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	C	
Myrtaceae	*Eucalyptus thozetiana*	Mountain Yapunyah	C	
Myrtaceae	*Melaleuca bracteata*	Black Tea Tree	C	
Myrtaceae	*Melaleuca leucadendra*	Broad-leaved Tea Tree	C	
Nyctaginaceae	*Boerhavia schomburgkiana*	Tar Vine	C	
Oleaceae	*Jasminum didymum* subsp. *racemosum*	Native Jasmine	C	
Orchidaceae	*Cymbidium canaliculatum*		C	
Phyllanthaceae	*Phyllanthus virgatus*		C	
Pittosporaceae	*Pittosporum spinescens*	Wallaby Apple	C	
Poaceae	*Ancistrachne uncinulata*	Hooky Grass	C	
Poaceae	*Aristida caput-medusae*	Dark Wiregrass	C	
Poaceae	*Aristida calycina var. calycina*	Wiregrass	C	
Poaceae	*Aristida echinata*		C	
Poaceae	*Aristida gracilipes*	Slender Wiregrass	C	
Poaceae	*Aristida latifolia*	Feathertop	C	
Poaceae	*Aristida lazarides*		C	
Poaceae	*Aristida personata*		C	
Poaceae	*Bothriochloa bladhii*	Forest Bluegrass	C	
Poaceae	*Bothriochloa decipiens*	Pitted Bluegrass	C	
Poaceae	*Bothriochloa ewartiana*	Desert Bluegrass	C	
Poaceae	*Brachyachne convergens*	Common Native Couch	C	
Poaceae	*Cenchrus ciliata*	Buffel Grass	I	
Poaceae	*Chionachne hubbardiana*	Barley Grass	C	
Poaceae	*Chloris virgata*	Feathertop Rhodes Grass	C	
Poaceae	*Chrysopogon fallax*	Golden Beardgrass	C	
Poaceae	*Dactyloctenium radulans*	Button Grass	C	
Poaceae	*Dichanthium sericeum*	Queensland Bluegrass	C	
Poaceae	*Digitaria brownii*	Cotton Panic	C	
Poaceae	*Echinochloa colona*	Awnless Barnyard Grass	I	
Poaceae	*Echinopogon ovatus*	Hedgehog Grass	C	
Poaceae	*Enneapogon truncatus*		C	
Poaceae	*Enteropogon acicularis*	Curly Windmill Grass	C	
Poaceae	*Enteropogon unispiceus*		C	
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	C	
Poaceae	*Eragrostis lanicaulis*		C	
Poaceae	*Eragrostis parviflora*	Weeping Lovegrass	C	
Poaceae	*Eragrostis sororia*	Purple Lovegrass	C	
Poaceae	*Eriachne mucronata*		C	
Poaceae	*Eriochloa pseudoacrotricha*		C	
Poaceae	*Eulalia aurea*	Silky Browntop	C	
Poaceae	*Heteropogon contortus*	Black Spear-grass	C	
Poaceae	*Iseilema vaginiflorum*	Red Flinders Grass	C	
Poaceae	*Leptochloa decipiens*		C	
Poaceae	*Megathyrsus maximus*	Green Panic	I	
Poaceae	*Melinis repens*	Red Natal Grass	I	
Poaceae	*Moorochloa eruciformis*		I	
Poaceae	*Panicum decompositum*	Australian Millet	C	
Poaceae	*Paspalidium caespitosum*	Brigalow Grass	C	
Poaceae	*Paspalidium gracile*	Slender Panic	C	
Poaceae	*Setaria pumila*		I	
Poaceae	*Sporobolus australasius*	Australian Dropseed Grass	C	

Family	Scientific Name	Common Name	NCA Status	EPBC Status
Poaceae	*Sporobolus caroli*	Fairy Grass	C	
Poaceae	*Themeda triandra*	Kangaroo Grass	C	
Poaceae	*Urochloa decumbens*	A Signal Grass	I	
Poaceae	*Urochloa foliosa*		C	
Potulacaceae	*Portulaca oleracea*	Pigweed	C	
Proteaceae	*Grevillea parallela*	Silver Grevillea	C	
Proteaceae	*Grevillea pteridifolia*	Fern-Leaved Grevillea	C	
Proteaceae	*Grevillea striata*	Beefwood	C	
Proteaceae	*Hakea arborescens*		C	
Rhamnaceae	*Alphitonia excelsa*	Red Ash, Soap Tree	C	
Rubiaceae	*Breynia oblongifolia*	Coffee Bush	C	
Rubiaceae	*Everistia vacciniifolia*		C	
Rubiaceae	*Psydrax odorata*	Stiff Box-Leaved Canthium	C	
Rutaceae	*Flindersia dissosperma*	Scrub Leopardwood	C	
Rutaceae	*Geijera parviflora*	Wilga	C	
Rutaceae	*Geijera salicifolia*	Brush Wilga	C	
Santalaceae	*Santalum lanceolatum*	Northern Sandalwood	C	
Sapindaceae	*Alectryon diversifolius*	Scrub Boonaree	C	
Sapindaceae	*Alectryon oleifolius subsp. elongatus*	Boonaree, Western Rosewood	C	
Sapindaceae	*Atalaya hemiglauca*	Western Whitewood	C	
Sapindaceae	*Dodonaea lanceolata*		C	
Sapindaceae	*Dodonaea viscosa* var. *spatulata*	Sticky Hop Bush	C	
Solanaceae	*Solanum esuriale*	Quena, Potato Weed	C	
Sparrmanniaceae	*Grewia latifolia*	Dysentry Plant	C	
Sparrmanniaceae	*Grewia retusifolia*		C	
Sterculiaceae	*Melhania oblongifolia*		C	
Tiliaceae	*Corchorus trilocularis*		C	
Tiliaceae	*Grewia retusifolia*		C	
Ulmaceae	*Trema tomentosa*	Poison Peach	C	
Verbenaceae	*Lantana camara*	Lantana (Class 3 Weed)	I	
Violaceae	*Hybanthus enneaspermus*	Spade Flower	C	
Vitaceae	*Cissus opaca*	Small-Leaved Water Vine	C	

Appendix 4:
Terrestrial Vertebrate Species List

Special Status abbreviations are as follows:

Queensland's *Nature Conservation Act 1992* (NCA status): E = Endangered; V = Vulnerable; R = Rare; S = of Special Concern (Migratory); CS = of Special Concern (Cultural Significance); C = Least Concern (Common); I = Introduced wildlife.

Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC status): E = Endangered; V = Vulnerable; M = Migratory species.

Other abbreviations: **Site** = BAAM survey sites; **Inc** = Incidental records (opportunistic records, i.e. species not recorded from survey sites); **PS** = species recorded during previous surveys undertaken on the Peak Downs mining lease (including southern sections of the current project area); **DB** = results of searches from the Queensland Museum, the EPA WildNet (Wildlife Online) and/or the Birds Australia databases.

Site and Incidental data was collected by BAAM staff during two surveys. In April 2008 Site and incidental data was collected. In August 2008 only incidental data was collected.

Unless otherwise noted, this table follows the nomenclature provided by the CSIRO List of Australian Vertebrates (Clayton *et al*. 2006) as it provides a single point of reference for all terrestrial vertebrate groups. Any notable variations in common and/or scientific names of conservation significant species are identified in the report text and as footnotes hereunder. With the exception of alterations due to subsequent taxonomic revision, species reported by sources other than BAAM are accepted at face value.

Family Genus Species	Common Name	Data Source				Status	
		Site	Inc	PS	DB	NCA status	EPBC status
AMPHIBIANS							
MYOBATRACHIDAE							
Crinia deserticola	Desert Froglet			X		C	
Limnodynastes ornatus	Ornate Burrowing Frog	1, 2, 3		X	X	C	
Limnodynastes salmini	Salmon-striped Frog			X		C	
Limnodynastes tasmaniensis	Spotted Grass Frog	1, 2		X		C	
Limnodynastes terraereginae	Northern Banjo Frog			X		C	
Notaden bennettii	Crucifix Toad				X	C	
Uperoleia lithomoda	Stonemason Toadlet			X		C	
HYLIDAE							
Cyclorana alboguttata	Striped Burrowing Frog		X	X		C	
Cyclorana brevipes	Short-footed Frog	3		X	X	C	
Cyclorana novaehollandiae	New Holland Frog	4		X		C	
Litoria caerulea	Green Tree Frog	1, 2, 3		X		C	
Litoria fallax	Eastern Dwarf Tree Frog			X		C	
Litoria inermis	Peter's Frog		X	X		C	
Litoria latopalmata	Broad-palmed Frog		X	X		C	
Litoria rothii	Roth's Tree Frog			X		C	
Litoria rubella	Desert Tree Frog	1, 3		X	X	C	
BUFONIDAE							
Bufo marinus	Cane Toad	2		X		I	

Family Genus Species	Common Name	Data Source				Status	
		Site	Inc	PS	DB	NCA status	EPBC status
REPTILES							
CHELIDAE							
Emydura macquarii	Macquarie Turtle			X		C	
GEKKONIDAE							
Diplodactylus conspicillatus	Fat-tailed Diplodactylus			X	X	C	
Diplodactylus steindachneri	Box-patterned Gecko			X	X	C	
Diplodactylus vittatus	Wood Gecko			X	X	C	
Gehyra catenata	Chain-backed Dtella			X		C	
Gehyra dubia	Dubious Dtella	1, 2		X		C	
Heteronotia binoei	Bynoe's Gecko			X	X	C	
Nephrurus asper	Rough Knob-tail			X	X	C	
Oedura monilis	Ocellated Velvet Gecko			X		C	
Strophurus williamsi	Eastern Spiny-tailed Gecko			X		C	
PYGOPODIDAE							
Lialis burtonis	Burton's Snake-lizard			X		C	
Pygopus schraderi	Eastern Hooded Scaly-foot			X		C	
SCINCIDAE							
Carlia munda	Shaded-litter Rainbow-skink			X	X	C	
Carlia pectoralis	Open-litter Rainbow-skink	1, 2		X	X	C	
Carlia schmeltzii	Robust Rainbow-skink			X		C	
Cryptoblepharus carnabyi	Spiny-palmed Shinning-skink			X	X	C	
Cryptoblepharus plagiocephalus	Callose-palmed Shinning-skink		X		X	C	
Cryptoblepharus virgatus	Wall Skink		X	X	X	C	
Ctenotus robustus	Eastern Striped Skink	1		X		C	
Ctenotus strauchii	Eastern Barred Wedgesnout Ctenotus			X	X	C	
Ctenotus taeniolatus	Copper-tailed Skink			X	X	C	
Eulamprus sokosoma	Stout Barsided Skink			X		C	
Glaphyromorphus punctulatus	Fine-spotted Mulch-skink	2				C	
Lampropholis delicata	Dark-flecked Garden Sunskink				X	C	
Lerista fragilis	Eastern Mulch-slider			X	X	C	
Lerista muelleri	Wood Mulch-slider			X		C	
Lerista punctatovittata	Eastern Robust Slider			X		C	
Lygisaurus foliorum	Tree-base Litter-skink			X		C	
Menetia greyii	Common Dwarf Skink			X	X	C	
Menetia timlowi	Dwarf Litter-skink			X		C	
Morethia boulengeri	South-eastern Morethia Skink			X	X	C	
Morethia taeniopleura	Fire-tailed Skink	1, 2		X		C	
AGAMIDAE							
Diporiphora australis	Tommy Roundhead			X		C	
Lophognathus burnsi	Burns' Dragon	2				C	

Family Genus Species	Common Name	Data Source				Status	
		Site	Inc	PS	DB	NCA status	EPBC status
Pogona barbata	Bearded Dragon			X		C	
VARANIDAE							
Varanus tristis	Black-headed Monitor			X		C	
TYPHLOPIDAE							
Ramphotyphlops sp.	unidentified Blind Snake			X		C	
BOIDAE							
Antaresia maculosus	Spotted Python		X	X		C	
Aspidites melanocephalus	Black-headed Python			X		C	
Morelia spilota	Carpet Python			X		C	
COLUBRIDAE							
Boiga irregularis	Brown Tree Snake			X		C	
Dendrelaphis punctulata	Common Tree Snake			X		C	
Tropidonophis mairii	Keelback			X		C	
ELAPIDAE							
Brachyurophis australis	Coral Snake			X		C	
Cryptophis boschmai	Carpentaria Snake	2				C	
Denisonia maculata	Ornamental Snake			X		V	V
Pseudechis australis	King Brown Snake			X		C	
BIRDS							
DROMAIIDAE							
Dromaius novaehollandiae	Emu		X	X		C	
PHASIANIDAE							
Coturnix ypsilophora	Brown Quail					C	
ANATIDAE							
Dendrocygna eytoni	Plumed Whistling-Duck		X	X	X	C	
Dendrocygna arcuata	Wandering Whistling-Duck			X		C	
Cygnus atratus	Black Swan		X	X		C	
Malacorhynchus membranaceus	Pink-eared Duck		X	X		C	
Chenonetta jubata	Australian Wood Duck	H1		X	X	C	
Nettapus coromandelianus	Cotton Pygmy-goose			X	X	R	M
Anas superciliosa	Pacific Black Duck		X	X	X	C	
Anas gracilis	Grey Teal		X	X	X	C	
Aythya australis	Hardhead		X	X		C	
PODICIPEDIDAE							
Tachybaptus novaehollandiae	Australasian Grebe		X	X		C	
Poliocephalus poliocephalus	Hoary-headed Grebe			X		C	
Podiceps cristatus	Great Crested Grebe		X	X		C	
CICONIIDAE							
Ephippiorhynchus asiaticus	Black-necked Stork				X	R	
THRESKIORNITHIDAE							
Threskiornis molucca	Australian White Ibis			X		C	
Threskiornis spinicollis	Straw-necked Ibis		X	X		C	

Family Genus Species	Common Name	Data Source				Status	
		Site	Inc	PS	DB	NCA status	EPBC status
Platalea regia	Royal Spoonbill		X	X		C	
Platalea flavipes	Yellow-billed Spoonbill		X			C	
ARDEIDAE							
Ixobrychus flavicollis	Black Bittern			X		C	
Nycticorax caledonicus	Nankeen Night Heron			X		C	
Ardea pacifica	White-necked Heron		X	X		C	
Ardea alba [1]	Great Egret		X	X	X	S	M
Egretta intermedia	Intermediate Egret			X		C	
Egretta novaehollandiae	White-faced Heron		X	X	X	C	
Egretta garzetta	Little Egret			X		C	
PHALACROCORACIDAE							
Phalacrocorax melanoleucos	Little Pied Cormorant		X	X		C	
Phalacrocorax sulcirostris	Little Black Cormorant		X	X		C	
Phalacrocorax varius	Pied Cormorant			X		C	
Phalacrocorax carbo	Great Cormorant			X		C	
ANHINGIDAE							
Anhinga melanogaster	Darter		X	X		C	
PELICANIDAE							
Pelecanus conspicillatus	Australian Pelican		X	X	X	C	
FALCONIDAE							
Falco cenchroides	Australian Kestrel	3, 4		X		C	
Falco longipennis	Australian Hobby		X	X		C	
Falco berigora	Brown Falcon	1, 4		X	X	C	
Falco subniger	Black Falcon		X			C	
Falco peregrinus	Peregrine Falcon			X		C	
ACCIPITRIDAE							
Aviceda subcristata	Pacific Baza			X		C	
Elanus axillaris	Black-shouldered Kite		X	X		C	
Milvus migrans	Black Kite	2, 4		X	X	C	
Haliastur sphenurus	Whistling Kite		X	X	X	C	
Haliaeetus leucogaster	White-bellied Sea-Eagle			X	X	S	M
Accipiter fasciatus	Brown Goshawk			X		C	
Accipiter cirrhocephalus	Collared Sparrowhawk			X		C	
Aquila audax	Wedge-tailed Eagle		X	X	X	C	
Hieraaetus morphnoides	Little Eagle			X		C	
OTIDIDAE							
Ardeotis australis	Australian Bustard	1		X	X	C	
RALLIDAE							
Porphyrio porphyrio	Purple Swamphen			X		C	
Gallinula tenebrosa	Dusky Moorhen			X		C	
Fulica atra	Eurasian Coot		X	X		C	
GRUIDAE							
Grus rubicunda	Brolga		X	X	X	C	
TURNICIDAE							

Family Genus Species	Common Name	Data Source				Status	
		Site	Inc	PS	DB	NCA status	EPBC status
Turnix pyrrhothorax	Red-chested Button-quail	1, 3				C	
Turnix velox	Little Button-quail			X		C	
RECURVIROSTRIDAE							
Himantopus himantopus	Black-winged Stilt			X		C	
CHARADRIIDAE							
Vanellus miles	Masked Lapwing		X	X	X	C	
Erythrogonys cinctus	Red-kneed Dotterel			X		C	
Elseyornis melanops	Black-fronted Dotterel		X	X		C	
JACANIDAE							
Irediparra gallinacea	Comb-crested Jacana			X		C	
SCOLOPACIDAE							
Tringa stagnatilis	Marsh Sandpiper			X		S	M
Actitis hypoleucos	Common Sandpiper			X		S	M
Calidris ruficollis	Red-necked Stint			X		S	M
Calidris acuminata	Sharp-tailed Sandpiper			X		S	M
GLAREOLIDAE							
Stiltia isabella	Australian Pratincole			X		C	
LARIDAE							
Larus novaehollandiae	Silver Gull		X			C	
Sterna caspia	Caspian Tern			X		S	M
Chlidonias hybrida	Whiskered Tern			X		C	
COLUMBIDAE							
Phaps chalcoptera	Common Bronzewing			X		C	
Ocyphaps lophotes	Crested Pigeon	3, 4, H1		X	X	C	
Geophaps scripta scripta	Squatter Pigeon (southern subspecies)	H1		X	X	V	V
Geopelia cuneata	Diamond Dove			X		C	
Geopelia placida	Peaceful Dove	3		X		C	
Geopelia humeralis	Bar-shouldered Dove		X	X		C	
PSITTACIDAE							
Cacatua roseicapilla	Galah	3		X	X	C	
Cacatua sanguinea	Little Corella			X		C	
Cacatua galerita	Sulphur-crested Cockatoo	2		X	X	C	
Nymphicus hollandicus	Cockatiel	3		X		C	
Trichoglossus haematodus	Rainbow Lorikeet	3, H1		X	X	C	
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet		X	X		C	
Glossopsitta pusilla	Little Lorikeet			X		C	
Platycercus elegans	Crimson Rosella					C	
Platycercus adscitus	Pale-headed Rosella	3		X	X	C	
Aprosmictus erythropterus	Red-winged Parrot	2		X	X	C	
CUCULIDAE							
Cuculus pallidus	Pallid Cuckoo		X	X	X	C	
Chalcites basalis	Horsfield's Bronze-Cuckoo		X	X		C	

Family Genus Species	Common Name	Data Source				Status	
		Site	Inc	PS	DB	NCA status	EPBC status
Chalcites lucidus	Shining Bronze-Cuckoo				X	C	
Eudynamys orientalis	Pacific Koel			X		C	
Scythrops novaehollandiae	Channel-billed Cuckoo			X		C	
CENTROPODIDAE							
Centropus phasianinus	Pheasant Coucal		X	X	X	C	
TYTONIDAE							
Tyto novaehollandiae novaehollandiae	Masked Owl (southern subspecies)			X		C	
Tyto alba	Barn Owl			X		C	
Tyto capensis	Grass Owl			X		C	
STRIGIDAE							
Ninox boobook	Southern Boobook	1		X		C	
PODARGIDAE							
Podargus strigoides	Tawny Frogmouth	2		X		C	
CAPRIMULGIDAE							
Eurostopodus argus	Spotted Nightjar			X		C	
Eurostopodus mystacalis	White-throated Nightjar			X		C	
Caprimulgus macrurus	Large-tailed Nightjar			X		C	
AEGOTHALIDAE							
Aegotheles cristatus	Australian Owlet-nightjar	1, H1		X		C	
APODIDAE							
Hirundapus caudacutus	White-throated Needletail			X	X	S	M
Apus pacificus	Fork-tailed Swift			X	X	S	M
CORACIIDAE							
Eurystomus orientalis	Dollarbird		X	X	X	C	
ALCEDINIDAE							
Dacelo novaeguineae	Laughing Kookaburra	1, 2, 3		X	X	C	
Dacelo leachii	Blue-winged Kookaburra	1, 3		X		C	
Todiramphus macleayii	Forest Kingfisher				X	C	
Todiramphus sanctus	Sacred Kingfisher		X	X		C	
Todiramphus pyrrhopygius	Red-backed Kingfisher		X	X		C	
MEROPIDAE							
Merops ornatus	Rainbow Bee-eater		X	X	X	S	M
MALURIDAE							
Malurus lamberti	Variegated Fairy-wren	4		X	X	C	
Malurus melanocephalus	Red-backed Fairy-wren	1, 2, 3		X		C	
PARDALOTIDAE							
Pardalotus punctatus	Spotted Pardalote			X		C	
Pardalotus rubricatus	Red-browed Pardalote			X		C	
Pardalotus striatus	Striated Pardalote	1, 3, H1		X	X	C	
ACANTHIZIDAE							
Pyrrholaemus sagittatus	Speckled Warbler			X		C	
Smicrornis brevirostris	Weebill	1, 3, H1		X	X	C	

Family Genus Species	Common Name	Data Source				Status	
		Site	Inc	PS	DB	NCA status	EPBC status
Gerygone fusca	Western Gerygone			X		C	
Gerygone olivacea	White-throated Gerygone		X	X	X	C	
Acanthiza reguloides	Buff-rumped Thornbill			X		C	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill		X	X		C	
Acanthiza nana	Yellow Thornbill		X	X		C	
MELIPHAGIDAE							
Lichenostomus chrysops	Yellow-faced Honeyeater		X	X		C	
Lichenostomus virescens	Singing Honeyeater	2, 4		X		C	
Meliphaga lewinii	Lewin's Honeyeater			X		C	
Manorina melanocephala	Noisy Miner	1, 3		X	X	C	
Manorina flavigula	Yellow-throated Miner	4, H1		X	X	C	
Entomyzon cyanotis	Blue-faced Honeyeater		X	X	X	C	
Melithreptus albogularis	White-throated Honeyeater		X	X		C	
Philemon citreogularis	Little Friarbird	1, 2, 3		X	X	C	
Philemon buceroides	Helmeted Friarbird			X		C	
Philemon corniculatus	Noisy Friarbird	1, 2		X	X	C	
Plectorhyncha lanceolata	Striped Honeyeater	1, 2, 3, H1		X	X	C	
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	4		X	X	C	
Lichmera indistincta	Brown Honeyeater		X	X	X	C	
Conopophila rufogularis	Rufous-throated Honeyeater			X		C	
PETROICIDAE							
Microeca fascinans	Jacky Winter		X	X		C	
Petroica goodenovii	Red-capped Robin		X	X		C	
POMATOSTOMIDAE							
Pomatostomus temporalis	Grey-crowned Babbler	1, 2, 3, 4		X		C	
NEOSITTIDAE							
Daphoenositta chrysoptera	Varied Sittella		X	X		C	
PACHYCEPHALIDAE							
Pachycephala rufiventris	Rufous Whistler		X	X	X	C	
Colluricincla harmonica	Grey Shrike-thrush	1		X		C	
DICRURIDAE							
Rhipidura rufifrons	Rufous Fantail			X		S	M
Rhipidura albiscapa	Grey Fantail		X	X		C	
Rhipidura leucophrys	Willie Wagtail	2, 4		X	X	C	
Dicrurus bracteatus	Spangled Drongo	H2		X		C	
Grallina cyanoleuca	Magpie-lark	2, H1		X	X	C	
Myiagra rubecula	Leaden Flycatcher			X	X	C	
Myiagra cyanoleuca	Satin Flycatcher			X	X	S	M
Myiagra inquieta	Restless Flycatcher		X	X		C	
ARTAMIDAE							
Cracticus torquatus	Grey Butcherbird	1, 2, 3, H1		X	X	C	

Family Genus Species	Common Name	Data Source				Status	
		Site	Inc	PS	DB	NCA status	EPBC status
Cracticus nigrogularis	Pied Butcherbird	1, 2, 3, 4		X	X	C	
Gymnorhina tibicen	Australian Magpie	1, 2		X	X	C	
Strepera graculina	Pied Currawong		X	X		C	
Artamus leucorynchus	White-breasted Woodswallow		X	X		C	
Artamus personatus	Masked Woodswallow			X		C	
Artamus superciliosus	White-browed Woodswallow			X		C	
Artamus cinereus	Black-faced Woodswallow		X	X		C	
Artamus cyanopterus	Dusky Woodswallow		X	X		C	
CAMPEPHAGIDAE							
Coracina tenuirostris	Cicadabird			X		C	
Coracina novaehollandiae	Black-faced Cuckoo-shrike	1, H1		X	X	C	
Coracina papuensis	White-bellied Cuckoo-shrike			X	X	C	
Coracina maxima	Ground Cuckoo-shrike	2			X	C	
Lalage sueurii	White-winged Triller		X	X		C	
ORIOLIDAE							
Sphecotheres vieilloti	Australasian Figbird			X		C	
Oriolus sagittatus	Olive-backed Oriole		X	X	X	C	
CORVIDAE							
Corvus orru	Torresian Crow	1, 2, 3, 4, H1		X	X	C	
Corvus coronoides	Australian Raven			X		C	
CORCORACIDAE							
Corcorax melanorhamphos	White-winged Chough		X	X		C	
Struthidea cinerea	Apostlebird		X	X	X	C	
PTILONORHYNCHIDAE							
Chlamydera maculata	Spotted Bowerbird	4		X		C	
Chlamydera nuchalis	Great Bowerbird			X		C	
HIRUNDINIDAE							
Cheramoeca leucosterna	White-backed Swallow			X		C	
Hirundo neoxena	Welcome Swallow		X	X		C	
Petrochelidon ariel	Fairy Martin		X	X		C	
Petrochelidon nigricans	Tree Martin		X	X		C	
ZOSTEROPIDAE							
Zosterops lateralis	Silvereye			X		C	
SYLVIIDAE							
Acrocephalus australis	Australian Reed-Warbler [2]		X	X		S	M
Megalurus timoriensis	Tawny Grassbird			X		C	
Cincloramphus mathewsi	Rufous Songlark		X	X		C	
Cincloramphus cruralis	Brown Songlark		X			C	
Cisticola exilis	Golden-headed Cisticola		X	X	X	C	
ALAUDIDAE							
Mirafra javanica	Horsfield's Bushlark		X	X		C	

Family Genus Species	Common Name	Data Source				Status	
		Site	Inc	PS	DB	NCA status	EPBC status
DICAEIDAE							
Dicaeum hirundinaceum	Mistletoebird		X	X		C	
PASSERIDAE							
Passer domesticus	House Sparrow			X		I	
MOTACILLIDAE							
Anthus australis	Australian Pipit		X	X	X	C	
ESTRILDIDAE							
Neochmia temporalis	Red-browed Finch			X		C	
Neochmia modesta	Plum-headed Finch			X		C	
Taeniopygia guttata	Zebra Finch	4		X		C	
Taeniopygia bichenovii	Double-barred Finch		X	X		C	
MAMMALS							
TACHYGLOSSIDAE							
Tachyglossus aculeatus	Short-beaked Echidna		X	X		CS	
DASYURIDAE							
Planigale tenuirostris	Narrow-nosed Planigale			X		C	
Sminthopsis macroura	Stripe-faced Dunnart			X		C	
PERAMELIDAE							
Isoodon macrourus	Northern Brown Bandicoot				X	C	
PHASCOLARCTIDAE							
Phascolarctos cinereus	Koala			X		CS	
PETAURIDAE							
Petaurus breviceps	Sugar Glider			X	X	C	
PSEUDOCHEIRIDAE							
Petauroides volans	Greater Glider			X		C	
PHALANGERIDAE							
Trichosurus vulpecula	Common Brushtail Possum			X		C	
POTOROIDAE							
Aepyprymnus rufescens	Rufous Bettong		X	X	X	C	
MACROPODIDAE							
Macropus agilis	Agile Wallaby			X		C	
Macropus dorsalis	Black-striped Wallaby			X		C	
Macropus giganteus	Eastern Grey Kangaroo	1		X		C	
Macropus robustus	Euro			X		C	
Macropus rufus	Red Kangaroo		X	X		C	
Wallabia bicolor	Swamp Wallaby			X		C	
PTEROPODIDAE							
Pteropus scapulatus	Little Red Flying-fox			X		C	
EMBALLONURIDAE							
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	1, 4, H2		X	X	C	
Taphozous georgianus	Common Sheathtail-bat			X		C	
Taphozous troughtoni	Troughton's Sheathtail-bat			X		E	
MOLOSSIDAE							
Chaerephon jobensis	Northern Freetail-bat	H2		X		C	

Family Genus Species	Common Name	Data Source				Status	
		Site	Inc	PS	DB	NCA status	EPBC status
Mormopterus beccarii	Beccari's Freetail-bat	2, 3, 4, H1, H2		X		C	
Mormopterus norfolkensis	Eastern Freetail-bat			X		C	
Mormopterus species 2	undescribed Freetail-bat			X		C	
Tadarida australis	White-striped Freetail-bat			X		C	
VESPERTILIONIDAE							
Miniopterus australis	Little Bent-wing Bat	H2		X		C	
Miniopterus schreibersii oceanensis	Common Bent-wing Bat (eastern form)	H2		X		C	
Chalinolobus gouldii	Gould's Wattled Bat	1, 2, 3, H1, H2		X		C	
Chalinolobus morio	Chocolate Wattled Bat			X		C	
Chalinolobus nigrogriseus	Hoary Wattled Bat			X		C	
Chalinolobus picatus	Little Pied Bat	1, 2, 3, 4, H1, H2		X		R	
Scotorepens balstoni	Inland Broad-nosed Bat	H1, H2		X		C	
Scotorepens greyii	Little Broad-nosed Bat	H1, H2				C	
Vespadelus troughtoni	Eastern Cave Bat			X		C	
MURIDAE							
Pseudomys delicatulus	Delicate Mouse			X	X	C	
Pseudomys gracilicaudatus	Eastern Chestnut Mouse			X		C	
Hydromys chrysogaster	Water Rat			X		I	
Melomys burtoni	Grassland Melomys	2				C	
Mus musculus	House Mouse			X		C	
Rattus fuscipes	Bush Rat	2				C	
Rattus rattus	Black Rat	1		X		I	
CANIDAE							
Canis lupus dingo	Dingo	H1		X			
FELIDAE							
Felis catus	House Cat		X	X		I	
LEPORIDAE							
Lepus capensis	Brown Hare			X		I	
Oryctolagus cuniculus	European Rabbit	4		X		I	
EQUIDAE							
Equus asinus	Donkey			X		I	
SUIDAE							
Sus scrofa	Pig		X	X		I	
BOVIDAE							
Capra hircus	Goat			X		I	

[1] also known as *Ardea modesta* Eastern Great Egret
[2] also known as Clamorous Reed-Warbler *Acrocephalus stentoreus*.

Appendix 5:
Comments on Terrestrial Vertebrate Species of Special Conservation Significance Obtained from Database Searches but Undetected in the Project Site

The following list is compiled from Appendix 2.

Special Status abbreviations are as follows:

Queensland's *Nature Conservation Act 1992* (NC Act Status): E = Endangered, **V** = Vulnerable, **R** = Rare, **S** = Special Cultural Significance, **C** = Least Concern wildlife.

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act Status): E = Endangered, V = Vulnerable, M = Migratory Species.

Zoological Name	Common Name	NC Act Status	EPBC Act Status	Comments
REPTILES				
Rheodytes leukops	Fitzroy Turtle	V	V	The Fitzroy Turtle is known only from the Fitzroy River and its tributaries. It occurs in areas of riffles alternating with large, deep pools with riverbeds composed of bedrock, stones or cobbles, and silty sand (Cann 1998; Tucker *et al*. 2001; EPA 2007). It is not expected to occur in the project site and no suitable habitat is present.
Paradelma orientalis	Brigalow Scaly-foot	V	V	See Section 4.3.5
Egernia rugosa	Yakka Skink	V	V	See Section 4.3.5
Lerista allanae	Greater Robust Fine-lined Slider	E	E	This species (also known as Allan's Lerista) is known from only three localities in central Queensland: Clermont, 55 km northeast of Clermont and 30 km northwest of Capella (Covacevich *et al*. 1996b). Specimens were found below the soil surface in black soil under grass tussocks on farmland with the following broad habitat types: open grasslands, scattered gums, moderately heavy groves of Tea Trees and occasional Bottle Trees (Covacevich *et al*. 1996a). The species was not seen between 1967 and 1992 despite searches by hand and pit fall trapping (Couper and Ingram 1992) and is thought to be extinct (Wilson and Swan 2008).
BIRDS				
Ardea ibis	Cattle Egret	S	M	See Section 4.3.5
Ephippiorhynchus asiaticus	Black-necked Stork	R		See Section 4.3.6

Zoological Name	Common Name	NC Act Status	EPBC Act Status	Comments
Erythrotriorchis radiatus	Red Goshawk	E	V	The Red Goshawk occurs in woodlands and forests, ideally with a mosaic of vegetation types and permanent water, particularly riverine forests. The species avoids both very dense and very open habitats. It is found in coastal and subcoastal areas. Although the species has home ranges of 120 km^2 and 200 km^2 (for females and males respectively) (Marchant and Higgins 1993) and there is some limited riverine habitat in the project site it is not predicted to occur. The highly modified local landscape with substantial areas of cleared land and relatively poor connectivity is considered to result in a very low likelihood of occurrence.
Gallinago hardwickii	Latham's Snipe	S	M	See Section 4.3.5
Numenius minutus	Little Curlew	S	M	See Section 4.3.5
Rostratula australis	Australian Painted Snipe	V	V	See Section 4.3.5
Rostratula benghalensis	Painted Snipe		M	See Section 4.3.5
Monarcha melanopsis	Black-faced Monarch	S	M	See Section 4.3.5
Neochmia ruficauda ruficauda	Star Finch (southern subspecies)	E	E	This subspecies is thought to comprise less than 50 mature individuals (Garnett and Crowley 2000). The most recent records for central Queensland are from the Rockhampton region but are considered to be aviary escapees (Higgins *et al*. 2006b). There are no Birds Australia New Atlas (1998-2002) records (Barrett *et al*. 2003) for central Queensland and the subspecies is likely to be locally extinct.
MAMMALS				
Nyctophilus timoriensis (SE Form)	Greater Long-eared Bat (SE Form)	V	V	See Section 4.3.5

Appendix 6:
Impact Assessment Methodology Matrices

Impact Element	Element Features		PRELIMINARY (UNMITIGATED) IMPACTS					
			Likelihood of Impact Occurring					Highest Impact Level Predicted
			Certain	Probable	Possible	Unlikely	Rare	
Area of national, state, regional or local conservation significance, species or communities that are endangered, vulnerable, rare, of concern, of important to state or regional biodiversity (fauna corridors, environmental weeds), or subject to international agreements (JAMBA, CAMBA, Ramsar).	Size of area/ habitat affected	Minor	Minor	Minor	Negligible	Negligible	Negligible	Minor
		Moderate	Significant	Moderate	Moderate	Minor	Negligible	Significant
		Significant	Catastrophic	Catastrophic	Significant	Moderate	Negligible	Catastrophic
	Intensity of impact	Minor	Significant	Moderate	Minor	Negligible	Negligible	Significant
		Moderate	Catastrophic	Significant	Moderate	Minor	Negligible	Catastrophic
		Significant	Catastrophic	Catastrophic	Significant	Moderate	Negligible	Catastrophic
	Ability of impact element to recover	Low	Catastrophic	Catastrophic	Significant	Minor	Minor	Catastrophic
		Medium	Significant	Significant	Moderate	Minor	Minor	Significant
		High	Moderate	Moderate	Moderate	Minor	Minor	Moderate

Impact Element	Mitigation Effectiveness		MITIGATED IMPACTS																		Highest Impact Level Predicted
			Likelihood of Impact Occurring & Predicted Unmitigated Impact Level																		
			Certain				Probable				Possible				Unlikely				Rare				
			C	S	Mo	M	C	S	Mo	M	C	S	Mo	M	C	S	Mo	M	C	S	Mo	M	
Area of national, state, regional or local conservation significance, species or communities that are endangered, vulnerable, rare, of concern, of important to state or regional biodiversity (fauna corridors, environmental weeds), or subject to international agreements (JAMBA, CAMBA, Ramsar).	Level to which mitigation measure alleviates impact	Slightly	C	S	Mo	M	C	S	Mo	M	C	S	Mo	M	C	S	Mo	M	C	S	Mo	M	C
		Moderately	S	Mo	M	N	S	Mo	M	M	S	Mo	M	M	Mo	M	M	N	Mo	M	M	N	S
		Significantly	Mo	M	M	N	Mo	M	M	N	Mo	Mo	M	N	M	M	N	N	M	N	N	N	Mo
		Completely	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Appendix 7:
EPBC Act Assessment of Significance - Listed Threatened Ecological Communities, Listed Threatened Species and Listed Migratory Species

EPBC Assessment of Impact Significance on Listed Endangered Ecological Communities in the Study Area

Criteria	Assessment of Significance
An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:	**Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin** This community is analogous to areas mapped as RE s 11.3.21, 11.4.4, 11.4.11, 11.8.11, 11.9.9, 11.9.12 and 11.11.17 under the provisions of the Queensland *Vegetation Management Act 1999*. One vegetation community recorded within the Study Area (i.e. Community 2) is analogous to RE 11.8.11.
Reduce the extent of an ecological community.	Polygons that are mapped as part of the current study as RE 11.8.11 (i.e. vegetation community 2) will be subject to removal and/or disturbance within the northern portion of the Study Area. The total area that is affected is more than 100 ha. Within the relevant Local Government Area (former Belyando Shire), the area that is affected equates to a loss of approximately 0.33% of its remaining extent. Within the relevant bioregion (Brigalow Belt North), it equates to a loss of approximately 0.07% of its remaining extent. With mitigation through offsetting, the result of the proposed action would not significantly reduce the extent of this ecological community.*
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.	A significant area of RE 11.8.11 within the project area would be removed as a result of the proposed action. With mitigation through offsetting and the control of Buffel Grass and Parthenium on site and within offset areas, the result of the proposed action would not contribute to the regional fragmentation of this already highly fragmented ecological community.
Adversely affect habitat critical to the survival of an ecological community.	Polygons that are mapped as part of the current study as RE 11.8.11 (i.e. vegetation community 2) will be subject to removal and/or disturbance within the northern portion of the Study Area. The total area that is affected is more than 100 ha. Within the relevant Local Government Area (former Belyando Shire), the area that is affected equates to a loss of approximately 0.33% of its remaining extent. Within the relevant bioregion (Brigalow Belt North), it equates to a loss of approximately 0.07% of its remaining extent. As this represents a small portion of the existing extent of this community, with mitigation through offsetting and the control of Buffel Grass and Parthenium on site and within offset areas, the result of the proposed action would not significantly adversely affect habitat critical to the survival of this ecological community.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	The community occurs on Cainozoic igneous rocks, particularly fresh basalt, and is generally associated with undulating to gently undulating rises. It usually occurs on the crests and middle and upper slopes (slopes 2–6%), although in places is occasionally present on lower slopes and flat areas (slopes 0–2%). Associated soils are moderately shallow to deep cracking clay soils with gravel, stone or linear gilgai sometimes present. The occurrence of this community in association with specific landforms, soil types and inferred drainage requirements indicates that a narrow range of conditions are required for its establishment. The proposed action will remove these features, thus reducing potential areas for the distribution of this community. The presence of Buffel Grass and Parthenium has contributed to the Endangered status of RE 11.8.11 as both species outcompete and suppress native grasslands in the region. Control of these species on site and as part of the management program for offsets may well establish healthier examples of this RE type than are currently present within the areas proposed for disturbance.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna	While the proposed action would remove the majority of the Natural Grasslands on site, those areas that remain would be managed to exclude Buffel Grass and Parthenium, thereby possibly affecting an increase in the number of functionally of important species within the grassland.

Criteria	Assessment of Significance
harvesting.	
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – assisting invasive species, that are harmful to the listed ecological community, to become established; or – causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.	While the proposed action would remove the majority of the Natural Grasslands on site, which have been assessed as being in poor ecological condition, those areas that remain would be managed to exclude Buffel Grass and Parthenium, thereby possibly affecting an increase in the quality of the grassland.
Interfere with the recovery of an ecological community.	It is proposed that areas of the community retained on site will be managed to control exotic species. With mitigation through offsetting and the control of Buffel Grass and Parthenium on site and within offset areas, the loss of Natural Grasslands through the proposed action would not interfere with the recovery of this ecological community.

* Based on a 1:1 offset scenario, excluding those areas subject to existing onsite clearing approval (see **Sections 5.1.1 and 5.2 of main report**).

An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:	**Brigalow (*Acacia harpophylla* dominant and co-dominant) communities** This community is analogous to areas mapped as RE s 6.4.2, 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14, 11.12.21, 12.8.23, 12.9-10.6 and 12.12.26 under the provisions of the Queensland *Vegetation Management Act 1999*. Four vegetation communities contained within the Study Area (i.e. Communities 4, 14, 16 and 18) have been identified as being analogous to REs 11.4.8, 11.4.9 and 11.9.5.
Reduce the extent of an ecological community.	Within the relevant Local Government Area (former Belyando Shire), approximately 0.03% of the remaining extent of RE 11.4.8, 0.04% of the remaining extent of RE 11.4.9 and 0.79% of the remaining extent of RE 11.9.5 would be affected by the proposed action. Within the relevant bioregion (Brigalow Belt North), this equates to a losses of approximately 0.01%, 0.02% and 0.003%, respectively, for each RE of their remaining extent. As this represents very small portions of the existing extent of the analagous communities, with mitigation through offsetting,, the result of the proposed action would not significantly reduce the extent of this ecological community.*
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.	Relatively small areas of REs 11.4.8, 11.4.9 and 11.9.5 within the project area would be removed as a result of the proposed action. With mitigation through offsetting and the control of Buffel Grass within offset areas, the result of the proposed action would not significantly contribute to the local fragmentation of this already highly fragmented ecological community.
Adversely affect habitat critical to the survival of an ecological community.	Within the relevant Local Government Area (former Belyando Shire), approximately 0.03% of the remaining extent of RE 11.4.8, 0.04% of the remaining extent of RE 11.4.9 and 0.79% of the remaining extent of RE 11.9.5 would be affected by the proposed action. Within

Criteria	Assessment of Significance
	the relevant bioregion (Brigalow Belt North), this equates to a losses of approximately 0.01%, 0.02% and 0.003%, respectively, for each RE of their remaining extent. As this represents very small portions of the existing extent of the analagous communities, with mitigation through offsetting and the control of Buffel Grass on site and within offset areas the result of the proposed action would not significantly adversely affect habitat critical to the survival of this ecological community.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	The presence of Buffel Grass has contributed to the Endangered status of Brigalow as this species invades the understorey, outcompetes and suppresses Brigalow species recruitment, and increases fire frequency and intensity in Brigalow communities. Control of this species on site and as part of the management program for offsets may well establish healthier examples of this RE type than are currently present within the areas proposed for disturbance.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting.	While the proposed action would remove a portion of the Brigalow communities on site, the remaining area would be managed to exclude Buffel Grass and other weed species. With the application of fire management aimed at reducing the frequency and intensity of fires in these areas, it is likely that there will be an increase in the number of functionally of important species within the Brigalow communities.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – assisting invasive species, that are harmful to the listed ecological community, to become established; or – causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.	While the proposed action would remove a portion of the Brigalow communities on site, which have been assessed as being in poor ecological condition, those areas that remain would be managed to exclude Buffel Grass and too frequent fire, thereby possibly affecting an increase in the quality of the woodland.
Interfere with the recovery of an ecological community.	It is proposed that areas of the Brigalow communities that are retained on site will be managed to control exotic species. With mitigation through offsetting and the control of Buffel Grass and too-frequent fire on site and within offset areas, the loss of areas of Brigalow through the proposed action would not interfere with the recovery of this ecological community.

* Based on a 1:1 offset scenario, excluding those areas subject to existing onsite clearing approval (see **Sections 5.1.1 and 5.2 of main report**).

EPBC Assessment of Significance on Listed Vulnerable Species in the Study Area*

Criteria	Assessment of Significance
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	**Brigalow Scaly-foot *Paradelma orientalis*** The Brigalow Scaly-foot was once thought to be confined to remnant Brigalow (*Acacia harpophylla*) or sparse tussock grass vegetation on grey cracking soils (Shea 1987). Recent records, however, have found the species in additional habitats including *Acacia falciformis* woodland, Gidgee (*A. cambagei*) woodland, Poplar Box *Eucalyptus populnea* open woodland, sandstone rises in dry sclerophyll forests, *Corymbia maculata* and *E. crebra* dominated forest and mixed open woodland with *Triodia mitchelli* (Schulz and Eyre 1997; Kutt *et al.* 2003). Most records are from relatively undisturbed habitats but the species does also occur in young regrowth (two-three years old) and heavily grazed areas (Kutt *et al*. 2003). Fragments of invertebrates such as spiders and crickets have been recorded from scats. However, sap, particularly from *Acacia* species, constitutes a significant proportion of this species diet (Tremul 2000).
Lead to a long-term decrease in the size of an *important population* of a species.	A portion of potential habitat for this species would be lost as a result of the proposed action. With mitigation through offsetting, the result of the proposed action would not significantly reduce the local extent of these habitats. It is expected that any possible decrease in any possible local population would be minor and temporary.
Reduce the area of occupancy of an *important population*.	It is expected that any reduction in the area of occupancy of any possible local population of the species would be minor and temporary.
Fragment an existing *important population* into two or more populations.	If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur.
Adversely affect *habitat critical to the survival of a species*.	A lack of historical records and study records indicates that there is no habitat present that is critical to the survival of the species.
Disrupt the breeding cycle of an *important population*.	It is expected that any disruption to any possible local population of the species would be minor and temporary.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The Study Area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.
Result in *invasive species* that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	The implementation of a pest and weed management plan is required under State legislation to control and prevent the establishment of invasive species as a result of the project.
Introduce disease that may cause the species to decline.	The implementation of a pest and weed management plan is required under State legislation to control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	The species is not known to occur in the Study Area, however, habitat rehabilitation and restoration activities using seed or seedlings of local provenance are likely to assist, rather than interfere, with the recovery of the species in the local area.

Criteria	Assessment of Significance
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	**Yakka Skink *Egernia rugosa*** Yakka Skinks live in colonies, occupying communal burrows, often under dead timber or deep rock crevices. They are found in dry open forests and woodlands, usually on coarse gritty soils that are well drained (Ehmann 1992; Cogger 2000; Drury 2001; Wilson 2005). The species is threatened by loss of habitat, loss of shelter sites through agricultural practices, too-frequent fire, trampling of burrows by livestock and predation by foxes and cats (Drury 2001). Based on soil type it is considered unlikely that Yakka Skink occurs north of Cherwell Creek on the Study Area. The species was targeted in earlier surveys south of Cherwell Creek (Ecoserve and LAMR 2005) but was not located nor was it reported as likely to occur. There are no database or survey records for the Study Area.
Lead to a long-term decrease in the size of an *important population* of a species.	It is expected that any possible decrease in any possible local population of the species would be minor and temporary.
Reduce the area of occupancy of an *important population*.	It is expected that any reduction in the area of occupancy of any possible local population of the species would be minor and temporary.
Fragment an existing *important population* into two or more populations.	If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur.
Adversely affect *habitat critical to the survival of a species*.	A lack of historical records and study records indicates that there is no habitat present that is critical to the survival of the species.
Disrupt the breeding cycle of an *important population*.	It is expected that any disruption to any possible local population of the species would be minor and short-term.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The Study Area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.
Result in *invasive species* that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	The implementation of a pest and weed management plan is required under State legislation to control and prevent the establishment of invasive species as a result of the project.
Introduce disease that may cause the species to decline.	The implementation of a pest and weed management plan is required under State legislation to control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	The species is not known to occur in the Study Area, however, habitat rehabilitation and restoration activities using seed or seedlings of local provenance are likely to assist, rather than interfere, with the recovery of the species in the local area.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	**Ornamental Snake *Denisonia maculata*** Ornamental Snake was recorded for the Study Area during a previous fauna survey on Peak Downs Mine. Two individuals were found during a nocturnal search. The location included known habitat characteristics for this species of inundated gilgais and Brigalow on deep-cracking clays. Targeted searches failed to locate any more individuals or suitable habitat (Ecoserve and LAMR 2005). The Ornamental Snake occurs in low-lying areas with deep-cracking clay soils that are subject to seasonal flooding, and in adjacent areas of

Criteria	Assessment of Significance
	clay and sandy loams. The species is found in woodlands and shrublands, such as Brigalow, and in riverine habitats, and lives in soil cracks and under fallen timber (Ehmann 1992; Wilson 2005; Wilson and Swan 2008). The location described above is almost 12 km south-east of the southern edge of the Study Area. There are no database records for the Study Area.
Lead to a long-term decrease in the size of an *important population* of a species.	It is expected that any possible decrease in any possible local population of the species would be minor and temporary.
Reduce the area of occupancy of an *important population*.	It is expected that any reduction in the area of occupancy of any possible local population of the species would be minor and temporary.
Fragment an existing *important population* into two or more populations.	If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur.
Adversely affect *habitat critical to the survival of a species*.	A lack of historical records and study records indicates that there is no habitat present that is critical to the survival of the species.
Disrupt the breeding cycle of an *important population*.	It is expected that any disruption to any possible local population of the species would be minor and temporary.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The Study Area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.
Result in *invasive species* that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	The implementation of a pest and weed management plan is required under State legislation to control and prevent the establishment of invasive species as a result of the project.
Introduce disease that may cause the species to decline.	The implementation of a pest and weed management plan is required under State legislation to control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	The species is not known to occur in the area of proposed disturbance, however habitat rehabilitation and restoration activities using seed or seedlings of local provenance are likely to assist, rather than interfere, with the recovery of the species in the local area.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	**Australian Painted Snipe *Rostratula australis*** The Australian Painted Snipe is a secretive, cryptic, crepuscular species that occurs in terrestrial shallow wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains (Marchant and Higgins 1993). The species is patchily distributed throughout Australia, with most records being in the south-east. Records are erratic, the species being absent from areas in some years and common in others. There are no records for the Study Area and the species would only be expected to occur occasionally at best. Artificial waterbodies possibly suitable for this species are not within the area of proposed disturbance.

Criteria	Assessment of Significance
Lead to a long-term decrease in the size of an *important population* of a species.	Any impacts on any local population will be minor and temporary. The creation of additional dams on site could result in a net increase in available habitat.
Reduce the area of occupancy of an *important population*.	The actual area of occupancy of the species will be unaffected in the long-term. The creation of additional dams on site could result in a net increase in available habitat.
Fragment an existing *important population* into two or more populations.	No population of this highly mobile species will be fragmented due to the proposed action.
Adversely affect *habitat critical to the survival of a species*.	No habitat considered critical to the survival of the species is present in the Study Area.
Disrupt the breeding cycle of an *important population*.	It is expected that any disruption to any possible local population of the species would be minor and temporary.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	No habitat to be modified, destroyed, removed, isolated or decreased by the project would result in the species decline. The creation of additional dams on site could result in a net increase in available habitat.
Result in *invasive species* that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Any impacts on any local populations or individuals would be minor and short-term, particularly following the implementation of a pest and weed management plan, as is required under State legislation to control and prevent the establishment of invasive species as a result of the project.
Introduce disease that may cause the species to decline.	The implementation of a pest and weed management plan is required under State legislation to control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	Population scale movement would be unaffected in the long-term and significant disruptions to breeding cycles and interference to species recovery is therefore unlikely. The creation of additional dams on site could result in a net increase in available habitat.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	**Squatter Pigeon (southern subspecies) *Geophaps scripta scripta*** During the recent BAAM survey Squatter Pigeons were observed on a number of occasions, usually as singletons, though two pairs were recorded in very close proximity. Most observations were at the same location, near a creek, and may have been of the same individual. All individuals were observed in areas of active grazing and substantial habitat degradation and their occurrence may reflect the nearby presence of water rather than food resources, or be simply a result of increased visibility. Earlier surveys of the Study Area recorded Squatter Pigeons in groups of up to seven individuals. Habitat details are not available for most of these records though the report authors state that the species is likely to occur anywhere within the area that has grassland (Ecoserve and LAMR 2005). The Squatter Pigeon, despite substantial declines and even local extinctions in the southernmost parts of its range, remains common locally even in areas degraded by cattle. What is uncertain is the extent to which such populations are dependent on less disturbed patches of habitat within the landscape. Squatter Pigeons are terrestrial, foraging and breeding on the ground. The species occurs in open dry sclerophyll woodland with grassy understorey, nearly always near permanent water. Birds may occasionally feed in sown grasslands and pastures. Squatter Pigeons eat mainly seeds, including those of exotic pasture plants, and some insects (Crome and Shields 1992;

Criteria	Assessment of Significance
	Higgins and Davies 1996).
Lead to a long-term decrease in the size of an *important population* of a species.	Any impacts on any local population would be minor and temporary.
Reduce the area of occupancy of an *important population*.	The actual area of occupancy of the species would be unaffected by the proposed action in the long-term.
Fragment an existing *important population* into two or more populations.	No important population of this mobile species would be fragmented due to the proposed action.
Adversely affect *habitat critical to the survival of a species*.	No habitat considered critical to the survival of the species is present in the Study Area.
Disrupt the breeding cycle of an *important population*.	Population scale movement would be unaffected in the long-term and no known breeding sites would be lost. As such, significant disruptions to breeding cycles as a result of the proposed action are unlikely.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	No habitat to be modified, destroyed, removed, isolated or decreased by the project would result in species decline.
Result in *invasive species* that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Any impacts on any local populations or individuals would be minor and temporary, particularly following the implementation of a pest and weed management plan, as is required under State legislation to control and prevent the establishment of invasive species as a result of the project.
Introduce disease that may cause the species to decline.	The implementation of a pest and weed management plan is required under State legislation to control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	Population scale movement would be unaffected in the long-term and significant disruptions to breeding cycles and interference to species recovery as a result of the proposed action are therefore unlikely.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	**Greater Long-eared Bat (south-eastern form) *Nyctophilus timoriensis*** The Greater Long-eared Bat is a medium-sized insectivorous bat species that occurs in dry forest and woodland, mallee, and other arid and semi-arid habitats. It roosts in tree hollows or under bark (NPWS 2003). It is a little known species that is rarely caught (Churchill 1998). This species occurs across southern Australia, including Tasmania, but avoids coastal regions on the south-eastern mainland (NPWS 2003). Mating occurs in autumn and a single litter is produced each year (Churchill 1998). The Greater Long-eared Bat is threatened by loss and fragmentation of habitat, loss of mature hollow-bearing trees, and the use of pesticides (NPWS 2003). The genus *Nyctophilus* is readily identifiable by Anabat call analysis, though there are major difficulties in further resolution to species level. However, there are no Anabat records for any species of *Nyctophilus* for the Study Area. It is therefore unlikely that the Greater Long-eared Bat is present in the Study Area; however sporadic use of the site by any individuals possibly present in the local area cannot be discounted.

Criteria	Assessment of Significance
Lead to a long-term decrease in the size of an *important population* of a species.	Any impacts on any local population would be minor and temporary.
Reduce the area of occupancy of an *important population*.	The actual area of occupancy of the species would be unaffected by the proposed action in the long-term.
Fragment an existing *important population* into two or more populations.	No population of this highly mobile species would be fragmented due to the proposed action.
Adversely affect *habitat critical to the survival of a species*.	No habitat critical to the survival of the species is present in the Study Area.
Disrupt the breeding cycle of an *important population*.	Overall, population scale movement would be unaffected in the long-term and significant disruptions to breeding cycles as a result of the proposed action are therefore unlikely.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	No habitat to be modified, destroyed, removed, isolated or decreased by the project would result in the species decline.
Result in *invasive species* that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Any impacts on any local populations or individuals would be minor and short-term, particularly following the implementation of a pest and weed management plan, as is required under State legislation to control and prevent the establishment of invasive species as a result of the project.
Introduce disease that may cause the species to decline.	The implementation of a pest and weed management plan is required under State legislation to control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	Population scale movement will be unaffected in the long-term and significant disruptions to breeding cycles and interference to species recovery as a result of the proposed action are therefore unlikely.

* Does not include EPBC Act listed species obtained from database searches but undetected in the Study Area during current and/or previous surveys and not expected to occur (as determined in Appendix 5).

EPBC Assessment of Significance on Listed Migratory Species in the Study Area*

Criteria	Assessment of Significance
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:	• **Australian Cotton Pygmy-Goose *Nettapus coromandelianus albipennis*;** • **Great Egret *Ardea alba* (also known as Eastern Great Egret *Ardea modesta*);** • **Cattle Egret *Bubulcus ibis* (also known as *Ardea ibis*);** • **White-bellied Sea-Eagle *Haliaeetus leucogaster;*** • **Australian Painted Snipe *Rostratula australis* **;** • **Latham's Snipe *Gallinago hardwickii*;** • **Little Curlew *Numenius minutus*;** • **Marsh Sandpiper *Tringa stagnatilis*;** • **Common Sandpiper *Actitis hypoleucos*;** • **Red-necked Stint *Calidris ruficollis*;** • **Sharp-tailed Sandpiper *Calidris acuminata*;** • **Caspian Tern *Sterna caspia* (also known as *Hydroprogne caspia*)** • **White-throated Needletail *Hirundapus caudacutus*;** • **Fork-tailed Swift *Apus pacificus*;** • **Rainbow Bee-eater *Merops ornatus;*** • **Black-faced Monarch *Monarcha melanopsis*;** • **Rufous Fantail *Rhipidura rufifrons*;** • **Satin Flycatcher *Myiagra cyanoleuca;* and** • **Australian Reed-Warbler *Acrocephalus australis* (also known as *Acrocephalus stentoreus*).**
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of *important habitat* for a migratory species.	There is little evidence to suggest that the Study Area supports 'important habitat' for migratory species. Given their migratory habits, the ephemeral nature of food and habitat resources, and the extent of habitat across their range, it is likely that the existing resources within the Study Area would be utilised infrequently and on a transitory basis only. Within the Study Area migratory wetland species are basically restricted to artificial waterbodies such as dams rather than natural systems such as Cherwell Creek and a variety of ephemeral gullies which do not provide suitable resources. A number of small artificial waterbodies will be lost due to the project which will reduce the quantity of suitable habitats, however, the larger and more suitable waterbodies are not within the area of proposed disturbance. Given their artificial nature, their size and the highly modified landscape within which they are set these waterbodies are not regarded as important habitat. The creation of additional dams on site could result in a net increase in available habitat for many of these species. Those remaining wetland species for which specific potential impacts need to be considered are discussed separately below, along with those migratory species that do not inhabit wetland areas. • **Australian Cotton Pygmy-Goose *Nettapus coromandelianus albipennis*** This species has previously been recorded within the Study Area, although not during the BAAM field survey. There is no potential for a direct impact associated with the removal of existing wetland habitat for the proposed mine. The proposed action would have minimal effects on any local population of this species. • **Great Egret *Ardea alba* and Cattle Egret *Bubulcus ibis*** These species are predicted to occur, within or nearby to the Study Area. Great Egret was recorded during the BAAM survey and has been recorded in previous surveys. There are no records of Cattle Egret and it is considered unlikely to occur on the study

Criteria	Assessment of Significance
	site. There is potential for a direct impact associated with the removal of existing wetland habitat during mine construction. Any such impacts involving habitat would be minor and may be mitigated by the habitat creation and enhancement activities noted above for other wetland species. The proposed action would have minimal effects on any local population of these species. • **White-bellied Sea-Eagle *Haliaeetus leucogaster*** This species has been recorded in previous surveys and is predicted to occur. There is potential for a direct impact associated with the removal of large trees during mine construction. Any such impacts involving habitat would be minor and may be mitigated by the retention of large trees (both live and dead), where practical. • **Australian Painted Snipe *Rostratula australis* and Latham's Snipe *Gallinago hardwickii*** These species are predicted to occur, within or nearby to the study area, although neither have been recorded previously. As little suitable wetland vegetation occurs in the Study Area these species would only be expected to occur on the study site occasionally, at best. There is no potential for a direct impact associated through the removal of existing wetland habitat during mine construction. The proposed action is not expected to have any effect on these species. • **Little Curlew *Numenius minutus*** This species may occur within or nearby to the Study Area, but has not been recorded previously. It is expected to occur on the study site occasionally, at best. There is potential for a direct impact associated with the removal of existing wetland and grassland habitat during mine construction. Any such impacts involving habitat would be minor. The proposed action is not expected to have any effect on this species. • **Marsh Sandpiper *Tringa stagnatilis,* Common Sandpiper *Actitis hypoleucos,* Red-necked Stint *Calidris ruficollis* and Sharp-tailed Sandpiper *Calidris acuminata*** These species have been recorded previously within or near the Study Area. There is potential for a direct impact associated with the removal of existing wetland habitat during mine construction. However, habitat considered suitable for these species (whether or not it can be considered 'important' habitat) will not be impacted by the proposed works. • **Caspian Tern *Sterna caspia*** This species has been recorded within or nearby to the study area in previously surveys. It is considered to be a sporadic visitor to the study site. There is no potential for a direct impact associated with the removal of existing wetland habitat during mine construction. The proposed action is not expected to have any effect on this species. • **Fork-tailed Swift *Apus pacificus* and White-throated Needletail *Hirundapus caudacutus*** These species have been recorded within or nearby the Study Area in previous surveys, and are predicted to occur. Both are aerial species for which the Study Area will not represent 'important habitat' and no impacts are expected due to mine construction or operation as these species forage over a wide variety of land use, including human infrastructure and large waterbodies. • **Rainbow Bee-eater *Merops ornatus*** Rainbow Bee-eater was regularly recorded across the Study Area and is a very common, widespread species. Consequently, the Study Area will not represent important habitat for the bird and any potential impacts during mine construction, such as loss of breeding substrate and loss of prey species due to clearing and inundation, would be negligible.
Result in invasive species that are	As noted above, the Study Area is not considered to be an area of 'important habitat' for migratory birds, whether they are wetland or

Criteria	Assessment of Significance
harmful to the migratory species becoming established in an area of *important habitat* for the migratory species.	terrestrial species. The local area has a history of forest clearing and habitat modification, which has benefited a number of feral and invasive flora and fauna species. The proponent proposes the implementation of a weed and feral animal control program for the project in accordance with any local and/or State government pest or weed management plans that will contribute to the overall enhancement of habitat for migratory species.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an *ecologically significant proportion* of the *population* of a migratory species.	There is no evidence to suggest that the Study Area supports an 'ecologically significant proportion of a population' of any of the migratory birds known or considered likely to occur. The creation of additional dams on site could result in a net increase in available habitat for many of these species. Those wetland species for which specific potential impacts need to be considered are discussed below, along with those migratory species that do not inhabit wetland areas. • **Australian Cotton Pygmy-Goose *Nettapus coromandelianus albipennis*** This species was not recorded within or nearby the Study Area, but is predicted to occur sporadically in low numbers. It breeds from late spring to mid autumn, nesting high in hollow trees near water and, if present, there is potential for a direct impact associated with the removal of existing wetland habitat and associated large dead trees suitable for nesting during mine construction. There is potential for breeding by this species within the Study Area but none of the possible areas is within the area of proposed disturbance. Any possible impacts on other aspects of lifecycle would be minor. • **Great Egret *Ardea alba* and Cattle Egret *Bubulcus ibis*** These species are predicted to occur, within or nearby to the study area. Great Egret was recorded during the BAAM survey and has been recorded in previous surveys. There are no records of Cattle Egret and it is considered unlikely to occur on the study site. There is potential for a direct impact associated with the removal of existing wetland habitat during mine construction. Any such impacts involving habitat would be minor. The proposed action would have minimal effects on any local population of this species. • **White-bellied Sea-Eagle *Haliaeetus leucogaster*** This species has been recorded in previous surveys and is predicted to occur. There is potential for a direct impact associated with the removal of large trees during mine construction. Any such impacts involving habitat would be minor and may be mitigated by the retention of large trees (both live and dead), where practical. Any possible impacts on lifecycle as a result of the proposed action would be minor. • **Australian Painted Snipe *Rostratula australis* and Latham's Snipe *Gallinago hardwickii*** These species are predicted to occur, within or nearby to the Study Area, although neither have been recorded previously. As little suitable wetland vegetation occurs in the Study Area these species would only be expected to occur on the study site occasionally, at best. Latham's Snipe breeds in the northern hemisphere. There is no potential for a direct impact associated with the removal of existing suitable wetland habitat during mine construction. Any such impacts involving habitat would be minor. The proposed action is not expected to have any effect on these species. • **Little Curlew *Numenius minutus*** This species may occur within or nearby to the Study Area, but has not been recorded previously. It breeds in the northern hemisphere and is expected to occur on the study site occasionally, at best. There is potential for a direct impact associated with the removal of existing wetland and grassland habitat during mine construction. Any such impacts involving habitat would be minor. The proposed action is not expected to have any effect on this species.

Criteria	Assessment of Significance
	• **Marsh Sandpiper *Tringa stagnatilis,* Common Sandpiper *Actitis hypoleucos,* Red-necked Stint *Calidris ruficollis* and Sharp-tailed Sandpiper *Calidris acuminata*** These species have been recorded within or near the Study Area on previous surveys. All of these species breed in the northern hemisphere. Habitat considered suitable for these species would not be impacted by the proposed action and would not have any effect on these species. • **Caspian Tern *Sterna caspia*** This species has been recorded within or nearby to the study area in previously surveys. It is considered to be a sporadic visitor and is not expected to breed within the Study Area. There is no potential for a direct impact associated with the removal of existing suitable wetland habitat during mine construction. Any such impacts involving habitat would be minor. The proposed action is not expected to have any effect on this species. • **Fork-tailed Swift *Apus pacificus* and White-throated Needletail *Hirundapus caudacutus*** These aerial species have been previously recorded within or nearby the Study Area, and are predicted to occur outside of their breeding seasons (they do not breed in Australia). Both are common, widespread species for which the Study Area will not support an 'ecologically significant proportion of a population' and no impacts are expected due to mine construction or operation. • **Rainbow Bee-eater *Merops ornatus*** Rainbow Bee-eater was regularly recorded across the Study Area and is a very common, widespread species. Consequently, the Study Area will not support an 'ecologically significant proportion of a population' and any potential impacts during mine construction, such as loss of breeding substrate and loss of prey species due to clearing and inundation, would be negligible. • **Black-faced Monarch *Monarcha melanopsis*, Rufous Fantail *Rhipidura rufifrons* and Satin Flycatcher *Myiagra cyanoleuca*** These species are predicted to occur within or nearby the Study Area. The Rufous Fantail and Satin Flycatcher have been recorded in previous surveys. These species would only be expected to occur on the study site occasionally, at best. If present, they have the potential to be directly impacted by the loss of riparian habitat suitable for foraging, resting during migration and/or breeding. However, most suitable habitat for these species lies outside of the area for proposed works resulting in a predicted insignificant impact on these species overall. • **Australian Reed-Warbler *Acrocephalus australis*** This species was recorded within the Study Area during the BAAM field survey and has also been recorded within or nearby in previous surveys. Where present, it has the potential to be directly impacted by the removal of existing wetland habitat during mine construction, although the most suitable habitat identified for this species lies outside the zone of the proposed works. Any associated impacts on the life cycles of any local population as a result of the proposed action would be minor.

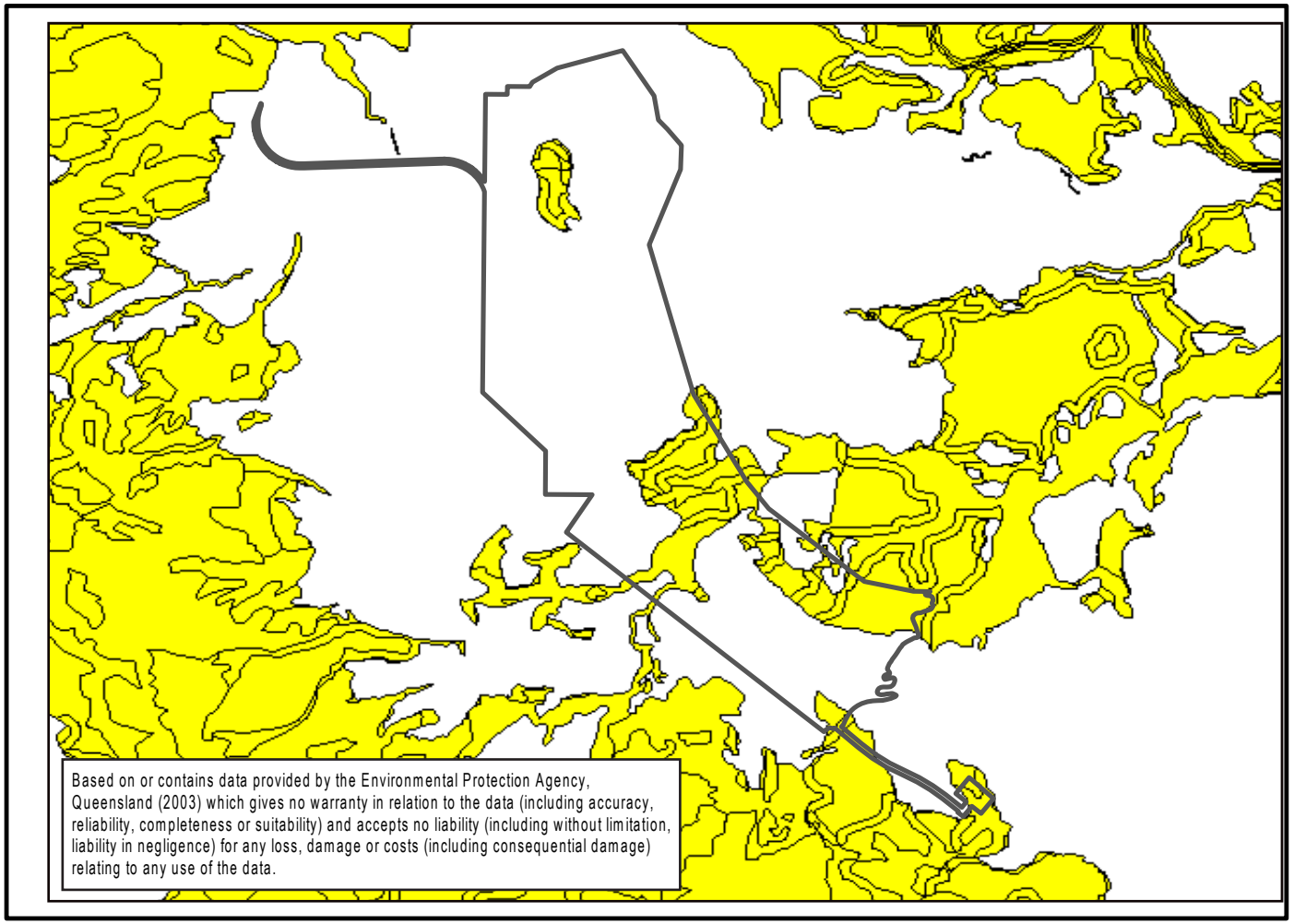
* Does not include EPBC Act listed species obtained from database searches but undetected in the Study Area during current and/or previous surveys and not expected to occur (as determined in Appendix 5).

** Painted Snipes in Australia have previously been considered a migratory subspecies of *Rostratula benghalensis* (Marchant and Higgins 1993). Most recently, the Australian birds have been considered to be an endemic species, *R. australis*, in which case *R. benghalensis* does not occur in Australia (Garnett and Crowley 2000; Geering *et al*. 2007).

Appendix 8:
Brigalow Belt North (BBN) Bioregion Biodiversity Planning Assessment (BPA) Mapping

ESRI ArcExplorer 2.0

Habitat For EVR Taxa (A Rating)



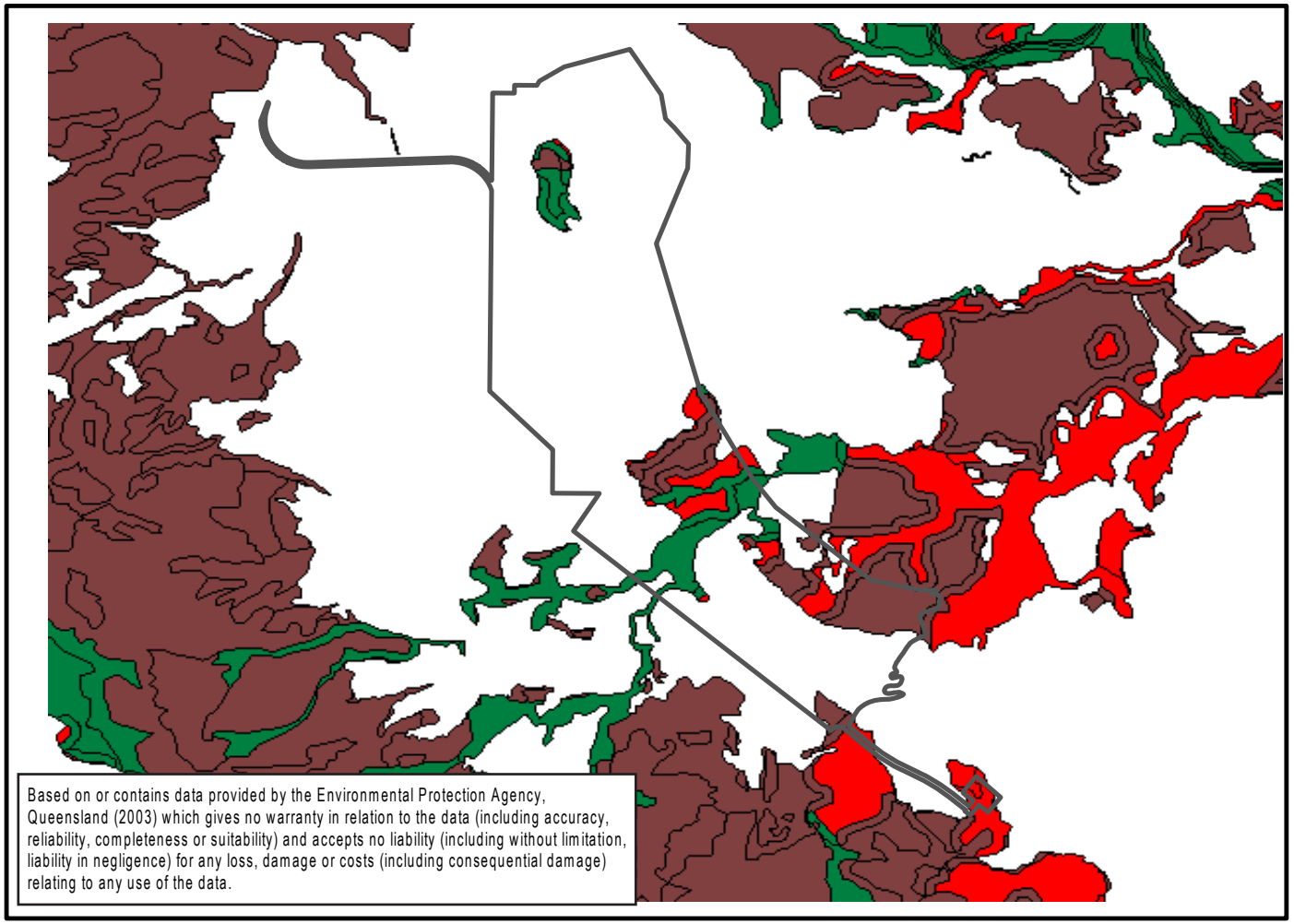
BRBN: Habitat for EVR taxa (A_RATING)

- HIGH
- LOW
- MEDIUM
- VERY HIGH

Wednesday, May 7 2008

ESRI ArcExplorer 2.0

State Ecosystem Value (B1 Rating)



BRBN: State Ecosystem Value (B1_RATING)

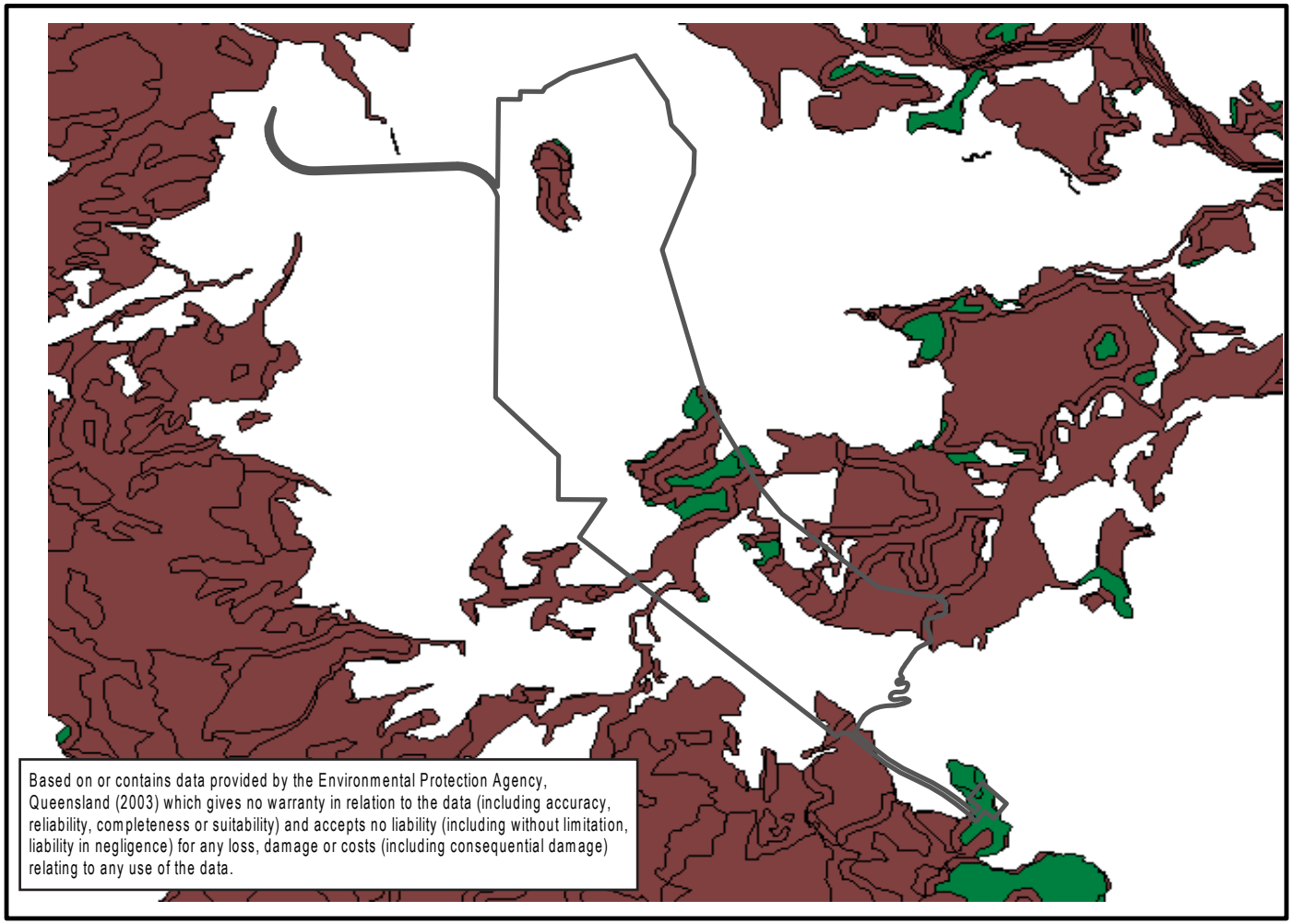
- HIGH
- LOW
- MEDIUM
- VERY HIGH

N

Wednesday, May 7 2008

ESRI ArcExplorer 2.0

Regional Ecosystem Value (B2 Rating)



BRBN: Regional Ecosystem Value (B2_RATING)

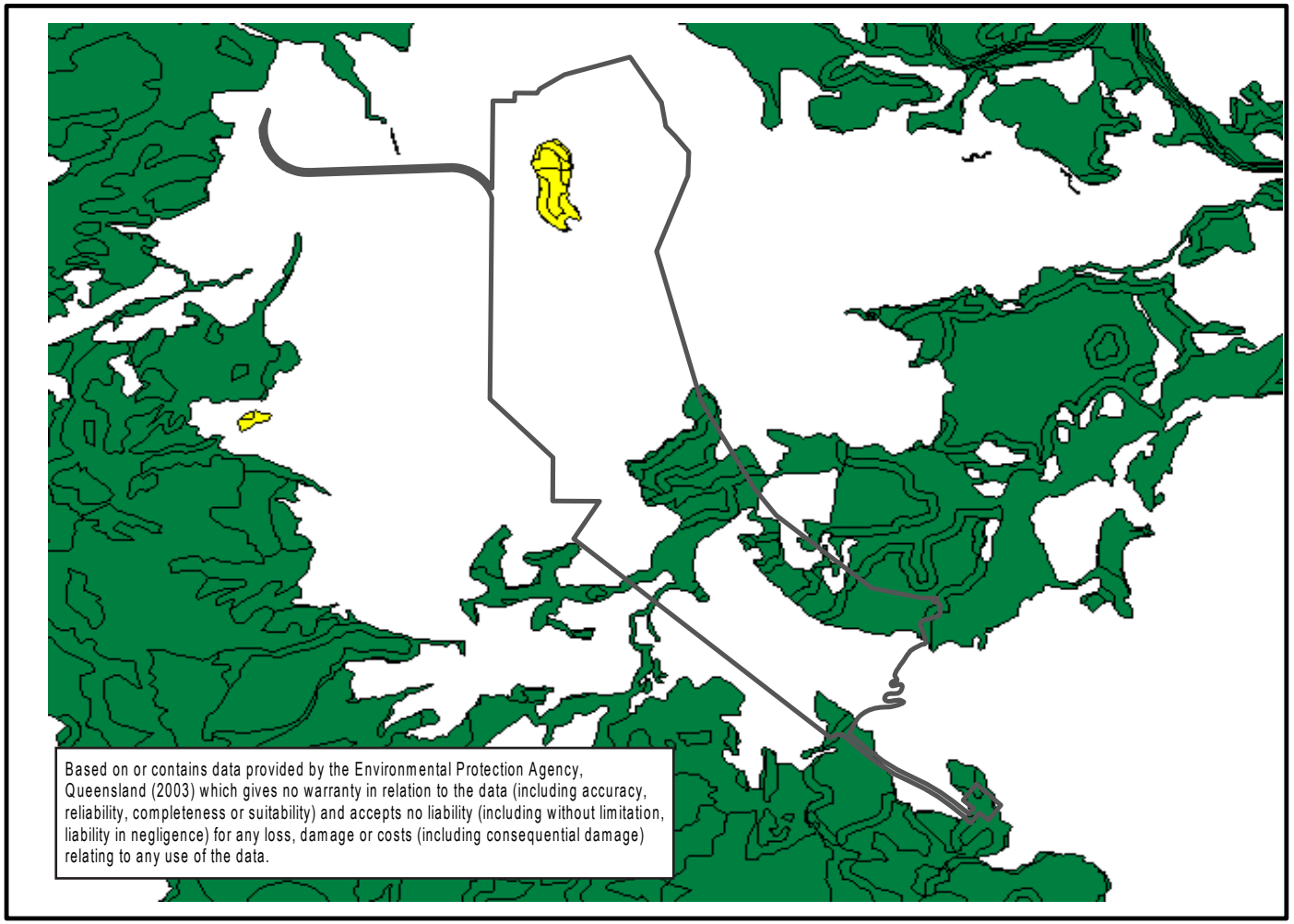
- HIGH
- LOW
- MEDIUM
- VERY HIGH

N

Wednesday, May 7 2008

ESRI ArcExplorer 2.0

Tract Size (C Rating)



BRBN: Tract Size (C_RATING)

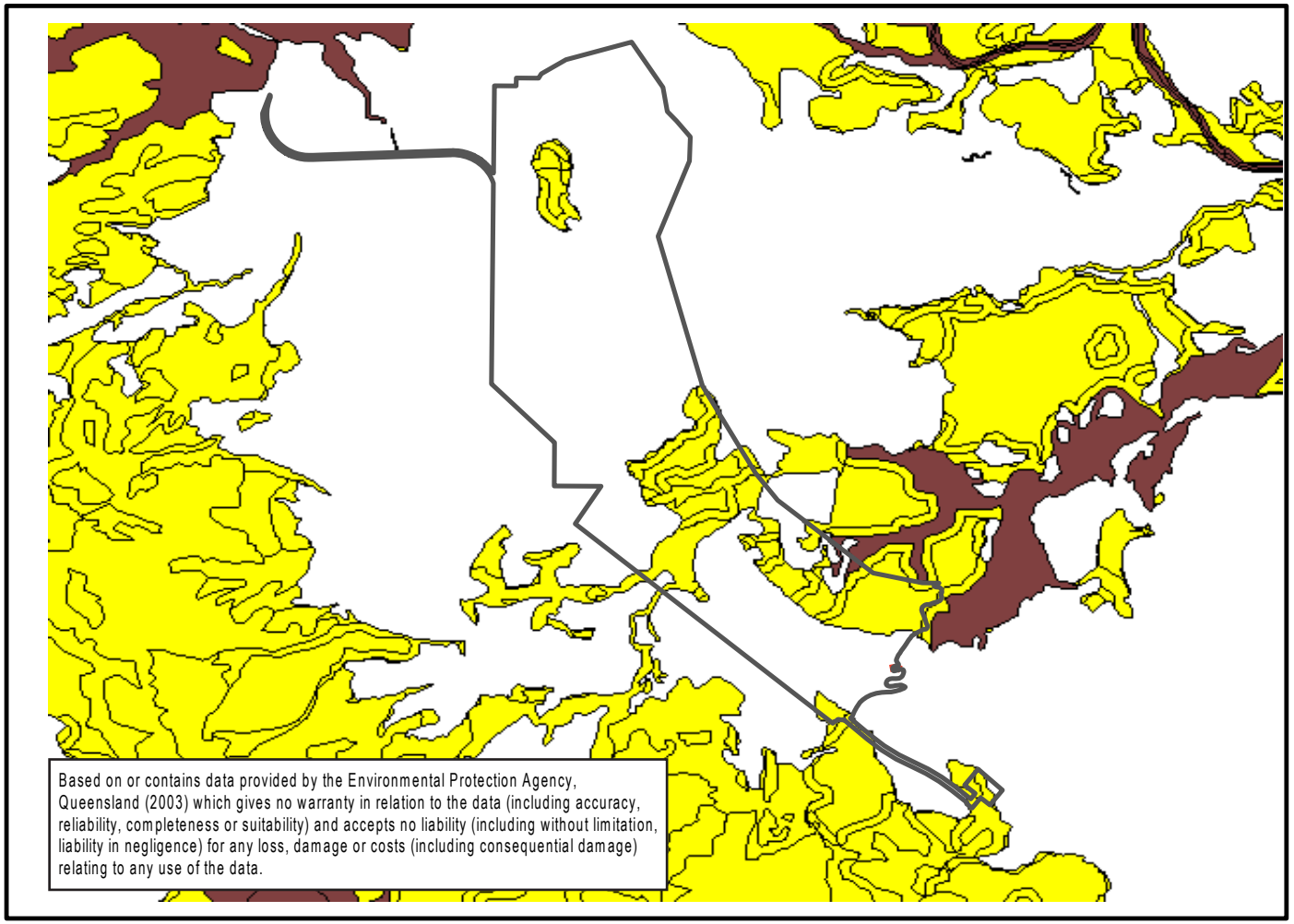
- HIGH
- LOW
- MEDIUM
- VERY HIGH

N

Wednesday, May 7 2008

ESRI ArcExplorer 2.0

State Relative Ecosystem Size (D1 Rating)



BRBN: State Relative Ecosystem Size (D1_RATING)

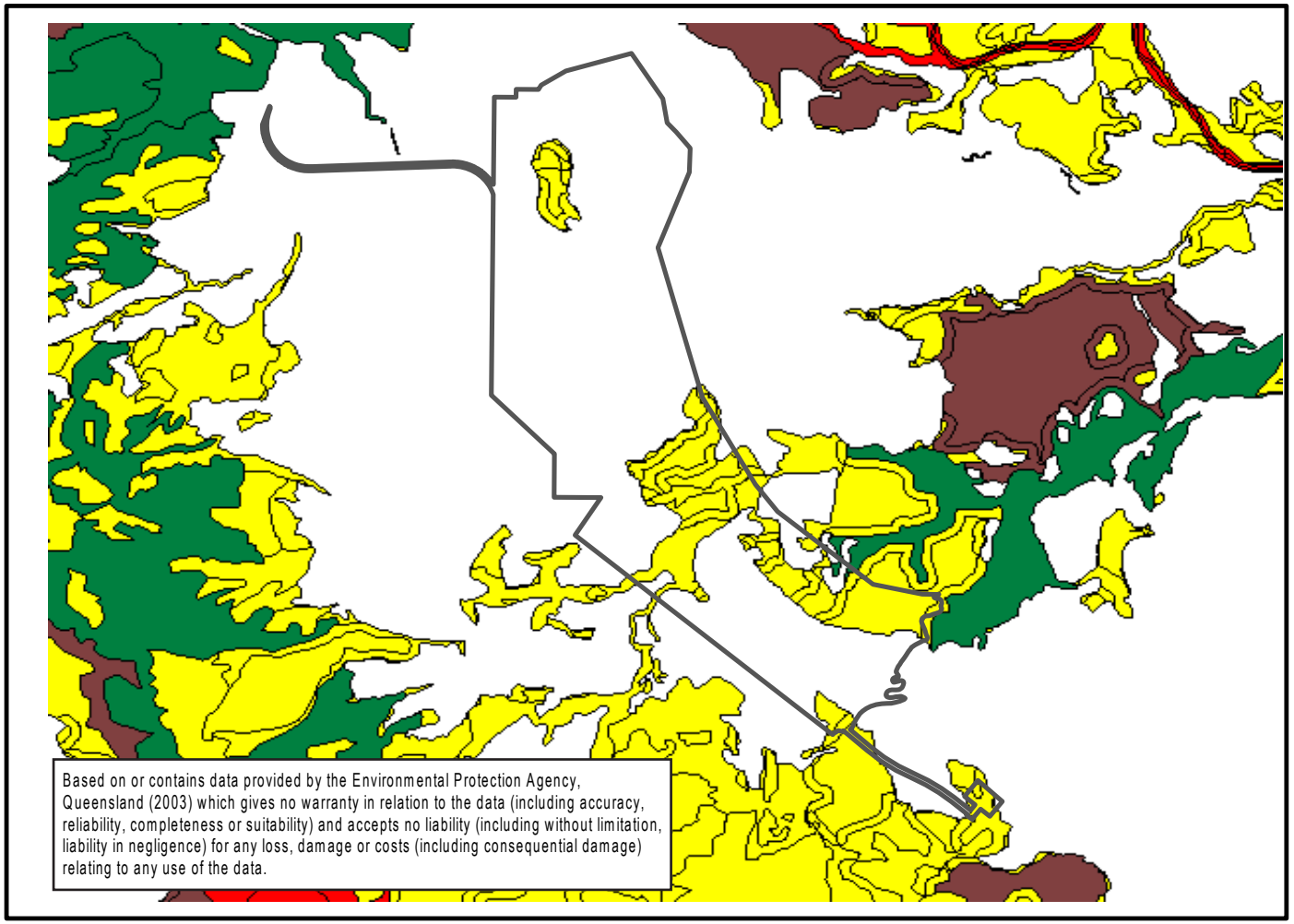
- HIGH
- LOW
- MEDIUM
- VERY HIGH

N

Wednesday, May 7 2008

ESRI ArcExplorer 2.0

Regional Relative Ecosystem Size (D2 Rating)



BRBN: Regional Relative Ecosystem Size (D2_RATIN

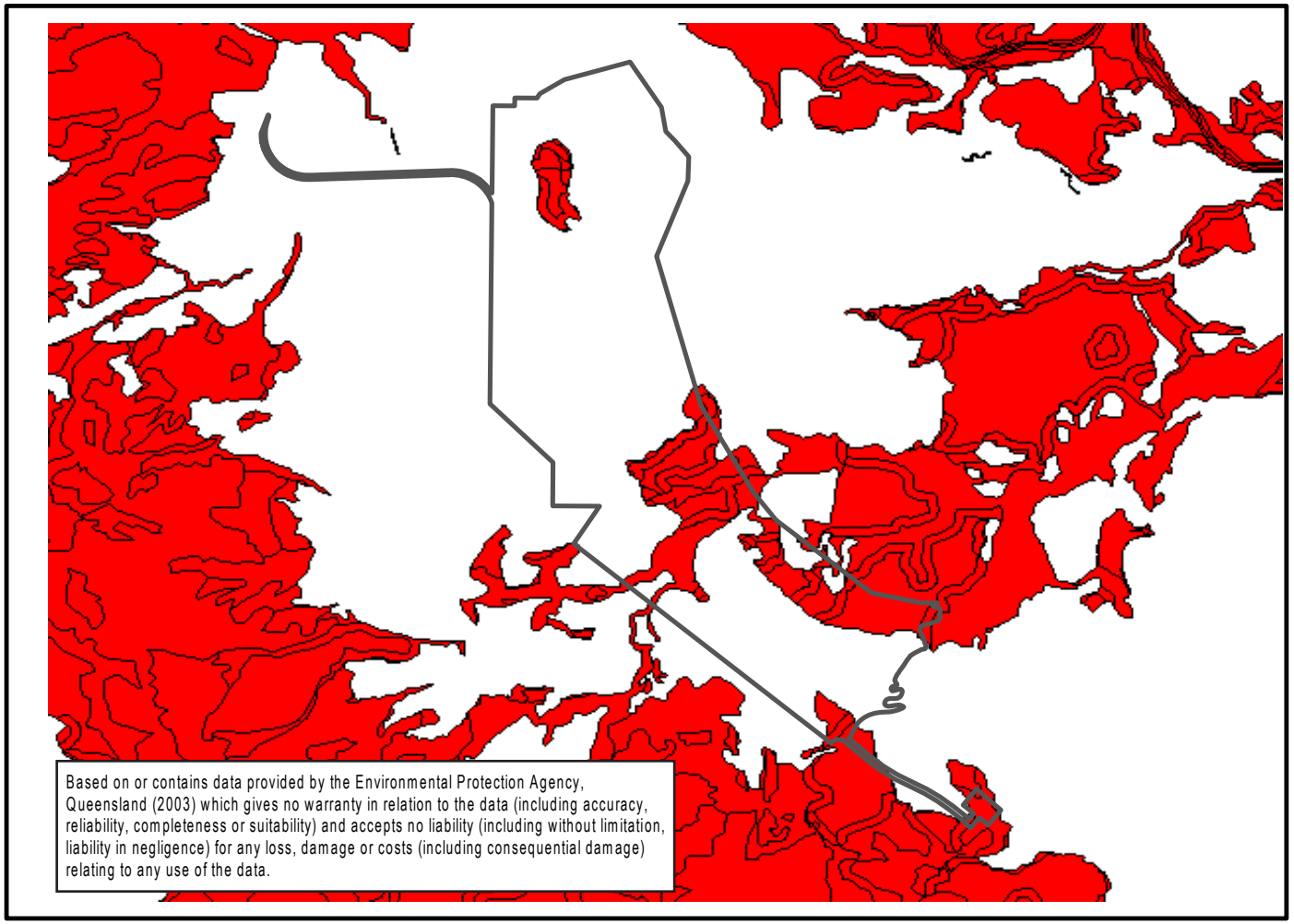
- HIGH
- LOW
- MEDIUM
- VERY HIGH

N

Wednesday, May 7 2008

ESRI ArcExplorer 2.0

Condition (E Rating)



BRBN: Condition (E_RATING)

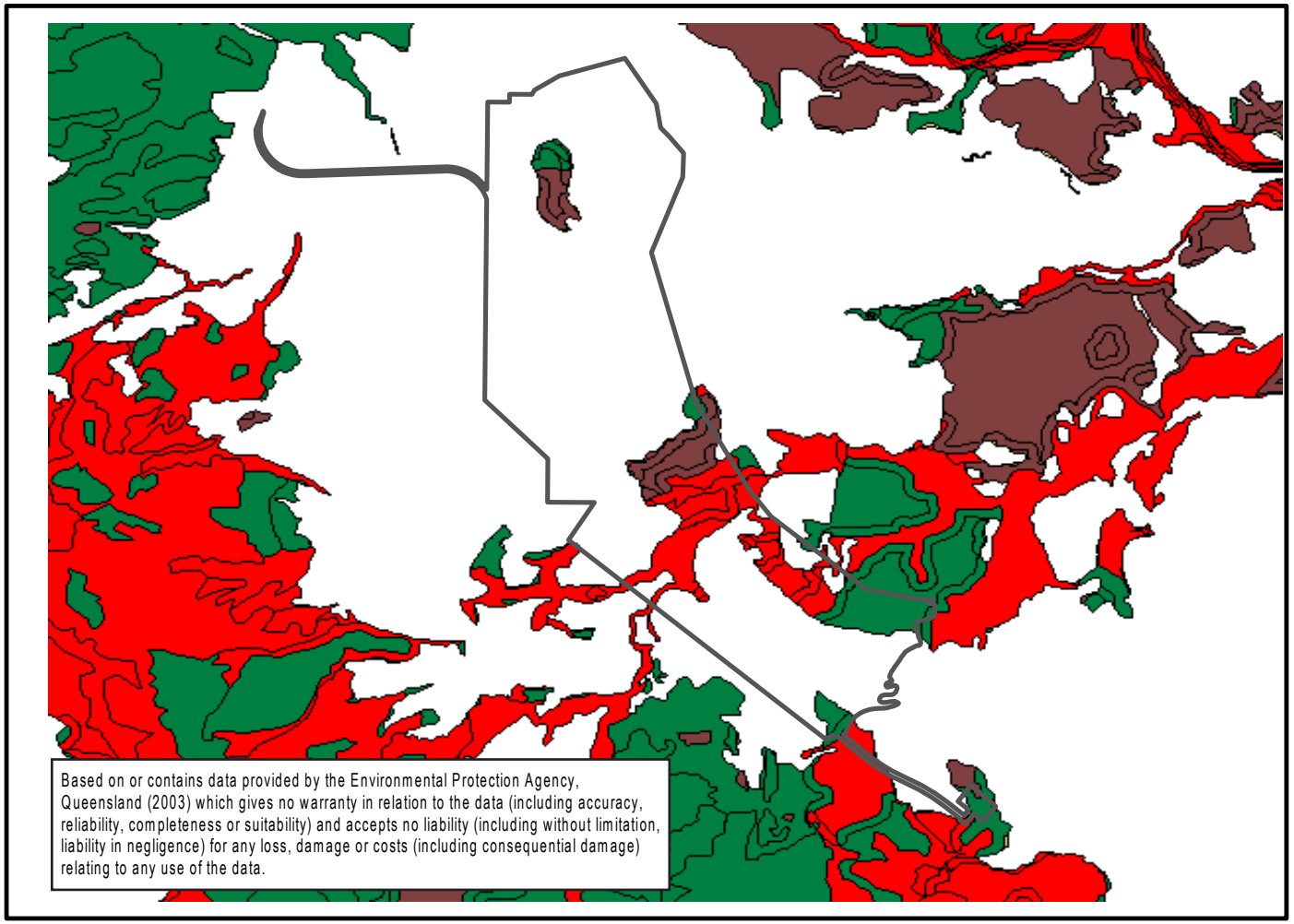
VERY HIGH

N

Wednesday, May 7 2008

ESRI ArcExplorer 2.0

Ecosystem Diversity (F Rating)



BRBN: Ecosystem Diversity (F_RATING)

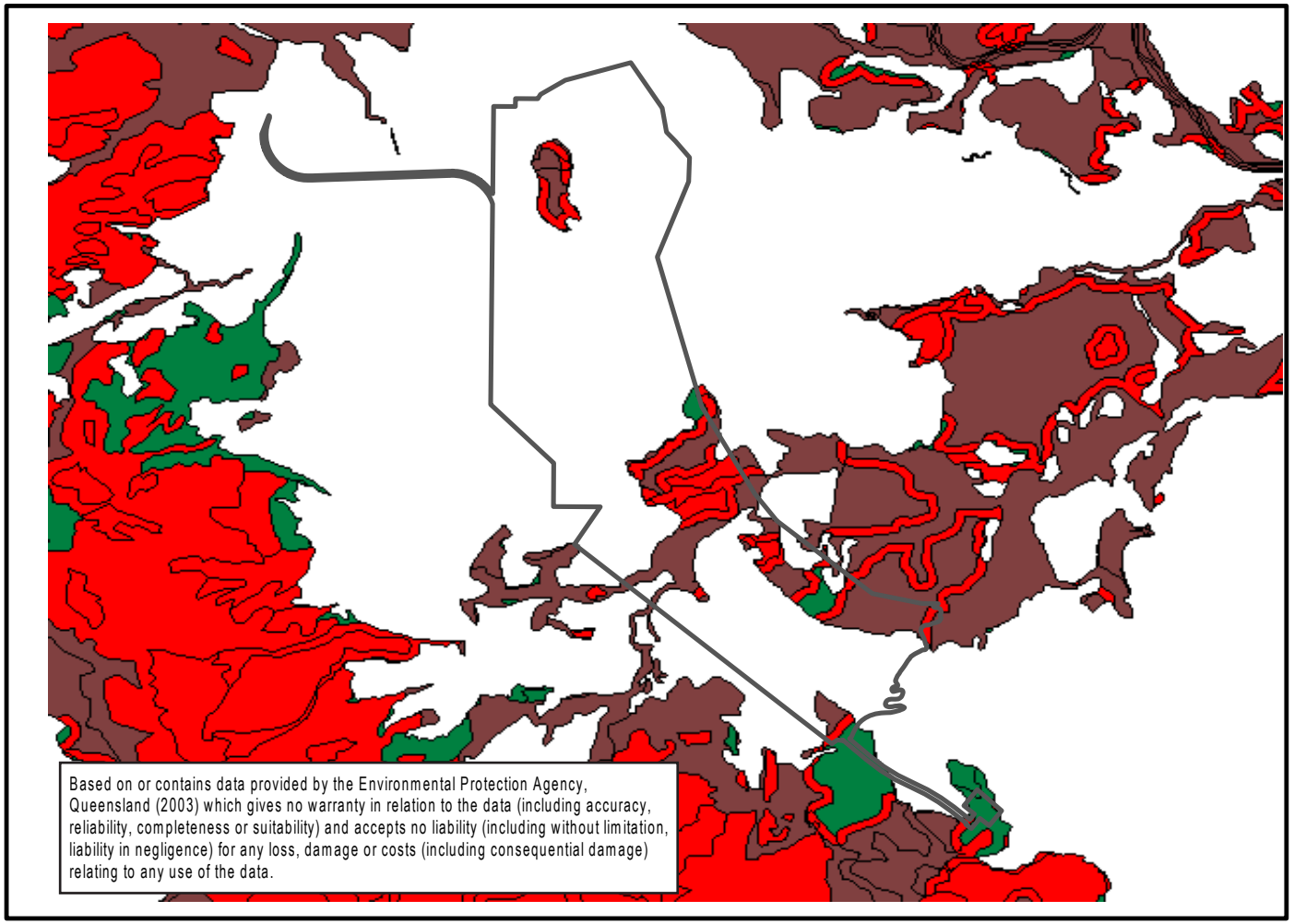
- HIGH
- LOW
- MEDIUM
- VERY HIGH

N

Wednesday, May 7 2008

ESRI ArcExplorer 2.0

Context and Connection (G Rating)



BRBN: Context & Connection (G_RATING)

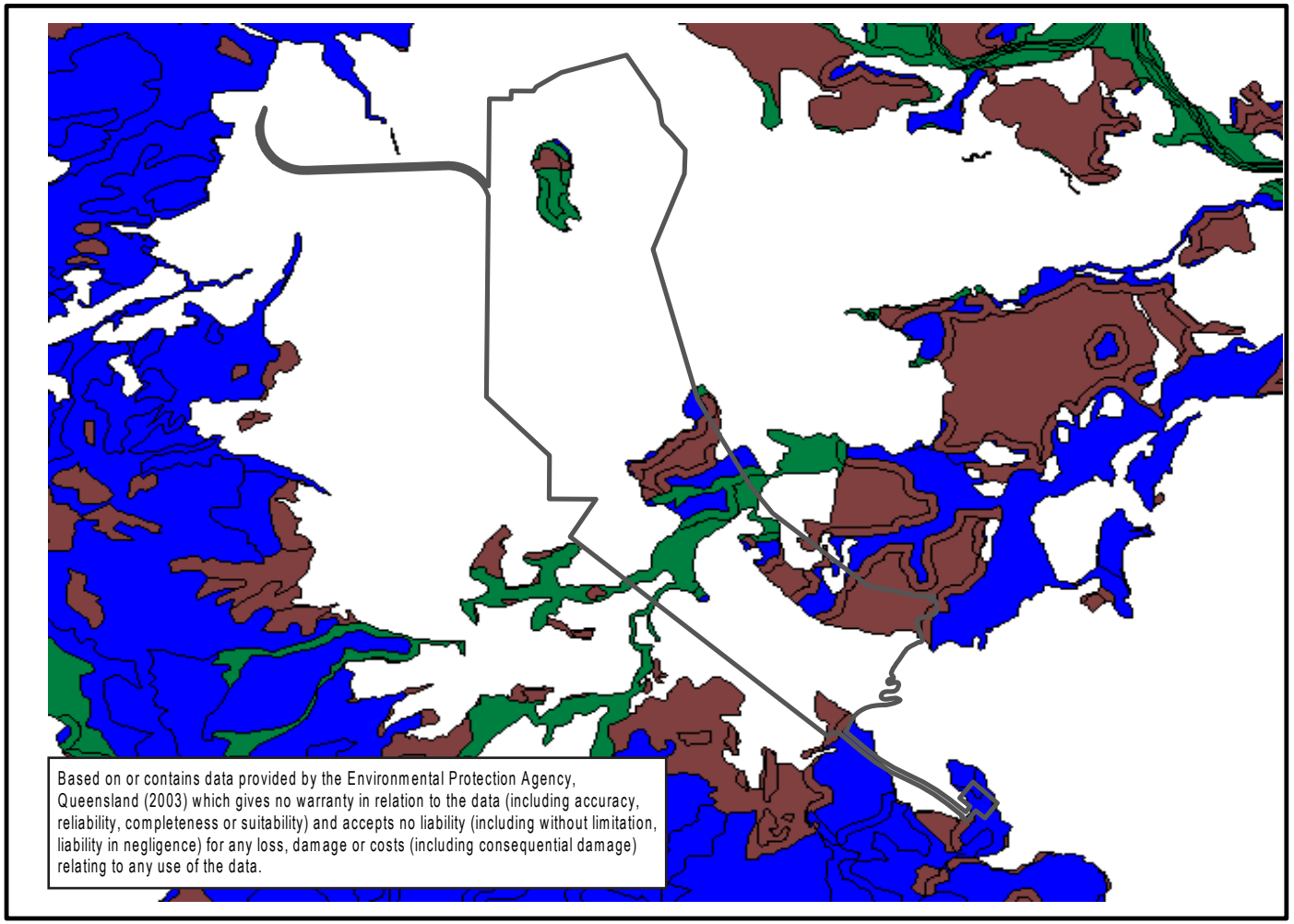
- HIGH
- LOW
- MEDIUM
- VERY HIGH

N

Wednesday, May 7 2008

ESRI ArcExplorer 2.0

BRBN: Biodiversity Significance



BRBN: Biodiversity Significance (BIO_SIG)

- Local or Other Values
- Non Bioregion Ecosystem
- Regional
- State
- State Habitat for EVR taxa

N

Wednesday, May 7 2008