H Matters of National Environmental Significance Report

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Appendix H Matters of National Environmental Significance

H.1 Executive Summary

H.1.1 Overview

The Proponent, Hancock Galilee Pty Ltd (HGPL) proposes to develop a new coal mine to produce up to 30 million tonnes of thermal coal annually for the export market for a period of 30 years. The coal mine, which is comprised of both open-cut and underground operations, is targeting the thermal coal seams in the Upper Permian coal measures of the Galilee Basin in Queensland, Australia. The coal mine, known as the Kevin's Corner Coal Project (the Project), will be situated in central Queensland approximately 110 kilometres south-west of Clermont, 340 kilometres south-west of Mackay and 65 kilometres north of the township of Alpha, the nearest residential area to the Project site.

The Project is largely contained within mining development licence (MDL) 333. Since the mid 1970s the Proponent has held MDL 333 and in the mid 1990s extended its tenure holding to include exploration permit for coal (EPC) 570 now known as MDL 285. In December 2007, the Proponent obtained a further EPC 1210. Portions of MDL 333 and EPC 1210 have been combined to form the new mining leases currently under application. HGPL has applied for mining lease application (MLA) 70425

This Matters of National Environmental Significance *(*MNES) report has been produced through consultation with the Department of Sustainability, Environment, Water, People and Communities (SEWPaC) coupled with an effort to fulfil the Terms of Reference (TOR) for the Project. This report discusses the Matters of National Environmental Significance (MNES) that relate to the Kevin's Corner Coal Mine Project Environmental Impact Statement (EIS) and are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The TOR describes the Project as the mine and infrastructure facilities, plus supply water and power supply utilities. The Project EIS addresses only the mine components as the remaining aspects are subject to separate environmental approvals and are not included. The EPBC Referral No. 2009/5033 was submitted by the Proponent to the Commonwealth Government and in September 2009 the project was determined to be a controlled action due to likely impacts on MNES.

To describe the existing environmental values of the Project area in terms of the presence of EPBC-listed species, a combination of ecological desktop assessments and seasonal field surveys were conducted. The desktop assessment comprised a review of relevant literature and database searches. Flora and fauna surveys were conducted to obtain ecological information relevant to the Project and to ground-truth results from desktop assessments. These assessments resulted in a list of EPBC-listed species that potentially occur on the Project site.

The presence/absence data obtained from the combined desktop and field assessments was then applied in a mapping study which used DERM data to describe the potential habitat available to the EPBC-listed species that may occur in the Project study area which includes the extent of all direct impacts. This habitat was overlaid with potential direct and indirect impact footprints and the area of potential habitat at risk of impacts from the Project was calculated, provided and discussed. The significance of these impacts was then assessed in relation to the amount of available habitat in the

region of the Project in conjunction with the mitigation measures and management strategies proposed for the Project.

H.1.2 EPBC Values

Desktop studies indicated the potential presence of 1 flora species of conservation significance (*Dicanthium queenslandicum*) listed under the EPBC Act. This species was considered to have a low likelihood of being present within the the Project area. One EPBC Act listed threatened ecological community (TEC) (Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin) was identified from the combined desktop and field assessments.

Review of database searches indicated the potential presence of 10 fauna species of conservation significance listed under the EPBC Act. Of these, 5 were considered to have a moderate likelihood of being present (*Neochmia ruficauda ruficauda, Denisonia maculate, Egernia rugosa,Furina dunmalli*, *Paradelma orientalis*) within the project site and 4, a low likelihood of presence (*Erythrotriorchis radiatus, Rostratula australis, Poephila cincta cincta, Nyctophilus timoriensis*). The remaining 1 EPBC Act listed threatened fauna species was recorded from field surveys of the project site (*Geophaps scripta scripta*). This species is listed as Vulnerable under the EPBC Act.

A total of 10 Migratory species listed under the EPBC Act (*Apus pacificus, Ardea alba, Ardea ibis, Gallinago hardwickii, Haliaeetus leucogaster, Hirundapus caudacutus, Merops ornatus, Myiagra cyanoleuca, Nettapus coromandelianus, Rostrtula benghalensis s. lat.*) were identified during the combined desktop and field survey effort.

H.1.3 Management and Mitigation Measures

Proposed avoidance and mitigation measures to reduce the Project direct and indirect impacts of the Project to MNES are presented (or referenced) in this report. Based on a quantitative analysis of overlaid 'high value potential habitat' for the 11 threatened flora and fauna species likely to occur in the Project study area, the total direct impact to 'high value potential habitat' is 2,800 ha (0.42% of habitat extent in the regional landscape defined as 137 km x 163 km region with the Project MLA as a centroid) and the total indirect impact to 'high value potential habitat' is 12,013 ha (1.79% of habitat extent in the regional landscape). This impact, when compared to habitat availability in the regional landscape, and in combination with the proposed management and mitigation measures, is not likely to significantly impact MNES.

The conservative approach used in the modelling process to assist with quantification of potential impacts has allowed an assessment of the significance of impacts to MNES. Where unavoidable impacts cannot be mitigated (i.e. vegetation clearing and associated loss of habitat) an Offsets Strategy for the Project has been developed and will be further refined in consultation with government agencies, giving consideration to relevant State and Commonwealth policies relating to offsets. This strategy includes planned ongoing studies to further refine and review the habitat mapping study presented in this report, including additional model validation as well as assessment of additional site specific information. The Offsets Strategy is presented in this EIS (Volume 2, Appendix Z)

The implementation of monitoring and reporting protocols will further allow the impacts to fauna, flora and vegetation communities to be minimised, and improveme the implementation of environmental management procedures and processes to further minimise impacts. These processes will result in the reduction of potential impacts from the Project on MNES.

H.2 Introduction

H.2.1 Project Overview

In July 2009, the Proponent publically advertised the Project's initial advice statement (IAS) for a 30 Mtpa combined open-cut and underground thermal coal mine in the Galilee Basin. The IAS identified the key components of the proposed Project and the linkage to the proposed Alpha Coal Rail and Abbot Point export facilities (both described separately in the Alpha Coal Project EIS).

The Project is situated in central Queensland approximately 110 kilometres south-west of Clermont, 340 kilometres south-west of Mackay and 65 kilometres north of the township of Alpha, the nearest residential area to the Project site (Figure H-1).

H.2.1.1 Coal Mine

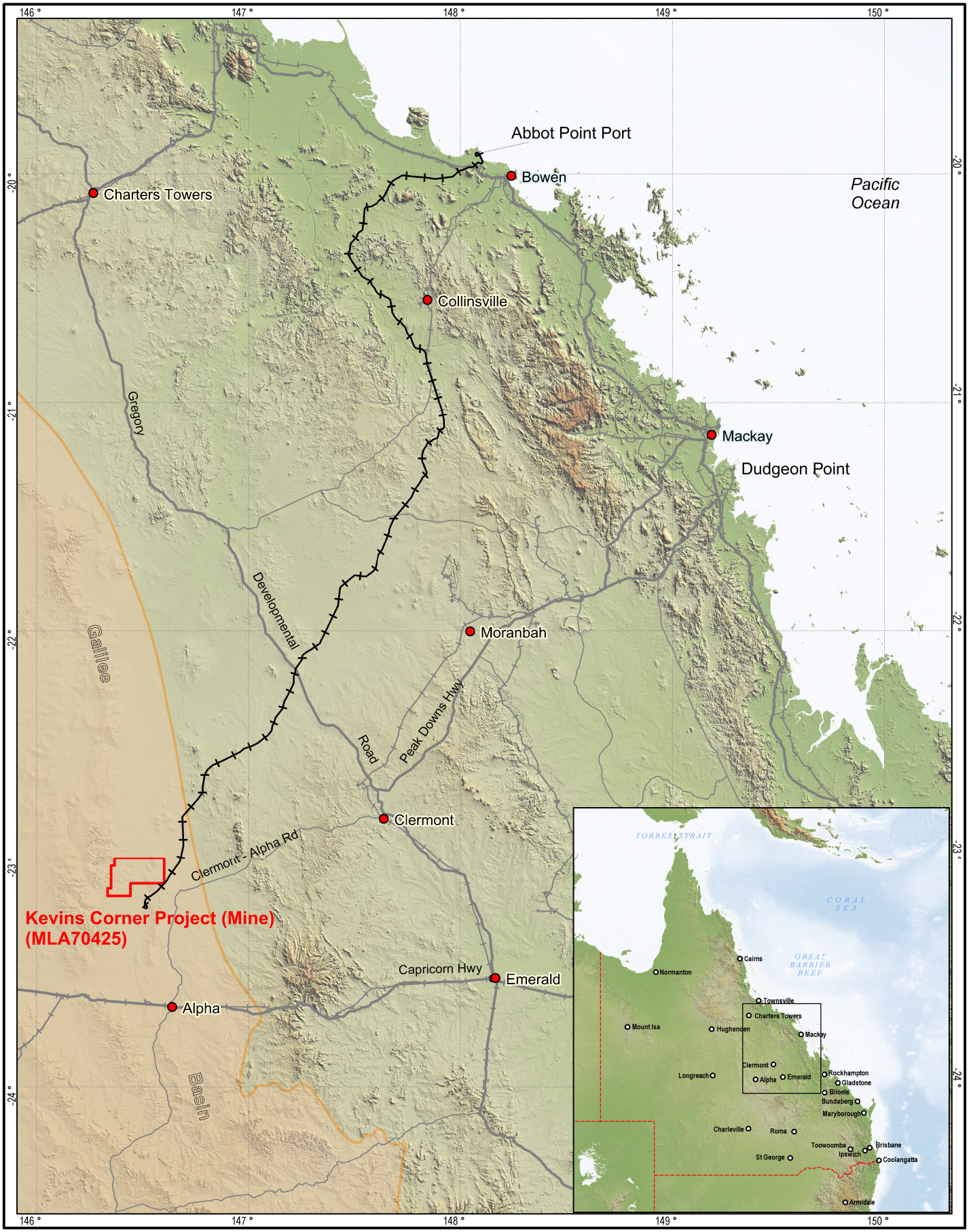
The combined open-cut and underground coal mine is proposed to produce up to 30 Mtpa of thermal coal for the export market. The scheduled life of mine (LOM) is 30 years, with sufficient resources to potentially extend the Project life beyond 30 years.

The Project consists of two open-cut pits (Central and Northern open-cut pits) extending over an initial strike length of 6.5 km and in time reducing to a steady strike length of 4 km, plus three underground longwall operations (Southern, Central and Northern underground) proposed in three independent mining areas. See Figure H-2 below for the proposed Project Layout.

Mining of the open-cut pits will commence at the seam sub-crop and progress down dip towards the west. The overburden will be removed by truck and shovel, excavators and dragline operations. For the first five to seven years it will be stockpiled in out-of-pit spoil emplacements, after which it will be used to progressively backfill the open-cut pits as the mine working areas advance to the west.

For the underground component, each longwall panel will be allocated an independent set of "mains" roadways for access, coal clearance and ventilation. The underground workings will require a separate belt drift and man-and-materials drift dedicated to each longwall operation.

The coal from the open-cut operations will be mined by excavator and transported by truck. Raw coal from the open cut will be processed at two Run of Mine (ROM) facilities where it will be reduced in size for further processing at the Coal Handling and Preparation Plant (CHPP). For the underground longwall operations, all ROM coal will be transported directly to the Coal Processing Plant (CPP) via an overland conveyor.



Mining Lease Application (MLA70425) Boundary
Proposed Alpha Project Rail Line

Source: See Copyright Details below and for full disclosure Please Refer to the EIS ***Volume 1 - References***

0 25 50km
Scale 1:2,500,000 (A4)
Projection: Geographic (GDA94)

Datum: GDA94, MGA Zone55

N W E S

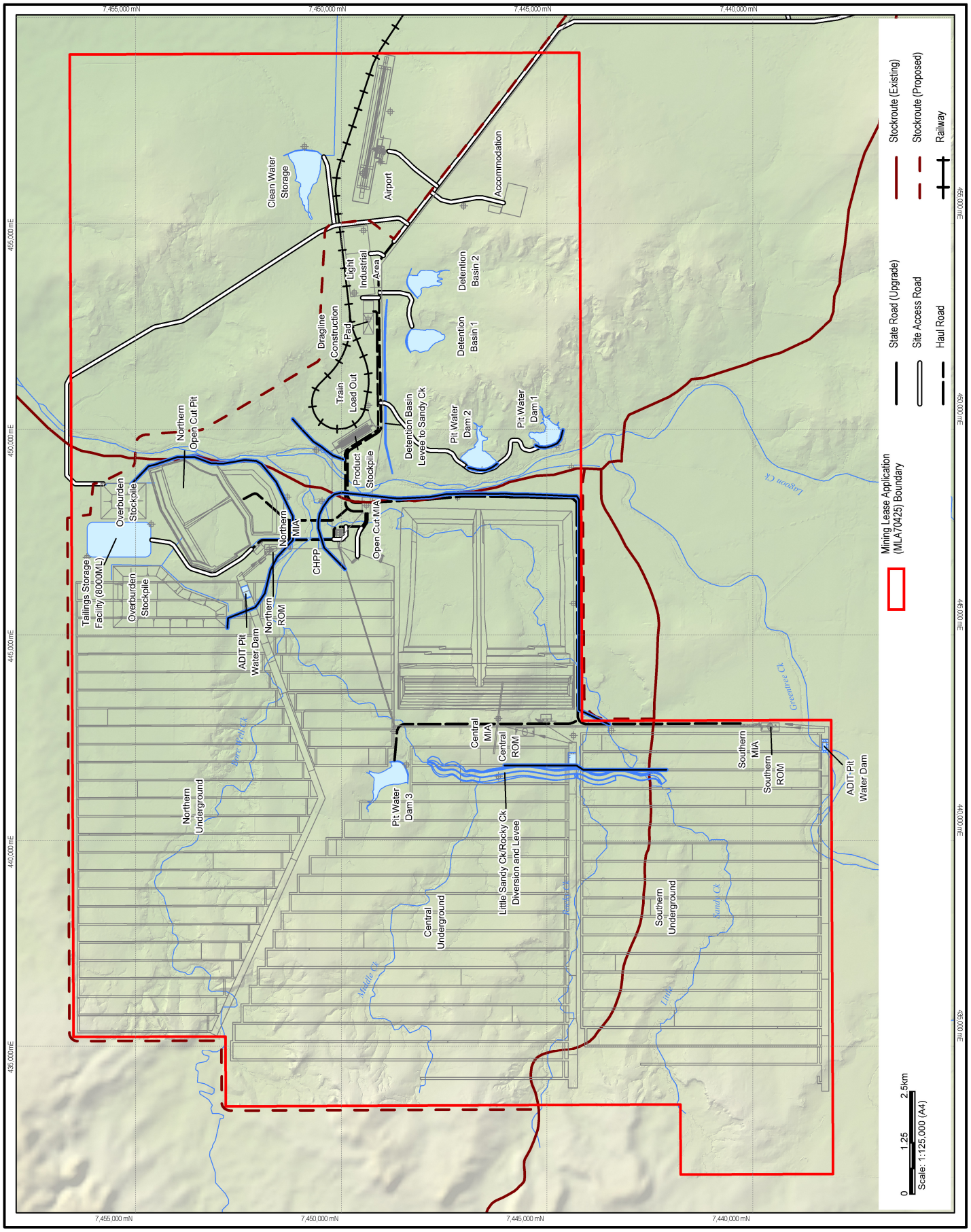
HANCOCK GALILEE PTY LTD
Kevin's Corner Project
Environmental Impact Statement

KEVINS CORNER REGIONAL LOCATION

Job Number	4262 6660
Revision	C
Date	12-09-2011

Figure: H-1

File No: 42626660-g-2012.wor



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Datum: GDA94, MGA Zone55

HANCOCK GALILEE PTY LTD

Kevin's Corner Project
Environmental Impact Statement

KEVINS CORNER
OVERALL SITE LAYOUT PLAN

Job Number	4262 6660
Revision	C
Date	12-09-2011

Figure: H-2

File No: 42626660-g-2013.wor

Coal Handling Preparation Plant and Mine Infrastructure

Sized raw coal will be transferred from the ROM facilities via conveyors to the multi-module CHPP, where it will be washed. The coal resource that is mined and placed through the ROMs will be processed to produce a competitive export thermal product, with a proportion of the coal reserves having potential to be marketed without processing. A tailings storage facility is required for the high moisture fine coal/clay fraction rejects (tailings). The coarse rejects (siltstone, mudstone, sandstone etc) from the CHPP will be placed in designated locations within the open-cut overburden emplacement areas.

The mine supporting infrastructure will include:

- Workshops, warehouses, administration buildings, training and emergency services building, tyre bays, and heavy welding shops with provision for other supporting services;
- Fuel and oil, explosives storage facilities;
- A Train Load-out (TLO) facility and rail loop;
- Raw water dams and environment dams;
- Construction and permanent accommodation village facilities;
- Mine access roads;
- Airport;
- Heavy Equipment Access Track;
- General landfill;
- Borrow pits;
- Creek diversions, drainage channels and levee bunds;
- Water and wastewater systems;
- Water treatment plant and sewerage treatment plant;
- Electrical systems; and
- Communications systems.

H.2.1.2 Construction

Construction stage activities will occur once the Mining Lease (ML) has been granted. The construction activities to be undertaken include the following:

The construction period has been estimated at 48 months. Within the initial nominal 27 month time frame, the following activities are planned:

- Mine operational equipment will be delivered, constructed and commissioned;
- Mine infrastructure will be constructed, such as site administration buildings, workshops, water management infrastructure, roads, accommodation, hardstands, draglines, electrical and communication systems, etc.; and

- The initial modules of the CHPP will be constructed and commissioned.

Coal mining activities are detailed in the Project Description (Volume 1, Section 2, Sub-Section 2.5.1. of this EIS). Throughout the LOM, infrastructure construction, maintenance, rehabilitation or decommissioning activities will be undertaken. As mining advances, infrastructure such as internal roads and additional water management infrastructure will be constructed, relocated, maintained or upgraded as required in order to fulfil operational and regulatory requirements.

The construction stage has three components:

- Site preparation;
- Civil works; and
- MIA building and CHPP construction.

Construction stage activities will occur during daylight hours, seven days a week. Some activities may be required to be conducted over a continuous 24-hour period. These may include but may not be limited to:

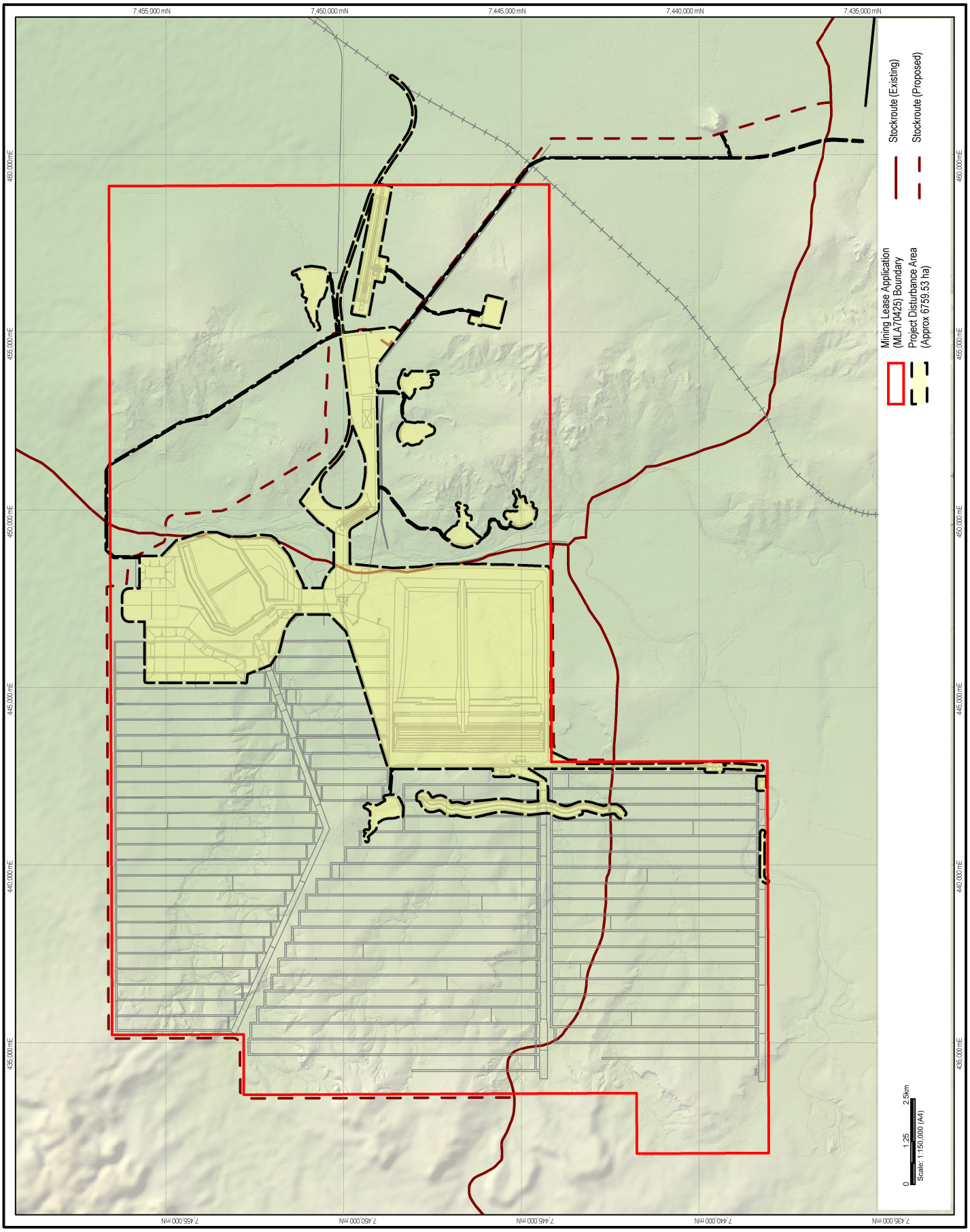
- Deliveries of materials, plant and equipment;
- Concrete batching and pouring;
- Electrical installation;
- Building fit-out; and
- Plant and equipment commissioning.

Due to the close proximity to Sandy Creek, all critical infrastructure is to be located at least 0.5 m above the predicted 1 in 3,000 year flood inundation level. This is in excess of the general requirement for protection from the Q100 flood inundation level.

H.2.1.3 Site Clearance

Site clearance will include vegetation clearing, topsoil stripping and stockpiling, bulk earthworks, and temporary drainage and water runoff management works. Site clearance will be staged to minimise the time of exposure of disturbed areas and degradation of topsoil. Plant and equipment involved in site clearance activities will include, but not be limited to, excavators, dozers, scrapers, graders, and water carts. All site vehicles and equipment will be properly serviced and maintained.

Figure H-3 below shows the proposed disturbance footprint.



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Datum: GDA94, MGA Zone55

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Kevin's Corner Project
Environmental Impact Statement

PROJECT DISTURBANCE AREA

Job Number	4262 6660
Revision	B
Date	12-09-2011

Figure: H-3

File No: 42626660-g-2117.wor

H.2.1.4 Project Operations

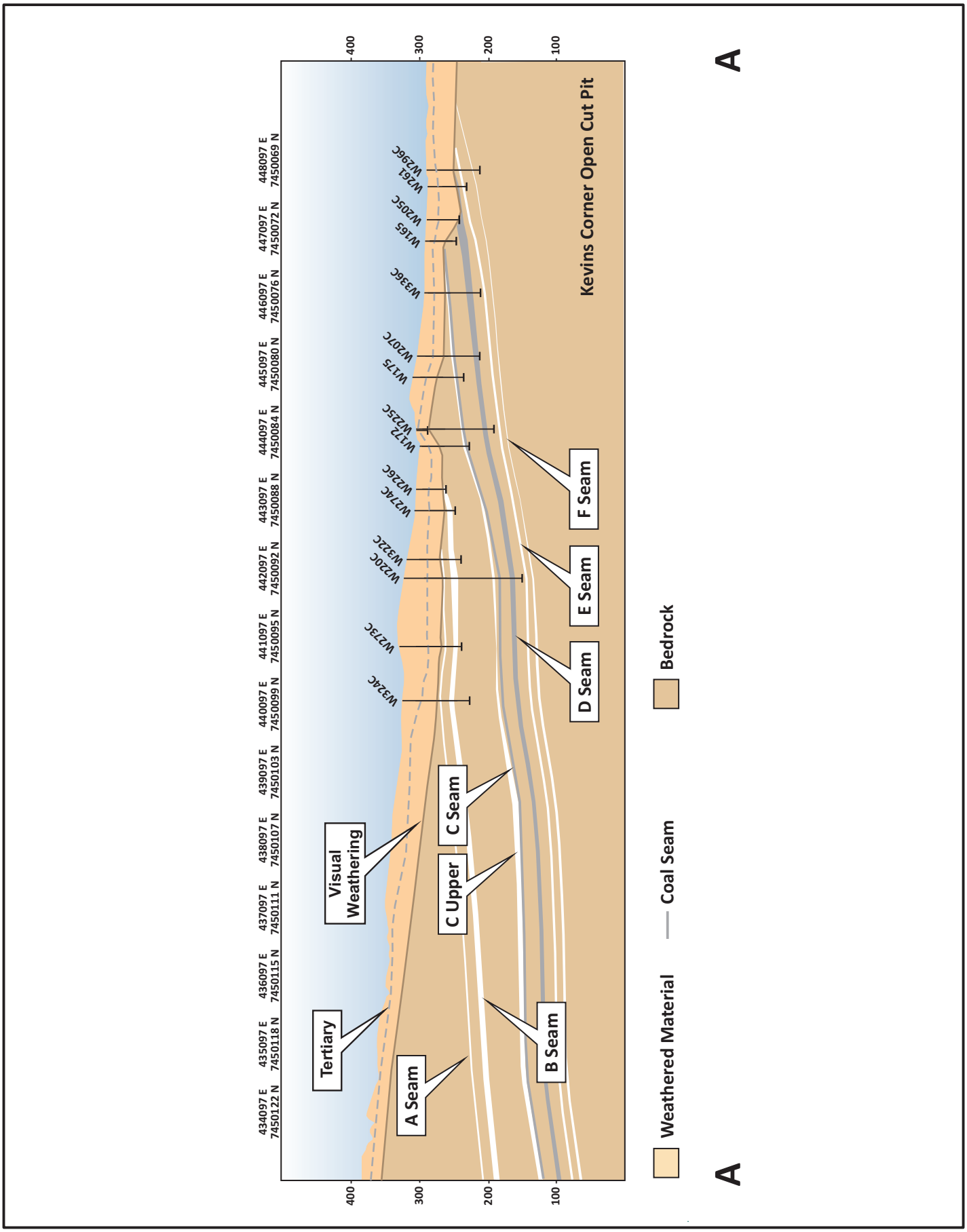
Following construction, operational activities will be ramped up over five years, peaking at production of approximately 40 Mtpa of ROM coal. The mine has the capacity to produce up to 30 Mtpa of product coal through the CPP. Typical coal production levels are expected to be around 26 to 27 Mtpa of product coal.

Coal Resource Base and Mine Life

The Kevin's Corner coal deposit and adjacent Alpha Coal deposit are situated in the Galilee Basin in central Queensland, Australia. The Galilee Basin is of Palaeozoic to Triassic age, approximately 480 km long and extends from the town of Tambo in the south to Pentland in the north. There are six logged coal seams in the Project area designated (in descending stratigraphical order) as A, B, C, D, E and F (Figure H-4). Seams A through D are considered to be recoverable under Joint Ore Reserves Committee (JORC).

The seams are contained within the Permian coal measures which are unconformably overlain across the total area by an unconsolidated cover of Tertiary sediments, ranging in thickness from 15 m to 45 m. The coal seams strike approximately north-south through the tenement area and have a regional dip of 1 to 2 degrees to the west. This, combined with the simple geometry of the deposit and apparent lack of significant faulting, lends itself to simple open cut strip layouts and underground panel layouts. This allows the possible application of large-scale semi-mobile open cut mining equipment and underground longwall methods.

The Project construction is anticipated to commence in 2012 will take 2 to 3 years, with the first coal being recovered in 2014. Final construction is completed in 2018 when the third longwall is ready to go into production. While these dates are best estimates available at the point of producing this report, they are indicative only providing timeframes for the construction phase and may change as a result of unforeseen circumstances.



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HANCOCK GALILEE PTY LTD

Kevin's Corner Project
Environmental Impact Statement

DIAGRAMMATIC
WEST-EAST CROSS-SECTION
THROUGH THE PROJECT AREA

Job Number	4262 6660
Revision	B
Date	12-09-2011

Figure: H-4

File No: 42626660-g-2118.cdr

H.2.2 Report Purpose

This purpose of this report is to assess the potential impacts of proposed development of the Project on MNES. The eight MNES protected under the EPBC Act, are:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (listed under the Ramsar Convention);
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park; and
- Nuclear actions (including uranium mines).

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), actions that have, or are likely to have, a significant impact on a matter of national environmental significance require approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities. On 11 August 2009, the proponent referred the project to the Commonwealth Government for a decision as to whether the project constitutes a 'controlled action' under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) (Referral No. 2009/5033).

On 8 September 2009, the proposed development of the Project was determined to be a controlled action under the EPBC Act due to the likely potential impacts on matters of national environmental significance (MNES). The relevant controlling provisions under the EPBC Act were determined as being:

- Sections 18 and 18A (listed threatened species and ecological communities);
- Sections 20 and 20A (listed migratory species).

The terms of reference (TOR) prepared by the Queensland Coordinator-General and Commonwealth Government for the Project's environment impact statement (EIS) requires that this report 'should bring together assessments of impacts on MNES in other chapters (e.g. water resources, flora and fauna, cultural heritage, cumulative impacts) and produce a standalone assessment in a format suited for assessment under the EPBC Act.' This report has been prepared to address the TOR for the Project that relate to MNES and facilitate the SEWPaC's assessment of the Project against the listed controlling provisions.

In order to provide as accurate an assessment as possible, habitat modelling and mapping have been undertaken for those EPBC Act-listed threatened flora and fauna species and threatened ecological communities identified through EIS studies as being of relevance to the Project. This mapping exercise has included the identification of potential habitat for these species both within the mine study area and the surrounding landscape. Additionally, potential impacts (direct and indirect) to these species and/or threatened ecological communities (TECs) have been quantified spatially. The results from this study facilitate the formulation of accurate management and mitigation protocols. Additionally, while an offsets strategy is presented in this EIS (Volume 2, Appendix Z) these results will

aid in further development of the strategy in consultation with relevant government agencies in an effort to offset significant impacts on habitat agreed as important to the survival of the EPBC listed species identified within this study.

Consultation with SEWPaC established the most appropriate methods to utilise for the enhancement of this assessment including an increase in the detail surrounding EPBC values and the potential impacts. For a more detailed overview of the methods applied in this assessment, see Section H.4 of this report.

The layout of this report is as follows:

- **Section H.3: Overview of the Matters of National Environmental Significance of relevance to the Project**
- **Section H.4: Terrestrial Flora and Fauna Assessment Methodology**
  - Overview of methodologies undertaken in EIS to evaluate these MNES
  - Outcomes of likelihood of occurrence assessment – threatened flora, fauna and TECs of relevance to the mine study area
  - Habitat modelling and mapping methodology (including validation and assumptions)
- **Section H.5: Flora and Fauna Assessment Results**
- **Section H.6:Assessment of Impacts to EPBC Act-listed Flora, TECs and Fauna**
  - Description of potential impacting processes (direct and indirect)
  - Quantification of area of habitat impacted (direct and indirect)
  - Proposed mitigation and management strategies to avoid/minimise/reduce identified impacts
- **Section H.7: Aquatic Flora, Fauna and Stygofauna Assessment Summary**
  - Description of methodologies undertaken in EIS to evaluate these MNES
  - Outcomes of likelihood of occurrence assessment – threatened flora, fauna and TECs of relevance to the mine study area
  - Proposed mitigation and management strategies to avoid/minimise/reduce identified impacts
- **Section H.8: Great Artisan Basin Impact Assessment**
- **Section H.9: Conclusion**
- **Section H.10: References**
- **Appendix H.A: Species Fact Sheets and Habitat Mapping**

H.3 Matters of National Environmental Significance relevant to the Project

This section summarises the MNES that are relevant and potentially impacted by the Project. Terrestrial and freshwater environments and EPBC-listed species are discussed. Table H-1 lists MNES that are relevant to the Project, identified through desktop review and survey effort. Greater detail relating to each can be found below in sections H.3.1 to H.3.7 Details of the studies undertaken

relating to MNES (flora and fauna) that are potentially impacted by the Project can be found in Sections H.4 to H.7.

Table H-1 MNES relevant to the Kevin's Corner Coal Mine Project

Aspect	Values
World Heritage Properties	The Great Barrier Reef World heritage Area is situated approximately 500 km east of the Project site. **No controlling provisions were determined**.
National Heritage Places	The Great Barrier Reef is situated approximately 500 km east of the Project site. **No controlling provisions were determined**.
Wetlands of international importance (Ramsar Wetlands)	– Not applicable but within same catchment as Ramsar Site Coongie Lakes. – Not applicable but within same catchment as Ramsar Site Shoalwater and Corio Bays area **No controlling provisions were determined.**
Threatened species and ecological communities	**Threatened ecological communities (TECs)** – 5 communities identified from database searches; – 1 was identified during field surveys; – The remaining 4 were not considered as potentially occurring on site as none of their constituent RE's were identified on site (Also refer to Section H.5.1) **Threatened flora species** – 4 species identified from the desktop study as potentially occurring on the site or in the region. – Only 1 species was considered to have a low likelihood of occurring within the impact footprint: king bluegrass (*Dicanthium queenslandicum*) after a detailed analysis of habitat requirements and their range of habitation; – No species recorded on site during field surveys (Refer to Section H.4.3.2) **Threatened fauna species** – 14 species identified from the desktop study as potentially occurring on the site; – 9 of these species have either a low or moderate likelihood of being present on the Project site after a detailed analysis of habitat requirements and their range of habitation; – 1 species was recorded on the site: squatter pigeon (*Geophaps scripta scripta*), (refer to Section H.5.3) **Controlling Provision determined.**
Migratory species	– 10 migratory bird species were identified within the mine study area from combined desktop and field surveys **Controlling Provision determined.**
Commonwealth marine areas	The Great Barrier Reef is situated approximately 500 km east of the Project site. **No controlling provisions were determined.**
The Great Barrier Reef Marine Park	The Great Barrier Reef is situated approximately 500 km east of the Project site. **No controlling provisions were determined.**
Nuclear Actions	Not applicable to this Project

H.3.1 Threatened species and ecological communities

The results of the EPBC Act Protected Matters Search Tool database search identified the following five EPBC Act listed Threatened Ecological Communities (TECs) as potentially being present within the Project area:

- Brigalow (*Acacia harpophylla* dominant and co-dominant);
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin;
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions;
- The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin; and
- Weeping Myall Woodlands.

However, during the flora and fauna surveys on and around the Project site, a constituent Regional Ecosystem of only one of these TEC's (Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin) was identified. As none of the remaining TEC's, nor any of their constituent Regional Ecosystems were identified during field surveys as being present on the Project site, the likelihood of the remaining TEC's being present on site was considered 'Unlikely'.

Initial database searches indicated that 5 EPBC Act listed flora species may potentially occur on site. In an effort to strengthen conclusions, a detailed analysis of habitat requirements and the range of habitation of the indicated species, as well as a revised database search in a more accurate geographic region (see Section H.4.1.1) were then conducted. As a result of this additional investigation, 1 species, king bluegrass (*Dicanthium queenslandicum)*, was considered to have a low likelihood of occurring on the Project site. No EPBC-listed threatened flora species were identified during field surveys of the mine study area.

Initial database searches indicated that 15 EPBC-listed fauna species as potentially occurring on the Project site. In an effort to strengthen conclusions, a detailed analysis of habitat requirements and the range of habitation of the indicated species, as well as a revised database search in a more accurate geographic region (see Section H.4.1.1) were then conducted. As a result of this additional investigation, 10 species were considered to have a low or moderate likelihood of occurring on the Project site and during field surveys 1 of these species, the squatter pigeon (*Geophaps scripta scripta*) which is listed as Vulnerable under the EPBC Act, was confirmed on site.

More detail relating to the results of the flora and fauna assessment can be found below in Section H.5.

H.3.2 Migratory Species

The results of the combined desktop and field surveys indicated a total of 10 migratory species potentially occurring on site, 2 of which were confirmed during field studies.

Habitat mapping was not undertaken for each individual migratory species. The rationale for this decision was two-fold:

- Habitat mapping for EPBC Act-listed threatened fauna species is considered likely to also capture habitat for migratory species (including woodland birds, wetland birds and aquatic reptiles). For example, potential habitat mapped for the squatter pigeon (southern) is likely to capture potential

habitat for woodland migratory bird species. Potential habitat mapped for the Australian painted snipe is likely to capture potential habitat for migratory birds associated with aquatic habitats (i.e. wetlands, rivers, farm dams etc.). Mitigation measures and habitat offsets for threatened species are thus likely to apply to migratory species also.

- Desktop studies and field observations did not indicate that any 'important habitat' for EPBC Act-listed migratory species, as defined in the Commonwealth's *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA (now SEWPaC), 2009b) occurs in the mine study area.

Further detail and a list of the migratory species can be found in Section H.5.2.

H.3.3 Other Protected Areas

A review of the Queensland Department of Environment and Resource Management (DERM) Environmentally Sensitive Areas (ESA) mapping for the Project site indicated the existence of two protected areas, the Cudmore Resources Reserve within the north western section of the site and the Cudmore National Park to the north-west of the MLA boundary (Figure H-5). Resources Reserves and National parks are protected and managed under the *Nature Conservation Act 1992* (NC Act).

The Project site may provide important landscape linkages between ESAs such as the Cudmore Resources Reserve and surrounding habitats. Habitat connectivity involves the linkages of habitats, species, communities and ecological processes. Smaller and more isolated habitat patches will have fewer species compared to large patches. Wildlife corridors are systems of linear habitat which enhance the connectivity of wildlife populations between the habitats they utilise and support ecological processes at a variety of spatial and temporal scales.

H.3.3.1 Cudmore Resources Reserve

Cudmore Resources Reserve is identified beneath Schedule 2, Part 1 of the *Nature Conservation (Protected Areas Management) Regulation 2006,* as a Resource Reserve placed under the management of joint trustees. Specifically the:

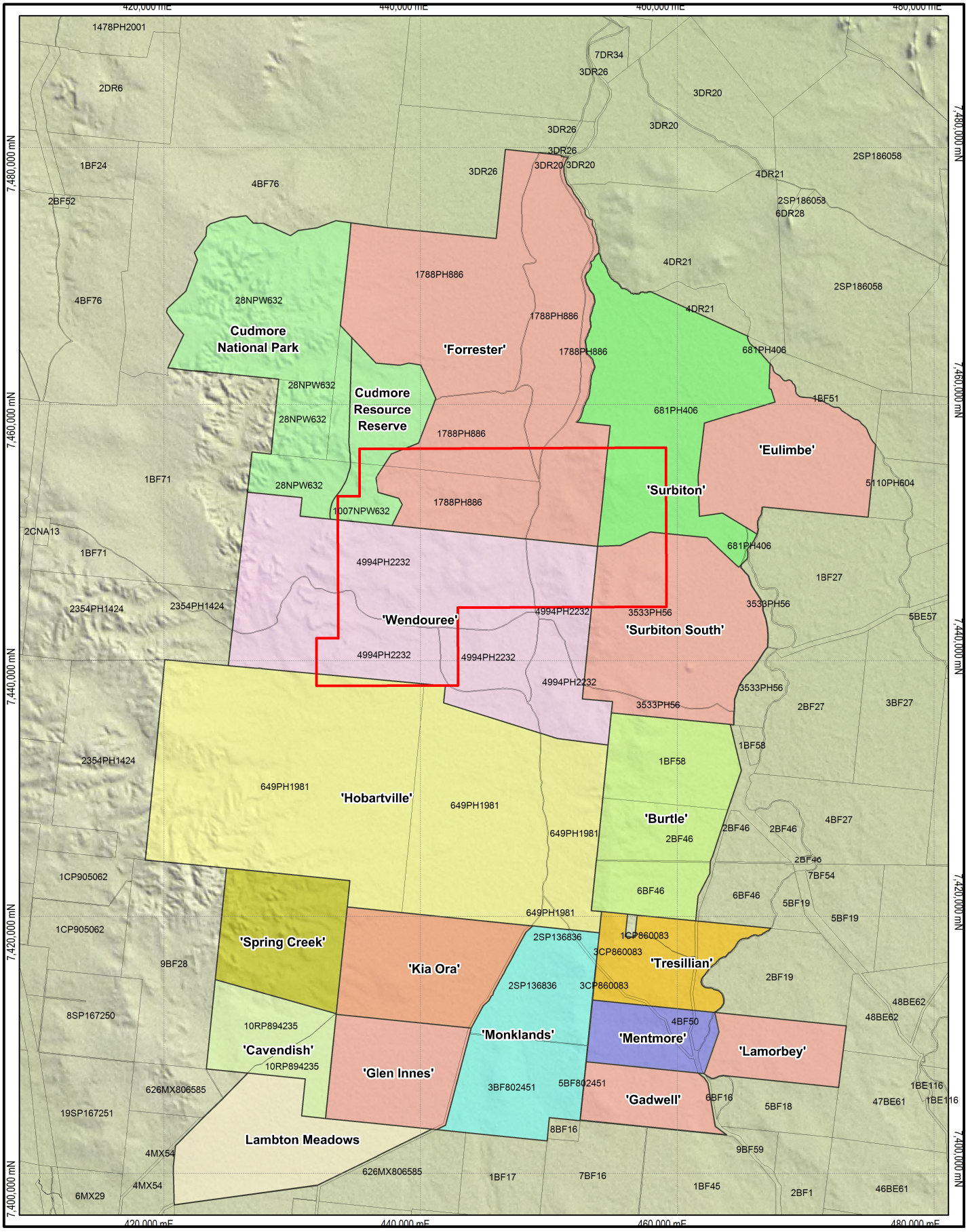
- Environment Chief Executive (DERM); and
- Mining Chief Executive (DEEDI).

The management principles of the resource reserves are generally managed to:

- Recognise and, if appropriate, protect the area's cultural and natural resources;
- Provide for the controlled use of the area's cultural and natural resources; and
- Ensure that the area is maintained predominantly in its natural condition (OQPC, 1992).

During early 2011 HGPL commenced discussions with DERM and DEEDI as joint custodians to seek approval for an "Interest in a Protected Area" in accordance with Section 34 of the NC Act. This section of the NC Act prescribes that a lease, agreement, licence, permit or other authority over, or in relation to, land in a protected area, may only be granted by the chief executive or trustees of the area with the consent of the chief executive. This consent may only be given if the proposed interest is consistent with the management principles of the area and management plan for the area, if a management plan has been approved. HGPL will seek a Lease beneath the *Land Act 1994* for the life of the mine for an interest in the Cudmore Resources Reserve. This lease will apply to lands subject to

the extent of MLA 70425 that are identified to be within the boundaries of Cudmore Resources Reserve.



Mining Lease Application (MLA70425) Boundary

Source: See Copyright Details below and for full disclosure Please Refer to the EIS ***Volume 1 - References***

0 3.75 7.5km
Scale: 1:400,000 (A4)

Datum: GDA94, MGA Zone55

N W E S

HANCOCK GALILEE PTY LTD

Kevin's Corner Project
Environmental Impact Statement

SURROUNDING LAND TENURE

Job Number	4262 6660
Revision	B
Date	12-09-2011

Figure: H-5

File No: 42626660-g-2119.wor

H.4 Terrestrial Flora and Fauna Assessment Methodology

H.4.1 Introduction

This section details the survey methodology employed to describe the existing ecological values of the mine study area. All ecological surveys were conducted by appropriately qualified ecologists, the qualifications and experience of which can be found in the Study Team summary (Volume 2, Appendix D) in this EIS.

H.4.1.1 Revised Desktop Assessment

In an effort to strengthen the initial results of this assessment on MNES, we have refined the DERM Wildlife Online database search area originally used in the Project EIS. The original search area was the Central Highlands Regional Council jurisdiction. This area was both excessively large producing disproportionate results, as well as geographically incorrect as it did not include the Project footprint within its boundary.

The revised search encompassed a 100km buffer surrounding the Project's Mine Lease Area 70425, using coordinates 22.75046, 145.989507; -22.753652, 146.963474; -23.656973, 146.963228; 23.653639, 145.982694 for the four corners of the search area. As a result of this revision, the species list being assessed within this report was revised and the results of the assessment are more accurate.

While the Wildlife Online search did require revision, the Protected Matters Report (as presented in the EIS) has been retained as it encompassed an area that closely mirrors the revised Wildlife Online search area.

H.4.2 Flora Assessment Methodology

To describe the existing terrestrial flora environmental values of the Project area, a combination of desktop assessments and seasonal field surveys were conducted. The desktop assessment comprised a review of relevant literature and database searches. Flora field surveys were conducted to obtain ecological information relevant to the Project and to ground-truth results from desktop assessments.

This section is based upon the findings of the Flora and Fauna Assessment Report (Volume 2, Appendix L1) presented in this EIS. The surveys were designed to capture seasonal variations in flora assemblages, and covered both the wet and dry seasons.

H.4.2.1 Desktop Assessment

Initial desktop methods involved a review of aerial photography and Regional Ecosystem (RE) maps of the Project site to gain an overall perspective of the vegetation distribution within the Project site and surrounds.

Following this initial review, the following databases were searched for historical records of flora within the mine study area and broader adjacent areas:

- EPBC Act Protected Matters Search Tool:
  - This database provides general guidance on MNES and other matters protected by the EPBC Act for a nominated area.
  - Search area encompassed a 100 km buffer surrounding the coordinates -22.99777, 146.36777; -22.99861, 146.6005; -23.11027, 146.6005; -23.11, 146.4416; 23.16416, 146.4416; 23.16444, 146.3338; 23.13083, 146.3344; -23.13027,146.3502, -23.03138,146.3505, -23.03111,146.3669

  Data retrieved 8 June 2010.
- Wildlife Online Database:
  - This database uses records collected from previous surveys, including the Queensland Museum surveys as well as records from the public. While screening of data occurs, some misidentifications are possible.
  - The initial search area encompassed the Central Highlands Regional Council jurisdiction. This data was retrieved 11 Feb 2009.
  - As discussed above in Section H.4.1.1, in an effort to gain greater accuracy in the results, the search was repeated within a revised search area.
- HERBREC Searches: This database provides information including taxon names and specimen data.

H.4.2.2 Field Survey

Nine site visits to conduct flora assessments across the Kevin's Corner mine study area in combination with the neighbouring Alpha Coal Project MLA, were undertaken between June 2008 and November 2010 (Table H-2).

Table H-2: Details of site visits and environmental conditions between 2008 and 2010

Site visit	Survey Days	Rainfall during and prior to each field survey (mm)	Temperature range (ºC)
25/06/2008 — 01/07/2008	7	12.8	3 – 25
08/10/2008 — 13/10/2008	5	54.4	17 – 34
04/03/2009 — 11/03/2009	7	216.9	18 – 33
28/09/2009 — 05/10/2009	8	1.4	9 – 35
23/11/2009 — 09/12/2009	16	61.4	15 – 40
15/03/2010 — 23/03/2010	8	338.7	17 – 30
12/04/2010 — 20/04/2010	8	237.2	15 – 32
22/06/2010 — 30/06/2010	8	17.6	13 - 25
08/11/2010 — 15/11/2010	7	253.3	18 -31

Overall Approach

The field survey involved a baseline study of the mine study area using standard floristic survey methods. Methods used were in accordance with the Queensland Herbarium's Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.1) (Neldner *et al.* 2005).

The Queensland Herbarium Methodology describes the following levels of sampling which were used in the field surveys:

- Secondary – Consists of 20 x 50 m plots. Data recorded in these transects includes a list of all species observed from all the major layers of vegetation. Species that fall outside the plot but are typical of the community are also listed. In addition, relative abundance for individual species in each strata is recorded, including density and foliage projection cover and height for the tree and shrub layers; and
- Quaternary or observation sites – These plots include location, the dominant species in the characteristic layer, and some landform and structural data. An intuitive classification of the vegetation is also recorded. These plots are commonly used in ground truthing existing mapping data for the area.

Field data collected using this methodology is compatible with the Queensland Herbarium CORVEG database. The level of assessment used in this study is discussed below.

Regional Ecosystem Mapping

A comprehensive vegetation survey was undertaken across the mine study area in order to confirm the current RE mapping sourced from the Queensland Herbarium. The survey was conducted using the following methods:

- A number of secondary transects in each vegetation type were established and a detailed floristic inventory of the dominant and associated woody plants (i.e. trees and shrubs) was undertaken. Secondary plots were positioned in vegetation representative of the community as a whole;
- In addition to the secondary transects, a number of quaternary transects were surveyed in order to assist with the mapping of REs;
- An assessment of the condition of the vegetation type with regard to quality and conservation value was undertaken at each transect; and
- The preparation of RE maps was undertaken through the use of aerial photographs, geological maps and ground truthing.

Surveys for Species of Conservation Significance

Targeted searches were undertaken during field surveys for species of conservation significance within habitat deemed suitable. Search methods used were as per the draft New South Wales Threatened Species Survey and Assessment Guidelines (New South Wales National Parks and Wildlife Service 2001).

The method outlined in the Department of Environment and Conservation (2004) guidelines that was used in this survey was the Random Meander Technique, which was adapted from Cropper (1993). As its name suggests, this technique involves traversing areas of suitable habitat in no set pattern whilst searching for the particular plant species. If there was any uncertainty in identifying the species, a voucher specimen was collected for confirmation by the Queensland Herbarium.

Flora Transects surveyed

Flora transects were conducted in each community found within the Project site. The locations of these transects are presented in Figure H-6. In addition to the transect study locations, incidental observations of flora species were recorded with notes on the vegetation community as they were encountered. Areas of disturbance such as roadsides, dams and creek crossings were also investigated as they often provide a foothold for a number of different species, particularly invasive weeds.

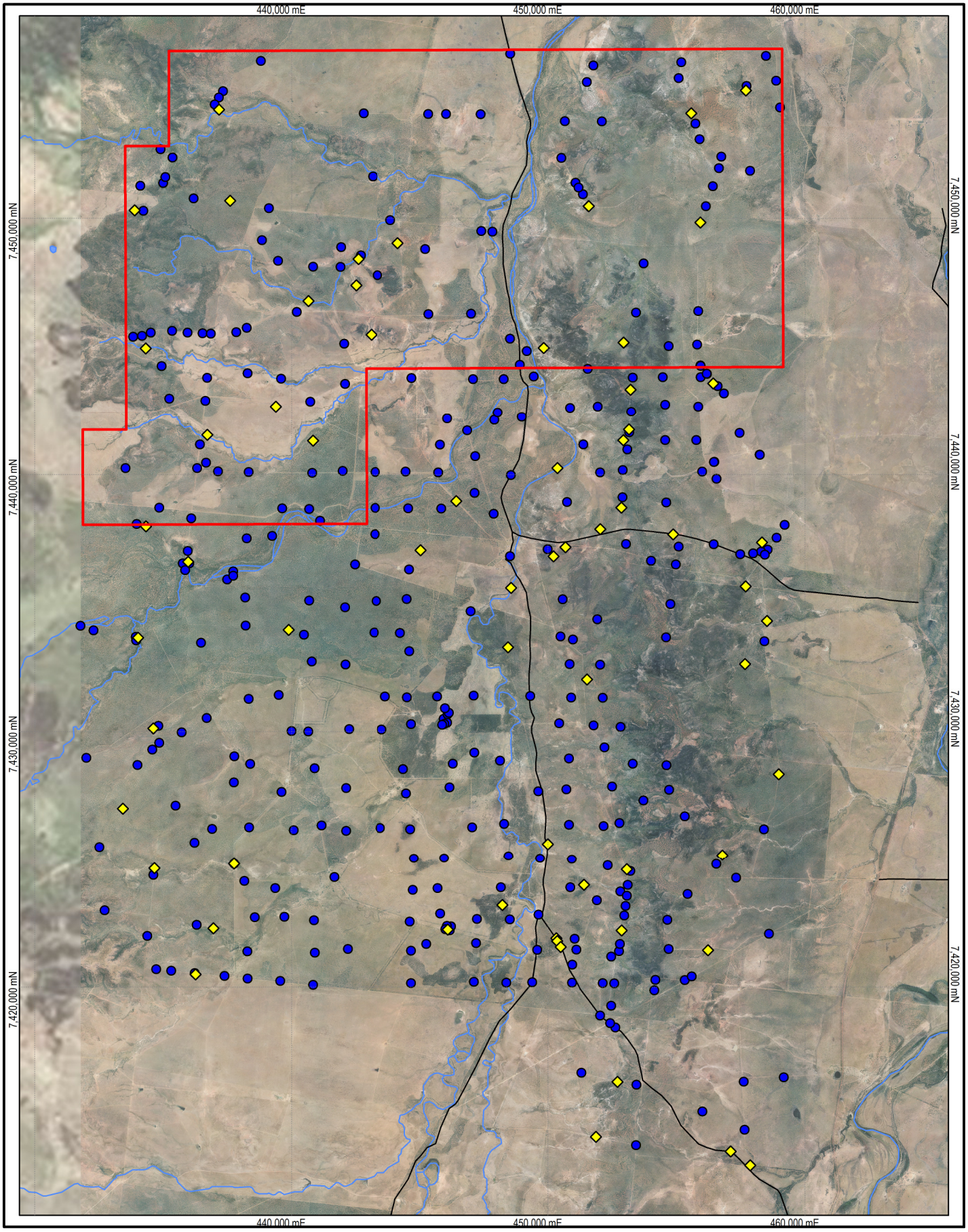
H.4.2.3 Likelihood of Occurrence of Listed Flora

To better enable the assessment and mapping of potential impacts posed by the Project, the following categories were assigned to EPBC listed flora species based on their likelihood of occurrence on the Project site:

- Unlikely to occur;
- Low likelihood of occurring;
- Moderate likelihood of occurring; and
- High potential of occurring.

These categories were determined by:

- Undertaking further database searches to assess species recorded in areas located near the Project;
- Assessing information from published field guides and from internet sites (such as SPRAT and Birds Australia) for currently known species distributions;
- Assessing habitat availability and climatic conditions on site during field surveys;
- Assessing habitat integrity during field surveys;
- Assessing the presence of predatory feral animal populations that may impact upon species presence during field surveys; and
- Accounting for the cryptic nature of species listed in the database searches and the limitations of identifying such species during the field surveys.



Mining Lease Application (MLA70425) Boundary
Secondary Transect
Quaternary Transect
Road
Drainage

Source: See Copyright Details below and for full disclosure Please Refer to the EIS ***Volume 1 - References***

0 2 4km
Scale: 1:200,000 (A4)

Datum: GDA94, MGA Zone55

N W E S

HANCOCK GALILEE PTY LTD

Kevin's Corner Project Environmental Impact Statement

SECONDARY AND QUATERNARY VEGETATION TRANSECTS ON AND ADJACENT TO THE PROJECT SITE

Job Number | 4262 6660
Revision | B
Date | 12-09-2011

Figure: H-6

File No: 42626660-g-2120.wor

H.4.3 Fauna Assessment Methodology

To describe the existing environmental terrestrial fauna values of the study area a combination of desktop assessments and seasonal field surveys were conducted. The desktop assessment comprised a review of relevant literature and database searches. Fauna surveys were conducted to obtain ecological information relevant to the Project and to ground truth results from desktop assessments.

The fauna sampling methodology for the Project site was based on 'standard survey' techniques that are used to sample terrestrial and aquatic vertebrate fauna. Sampling of fauna was conducted primarily along transects established in each of the major vegetation communities.

At each of the standard trapping sites the following survey methods were used:

- Habitat assessment;
- Pitfall trapping;
- Elliott trapping;
- Ultrasonic bat detection (Anabat);
- Funnel trapping;
- Spotlighting; and
- Active searching.

H.4.3.1 Desktop Assessment

Following this initial review, the following databases were searched for historical records of flora within the mine study area and broader adjacent areas:

- EPBC Act Protected Matters Search Tool:
  - This database provides general guidance on MNES and other matters protected by the EPBC Act for a nominated area.
  - Search area encompassed a 100 km buffer surrounding the coordinates -22.99777, 146.36777; -22.99861, 146.6005; -23.11027, 146.6005; -23.11, 146.4416; 23.16416, 146.4416; 23.16444, 146.3338; 23.13083, 146.3344; -23.13027,146.3502, -23.03138,146.3505, -23.03111,146.3669

  Data retrieved 8 June 2010.
- Wildlife Online Database:
  - This database uses records collected from previous surveys, including the Queensland Museum surveys as well as records from the public. While screening of data occurs, some misidentifications are possible.
  - The initial search area encompassed the Central Highlands Regional Council jurisdiction. This data was retrieved 11 Feb 2009.
  - As discussed above in Section H.4.1.1, in an effort to gain greater accuracy in the results, the search was repeated within a revised search area.

H.4.3.2 Field Survey

Eight site visits to conduct fauna assessments across the Kevin's Corner mine study area in combination with the neighbouring Alpha Coal Project MLA were undertaken between June 2008 and June 2010. The site visits included both wet and dry season surveys as detailed in above in Section 4.2.2.

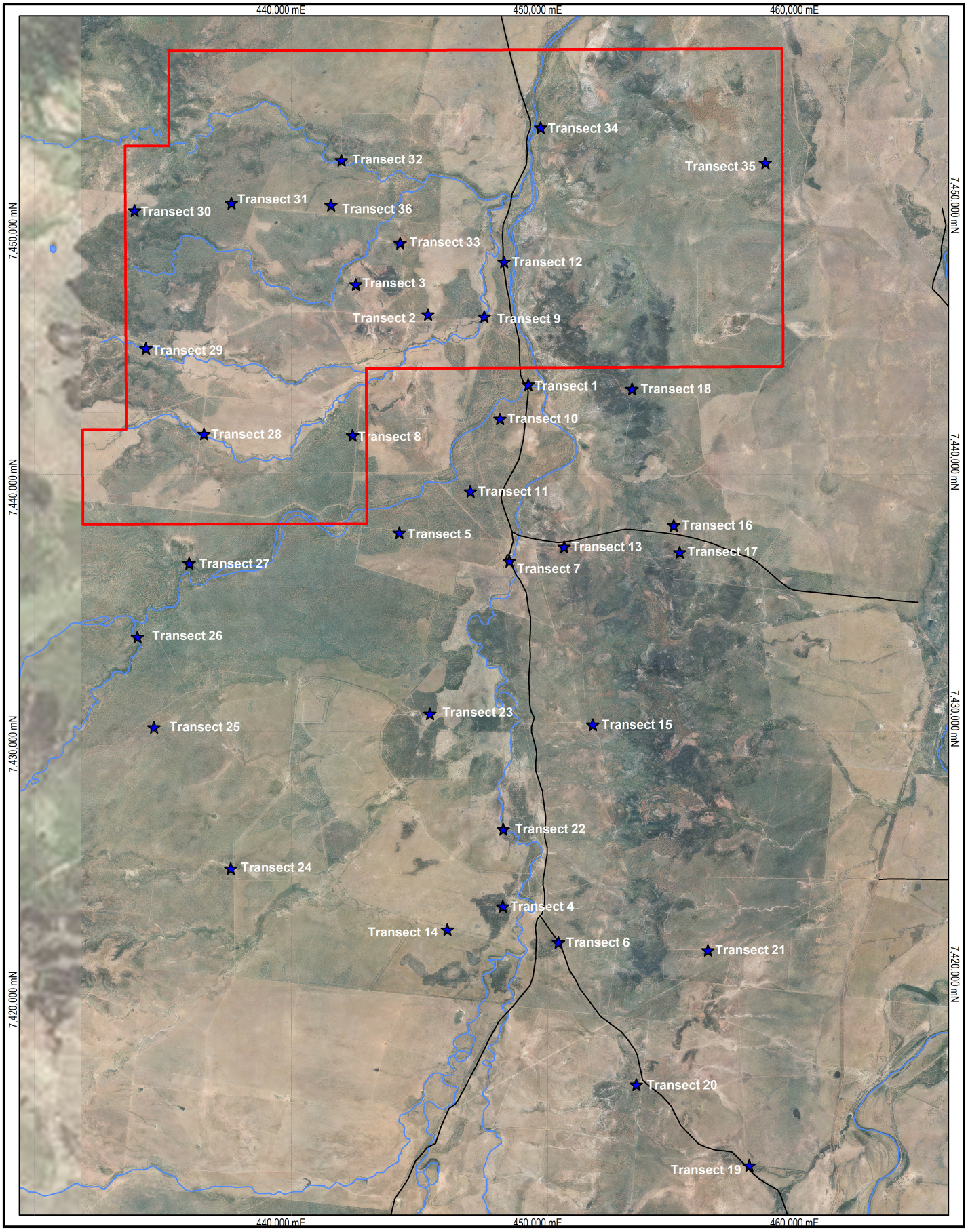
A total of thirty-six fauna transect sites were established on and surrounding the mine study area. Each site was subject to trapping regimes of up to four consecutive nights for pitfall traps and five consecutive nights for all other traps. Locations of these fauna transects are shown in Figure H-7 below.

Fauna transects were established across the range of vegetation communities present on the mine study area. Fauna transect sites outside the mine study area were utilised in this fauna assessment, as habitat types are synonymous with habitat on the mine study area. Also, most fauna species identified are mobile and have the ability to inhabit habitat inside and outside the MLA. A combination of pitfall lines, funnel, cage, Elliot traps and Anabat recordings were used to assess the presence and abundance of species at these locations. Active searching and bird surveys were undertaken to supplement data from the transect sites. Transects were positioned to maximise the potential for sampling all wildlife present by targeting the full range of habitat types present on and surrounding the mine study area.

A summary of the survey effort is presented below in Table H-3.

Table H-3 Snapshot of Kevin's Corner and Alpha Coal Fauna Field-Survey Effort

Survey Method	Survey Effort
Spotlighting - Walk	67 Hours
Spotlighting – Driving	48 Hours
Elliot Trapping	1,709 Trap Nights
Pitfall Trapping	400 Trap Nights
Funnel Trapping	293 Trap Nights
Cage Trapping	209 Trap Nights
Micro-Bat Surveying	45 Nights
Bird Surveying	2 ha for 20 mins per transect



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0 2 4km
Scale: 1:200,000 (A4)

Datum: GDA94, MGA Zone55

N W E S

HANCOCK GALILEE PTY LTD

Kevin's Corner Project
Environmental Impact Statement

FAUNA TRANSECT SITES ON AND ADJACENT TO THE PROJECT SITE

Job Number	4262 6660
Revision	B
Date	12-09-2011

Figure: H-7

File No: 42626660-g-2121.wor

Brief descriptions of the techniques employed at each transect to survey fauna occurring on and surrounding the mine study area are provided below.

Elliott trapping

Type A Elliott traps were used to target small ground-dwelling mammals inhabiting the mine study area and surrounding areas. Traps were baited with a mixture of rolled oats, honey, peanut butter and vanilla essence. Elliott traps were positioned in two rows at each transect, approximately 100 m apart, with each trap separated by approximately 10 metres. The overall survey effort (combining each field survey) totalled 1,709 Elliot trap nights.

Pitfall trapping

A pitfall trap-line was established at all primary transects to target small ground-dwelling fauna (reptilian, mammalian and amphibian). Each line consisted of a 20 centimetre (cm) tall wire-mesh drift fence running along the ground and crossing the middle of five 20 litre buckets buried flush with the soil surface. The bottom of drift fences was buried slightly to guide target species towards a bucket. A small amount of soil, leaf litter and water (soaked into a sponge) was placed in the bottom of each bucket to provide shelter and moisture for captured wildlife. The overall survey effort totalled 400 pitfall trap nights.

Funnel trapping

Funnel traps were employed to catch medium and large-sized terrestrial, diurnal snakes and some of the widely foraging, medium-sized skinks, dragon and arboreal geckos, which are able to climb out of pitfall traps. Funnel traps were placed at the end of each drift fence at the pitfall trap-lines and along fallen timber at secondary trap sites. Total funnel trap effort for all surveys was 293 trap nights.

Cage trapping

Cage traps are mostly useful for capturing medium sized fauna that are unlikely to be caught in pit and funnel traps. The overall survey effort for cage trapping was 209 trap nights.

Micro-bat surveying

Micro-bats (Microchiropterans) form an extremely diverse group of wildlife and the identification of individual species requires the use of specialised survey methods due to the superficial similarity of many species, their small size, and largely inaudible calls.

In order to navigate and hunt at night micro-bats use high frequency echolocation calls, most of which are above the frequency range audible to humans (i.e. ultrasound). These echolocation calls provide an opportunity to unobtrusively survey and identify micro-bats through the use of a specialised electronic bat call recorder called Anabat. The Anabat was utilised throughout surveys, recording micro-bat calls at each vegetation community. This method therefore represents a broad census technique which facilitates the detection of a broad suite of micro-bats which utilise the mine study area and surrounding areas. Recordings were sent to an expert Anabat call analyst (Mr. Greg Ford – Toowoomba, Queensland) for species identification. The overall Anabat survey effort was 45 nights.

Bird surveying

A dedicated search for diurnal birds using a standardised survey technique (2ha for 20 minutes) was conducted visually and aurally on mornings and afternoons of the survey in the immediate vicinity of each fauna transect. In addition, opportunistic diurnal searches were also conducted on foot in areas

considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

Spotlighting

Spotlighting was carried out at night in various sections of the mine study area and surrounding areas in an attempt to observe nocturnal wildlife not likely to be detected by other survey methods, such as owls and arboreal mammals. Two spotlighting techniques were employed:

- **Walk searches:** Various habitats surrounding and within the mine study area were selected for spotlighting on foot, especially those considered likely to have high wildlife diversity or to contain cryptic or threatened species. These areas were randomly traversed by two ecologists equipped with spotlights and binoculars. Where possible rock fissures, bark crevices and tree hollows were investigated. A slow walking speed (approximately 1 km per hour) was maintained to facilitate intensive listening and thorough visual searching. While this technique improves the likelihood of detecting small cryptic species, it is a time-consuming activity that does not permit the coverage of large areas. The total spotlight hours undertaken on foot within and surrounding the mine study area was 67 hours.
- **Vehicle searches:** Spotlighting was also conducted from a slow-moving vehicle where established roads/tracks permitted driving through areas considered likely to have high wildlife diversity or to contain cryptic or threatened species. A 55 watt 12 volt spotlight was used to scan roadside vegetation for arboreal and ground-dwelling wildlife. An advantage of this survey technique is the efficiency with which large areas can be covered, although small cryptic species can be easily overlooked. A total of 48 hours of vehicle spotlighting was undertaken throughout the course of all surveys.

Habitat searching

To further enhance the likelihood of detecting small cryptic species, opportunistic diurnal searches of likely micro-habitats were conducted at each transect and in other selected areas surrounding the mine study area. Searches involved the rolling of rocks and logs, rustling through leaf litter, and the peeling back of exfoliating bark from standing trees. Observed animals were caught where possible to aid positive species identification.

Scat/Track searching

At each transect location a search of the immediate area was conducted for evidence of the presence of cryptic wildlife species through the identification of obvious tracks, scats and other signs of occupation (for example, tree trunk scratchings).

Incidental recordings

Throughout the survey period numerous wildlife species were observed or heard within the mine study area during the course of routine activities, such as setting and checking trap-lines, or driving between transects. Where required, a closer inspection of detected wildlife was carried out to ensure positive species identification. All incidental observations were recorded and appropriate notes made on the surrounding habitat.

H.4.3.3 Likelihood of Occurrence of Listed Fauna

The following categories were assigned to the identified species based on their likelihood of occurrence to enable the assessment and mapping of potential impacts posed by the Project:

- Unlikely to occur;
- Low likelihood of occurring;
- Moderate likelihood of occurring; and
- High potential of occurring.

These categories were determined by:

- Undertaking further database searches to assess species recorded in areas located near the Project;
- Assessing information from published field guides and from internet sites (such as SPRAT and Birds Australia) for currently known species distributions;
- Assessing habitat availability and climatic conditions on site during field surveys;
- Assessing habitat integrity during field surveys;
- Assessing the presence of predatory feral animal populations that may impact upon species presence during field surveys; and
- Accounting for the cryptic nature of species listed in the database searches and the limitations of identifying such species during the field surveys.

H.4.4 Species Mapping Methodology

A habitat modelling and mapping methodology was developed to spatially depict, assess and quantify, the direct and indirect impacts to the EPBC Act-listed flora and fauna species potentially occurring in the mine study area region. The methodology for modelling and mapping threatened species habitat, involved the identification of species-specific habitat criteria that were input into a model that identified potential habitat. The model was underpinned by amended Queensland vegetation (i.e. Regional Ecosystem) mapping.

A variety of sources were consulted in the development of the species-specific habitat criteria. The Queensland DERM Essential Habitat factors for individual species were reviewed where these were available – these factors relate to habitat features associated with individual species listed under the *Queensland Nature Conservation Act 1992* (NC Act), for which Essential Habitat is mapped. Essential Habitat factors (where available) that were input into the habitat model included REs and altitude. Where Essential Habitat factors were not available, REs were selected based on knowledge of the species broad habitat preferences, and in consideration of the REs associated with species that have similar habitat preferences.

The DERM Biodiversity Planning Assessments (BPA) for the Brigalow Belt and Desert Uplands bioregions were reviewed as part of the habitat model development. BPAs (and associated mapping and geospatial data) identify landscape scale biodiversity features at varying levels of significance (local, regional, state / low – very high). The mapping methodology is underpinned by DERM's remnant vegetation (i.e. RE) mapping, and based upon the DERM Biodiversity Assessment and

Mapping Methodology. Expert panel reports provide information on the landscape-scale values of bioregions, and in some instance identify bioregional priority taxa. Two BPA criteria (F and G as described below) were input into the habitat model so that an indication of the 'value' of mapped vegetation units (i.e. mapped RE polygons) could be ascertained (in lieu of assessing the value of habitats in the broader study area.

Criteria F – Ecosystem Diversity

This criterion describes habitat complexity, based on the number and size of ecosystems and wetlands present in an area (Queensland Environmental Protection Agency (EPA) (now DERM, 2002). The two concepts, 'richness' (number of different ecosystems) and 'evenness' (relative abundance of ecosystems), are considered when attributing an Ecosystem Diversity rating to a particular area (EPA, 2002). For example, areas with a high Ecosystem Diversity typically have relatively many RE's and ecotones (EPA, 2002). Simpson's Diversity Index is used to determine Ecosystem Diversity (EPA, 2002) which is rated as Low, Medium, High or Very High for individual remnant vegetation units (i.e. RE polygons).

Criteria G – Context and Connection

This criterion is based upon the extent to which a mapped RE polygon incorporates or buffers other ecologically noteworthy areas (i.e. other remnant vegetation units and/or wetlands/waterways) (EPA, 2002). With respect to connection, remnant vegetation units that are connected to other REs are considered to be more representative of biodiversity, contribute more to a habitat network (i.e. connectivity) and exhibit greater resilience to disturbance (EPA, 2002). The extent to which an RE incorporates/buffers/connects to other mapped vegetation and/or wetlands/waterways determines its BPA (Criteria G) rating: Low, Medium, High or Very High for individual remnant vegetation units (i.e. RE polygons).

In addition to the Essential Habitat factors and BPA criteria, the habitat model considered proximity to mapped waterways (i.e. rivers, streams, wetlands), where this was considered to be an important habitat feature.

The outputs of the model allowed for four potential habitat categories to be mapped:

- 'Confirmed habitat'
- 'High value potential habitat'
- 'Low value potential habitat'
- 'Generally not suitable as habitat'

For the 'potential habitat' categories the primary mapping criterion (filter) was Queensland DERM RE mapping (Version 6.0b). Subsequent criteria used to value habitat varied by species, and included:

- Ecosystem Diversity (Criteria F) and Context and Connection (Criteria G) rating (of mapped RE polygon (as selected via primary filter)) – these values were extracted from the Queensland DERM Biodiversity Planning Assessment mapping for the Project study area
- Proximity of RE polygon to water sources (natural and artificial) – proximity varied by species depending on degree of association with water
- Altitude (species-specific information acquired from DERM Essential Habitat factors database, where available)

- Where the primary criterion (i.e. REs attributed to individual species) did not occur, or where available information on species distribution indicated lack of presence, RE polygons (or non-remnant patches) were mapped as 'generally not suitable'.

Habitat mapping was undertaken at two scales:

- **Regional scale:** a map displaying the Project area and surrounding landscape, with all four habitat categories mapped across the regional landscape. The scale of these maps is 1:500,000 analysing an area of 137 km x 163 km.
- **Mine study area ('local') scale:** a map series displaying 'confirmed habitat', 'high value potential habitat' and 'low value potential habitat' within the MLA.

A direct impact contour was overlaid on the habitat maps (regional and Project study area). This contour comprises the direct disturbance footprint as displayed in Figure H-3.

To establish the spatial extent of indirect impacts, the Project EIS results, in combination with relevant literature, were reviewed. This review established that indirect impacts on MNES could be categorised as noise, vibration, light, dust, subsidence and invasive species. The extent of each of these indirect impacts was also established during this review and a contour for each was produced. These contours were then applied in the impact assessment to quantify the spatial extent of each indirect impact. More detail of each of these impacts can be found below in Section H.4.4.4.

To inform analyses relating to habitat fragmentation, the BPA mapping Criteria J (Corridors) was applied to the habitat maps and direct and indirect impacts were assessed accordingly.

H.4.4.1 Model Validation

To test the outputs of the model, habitat mapping for the black-throated finch (southern) was undertaken for the Townsville region, using the same criteria as those applied to the Project study area and surrounding landscape. The potential habitat map that was produced for the Townsville region was compared with the 'map of important areas' for the black-throated finch (southern) as presented in the Significant Impact Guidelines for the Endangered Black-Throated Finch (southern) (*Poephila cincta cincta*) (Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA – now SEWPAC), 2009). The 'map of important areas' depicts sighting records within a 5 km buffer around each record. When compared, the potential habitat map produced via the habitat model closely resembled the 'map of important areas' in that important areas were generally identified as 'high value potential habitat' for the subspecies. 'Low value potential habitat' typically corresponded with areas adjacent to mapped 'important' areas'. The results of this visual comparison instilled confidence in the validity of the habitat modelling and mapping process.

H.4.4.2 Model and Mapping Assumptions

Importantly, the potential habitat mapping outputs have limitations. That is, the model attempts to describe 'potential habitat' based on key habitat features at a regional scale, but does not attempt to describe or predict where a particular species might occur. This is an important differentiation, as there are a number of factors that contribute to where a species occurs in the landscape. This not only includes those habitat factors that are important and naturally occur in the landscape (vegetation communities, floristic composition, water availability, food and shelter resources, local micro habitat features), but may also include those disturbance factors that have a negative effect on distribution and abundance (habitat condition, introduced species abundance, past land use).

The modelling and mapping process does not take into account localised features, previous disturbance (other than the current extent of remnant vegetation), and relationships with introduced species, local habitat condition or current land use. It takes key habitat features at a regional scale that can be spatially represented to describe potential habitat. For this reason, the mapping outputs of potential habitat do not reflect current distribution or predict occurrence of a species and may provide an overestimate of where species actually occur.

Likewise, while potential habitat has been mapped, it is not considered that all potential habitat is occupied. Therefore any quantification of potential direct and indirect impact is relevant only to potential habitat, and not occupied habitat.

The habitat modelling and mapping exercise was also underpinned by a number of assumptions. Habitat criteria for individual species were based on the **available information** for that species using a conservative approach to capturing their entire potential habitat applied (based on an understanding of species habitat requirements and distribution).

The geospatial data incorporated into the model may be susceptible to inaccuracies, particularly as ground-truthed data has not been included in this assessment to date. Where a particular habitat feature (i.e. an RE) occurred as part of a mapped mixed polygon (a vegetation unit comprising a number of different REs), it was only considered to be potential habitat where the specified 'habitat' RE comprised at least 20% of the mapped vegetation unit. The 20% limit is a conservative approach that allows for mixed polygons that include specified REs to be accommodated in the modelling process.

Habitat value was informed by applying Queensland DERM BPA mapping data to the model. Field observations relating to habitat value in the Project area will be incorporated into the discussion of potential impacts to habitat for threatened species.

In general, the modelling and mapping exercise sought to identify where potential habitat occurred for each species over an extent of several thousand square kilometres. While the actual occurrence and value of potential habitat 'on the ground' may not be reflected by the mapping in some instances (i.e. where vegetation mapping inaccuracies occur or where habitat value is diminished due to localised degrading processes), the conservative approach applied and the model validation indicate that the process will allow for a more realistic assessment of impacts of the Project to threatened species and TECs upon further refinement.

Further refinement and review of the habitat mapping, including assessment of additional site specific information, will be undertaken as part of planned ongoing studies. The updates will be available to inform the assessment of direct and indirect impacts, and finalisation of the offsets strategy.

H.4.4.3 Impact Quantification

Quantification of the amount of potential habitat for each threatened flora and fauna species was undertaken with respect to the area (and relative proportion) of potential habitat (confirmed, high value and low value) affected by direct impacts and indirect impacts.

In this study, direct impacts have been defined as *MNES that are cleared or killed as a result of the project* and indirect impacts have been defined as *identified alterations to the environment surrounding the Project in which MNES may exist, that may cause degradation to a point where MNES are negatively impacted*.

H.4.4.4 Description of Indirect Impacts

In order to assess the scale of indirect impacts on MNES it was necessary to calculate the spatial extent of each impact. As discussed above, this calculation resulted in a series of indirect impact contours which, when combined, created a single indirect impact footprint which could be used in quantifying the indirect impact spatially. Where indirect impacts were determined to overlap directly impacted areas, the direct impact nullified the indirect impact based on the assumption that MNES could not exist once directly impacted. In such circumstances the area of overlap was not accounted for in the indirect impact analysis.

A description of the indirect impacts that had a pre-defined spatial extent follows.

Noise

General detailed information relating to noise impacts from the Project can be found in the Noise and Vibration section of this EIS (Volume 1, Section 15).

There are currently no noise goals or standards defined for the protection of flora and fauna. However, through the completion of a literature review, it was established that noise has the potential to cause stress, hearing damage and behavioural changes in fauna (van der Ree *et al*., 2008). It may also increase the susceptibility of some animals to predation by reducing predator avoidance. Studies undertaken on the effects of roadside noise on birds, which are the most well studied vertebrate group, suggest impacts are most significant between 50 and 70 dB(A) at distances of < 100 m. Conversley, mammals are thought to be generally less impacted by noise (FWHA, 2004). In assessments undertaken near the region of concern in this study, noise is not a recognised threat to priority vertebrate fauna taxa listed in the Burdekin Natural Resource Management (NRM) Region *Back on Track Actions for Biodiversity* report (the 'Back on Track report') (Department of Environment and Resource Management, 2010).

As such, a worst-case scenario 60 dB contour from all proposed works has been modelled and, in an effort to apply greater conservatism, this contour has been extended by an additional 200 m to produce a final noise indirect impact contour.

Dust

General detailed information relating to the impacts of dust from the Project can be found in the Air Quality section of this EIS (Volume 1, Section 13).

There are currently no air quality (dust) goals or standards defined for the protection of flora and fauna. The available information suggests that the standards and goals that are currently defined to protect human health and amenity are more stringent than required to protect against dust impacts on flora and fauna. As such a review of the available research work on dust impacts on vegetation for the Curragh North Project was undertaken (Doley 2003). This review concluded that:

- Mineral dusts, resulting from mining, quarrying, road operations, mineral processing, and wind erosion may be deposited on vegetation to the extent that they impede growth and threaten the survival of plants.
- Dusts that are chemically inert, or which do not markedly alter substrate pH, are generally effective (i.e. in adversely affecting plant growth) if the dust load is greater than 5 g/m^2.

- Model calculations on a cotton crop suggest that dust loads of 5 g/m² or dust deposition rates of 500 mg/m²/day are unlikely to have a detectable effect on vegetative growth under the sunny conditions most conducive to cotton growth. A dust deposition rate of 1,000 mg/m²/day is predicted to result in measurable reductions in crop growth during overcast weather, but the effect may be more difficult to detect in sunny weather

As a result of the above research a precautionary threshold of dust deposition rate of 500 mg/m²/day has been established as a threshold for any likely adverse impacts on surrounding vegetation. This deposition rate contour has been modelled thereby formulating the indirect impact contour.

Vibration

General detailed information relating to Vibration impacts from the Project can be found in the Noise and Vibration section of this EIS (Volume 1, Section 15).

Calculations made as part of the EIS assessment indicate that blasts requiring up to 1,300 kg maximum instantaneous charge would not exceed the most stringent 115 dB(L) overpressure criterion at any of the identified sensitive receptor locations the closest of which is approximately 7 km. At this location overpressure levels of no more than 113 dB(L) are predicted.

Holthuijzen *et al*. (1990) experimentally examined the influence of blasting regimes at mines on nesting prairie falcons, testing tolerance of up to 140 dB, finding no observable effects to blasts in the range 560 – 1,000 m. Call (1979), suggested that new mining operations should not be allowed within 800 m of existing non-habituated prairie falcon pairs. Because vibration impacts vary between species and will be intermittent a conservative buffer distance of 1,000 m from the edge of the pit has been applied.

Light

General detailed information relating to light impacts from the Project can be found in the Landscape Character section of this EIS (Volume 1, Section 7).

Lighting associated with construction works at night will be implemented in a manner to reduce light pollution into the surrounding area (i.e. directional lighting, lighting with protective guards). It is considered unlikely that construction-related light will extend far beyond the immediate construction area, and as such, any adverse impacts (i.e. behavioural disruption, increased predator exposure) will be extremely localised. Light pollution is not recognised as a threat to priority vertebrate fauna taxa listed in the Burdekin NRM Region Back on Track report. The Commonwealth Government's *Review of mitigation measures used to deal with the issues of habitat fragmentation* report (van der Ree *et al.*, 2008) does not discuss light pollution beyond identifying it as a potential indirect impact associated with linear infrastructure. It is not considered likely that construction and/or operational lighting will be of consequence beyond approximately 50 m from the edge of the established disturbance footprint.

Invasive Species

General detailed information relating to invasive species impacts from the Project can be found in the Terrestrial Ecology section of this EIS (Volume 1, Section 9).

Construction activities may spread weeds via construction vehicles and plant, and the movement of soil (fill). Clearing of previously undisturbed vegetation may facilitate the spread of disturbance-tolerant animals and plants. The creation of an edge (the side of a directly impacted area) in previously undisturbed areas may facilitate the growth of disturbance-tolerant, highly competitive weed species,

due to alteration of localised conditions at that edge (i.e. greater exposure to sunlight, wind – 'edge effects').

The Commonwealth Government's *Review of mitigation measures used to deal with the issues of habitat fragmentation* report (van der Ree *et al.*, 2008) summarises literature on habitat fragmentation impacts (and mitigation measures) associated with linear infrastructure. With respect to edge effects, of which weed incursion is a notable factor, van der Ree *et al.* (2008) reported that linear infrastructure projects may cause weed proliferation where previously undisturbed areas are cleared.

While strategies will be implemented to minimise the potential for invasive species impacts during the construction and operational phases of the Project, in recognition of current disturbances, the risk associated with invasive species for threatened fauna and flora are sufficiently high so that a conservative approach to describing indirect impacts has been adopted. Thus, a 100 m buffer from the edge of the established disturbance footprint has been applied.

Groundwater

General detailed information relating to Groundwater impacts from the Project can be found in the Groundwater section of this EIS (Volume 1, Section 12).

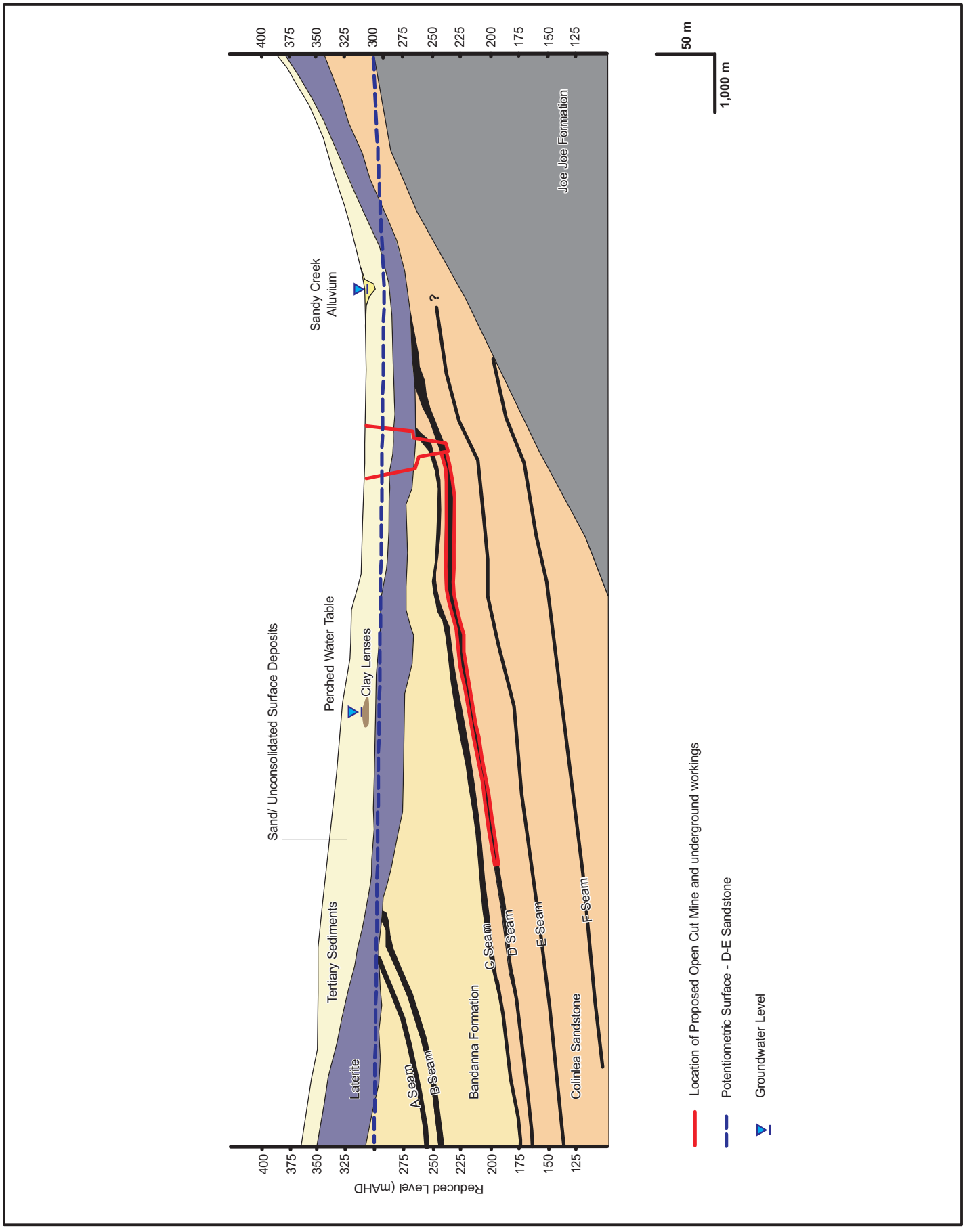
The impacts of groundwater drawdown on vegetation communities within the Project site are regarded as low. There are no identified groundwater dependent ecosystems located on the Project site, and the groundwater piezometeric levels associated with usable aquifers are at depths >20 m and thus not accessible to the existing vegetation. Current information (groundwater level monitoring on site) indicates little or no hydraulic connectivity (linkage) between the piezometeric groundwater levels (associated with the underlying confined aquifers) and the ephemeral surface water resources or perched water tables. Thus any decrease in groundwater levels, due to mine depressurisation will not impact on the vegetation communities.

Incidents of isolated perched groundwater during and immediately after the wet season, within the weathered Tertiary laterite and saprolite and clay-rich Quaternary alluvium, where groundwater has been recorded at depths of 0.5 to 1.5 m below surface, are possible (Figure H-8). These perched water tables may provide limited water (low sustainable volumes) for local vegetation communities.

Based on the low permeability of the Tertiary laterite and saprolite and the very low topographic gradients, drawdown within these Tertiary units, resulting from open pit mining, would be limited to some 10 to 100 m around the pits. Any perched water within this zone would be expected to report to the open pit. The vegetation in the area immediately adjacent to the mine pit will, however, be disturbed / removed due to the envisaged infrastructure (surface water levees, roads, water and power easements, etc.).

In order to validate this conceptualisation and obtain additional groundwater - surface water interaction information across the entire mine site, nested bores, comprising shallow (~ 10 m into the weathered Tertiary and Quaternary alluvium) and deep (~ 30 m into the underlying coal seam aquifers) are being constructed along Sandy Creek. These bores will allow for further assessment of possible hydraulic connectivity.

Overall we have selected a 200 m buffer from the edge of the mine pits in a conservative effort to minimise the potential of indirectly impacting Groundwater Dependent Ecosystems (GDE's).



Source: See Copyright Details below and for full disclosure Please Refer to the EIS ***Volume 4- References.***

0 2 4Km

Scale 1:150 000 (A3)

Datum: GDA 94, MGA Zone55

N W E S

HANCOCK GALILEE PTY LTD

Kevin's Corner Project
Environmental Impact Statement

GROUNDWATER LEVELS

Job Number	4262 6660
Revision	B
Date	12-09-2011

Figure: H-8

File No: 42626660-g-2122.cdr

H.4.5 Assessment of Impacts on Flora and Fauna

Desktop information, field survey results and habitat mapping were used to identify potential impacts to EPBC Act-listed threatened and migratory fauna of relevance to the Project study area. This assessment included:

- A review of impacting processes (including EPBC Act-listed key threatening processes, and Project-specific direct and indirect impacts) potentially applicable to EPBC Act-listed threatened and migratory fauna;
- Quantification of direct and indirect impacts to potential habitat for EPBC Act-listed threatened and migratory fauna, including:
  - Comparative analysis of amount of potential habitat exposed to *direct impacts* with amount of potential habitat available in regional landscape (as defined below in Section H.6.2.1 - where regional landscape is the landscape surrounding the Project study area as depicted on a map sheet at a scale of 1:500,000)
  - Comparative analysis of amount of potential habitat exposed to *indirect impacts* with amount of potential habitat available in regional landscape (as defined below in Section H.6.2.2 - where regional landscape is the landscape surrounding the Project study area as depicted on a map sheet at a scale of 1:500,000)
- Discussion of impacts on a species-by-species basis, including assessment of significance of impacts in accordance with the Commonwealth's *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA (now SEWPAC), 2009b);
- Identification of areas in the Project area where impacts to numerous MNES may occur (overlay of potential habitat for all threatened species (flora and fauna) and TECs; and
- Description of proposed mitigation measures (as presented in the Project EMP presented in Volume 2, Appendix W of this EIS), and where these measures should be targeted based on the results of impact assessment.

H.5 Flora and Fauna Assessment Results – Desktop, Field and Habitat Mapping

H.5.1 Listed Threatened Ecological Communities

The results of the EPBC Act Protected Matters Search Tool database search identified five EPBC Act listed Threatened Ecological Communities (TECs) as potentially being present within the mine study area (Table H-5). Of these five, only one TEC, Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin, was identified during field surveys.

Further desktop studies and analyses classified the four remaining TEC's as 'unlikely' to be present for the following reasons:

- Brigalow (Acacia harpophylla dominant and co-dominant)
  - The Project MLA is primarily within the Desert Uplands Bio-region and does not contain any of this TEC's constituent Regional Ecosystems.
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions

  - The Project MLA is primarily within the Desert Uplands Bio-region and does not contain any of this TEC's constituent Regional Ecosystems.
- The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin (GAB)
  - The Project MLA does not contain any of this TEC's constituent Regional Ecosystems, nor does is the project likely to impact the groundwater of the GAB.
- Weeping Myall Woodlands.
  - While the Project MLA does contain one of this TEC's constituent Regional Ecosystems, Weeping Myall (*Acacia pendula*) is not present on site and therefore this TEC it is not considered to be present.

H.5.2 Listed Migratory Species

The results of the original Protected Matters Search Tool indicated that ten EPBC Act listed Migratory fauna species may potentially occur within the Project site. During the field survey periods, the presence of two of these ten species was confirmed on site. In total, three of the species were considered to have a moderate or high potential of occurring on the Project site, and the final five were considered to have a low potential of occurring on the Project site. See Table H-4 below for a list of these species.

As habitat mapping for EPBC Act-listed threatened species is considered likely to also capture habitat for migratory species (including woodland birds, wetland and (freshwater) aquatic reptiles) it was not deemed necessary to map the potential migratory species habitat. Furthermore, mitigation measures and habitat offsets for the assessed threatened species are also likely to apply to migratory species.

Table H-4 Migratory species indicated via desktop searches and field surveys

Scientific Name	Common Name	Identified during Desktop Searches	Identified during Field Surveys	Likelihood of Occurrence
Apus pacificus	Fork-tailed Swift	✓		Moderate
Ardea alba	Great Egret	✓	✓	Confirmed
Ardea ibis	Cattle Egret	✓		High
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	✓		Low
Haliaeetus leucogaster	White-bellied Sea-Eagle	✓		Low
Hirundapus caudacutus	White-throated Needletail	✓		Low
Merops ornatus	Rainbow Bee Eater	✓	✓	Confirmed
Myiagra cyanoleuca	Satin Flycatcher	✓		Low
Nettapus coromandelianus	Cotton Pygmygoose	✓		Moderate
Rostrtula benghalensis s. lat.	Painted Snipe	✓		Low

H.5.3 EPBC-listed Flora and Fauna Species

Detailed in Table H-5 below is a summary of the desktop assessment, field survey and habitat mapping results for each of the 20 threatened species and 5 TECs identified through any of the surveys conducted for the Project. Further information on each of the MNES listed below, that are considered to have a low, moderate, high likelihood of occurring, or a confirmed occurrence, on the Project site. The habitat mapping for each of these MNES is also presented in Appendix H.A of this report. An assessment of the significance of the impacts to these MNES is provided in Section H.6.7 below.

Table H-5 Summary of Results – Threatened Flora and Fauna

Species	Classification under EPBC Act	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Threatened Ecological Communities					
Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	Endangered	This TEC was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.	Flora assessments undertaken in accordance with the methodologies detailed in Section H.4.2. Neither this TEC nor any of its constituent Regional Ecosystems were identified during on site field surveys.	Confirmed	Relatively small amounts of this TEC were found south-east of the MLA, with the proposed access road dissecting two portions of the mapped habitat. There was very little additional representation in the regional landscape.
Brigalow (*Acacia harpophylla* dominant and co-dominant)	Endangered	This TEC was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.	Flora assessments undertaken in accordance with the methodologies detailed in Section H.4.2. Neither this TEC nor any of its constituent Regional Ecosystems were identified during on site field surveys.	Unlikely	As the TEC was considered unlikely to occur on the site it was not mapped.

Species	Classification under EPBC Act	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Weeping Myall Woodlands	Endangered	This TEC was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.	Flora assessments undertaken in accordance with the methodologies detailed in Section H.4.2. Neither this TEC nor any of its constituent Regional Ecosystems were identified during on site field surveys.	Unlikely	As the TEC was considered unlikely to occur on the site it was not mapped
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	This TEC was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.	Flora assessments undertaken in accordance with the methodologies detailed in Section H.4.2. Neither this TEC nor any of its constituent Regional Ecosystems were identified during on site field surveys.	Unlikely	As the TEC was considered unlikely to occur on the site it was not mapped
The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin	Endangered	This TEC was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.	Flora assessments undertaken in accordance with the methodologies detailed in Section H.4.2. Neither this TEC nor any of its constituent Regional Ecosystems were identified during on site field surveys.	Unlikely	As the TEC was considered unlikely to occur on the site it was not mapped

Species	Classification under EPBC Act	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Plants					
Acacia ramiflora	Vulnerable	The species was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. This species was not catalogued within the Queensland DERM Wildlife Online and Queensland Herbarium HERBRECS databases.	Flora assessments undertaken in accordance with the methodologies detailed in Section H.4.2. *Acacia ramiflora* was not detected in the Project study area during field surveys.	Unlikely	As the Species was considered unlikely to occur it was not mapped
Cadellia pentastylis (Ooline)	Vulnerable	The species was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. This species was not catalogued within the Queensland DERM Wildlife Online and Queensland Herbarium HERBRECS databases.	Flora assessments undertaken in accordance with the methodologies detailed in Section H.4.2. *Cadellia pentastylis* was not detected in the Project study area during field surveys.	Unlikely	As the Species was considered unlikely to occur it was not mapped
Corymbia clandestina	Vulnerable	This species was identified within the Queensland DERM Wildlife Online Search. The species was not predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool and was not catalogued within the Queensland DERM Wildlife Online and Queensland Herbarium HERBRECS databases.	Flora assessments undertaken in accordance with the methodologies detailed in Section H.4.2. *Corymbia clandestina* was not detected in the Project study area during field surveys.	Unlikely	As the Species was considered unlikely to occur it was not mapped

Species	Classification under EPBC Act	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Dichanthium queenslandicum (King Bluegrass)	Vulnerable	The species was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. This species was not catalogued within the Queensland DERM Wildlife Online and Queensland Herbarium HERBRECS databases.	Flora assessments undertaken in accordance with the methodologies detailed in Section H.4.2. *Dichanthium queenslandicum* was not detected in the Project study area during field surveys.	Low likelihood of occurring	Relatively small amounts of high and low value *Dichanthium queenslandicum* habitat was found south-east of the MLA, with the proposed access road dissecting two portions of the mapped habitat. There was very little additional representation in the regional landscape.
Eriocaulon carsonii (Salt Pipewort, Button Grass)	Endangered	The species was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. This species was not catalogued within the Queensland DERM Wildlife Online and Queensland Herbarium HERBRECS databases.	Flora assessments undertaken in accordance with the methodologies detailed in Section H.4.2. *Ericaulon carsonii* was not detected in the Project study area during field surveys.	Unlikely	As the Species was considered unlikely to occur it was not mapped

Species	Classification under EPBC Act	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Birds					
Geophaps scripta scripta (squatter pigeon southern)	Vulnerable	*Geophaps scripta scripta* was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool and the Queensland DERM Wildlife Online database returned a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. *Geophaps scripta scripta* was recorded during the survey within the non-remnant grassland vegetation community.	Confirmed occurrence	Much of the regional landscape surrounding the mine area and within the Project MLA contains potential high and low value habitat for *Geophaps scripta scripta*.
Neochmia ruficauda ruficauda (star finch)	Endangered	*Neochmia ruficauda ruficauda* was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. Targeted field surveys failed to confirm the presence of any *Neochmia ruficauda ruficauda* individuals in the study area.	Moderate likelihood of occurring.	Neither the regional landscape surrounding the Project MLA, nor the MLA has itself contains a large amount of potential high or low value habitat for *Geophaps scripta scripta*. The habitat that does exist is largely centred around waterways.

Species	Classification under EPBC Act	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Erythrotriorchis radiatus (red goshawk)	Vulnerable	*Erythrotriorchis radiatus* was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool and the Queensland DERM Wildlife Online database returned a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. Targeted field surveys failed to confirm the presence of any *Erythrotriorchis radiatus* individuals in the study area.	Low likelihood of occurring.	Much of the regional landscape surrounding the mine area and within the Project MLA contains potential high and low value habitat for *Erythrotriorchis radiatus*.
Rostratula australis (Australian painted snipe)	Vulnerable	*Rostratula australis* was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. Targeted field surveys failed to confirm the presence of any *Rostratula australis* individuals in the study area.	Low likelihood of occurring	Potential high and low value habitat for *Rostratula australis* is sparsely represented throughout the Project MLA and the surrounding region.
Poephila cincta cincta (black-throated finch)	Endangered	*Poephila cincta cincta* was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. No historical records of this species were returned from a query of relevant databases.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. Targeted field surveys failed to confirm the presence of any *Poephila cincta cincta* individuals in the study area.	Low likelihood of occurring	Much of the regional landscape surrounding the mine area and within the Project MLA contains potential high and low value habitat for the *Poephila cincta cincta*.

Species	Classification under EPBC Act	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Mammals					
Nyctophilus timoriensis (greater long-eared bat)	Vulnerable	*Nyctophilus timoriensis* was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. No historical records of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. *Nyctophilus timoriensis* was not detected from the Project study area during field surveys.	Low likelihood of occurrence.	Much of the regional landscape surrounding the mine area and within the Project MLA contains potential high and low value habitat for *Nyctophilus timoriensis*.
Dasyurus hallucatus (northern quoll)	Endangered	*Dasyurus hallucatus* was predicted to occur in the Project study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database returned a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. *Dasyurus hallucatus* was not detected from the Project study area during field surveys.	Unlikely	As the Species was considered unlikely to occur it was not mapped

Species	Classification under EPBC Act	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Lasiorhinus krefftii (northern hairy-nosed wombat)	Endangered	*Lasiorhinus krefftii* was predicted to occur in the Project study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. *Lasiorhinus krefftii* was not detected from the Project study area during field surveys.	Unlikely	As the Species was considered unlikely to occur it was not mapped
Sminthopsis douglasi (julia creek dunnart southern)	Endangered	*Sminthopsis douglasi* was predicted to occur in the Project study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. *Sminthopsis douglasi* was not detected from the Project study area during field surveys.	Unlikely	As the Species was considered unlikely to occur it was not mapped
Reptiles					
Denisonia maculata (ornamental snake)	Vulnerable	*Denisonia maculata* was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. *Denisonia maculata* was not detected from the Project study area during field surveys.	Moderate likelihood of occurrence.	No potential habitat for *Denisonia maculata* was mapped within the MLA. A reasonable proportion of the regional landscape to the east of the mine area has potential high and low value habitat, however, none was mapped to the north-west of the Project.

Species	Classification under EPBC Act	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Egernia rugosa (yakka skink)	Vulnerable	*Egernia rugosa* was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database returned a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. *Egernia rugosa* was not detected from the Project study area during field surveys.	Moderate likelihood of occurrence.	Much of the regional landscape surrounding the mine area and within the Project MLA contains potential high and low value habitat for *Egernia rugosa*.
Furina dunmalli (Dunmall's snake)	Vulnerable	*Furina dunmalli* was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. *Furina dunmalli* was not detected from the Project study area during field surveys.	Moderate likelihood of occurrence.	No potential habitat for *Furina dunmalli* was mapped within the Project MLA, however a reasonable proportion of the regional landscape to the east of the mine area had potential high and low value habitat mapped.
Lerista allanae (retro slider)	Endangered	*Lerista allanae* was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. *Lerista allanae* was not detected from the Project study area during field surveys.	Unlikely	As the Species was considered unlikely to occur it was not mapped

Species	Classification under EPBC Act	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Paradelma orientalis (brigalow scaly-foot)	Vulnerable	*Paradelma orientalis* was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. *Paradelma orientalis* was not detected from the Project study area during field surveys.	Moderate likelihood of occurrence.	The majority of the regional landscape surrounding the mine area and all of the Project MLA, is devoid of potential high and low value habitat for *Paradelma orientalis*. The only potential habitat is over 80 km south of the Project MLA.
Rheodytes leukops (Fitzroy river turtle)	Vulnerable	*Rheodytes leukops* was predicted to occur in the Project study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments undertaken in accordance with the methodologies detailed in Section H.4.3. *Rheodytes leukops* was not detected from the Project study area during field surveys.	Unlikely	As the Species was considered unlikely to occur it was not mapped

H.6 Assessment of Impacts – Listed Flora and Fauna

H.6.1 Introduction

The potential impacts of the Project are identified below and are considered as a consequence of the Project's construction and operation activities.

In designing the Project reducing environmental impacts has been considered. Significant examples of this are evident in the minimisation of waterway diversions as far as possible, as well as positioning the levees ensuring flood plains are as wide as possible. Additionally, as Project operations are largely underground, both direct and indirect impacts are minimised. Noise and dust impacts are significantly lower than those of open cut operations, and the amount of vegetative clearance required is minimised. The open cut operations that are proposed will be a strike length of approximately 4 km when in steady state operations and are unlikely to run the full life of the project.

However, the construction of some of the mine infrastructure has the potential to affect fauna populations through habitat loss, population isolation, edge and barrier effects, and an increase in mortality from mine activities and increased traffic and road use. The development of some of the mine infrastructure will involve landscape modification procedures through vegetation clearing, a recognised threatening process that can affect different taxa in differing ways.

The following potential impacts on fauna may result from the proposed works at the Project site:

- Land clearing and mining activities may reduce the available breeding and foraging habitat for fauna native species;
- Increased risk of fauna mortality resulting from vehicle strike and the destruction of tree hollows;
- Disruption of species behaviour;
- Increased habitat fragmentation and loss of connectivity across the mine infrastructure and pit areas;
- Diversion of creeks will reduce the extent of riparian habitats and contribute to habitat fragmentation;
- An increase in noise, vibration and dust associated with the construction and operational phases of the Project may lead to the displacement of native species from their current home ranges;
- Changes in flow patters accompanied with an increased risk of sedimentation in riparian woodlands downstream of the proposed mine site. Higher levels of erosion can lead to a loss of morphological diversity in streams adversely affecting habitat quality that may result in biodiversity loss in affected areas;
- Habitat modification may result in conditions more favourable to introduced fauna species identified as utilising the Project site, including the cane toad, feral pig, European rabbit, house mouse and feral goat;
- Mine-related infrastructure, such as sediment dams, may be accessible to fauna and may provide additional water sources;

- Vegetation clearing will result in a localised reduction in the amount of roost and nesting sites, microhabitats and potential foraging areas for many fauna species. This would add population pressure (such as competition for roost sites, mates and food resources) to resident bats in these adjacent areas and may potentially lead to decreased population viability; and

H.6.1.1 Critical Habitat

Habitat listed on the register of Critical Habitat (SEWPaC 2009) are areas of land that are defined as crucial to the survival of particular threatened species, populations or ecological communities.

There are no areas of recommended or declared critical habitat that are relevant to the Project site or the surrounding locality.

H.6.1.2 Key Threatening Processes Listed Under the EPBC Act

There are eight key threatening processes (KTP's) relevant to the EPBC-listed flora and twelve relevant to the EPBC-listed fauna, of the Project site. These are listed and described below in Table H-6.

Table H-6 List of Key Threatened Processes relevant to EPBC-Listed Fauna and Flora of the Project site, with descriptions

Key Threatened Process	KTP Description	Relevance	
		Flora	Fauna
Land Clearance	Land clearance is defined as "the destruction of the above ground biomass of native vegetation and its substantial replacement by non-local species or by human artefacts" (TSSC 2001a). While the Project will require land clearance, with the adoption of mitigation measures the Project is considered unlikely to result in a significant increase to this KTP.	✓	✓
Competition and Land Degradation by Unmanaged Goats	Unmanaged Goats (*Capra hircus*) have the potential to result in significant land degradation, as well as direct impacts to a number of native and threatened species (DEWHA 2008a). This introduced species is known to occur in the Desert Uplands Bioregion (CDU 2001b), and was observed within the study area during site field surveys. However, assuming mitigation measures are adopted that aim to manage feral species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	✓	✓
Dieback Caused by the Root-rot Fungus (*Phytophthora cinnamomi*)	There was no evidence of dieback caused by the Root-rot Fungus (*Phytophthora cinnamomi*) within the study area at the time of field surveys. However, the Project has the potential to spread this pathogen into the Project site, via infected machinery or the transport of infected soil material. Mitigation measures including the washing of at risk machinery prior to working on site and limiting the importation of any soil material will minimise the potential for impact on this KTP.	✓	✗

Key Threatened Process	KTP Description	Relevance	
Competition and land degradation by rabbits	European Rabbits (*Oryctolagus cuniculus*) are considered to be one of Australia's most serious vertebrate pests. Rabbits threaten the survival of a number of native flora and fauna species, and vegetation communities; while the serious erosion problems caused by the species grazing and burrowing habits can have vast implications for landforms, geomorphic processes and sensitive sites, as well as primary industries (OEH 2011). This species is known to occur in the Desert Uplands Bioregion (CDU 2001b), and was observed within the study area during site field surveys. However, assuming mitigation measures are adopted that aim to manage feral species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	✓	✓
Invasion of Northern Australia by Gamba Grass and other introduced grasses	The introduced Gamba grass *Andropogon gayanus* is currently distributed throughout far-northern Queensland and coastal regions of the Northern Territory. Although Gamba Grass is not currently considered a threat to the Desert Uplands Bioregion, the species distribution is believed to expand greatly in response to global climate change. Whereby the predicted effects of increasing mean temperature and changing rainfall is expected to cause a southerly shift in the species distribution, allowing it to grow further south along the Queensland coast (QLD DPI 2008). As such, this species may pose a significant threat to the Project site in the future. Furthermore, 39 significant weeds have been recorded in the Desert Uplands Bioregion, of which 8 are introduced grasses including – Buffel Grass (*Cenchrus ciliaris)*, Burr Grass (*Cenchrus echinatus),* Olive Hymenachne (*Hymenachne emplexicaulis)*, Chinese Fountain Grass (*Pennisetum setaceum),* Johnson Grass (*Sorghum halepense),* Rat's Tail Grass (*Sporobolus spp.)* and Para Grass (*Urochloa mutica)* (CDU 2001a). Assuming mitigation measures are adopted that aim to manage invasive weed species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	✓	✓
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	Escaped garden plants are believed to threaten the viability of a number of threatened native species and ecological communities throughout Australia. The invasion of escaped garden plants can have a number of adverse impacts on native species, including - genetic effects, introduction of disease, competition for resources, prevention of recruitment, alteration of ecosystem processes and changes to the abundance of native flora and fauna (TSSC 2010). There are 7 invasive garden plants that are now recognised as Weeds of National Significance that are known occur within the Desert Uplands Bioregion (CDU 2001a, TSSC 2010). These include Athel pine (*Tamarix aphylla)*, Lantana (*Lantana camara),* Salvinia (*Salvinia molesta)*, Mesquite (*Prospis pallida)* and (*Prospis glandulosa x velutina),* Parkinsonia (*Parkinsonia aculeate)* and Rubber vine (*Cryptostegia grandiflora).* Assuming mitigation measures are adopted that aim to manage weed species within the Project site, the Project is considered unlikely to result in a significant increase to this KTP.	✓	✓

Key Threatened Process	KTP Description	Relevance	
Loss of Terrestrial Climatic Habitat Caused by Anthropogenic Emissions of Greenhouse Gases	The Loss of Terrestrial Climatic Habitat caused by Anthropogenic Emissions of Greenhouse Gases is defined as the *reductions in the bioclimatic range within which a given species or ecological community exists due to emissions induced by human activities of greenhouse gases (TSSC 2001b)*. Climate change and associated impacts are considered unlikely to be significantly impacted by the Project. This KTP has been addressed in the Greenhouse Gas Assessment SEIS Volume 2, Appendix Q undertaken for this project.	✓	✓
Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs	Feral pig (*Sus scrofa)* activity results in degradation of habitat, disease transmission, and increased competition for resources with native species as well as predation upon native species (TSSC 2001c). This introduced species is known to occur in the Desert Uplands Bioregion (CDU 2001b), and feral pig activity was observed in the study area during site field surveys. As such, mitigation measures are recommended to minimise the potential for the Project to result in an increase to this KTP.	✓	✓
Predation by European Red Fox	The European Red Fox (*Vulpes vulpes)* is known to occur in the Desert Uplands Bioregion (CDU 2001b), however was not observed within the study area during site field surveys. Assuming mitigation measures are adopted that aim to manage feral species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	✗	✓
The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Bufo marinus*).	Cane Toads (*Bufo marinus)* eat a wide variety of prey, breed opportunistically and have a far greater fecundity than native anurans. Cane Toads also have the potential to compete with native species for food and shelter. As all stages of the Cane Toad's lifecycle are poisonous, predators are susceptible to death by toxic ingestion (SEWPaC, 2010). This introduced species is known to occur in the Desert Uplands Bioregion (CDU 2001b), and was observed within the study area during site field surveys. Threatened species predicted or known* to occur within the region of the Project that are directly threatened by Cane Toads (TSSC 2005) include: – Rainbow Bee-eater* (*Merops ornatus*); – Ornamental Snake (*Denisonia maculata*); and – Northern Quoll (*Dasyurus hallucatus*). The Project has the potential to cause disturbance to the surrounding area, which may facilitate the movement of Cane Toads in the region and provide further habitat for the species. However, assuming mitigation measures are adopted that aim to manage feral species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	✗	✓
Psittacine Circoviral (Beak and Feather) Disease Affecting Endangered Psittacine Species	Beak and feather *(Psittacine Circoviral*) disease is a disease affecting parrots and their allies (psittacines). It is often fatal to birds that contract it, and most species do not respond to treatment (TSSC 2001d). The Project is considered unlikely to result in an increase to this KTP, as there are unlikely to be any additional pressures placed on threatened avian species within the locality, assuming mitigation measures are adopted.	✗	✓

Key Threatened Process	KTP Description	Relevance	
Infection of Amphibians with Chytrid Fungus Resulting in Chtreidiomycosis	Chytrid fungus is known to threaten a number of listed frog species, and several common species also appear to be susceptible to it. Mitigation measures are recommended to minimise the potential for introduction of this fungus into the Project site, and should be adopted in order to ensure that the Project does not result in an increase to this KTP.	✘	✓
Predation by Feral Cats	Feral cats (*Felis catus)* are a significant threat to native fauna on the Australian mainland and many offshore islands (DEWHA 2008b). This introduced species is known to occur in the Desert Uplands Bioregion (CDU 2001b), and was observed within the study area during site field surveys. However, assuming mitigation measures are adopted that aim to manage feral species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	✘	✓

***Not identified on the Project site within the course of this study**

H.6.2 Impacts and Mitigation

Outlined below is a description of those processes related to the Project that have the potential to adversely affect flora and fauna species/ecological communities protected under the EPBC Act. For each impacting process, the following information is provided:

- An overview of the process including its causes and potential impacts
- How the impacting process relates to those EPBC Act-listed threatened flora species, TECs and threatened and migratory fauna species of relevance to the Project study area
- How the process will be managed and mitigated to avoid/minimise/reduce adverse impacts to those EPBC Act-listed threatened flora species, TECs and threatened and migratory fauna species of relevance to the Project study area

H.6.2.1 Direct Impacts - Flora and Fauna

Direct impacts are defined as those areas of the project area that are physically disturbed (cleared) by the project activities including mining pit and mine infrastructure. The mine component disturbance area is presented above in Section 2.1, Figure H-3. The disturbance area is a generic area designed to encompass all of the potential direct impact areas on the mining lease.

Vegetation Clearance

Description of the Impact

Maintaining stands of vegetation across the Project site is important in order to maintain high biodiversity levels, carbon sequestration, and aiding ecosystems to maintain an assimilative capacity. Vegetation stands also help to combat the potential impacts of anthropogenic activities, by providing natural solutions to environmental problems, such as soil and bank stabilisation and reducing the risk of salinity and overland flow. Vegetation also provides important habitat for a range of fauna species.

Clearance of habitat can also cause a range of impacts categorised broadly as barrier or edge effects. These effects can include the introduction and / or spread of weed species throughout the Project site, alteration to microclimatic conditions (such as greater light intensity, more wind penetration, lower

humidity) and a reduction in plant health through loss of photosynthetic potential (e.g. as a result of plants being covered by dust generated from vehicle movement on unsealed tracks).

Relevance to Listed Flora and Fauna

The unavoidable loss of potential habitat for EPBC Act-listed threatened flora species, TECs and threatened and (and by proxy, migratory) fauna species of relevance to the Project study area was quantified via the habitat modelling and mapping exercise described in Section H.4.4. Potential habitat maps are provided in Appendix H.A of this report.

Presented below are the results of this quantitative analysis with respect to mapped habitat that will experience direct impacts (i.e. habitat within the 'direct impact footprint' as defined in Section H.4.4.3):

- Table H-7 presents a quantification of the amount of mapped 'high value potential habitat' that will be exposed to direct impacts associated with vegetation clearing
- Table H-8 presents a quantification of the amount of mapped 'low value potential habitat' that will be exposed to direct impacts associated with vegetation clearing

Table H-7 Quantification of Direct Impacts to 'High Value Potential Habitat'

	A	B	C	D	E	F
	Direct impact - number of hectares of HVPH* impacted	Number of hectares of HVPH* in landscape#	% HVPH* in landscape# directly impacted i.e. (a/b)*100	Direct impact footprint area	% Direct impact footprint area that is HVPH* (i.e. a/d)*100	% HVPH* in landscape# i.e. (b/total area of landscape)*100
Threatened Ecological Communities						
Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin	9 ha	1,325 ha	0.65%	7,006 ha	0.12%	0.06%
Plants						
Dichanthium queenslandicum (King Bluegrass)	9 ha	756 ha	1.14%	7,006 ha	0.12%	0.03%
Birds						
Geophaps scripta scripta	1,548 ha	329,846 ha	0.47%	7,006 ha	22.10%	14.36%
Neochmia ruficauda ruficauda	106 ha	30,175 ha	0.35%	7,006 ha	1.51%	1.31%
Erythrotriorchis radiatus	189 ha	51,631 ha	0.37%	7,006 ha	2.87%	2.25%
Rostratula australis	71 ha	36,164 ha	0.20%	7,006 ha	1.01%	1.57%
Poephila cincta cincta	1,747 ha	182,660 ha	0.96%	7,006 ha	24.94%	7.95%
Mammals						
Nyctophilus timoriensis (South eastern form)	189 ha	61,109 ha	0.31%	7,006 ha	2.70%	2.66%
Reptiles						
Denisonia maculata	9 ha	135,919 ha	0.01%	7,006 ha	0.13%	5.92%
Egernia rugosa	2801 ha	660,792 ha	0.42%	7,006 ha	39.98%	28.78%
Furina dunmalli	0.00 ha	141,826 ha	0.00%	7,006 ha	0.00	6.18%
Paradelma orientalis	0.00 ha	3,185 ha	0.00%	7,006 ha	0.00%	0.14%

*HVPH – 'high value potential habitat'
- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

Table H-8 Quantification of Direct Impacts to 'Low Value Potential Habitat'

	A	B	C	D	E	F
	Direct impact - number of hectares of HVPH* impacted	Number of hectares of HVPH* in landscape#	% HVPH* in landscape# directly impacted i.e. (a/b)*100	Direct impact footprint area	% Direct impact footprint area that is HVPH* (i.e. a/d)*100	% HVPH* in landscape# i.e. (b/total area of landscape)*100
Plants						
Dichanthium queenslandicum (King Bluegrass)	0.00 ha	504 ha	0.00%	7,006 ha	0.00%	0.02%
Birds						
Geophaps scripta scripta	1,555 ha	575,590 ha	0.27%	7,006 ha	22.19%	25.07%
Neochmia ruficauda ruficauda	851 ha	225,408 ha	0.38%	7,006 ha	12.15%	9.82%
Erythrotriorchis radiatus	2,913 ha	851,049 ha	0.34%	7,006 ha	41.59%	37.06%
Rostratula australis	205 ha	81,431 ha	0.25%	7,006 ha	2.93%	3.55%
Poephila cincta cincta	1,642 ha	909,067 ha	0.18%	7,006 ha	23.44%	39.59%
Mammals						
Nyctophilus timoriensis (South eastern form)	3,199 ha	1,049,627 ha	0.30%	7,006 ha	45.67%	45.71%
Reptiles						
Denisonia maculata	36.56 ha	206,439 ha	0.02%	7,006 ha	0.52%	8.99%
Egernia rugosa	588 ha	448,242 ha	0.13%	7,006 ha	8.40%	19.52%
Furina dunmalli	0.00 ha	156,381 ha	0.00%	7,006 ha	0.00%	6.81%
Paradelma orientalis	0.00 ha	2,002 ha	0.00%	7,006 ha	0.00%	0.09%

*LVPH – 'low value potential habitat'
- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

How Impact will be Mitigated / Managed

Although the vegetation within the Project site is well-represented in the wider region and does not represent any EPBC Act listed communities, in recognition of the intrinsic value of ecological habitat, every effort will be made to keep proposed disturbance areas to a minimum.

Clearing of vegetation along Sandy Creek will be minimised to maintain habitat connectivity and provide a movement corridor for small terrestrial fauna species. Whilst this community will be physically fragmented, the actual degree of habitat fragmentation is highly dependent on the mobility of the organism in question (McIntyre and Hobbs 1999) and disconnected areas may continue to be utilised by some species if kept intact. Given the abundance of this community in the wider region it is unlikely the disturbance will have a considerable impact on its ecological value or habitat provision.

Native vegetation removal will be conducted only after:

- The areas to be cleared have been clearly delineated and identified to equipment operators and supervisors;
- Weed control measures such as vehicle wash downs have been implemented to prevent the spread of weed species along riparian corridors;
- Appropriate erosion and sediment-control structures are in place; and
- Clearance from environmental staff has been obtained.

To maintain the integrity of vegetated land that is not cleared, appropriate erosion and sediment controls are will be applied to prevent sediment deposition in remaining habitat. Maintenance of retained areas of existing vegetation would also provide a source of seed for mine rehabilitation works.

An offsets strategy is presented in this EIS (Volume 2, Appendix Z) and will be further developed in consultation with relevant government agencies in an effort to offset significant impacts on habitat agreed as important to the survival of the EPBC listed species identified within this study.

Fauna Mortality

Description of the Impact

Any construction activity undertaken in an undisturbed environment has the potential to cause wildlife mortality if animals are present when vegetation is cleared, or where animals venture into active construction zones. Construction of the mine will require clearance of native vegetation therefore fauna residing in this vegetation may experience direct mortality. Animals that are particularly at risk include those that shelter in hollows, beneath rocks, logs and bark and ground animals that tend to hide rather than flee at approaching danger.

Increased vehicular movements associated with construction and operational activities have the potential to increase the incidence of wildlife strike and road kill. However, given vehicle movements are expected to be relatively slow the risk is expected to be minimised. Similarly, wildlife that is highly mobile is at risk of being trapped or injured in open pits or trenches within the Project site.

Relevance to Listed Flora and Fauna

Any species of conservation significance within the direct impact footprint are at risk of mortal impacts. Table H.7 and Table H.8 above outline the amount of potential high and low value habitat within the direct impact footprint for each species.

How Impact will be mitigated/managed

Measures will be taken to minimise harm to affected fauna communities by inspecting the vegetation to be disturbed prior to clearing to ascertain whether any fauna are present. If fauna is present, it will be given the opportunity to move on naturally before clearing occurs.

The southern Squatter Pigeon, recorded during the surveys is directly threatened by *clearing and fragmentation of grassy woodland habitat for agriculture and development* (Department of Environment and Conservation, 2004). Relevant habitat clearance related mitigation measures for this species will therefore include:

- Care will be taken to ensure no mortality occurs due to vehicle strike. The behavioural characteristics of this pigeon tends to make it vulnerable to such accidents in that it is known to freeze in an attempt to go unnoticed instead of fleeing like the majority of other birds. This species has commonly been observed on tracks and roadways and in areas of vehicle activity. Persons operating vehicles in and adjacent to the Project site should be made aware of the presence of this threatened species and the potential for it to be encountered on vehicle tracks;
- Fauna spotters will conduct a thorough survey of the site prior to any vegetation clearing to determine the location of any squatter pigeon nests. Particular attention should be given to areas of short dry grass, grass tussocks and under bushes and fallen logs. If nests are located, translocation of the eggs/young should be conducted by qualified personnel to a suitable nearby habitat;
- Control of pest species, such as the European Rabbit and Feral Goat in areas known to be foraging habitat; and pests such as the Feral Cat in areas where the Southern Squatter Pigeon is known to flock; and
- Raise awareness of this species through a staff induction program, including photos, descriptions and preferred habitat.

H.6.2.2 Indirect Impacts – Flora and Fauna

The indirect impacts were calculated based on each impacts rationale as outlined below. As discussed above in Section H.4.6.3, in some cases, due to the conservative nature of the current direct disturbance area, the indirect impact will be nullified. An example of this is the groundwater indirect impact which has been calculated as a function of the distance to the mining pit. In many areas of the site the direct impact footprint extends beyond the potential impact envelope (200 m from the pit) resulting in no indirect impact in relation to groundwater in those areas.

Indirect Impact - Habitat Fragmentation and East - West Connectivity

Description of Impact

Barrier effects on fauna occur when a species is unable or unwilling to move between suitable habitats. This is caused by increased habitat fragmentation due to the construction of roadways and other mine infrastructure. The species that are most vulnerable to barrier effects include habitat-specific fauna and species with low mobility (where even a small reduction in mobility can reduce genetic continuity within a population, hence reducing the effective population size). Species least vulnerable to barrier effects tend to be those that are highly mobile, including birds and larger mammals, although even these species can vary in their response to barriers. Species with low mobility that utilise the Project site have the potential to become genetically isolated. This occurs when individuals from a population within one fragment are unable to interbreed with individuals from populations in adjoining fragments.

Relevance to Listed Flora and Fauna

The Queensland DERM BPA mapping Criterion J ('Corridors') was applied to the habitat mapping (as presented in Appendix H.A of this report). This criterion ensures both existing vegetated corridors important for contiguity including re-growth and cleared areas that could serve this purpose if revegetated are assessed. These corridors include riparian habitats, transport corridors and "stepping stones" for motile species.

As a result of this mapping exercise Brigalow Belt and Desert Uplands corridors were identified within the region of the Project (see maps produced in Appendix H.A), however no corridors were identified within either the indirect or direct disturbance or the MLA of the Project. Thus, this potential indirect impact from the Project is not considered of relevance to EPBC-listed Flora and Fauna.

Indirect Impact - Water Resources and Pollution

Description of Impact

For riparian woodlands downstream of the proposed mine site, changes in stream flow patterns can possibly result in increased levels of stream erosion (depending on surface water diversion design) and thus elevated concentrations of suspended sediment. Higher levels of erosion can lead to a loss of morphological diversity in streams, thereby adversely affecting habitat quality. Such a reduction in habitat quality may also result in a loss of biodiversity in impacted areas.

Mine water demands for the Project comprise:

- CHPP make-up water;
- Haul road, coal transport and hardstand watering (dust suppression);
- Workshop and vehicle wash (Mining Infrastructure Area [MIA]);
- Potable water; and
- Miscellaneous uses, such as construction water.

The construction of a diversion channel and system of levees is proposed to divert flows in Little Sandy Creek and Rocky Creek around the central open-cut pit and into Middle Creek. The diversion may result in some impacts on the environmental values of the aquatic flora and fauna including:

- Clearing of riparian vegetation may result in erosion and sedimentation-related impacts, especially in the early years after the diversion, prior to re-establishment of foliage;
- High velocity flows can dislodge young establishing plants with inadequate root systems. Similarly, if plants are unable to establish deep root systems that can access deep soil water during the dry season, their probability of surviving is reduced;
- For sections of the channel excavated into rock, there is a risk that shallow rooted plants will be dislodged during high flows or not survive during the dry season, due to inadequate root depth which provides anchoring and/or access to soil moisture;
- Sections of the diversion channel which are cut into softer alluvial material would require a different set of parameters for vegetation establishment. In particular, instability of topsoil placed on the channel banks can result in young plants being scoured out. Even though soft when wet, the banks can also be compacted during construction thus restricting initial root establishment;
- Clearing of riparian vegetation may result in fragmentation of a valuable wildlife corridor, which, while not a major issue for mobile species (birds, bats), can be detrimental for the smaller terrestrial species; and
- Works occurring in the creek during and immediately following periods of flow may impede fish movements.

Relevance to Listed Flora and Fauna

Changes to water quality and hydrology as a result of the Project may impact upon the quality of habitat for EPBC Act-listed species associated with the aquatic environment. EPBC-Act listed fauna that may utilise riparian habitats include the black-throated finch (southern), squatter pigeon (southern), red goshawk, Australian painted snipe, northern quoll and ornamental snake.

How Impact will be mitigated/managed

Other diversion channel design and construction studies as well as recommendations from the ACARP guidelines, show that constructing the diversion channel in stages and having a rehabilitation plan can increase the success of vegetation establishment and reduced the chance of excessive channel erosion. Based on the current mine plan, the diversion channel would be constructed early in the mine development. Stabilisation measures, such as rock riprap or similar works, would be constructed as part of the diversion channel to protect the channel from erosion following construction and commissioning, allowing for vegetation to progressively establish along the diversion channel.

Should the mine plan change or difficulties during construction be encountered (e.g. unfavourable geology encountered) and the time allowed for vegetation establishment reduced, hard engineering erosion protection techniques may be implemented, such as rock armouring.

Quickly establishing deep healthy root systems for both artificial and naturally established native plants will be critical to the ecological success of the diversion. A comparison of the diversion channel to geotechnical information has not been conducted for this study, but it is likely that most of the diverted channel will be cut into softer alluvial soils and some rock. Site preparation requirements, as a prerequisite for vegetation establishment, will be different for each substrate condition.

Rapid and deep root development must be encouraged with adequate soil depth created by adding rock cover and infilling with weed free, non-dispersive soil. In addition, in sections of the alluvial

channel where there are dispersive soils (if found), geotextile could be placed on the bank before capping with fractured rock. In these sections, the depth of the rock/soil mix could be increased to allow for restricted root growth through the underlying geotextile.

Diligent weed control, particularly in the stripping, stockpiling and re-spreading of topsoil will be a high priority. Basic machinery hygiene would need to be maintained. Grazing animals may also damage newly revegetated areas and these would need to be excluded by fencing if necessary.

The design of the diversion channel at the transitions with the four creeks would need to consider protection strategies. Protection strategies such as rock armouring should be considered for the bed and banks to ensure that the changes in flow direction do not create scour potential.

The proposed surface water monitoring for the Project will include surface water quality monitoring and monitoring of stream diversion performance. The proposed monitoring programs are detailed in the Surface Water section of this EIS (Volume 1, Section 11.5) and summarised below.

Two programs are proposed for surface water quality monitoring. A baseline monitoring program and an on-going water quality monitoring program are proposed to assess the impact of the Project operations on the receiving environment. Both programs would be undertaken in accordance with the *DERM Monitoring and Sampling Manual 2009,* which provides guidance on techniques, methods and standards for sample collection; sample handling; quality assurance and control; and data management.

A proposed monitoring program for the Little Sandy Creek, Rocky Creek, and Middle Creek diversion is based on the "Monitoring and Evaluation Program for Bowen Basin Diversions" (ID&A, 2000) undertaken for the Australian Coal Association Research Program (i.e. the ACARP guidelines for stream diversions). The goal of the monitoring program is for the diversion to be considered as a reach or stream operating in dynamic equilibrium in order to achieve diversion licence relinquishment. Application for diversion licence relinquishment will occur at mine closure and depend on outcomes of the monitoring program.

Indirect Impact - Noise, Vibration and Light

Description of Impact

Construction and operation activities may cause increases in noise, vibration and light disturbance. This may result in localised disturbance to wildlife behaviours and dynamics (i.e. foraging, breeding and nesting) adjacent to the Project footprint. For example, exposure to unusual noise and light disturbance has been known to influence nesting behaviour and species richness in some sensitive species, especially birds (Francis *et al*., 2009). Increased lighting may also subject some native species to higher levels of predation.

Detail relating to the spatial extent of Noise, Vibration and Light impacts can be found above in Section H.4.6.4.

Relevance to Listed Flora and Fauna

Habitat degradation associated with noise, vibration and light may cause a reduction in the suitability of habitat for less-mobile species (i.e. ground-dwelling reptiles (ornamental snake, yakka skink, Dunmall's snake, brigalow scaly-foot), nesting birds (black-throated finch (southern), squatter pigeon (southern), red goshawk), and temporary avoidance of suitable habitat by more wide-ranging animals

(i.e. northern Quoll, EPBC Act-listed threatened and migratory birds of relevance to mine study area). The extent of the impacts, as discussed above in Section H.4.6.4, is unlikely to extend beyond the following:

- Noise – 200 m from the edge of a modelled 60 dB noise contour.
- Vibration – 1,000 m from the edge of the open cut pit.
- Light – 50 m from the edge of the project disturbance area.

How Impacts will be mitigated/managed

In an effort to minimise the impacts of Noise, Vibration and Light on EPBC Listed species potentially occurring within the indirect impact zones, the following strategies will be adopted.

Noise and Vibration

The Proponent will:

- maintain all plant and equipment in good working order to ensure compliance with the noise criteria;
- site and design noise generating plant to comply with the applicable noise criteria at receptor locations outside of the mining lease boundary;
- develop a noise, vibration and overpressure monitoring program, making results of this monitoring available to the relevant authority upon request; and
- take immediate action to investigate and remedy any exceedance of the established noise, vibration or overpressure criteria; and

The following control strategies for blasting will be implemented:

- Carry out blasting only during daylight hours.
- Where there exists the possibility that instantaneous, short-duration, high-level noise events may occur during night-time hours (22:00 – 07:00), consideration will be given to the potential for the disturbance of sleep within residences and the accommodation village.
- Where monitoring or complaints indicate airblast overpressure or ground vibration levels of impact consistently above the environmental protection objectives, the following mitigations measures will be considered:
  - Reducing the maximum instantaneous charge (MIC) by using delays, reduced hole diameter and/or deck loading;
  - Changing the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination;
  - Ensuring stemming depth and type is adequate; and
  - Restricting blasts to favourable weather conditions.

Light

Mitigation measures that may assist in minimising potential light spill include:

- Dust suppression programs;
- Shielding lights with hoods and louvers where practicable;
- Orientating workshop buildings within the mine disturbance area to minimise potential light spill; and
- Work programs will also be arranged, where possible, so that some activities to be carried out across surface areas of the mine that may be visible from surrounding view locations, occur within daylight hours of operation.

Indirect Impact - Dust

Description of Impact

There are currently no air quality (dust) goals or standards defined for the protection of flora and fauna. The available information suggests that the standards and goals that are currently defined to protect human health and amenity are more stringent than required to protect against dust impacts on flora and fauna.

Detail relating to the spatial extent of Dust impacts can be found above in Section H.4.6.4.

Relevance to Listed Flora and Fauna

As mineral dusts, resulting from mining, quarrying, road operations, mineral processing, and wind erosion may be deposited on vegetation to the extent that they impede growth and threaten the survival of plants, project-related dust activities may have localised impacts on habitat that may be suitable for EPBC Act-listed flora and fauna. As discussed above in section H.4.6.4, the extent at which dust impacts are likely to cause such harm is at a deposition rate of 500 mg/m²/day.

How Impact will be mitigated/managed

Control of ambient levels of dust as a result of the operation of the Project may be achieved through reduction of source generation. This may be achieved using several management measures, including:

- Engineering control measures (partially included in the dispersion modelling);
- Dust suppression measures (partially included in the dispersion modelling);
- Rehabilitation of exposed surfaces (excluded from the dispersion modelling); and
- Operational procedures (excluded from the dispersion modelling).

Engineering Control Measures

The Proponent has designed engineering control measures into the project, where appropriate and technically possible. Controls incorporated in the dispersion modelling, that will be implemented on-site, include:

- watering during processing at the CHPP using water sprays; and
- U-shaped conveyors resulting in reduced emissions during high speed winds.

Additional control measures will be considered for application at the site that may further reduce dust emissions may include but are not limited to:

- enclosure of transfer points and sizing stations;
- roof on overland conveyors;
- belt washing and belt scrapers to minimise dust from the return conveyors;
- reduced drop height from stackers to stockpiles; and
- enclosure of raw coal surge bins.

Dust Suppression Measures

Dust suppression measures will primarily include the application of water to control dust emissions such as:

- watering of haul roads to best-practice level (more than 2 litres/m^2/hour of water applied).

Other possible dust suppression measures that will be considered and may be applied at the site include:

- watering of ROM stockpiles using water sprays as required (e.g. when dust is visibly observed as being generated from stockpiles due to stacking and reclaiming activities, or as a result of wind speed dependant emissions);
- water sprays on stacker/reclaimer units;
- water sprays at conveyor transfer points; and
- optimal moisture content of product coal and reject material as they leave the CHPP which avoids the need for supplementary watering.

In the event that adverse conditions are encountered during cumulative operation of the Project and the Alpha Coal Project (Mine), additional dust suppression measures may have to be implemented. The requirements for these additional dust suppression measures will be determined through the Operational and On-Site Meteorological Monitoring Program, detailed in the EMP presented in this EIS (Volume 2, Appendix W, Section W.3.3.8 Monitoring).

Indirect Impact - Introduced Species

Description of Impact

Edge effects resulting from the proposed works can include the establishment of weeds, alteration to microclimatic conditions (such as greater light intensity, more wind penetration, lower humidity) and a reduction in plant health through loss of photosynthetic potential (as a result of plants being covered by dust generated from vehicle movement on unsealed tracks). In the absence of appropriate control measures, the Project has the potential to cause impacts in relation to edge effects, and particularly in relation to the introduction and / or spread of weed species throughout the mine study area.

Three weed species declared as Class 2 weeds under the LP Act were recorded on the Project site during field surveys. The Class 2 classification means that the pests are established in Queensland and have, or could have adverse economic, environmental or social impacts. The management of these species requires regional coordination and are subject to programs led by the local government, community or landowners. Under the LP Act, landowners must take reasonable steps to keep land

free of Class 2 pests. An increase in introduced fauna species may also occur as the mine study area becomes utilised.

Detail relating to the spatial extent of Invasive Species impacts can be found above in Section H.4.4.4.

Relevance to Listed Flora and Fauna

Weeds and pests pose a significant threat to Australia's natural ecosystems. Extensive invasions can change ecological structure and upset the ecological balance in affected communities as they compete for space and resources with native species, including the EPBC-listed species identified within this assessment. In particular mines are prone to weed invasion, particularly where soils have been disturbed, along transport routes and surrounding infrastructure areas. The risks posed by weeds in mining areas include the introduction of new species, the spread of weeds to adjacent areas and increases in weed abundance in disturbed areas. Weeds can also diminish rehabilitation efforts by outcompeting species selected for revegetation and reduce overall land productivity.

How Impact will be mitigated/managed

Weeds

A number of weed management strategies are proposed to minimise the potential of future weed infestations. These will be adopted for all stages of mine activity including construction, operation and rehabilitation:

- The present location of weeds will be highlighted and a comprehensive weed spraying program implemented prior to the commencement of works. Declared weed species will be treated as per the relevant DEEDI fact sheet for each particular species;
- All organic materials, such as soil, will be certified as weed-free prior to acceptance on-site;
- Wash down facilities will be constructed at access points for vehicles arriving and departing from the Project site. These facilities will be bunded and located away from drainage lines to minimise the risk of weed spread;
- All vehicles entering the Project site and leaving properties known to contain declared weeds will be thoroughly washed down before entering clean areas; ensuring wheels, wheel arches and the undercarriage are free of mud and plant material;
- Radiators, grills and vehicle interiors will be cleaned for accumulated seed and plant material;
- Soil and fill material from weed affected areas will not be transported to clean sites. Minimising soil disturbance will limit the ability of weeds to become established;
- If weeds of management concern are identified, they will be eradicated from the site in accordance with local best management practice from the Jericho Shire Pest Management Plan and/or the DEEDI Pest Fact sheets Burdekin Dry Tropics Regional Pest Management Strategy (Maunsell Australia Pty Ltd, 2008) and / or the DEEDI Pest Fact Sheets (DEEDI, 2007);
- Observations of treated areas to assess the success of declared weed eradication will be undertaken;
- To promote the awareness of weed management issues, weed management will be included in the site induction program for the Project; and

- Prepare a site-specific Weed Management Plan (WMP). The WMP will describe how the weeds are to be managed in accordance with the LP Act and / or local government requirements for weeds not declared under state legislation.

The following monitoring and reporting criteria are to be implemented for the Project study area:

- A Weed and Pest Management Plan is to be developed for implementation during construction;
- Monitoring in the form of annual observations by site personnel for weeds of management concern should be undertaken. These should be conducted following significant rain events in the wet season particularly in disturbed areas, roadsides, riparian zones and wash down facilities;
- All materials should be certified as weed free prior to acceptance on-site; and
- Monitoring in the form of annual observations by site personnel for weeds of management concern will be undertaken. These will also be conducted following significant rain events particularly in disturbed areas, roadsides, riparian zones and wash down facilities once safe access can be provided.

Pests

There were eight introduced pest fauna species recorded during the field surveys, including the Cane Toad (*Rhinella marina*), House Mouse (*Mus musculus*), Feral Cat (*Felis catus*), Feral Pig (*Sus scrofa*), European Rabbit (*Oryctolagus cuniculus*), Feral Goat (*Capra hircus*), Feral Dog (*Canis lupis familiaris*) and Dingo/Wild Dog (*Canis familiaris dingo*), The latter six of the introduced pest fauna species identified on the Project site are declared as 'Class 2' pests under the Land Protection (Pest and Stock Route Management) Act 2002. Due to the potential for these species to impact on the environmental values of the Project Site, land managers are legally required to take reasonable steps to ensure that lands are kept free of Class 2 pests.

An EMP has been developed for the Project, detailing the management strategies which will be implemented to address the potential impacts of significant vertebrate pests (Volume 2, Appendix W, Section W.3.9.5). Environmental monitoring will be undertaken both during construction and operational phases of the project. Monitoring data shall be assessed and documented for future and current applications including advancements in mitigation measures and current adaptive management practices. Monitored data shall be reported to the relevant authority, particularly DERM, who plays a major role in environmental regulation and management within the mining industry.

The Project's pest management strategies will include the following actions:

- the present location of weeds will be highlighted and a comprehensive weed spraying program be implemented, prior to the commencement of works. Declared weed species will be treated per the relevant Queensland Department of Employment, Economic Development and Innovation (DEEDI) fact sheet for each particular species;
- monitoring in the form of annual observations by site personnel for weeds of management concern will be undertaken. These will also be conducted following significant rainfall events, particularly in disturbed areas, roadsides, riparian zones and wash down facilities, once safe access can be provided;

- wash down facilities will be constructed at access points for vehicles arriving and departing from the Project site. These facilities will be bunded and located away from drainage lines, in order to minimise the risk of weed spread;
- all vehicles entering the Project site and leaving properties known to contain declared weeds will be thoroughly washed down before entering clean areas; ensuring wheels, wheel arches and the undercarriage are free of mud and plant material;
- radiators, grills and vehicle interiors will be cleaned for accumulated seed and plant material;
- a site-specific feral animal control plan will be generated and implemented on the Project site;
- soil and fill material from weed-affected areas will not be transported to clean sites. Minimising any soil disturbance has the potential to limit the ability of weeds to become established; and
- if weeds of management concern are identified, they will be eradicated from the site in accordance with local best management practice from the Burdekin Dry Tropics Regional Pest Management Strategy (Maunsell Australia Pty Ltd, 2008) and / or the DEEDI Pest Fact Sheets (DEEDI, 2007).

Indirect Impact - Groundwater Drawdown

Description of Impact

Some ecological communities can be reliant on groundwater sources for their survival. Such communities are reffered to as Groundwater Dependent Ecosystems (GDE). In such instances, if the groundwater of which the GDE is dependent upon is drawn down, the survival of the GDE can be at risk.

Relevance to Listed Flora and Fauna

The impacts of groundwater drawdown on vegetation communities within the Project site are regarded as low. There are no identified groundwater dependent ecosystems located on the Project site, and the groundwater piezometeric levels associated with usable aquifers are at depths >20 m and thus not accessible to the existing vegetation.

Greater detail relating to this can be found above in Section H.4.4.4.

How Impact will be mitigated/managed

In order to validate this conceptualisation and obtain additional groundwater - surface water interaction information across the entire mine site, nested bores, comprising shallow (~ 10 m into the weathered Tertiary and Quaternary alluvium) and deep (~ 30 m into the underlying coal seam aquifers) are being constructed along Sandy Creek. These bores will allow for further assessment of possible hydraulic connectivity.

Based on the bore baseline monitoring program, trigger and guideline values for assessing impacts of groundwater drawdown related to mining activities will be proposed for all identified aquifers, including the perched water table(s). If mine induced groundwater drawdown is indicated, mitigation through the Proponents "make-good" commitment will be made, which could include artificial recharge of affected areas.

Indirect Impact - Waste

Waste generation will occur throughout construction, operation and decommissioning of the Project. On the basis of estimated waste generation and characterisation, a practical waste management system will be developed and implemented to avoid the impacts of waste generation and disposal on the environment or health of the Project workforce or local community.

Waste is generally split into two types, mining waste and general (non-mining) waste. Project waste generated through mining (overburden) and coal processing (coarse rejects and tailings) has been defined within this EIS as mining waste (i.e. materials of non current marketable or useful value). The coarse reject as the name implies is the larger pieces of overburden and coal that are not suitable for product sale. The tailings material is the fine component of this waste material and is typically too high in ash or moisture to be of marketable value. Both coarse reject and tailings are segregated from the coal product in the CHPP. The Project coal rejects (coarse and fine) are expected to comprise in the order of 1.7% of all mining waste produced by the Project. The Project is expected to generate up to 30 Mtpa of product coal from open cut pit and longwall underground operations with the scheduled 30 year life of mine.

Environmental harm could potentially occur in and around the Project site if wastes are not managed properly according to the planned management strategies. Sensitive receptors including residences and ecosystems sounding the Project site could be impacted if AMD from PAF mining wastes and other waste streams entered waterways and groundwater systems and migrated off-site. Similar, air emissions, such as dust, have the potential to impact off-site sensitive receptors. The following waste streams from the Project have the potential to impact on the environment:

- solid waste (other than mining waste) including regulated waste, general waste and sewage;
- coal and mining wastes;
- waste water from the mining operations and CHPP; and
- air emissions including particulates, fumes and odour from the Project during construction and operation.

The following mitigation and management measures will be adopted to ensure any impacts from waste on MNES is minimised.

General Mine Waste Measures

- All regulated waste will be appropriately disposed of to a facility licensed to receive such wastes and, where required, be tracked.
- As part of the staff awareness and induction program, re-use and recycling will be encouraged.

Mining Waste Measures

- A Mining Waste Management Plan (MWMP) will be developed for the Project prior to construction and will detail the mining waste management strategies for the Project and will focus on managing and monitoring the AMD potential and saline/sodic characteristics of coal and mine waste materials.
- The Proponent will continue ongoing infill drilling programs and operational geochemical characterisation of coal and mining waste materials from the Project area to verify the predicted geochemical characteristics of these materials..

- Acquired geochemical data will be used to refine the management strategies adopted for coal and mining waste materials. For future work, in addition to standard acid-base and metals testing (static tests) and kinetic leach column tests, geochemical characterisation of overburden materials will include assessing the general soil properties (sodicity, exchangeable cations) of selected mined waste materials to confirm their suitability for use in surface revegetation and rehabilitation activities.Surface water and leachate derived from, or in contact with, coal and mining waste materials will be monitored to ensure that water quality is being managed and not significantly compromised by proposed site management practices.
- Surface water and leachate derived from, or in contact with, coal and mining waste materials will be monitored to ensure that water quality is being managed and not significantly compromised by proposed site management practices. Potentially impacted surface waters will be primarily managed by retaining water on-site. This water will be reused in the site water management system. This will be particularly important in the CHPP and open pit areas where stored materials may produce brackish run-off water.
- Coal and mining waste materials will be monitored for geochemical characteristics (pH, EC, acidity, alkalinity, sulphur species (total Sulphur and chromium reducible Sulphur) and ANC) on a monthly basis until such time as the variability of the geochemical characteristics of these materials is well defined (approximately 12 months).
- Surface and seepage water at coal and mining waste storage areas will also be monitored on a monthly basis (as well as opportunistically during rainfall events when access is available) and tested for pH, EC, Total Dissolved Solids (TDS), acidity and alkalinity, major anions (sulphate (SO4), chloride (Cl), fluoride (F)), major cations (calcium (Ca), magnesium (Mg), sodium (Na) and potassium (K)) and trace metals (aluminium(Al), arsenic (As), antimony (Sb), boron (B), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), molybdenum (Mo), nickel (Ni), selenium (Se), silver (Ag), uranium (U), vanadium (V) and zinc (Zn)) will be included in the range of parameters tested in these water samples, initially on a quarterly basis (for 12 months) and then on an annual basis throughout the life of mine.
- Open-pit mining geological control coupled with pre-mining and ongoing geochemical sampling and testing of mining materials will be used to delineate the extent of any minor amounts of PAF overburden materials located near the coal units and ensure that these are selectively handled and managed in a similar manner to PAF coarse coal reject materials.
- Future sampling and geochemical testing of mining materials at the Project will be completed to align the infill drilling and future drilling programs.

Indirect Impact - Subsidence

Description of Impact

In longwall mining, a panel of coal, typically about 400 m wide and 3.5 km to 6 km long and 2.8 to 4.5 m thick, is removed by longwall shearing machinery, which travels back and forth across the coalface. The area immediately in front of the coalface is supported by a series of hydraulic roof supports, which temporarily hold up the roof strata and provide a working space for the shearing machinery and face conveyor. After each slice of coal is removed, the hydraulic roof supports, the face conveyor and the shearing machinery are moved forward.

When coal is extracted using this method, the roof above the seam is allowed to collapse into the void that is left as the face retreats. This void is referred to as a goaf. As the roof collapses into the goaf, the fracturing settlement of the rock progresses through the overlying strata and results in sagging and bending of the near surface and subsidence of the ground above. Generally, subsidence occurs over the centre of the longwall panel and tapers off around the perimeter of the longwall. The subsidence is typically less than the thickness of the coal extracted underground. Where several panels are mined in a series, chain pillars are left between the panels. The chain pillars crush and distort as the coal is removed from both sides of them, but usually, they do not totally collapse, and hence the pillar provides a considerable amount of support to the strata above them leaving an area of less subsidence than where the coal has been extracted.

The subsidence at the surface does not occur suddenly but develops progressively as the coal is extracted within the area of influence of the extracted panel. As further adjacent panels are extracted, additional subsidence occurs where the coal is extracted. The subsidence effect at the surface occurs in the form of a very slow moving wave, which is typically 6 m per day in the direction of extraction. A map showing the predicted subsidence arising from the proposed longwall mining is shown on Figure H-9.

General potential surface impacts as a result of subsidence can include:

- Impacts to catchment boundaries, potentially resulting in self contained catchment areas, where water that would have runoff to the creek channels prior to subsidence, could now pool within the subsided area and be lost to groundwater due to percolation;
- Loss of surface water flow through limited surface cracking, where the goaf connects through to the surface;
- Change to stream bed profiles between longwall panels, resulting in erosion between adjacent longwall panels and sedimentation over the tops of the longwall panels;
- Potentially increased or reduced flood capacity in channels, resulting in changes to the frequency of inundation of floodplain areas;
- Reduce stability of the proposed levees or other water retention devices within the subsidence area and increasing the risk of a failure during a flood event.

Additionally, as the panels subside, there is the potential that the volume of water that would have contributed to the downstream system could be lost of the creek system by:

- Formation of surface depressions which capture direct rainfall and no longer drain to the natural (or diverted) channel; and
- Increased percolation to the groundwater through surface cracking

However, effects of subsidence will be limited due to high plasticity of the overburden materials (Further detail in relation to these soils can be found in the Geology section of this EIS (Volume 1, Section 4)). In addition, as the longwall operations will be progressing from East to West, under a rising topography, the effect of ponding water will be limited.

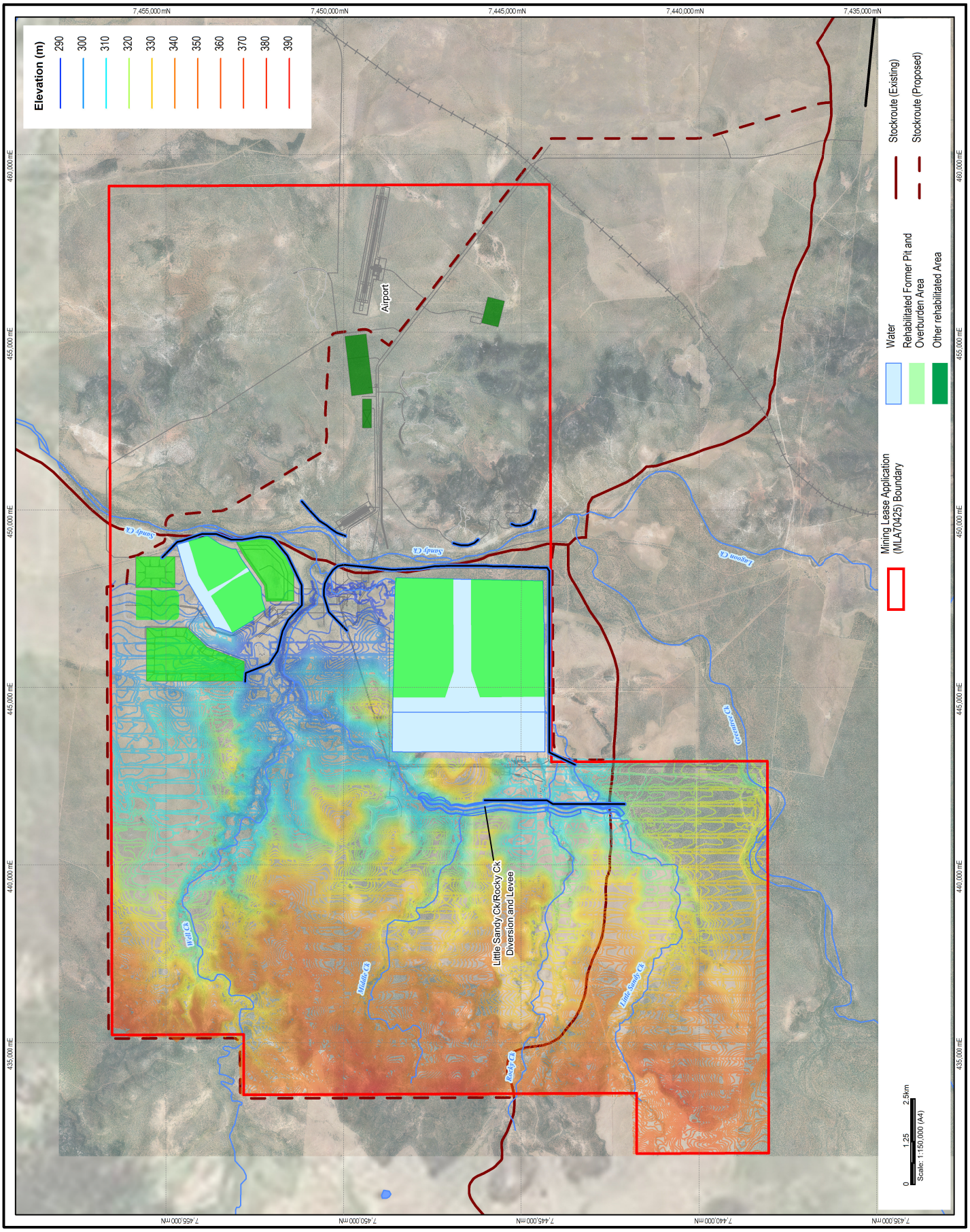
Relevance to Listed Flora and Fauna

Due to the low degree of projected subsidence, negative impacts on Terrestrial Flora and Fauna as a direct result of subsidence are likely to be minimal. Based on the current underground mine plan and subsidence surface terrain modelling, the reduction in the effective catchment area and catchment yield of the Sandy Creek is expected to be small. The area of the Sandy Creek catchment upstream of the Project area is approximately 2,190 km^2 and the Sandy Creek catchment area to the confluence with Well Creek, is approximately 2,210 km^2. It is predicted that a combined area of approximately 2 km^2 will become isolated from the Sandy Creek catchment through subsidence and will temporarily store ponded water. This represents an effective reduction in the Sandy Creek catchment upstream of the site of approximately 0.7%. The effective reduction in the total catchment area of the Sandy Creek catchment is approximately 0.1%. The reduction in catchment area and downstream catchment yield should therefore not adversely impact the local catchment.

How Impact will be mitigated/managed

There are a range of proposed mitigation and management strategies in relation to Subsidence at the Project. These are also discussed in Section W.3.4.6 of the EM Plan (Volume 2, Appendix W of this EIS) and include:

- in order to mitigate the effects of pooled water from self contained catchments, the progressive re-establishment of free drainage in the subsidence area will be completed, as far as practicable (e.g. excavated trapezoidal drainage channels) where the rehabilitation will not have a detriment over the subsided area;
- surface cracks greater than 20 mm, will be treated with deep ripping, infilling with clay, and dynamic compaction to reduce water loss. Alternative more expensive treatments such as bentonite injection will be available as fall-back contingency measures in the event that losses continue to occur;
- a post subsidence drainage and waterway monitoring program including mapping downstream and upstream of the active subsidence zone will be used to determine if any increased erosion, sedimentation is occurring in the channel to unsustainable level and/or surface flow losses into cracks is occurring between longwall blocks. Surface cracks within drains and waterways that have not naturally filled after approximately three storm events will be sealed with clay;
- if natural channel erosion and sedimentation does not reduce the volume of channel bed depressions (and consequent ponded water volumes), remedial works to reinstate an evenly graded bed profile (i.e. free draining channel) will be considered; and
- reaches of levee embankments would be assessed for cracking and reconstructed where cracking had the potential to reduce the 1:1,000 AEP flood immunity.



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Datum: GDA94, MGA Zone55

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Kevin's Corner Project
Environmental Impact Statement

FINAL INDICATIVE LANDFORM

Job Number	4262 6660
Revision	B
Date	12-09-2011

Figure: H-9

File No: 42626660-g-2123.wor

Quantification of Indirect Impacts

An 'indirect impact footprint' was established for each of the indirect impacts from the Project as discussed in Section H.4.4.3 and H.4.4.4 of this report. The amount of potential habitat for EPBC Act-listed threatened flora species, and threatened and (and by proxy, migratory) fauna species of relevance to the mine study area that may experience indirect impacts from the Project was quantified via the habitat modelling and mapping exercise described in Section H.4.4.

Presented below are the results of this quantitative analysis with respect to mapped habitat that may experience indirect impacts:

- Table H-9 presents a quantification of the amount of mapped 'high value potential habitat' that may be exposed to indirect impacts
- Table H-10 presents a quantification of the amount of mapped 'low value potential habitat' that may be exposed to indirect impacts

Table H-9 Quantification of Indirect Impacts to 'High Value Potential Habitat'

	A	B	C	D	E	F
	Indirect impact - number of hectares of HVPH* impacted	Number of hectares of HVPH* in landscape#	% HVPH* in landscape# directly impacted i.e. (a/b)*100	Indirect impact footprint area	% Indirect impact footprint area that is HVPH* (i.e. a/d)*100	% HVPH* in landscape# i.e. (b/total area of landscape)*100
Threatened Ecological Communities						
Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin	43 ha	1,325 ha	3.28%	21,897 ha	0.20%	0.06%
Plants						
Dichanthium queenslandicum (King Bluegrass)	43 ha	756 ha	5.74%	21,897 ha	0.20%	0.03%
Birds						
Geophaps scripta scripta	6,371 ha	329,846 ha	1.93%	21,897 ha	29.10%	14.36%
Neochmia ruficauda ruficauda	599 ha	30,175 ha	1.98%	21,897 ha	2.73%	1.31%
Erythrotriorchis radiatus	1,983 ha	51,631 ha	3.84%	21,897 ha	9.06%	2.25%
Rostratula australis	1,511 ha	36,164 ha	4.18%	21,897 ha	6.90%	1.57%
Poephila cincta cincta	6,976 ha	182,660 ha	3.82%	21,897 ha	31.86%	7.95%
Mammals						
Nyctophilus timoriensis (South eastern form)	2,164 ha	61,109 ha	3.54%	21,897 ha	9.88%	2.66%
Reptiles						
Denisonia maculata	47 ha	135,919 ha	0.03%	21,897 ha	0.21%	5.92%
Egernia rugosa	12,380 ha	660,792 ha	1.87%	21,897 ha	56.54%	28.78%
Furina dunmalli	0.00 ha	141,826 ha	0.00%	21,897 ha	0.00%	6.18%
Paradelma orientalis	0.00 ha	3,185 ha	0.00%	21,897 ha	0.00%	0.14%

*HVPH – 'high value potential habitat'
- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

Table H-10 Quantification of Indirect Impacts to 'Low Value Potential Habitat'

	A	B	C	D	E	F
	Indirect impact - number of hectares of LVPH* impacted	Number of hectares of LVPH* in landscape#	% LVPH* in landscape# directly impacted i.e. (a/b)*100	Indirect impact footprint area	% Indirect impact footprint area that is LVPH* (i.e. a/d)*100	% LVPH* in landscape# i.e. (b/total area of landscape)*100
Plants						
Dichanthium queenslandicum (King Bluegrass)	0.00 ha	504.15 ha	0.00%	21,897 ha	0.00%	0.02%
Birds						
Geophaps scripta scripta	6,658 ha	575,590 ha	1.16%	21,897 ha	30.41%	25.07%
Neochmia ruficauda ruficauda	3,023 ha	225,408 ha	1.34%	21,897 ha	13.81%	9.82%
Erythrotriorchis radiatus	11,046 ha	851,049 ha	1.30%	21,897 ha	50.44%	37.06%
Rostratula australis	103 ha	81,431 ha	0.13%	21,897 ha	0.47%	3.55%
Poephila cincta cincta	7,981 ha	909,067 ha	0.88%	21,897 ha	36.45%	39.59%
Mammals						
Nyctophilus timoriensis (South eastern form)	12,794 ha	1,049,627 ha	1.22%	21,897 ha	58.43%	45.71%
Reptiles						
Denisonia maculata	131 ha	206,439 ha	0.06%	21,897 ha	0.60%	8.99%
Egernia rugosa	2,577 ha	448,242 ha	0.58%	21,897 ha	11.77%	19.52%
Furina dunmalli	0.00 ha	156,381 ha	0.00%	21,897 ha	0.00%	6.81%
Paradelma orientalis	0.00 ha	2,002 ha	0.00%	21,897 ha	0.00%	0.09%

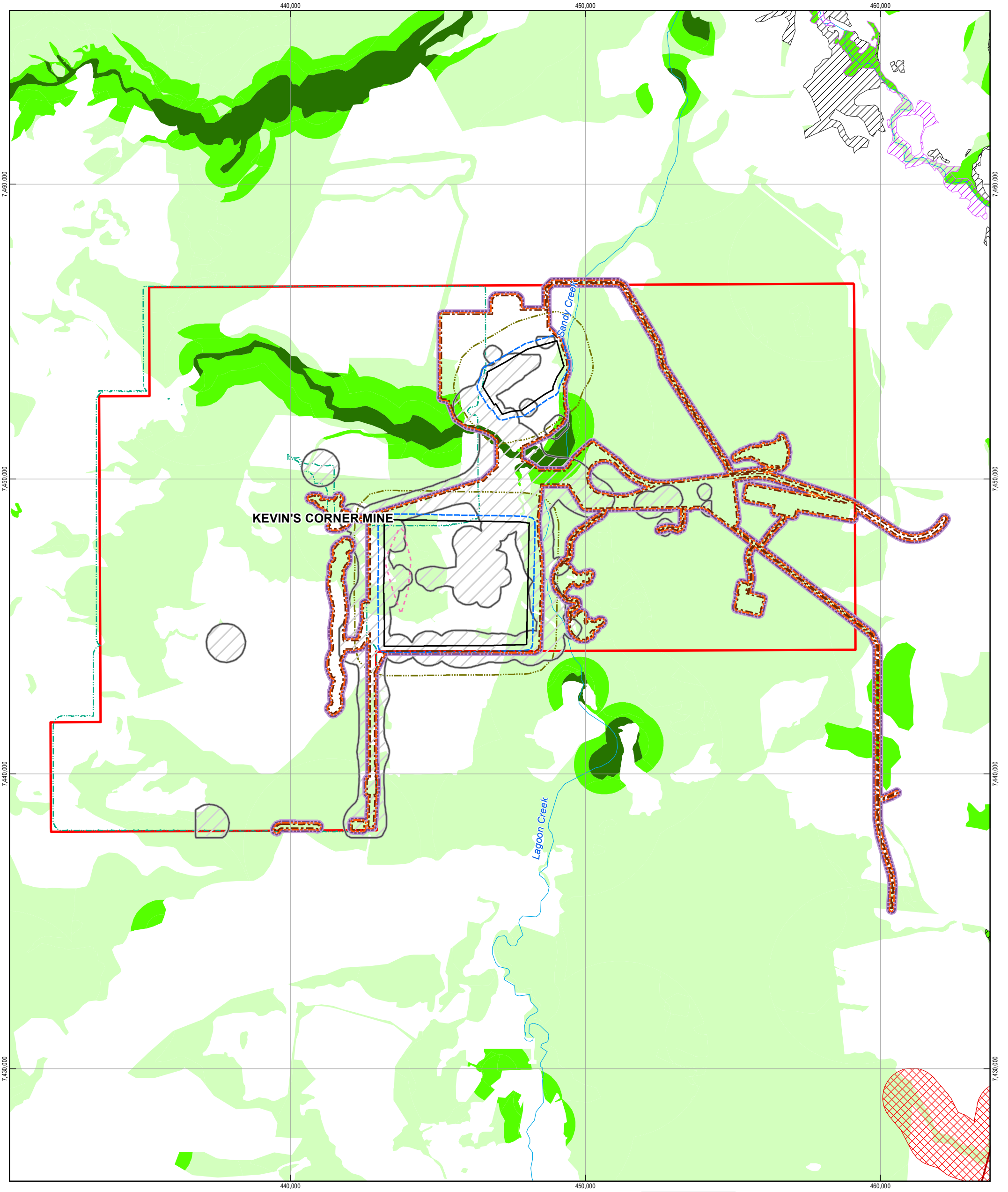
*LVPH – 'low value potential habitat'
- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

H.6.3 Overlay of Impacted Areas

Areas of High Value Potential Habitat (HVPH) within the Project area and region were spatially modelled according to the number of EPBC Act-listed species potentially occurring within them (Figures H-10 and H-11).

As shown in Figure H-10 and Figure H-11, habitats associated with watercourses have the potential to support numerous EPBC Act-listed threatened flora species and threatened (and by proxy, migratory) fauna species. The potential for riparian areas to provide suitable habitat for EPBC Act-listed flora and fauna, as well as the value of these habitats as wildlife corridors (local and regional) for all wildlife, highlights the importance of riparian areas in this landscape. As such, the mitigation measures outlined above should be comprehensively employed at all water crossings and the vegetation (habitat) adjacent to waterways.

Presented below the figures are the results of the quantitative analysis with respect to mapped (overlayed) 'high value potential habitat' that may experience direct and indirect impacts from the Project. Table H-11 presents data relating to the area of habitat that may be subjected to direct impacts. Table H-12 presents data relating to the area of habitat that may be subjected to indirect impacts



LEGEND

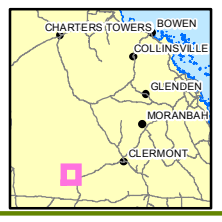
- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Overlay of HVPH Impacted Area
Number of Species
- 1 - 3
- 4 - 6
- 7 - 10
- > 10

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration



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1:120,000 (at A3)

0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Kevin's Corner Project
Environmental Impact Statement

OVERLAY OF HVPH IMPACTED AREA - KEVIN'S CORNER MINE

Job Number	41-23742
Revision	A
Date	19 SEP 2011

Figure H - 10

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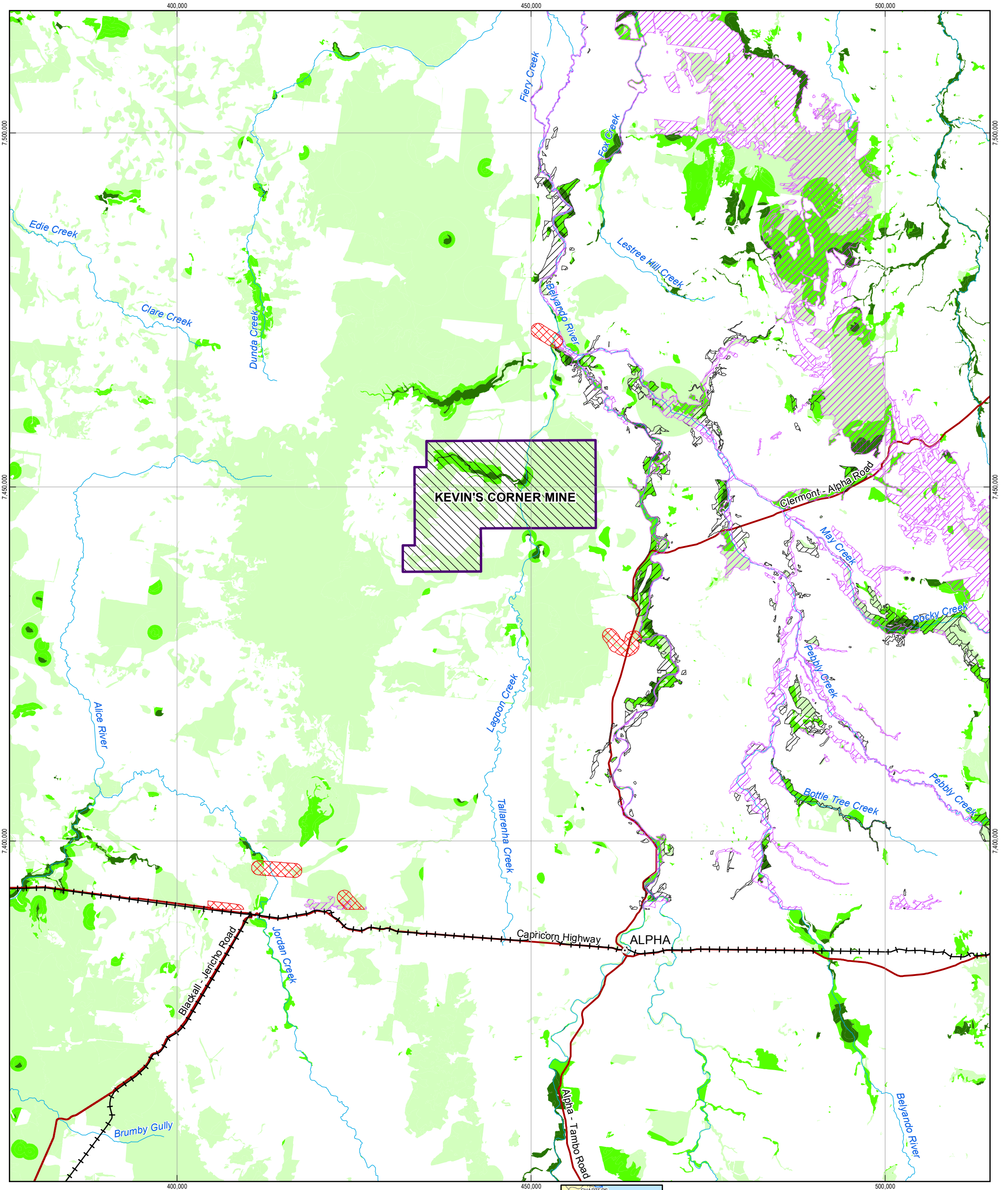

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Overlay of HVPH Impacted Area
Number of Species
- 1 - 3
- 4 - 6
- 7 - 10
- > 10

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1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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OVERLAY OF HVPH IMPACTED AREA - REGIONAL

Job Number	41-23742
Revision	A
Date	19 SEP 2011

Figure: H - 11

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Table H-11: Quantification of Direct Impacts to Overlayed Potential Habitat and Threatened Ecological Communities

	A	B	C	D	E	F
	Direct impact - number of hectares of potential habitat (overlayed)	Number of hectares of potential habitat (overlayed) – landscape#	% potential habitat (overlayed) in landscape# directly impacted i.e. (a/b)*100	Direct impact footprint area	% Direct impact footprint area that is potential habitat (overlayed) (i.e. a/d)*100	% potential habitat (overlayed) in landscape# i.e. (b/total area of landscape)*100
Potential habitat for 1-3 species	2,602 ha	557,130 ha	0.47%	7,006 ha	37.15%	24.26%
Potential habitat for 4-6 species	154 ha	87,363 ha	0.18%	7,006 ha	2.20%	3.80%
Potential habitat for 7-10 species	44 ha	26,244 ha	0.17	7,006 ha	0.63%	1.14%
Potential habitat for >10 species	0.00 ha	0.00 ha	0.00	7,006 ha	0.00	0.00

- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

Table H-12 Quantification of Indirect Impacts to Overlayed Potential Habitat and Threatened Ecological Communities

	A	B	C	D	E	F
	Indirect impact - number of hectares of potential habitat and TECs (overlayed)	Number of hectares of potential habitat and TECs (overlayed) – landscape#	% potential habitat and TECs (overlayed) in landscape# indirectly impacted i.e. (a/b)*100	Indirect impact footprint area	% indirect impact footprint area that is potential habitat and TECs (overlayed) (i.e. a/d)*100	% potential habitat and TECs (overlayed) in landscape# i.e. (b/total area of landscape)*100
Potential habitat for 1-3 species	10,440 ha	557,130 ha	1.87%	21,897 ha	47.68%	24.26%
Potential habitat for 4-6 species	1,573 ha	87,363 ha	1.80%	21,897 ha	7.18%	3.80%
Potential habitat for 7-10 species	529 ha	26,244 ha	2.01%	21,897 ha	2.41%	1.14%
Potential habitat for >10 species	0.00 ha	0.00 ha	0.00	21,897 ha	0.00	0.00

- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

H.6.4 Monitoring and Reporting

Environmental monitoring will occur in accordance with the requirements of the Environmental Authority. The environmental monitoring program will survey and report on aspects of rehabilitation success, surface water quality, groundwater quality and level, particulate and dust deposition and noise. Detail of the proposed monitoring, commitments and Environmental Authority conditions have been included in the relevant sections of the EMP found in this EIS (Volume 2, Appendix W).

The Proponent also aims to provide timely, relevant and appropriately presented information to government authorities, the local community and the general public on the environmental performance of the Project.

Reporting commitments under the Environmental Authority and other legislation will be complied with and includes:

- prepare Annual Returns as required under the Environmental Protection Act 1994;
- submit National Pollutant Inventory (NPI) reports as necessary; and
- report incidents that may potentially compromise compliance with the conditions of the Environmental Authorities immediately to operations management.

Internally, the site Environmental Manager will (in a timely manner) report any incidents or breaches of the EMP or EA conditions to key site personnel and report to the DERM in accordance with the requirements of the Project's Environmental Authority.

With regards to the vulnerable EPBC listed southern Squatter Pigeon (*Geophaps scripta scripta*), the following regional and local priority threat abatement actions approved under s266B of the *Environment Protection and Biodiversity Conservation Act 1999* can be undertaken to support its recovery. An adaptation of relevant Threatened Species Scientific Committee (2008fp) recovery commitments relevant to the Project include:

- Monitoring of known population within the Project area to identify potential threats.
- Manage threats to areas of vegetation that support important populations.
- Develop and implement a stock management plan for key sites.
- Develop and implement a management plan, or nominate an existing plan to be implemented, for the control and eradication of feral herbivores in areas inhabited by the Southern Squatter Pigeon.
- Implement the appropriate recommendations outlined in the Threat Abatement Plan for Predation by Feral Cats (EA, 1999a) and the Threat Abatement Plan for Predation by the European Red Fox (EA, 1999b) in areas inhabited by the Southern Squatter Pigeon.
- Raise awareness amongst all staff involved with the mine site regarding the appearance of the Southern Squatter Pigeon as well as its location on site. Staff should be encouraged to record sightings of the bird.

H.6.5 Decommissioning and Rehabilitation

A rehabilitation strategy has been developed for the Project. It provides details on the proposed final land form and planned rehabilitation activities for the entire Project area. The strategy covers a range of factors that will be accounted for during the rehabilitation process including:

- Proposed post mining land use;
- Proposed post mining land classification;
- Landform design and planning;
- Rehabilitation principles;
- Staged/progressive rehabilitation;
- The management of topsoil resources for use in rehabilitation of the site;
- The proposed revegetation strategy for the project area;
- Weed management;
- Rehabilitation success criteria; and
- Rehabilitation monitoring and maintenance requirements which will apply.

The objectives of rehabilitating the disturbed land comprise:

- achievement of acceptable post-disturbance land use suitability – mining and rehabilitation will aim to create a stable landform with land use capability and/or suitability similar to that prior to disturbance, unless other beneficial land uses are pre-determined and agreed. This will be achieved by setting clear rehabilitation success criteria and outlining the monitoring requirements that assess whether or not these criteria are being accomplished;
- creation of stable post-disturbance landform - mine wastes and disturbed land will be rehabilitated to a condition that is self-sustaining, or to a condition where maintenance requirements are consistent with an agreed post-mining land use; and
- preservation of downstream water quality – surface and ground waters that leave the mining leases should not be degraded to a significant extent. Current and future water quality will be maintained at levels that are acceptable for users downstream of the site.

Rehabilitation of the disturbed land associated with mining will proceed as soon as practicable after the areas becoming available for rehabilitation. The rehabilitation of disturbed land at the mine site will be conducted so that:

- suitable vegetation species are used to achieve the nominated post-mine land uses;
- the potential for water and wind induced erosion is minimised, including the likelihood of environmental impacts being caused by the release of dust;
- the quality of surface water released from the site is such that releases of contaminants are not likely to cause environmental harm;
- the water quality of any residual water bodies (other than the final void) is suitable for the nominated use and does not have the potential to cause environmental harm; and

- the final landform is stable and not subject to slumping or erosion which would result in the agreed post mining landform not being achieved.

Monitoring of the rehabilitated areas will broadly involve the following:

- ongoing chemical analysis of topsoil;
- comparison of soil erosion rates and rill and gully dimensions with measurements taken from reference sites;
- comparison of vegetation measurements with measurements taken from reference sites;
- ongoing analysis of water quality parameters in accordance with the development consent and environmental protection licence conditions from data collected monthly at water storages, ramps and pits, sedimentation dams and sewage effluent outfalls on-site, and continually from creeks (upstream and downstream of mine); and
- visual surveillance including the use of digital photogrammetry / low level oblique or vertical aerial photography to monitor changes over time in the rehabilitation (e.g. changes in vegetation structure, erosion rates and landform drainage).

Further detail relating to the Project's rehabilitation can be found in Decommissioning and Rehabilitation section of this EIS (Volume 1, Section 26).

H.6.6 Cumulative Impacts

The incremental effect of multiple impact sources (past, present and future) is referred to as 'cumulative impacts'. These impacts may become exacerbated over time. A consideration of cumulative environmental impacts combines Project impacts with additional, regional impacts from external sources. It is possible that the highly localised direct impacts and indirect impacts from the Project may contribute to a greater regional loss of/degradation of habitat when an area of impact is assessed cumulatively.

Residual impacts are impacts that remain after a project's environmental management strategies, mitigation measures, and rehabilitation plans have been carried out. Residual impacts for the Project include removal of vegetation and associated habitat. Where there is residual loss or degradation of vegetation, habitat or land use upon completion of mine decommissioning (or as residual impact is identified prior to decommissioning), compensation in the form of further habitat rehabilitation, compensatory habitat, land rehabilitation, contribution to research or offsets can be employed.

The Project is expected to have varying potential cumulative impacts on the environment. Potential impacts are expected to be predominantly localised around the mine site and will continue for the life of the Project. Where possible, adverse impacts are avoided or mitigated via implementation of sound environmental protection and management criteria.

Cumulative effects associated with the Project may include impacts to air quality (dust), groundwater, surface water and noise etc. Additional cumulative effects may occur due to the compounding and synergistic interactions arising from other developments, occurring in the same area or over similar time frames to the project being assessed. Environmental values may be impacted as a result of a geographic overlap of project areas, scheduling overlap or using the same infrastructure, services and resources. Many of the cumulative effects associated with the Project are derived on a broader scale

from transport, economic and social interactions between the Project and other existing or proposed projects within the Project vicinity.

The proposed projects located adjacent to the Project that have the potential to contribute to a significant cumulative impact particularly on social and environmental values in the local area are listed below in Table H-13.

Table H-13: Proposed projects relevant to assessing cumulative impacts of Kevin's Corner Project

Project	Area	Location	Description	Project Status
Alpha Coal Project, Hancock Coal Pty Ltd	Local	Alpha, 50 km north-west.	Open cut coal mine producing 30 Mtpa. Maximum personnel – 2,300	SEIS completed
Galilee Basin Power Station, Galilee Power Pty Ltd (fully owned subsidiary of Waratah Coal Pty Ltd)	Regional	Alpha, 30 km north-west, immediately to the east of Waratah Galilee Coal Mine.	Coal-fired power station producing 900 MW (net). Maximum personnel – 1,000	IAS completed
Waratah Galilee Coal Mine, Waratah Coal Inc. (China First)	Local	Alpha, 13 km west and 35 km north.	Open cut mine with export capacity of 25 Mtpa and capability to expand to more than 50 Mtpa. Maximum personnel – 2,200	EIS advertised
South Galilee Coal Project (SGCP), joint venture of AMCI (Alpha) Pty Ltd and Alpha Coal Pty Ltd.	Regional	Alpha, immediately south-west.	15-20 Mtpa open cut and underground mining operation and associated infrastructure. Maximum personnel – 1,500	IAS completed
Carmichael Coal Mine and Rail Project	State/ National	Clermont	Open cut and underground mine and rail infrastructure, up to 60 Mtpa. Maximum personnel – not known	IAS completed
Powerlink power transmission line	Regional	-	Transmission lines from Lilyvale substation to a new Galilee Hub substation (during construction phase). Maximum personnel – 500	EIS advertised
SunWater raw water line	Regional	-	Water pipeline from Moranbah to a raw water dam within Alpha Coal Project MLA (during construction phase). Maximum personnel – 500	-

H.6.7 Significance of Impacts

Habitat mapping has allowed for the identification of the spatial distribution of potential habitat for the one threatened ecological community, one threatened flora species, ten threatened (and by proxy, migratory) fauna species that may occur, with unknown spatial and temporal variability, across the Project study area. The amount of potential habitat that may experience direct and indirect impacts from the Project has been quantified and an overlay of potential habitat for each of the species was produced. This allowed for identification of areas which may be particularly noteworthy for EPBC Act-

listed flora and fauna. Subsequently, further investigation which may result in management and mitigation may be required.

A discussion of the impacting processes associated with the Project, and how these processes may relate to and impact upon the relevant MNES (flora and fauna) was presented, as well as impact-specific mitigation and management strategies that will prevent, reduce or minimise these impacts.

Presented below is a summary of the significance of impacts to EPBC Act-listed flora, ecological communities and fauna, in the context of the Commonwealth Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DEWHA, 2009b). This assessment expands upon the assessment of significance previously presented in this report.

H.6.7.1 Threatened Species

Endangered Species

The two EPBC-Act listed endangered species considered at risk of potential impacts from the Project were the black-throated finch (southern) and the star finch. Neither species was detected during field studies. Furthermore, during desktop assessments there was no indication that the Project area supported a 'population' of either species, as defined under the EPBC Act. This definition states that a *'population of a species is defined…as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:*

- *a geographically distinct regional population, or collection of local populations, or*
- *a population, or collection of local populations, that occurs within a particular bioregion (DEWHA, 2009b).*

The habitat mapping assessment conducted as part of this study indicated that potential habitat for both species does occur within the Project area and in the surrounding landscape. However, the amount of potential habitat likely to be impacted directly or indirectly by the Project was minimal in proportion to that indicated in the surrounding region. HVPH for the star finch directly impacted was < 1% while the HVPH indirectly disturbed was 1.98% of that found in the surrounding region. In the case of the black-throated finch, the study indicated < 1% of the HVPH in the region would be directly disturbed and 3.82% indirectly disturbed. In both cases this is likely to be less than the margin of error associated with such an analysis.

Although unavoidable loss of potential habitat will be discussed with Federal and State agencies during further development of the offsets strategy, results of this analysis indicate that minimal additional and consequential impacts on either of these species will occur. This conclusion is strengthened when coupled with the implementation of sound mitigation measures, management strategies and monitoring programmes as detailed in the EMP presented in this EIS (Volume 2, Appendix W).

Vulnerable Species

The assessment of the significance of the impacts of an action on EPBC Act-listed vulnerable species focuses on impacts to 'important populations'. An 'important population' is:

- *a population that is necessary for a species long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are*:
  - *key source populations either for breeding or dispersal*
  - *populations that are necessary for maintaining genetic diversity, and/or*
  - *populations that are near the limit of the species range (DEWHA, 2009b).*

As a result of field and desktop studies, a total of 8 EPBC-Act listed vulnerable species were considered to be at risk of potential impacts from the Project. Of the 10 species only the squatter pigeon (southern) was detected during field studies.

Mapping of the potential habitat utilised by EPBC listed species in the Project area indicated that 3 species (*Furina dunmalli, Dicanthium queenslandicum and Paradelma orientalis*) were unlikely to be impacted as none of their potential habitat was indicated within the direct or indirect footprints.

The squatter pigeon had the greatest percentage of the HVPH potentially impacted directly by the Project of all the vulnerable species in the Project region with 0.47% of the regional habitat being potentially impacted. Furthermore, if conservative estimates of habitat impact are considered by combining the percentage of HVPH with LVPH, impacts are still considered to be minimal. Here, the greatest impact was also on squatter pigeon habitat with 0.74% of the regional habitat being potentially impacted.

Although unavoidable loss of potential habitat will be discussed with Commonwealth and State agencies during further development of the offsets strategy, our analyses indicate that additional and consequential impacts on any of these species will be minimal. This conclusion is strengthened when coupled with the implementation of sound mitigation measures, management strategies and monitoring programmes as detailed in the EMP presented in this EIS (Volume 2, Appendix W).

Migratory Species

The Commonwealth *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DEWHA (now SEWPAC), 2009b) defines 'important habitat' for migratory species as:

- *habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or*
- *habitat that is of critical importance to the species at particular life-cycle stages, and/or*
- *habitat utilised by a migratory species which is at the limit of the species range, and/or*
- *habitat within an area where the species is declining*

The ten migratory species which were positively identified as a result of combined desktop and field surveys efforts are geographically widespread throughout eastern Queensland. The local populations on the Project site are unlikely to constitute an 'ecologically significant proportion' of the total populations. Furthermore, the Project site is not at the limit of these species range, nor are these species considered to be declining within the region. As habitat present on the site is replicated throughout the greater region it is unlikely that the existing habitat present is critical for the survival of

any of these species. Therefore, it is unlikely that the Project will have a significant impact on the regional populations of these species.

Threatened Ecological Communities

As a result of the ecological studies utilised in this study, one TEC was confirmed as being at risk of direct impacts from the Project. The TEC Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin was identified while conducting field surveys along the potential access road to the south east of the MLA. The project proposes to clear 1,325 ha of this TEC for the construction of an MLA access road.

The Commonwealth *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DEWHA, 2009b) state that an action resulting in any of the following constitutes a significant impact to a TEC:

- *reduce the extent of an ecological community*
- *fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*
- *adversely affect habitat critical to the survival of an ecological community*
- *modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*
- *cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting*
- *cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:*
  - *assisting invasive species, that are harmful to the listed ecological community, to become established, or*
  - *causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or*
- *interfere with the recovery of an ecological community*

The Project will reduce the extent and fragment this TEC. This is an unavoidable impact of the Project and will need to be considered as part of the development of the Projects offset strategy.

Beyond direct loss of each TEC, indirect impacts are expected to be minimal as a result of the implementation of the proposed mitigation and management strategies described for indirect impacts associated with pest species, habitat degradation and changes to aquatic systems (including floodplains).

H.6.8 Summary of Impacts

The analysis conducted in this report indicates that while there is a risk of impacts on potential habitats of 7 of the 10 EPBC-listed species either confirmed on site during field surveys, or considered to have a low, moderate or high likelihood of occurring on site, the impacts are likely to be low. When considering the results of the habitat mapping analysis in combination with the range of mitigation measures, management strategies and monitoring programs detailed in the EMP presented in this EIS (Volume 2, Appendix W), the overall impacts on any EPBC-listed species are likely to be insignificant.

In conclusion, the results of this study indicate that the Project is unlikely to:

- *lead to a long-term decrease in the size of a population,*
- *reduce the area of occupancy of the species,*
- *fragment an existing population into two or more populations,*
- *adversely affect habitat critical to the survival of a species,*
- *disrupt the breeding cycle of a population,*
- *modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,*
- *result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat,*
- *introduce disease that may cause the species to decline, or*
- *interfere with the recovery of the species* (DEWHA, 2009b).

H.7 Aquatic Flora and Fauna and Stygofauna

H.7.1 Methodology

To describe the existing aquatic flora and fauna values of the study area a combined desktop and seasonal field survey was conducted. The desktop assessment comprised a review of relevant literature and database searches. Surveys were conducted to obtain ecological information relevant to the Project and to ground-truth results from desktop assessments.

The aquatic flora and fauna sampling methodology for the Project site was based on 'standard survey' techniques that are used to sample aquatic and aquatic vertebrate fauna. Sampling was conducted using the following survey methods:

- Surface Water Quality Sampling
- Aquatic and riparian vegetation identification;
- Macro-invertebrate sampling;
- Aquatic vertebrate fauna sampling, involving drag netting and baited traps;
- Spotlighting; and
- Habitat assessments.

- This section is based upon the findings contained in the Aquatic Ecology Assessment Report presented in this EIS (Volume2, Appendix L2)

H.7.1.1 Desktop Survey

The following databases were searched for historical records of flora and fauna within the vicinity of the mine study area that have habitat requirements intrinsically linked to aquatic habitats:

- EPBC Act Online Database:
  - This database provides general guidance on MNES and other matters protected by the EPBC Act for a nominated area.
  - Search area encompassed a 100km circular buffer centred at coordinates -23.24,146.46
- Wildlife Online Database (Department of Environment and Resource Management (DERM):
  - This database uses records collected from previous surveys, including the Queensland Museum surveys as well as records from the public.
  - While screening of data occurs, some misidentifications are possible.
  - The search area was 100 km x 100 km, surrounding the Mine Study Area. The coordinates of the revised search area are Point A -22.75046, 145.989507; Point B -22.753652, 146.963474; Point C -23.656973, 146.963228; Point D -23.653639, 145.982694.

H.7.1.2 Field Survey

A total of 29 aquatic sites were assessed to determine the overall condition of the available aquatic ecosystems within the Project site (Figure H-12). Water samples were taken where surface water was present. The initial aquatic survey was undertaken between the 16th and 21st of March 2009, and an additional survey was undertaken between the 15th and 22nd of March 2010. The analytical results for surface water quality were compared with the Australia and New Zealand Environment and Conservation Council (ANZECC) Guideline trigger values (2000).

Initial site scoping was conducted using two methods. Firstly, aerial photography and topographic maps of the Project site were reviewed, in order to gain an overall perspective of the location of watercourses, and the direction of water flow.

Secondly, accessible areas of the Project site were broadly surveyed from a vehicle. This allowed the targeting of upstream, midstream, and downstream locations, as well as habitats potentially occupied by species of conservation significance.

Aquatic and Riparian Vegetation Identification

At each of the sites surveyed, a brief description of the riparian vegetation was recorded. This is captured more fully in the Terrestrial Flora and Fauna Report presented in this EIS (Volume 2 Appendix L1). Where in-stream flora was observed, these species were also identified and their dominance recorded.

Macro-invertebrate Sampling

The shallows of the waterbodies at 17 sites were kick-sampled (disturbing the stream bed and passing a D-frame net with a 100 micrometre mesh-size through the resulting plume, along 5-10 m sections of the water body). Various microhabitats within the stream were targeted. All macro-invertebrates, sampled over a 20 minute period, were placed in a preservative solution and identified to Family or

Sub-Family level. Samples collected during the March 2009 survey were identified at the Australian Centre for Tropical Freshwater Research, and samples collected in March 2010 were identified by FRC Environmental.

Aquatic Vertebrate Fauna Sampling

The aquatic vertebrate composition of each survey site was tested at a total of 16 sites using two methods: drag netting, and baited traps, as explained below.

Drag Netting

The waterbody at each survey site in which vertebrate fauna sampling was undertaken was swept using a 25 mm mesh-size drag net strung between two people as they walked slowly up sections of the waterbody. This method allows large sections of the watercourse to be sampled; however, snags and benthic debris can allow fish to avoid the net. Watercourses too narrow / shallow to allow the net to extend were excluded from drag netting. A total of 12 sites were drag netted over the course of the field survey.

Baited Traps

Opera-house and box traps were used at each site where trapping was to be undertaken to target carnivorous species. Traps were baited with either dry dog biscuits or bones to lure fish and other vertebrates into the traps. At each site where trapping was undertaken, four traps were left out for three nights each, and emptied at first light. All animals captured were identified, counted and released back into the water. A total of 168 trap nights were conducted on the mine study area.

Spotlighting

Spotlighting was carried out at night along various sections of the waterbodies in an attempt to observe nocturnal wildlife, such as frogs and reptiles that are less likely to be detected by other survey methods.

Habitat Assessment

A habitat assessment was performed at 18 selected sites using a modified version of the AUSRIVAS protocols developed by the Department of Natural Resources and Mines in 2002. AUSRIVAS is a nationally standardised method for giving an assessment of the biological health of inland rivers within Australia. Each surveyed site was given a score out of 135, with higher numbers indicating favourable habitats normally associated with healthy waterways.

Stygofauna sampling

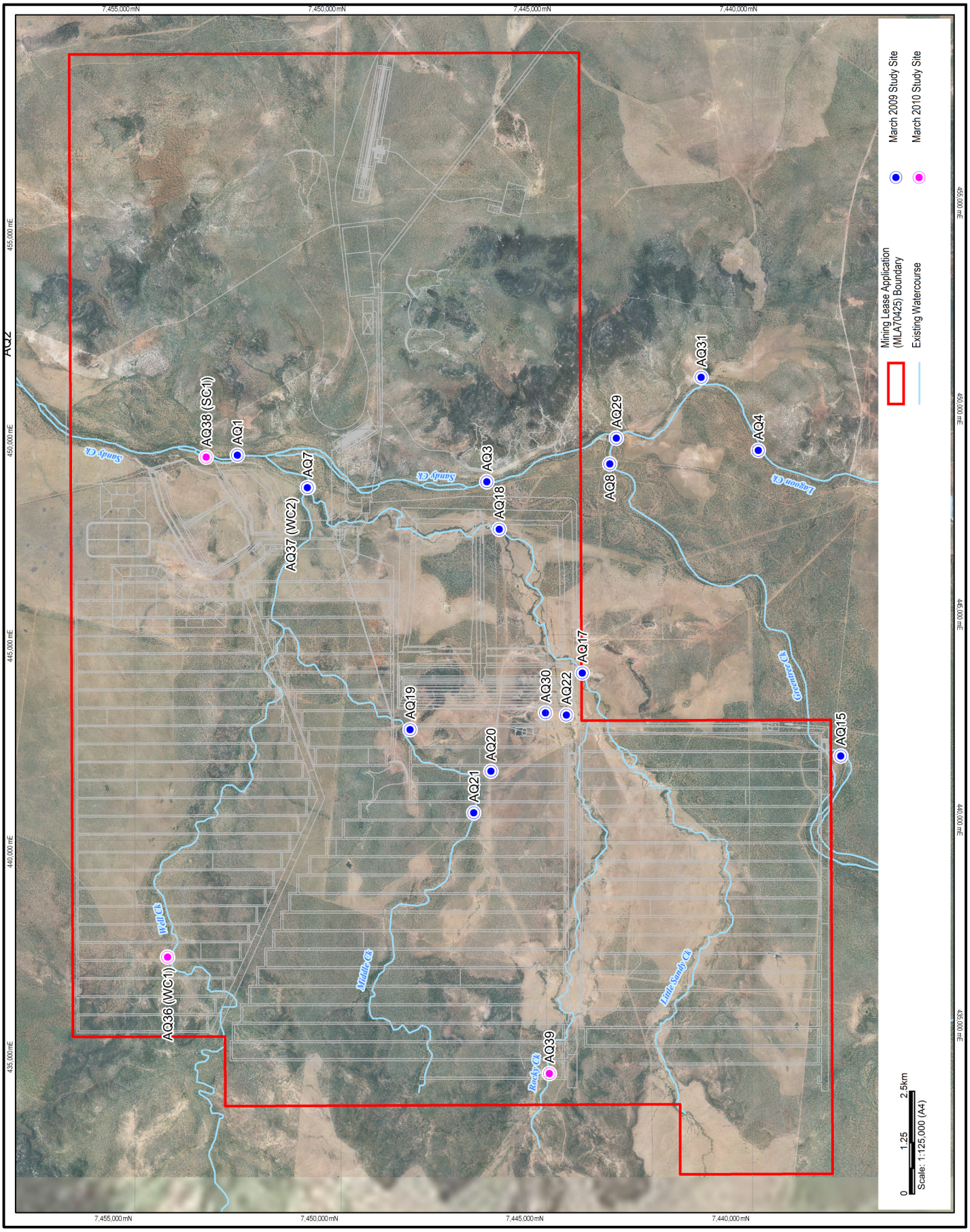
A total of seven groundwater samples were collected for stygofauna assessment by AARC in March and June 2010 (within the Kevin's Corner Project site boundary) and four more samples were collected in November 2010 (outside the Kevin's Corner MLA) (Figure H-13) as per WA EPA guidelines for pilot-scale studies. It should be noted that most of the bores sampled were DERM registered bores and the DERM bore number has been used to identify each location where applicable. All samples were sent to the ALS Water Science Group laboratory in Brisbane for processing.

Stygofauna samples were collected using a weighted net of 50 micrometre (µm) mesh. Stygofauna sampling methods are detailed in Appendix A and are briefly described below. The net was lowered to the bottom of each bore, raised and lowered four times to dislodge any resting animals, then retrieved

slowly to the surface. At the top of each haul, the entire contents of the net were emptied into a 50 µm sieve. After six hauls the sample was transferred to a labelled jar, filled with 100 per cent (%) AR-grade ethanol. Samples were then sent to the ALS Water Science Group Laboratory in Brisbane for processing and fauna identification.

Rose Bengal dye, which stains animal tissue pink, was added to each sample before processing to allow stygofauna to be distinguished from sediments and to reduce sorting time. Samples were elutriated to separate the heavier mineral component from the lighter organic component of the sample, and poured through a 50 µm sieve. The sieve contents, consisting of fine sediments, fauna, and other organic material, were spread thinly over the base of a channelled sorting tray. All fauna were identified to the lowest taxonomic level possible under dissecting microscopes and placed in vials containing 100% ethanol.

Stygofauna were examined using Leica MZ 9.5 stereo-dissection microscopes with planachromat objectives and a zoom capability between 6.3x and 60x magnification. A digital camera was attached which allowed for the production of a photographic reference collection when required. Stygofauna were identified to Order / Family level (where possible) using published taxonomic keys, unpublished working keys, and a specimen reference collection maintained by ALS.



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Datum: GDA94, MGA Zone55

HANCOCK GALILEE PTY LTD

Kevin's Corner Project
Environmental Impact Statement

AQUATIC SURVEY LOCATIONS ON THE PROJECT SITE

Job Number	4262 6660
Revision	B
Date	12-09-2011

Figure: H-12

File No: 42626660-g-2124.wor

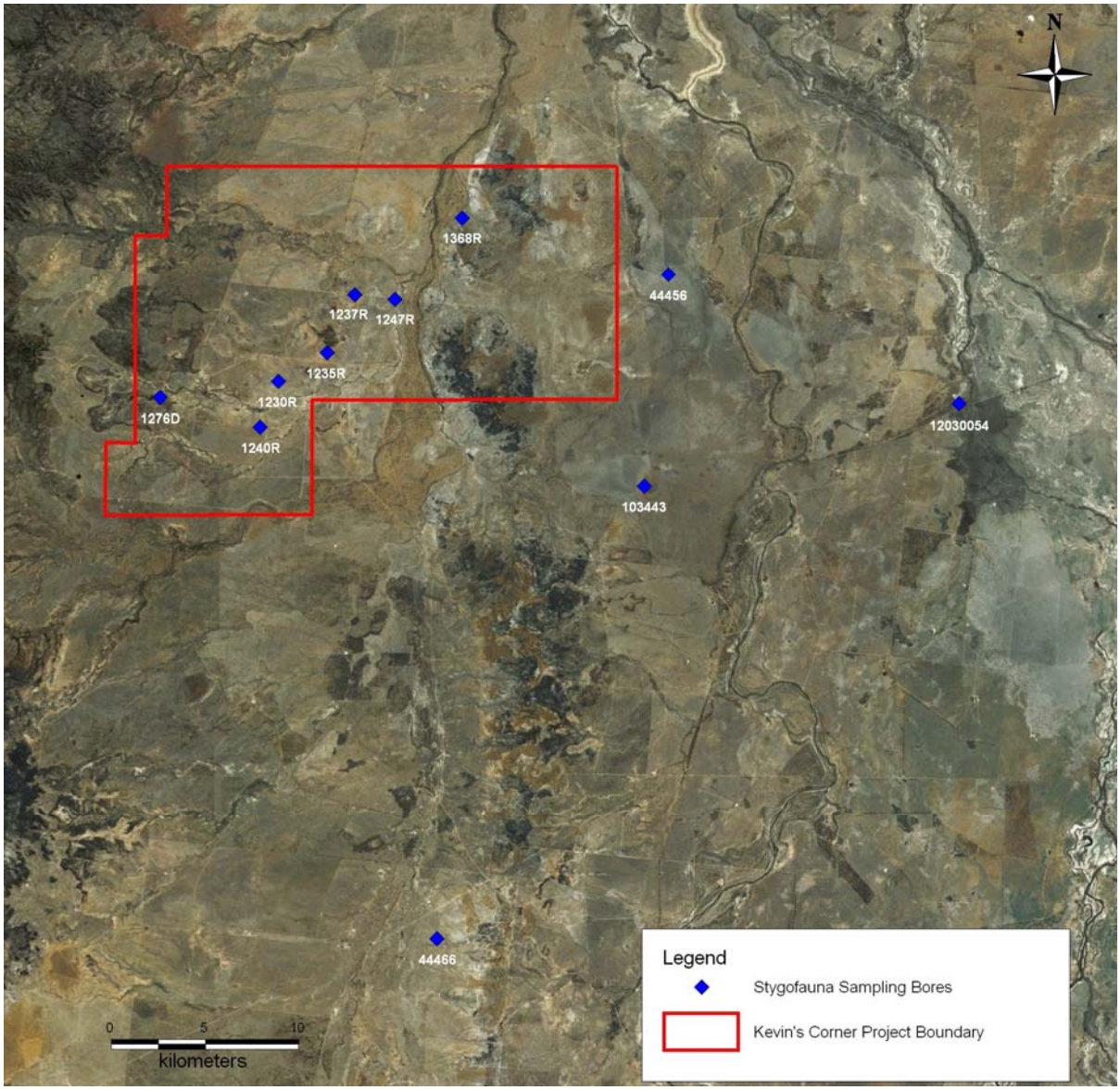

Figure H-13 Distribution of Stygofauna Sampling Locations on and around the Project study area

H.7.1.3 Results of Aquatic Flora, Fauna Assessment

No aquatic flora or fauna species listed under the EPBC Act were identified during the course of the survey.

H.7.1.4 Results of Stygofauna Assessment

Eight individuals of the stygofauna syncarid genus *Notobathynella* were identified in one groundwater sample from outside the Project Mining Lease Application. This sample was collected from groundwater bore 103443 (Surbiton South) in November 2010, which lies approximately five km south east of the Kevin's Corner Mining Lease Application and 13 km from the nearest mining area. A separate sample collected from the Project site yielded a single copepod specimen of *Macrocyclops albidus.* This copepod is a widespread surface-dwelling species which is occasionally encountered in groundwater. However, this species does not live in groundwater and is therefore not considered to be stygofaunal.

H.8 Great Artesian Basin

H.8.1 Proximity

The proposed project, located within the Galilee Basin targets coal seams of the Colinlea Sandstone. This Permian age unit and the overlying Permian Bandanna Formation subcrop several kilometres to the east of the younger Triassic age Great Artesian Basin (GAB).

The confined aquifers of the GAB are bounded below by the Rewan Group (Habermehl, 2000), indicating that the proposed Hancock mining activities will occur in older formations below and to the east of the GAB and separated from the oldest GAB aquifer, the Clematis Sandstone, by the thick Rewan Group, which is a regional aquitard.

A geological cross-section (Figure H-13), west-east, (covering a distance of 310 km) through the proposed mining area was compiled based on available exploration log data for the area. The cross-section indicates the contiguous (~ 175 m) Rewan Group separating the Bandana Formation (containing the A-B coal seams) and the Clematis Sandstone GAB aquifer. The target coal seams for the project mining operations are partly the C and mainly, in the western and underground operations, the D coal seams within the Colinlea Sandstone, which are further separated from the GAB by the groundwater poor (in terms of both quantity and quality) Bandana Formation.

Figure H-14 provides a 1: 350 000 scale geological plan view of the area indicating the geological unit outcrops and the Kevin's Corner MLA 70425 and Alpha MLA 70426 boundaries. The regional geological model shows that the Rewan Group and the Clematis Sandstone outcrop outside of the Kevin's Corner MLA 70425 boundary, thus no GAB units overlie any of the areas proposed for mining..

H.8.2 Potential Impacts

Dewatering of the overburden sediments and depressurising of the sediments (D-E sands) below the target coal seams can potentially induce groundwater flow from the adjacent (overlying and underlying) units. The induced flow can result in decreases in groundwater levels within the surrounding units; which in turn could result in decreased bore yields.

The potential for induced flow from the adjacent Rewan Group was considered to determine whether mine dewatering could impact on the GAB units, more specifically the closest GAB aquifer, the Clematis Sandstone.

See Figures H-14 and H-15 for further interpretation. However, note that Figure H-14 is vertically exaggerated by 30:1, i.e. the vertical axis is exaggerated 30-fold for the purposes of displaying the geological strata effectively.

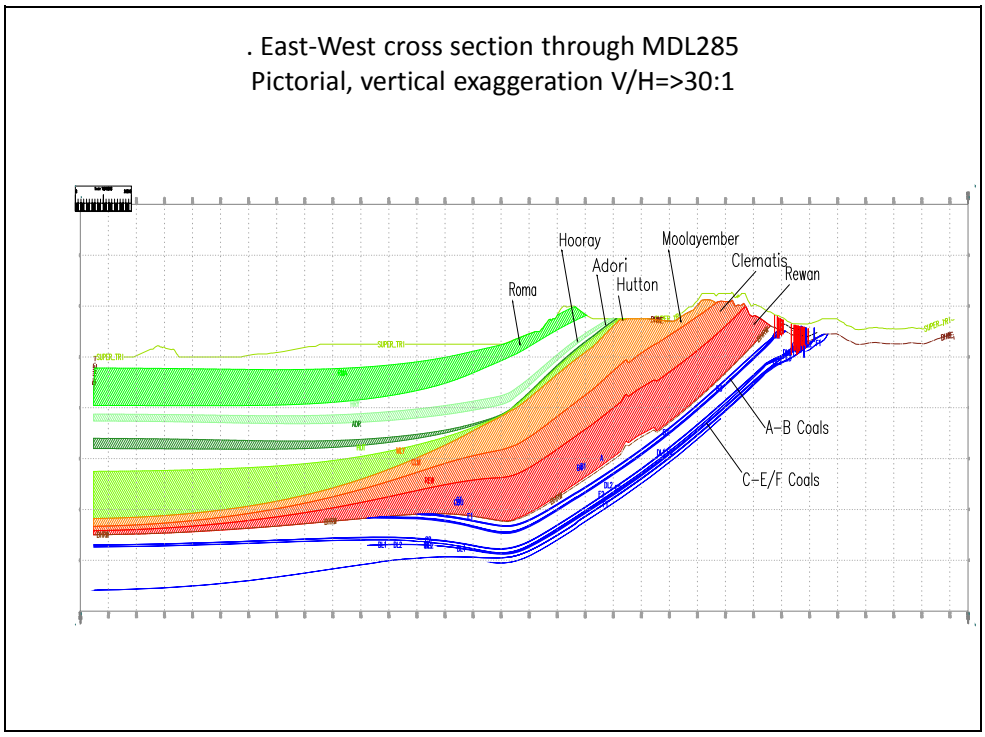

Figure H-14: East-West cross-section across geological model (source, Salva, 2009)

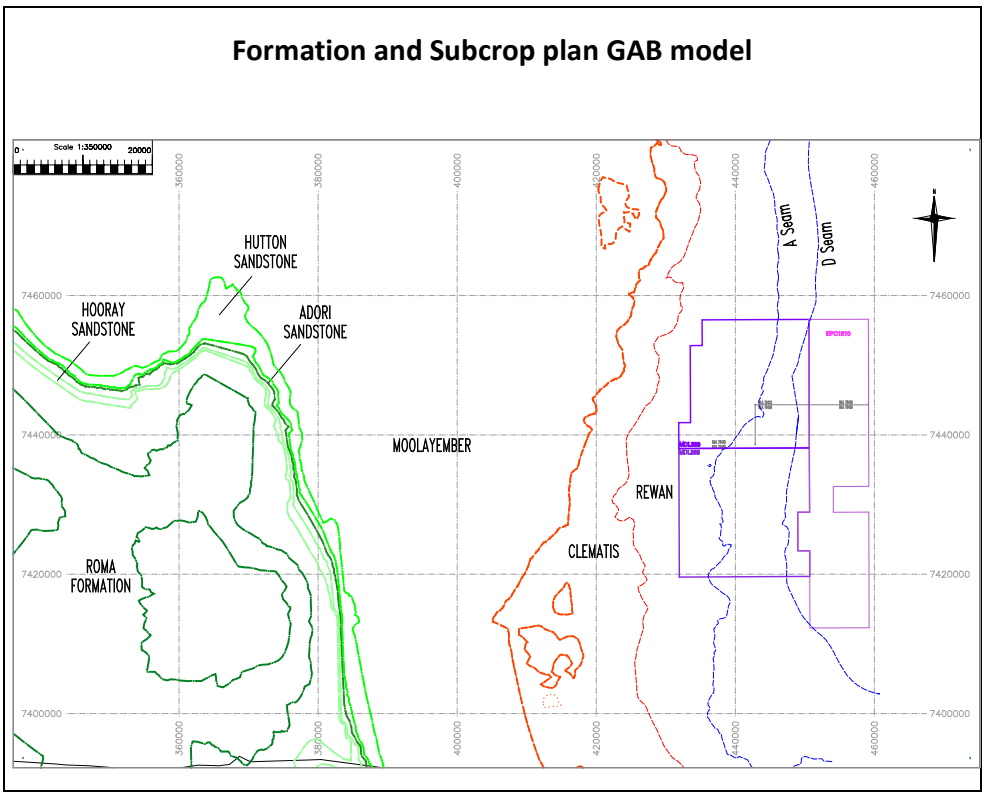

Figure H-15: Formation and subcrop plan from GAB model (Source: Salva, 2009)

H.8.3 Impact Assessment

H.8.3.1 Desktop Study

The Rewan Group comprises mudstone, siltstone, and lithic sandstone of fluvial, lacustrine, and aeolian origin, and is of low porosity and permeability (Butcher, 1984). The Rewan Group comprises an upper shale section, which seals the basal Rewan Group sandstone (Henning et al., 2006). This upper shale is considered a barrier to groundwater migration from the deeper coal seams (Conybeare, 1970). The maximum encountered thickness of the Rewan Group is 1,363 m in the Bowen Basin (DME, 1997) but it is suspected that the Rewan Group can reach a maximum thickness of 3,500 m. This unit is widely recognised as the basal unit of the GAB.

All of the water-bearing units below the Rewan Group exist as confined water-bearing units that contain reservoirs of groundwater, which display different hydraulic characteristics and different hydrochemistry indicating a distinctly different hydrogeological system to the GAB (GABCC, 1998). The deeper water bearing units associated with the Permian coal measures are isolated from the GAB aquifers by the Rewan Group confining unit and are considered to be isolated water-bearing units (WorleyParsons, 2010).

Permeability of the Rewan Group aquitard is in the order of 0.1 millidarcy[1] to 1.0 millidarcy (9.3×10^{-5} to 9.3×10^{-4} m^2/day) (Cadman and Pain, 1998). This very low permeability retards groundwater movement, which is in line with Butcher (1984) who considers the Rewan Group as a barrier to vertical migration of groundwater from below to the GAB.

A study by Henning et al. (2006) evaluated inter-aquifer flow between the Clematis Sandstone, Rewan Group, Moolayember Formation and the Precipice Sandstone within the GAB. The study concluded that the Moolayember Formation and the upper Rewan Group (shale) act as effective barriers to vertical groundwater movement between units.

It is generally accepted that the Rewan Group is a regional aquitard that prevents significant inter-aquifer transmission of water within and between basins. There is no evidence, based on the exploration data compiled by Salva (2009) during the generation of the regional geological model (Figure 14 and Figure 15), of any large scale geological structures (faults, etc.), within the proposed mine areas that could promote inter-aquifer or inter-basin hydraulic connection.

H.8.3.2 Depressurisation

The potential impacts of depressurising the D-E sands below the D coal seam, to be mined at Kevin's Corner, were evaluated based on available data, which allowed for the conceptualisation of the hydrogeology within the study area. This conceptualisation was used to construct a predictive numerical groundwater model. The modelling is currently being undertaken to assess the potential impacts of mine dewatering on groundwater resources and potentiometric levels. Initial model predictions indicate that, due to the low permeable nature of the Rewan Group to the west and the Joe Joe Formation (aquitard) to the east, dewatering will elongate north-south within the more permeable Colinlea Sandstone.

[1] The SI unit for permeability is m^2. A traditional unit for permeability is the darcy (D), or more commonly the *millidarcy* (mD) (1 darcy $\approx 10^{-12} m^2$).

Potentiometric pressures will decrease, resulting in declining groundwater levels, along strike and to the west (hanging wall units above the D coal seam) of the proposed Kevin's Corner coal project. Drawdown could result in a hydraulic gradient from the overlying Permian Bandana Formation and the adjacent Rewan Group to the depressurised D-E sands. In order to evaluate the potential for induced flow the permeability (vertical) of the Rewan Group was considered and included in the numerical groundwater model.

H.8.3.3 Site specific permeability data

In order to obtain representative permeability data, both horizontal and vertical, for the Rewan Group, an assessment of the Queensland Petroleum Exploration Data (QPED) database was conducted. Eighteen bores were recorded containing permeability data, obtained from drill stem tests during exploration drilling, within the study area.

The available QPED records are summarised in Table H-14. The permeability (hydraulic conductivity) was determined for different depths within the bores. Several tests did not result in a response during the drill stem tests, indicating very low permeability (lower than the lowest permeability measured in Table H-14, 0.0009 m/day).

Table H-14 Drill stem test data

Bore No	Test depth (m)	Porosity (%)	Permeability Horizontal (m/day)	Permeability Vertical (m/day)
476	575.46	23.3	0.014	0.0014
476	578.82	12.2	0[2]	0
476	588.87	17.1	0	0
476	593.14	12	0	0
476	597.41	30	0.79	0.47
476	601.98	25.9	0.86	0.011
476	619.35	28.2	0.13	0.012
476	623.62	26.4	4.44	0.14
476	629.11	23.5	0.016	0.015
476	636.42	23.4	0.055	0.036
476	645.26	28.3	0.43	1.18
476	651.05	27.3	2.07	0.05
476	657.15	27.6	0.83	0.34
478	40.2	23.3	0.28	0.015
772	541.9	23	0	0
772	641.6	13.5	0	0
772	734.3	16	0	0
1045	906.37	18.2	0.07	0.006
1045	919	17.2	0.44	0.07
1045	929.3	20.3	0.28	0.028
1443	1149.43	20	0.02	0.005

[2] No response during drill stem test indicating very low permeability (< 0.0009 m/day or 1 x 10^{-8} m/s)

Bore No	Test depth (m)	Porosity (%)	Permeability Horizontal (m/day)	Permeability Vertical (m/day)
1443	1158.28	25	0.099	0.07
1443	1169.02	25	0.099	0.07
1443	1179.57	25	0.13	0.055
1443	1193.63	22	0.029	0.005
1443	1203.21	21	0.029	0.0048
1443	1212.34	18	0.027	0.004
1443	1221.69	18	0.0048	0.003
1443	1234.57	23	0.0039	0.001
1443	1241.97	24	0.055	0.002
1443	1251.97	21	0.06	0.004
1443	1266.85	19	0.17	0.002
2232	22.4	27	0.001	0
2232	22.8	26	0.0009	0
2232	64	26	0.014	0

H.8.4 Evaluation of Potential Impacts on the Great Artesian Basin

These results indicate heterogeneity within the Rewan Group mapped within the Galilee Basin. The Rewan Group contains layers of very low permeability. These layers provide the confining pressures required for artesian and sub-artesian conditions recorded in the GAB and reduce the potential for vertical flow. The results validate the conceptualisation that the Rewan Group acting as a regional aquitard, which prevents inter-aquifer and inter-basin flow.

Depressurisation and mine dewatering within the Colinlea Sandstone units will result in a decrease in potentiometric pressures within the Colinlea Sandstone. This reduction in pressure will result in induced flow from the younger Bandana Formation, which overlies and is immediately west of the Colinlea Sandstone. The drawdown within the Colinlea Sandstone and Bandana Formation is predicted to expand towards the west, outside the Kevin's Corner MLA 70425, until it reaches the Rewan Group. Based on the very low permeability of the Rewan Group, the drawdown cone will elongate along strike within the more permeable Colinlea Sandstone and Bandana Formation (which has a higher permeability relative to Rewan Group).

The very low permeability of the Rewan Group, especially in the vertical direction, will limit groundwater movement from the Rewan Group to the depressurised mine, thus the impacts of mine dewatering on the Rewan Group and ultimately to the Clematis Sandstone are therefore recognised as negligible.

Ongoing groundwater modelling, using site monitoring data, will be conducted to provide verification of this impact evaluation.

H.9 Conclusion

This assessment has identified a number of EPBC-listed species which potentially use habitat on the Project site and as a result of the Project they may be at risk from direct and indirect impacts. However, the scale of the potential impacts on available potential habitat when compared to that available in the surrounding region, offer strong indications that any EPBC-listed species occurring on or around the Project site are unlikely to be negatively impacted. The implementation of sound mitigation measures, management strategies and monitoring programmes as detailed in the Kevin's Corner EMP presented in this EIS (Volume 2, Appendix W) will further minimise these potential impacts.

However, the results of this assessment should be taken into consideration alongside the assumptions and limitations discussed in Section H.4.4.2 of this report. Actual impacts that will require offsetting as a result of the Project will differ from those presented in this report and it is expected that real impacts will be either in the order of reasonable best case scenario presented in this report or even less so. Further refinement and review of the habitat mapping, including assessment of additional site specific information, will be undertaken as part of planned ongoing studies. The updates will be available to inform the assessment of direct and indirect impacts, and finalisation of the offsets strategy.

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Appendix H.A Threatened Species Profiles

H.A.1.1 Introduction

Outlined below is a summary of information relating to the assessment of impacts to threatened species and ecological communities protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that are of relevance to the mine study area. For each threatened species and threatened ecological community (TEC) identified during field studies and/or predicted to occur in the mine study area by the Commonwealth's Protected Matters Search Tool and/or previously recorded from the desktop search extent, the following information is presented:

- a general overview of species distribution and habitat requirements;
- a summary of threatening processes known or considered to be of relevance to the species;
- commonwealth survey guidelines applicable to the species and the survey effort undertaken during field studies for the Project EIS;
- species specific desktop assessment results;
- species specific field survey results;
- habitat mapping criteria selected to model and map potential habitat for the threatened species of relevance to the mine study area (with descriptive text explaining the rationale for habitat criteria selection provided where necessary);
- a 'regional' map depicting potential habitat for each species/TEC in the mine study area and surrounding landscape; and
- a figure depicting potential habitat for each species/TEC in the mine study area

H.A.1.2 Black-Throated Finch (southern)

H.A.1.2.1 EPBC Status

Endangered

H.A.1.2.2 Distribution and Habitat Information

The black-throated finch (southern) (*Poephila cincta cincta*) was previously found throughout eastern and central Queensland north of the New South Wales border, however it is now only known from the Townsville region and scattered sites in central Queensland (Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC), 2011a). This largely sedentary, gregarious bird inhabits grassy open woodland and open forest habitats characterised by trees belonging to the genera *Eucalyptus*, *Corymbia*, *Acacia* and *Melaleuca* (SEWPAC, 2011a). Generally it occurs in habitats near watercourses or water bodies - almost all recent records of the subspecies south of the tropics have been in riparian areas (SEWPAC, 2011a). Three critical habitat resources are required to support the black-throated finch (southern):

- Water sources (both natural and artificial)
- Grass seeds (a mosaic of species that provide forage throughout the year (particularly during the wet season)
- Trees that provide suitable nesting habitat (Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA (now SEWPAC), 2009a); SEWPAC, 2011a)

Existing populations of the black-throated finch (southern) are thought to be highly fragmented (SEWPAC, 2011a).

H.A.1.2.3 Threatening Processes

The background paper to the Commonwealth Government's *Significant Impact Guidelines for the Endangered Black-Throated Finch (southern) (Poephila cincta cincta)* (DEWHA, 2009a) identifies the following as key threats to the black-throated finch (southern):

- Habitat loss / fragmentation (through land clearing for development) and habitat degradation (trampling by domestic stock and feral animals; weed infestations)
- Inappropriate fire regimes
- Stock grazing (altered ground cover, degradation of water sources)
- Resource bottlenecks
- Drought (DEWHA, 2009)

Other threats include:

- Illegal trapping for the bird trade
- Hybridisation with the northern subspecies of the black-throated finch (*Poephila cincta atropygialis)*
- Predation by feral animals (DEWHA, 2009a)

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance

- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

H.A.1.2.4 Survey Guidelines and Field Survey Effort

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2009b) details recommended survey methodologies for detecting the black-throated finch (southern). As a guide, it is recommended that 10 hours per day are spent searching for the subspecies (in suitable habitat) over a five day period, for areas less than 50 ha (DEWHA, 2009b). In addition, surveys targeting waterholes and woodswallow nests are recommended to be carried out over two days for a minimum of six hours per day (DEWHA, 2009).

The Background Paper to the Commonwealth Government's *Significant Impact Guidelines for the Endangered Black-Throated Finch (southern) (Poephila cincta cincta)* (DEWHA, 2009a) expands upon the recommended survey guidelines presented in the *Survey Guidelines for Australia's Threatened Birds*. In summary, these guidelines indicate that presence/absence studies should comprise:

- Dry season: water source watching (recommended six hours per day for two days, for each water source in the study area)
- Wet season: water source watching (as described in point above) and targeted woodland searches within 600 m radius of water sources (one hour per hectare for a maximum of ten hours) (DEWHA, 2009a)

At the comprehensive and rapid fauna survey sites depicted in Figure H-6, standardised bird surveys (2ha for 20 minutes) for all bird species were undertaken. The bird survey methodology is described in Section H.4.5.2. In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

H.A.1.2.5 Desktop Assessment Results

The black-throated finch (southern) was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

No historical records of this species were returned from a query of relevant databases in the desktop search extent (as defined in Section H.4.3).

H.A.1.2.6 Field Results

The black-throated finch (southern) was not recorded in the mine study area during seasonal field studies for the Project EIS.

H.A.1.2.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section H.4.6.

The habitat criteria used to model and map potential habitat for the black-throated finch (southern) are presented in Table H.A-1 below.

Table H.A-1 Habitat Mapping Criteria – Black-Throated Finch (southern)

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Proximity to water#
'Confirmed habitat'	5 km radius around post-1995 records - sourced from the *Significant Impact Guidelines for the Endangered Black-Throated Finch (southern) (Poephila cincta cincta)* (DEWHA, 2009a) http://www.environment.gov.au/epbc/publications/pubs/black-throated-finch-background.pdf	NA				
'High value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9.2, 10.9.3, 10.9.5, 10.9.6, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.35, 11.3.36, 11.3.37, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.14, 11.10.1, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12,	Very High or High	Very High or High	50 – 350 m	RE polygon ≤ 3 km from water

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Proximity to water#
		11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.17, 11.12.20				
'Low value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9.2, 10.9.3, 10.9.5, 10.9.6, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.35, 11.3.36, 11.3.37, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.14, 11.10.1, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.17, 11.12.20	Medium or Low	Medium or Low	< 50 m or >350 m	RE polygon > 3 km from water
'Generally not suitable'	NA	All other REs and non-remnant vegetation				

*sourced from Queensland Department of Environment and Resource Management (DERM) Essential Habitat Factors for black-throated finch (southern)
#includes rivers/streams, wetlands and bores for which geospatial data was available

Habitat within approximately 5 km of the centre of mapped 'important areas' for the black-throated finch (southern), as presented in the Background Paper to the Commonwealth Government's *Significant Impact Guidelines for the Endangered Black-Throated Finch (southern) (Poephila cincta cincta)* (DEWHA, 2009a), was mapped as 'confirmed habitat'.

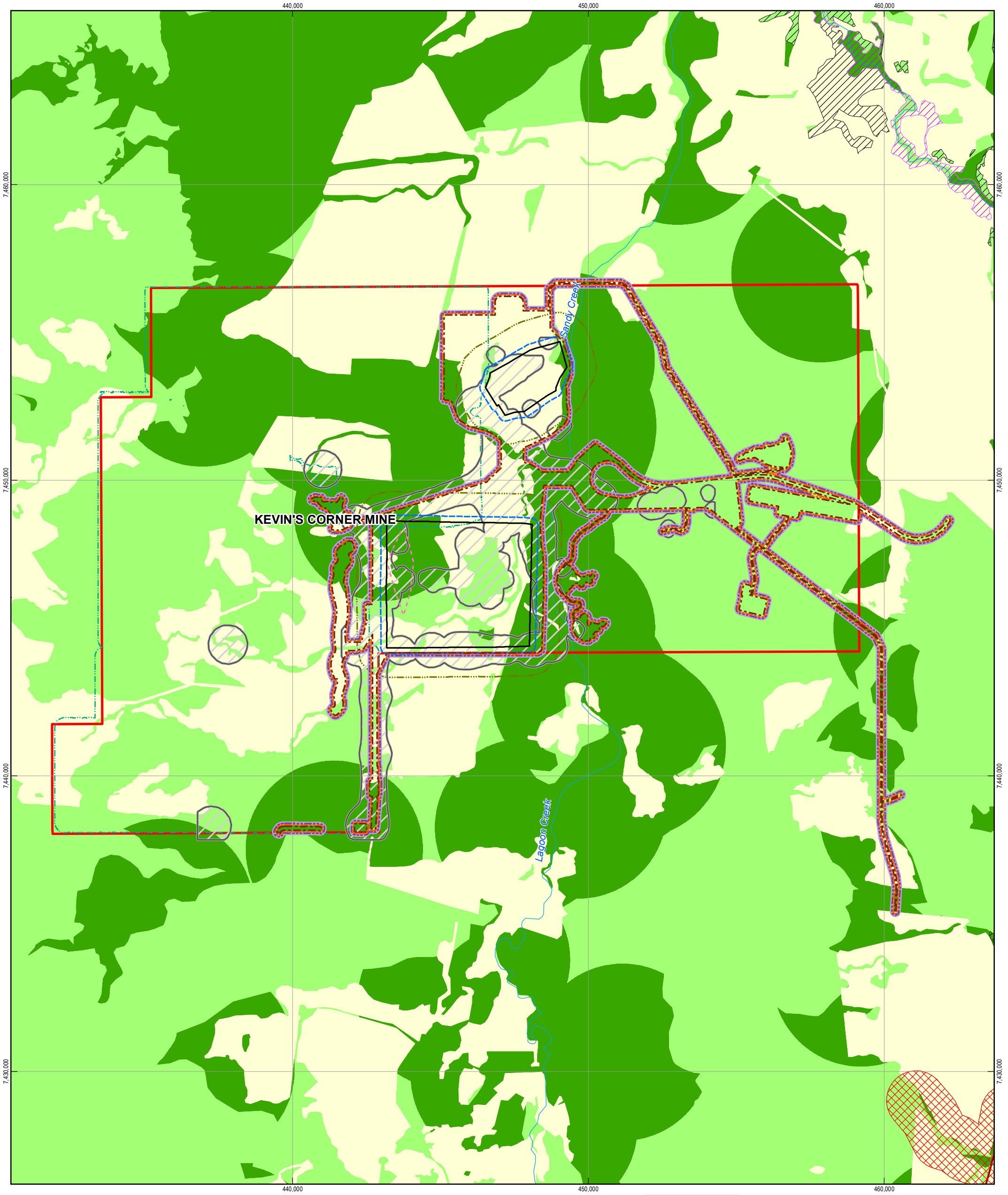
In order to qualify as 'high value potential habitat' for the black-throated finch (southern), based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain a Regional Ecosystem (RE) listed in Table H.A-1 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (Queensland DERM Biodiversity Planning Assessment (BPA) Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur at an altitude of 50 – 350 metres **AND**
- Occur within 3 km of a watercourse (river, stream, wetland or bore, for which geospatial data exists)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND**/**OR** altitude < 50 m or > 350 m **AND**/**OR** polygon > 3 km from watercourse), the RE polygon was mapped as 'low value potential habitat'.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the black-throated finch (southern) are provided below.

A discussion of direct and indirect impacts to the black-throated finch (southern) is provided in Section H.6. The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.



LEGEND

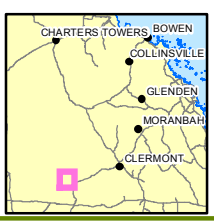
- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Black Throated Finch Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:120,000 (at A3)

0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Kevin's Corner Project
Environmental Impact Statement

POTENTIAL BLACK THROATED FINCH HABITAT - KEVIN'S CORNER MINE

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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400,000 450,000 500,000

7,500,000 7,450,000 7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Lestree Hill Creek
Belyando River
KEVIN'S CORNER MINE
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Pebbly Creek
Bottle Tree Creek
Pebbly Creek
Alice River
Lagoon Creek
Tallarenha Creek
Capricorn Highway
ALPHA
Blackall - Jericho Road
Jordan Creek
Brumby Gully
Alpha - Tambo Road
Belyando River

400,000 450,000 500,000

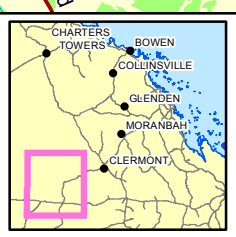
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Black Throated Finch Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



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1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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HANCOCK GALILEE PTY LTD

Kevin's Corner Project
Environmental Impact Statement

POTENTIAL BLACK THROATED FINCH HABITAT - REGIONAL

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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H.A.1.3 Squatter Pigeon (southern)

H.A.1.3.1 EPBC Status

Vulnerable

H.A.1.3.2 Distribution and Habitat Information

The ground-dwelling squatter pigeon (southern) (*Geophaps scripta scripta*) occurs from the dry tropics of central Queensland to the south east of the state (SEWPAC, 2011b). During the 20th Century the squatter pigeon (southern) experienced a northwards range contraction, and it is now not known to occur in New South Wales (SEWPAC, 2011b). At some locations in the northern part of its current distribution the squatter pigeon (southern) remains locally abundant (SEWPAC, 2011g), and is considered to be common in cattle-grazed country north of the Tropic of Capricorn (SEWPAC, 2011b).

This bird is generally associated with open eucalypt woodland or forest habitat with a grassy understorey, particularly near water (SEWPAC, 2011b). It less frequently inhabits disturbed areas (i.e. around roads, stockyards) (SEWPAC, 2011b). A variety of food items are taken by this ground-dwelling forager, including seeds (grass, legumes, herbs, forbs), insects and ticks (SEWPAC, 2011b).

H.A.1.3.3 Threatening Processes

The three main threats to the squatter pigeon (southern) are:

- Loss of habitat associated with land clearing (for agriculture and industry)
- Habitat degradation by grazing herbivores
- Predation by native and introduced predators – most notably by cats and foxes (SEWPAC, 2011b)

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

H.A.1.3.4 Survey Guidelines and Survey Effort

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2009b) details recommended survey methodologies for detecting the squatter pigeon (southern) - namely searches or transect surveys, and flushing surveys, in suitable habitat. It is recommended that 15 hours over at least 3 days be invested in area searches/transect surveys (for areas less than 50 ha), and 10 hours over at least 3 days be invested in flushing surveys (for areas less than 50 ha).

At the comprehensive and rapid fauna survey sites depicted in Figure H-6, standardised bird surveys (2ha for 20 minutes) for all bird species were undertaken. The bird survey methodology is described in Section H.4.5.2. In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

H.A.1.3.5 Desktop Assessment Results

The squatter pigeon (southern) was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

The Queensland DERM Wildlife Online database returned a record of this species from the desktop search extent (as defined in Section H.4.3).

H.A.1.3.6 Field Results

The squatter pigeon (southern) was recorded during the field survey for the Project EIS, with individuals observed within non-remnant grassland habitat.

H.A.1.3.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section H.4.6.

The habitat criteria used to model and map potential habitat for the squatter pigeon (southern) are presented in Table H.A-2 below.

Table H.A-2 Habitat Mapping Criteria – Squatter Pigeon (southern)

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Proximity to water#
'Confirmed habitat'	Remnant vegetation within 5 km radius of squatter pigeon (southern) records from EIS studies for Alpha Coal Project (Mine)	NA			
'High value potential habitat'	NA	Brigalow Belt Bioregion (i.e. Bioregion 11): REs in Landzone 3, 4, 5, 8, 9, 11, 12 - specifically: 11.3.10, 11.3.12, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.2, 11.3.23, 11.3.25, 11.3.26, 11.3.28, 11.3.29, 11.3.3, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.3.4, 11.3.6, 11.3.7, 11.3.9, 11.4.10, 11.4.12, 11.4.13, 11.4.2, 11.4.7, 11.4.8, 11.5.1, 11.5.12, 11.5.13, 11.5.17, 11.5.2, 11.5.20, 11.5.21, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.8.1, 11.8.12, 11.8.14, 11.8.15, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.1, 11.9.10, 11.9.13, 11.9.14, 11.9.2, 11.9.7, 11.9.9, 11.11.1, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.12.1, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.17, 11.12.19, 11.12.2, 11.12.20, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9 Desert Uplands Bioregion (i.e. Bioregion 10): REs in Landzone 3, 4, 5, 9 - specifically: 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.2, 10.3.20, 10.3.27, 10.3.28, 10.3.5, 10.3.6, 10.3.9, 10.4.3, 10.4.9, 10.5.1, 10.5.10, 10.5.11, 10.5.12, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.9.2, 10.9.3, 10.9.5	Very High or High	Very High or High	RE polygon ≤ 3 km from water
'Low value potential habitat'	NA	Brigalow Belt Bioregion (i.e. Bioregion 11): REs in Landzone 3, 4, 5, 8, 9, 11, 12 - specifically: 11.3.10, 11.3.12, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.2, 11.3.23, 11.3.25, 11.3.26, 11.3.28, 11.3.29, 11.3.3, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.3.4, 11.3.6, 11.3.7,	Medium or Low	Medium or Low	RE polygon > 3 km from water

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Proximity to water#
		11.3.9, 11.4.10, 11.4.12, 11.4.13, 11.4.2, 11.4.7, 11.4.8, 11.5.1, 11.5.12, 11.5.13, 11.5.17, 11.5.2, 11.5.20, 11.5.21, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.8.1, 11.8.12, 11.8.14, 11.8.15, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.1, 11.9.10, 11.9.13, 11.9.14, 11.9.2, 11.9.7, 11.9.9, 11.11.1, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.12.1, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.17, 11.12.19, 11.12.2, 11.12.20, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9 Desert Uplands Bioregion (i.e. Bioregion 10): REs in Landzone 3, 4, 5, 9 - specifically: 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.2, 10.3.20, 10.3.27, 10.3.28, 10.3.5, 10.3.6, 10.3.9, 10.4.3, 10.4.9, 10.5.1, 10.5.10, 10.5.11, 10.5.12, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.9.2, 10.9.3, 10.9.5			
'Generally not suitable'	NA	All other REs and non-remnant veg			

* No DERM Essential Habitat factors available at time of preparation - Selected REs typically those that feature eucalypt woodland / forest habitat. REs from landzones 6 (dunefields), 7 (ironstone jump-ups) and 10 (sandstone ranges) not considered for analysis - considered to be generally unsuitable habitat. # includes rivers/streams, wetlands and bores for which geospatial data was available

Habitat within approximately 5 km of sighting records from EIS/SEIS studies was mapped as 'confirmed habitat'.

In order to qualify as 'high value potential habitat' for the squatter pigeon (southern), based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain an RE listed in Table H.A-2 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) AND
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) AND
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) AND
- Occur within 3 km of a watercourse (river, stream, wetland or bore, for which geospatial data exists)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND**/**OR** polygon > 3 km from watercourse), the RE polygon was mapped as 'low value potential habitat'

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table H.A-2, or was non-remnant vegetation, it was mapped as 'generally not suitable' for the subspecies

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the squatter pigeon (southern) are provided below.

A discussion of direct and indirect impacts to the squatter pigeon (southern) is provided in Section H.6). The area of 'confirmed habitat', 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.

440,000 450,000 460,000

7,460,000 7,450,000 7,440,000 7,430,000

Sandy Creek

KEVIN'S CORNER MINE

Lagoon Creek

LEGEND

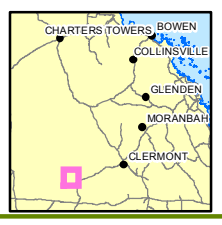
- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Squatter Pigeon Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:120,000 (at A3)

0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N

HANCOCK GALILEE PTY LTD

Kevin's Corner Project
Environmental Impact Statement

POTENTIAL SQUATTER PIGEON HABITAT - KEVIN'S CORNER MINE

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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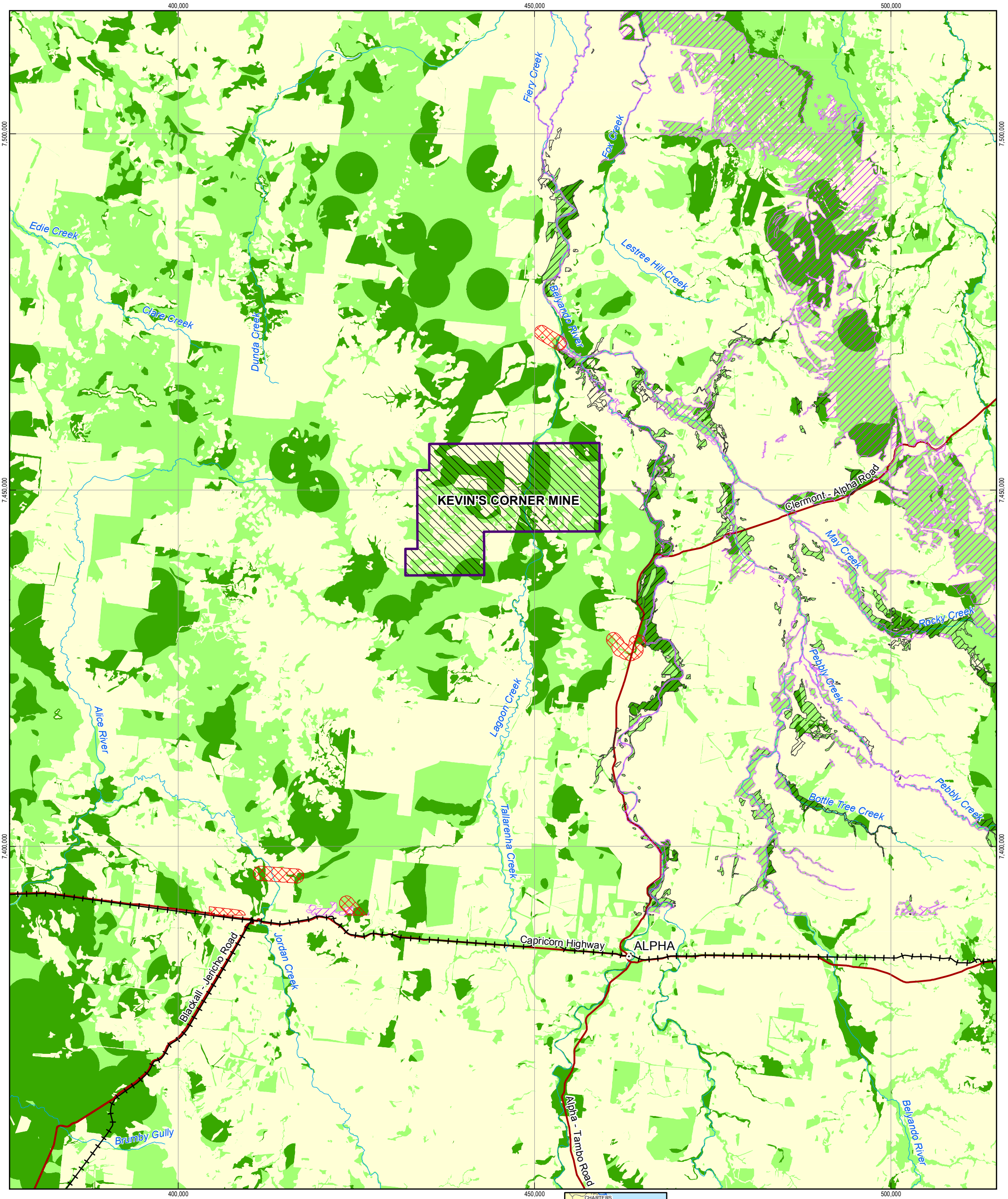

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Squatter Pigeon Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Kevin's Corner Project
Environmental Impact Statement

POTENTIAL SQUATTER PIGEON HABITAT - REGIONAL

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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H.A.1.4 Red Goshawk

H.A.1.4.1 EPBC Act Status

Vulnerable

H.A.1.4.2 Distribution and Habitat Information

The red goshawk (*Erythrotriorchis radiatus*) is sparsely distributed across northern sub-coastal and coastal Australia (SEWPAC, 2011c). This species inhabits forests and woodlands featuring a mosaic of vegetation types, particularly where these occur near permanent water (Marchant and Higgins, 1993). Forests of intermediate density are particularly favoured, as are ecotones between variably dense habitats (i.e. ecotones between rainforest and sclerophyll forest) (SEWPAC, 2011c). Large bird populations (the primary prey of this species) are also an important determinant of red goshawk distribution (SEWPAC, 2011c). It generally avoids open habitats, and is only rarely encountered over agricultural land (Marchant and Higgins, 1993). Nesting occurs in tall trees within one km of permanent water, generally in open, biologically-rich forest or woodland (Marchant and Higgins, 1993).

H.A.1.4.3 Threatening Processes

The main threatening process that has historically, and continues to adversely impact the red goshawk, is land clearing and associated habitat loss (SEWPAC, 2011c). Other potential threats to the species include:

- Agricultural practices (application of persistent pesticides, livestock degradation of riparian habitats, overgrazing and resultant impacts to prey densities)
- Altered fire regimes
- Shooting by poultry and pigeon owners
- Extreme natural events (bushfires, cyclones)
- Disturbance by birdwatchers at known nesting sites
- Poisoning
- Genetic bottlenecks (SEWPAC, 2011c)

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

H.A.1.4.4 Survey Guidelines and Field Survey Effort

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2009b) details recommended survey methodologies for detecting the red goshawk. Ground surveys for red goshawk nests in tall riparian trees are the suggested technique for detecting the presence of this species. Over a ten day period it is recommended that 80 hours are spent searching for nests in suitable area.

At the comprehensive and rapid fauna survey sites depicted in Figure H-6, standardised bird surveys (2ha for 20 minutes) for all bird species were undertaken. The bird survey methodology is described in Section H.4.5.2. In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

H.A.1.4.5 Desktop Assessment Results

The red goshawk was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

The Queensland DERM Wildlife Online database returned a record of this species from the desktop search extent (as defined in Section H.4.3).

H.A.1.4.6 Field Results

No red goshawks were recorded in the mine study area during seasonal field studies for the Project EIS. No red goshawk nests were detected.

H.A.1.4.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section H.4.6.

The habitat criteria used to model and map potential habitat for the red goshawk are presented in Table H.A-3 below.

Table H.A-3 Habitat Mapping Criteria – Red Goshawk

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Proximity to water#
'Confirmed habitat'	5 km radius around known records - sourced from the (Queensland) *Red Goshawk Conservation Management Profile* (Queensland Environmental Protection Agency (EPA), 2006)	NA			
'High value potential habitat'	NA	Brigalow Belt Bioregion (i.e. Bioregion 11): REs in Landzone 3, 4, 5, 8, 9, 11, 12 - specifically: 11.3.10, 11.3.12, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.2, 11.3.23, 11.3.25, 11.3.26, 11.3.28, 11.3.29, 11.3.3, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.3.4, 11.3.6, 11.3.7, 11.3.9, 11.4.10, 11.4.12, 11.4.13, 11.4.2, 11.4.7, 11.4.8, 11.5.1, 11.5.12, 11.5.13, 11.5.17, 11.5.2, 11.5.20, 11.5.21, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.8.1, 11.8.12, 11.8.14, 11.8.15, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.1, 11.9.10, 11.9.13, 11.9.14, 11.9.2, 11.9.7, 11.9.9, 11.11.1, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.12.1, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.17, 11.12.19, 11.12.2, 11.12.20, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9 Desert Uplands Bioregion (i.e. Bioregion 10): REs in Landzone 3, 4, 5, 9 - specifically: 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.2, 10.3.20, 10.3.27, 10.3.28, 10.3.5, 10.3.6, 10.3.9, 10.4.3, 10.4.9, 10.5.1, 10.5.10, 10.5.11, 10.5.12, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.9.2, 10.9.3, 10.9.5	Very High or High	Very High or High	RE polygon ≤ 1 km from water
'Low value potential habitat'	NA	Brigalow Belt Bioregion (i.e. Bioregion 11): REs in Landzone 3, 4, 5, 8, 9, 11, 12 - specifically: 11.3.10, 11.3.12, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.2, 11.3.23, 11.3.25, 11.3.26, 11.3.28, 11.3.29, 11.3.3, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.3.4, 11.3.6, 11.3.7,	Medium or Low	Medium or Low	RE polygon > 1 km from water

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Proximity to water#
		11.3.9, 11.4.10, 11.4.12, 11.4.13, 11.4.2, 11.4.7, 11.4.8, 11.5.1, 11.5.12, 11.5.13, 11.5.17, 11.5.2, 11.5.20, 11.5.21, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.8.1, 11.8.12, 11.8.14, 11.8.15, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.1, 11.9.10, 11.9.13, 11.9.14, 11.9.2, 11.9.7, 11.9.9, 11.11.1, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.12.1, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.17, 11.12.19, 11.12.2, 11.12.20, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9 Desert Uplands Bioregion (i.e. Bioregion 10): REs in Landzone 3, 4, 5, 9 - specifically: 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.2, 10.3.20, 10.3.27, 10.3.28, 10.3.5, 10.3.6, 10.3.9, 10.4.3, 10.4.9, 10.5.1, 10.5.10, 10.5.11, 10.5.12, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.9.2, 10.9.3, 10.9.5			
'Generally not suitable'	NA	All other REs and non-remnant veg			

* No Essential Habitat factors available at time of preparation - Selected REs typically those that feature eucalypt woodland / forest habitat. REs from landzones 6 (dunefields), 7 (ironstone jump-ups) and 10 (sandstone ranges) not considered for analysis - generally unsuitable habitat
# includes rivers/streams and wetlands for which geospatial data was available

Habitat within approximately 5 km of the center of mapped known records for the red goshawk, as presented in the *Red Goshawk Conservation Management Profile* (EPA, 2006), was mapped as 'confirmed habitat'

In order to qualify as 'high value potential habitat' for the red goshawk, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

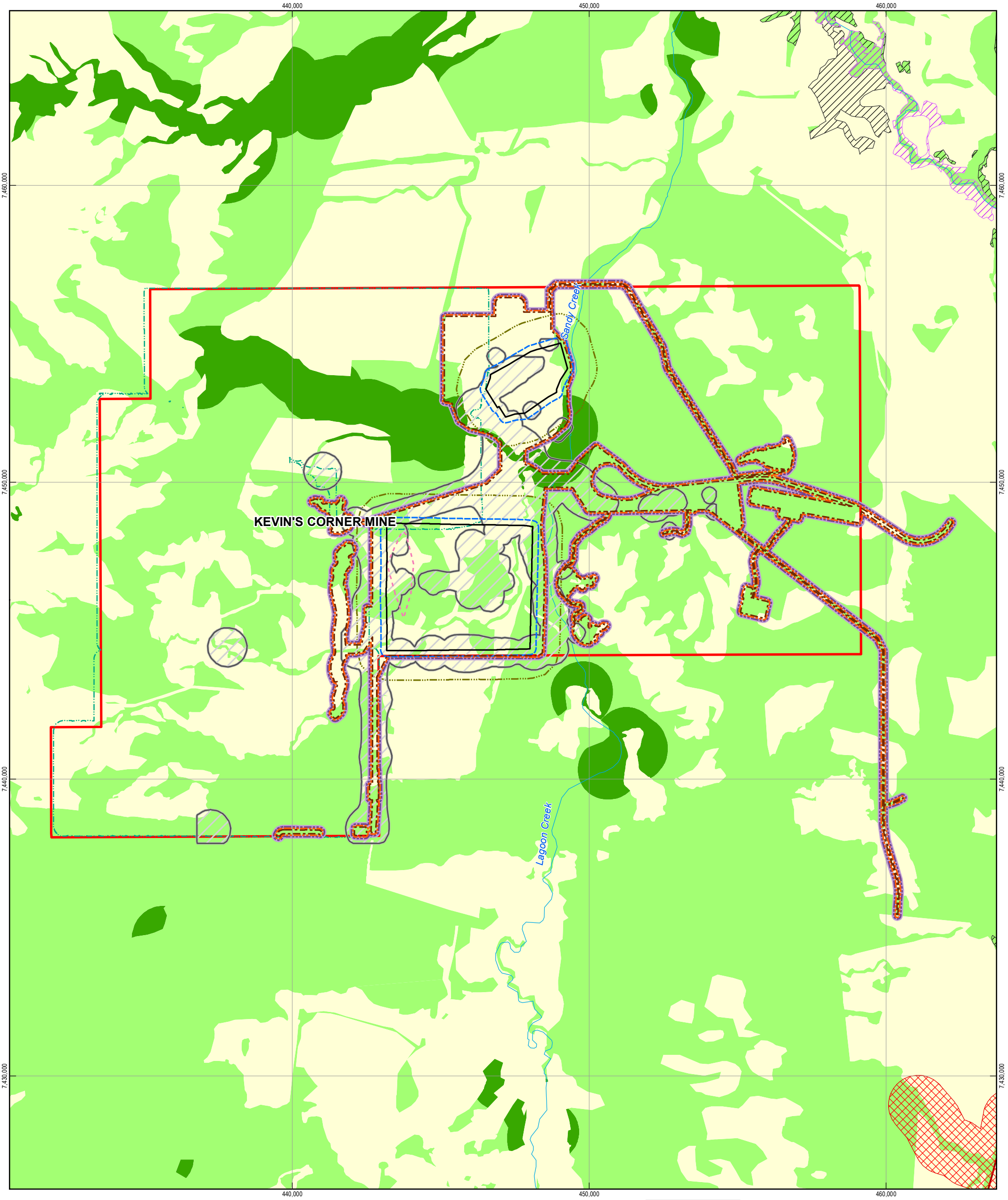
- Contain an RE listed in Table FA.A-3 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur within 1 km of a watercourse (river, stream or wetland, for which geospatial data exists)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND**/**OR** polygon > 1 km from watercourse), the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table H.A-3 or was non-remnant vegetation, it was mapped as 'generally not suitable' for the species.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the red goshawk are provided below.

A discussion of direct and indirect impacts to the red goshawk is provided in Section H.6. The area of 'confirmed habitat', 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.



LEGEND

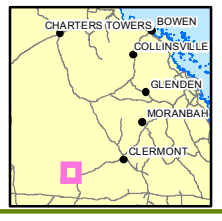
- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Red Goshawk Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration



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0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Kevin's Corner Project
Environmental Impact Statement

POTENTIAL RED GOSHAWK HABITAT- KEVIN'S CORNER MINE

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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400,000 450,000 500,000

7,500,000 7,450,000 7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Lestree Hill Creek
Belyando River
KEVIN'S CORNER MINE
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Alice River
Lagoon Creek
Tallarenha Creek
Capricorn Highway
ALPHA
Blackall - Jericho Road
Jordan Creek
Brumby Gully
Alpha - Tambo Road

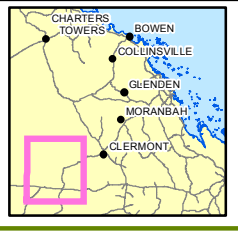
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Red Goshawk Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Environmental Impact Statement

POTENTIAL RED GOSHAWK HABITAT - REGIONAL

Job Number	41-23742
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Date	19 SEP 2011

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H.A.1.5 Star Finch

H.A.1.5.1 EPBC Act Status

Endangered

H.A.1.5.2 Distribution and Habitat Information

The distribution of star finch (*Neochmia ruficauda ruficauda*) populations is limited to central Queensland (Threatened Species Scientific Committee, 2008). The few accepted records suggest distribution of the star finch extends north to Bowen, west to beyond Winton and, based on recent records, south to near Wowan. Typical habitat favoured by the star finch (eastern) includes grasslands and grassy woodlands located close to bodies of fresh water (Garnett 1993; Gould 1865; Holmes 1996) as well as woodland areas associated with permanent water or those areas regularly inundated (SEWPaC, 2011). Occasionally, star finch (eastern) has also been recorded in cleared or suburban areas such as along roadsides and in towns (Baldwin 1975; Cayley 1932; Holmes 1996, 1998; Marshall 1932).

H.A.1.5.3 Threatening Processes

Several factors are thought to have contributed to the decline in star finch populations over the last several decades. Collection for the bird trade in the early 20th century coupled with impacts from prolonged drought on their preferred water-related habitat, resulted in an initial decline in the star finch population. Today, impacts include habitat degradation caused by over-grazing and trampling of habitat by livestock (Garnett & Crowley, 2000).

Currently, threats to the star finch as published by the Threatened Species Scientific Committee include:

- continued degradation of habitat by livestock;
- predation by introduced species such as feral cats (*Felis catus*) and European red foxes (*Vulpes vulpes*);
- invasive weeds threatening preferred habitat; and
- poisoning by contaminants, such as cyanide, employed in mining operations (Holmes, 1998; Garnett & Crowley, 2000).

H.A.1.5.4 Survey Guidelines and Field Survey Effort

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2009b) details recommended survey methodologies for detecting the star finch (eastern). As a guide, it is recommended that 15 hours per day are spent searching for the subspecies (in suitable habitat) over a five day period, for areas less than 50 ha (DEWHA, 2009b). In addition, surveys targeting waterholes, particularly during dry season are recommended to be carried out over four days for a minimum of ten hours per day (DEWHA, 2009).

Surveys should consist of area searches or transect-point surveys in suitable habitat such as rank grasses in riparian areas with pandanus or corypha palm as well as within flocks of other finches. Detection by calls and sighting with broadcast (playback) surveys especially in the morning and evening are appropriate. Targeted searches and subsequent watches of waterholes in the dry season may prove useful.

At the comprehensive and rapid fauna survey sites depicted in Figure H-6, standardised bird surveys (2ha for 20 minutes) for all bird species were undertaken. The bird survey methodology is described in Section H.4.5.2. In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

H.A.1.5.5 Desktop Assessment Results

The star finch was predicted to occur in the region of the mine study area by the Commonwealth Protected Matters Search Tool as well as searches of historical records (Wildlife Online Database). This combined desktop survey effort indicated a moderate potential for this species to exist within the proposed mine region.

A detailed description of the desktop studies undertaken can be found within Section H.4.3.

H.A.1.5.6 Field Results

The star finch (eastern) was not recorded in the mine study area during field studies for the Project EIS.

H.A.1.5.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section H.4.6.

The habitat criteria used to model and map potential habitat for the star finch (eastern) are presented in Table H.A-4 below.

Table H.A-4 Habitat Mapping Criteria – Star Finch

Mapping category	Known point records	Regional Ecosystems	Queensland BPA Criteria F- Ecosystem Diversity	Queensland BPA Criteria G – Context and Connection	Altitude*	Proximity to water#
'Confirmed habitat'	NA	NA				
'High value potential habitat'	NA	Landzone 3	Very High or High	Very High or High	NA	RE polygon < 1 km from water
'Low value potential habitat'	NA	Landzone 3	Medium or Low	Medium or Low	NA	RE polygon > 1 km from water
'Generally not suitable'	NA	All other REs and non-remnant vegetation				

*sourced from Queensland Department of Environment and Resource Management (DERM) Essential Habitat Factors for black-throated finch (southern)
#includes rivers/streams, wetlands and bores for which geospatial data was available

In order to qualify as 'high value potential habitat' for the star finch, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain a Regional Ecosystem (RE) listed in Table FA.A-4 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (Queensland DERM Biodiversity Planning Assessment (BPA) Criteria F – an indication of habitat complexity) AND
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) AND
- Occur within 1 km of a watercourse (river, stream, wetland or bore, for which geospatial data exists)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND**/**OR** polygon > 1 km from watercourse), the RE polygon was mapped as 'low value potential habitat'.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the star finch are provided below.

A discussion of direct and indirect impacts to the star finch is provided in Section H.6. The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.

440,000 450,000 460,000

7,460,000 7,450,000 7,440,000 7,430,000

Sandy Creek

KEVIN'S CORNER MINE

Lagoon Creek

LEGEND

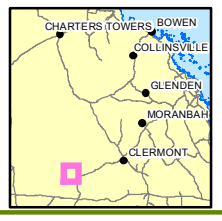
- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Star Finch Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration



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0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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POTENTIAL STAR FINCH HABITAT - KEVIN'S CORNER MINE

Job Number	41-23742
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7,400,000

KEVIN'S CORNER MINE

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Lestree Hill Creek
Belyando River
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Alice River
Lagoon Creek
Tallarenha Creek
Capricorn Highway
ALPHA
Blackall - Jericho Road
Jordan Creek
Brumby Gully
Alpha - Tambo Road

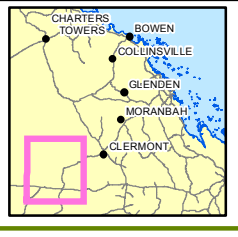
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Star Finch Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



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1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Environmental Impact Statement

POTENTIAL START FINCH HABITAT - REGIONAL

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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H.A.1.6 Australian Painted Snipe

H.A.1.6.1 EPBC Act Status

Vulnerable

H.A.1.6.2 Distribution and Habitat Information

The Australian painted snipe (*Rostratula australis*) has a scattered distribution across eastern and northern Australia (SEWPAC, 2011d). It has been recorded from wetlands in all Australian states, although it is most prevalent in eastern Australia (SEWPAC, 2011d).

Shallow freshwater wetlands are the main habitat for the Australian painted snipe (Marchant and Higgins, 1993). Such wetlands may include lakes, swamps, claypans, inundated/waterlogged grassland, dams, irrigated crop land and sewage ponds (Marchant and Higgings, 1993). Preferred wetland habitats boast emergent vegetation (including tussocks, grasses, sedges, rushses, reeds, canegrass and/or Melaleuca) (Marchant and Higgins, 1993). Nesting occurs amongst vegetation in or adjacent to wetlands (SEWPAC, 2011d).

H.A.1.6.3 Threatening Processes

The major threat to the Australian painted snipe is the loss or alteration of wetland habitats (SEWPAC, 2011d). Degradation may result from changes to water quality, livestock (trampling and overgrazing), altered flow regimes, altered fire regimes and invasive weeds (SEWPAC, 2011d). While not recognised as a contributing factor to the species' decline, predation by introduced predators such as foxes and cats may pose a potential threat to the Australian painted snipe (SEWPAC, 2011d).

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

H.A.1.6.4 Survey Guidelines

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2009b) details recommended survey methodologies for detecting the Australian painted snipe. This includes targeted stationary observations at dawn and dusk of suitable wetland habitat, for a minimum of 10 hours over five days. Land-based area searches or line transects through wetland habitat are also recommended, for a minimum of 10 hours over three days. For both techniques the recommended times relate to sites less than 50 ha, where a wetland is present and holding water (but not flooded).

During field surveys for the Project , a minimum of one hour was invested in bird searches at the 20 comprehensive survey sites, and a minimum of 20 minutes was spent searching at each rapid assessment site. At the comprehensive and rapid fauna survey sites depicted in Figure H-6, standardised bird surveys (2ha for 20 minutes) for all bird species were undertaken. The bird survey

methodology is described in Section H.4.5.2 EPBC Report . In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

H.A.1.6.5 Desktop Assessment Results

The Australian painted snipe was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

No historical records of this species were returned from a query of relevant databases in the desktop search extent (as defined in Section H.4.3).

H.A.1.6.6 Field Results

The Australian painted snipe was not recorded in the mine study area during seasonal field studies for the Project EIS.

H.A.1.6.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section H.4.6.

The habitat criteria used to model and map potential habitat for the Australian painted snipe are presented in Table H.A-5 below.

Table H.A-5 Habitat Mapping Criteria – Australian Painted Snipe

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection
'Confirmed habitat'	No sighting records / point data available	NA		
'High value potential habitat'	NA	RE 11.3.27 OR Habitat patch (i.e. remnant vegetation polygon) within 0.5 km of a water source (i.e. river, lake, wetland)	Very High or High	Very High or High
'Low value potential habitat'	NA	RE 11.3.27 OR Habitat patch (i.e. remnant vegetation polygon) within 0.5 km of a water source (i.e. river, lake, wetland)	Medium or Low	Medium or Low
'Generally not suitable'	NA	NA		

* No DERM Essential Habitat factors available at time of preparation - habitats associated with wetlands (i.e. rivers/streams and wetlands) for which geospatial data was available was mapped

No sighting records or point data for the Australian painted snipe was available and as such no 'confirmed habitat' was mapped for the species.

In order to qualify as 'high value potential habitat' for the Australian painted snipe, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain an RE listed in Table H.A-5 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **OR** any other RE occurring within 0.5 km of water source **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) AND
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low), the RE polygon was mapped as 'low value potential habitat'

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table H.A-5, or was non-remnant vegetation, it was mapped as 'generally not suitable' for the species

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the Australian painted snipe are provided below.

A discussion of direct and indirect impacts to the Australian painted snipe is provided in Section H.6. The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.

440,000 450,000 460,000

7,460,000 7,450,000 7,440,000 7,430,000

Sandy Creek

KEVIN'S CORNER MINE

Lagoon Creek

LEGEND

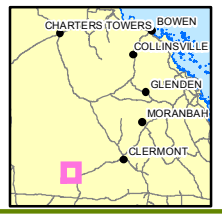
- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

A. Painted Snipe Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Kevin's Corner Project
Environmental Impact Statement

POTENTIAL A. PAINTED SNIPE HABITAT - KEVIN'S CORNER MINE

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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7,500,000 7,450,000 7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Lestree Hill Creek
Belyando River
KEVIN'S CORNER MINE
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Alice River
Lagoon Creek
Tallarenha Creek
Capricorn Highway
ALPHA
Blackall - Jericho Road
Jordan Creek
Brumby Gully
Alpha - Tambo Road

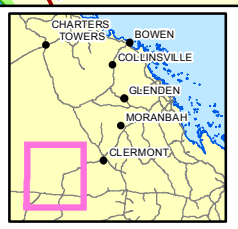
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

A. Painted Snipe Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Kevin's Corner Project
Environmental Impact Statement

POTENTIAL A. PAINTED SNIPE HABITAT - REGION

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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H.A.1.7 Ornamental Snake

H.A.1.7.1 EPBC Act Status

Vulnerable

H.A.1.7.2 Distribution and Habitat Information

The ornamental snake (*Denisonia maculata*) is known from the Brigalow Belt North and parts of the Brigalow Belt South bioregions (SEWPAC, 2011h). This species' distribution is associated with the drainage system of the Fitzroy and Dawson Rivers (SEWPAC, 2011h).

Suitable habitat for this species occurs in remnant vegetation on, or surrounding gilgai mounds and depressions, with the maintenance of these environments important for the persistence of this species (SEWPAC, 2011h). Habitat for the ornamental snake is likely to be found in brigalow (*Acacia harpophylla*), gidgee (*Acacia cambagei*), blackwood (*Acacia argyrodendron*) and coolabah (*Eucalyptus coolabah*) dominated vegetation communities as well as grasslands associated with gilgais (SEWPAC, 2011h). The ornamental snake's preferred habitat is within woodlands and open forests associated with moist areas, similar to the habitat of frogs, which are its favoured prey (SEWPAC, 2011h). Microhabitat for this species includes logs, coarse woody debris, and ground litter (SEWPAC, 2011h).

H.A.1.7.3 Threatening Processes

Ornamental snake populations have experienced declines in abundance throughout recent decades, possibly due to a number of factors (SEWPAC, 2011h). The primary threats to the persistence of this species include:

- Habitat loss through land clearing for development
- Habitat fragmentation
- Habitat degradation by cattle overgrazing and alteration of soil structure
- Alteration of landscape hydrology in gilgai environments
- Alteration of water quality through pollution of watercourses (SEWPAC, 2011h)

Other threats include:

- Interactions with the cane toad (*Rhinella marina*)
- Invasive weeds
- Predation by feral species (SEWPAC, 2011h)

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs
- The biological effects, including lethal toxic ingestion, caused by cane toads (*Bufo marinus* (now *Rhinella marina*))

H.A.1.7.4 Survey Guidelines

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Reptiles* (SEWPAC, 2011i) details recommended survey methodologies for detecting the ornamental snake. The survey guidelines state that no survey methods are known to reliably detect ornamental snakes during dry weather/seasons (SEWPAC, 2011i). Searches conducted around suitable gilgai habitat while frogs are active is the most reliable method to encounter this species - if wet weather inhibits access to gilgai habitats, driving roads at night while frogs are active is also identified as a survey method (SEWPAC, 2011i). Diurnal searches under logs, coarse woody debris, ground litter and other sheltering sites could also be employed (SEWPAC, 2011i). The survey guidelines also state that pitfall and funnel trap complexes could be trialled, however that these methods are likely to return low yields (SEWPAC, 2011i).

The Commonwealth Government's *Draft Referral guidelines for the nationally listed Brigalow Belt Reptiles* (SEWPAC, 2011j) also identify targeted survey efforts and techniques required to detect the ornamental snake. In summary, the survey techniques suitable for detecting the ornamental snake include:

- One-off diurnal searches of microhabitats during the coolest parts of the day surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three days
- Spotlighting inundated gilgais, riparian habitats, and large logs between dusk and early morning hours surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three nights
- Pitfall and funnel trapping using six 20 litre buckets distributed under a 30 m drift fence where suitable microhabitats occur. Funnel traps should be placed at the end of each pitfall line, with at least two replicates for each habitat type

As outlined in section H.4.5.2, a total of 36 fauna transect sites were established on and surrounding the Project site. Each site was subject to trapping regimes of up to four consecutive nights for pitfall (in combination with funnel) traps and five consecutive nights for Cage and Elliot Traps. This trapping was conducted in conjunction with spotlighting (walking and driving), opportunistic diurnal micro-habitat searches, scat and track searched as well as incidental recording.

H.A.1.7.5 Desktop Assessment Results

The ornamental snake was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

The Queensland DERM Wildlife Online database returned a record of this species from the desktop search extent (as defined in Section H.4.3).

H.A.1.7.6 Field Results

The ornamental snake was not detected during field studies for the Project.

H.A.1.7.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section H.4.6.

The habitat criteria used to model and map potential habitat for ornamental snake are presented in Table H.A-6 below.

Table H.A-6 Habitat Mapping Criteria – Ornamental Snake

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F-Ecosystem Diversity	Queensland BPA Criteria G – Context and Connection	Altitude*
'Confirmed habitat'	Remnant vegetation within 5 km radius of ornamental snake record from Project SEIS field studies	NA			
'High value potential habitat'	NA	11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21	Very High or High	Very High or High	100 – 450 m
'Low value potential habitat'	NA	11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2,	Medium or Low	Medium or Low	Altitude < 100m or Altitude > 450m

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F-Ecosystem Diversity	Queensland BPA Criteria G – Context and Connection	Altitude*
		11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21			
'Generally not suitable'	NA	All other REs and non-remnant vegetation			

*sourced from DERM Essential Habitat Factors for ornamental snake

Remnant vegetation within 5 km of the one ornamental snake record from Project field studies was mapped as 'confirmed habitat'.

In order to qualify as 'high value potential habitat' for the ornamental snake, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain an RE listed in Table H.A-6 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur at an altitude of 100 – 450 metres

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND/OR** altitude < 100 m or > 450 m, the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table H.A-6 or was non-remnant vegetation, it was mapped as 'generally not suitable' for the species.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the ornamental snake are provided below.

A discussion of direct and indirect impacts to the ornamental snake is provided in Section H.6. The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.

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7,460,000 7,450,000 7,440,000 7,430,000

Sandy Creek

KEVIN'S CORNER MINE

Lagoon Creek

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Ornamental Snake Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration

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1:120,000 (at A3)

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Kevin's Corner Project
Environmental Impact Statement

POTENTIAL ORNAMENTAL SNAKE HABITAT - KEVIN'S CORNER MINE

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Lestree Hill Creek
Belyando River
KEVIN'S CORNER MINE
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Pebbly Creek
Alice River
Lagoon Creek
Tallarenha Creek
Capricorn Highway
ALPHA
Blackall - Jericho Road
Jordan Creek
Brumby Gully
Alpha - Tambo Road
Belyando River

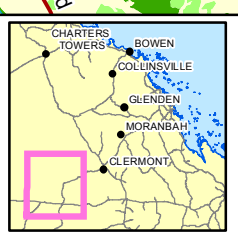
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Ornamental Snake Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



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1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Kevin's Corner Project
Environmental Impact Statement

POTENTIAL ORNAMENTAL SNAKE HABITAT - REGION

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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H.A.1.8 Dunmall's Snake

H.A.1.8.1 EPBC Act Status

Vulnerable

H.A.1.8.2 Distribution and Habitat Information

Dunmall's Snake (*Furina dunmalli*) has a highly fragmented distribution from Yeppoon in Queensland to the New South Wales border and as far south as Ashford in New South Wales. The snake is very rare or secretive with limited existing records (SEWPAC, 2011k).

Records indicate the species occurs at elevations of 200–500 m above sea level. Dunmall's snake is known to occur in forest and woodland habitats dominated by the following species:

- Brigalow (*Acacia harpophylla*) on black alluvial cracking clay and clay loams
- Wattles (*A. burowii, A. deanii, A. leioclyx*)
- Cypress (*Callitris* spp.)
- Bull-oak (*Allocasuarina luehmannii*)
- Spotted Gum (*Corymbia citriodora*)
- Ironbark (*Eucalyptus crebra* and *E. melanophloia*) on coarse-grained sediments (SEWPAC, 2011k)

Little is known about the species' microhabitat requirements. Individuals have been found sheltering under fallen timber and ground litter, and the species may use cracks in alluvial clay soils (SEWPAC, 2011k).

H.A.1.8.3 Threatening Processes

The distribution of Dunmall's snake is highly fragmented and the species has experienced dramatic declines. The major threats to Dunmall's snake are identified as:

- Habitat loss through land clearing for development (mining, urban and agriculture)
- Habitat degradation by overgrazing of domestic stock
- Loss of microhabitats in the form of fallen timber and ground litter
- Invasion of weeds
- Predation by feral species
- Alteration of landscape hydrology in gilgai and swamp environments

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs
- The biological effects, including lethal toxic ingestion, caused by cane toads (*Bufo marinus* (now *Rhinella marina*)).

H.A.1.8.4 Survey Guidelines

Dunmall's snake is secretive, difficult to detect and commonly misidentified. Whilst no survey methods are known to reliably detect the species, the Commonwealth Government's *Survey Guidelines for Australia's Threatened Reptiles* (SEWPAC, 2011i) details recommended survey methodologies for detecting the Dunmall's snake. These methods include active searching of sheltering microhabitat sites (woody debris and leaf litter), pitfall trapping and spotlighting along roads. It should be noted that these methods are considered likely to return low yields.

The Commonwealth Government's *Draft Referral guidelines for the nationally listed Brigalow Belt Reptiles* (SEWPAC, 2011j) also identify targeted survey effort and techniques required to detect the Dunmall's snake. In summary, the survey techniques suitable for detecting the Dunmall's snake include:

- One-off diurnal searches of microhabitats during the coolest parts of the day surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three days
- Spotlighting inundated gilgais, riparian habitats, and large logs between dusk and early morning hours surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three nights
- Pitfall and funnel trapping using six 20 L buckets distributed under a 30 m drift fence where suitable microhabitats occur. Funnel traps should be placed at the end of each pitfall line, with at least 2 replicates for each habitat type.

As outlined in section H.4.5.2, a total of 36 fauna transect sites were established on and surrounding the Project site. Each site was subject to trapping regimes of up to four consecutive nights for pitfall (in combination with funnel) traps and five consecutive nights for Cage and Elliot Traps. This trapping was conducted in conjunction with spotlighting (walking and driving), opportunistic diurnal micro-habitat searches, scat and track searched as well as incidental recording.

H.A.1.8.5 Desktop Assessment Results

Dunmall's snake was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

No historical records of this species were returned from a query of relevant databases in the desktop search extent (as defined in Section H.4.3).

H.A.1.8.6 Field Results

Dunmall's snake was not recorded in the mine study area during seasonal field studies for the Project EIS.

H.A.1.8.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section H.4.6.

The habitat criteria used to model and map potential habitat for Dunmall's snake are presented in Table H.A-7 below.

Table H.A-7 Habitat Mapping Criteria – Dunmall's Snake

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Modelled distribution (SEWPAC, 2011j)#
'Confirmed habitat'	No sighting records / point data available	NA				
'High value potential habitat'	NA	11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21	Very High or High	Very High or High	200-500 m	Within SEWPA,(2011j) modelled distribution ('likely to occur' and 'may occur')
'Low value potential habitat'	NA	11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21,	Medium or Low	Medium or Low	<200m >500 m	Within SEWPA,(2011j) modelled distribution ('likely to occur' and 'may occur')

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Modelled distribution (SEWPAC, 2011j)#
		11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21				
'Generally not suitable'	NA	REs from all other land zones and non-remnant vegetation Outside of modelled distribution (SEWPAC, 2011j) all habitat will be generally not suitable				

*No Essential Habitat Factors were available for Dunmall's snake. Those REs from the Brigalow Belt Bioregion that are Essential Habitat factors for the ornamental snake (which shares similar habitat preferences to Dunmall's snake) were used to map habitat for this species. Altitude criteria derived from information presented in Commonwealth Government Species Profile and Threats (SPRAT) database profile of Dunmall's snake (SEWPAC, 2011k)

Modelled distribution mapping, presented in the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles* (SEWPAC, 2011j), available at: http://www.environment.gov.au/epbc/publications/brigalow-belt-reptiles.html

No sighting records or point data for the Dunmall's snake was available and as such no 'confirmed habitat' was mapped for the species

In order to qualify as 'high value potential habitat' for Dunmall's snake, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain an RE listed in Table H.A-7 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur at an altitude of 200 – 500 metres **AND**
- Occur within the modelled distribution of the species

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND**/**OR** altitude < 200 m or > 500 m), the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table H.A-7, or was non-remnant vegetation, or was outside the modelled distribution for the Dunmall's snake, it was mapped as 'generally not suitable' for the species.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for Dunmall's snake are provided below.

A discussion of direct and indirect impacts to the Dunmall's snake is provided in Section H.6. The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.

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Sandy Creek

KEVIN'S CORNER MINE

Lagoon Creek

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Dunmall's Snake Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration

Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:120,000 (at A3)

0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N

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Kevin's Corner Project
Environmental Impact Statement

POTENTIAL DUNMALL'S SNAKE HABITAT - KEVIN'S CORNER MINE

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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7,500,000
7,450,000
7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Lestree Hill Creek
Belyando River
KEVIN'S CORNER MINE
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Pebbly Creek
Lagoon Creek
Tallarenha Creek
Alice River
Blackall - Jericho Road
Jordan Creek
Capricorn Highway
ALPHA
Alpha - Tambo Road
Brumby Gully
Belyando River

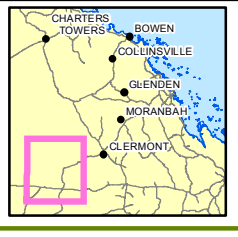
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Dunmall's Snake Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N

HANCOCK GALILEE PTY LTD

Kevin's Corner Project
Environmental Impact Statement

POTENTIAL DUNMALL'S SNAKE HABITAT - REGION

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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H.A.1.9 Yakka Skink

H.A.1.9.1 EPBC Act Status

Vulnerable

H.A.1.9.2 Distribution and Habitat Information

The yakka skink (*Egernia rugosa*) has a discontinuous and patchy distribution stretching from Cape York Peninsula to south east Queensland. The Brigalow Belt (North and South) bioregions are within this species' distribution (SEWPAC, 2011l).

The yakka skink is known to occur in the EPBC Act-listed Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community and in the Queensland Regional Ecosystem (RE) 11.3.2 which may coincide with the EPBC Act-listed Endangered Weeping Myall Woodlands Threatened Ecological Community.

The yakka skink is commonly associated with the following woodland and open forest types:

- Brigalow (*Acacia harpophylla*)
- Mulga (*A. aneura*)
- Bendee (*A. catenulata*)
- Lancewood (*A. shirleyi*)
- Belah (*Casuarina cristata*)
- Poplar box (*Eucalyptus populnea*)
- Ironbark (*Eucalyptus spp.)*
- White cypress pine (*Callitris glaucophylla*).

The yakka skink is commonly found sheltering under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows. This species is not generally found in trees or rocky habitats. The species often takes refuge in hollow logs, dense ground vegetation and deep burrow systems. The yakka skink can persist in cleared habitats where shelter is provided by log piles, deep gullies, tunnel erosion/sinkholes and rabbit warrens. Yakka skinks will create communal defecation sites or scat piles near the entrance to their burrows (SEWPAC, 2011l).

H.A.1.9.3 Threatening Processes

Yakka skink populations, like other reptiles in the Brigalow Belt bioregion, have experienced declines, possibly due to a number of factors. Threats to the persistence of this species include:

- Habitat reduction through land clearing for development
- Habitat degradation
- Removal of microhabitats
- Inappropriate roadside management
- Predation by feral species (SEWPAC, 2011l).

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases

- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

H.A.1.9.4 Survey Guidelines

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Reptiles* (SEWPAC, 2011i) details recommended survey methodologies for detecting the yakka skink. The most reliable method of detection for this species is active searches for burrow systems and communal defecation sites. Once these locations have been identified the species can be confirmed through trapping around burrows, observations from a distance and shining a torch down the burrow at night (SEWPAC, 2011i).

The Commonwealth Government's *Draft Referral guidelines for the nationally listed Brigalow Belt Reptiles* (SEWPAC, 2011j) also identify targeted survey effort and techniques required to detect the yakka skink. In summary, the survey techniques suitable for detecting the yakka skink include:

- One-off diurnal searches of microhabitats during the coolest parts of the day surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three days
- Spotlighting inundated gilgais, riparian habitats, and large logs between dusk and early morning hours surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three nights
- Cage and Elliot traps should be places close as possible to burrow entrances

As outlined in section H.4.5.2, a total of 36 fauna transect sites were established on and surrounding the Project site. Each site was subject to trapping regimes of up to four consecutive nights for pitfall (in combination with funnel) traps and five consecutive nights for Cage and Elliot Traps. This trapping was conducted in conjunction with spotlighting (walking and driving), opportunistic diurnal micro-habitat searches, scat and track searched as well as incidental recording.

H.A.1.9.5 Desktop Assessment Results

The yakka skink was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

The Queensland DERM Wildlife Online database returned a record of this species from the desktop search extent (as defined in Section H.4.3).

H.A.1.9.6 Field Results

The yakka skink was not recorded in the mine study area during seasonal field studies for the Project EIS.

H.A.1.9.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section H.4.6. The habitat criteria used to model and map potential habitat for yakka skink are presented in Table H.A-8 below.

Table H.A-8 Habitat Mapping Criteria – Yakka Skink

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*
'Confirmed habitat'	No sighting records / point data available	NA			
'High value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9.2, 10.9.3, 10.9.5, 10.9.6, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.6, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.15, 11.5.16, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.3, 11.8.4, 11.8.5, 11.8.6, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.4, 11.9.5, 11.9.6, 11.9.7, 11.9.8, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.11.21, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.19, 11.12.20, 11.12.21	Very High or High	Very High or High	100 – 1000 m
'Low value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9.2, 10.9.3, 10.9.5, 10.9.6, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4,	Medium or Low	Medium or Low	Altitude < 100 m or Altitude > 1000 m

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*
		10.10.5, 10.10.7, 11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.6, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.15, 11.5.16, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.3, 11.8.4, 11.8.5, 11.8.6, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.4, 11.9.5, 11.9.6, 11.9.7, 11.9.8, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.11.21, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.19, 11.12.20, 11.12.21			
'Generally not suitable'	NA	All other REs and non-remnant vegetation			

*sourced from DERM Essential Habitat Factors for yakka skink

No sighting records or point data for the yakka skink was available and as such no 'confirmed habitat' was mapped for the species.

In order to qualify as 'high value potential habitat' for the yakka skink, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain an RE listed in Table FA.A-8 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur at an altitude of 100 – 1000 metres

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND/OR** altitude < 100 m or > 1000 m, the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table H.A-8, or was non-remnant vegetation, it was mapped as 'generally not suitable' for the species.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the yakka skink are provided below.

A discussion of direct and indirect impacts to the yakka skink is provided in Section H.6. The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.

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Sandy Creek

KEVIN'S CORNER MINE

Lagoon Creek

LEGEND

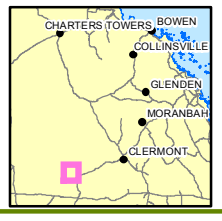
- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Yakka Skink Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Kevin's Corner Project
Environmental Impact Statement

POTENTIAL YAKKA SKINK HABITAT - KEVIN'S CORNER MINE

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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7,500,000 7,450,000 7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Lestree Hill Creek
Belyando River
KEVIN'S CORNER MINE
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Alice River
Lagoon Creek
Tallarenha Creek
Jordan Creek
Blackall - Jericho Road
Capricorn Highway
ALPHA
Alpha - Tambo Road
Brumby Gully

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Yakka Skink Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Kevin's Corner Project
Environmental Impact Statement

POTENTIAL YAKKA SKINK HABITAT - REGIONAL

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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H.A.1.10 Brigalow Scaly-Foot

H.A.1.10.1 EPBC Act Status

Vulnerable

H.A.1.10.2 Distribution and Habitat Information

The brigalow scaly-foot's (*Paradelma orientalis*) distribution is highly fragmented throughout its Queensland range. The species' distribution is centred on the Brigalow Belt of Queensland. The species occurs in the Brigalow Belt North and South bioregions, the southern parts of the Desert Uplands bioregion and the Mulga Lands bioregion (SEWPAC, 2011m).

The species is found on sandstone ridges to undulating plains in a wide diversity of remnant and non-remnant open forest and woodland habitats including:

- Brigalow (*Acacia harpophylla*) communities
- Gidgee (*Acacia cambagei*)
- Bendee (*Acacia catenulata*)
- Lancewood (*Acacia shirleyi*)
- Broad-leafed hickory wattle (*Acacia falciformis*)
- Blue spotted gum (*Corymbia citriodora*)
- Narrow-leaved ironbark (*Eucalyptus crebra*)
- Bimble/poplar box (*Eucalyptus populnea*)
- Belah (*Casuarina cristata*)
- Cypress pine (*Callitris columellaris*)
- Buloke/bull oak (*Allocasuarina luehmannii*).

The species is also known to persist in highly disturbed vegetation types. Brigalow scaly-foot microhabitats are known to include sandstone slabs, surface debris and grass hummocks.

H.A.1.10.3 Threatening Processes

Brigalow scaly-foot populations have experienced declines in abundance possibly due to a number of factors (SEWPAC, 2011m). Threats to the persistence of this species include:

- Habitat loss through land clearing for development
- Habitat fragmentation
- Inappropriate roadside burns, slashing and road widening
- Introduction of roadside lighting
- Inappropriate fire
- Predation by feral species (SEWPAC, 2011m)

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

H.A.1.10.4 Survey Guidelines

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Reptiles* (SEWPAC, 2011i) details recommended survey methodologies for detecting the brigalow scaly-foot. The most appropriate survey methods for this species are diurnal hand searches under potential microhabitat such as rocks, fallen bark, leaf litter and timber combined with nocturnal spotlighting searches on the ground and the lower portion of rough barked, sap exuding trees (SEWPAC, 2011i).

The Commonwealth Government's *Draft Referral guidelines for the nationally listed Brigalow Belt Reptiles* (SEWPAC, 2011j) also identify targeted survey effort and techniques required to detect the brigalow scaly-foot. In summary, the survey techniques suitable for detecting the brigalow scaly-foot include:

- One-off diurnal searches of microhabitats during the coolest parts of the day surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three days
- Spotlighting inundated gilgais, riparian habitats, and large logs between dusk and early morning hours surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three nights
- Pitfall and funnel trapping using six 20 L buckets distributed under a 30 m drift fence where suitable microhabitats occur. Funnel traps should be placed at the end of each pitfall line, with at least 2 replicates for each habitat type

As outlined in section H.4.5.2, a total of 36 fauna transect sites were established on and surrounding the Project site. Each site was subject to trapping regimes of up to four consecutive nights for pitfall (in combination with funnel) traps and five consecutive nights for Cage and Elliot Traps. This trapping was conducted in conjunction with spotlighting (walking and driving), opportunistic diurnal micro-habitat searches, scat and track searched as well as incidental recording.

H.A.1.10.5 Desktop Assessment Results

The brigalow scaly-foot was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

The Queensland DERM Wildlife Online database returned a record of this species from the desktop search extent (as defined in Section H.4.3).

H.A.1.10.6 Field Results

The brigalow scaly-foot was not recorded in the mine study area during seasonal field studies for the Project EIS.

H.A.1.10.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section H.4.6. The habitat criteria used to model and map potential habitat for ornamental snake are presented in Table H.A-9 below.

Table H.A-9 Habitat Mapping Criteria – Brigalow Scaly-foot

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude *	Modelled distribution (SEWPAC, 2011j)#
'Confirmed habitat'	No sighting records / point data available	NA				
'High value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.7, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.29, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.6, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9 .2, 10.9.3, 10.9.5, 10.9.6, 10.9.7, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.1.4, 11.2.1, 11.2.2, 11.2.3, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.11, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.1, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.13, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.4, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.8, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.5, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.18, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.4, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10,	Very High or High	Very High or High	0 – 800 m	Within SEWPAC (2011j) modelled distribution ('likely to occur' and 'may occur')

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude *	Modelled distribution (SEWPAC, 2011j)#
		11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21				
'Low value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.7, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.29, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.6, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9 .2, 10.9.3, 10.9.5, 10.9.6, 10.9.7, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.1.4, 11.2.1, 11.2.2, 11.2.3, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.11, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.1, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.13, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.4, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.8, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.5, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.18, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.4, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16,	Medium or Low	Medium or Low	>800 m	Within SEWPAC (2011j) modelled distribution ('likely to occur' and 'may occur')

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude *	Modelled distribution (SEWPAC, 2011j)#
		11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21				
'Generally not suitable'	NA	REs from all other land zones and non-remnant vegetation Outside of modelled distribution (SEWPAC, 2011j) all habitat will be generally not suitable				

*sourced from DERM Essential Habitat Factors for brigalow scaly-foot
modelled distribution mapping, presented in the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles* (SEWPAC, 2011j), available at:
http://www.environment.gov.au/epbc/publications/brigalow-belt-reptiles.html

No sighting records or point data for the brigalow scaly-foot was available and as such no 'confirmed habitat' was mapped for the species.

In order to qualify as 'high value potential habitat' for the brigalow scaly-foot, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain an RE listed in Table H.A-9 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur at an altitude of 0 – 800 metres **AND**
- Occur within the modelled distribution of the species

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND**/**OR** altitude > 800 m), the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table H.A-9, or was non-remnant vegetation, or was outside the modelled distribution for the brigalow scaly-foot, it was mapped as 'generally not suitable' for the species.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the brigalow scaly-foot are provided below.

A discussion of direct and indirect impacts to the brigalow scaly-foot is provided in Section H.6. The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.

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Sandy Creek

KEVIN'S CORNER MINE

Lagoon Creek

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Brigalow Scaly-foot Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Environmental Impact Statement

POTENTIAL BRIGALOW SCALY-FOOT HABITAT - KEVIN'S CORNER MINE

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Lestree Hill Creek
Belyando River
KEVIN'S CORNER MINE
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Alice River
Lagoon Creek
Tallarenha Creek
Capricorn Highway
ALPHA
Blackall - Jericho Road
Jordan Creek
Brumby Gully
Alpha - Tambo Road

CHARTERS TOWERS
BOWEN
COLLINSVILLE
GLENDEN
MORANBAH
CLERMONT

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Brigalow Scaly-foot Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Kevin's Corner Project
Environmental Impact Statement

POTENTIAL BRIGALOW SCALY-FOOT HABITAT - REGIONAL

Job Number	41-23742
Revision	A
Date	19 SEP 2011

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H.A.1.11 Greater long-eared bat

H.A.1.11.1 EPBC Act status

Vulnerable

H.A.1.11.2 Distribution and Habitat Information

In Queensland, the greater long-eared bat (*Nytopholis timoriensis)* is found primarily in the Brigalow Belt South Bioregion, extending eastwards to the Bunya Mountains National Park, with presence recorded as far north as the Expedition Range and Dawson River areas and a westerly range extending into the Mulgalands Bioregion and west of Bollon. There are limited records in Victoria, with patchy distributions in the Northern Plains and Mallee regions and more trapping surveys in the Hattah-Kulkyne National Park and Nowingi area, north-west Victoria, than elsewhere in the state (Koehler 2006; Lumsden 1994; Lumsden et al. 2008).

The Greater Long-eared Bat occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodlands. Throughout inland Queensland, the species habitat is dominated by various eucalypt and bloodwood species, and various types of tree mallee with it being most abundant in vegetation with a distinct canopy and a dense cluttered shrub layer (Dominelli 2000; Ellis et al. 1999; Koehler 2006; Lumsden 1994; McFarland et al. 1999; Parnaby 1995; Turbill & Ellis 2006).

H.A.1.11.3 Threatening Processes

There is a lack of data available in order to accurately assess the population decline of the greater long-eared bat thereby determining past and current threats (SEWPaC, 2011). It is thought however, past tree clearing is likely to be a major factor in the species' decline.

Schulz and Lumsden (2010) suggest that current potential threats could include habitat loss and fragmentation, fire, forestry activities, overgrazing and exposure to agrichemicals, predation by feral species, tree hollow competition and climate change.

H.A.1.11.4 Survey Guidelines and Field Survey Effort

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Bats* (DEWHA, 2009b) details recommended survey methodologies for detecting the greater long-eared bat

It is recommended that passive acoustic detection methods (e.g. Anabat detectors) are used to identify areas potentially used by long-eared bats even if species level discrimination is not possible. Acoustic detection of long-eared bats can then be followed up by an appropriate trapping regime (e.g. Harptraps, mistnests). Surveys are best conducted on warmer nights from October to April.

Bat surveys were undertaken at the sites depicted in Figure H-6 of the MNES Report , standardised. The bat survey methodology is described in Section FA.4.3.2.5 of the MNES Report .

H.A.1.11.5 Desktop Assessment Results

The greater long-eared bat was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

No historical records of this species were returned from a query of relevant databases in the desktop search extent as defined in Section H.4.3.

H.A.1.11.6 Field Results

The greater long-eared bat was not recorded in the mine study area during field studies for the Project EIS.

H.A.1.11.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section H.4.6 of the MNES Report.

The habitat criteria used to model and map potential habitat for the greater long-eared bat is presented in Table H.A-10 below.

Table H.A-10 Habitat Mapping Criteria – greater long-eared bat

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Distance to water	Modelled distribution (SEWPAC, 2011j)#
'Confirmed habitat'	NA	Not confirmed				
'High value potential habitat'	NA	All remnant vegetation	Very high High	Very high High	Habitat patch (i.e. remnant vegetation polygon) within 1km of a permanent water source (i.e. river, large lake, wetland).	Permanent water sources identified through rivers / streams data layer and wetland data layers: Directory of Important Wetlands mapping layer; DERM WetlandInfo mapping layer; DERM Wetland Protection Area mapping layer; and DERM Wetland Management Area mapping layer.
'Low value potential habitat'	NA	All remnant vegetation	Medium Low	Medium Low	Habitat patch (i.e. remnant vegetation polygon) further than 1km of a permanent water source (i.e. river, large lake, wetland).	
'Generally not suitable'	NA	All other REs and non-remnant vegetation				

No sighting records or point data for the greater long-eared bat was available and as such no 'confirmed habitat' was mapped for the species.

In order to qualify as 'high value potential habitat' for the greater long-eared bat, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

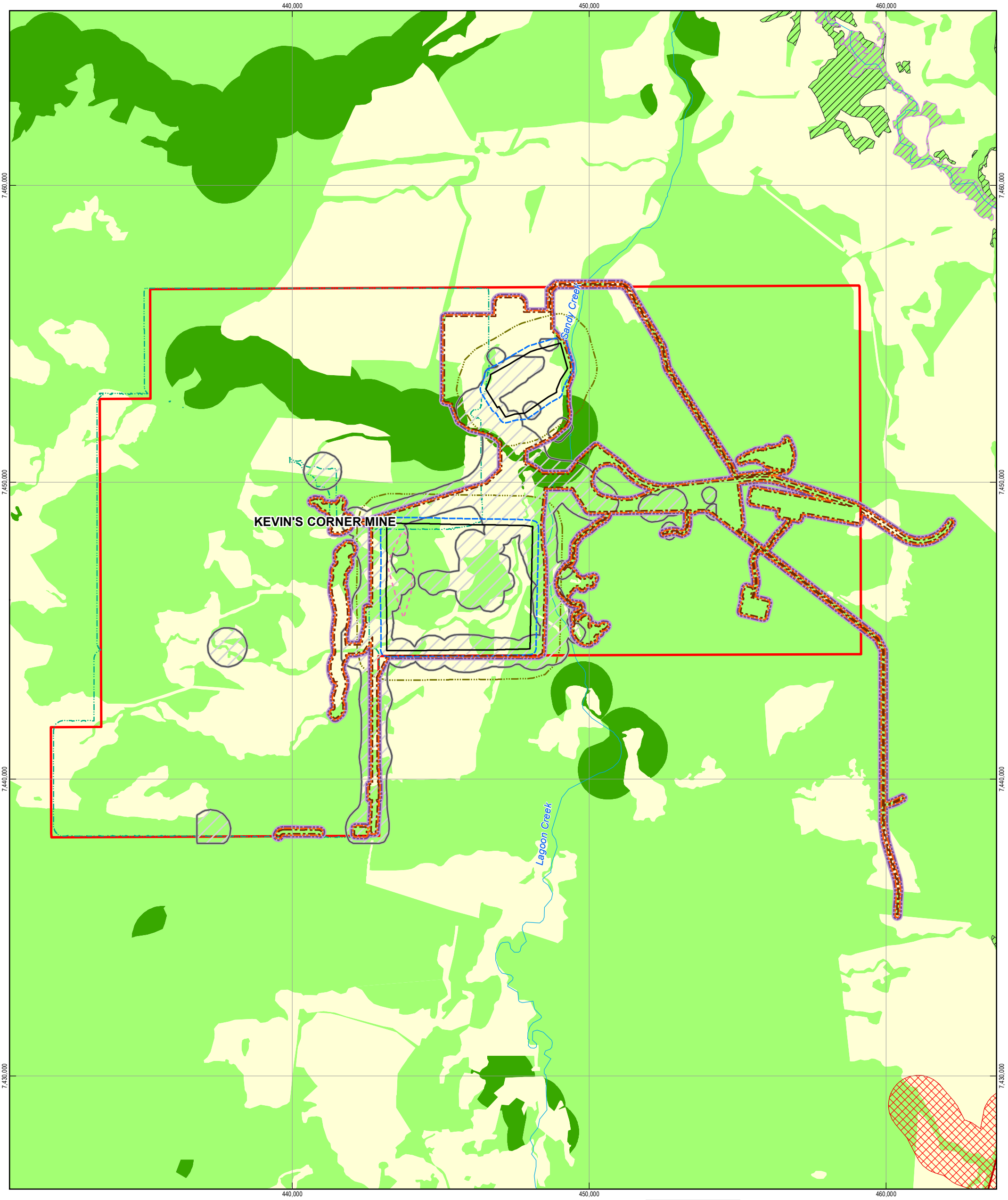
- Contain an RE listed in 10 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Have a habitat patch (i.e. remnant vegetation polygon) within 1km of a permanent water source (i.e. river, large lake, wetland)
- Occur within the modelled distribution of the species

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND**/**OR** habitat patch > 1000 m), the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table H.A-10, or was non-remnant vegetation, or was outside the modelled distribution for the greater long-eared bat, it was mapped as 'generally not suitable' for the species.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the brigalow scaly-foot are provided below.

A discussion of direct and indirect impacts to the greater long-eared bat is provided in Section H.6. The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.



LEGEND

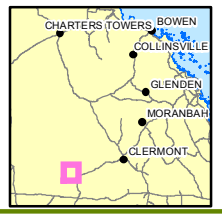
- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Greater Long Eared Bat Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Lestree Hill Creek
Belyando River
KEVIN'S CORNER MINE
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Alice River
Lagoon Creek
Tallarenha Creek
Capricorn Highway
ALPHA
Blackall - Jericho Road
Jordan Creek
Brumby Gully
Alpha - Tambo Road

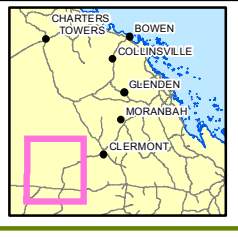
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Greater Long Eared Bat Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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H.A.1.12 Dicanthium queenslandicum

H.A.1.12.1 EPBC Act Status

Vulnerable

H.A.1.12.2 Distribution and Habitat Information

Limited information on the ecology of this species is available. It is broadly distributed across central eastern Queensland. Habitat known to be utilised by this species includes self-mulching cracking black clay soils.

H.A.1.12.3 Threatening Processes

As this species occurs in broadly similar habitats to *Dichanthium setosum*, it is considered that the threatening processes applicable to the latter species will also be relevant to *Dichanthium queenslandicum*, namely:

- Heavy grazing by domestic stock
- Habitat loss (clearing for agricultural purposes)
- Inappropriate fire regimes
- Weeds
- Road widening

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases

H.A.1.12.4 Survey Guidelines

Specific survey guidelines are not available for this species.

Flora surveys at the sites depicted in Figure H-5 sought to document the presence of *Dichanthium queenslandicum* (and/or the occurrence of suitable habitat), through the methodologies outlined in Section H.4.2.

H.A.1.12.5 Desktop Assessment Results

The species was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

This species has been previously recorded from the desktop search extent (as defined in Section H.4.3), as catalogued by the Queensland DERM Wildlife Online search.

H.A.1.12.6 Field Results

Dichanthium queenslandicum was not recorded in the mine study area during seasonal field studies for the Project EIS.

H.A.1.12.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section H.4.6.

The habitat criteria used to model and map potential habitat for *Dichanthium queenslandicum* are presented in Table H.A-11 below.

Table H.A-11 Habitat Mapping Criteria – *Dichanthium queenslandicum*

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection
'Confirmed habitat'	No sighting records / point data available	NA		
'High value potential habitat'	NA	11.3.21, 11.4.4, 11.8.5, 11.8.11	Very High or High	Very High or High
'Low value potential habitat'	NA	11.3.21, 11.4.4, 11.8.5, 11.8.11	Medium or Low	Medium or Low
'Generally not suitable'	All other REs and non-remnant vegetation			

*No DERM Essential Habitat factors were sourced at time of preparation of model. REs with potential to support *Dichanthium queenslandicum* identified from the DERM Regional Ecosystem Description Database.

No sighting records or point data for *Dichanthium queenslandicum* was available and as such no 'confirmed habitat' was mapped for the species.

In order to qualify as 'high value potential habitat' for *Dichanthium queenslandicum*, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain an RE listed in Table H.A-11 (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low), the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table H.A-11, or was non-remnant vegetation, it was mapped as 'generally not suitable' for the species.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for *Dichanthium queenslandicum* are provided below.

A discussion of direct and indirect impacts to *Dichanthium queenslandicum* is provided in Section H.6. The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.

440,000
450,000
460,000
7,460,000
7,450,000
7,440,000
7,430,000

Sandy Creek

KEVIN'S CORNER MINE

Lagoon Creek

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Dicanthium queenslandicum Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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400,000
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500,000
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7,450,000
7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Lestree Hill Creek
Belyando River
KEVIN'S CORNER MINE
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Pebbly Creek
Alice River
Lagoon Creek
Tallarenha Creek
Capricorn Highway
ALPHA
Blackall - Jericho Road
Jordan Creek
Brumby Gully
Alpha - Tambo Road
Belyando River

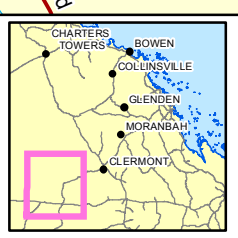
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Dicanthium queenslandicum Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



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Kilometers

Map Projection: Universal Transverse Mercator
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H.A.1.13 Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin Threatened Ecological Community

H.A.1.13.1 EPBC Act status

Endangered

H.A.1.13.2 Distribution and Habitat Information

The Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (Natural Grasslands) TEC occurs only in Queensland (TSSC, 2008d). It broadly occurs where the Fitzroy River Basin and the Brigalow Belt North coincide. The range of the TEC extends from Collinsville in the north to Carnarvon National Park in the south (TSSC, 2008d).

This TEC is comprised of grasslands dominated by native grasses occurring on cracking clay plains or undulating rises. The soils are generally dark and relatively deep, and trees and shrubs are very sparse to absent (projective foliage cover for trees is typically less than 10%, and shrubs less than 50%). A number of native tussock grass species have been nominated as indicator species (mostly *Aristida spp., Astrebla spp., Dichanthium spp*. and *Panicum spp*.) – at least three to four of these indicator species must be present within at least a one hectare patch for the TEC to be present (among other factors) (TSSC, 2008d).

In Queensland, the TEC comprises 7 REs from the Brigalow Belt bioregion. These REs are presented in table H.1-14 below.

Table H.A-1 REs from the Brigalow Belt Bioregion comprising the Natural Grasslands TEC

Regional Ecosystem	Short description
11.3.21	*Dichanthium sericeum* and/or *Astrebla spp.* grassland on alluvial plains - Cracking clay soils
11.4.4	*Dichanthium spp., Astrebla spp.* grassland on Cainozoic clay plains
11.4.11	*D. sericeum*, *Astrebla* spp. and patchy *Acacia harpophylla*, *Eucalyptus coolabah* on Cainozoic clay plains
11.8.11	*D. sericeum* grassland on Cainozoic igneous rocks
11.9.3	*Dichanthium spp., Astrebla spp.* grassland on fine-grained sedimentary rocks
11.9.12	*D. sericeum* grassland with clumps of *A. harpophylla* on fine-grained sedimentary rocks
11.11.17	*D. sericeum* grassland on old sedimentary rocks with varying degrees of metamorphism and folding

Threatening Processes

The Natural Grasslands TEC is estimated to have declined by 64% since European settlement. Of the 36% remaining, 60% is considered to be in a degraded state, and only 10% is in condition considered sustainable. Identified threats to this TEC include:

- Grazing, cropping and pasture improvement
- Weeds and pest animals
- Mining activities

- Road and other infrastructure development
- Key threatening processes listed under the EPBC Act that may be of relevance to this TEC include:
- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation, habitat degradation, competition and disease transmission by feral pigs

Survey Guidelines

Specific survey guidelines are not available for this Threatened Ecological Community. Flora surveys at the sites depicted in Figure H-5 sought to document the presence of this TEC, through the methodologies outlined in Section H.4.2.

Desktop Assessment Results

This TEC was predicted to occur in rail study area by the Commonwealth Protected Matters Search Tool.

H.A.1.13.3 Field Results

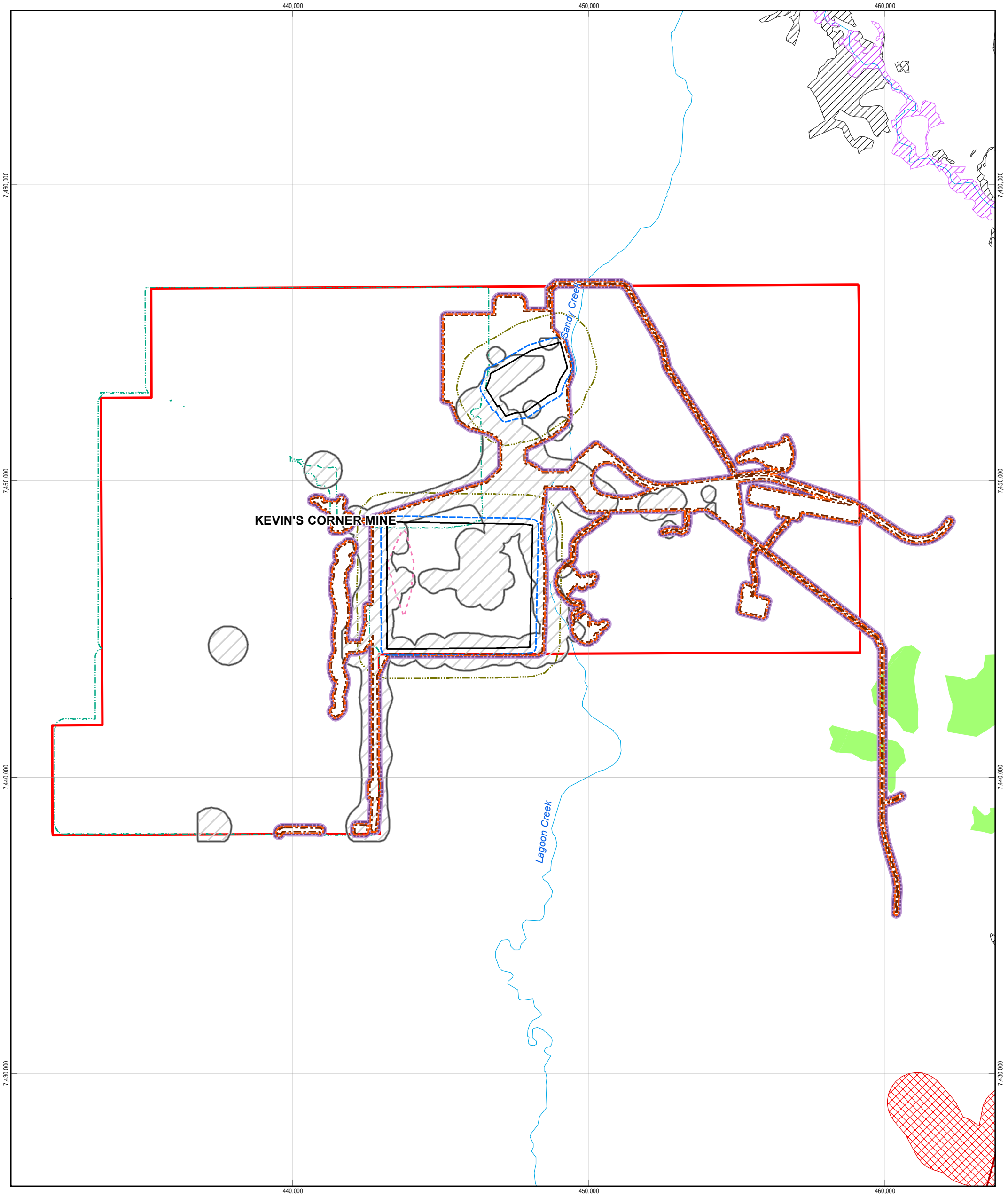
RE verifications conducted as part of flora field surveys indicated that this TEC was present within the Project disturbance footprint. Within the rail study area the majority of this TEC was located within RE 11.8.11. However, it is important to note that the standard a vegetation community must meet to be mapped as remnant vegetation under the Queensland VM Act, is generally lower than that required by the EPBC Act. For example, grasslands that have a high coverage of exotic species but that are expected to recover to a more natural species diversity within 15 years will be mapped as remnant by the Queensland Herbarium (Nelder *et al.,* 2005). By contrast, the diagnostic criteria for the Natural Grasslands TEC requires that perennial, non-woody exotic species comprise less than 30% of the total projected perennial plant cover (TSSC, 2008d). This means that many areas within the rail study area mapped as one of the seven REs listed above may not satisfy the criteria for the Natural Grasslands TEC.

H.A.1.13.4 Habitat Mapping Criteria

The seven constituent REs of the Natural Grasslands TEC were mapped (using a base mapping layer comprising DERM Version 6 and field verified REs).

The regional and local scale potential distribution maps for EPBC Act listed TECs are provided in the figures below.

A discussion of direct and indirect impacts to the Natural Grasslands TEC is provided above in Section H-6. The area of Natural Grasslands TEC that may experience direct and indirect impacts from the Project is discussed and measures to manage and mitigate potential impacts are presented.



LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Kevin's Corner MLA
- Mine Pit
- Direct Disturbance Footprint

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Indirect Impact Buffer Contour
- Dust
- Groundwater
- Light
- Invasive Species
- Noise
- Subsidence
- Vibration

Threatened Ecological Communities
- Natural Grasslands

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0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Lestree Hill Creek
Belyando River
KEVIN'S CORNER MINE
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Pebbly Creek
Alice River
Lagoon Creek
Tallarenha Creek
Capricorn Highway
ALPHA
Blackall - Jericho Road
Jordan Creek
Brumby Gully
Alpha - Tambo Road
Belyando River

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Vegetation Corridor (Brigalow Belt)
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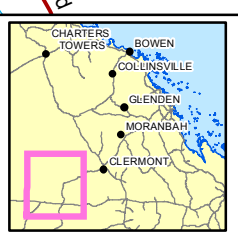
Threatened Ecological Communities
- Natural Grasslands



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1:500,000 (at A3)

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Kilometers

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