MSES Ecological Impact Assessment Report

Dugald River Windfarm Optimised Design

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WTS acknowledge the work of EcoSmart Ecology for their ongoing commitment to ecological survey and monitoring at MMGs Dugald River Mine and for the preparation of a summary of survey effort since 2013 to support this assessment.

Executive Summary

MMG Dugald River Pty Ltd (MMG) is proposing to develop the Dugald River Wind Farm Project (the Project) which comprises the construction, operation and decommissioning of up to 24 Wind Turbine Generators (WTGs) in a two-stage approach. Ancillary features of the Project include up to two (2) permanent Meteorological Masts (Met Masts), as well as associated infrastructure including a Battery Energy Storage System (BESS), access tracks, foundations, hardstand areas, underground cabling, overhead powerlines, material laydown areas, construction areas and a centralised operations area facility. A Battery Energy Storage System (BESS) which may form part of the Project at a future point and has been incorporated in the Disturbance Footprint. The Project is located approximately 63 km northwest of Cloncurry in western Queensland and situated upon the Knapdale Range. The Disturbance Footprint has a maximum area of 136.82 ha (comprising both permanent and temporary disturbance).

Wulguru Technical Services Pty Ltd (WTS) was engaged by Environmental Resources Management Pty Ltd (ERM), on behalf of MMG, to undertake an ecological impact assessment for the proposed Project to determine potential impacts of Matters of State Environmental Significance (MSES).

The Project is to be assessed under the *Planning Act 2016* and Performance Outcomes (PO) under State code 23: 'Wind farm development' were considered as part of this assessment to ensure adherence to current Queensland Government standards of assessment. This ecological assessment report has been provided in line with the requirements of the code.

Ecological Assessment

Ecological assessments have been undertaken to describe the ecological values that the Disturbance Footprint intersects, and to identify potential impacts to MSES. The assessment involved desktop investigations using several publicly available databases, as well as 16 years of field survey data within the Knapdale Range. This is considered to be a robust dataset (due the inclusion of the variety of surveys completed and the more recent validation of relevant environmental values) for the Project and more than sufficient to adequately assess the potential impacts.

The Project lies on the boundary of the Leichhardt Basin and the Flinders Basin. Drainage from the Knapdale range flows to stream order five watercourse Cabbage Tree Creek of the Leichhardt River sub-basin to the north and west and to stream order five watercourse Dugald River of the Cloncurry River sub-basin to the east and south. The rolling hills of the Knapdale Range reach maximum elevations of approximately 310 m AHD (Queensland Globe, 2023), declining in all directions into grassy plains. The Project is proposed to be located at elevations between 270 - 310 m AHD, in vegetation that is largely composed of *Eucalyptus leucophloia* low open woodland.

Multiple Endangered, Vulnerable, or Near Threatened (EVNT) species under the *Nature Conservation Act 1992* (NC Act) have been mapped as potentially occurring within the Disturbance Footprint or its immediate vicinity. However, only one EVNT species, the Purple-necked Rock-wallaby (*Petrogale purpureicollis*) (PNRW) is known to occur. Additionally, one Special Least Concern (SL) species, the short-beaked echidna (*Tachyglossus aculeatus*), is also known to occur. The Mertens water monitor (*Varanus mertensi*) (also listed

under the *Environment Protection and Biodiversity Conservation Act 1999*), has been detected in the vicinity of the Disturbance Footprint and is therefore potentially subject to downstream impacts.

The Disturbance Footprint primarily intersects of Regional Ecosystems with a biodiversity status (BD status) of No Concern at present. However, through ground-truthing surveys, 0.18 ha of RE 1.3.7b, a defined Endangered RE, was confirmed as being located within the Disturbance Footprint.

Potential Impacts

The Project has the potential to have both direct and indirect impacts on MSES values during the construction, operation, and decommissioning phases. Specific impacts for NC Act listed species identified as possible, likely, or known to occur within the Disturbance Footprint have been assessed in this report.

The potential impacts during construction, operation, and decommissioning have been identified and evaluated, with management measures to avoid, minimise, and mitigate impacts proposed. Importantly, a process of pre-clearance surveys prior to construction of the proposed development to support adjustments of infrastructure to further avoid ecological values is a key commitment.

Significant Residual Impact Assessments

Significant Residual Impact (SRI) Assessments were undertaken for 11 EVNT and 16 SL species, and two matters of regulated vegetation, identified as occurring or having the potential to occur within the Disturbance Footprint.

The Disturbance Footprint and its immediate vicinity was not considered suitable habitat for any of the bird species assessed. It does not contain habitat features that would support bird populations, such as a permanent water source. The only exception is the Tailings Storage Facility (TSF), but it has been excluded due to its high acidity, sulphate levels, and heavy metal contamination, which make it unsuitable for bird use.

The Disturbance Footprint is considered potential dispersal habitat for bird species, meaning that while it isn't ideal for long-term habitation, it could be used temporarily by birds.

Based on the assessment, the Project is unlikely to have an SRI on any of the bird species assessed.

The nearest record of the Mertens Water Monitor is approximately 2 km from the Disturbance Footprint, directly adjacent to the Dugald River. The Disturbance Footprint does not contain habitat which would be considered suitable, and it is unlikely that the species would use the Disturbance Footprint for dispersal. This species, identified as a Matter of National Environmental Significance (MNES), has been included in the assessment primarily to determine whether it could be indirectly affected by activities within the Disturbance Footprint, as its habitat lies downstream. It was determined unlikely that the Project would result in an SRI for this species.

It was determined Possible that the Project would result in an SRI to the PNRW Protected Wildlife Habitat, listed as Vulnerable (NC Act), however an SRI is Possible for Regulated Vegetation - Essential Habitat for the PNRW, which is mapped across the Knapdale Range. The analysis of SRI for the Protected Wildlife Habitat for the PNRW utilises the habitat spatial analysis to assess the difference between denning and foraging/dispersal habitat. The impacts to Essential Habitat are assessed in section 5.2.2 of this report and for Protected Wildlife Habitat for PNRW in section 5.4.1.

Compliance with the Performance Outcomes associated with clearing of vegetation intersecting a watercourse or drainage feature in accordance to State Code 16: Native Vegetation Clearing has been outlined in Section 5.2.1.1.

Commitments

The following management strategies have been committed to with the purpose of monitoring the impacts of the Project and informing implementation and adjustment of control measures:

- Ongoing fauna monitoring within the Disturbance Footprint and its immediate vicinity and maintaining records of any fauna interactions, through vigilance and carrion surveying;
- Maintaining records of aerial fauna movement through the Disturbance Footprint;
- Implementation of a Bird and Bat Management Plan (BBMP);
- Implementation of a Vegetation and Fauna Management Plan (VFMP);
- Implementation of a Weed and Pest Species Management Plan (WPMP); and
- Implementation of a Rehabilitation Plan (RP).

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Definitions

Term	Definition
AARC	AustralAsian Resource Consultants
AHD	Australian Height Datum
ALA	Atlas of Living Australia
BBMP	Bird and Bat Management Plan
BBUS	Bird and Bat Utilisation Survey
CEMP	Construction Environmental Management Plan
DRM	Dugald River Mine
EAAFP	East Asian-Australasian Flyway Partnership
ERE	Endangered Regional Ecosystem
ERM	Environmental Resources Management Pty Ltd
ESA	Environmentally Sensitive Area
ESCP	Erosion and Sediment Control Plan
EVNT	Endangered, Vulnerable, or Near Threatened. Also includes Critically Endangered and Threatened species.
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
GBO	General Biosecurity Obligations
GTRE	Ground truthed Regional Ecosystem
LoO	Likelihood of Occurrence
MMG	MMG Limited
MSES	Matters of State Environmental Significance
NWPS	North West Power System
OEMP	Operational Environmental Management Plan
PO	Performance Objective
PMAV	Property Map of Assessable Vegetation
PNRW	Purple-necked Rock-wallaby
RE	Regional Ecosystem
PRP	Preliminary Rehabilitation Plan
RSA	Rotor-swept Area
SSPO	Site Stabilisation Plan – Operations
SRI	Significant Residual Impact
SWMP	Surface Water Management Plan
VFMP	Vegetation and Fauna Management Plan
WTG	Wind Turbine Generator
WTS	Wulguru Technical Services
VM Act	*Vegetation Management Act 1999*
BD Status	Biodiversity Status
DIWA	Directory of Important Wetlands in Australia
NC Act	*Nature Conservation Act 1992*
SL	Special Least Concern
VFMP	Vegetation and Fauna Management Plan
WPMP	Weed and Pest species Management Plan

1. Introduction

MMG Dugald River Pty Ltd (MMG) is proposing to develop the Dugald River Wind Farm Project (the Project) which comprises construction, operation and decommissioning of up to 24 WTGs in a two-stage approach. Ancillary features of the Project include up to two (2) permanent Met Masts, as well as associated infrastructure including a BESS, access tracks, foundations, hardstand areas, underground cabling, overhead powerlines, material laydown areas, construction areas and a centralised operations area facility. A BESS, which may form part of the Project at a future point, has been incorporated in the Disturbance Footprint.

1.1. Scope and Objectives

Wulguru Technical Services Pty Ltd (WTS) was engaged by Environmental Resources Management Pty Ltd (ERM), on behalf of MMG, to prepare an assessment for impacts against Matters of State Environmental Significance (MSES) with regard to proposed Project.

The purpose of this Report is to:

- Describe the proposed Project;
- Assess the impacts of the Project against MSES; and
- Identify management actions to avoid, minimise and mitigate these impacts.

1.2. Project Description

The Project comprises the construction and operation of up to 24 X 6 MW WTGs and associated ancillary infrastructure. The Project has a Disturbance Footprint of up to 136.82 ha, which comprises both permanent and temporary disturbance and will be undertaken over two stages. Details of the property and project are listed in Table 1 and Table 2 respectively. The Project will consist of a clearing phase, a construction phase, an operational phase, and a decommissioning phase.

Table 1: Property description

Company Name	MMG Dugald River Mine Pty Ltd
Local Government Area	Cloncurry Shire Council
Bioregion/Subregion	Mount Isa Inlier of the Northwest Highlands
Drainage basin/sub-area	Leichhardt Basin and Flinders Basin
Lot on Plan	Lot 92 on SP303378, Lot 36 on AP23793, and Lot 1 on AP23793

Table 2. Project Description

Project Phases	Features	Area (ha)
Stage 1	Eight WTGs, 2 met masts, hardstand areas, access tracks, material storage and laydown areas, 33kV and 220kV powerlines and associated infrastructure, BESS, project/construction management office	74.09
Stage 2	Up to 16 WTGs, hardstand areas, access tracks, expanded BESS, easement connection between Phase 1 and 2	62.73
Total proposed Disturbance Footprint of the Project		**136.82 ha**

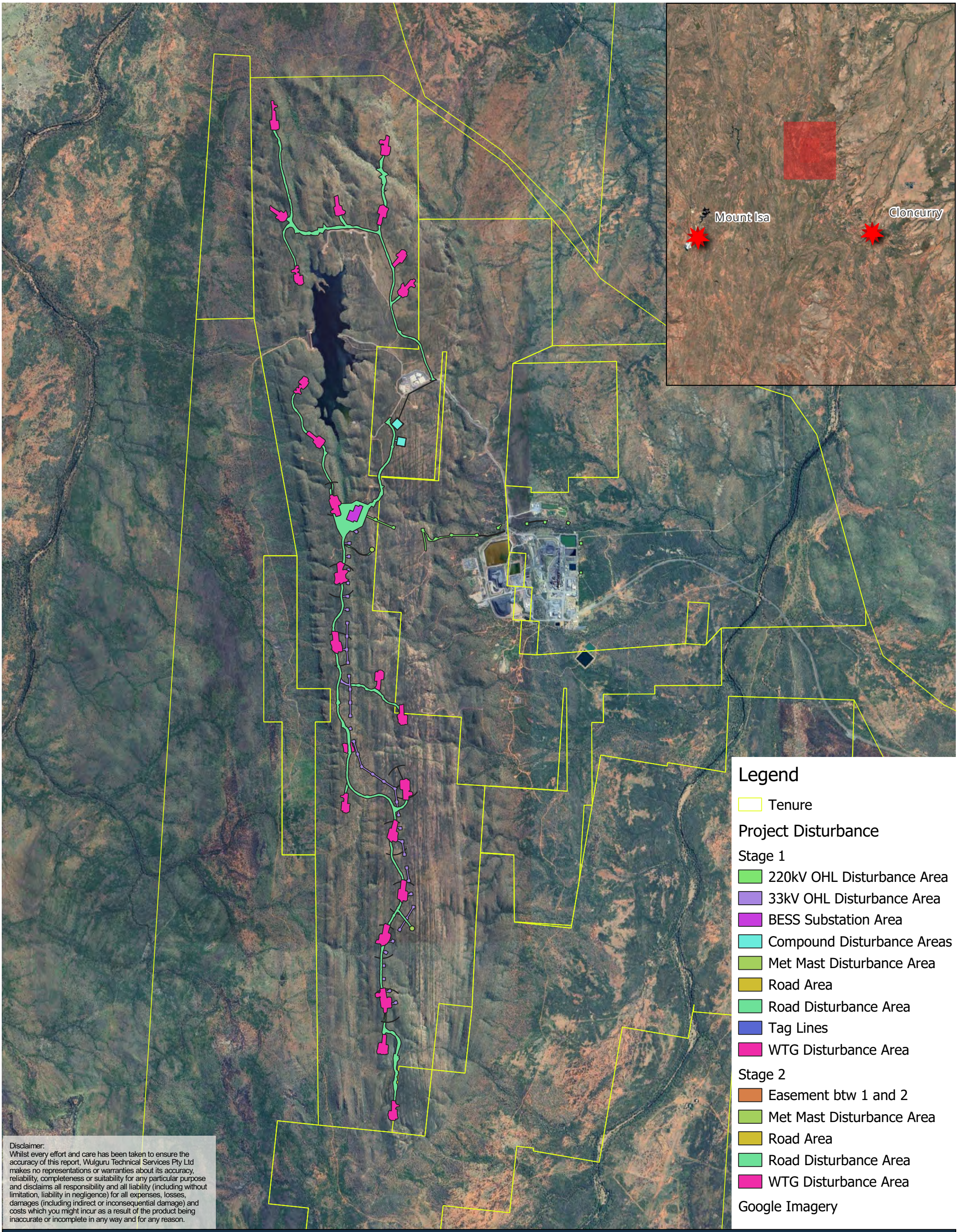


FIGURE 1. DUGALD RIVER WIND FARM DISTURBANCE FOOTPRINT

1 0 1 2 km

CRS: GDA94 / MGA zone 54
Scale: 1:40,000 @A3

Date: 2 April 2026
Author: M. Kaminski
Version: 0.01

WULGURU TECHNICAL SERVICES

Project Number: 2026.01014
Client: Sunshine Metals

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1.2.1. Project Purpose

The purpose of the Project is to generate renewable energy using the available wind resource associated with the Knapdale Range. Generated power will service mining operations at the Dugald River Mine (DRM) with additional energy generated to be sold into the North West Power System (NWPS) to contribute to achievement of targets associated with the Queensland Energy and Jobs Plan.

Energy is one of the highest operating costs for operations at the DRM and is subject to pricing variability. The DRM operation currently sources electricity from the gas fired Diamantina Power Station and the recently commissioned Dugald River Solar Farm.

The Project will provide power generation to service mining operations at the DRM through a renewable energy source that will reduce operational costs and stabilise price volatility whilst providing positive environmental outcomes in the form of reduced emissions.

The Project has the potential to displace 40% of electricity related emissions and 900 tonnes of CO2e per week which will assist MMG to achieve their commitment of Net Zero Scope 1 and Scope 2 emissions by 2050.

1.2.2. Project Details

The proposed candidate WTG Model is the 'Goldwind DW 165-5.2/5.6/6.0 MW' which has the following features and dimensions:

- Hub height: 130 m
- Rotor diameter: Up to 165 m
- Rotor-swept Area: 21,382 m^2 between 47.5 m and 212.5 m above the WTG pad.

The Rotor-swept Area (RSA) was delineated based on input from MMG to provide the necessary bounds for pre-construction or control survey sites where a physical turbine is not present for reference. The RSA was considered at the largest dimensions possible to allow for design adjustments.

Hardstand Pads

The Disturbance Footprint includes an area designed to accommodate crane pads, temporary laydown areas as well as WTG assembly and erection. An area of 5 ha of hardstand area has been proposed for each WTG.

The area of disturbance for each WTG will vary in response to civil design requirements and therefore, the actual area of disturbance between each WTG will vary. Notwithstanding variations at each WTG, the total Disturbance Footprint will not exceed 136.82 ha.

Access and Infrastructure Corridor

The Disturbance Footprint includes a defined access and infrastructure corridor which will be developed to facilitate access to the proposed hardstand areas. The proposed access and infrastructure corridor has a maximum width of 7 m. The actual width will vary depending on manoeuvring requirements and topographical considerations subject to detailed design.

Where possible, existing light vehicle tracks will be used and widened to reduce the creation of additional disturbance. The access and infrastructure corridor will be created through a program of earthworks deigned to achieve the required geometrical alignment for the movement of WTG components. For transparency, the Disturbance Footprint calculation does not include any areas of existing tracks and therefore, is considered an overly conservative figure.

It is anticipated that the access tracks will be created through the stripping of vegetation and scraping of topsoil which will be stockpiled for future rehabilitation requirements. Minor quantities of fill material may also be brought to site on an as-needed basis, however, this is anticipated to be very minor.

Waterway crossings will be constructed at locations that minimise the extent of disturbance and vegetation clearing. Watercourses intersected by the Disturbance Footprint are of low stream order and are ephemeral. Bed level crossings will be the preferred construction method to allow unobstructed surface water flows to occur during periods of incidental flow.

Powerlines (33 kV) will be installed to transfer power from each WTG to a collection substation. The powerline system will be installed as a combination of underground and overhead lines where appropriate to minimise ground disturbance and ensure safe construction and operation procedures. Where necessary, the above ground lines would be supported by poles.

Collection Substation

The Disturbance Footprint includes a dedicated area which will accommodate a substation and a future Battery Energy Storage System for the Project. The substation will be the terminal point for electrical infrastructure associated with the WTGs and will be connected to electrical infrastructure (Dugald River Switch Yard) located on the Dugald River Mine via an overhead transmission line. The DRM has an established connection to overhead high-voltage electrical infrastructure linked to the NWPS from Chumvale Station.

Transmission Line

The Disturbance Footprint includes a 220 kV transmission line which links the Dugald River Wind Farm substation to the Dugald River Mine Switch Yard. The transmission line has a conservative width of 20 m which will comprise clearing for access to power poles which will be created as extensions from existing tracks.

1.3. Site Description

The Disturbance Footprint is located on the Knapdale Range approximately 63 km northwest of Cloncurry in western Queensland.

The Knapdale Range lies within the Mount Isa Inlier subregion of the Northwest Highlands bioregion which is largely characterised by the tilted metamorphic hills and ranges. The Knapdale Range reaches maximum elevation of approximately 310 m AHD, the Disturbance Footprint itself spans from 210 - 310 m AHD (Queensland Globe, 2023).

Vegetation across the Disturbance Footprint consists of low open woodland and open Spinifex dominant grasslands, with moderate to sparse *Acacia* spp. dominant shrub layers throughout. Soil types range from rocky, skeletal soil types to shallow-moderate sandy loam towards the eastern base of the range.

1.3.1. Regional Context and Climate

The Project lies on the boundary of the Leichhardt Basin and the Flinders Basin. Drainage from the Knapdale Range flows to stream order five watercourse Cabbage Tree Creek of the Leichhardt River sub-basin to the north and west and to stream order five watercourse Dugald River of the Cloncurry River sub-basin to the east and south through several tributaries including Silvermine Creek and North Creek. Watercourses intersecting the Disturbance Footprint itself are unnamed stream order one and two and are typically ephemeral though rocky waterholes that may persist through the dry season are known to occur in the upper catchments.

A summary of data from Weather Station number 0291411 located at the Cloncurry Airport (Figure 2) indicates that temperatures in the region tend towards mild to cool dry winters with lowest mean minimum temperatures around 10 °C in July. December has the highest mean maximum temperature of 38.7 °C. Summers are typically hot and wet with heavy tropical and flashy rain events common during this period. The mean annual rainfall for the region is 500 mm.

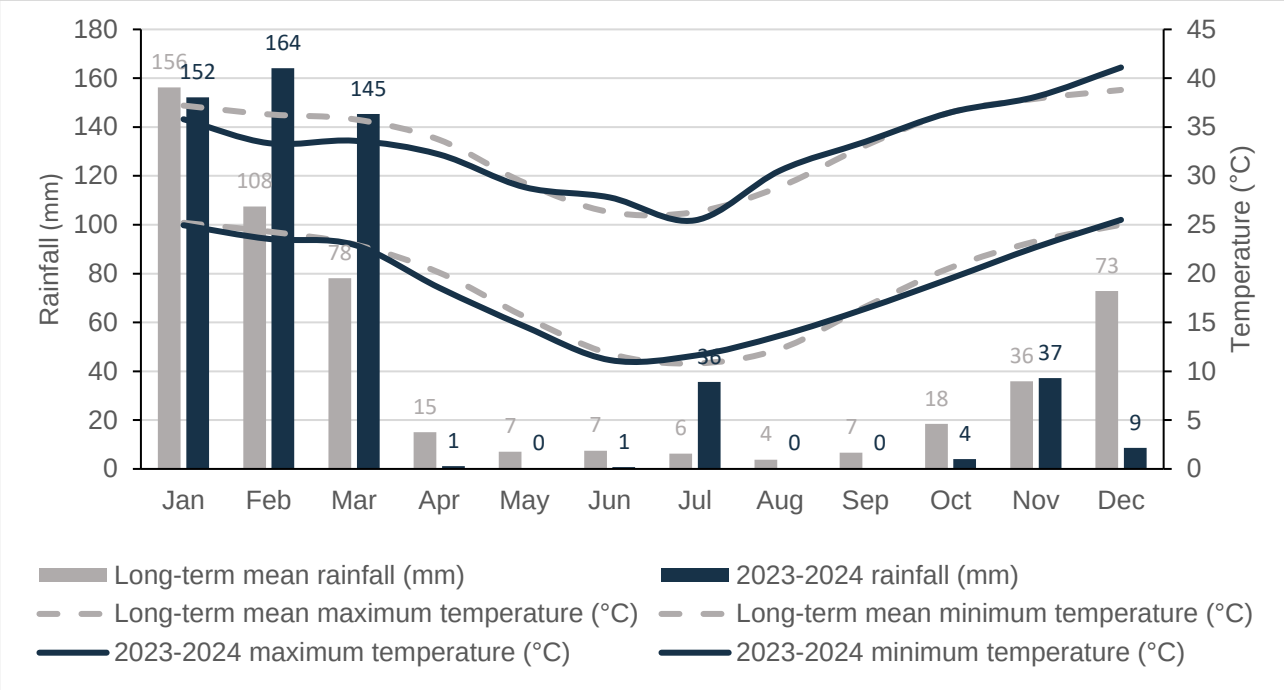


Figure 2: Climate statistics in at Cloncurry Airport weather station (029141) 2023-2024

1.4. Legislative Context

Planning Act 2016

The purpose of the *Planning Act 2016* is to establish an efficient, effective, transparent, integrated, coordinated, and accountable system of land use planning, development assessment, and related matters that facilitates the achievement of ecological sustainability.

Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act), the Nature Conservation (Animals) Regulation 2020 and the Nature Conservation (Plants) Regulation 2020 provide a legislative framework for the protection and conservation of Queensland's native plants and animals.

Under the framework, species of conservation significance are assessed and categorised with respect to population, distribution and potential threats and impacts.

The objectives of the NC Act are achieved through an integrated and comprehensive conservation strategy that protects and conserves threatened and special interest species and their habitat, and protected areas.

Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VM Act) exists to regulate the clearing of vegetation in a way that:

- Conserves remnant vegetation;
- Ensures clearing does not cause land degradation;
- Prevents loss of biodiversity;
- Maintains ecological processes;
- Reduces greenhouse gas emissions; and
- Allows for sustainable land use.

The objectives of the VM Act are achieved through providing for assessment benchmarks for vegetation clearing, the enforcement of vegetation clearing provisions, the regulated of certain regrowth vegetation, and the application of the precautionary principle.

State Code 23: Wind farm development

The purpose of State Code 23 is to ensure that the impacts arising from the construction, operation, and decommissioning of wind farms do not result in unacceptable adverse impacts on individuals, communities, and the natural environment. Under State code 23, the relevant Performance Outcomes (PO) were considered as part of the impact assessment to ensure adherence to standards of assessment. The following relevant PO were considered as part of this assessment.

- PO1 - Development is located and designed to ensure that:
    - protected wildlife and associated habitats; and
    - areas of high ecological value

are protected from adverse impacts.

- PO2 - Development is constructed to ensure that:
    - protected wildlife and associated habitats; and
    - areas of high ecological value

  are protected from adverse impacts.

- PO3 - Development operations ensure that protected wildlife and birds and bats are protected from adverse impacts.
- PO4 - Areas cleared for the construction of a wind farm are progressively rehabilitated to the maximum extent practicable following construction without impeding the safe and efficient operations and maintenance of the wind farm.
- PO6 - The wind farm, including ancillary infrastructure, is designed and sited to minimise crossings of and interference with natural drainage lines, waterways and wetlands.

Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) is Queensland's primary piece of environmental legislation. The objective of the EP Act is to 'protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends'. The EP Act ensures adherence to the protection and conservation of protected matters listed in Queensland's other key pieces of legislation such as the NC Act*,* the *Water Act 2000,* and the VM Act*.*

Environmental Offsets Act 2014

The *Environmental Offsets Act 2014,* and the Environmental Offsets Regulation 2014 provide a legislative framework for the assessment and delivery of environmental offsets in Queensland.

The Queensland Environmental Offsets Policy provides a single, consistent, whole-of-government policy for the assessment of offset proposals to satisfy offset conditions. This policy clarifies how offsets for matters of environmental significance in Queensland should be designed and delivered, including offsets for impacts to marine parks and protected areas (other than coordinated conservation areas) and matters of local environmental significance.

Environmental Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Commonwealth Government's key piece of environmental legislation. It provides a legal framework for the protection of the environment at a national level and focuses interest on protecting Matters of National Environmental Significance (MNES) as defined in Part 3 Division 1 of the Act and includes:

- World Heritage Properties;
- National Heritage Places;
- Wetlands of international importance (listed under the Ramsar Convention);
- Nationally threatened species and ecological communities;
- Migratory species;

- Commonwealth marine areas;
- The Great Barrier Reef Marine Park;
- Nuclear actions (including uranium mining); and
- A water resource, in relation to coal seam gas and large coal mining developments.

If a proposed development or other action ('proposed action') is likely to have a significant impact upon an MNES, then it must be referred for assessment under the EPBC Act.

1.5. Qualifications and Experience

Data collated to inform this Report has been drawn from several sources. Various ecological surveys have been undertaken within the Disturbance Footprint and surrounding area since 2008 as part of the DRM. All ecological surveys have been undertaken by Suitably Qualified Persons for the purpose of ecological surveys.

Terrestrial Flora and Fauna surveys were undertaken by AustralAsian Resource Consultants (AARC) between 2008 and 2011. The Project Manager was Andrew Pearce (Environmental Scientist), and Survey Report authors were Brendan Massy (Environmental Scientist) and Julie Byrd (Environmental Scientist) (AustralAsian Resource Consultants Pty Ltd, 2011).

EcoSmart Ecology have been undertaking the delivery of ecological services and monitoring programs at the DRM since 2013. Lead by Director and Principal Ecologist Mark Sanders, who has over 20 years' experience in terrestrial ecology, all ecological surveys have been conducted by suitably qualified and experienced ecologists. Details of qualifications and experience are provided in Table 1.1 of EcoSmart's fauna survey report (Ecosmart Ecology, 2023).

WTS have been undertaking the delivery of ecological surveys at the DRM since 2021. Lead originally by Delwyn Windridge who has more than 10 years' experience in the undertaking of ecological surveys and impact assessments, and then later by Haley Harding with 5 years' ecological experience. Additional support was provided by team members Dr Andrew Fletcher (21 years' experience), Dylan Case (4 years' experience), Jamie Smith (2 years' experience), and Harry Bonnell (2 years' experience).

2. Methodology

2.1. Desktop Analysis

A comprehensive desktop analysis was undertaken to identify potential environmental values, constraints, and potential impacts of the Disturbance Footprint and to enhance understanding of the ecological values present. Despite the area being extensively studied, the Precautionary Principle was applied, and species and protected matters searches were undertaken using a 50 km search buffer from a central point (Latitude: -20.24531, Longitude: 140.13467) located within the Disturbance Footprint. EVNT Species were assessed using the default search tool radius (10 km) due to their localised nature.

The purpose of this assessment is to identify actual or potential impacts to MSES. Table 3 identifies the core sources used to inform the desktop assessment for this Report.

Table 3: Search tools used to prepare Ecology Desktop Scoping report

Search/Resource	Source	Search Criteria	Output	Date of Retrieval / Accessed
MSES database (Matters of State Environmental Significance)	https://www.qld.gov.au/environment/pollution/management/environmental-reports-online	2 km radius from central point of Disturbance Footprint, Lot 92 on SP303378, Lot 36 on AP23793, and Lot 1 on AP23793	Possible presence of species or species habitats for environmentally significant species	January 2025
Vegetation management regulated vegetation management map - version 7.09 Released 3 Feb 2025	https://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={9CC053EC-585B-4C41-A713-E1D04543CCC2}	Cloncurry Shire	Mapped regulated vegetation categories	January 2025
Vegetation management regional ecosystem map - version 13.00. Released 22 Nov 2023	https://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={BCFBDC29-85AF-46B5-85E3-41C5A4B2057A}	Cloncurry Shire	Mapped regional ecosystems and statuses	January 2025
Vegetation management essential habitat map no attribute - version 12.00. Released 22 Nov 2023	https://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={8739E87A-4EDD-4E20-A377-1EE0445B00A0}	Cloncurry Shire	Mapped essential habitat as defined in the VM Act	January 2025
East Asian-Australasian Flyway Partnership (EAAFP) Site Information Sheets	https://www.eaaflyway.net/australia/	N/A	Species lists for a network of internationally important sites for migratory bird species	November 2024
ESAs database (Environmentally Sensitive Areas)	https://environment.des.qld.gov.au/management/maps-of-environmentally-sensitive-areas	2 km radius from central point of Disturbance Footprint	Maps of environmentally sensitive areas if present	November 2024
Wildnet Species List	https://apps.des.qld.gov.au/report-request/species-list/	50 km radius from central point of Disturbance Footprint	Point records for species	January 2025
WetlandInfo	https://wetlandinfo.des.qld.gov.au/wetlandmaps/	polygon drawn on interactive map	Locations of MSES such as Ramsar wetlands, nationally important wetlands, groundwater-dependent ecosystems, protected areas of Qld	November 2024

Queensland Globe	https://qldglobe.information.qld.gov.au/	Disturbance Footprint and surrounds	Surface geology, regulated vegetation, protected plants flora survey trigger map, essential habitat map	November 2024
Modelled potential habitat for select threatened species - Queensland	https://www.data.qld.gov.au/dataset/potential-habitat-models-2022-queensland-series	10 km radius from central point of Disturbance Footprint	Spatial layer showing modelled potential habitat for threatened flora and fauna species	November 2024
Atlas of Living Australia (ALA)	Area report – interactive https://spatial.ala.org.au/	50 km radius from central point of Disturbance Footprint	Point records for species of interest e.g., Threatened species	November 2024
Wildnet Database Species Profile Search	https://apps.des.qld.gov.au/species-search/	Species Name	NC ACT listed species information	November 2024
Terrestrial Flora and Fauna Assessment report	AustralAsian Resource Consultants	N/A	Terrestrial Flora and Fauna survey results from 2008-2011	November 2024
Dugald River Wind Farm Fauna Survey Results 2023	EcoSmart Ecology	~ 15 Ha Survey effort to date	Summary of Terrestrial Flora and Fauna survey results from 2014-2023	November 2024
Dugald River Wind Farm BBUS Results 2024	WTS	N/A	Summary of BBUS results from 2024	November 2024

2.1.1. Likelihood of Occurrence Analysis

During the desktop phase, each species of conservation significance was assessed against the criteria described in Table 4 to determine Likelihood of Occurrence (LoO) within the Disturbance Footprint. The LoO for each species was examined post-survey and amended taking into consideration the observed habitat values and ecological assessments. Results of desktop analysis are discussed in the section 3 of this report.

Table 4: Likelihood of Occurrence criteria

Status	Definition
Known	Species known to occur from recent reliable records* within the Disturbance Footprint.
Likely	Recent reliable records of the species within 1 km of the Disturbance Footprint and/or preferred habitat known to be present, and recent reliable records within 5 km.
Possible	Species recorded[x] within 50 km of the Disturbance Footprint and/or suitable habitat mapped as present.
Unlikely	Species not recorded within 50 km of the Disturbance Footprint and suitable habitat not mapped as present.

*Records less than 20 years old and from reputable sources using vetted data (primarily Wildnet)

[x]May include older and unconfirmed records

2.2. Survey Effort

A significant amount of technical and ecological studies provides the information to which this Report largely refers. Available information for this Report dates back to 2008 with the commencement of environmental

assessments for the *Dugald River Mine Project Environmental Impact Statement* which was submitted for assessment in 2011. More recent assessments and monitoring surveys bring to currency the information used to support the desktop component of this Report, ensuring relevancy. EcoSmart Ecology additionally commenced the undertaking of Bird and Bat Utilisation Surveys in 2023 to support the environmental assessments relating to the Project. These surveys continued throughout 2024 with a combined two years of Bird and Bat Utilisation Survey effort completed to date. WTS undertook supplementary vegetation and habitat assessments for the Preliminary Project Design in October 2023 to ensure compliance with the requirements for currency of information and due diligence of process. More recent vegetation surveys and spatial analyses have been conducted in other areas on and surrounding the Knapdale Range.

Whilst the majority of the survey sites occur outside of the Disturbance Footprint (see BBUS, EcoSmart vertebrate sites and Ground truthed RE [GTRE] sites in Figure 3), the habitat present across the Knapdale Range, with particular regard to birds, bats, and the PNRW, is fairly homogeneous and therefore it is likely that the areas surveyed provide sufficient data to assess the ecological values of the Disturbance Footprint. Additionally, spatial analyses were undertaken to further provide insight into the ecological values of the Disturbance Footprint specifically (Section 2.3). Habitat within and surrounding the Disturbance footprint is considered homogenous due to the evidence from previous ground-truthing surveys and habitat assessments within and surrounding the Disturbance Footprint and the more recent habitat assessments that WTS undertook that validated previous findings.

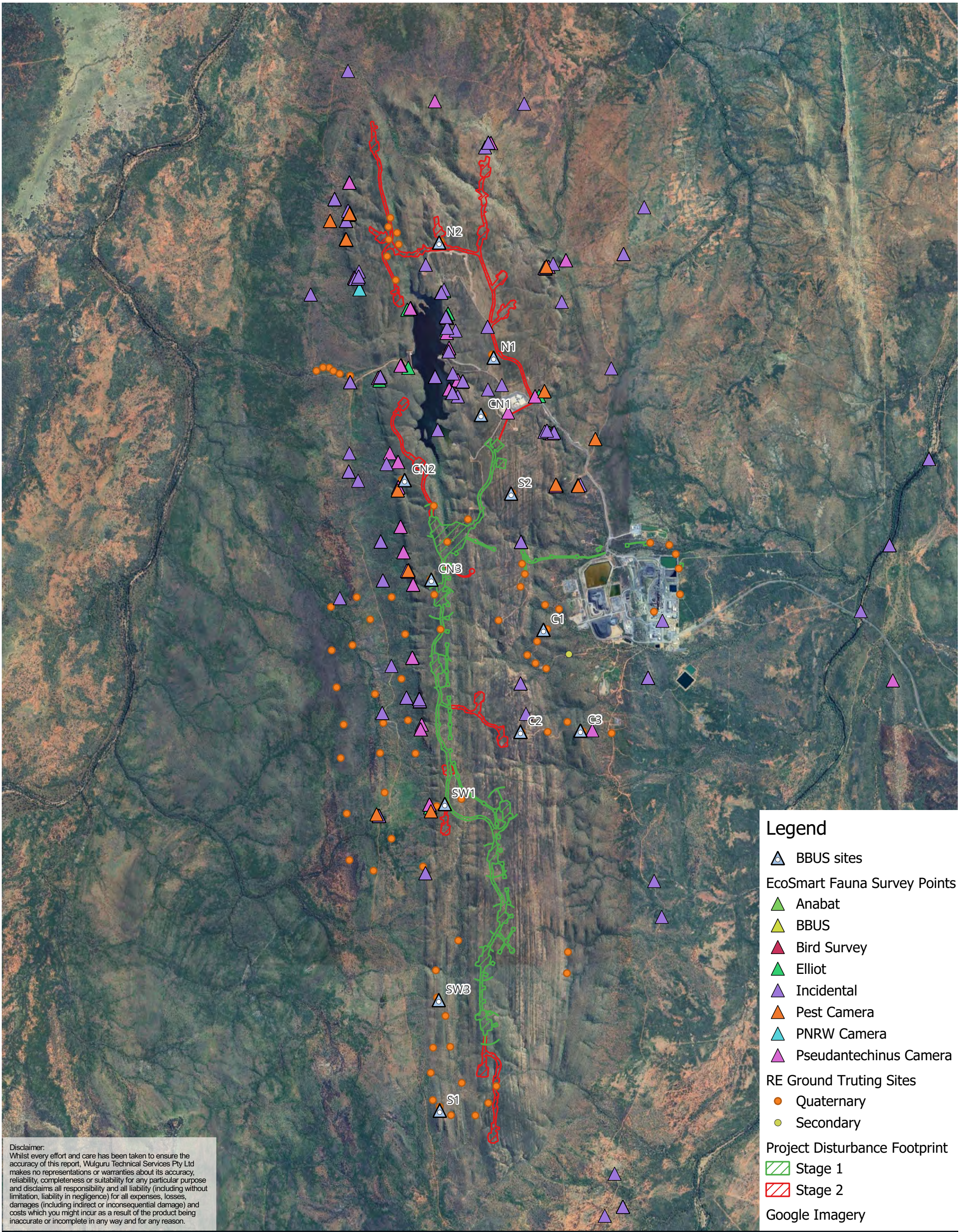


FIGURE 3. ECOLOGICAL SURVEY EFFORT

1 0 1 2 km

CRS: GDA94 / MGA zone 54
Scale: 1:40,000 @A3

Date: 2 April 2026
Author: M. Kaminski
Version: 0.01

Project Number: 2026.01014
Client: Sunshine Metals

WULGURU TECHNICAL SERVICES

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Table 5. Survey effort

Company	Method	Unit	Total
AARC	Regional Ecosystem secondary sites	Number of sites	37
2008 - 2011	Regional Ecosystem quaternary sites	Number of sites	245
	Survey for flora Species of Conservation Significance	N/A	N/A
	Elliott Trapping	Trap nights	1,434
	Pitfall trapping	Trap nights	84
	Funnel trapping	Trap nights	96
	Anabat recording	Recording nights	14
	Harp trap	Trap nights	9
	Bird survey	Opportunistically	N/A
	Spotlighting – walking survey	Person hours	19
	Spotlighting – vehicle survey	Person hours	14
	Scat/Track searching	Opportunistically	N/A
	Incidental recordings	Opportunistically	N/A
EcoSmart	Regional Ecosystem quaternary sites	Number of sites	8
2013 - 2023	BBUS – Anabat	Anabat-nights	16
	BBUS – Bird Survey	Person hours	16
	Bird Survey Transect	Person hours	28.5
	PNRW white-flash camera	Trap-nights	1,525
	PSEUD white-flash camera	Trap-nights	3,149
	Pest black-flash camera	Trap-nights	200
	Elliott Trap	Trap-nights	2,000
	Pitfall Trap	Trap-nights	30
	Foot traverses	Person hours	2,424
WTS	Regional Ecosystem quaternary sites	Number of sites	91
2023 - 2024	BBUS – Anabat	Anabat-nights	48
	BBUS – Bird Survey	Person hours	48

2.2.1.1. AARC Surveys 2008-2011

AARC undertook terrestrial flora and fauna surveys from 2008-2011 to inform the *Dugald River Mine Project Environmental Impact Statement*. The initial wet season survey on the Project site was undertaken over nine consecutive days between the 27th of March and the 4th of April 2008. The dry season survey on the Project site and an initial assessment of the corridors was undertaken over ten consecutive days between the 4th and 13th of August 2008. An additional three day assessment of the powerline corridor was conducted from the 1st to the 3rd of October 2008. A final three day assessment of modifications to the alignment of the access road and water pipeline was conducted between the 7th and 9th of April 2010. An additional wet season survey occurred between the 21st and 31st of March 2011, to capture ephemeral flora species and to supplement the existing fauna catalogue from previous surveys.

Flora surveys were undertaken accordance with the Queensland Herbarium's *Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland* (Nelder, Wilson, Thompson, & Dellewaard, 2005) to 1:25,000 Scale for Vegetation Mapping. The surveys consisted of 37 secondary, and 245 quaternary level transects in representative vegetation communities. Assessment of aerial/satellite imagery was used to extrapolate the data across the remainder of the mapped area. Where habitat suitable for EVNT flora species was identified, targeted species survey meanders were conducted. Surveys were conducted for both terrestrial and aquatic flora species during the wet season to ensure the highest level of detectability, especially in regard to ephemeral aquatic flora species.

Fauna surveys were undertaken in accordance with *Recommended Fauna Survey Methodology for Environmental Impact Assessments* (Department of Environment and Resource Management, 2009). Six primary transects and eight secondary transects were surveyed in 2008 and an additional six fauna monitoring sites established in 2011. Habitat assessments were conducted across the site, including along watercourses and drainage lines for assessments of aquatic habitat.

Further details regarding the methodology can be found in AARC's flora and fauna assessment report (AustralAsian Resource Consultants Pty Ltd, 2011).

2.2.1.2. EcoSmart Ecology Surveys 2013-2023

EcoSmart Ecology has been undertaking flora and fauna survey and monitoring activities within the DRM mining leases and adjacent area since 2013 and collected considerable amounts of data particularly with respect to fauna and faunal assemblages and PNRW populations of the area.

Two rounds of BBUS were undertaken by EcoSmart Ecology in May and September 2023 at eight survey sites, four of which are proposed turbine locations that will become impact sites upon commencement of construction and operation. BBUS survey methodology is discussed further in section 2.2.1.3 below.

Comprehensive EcoSmart Ecology fauna survey effort details can be found in section 2.0 of EcoSmart's fauna survey report (Ecosmart Ecology, 2023) and Figures of survey locations provided in Figures 2.1-2.3 (APPENDIX A: EcoSmart Fauna Survey Report). PNRW surveys were conducted in accordance with the recommended survey approach from the Purple-necked rock-wallaby Targeted species survey guidelines (Rowland, 2012).

EcoSmart Ecology additionally undertook regional ecosystem ground-truthing surveys in 2021 to prepare a Property Map of Assessable Vegetation (PMAV). A total of 32 quaternary surveys were completed specifically across the DRM mining leases to inform and delineate the location of RE 1.3.7b: *Eucalyptus camaldulensis* woodland on channels and levees which is allocated a Biodiversity Status of endangered due to its importance as seasonal water bird habitat; regional corridor for fauna.

All monitoring conducted during each survey was conducted between the dates shown under "Start" and "End" in Table 6, but were not necessarily conducted over this entire period (e.g., bird surveys typically only conducted on one morning per survey).

Table 6. EcoSmart Ecology Survey Timing

Year	Period	Monitoring conducted*	Start	End
2014	Post-Wet Season	PNRW, PEST	11/04/2014	17/04/2014
	Pre-Wet Season	PNRW, PEST	7/08/2014	13/08/2014
2015	Post-Wet Season	PNRW, PEST	7/05/2015	14/05/2015
	Carpentarian Pseudantechinus Initial Survey		30/06/2015	10/07/2015
	Pre-Wet Season	PNRW, PEST	7/09/2015	14/09/2015
2016	Post-Wet Season	PNRW, PEST, PSEUD	11/05/2016	18/05/2016
	Pre-Wet Season	PNRW, PEST, PSEUD	18/09/2016	25/09/2016
2017	Post-Wet Season	PNRW, PEST, PSEUD	2/05/2017	11/05/2017
	Pre-Wet Season	PNRW, PEST, PSEUD	14/08/2017	23/08/2017
2018	Post-Wet Season	PNRW, PEST, PSEUD	2/05/2018	11/05/2018
	Pre-Wet Season	PNRW, PEST, PSEUD	10/10/2018	19/10/2018
2019	Post-Wet Season	PNRW, PEST, PSEUD	8/04/2019	17/04/2019
	Pre-Wet Season	PNRW, PEST, PSEUD, BIRD	1/10/2019	11/10/2019
2020	Post-Wet Season	PNRW, PEST, PSEUD, BIRD	7/04/2020	16/04/2020
	Pre-Wet Season	PNRW, PEST, PSEUD, BIRD	8/09/2020	17/09/2020
2021	Post-Wet Season	PNRW, PEST, PSEUD, BIRD	7/04/2021	16/04/2021
	Pre-Wet Season	PNRW, PEST, PSEUD, BIRD	27/08/2021	5/09/2021
	PMAV Flora Surveys	Regional ecosystem ground-truthing	08/2021	08/2021
2022	Post-Wet Season	PNRW, PEST, BIRD	17/05/2022	23/05/2022
	Pre-Wet Season	PNRW, PEST, BIRD, PIT	27/09/2022	3/10/2022
2023	Post-Wet Season	PNRW, PEST, BIRD, BBUS, BBUS site RE ground-truthing and habitat assessment, PIT	2/05/2023	11/05/2023
	Pre-Wet Season	PNRW, PEST, BIRD, BBUS	5/09/2023	16/09/2023

*PNRW = Purple-necked Rock-wallaby monitoring; PEST = Pest monitoring; PSEUD = Carpentarian Pseudantechinus monitoring; BIRD = Bird survey transects; PIT = Pitfall traps; BBUS = Bird and Bat Utilisation Survey monitoring

2.2.1.3. Wulguru Technical Services 2023 - 2025

Vegetation ground-truthing surveys and habitat assessments of the Disturbance Footprint and the surrounding area were undertaken by WTS in October 2023 and June 2024 to supplement the existing data and ensure currency of available information.

Regional ecosystem ground-truthing was undertaken in accordance with the *Methodology for surveying and mapping regional ecosystems and vegetation communities in Queensland. Version 7.0* (Neldner, et al., 2023). 91 secondary and quaternary surveys were conducted across the Knapdale Range.

As part of preliminary design works in 2023, habitat assessments were undertaken at each of the potential WTGs pad locations associated with the Preliminary Project Design and the proposed laydown/rigging areas and locations of other proposed ancillary infrastructure related to electrical current transport and storage. Habitat values were recorded as per the *Basic Site Information* field sheet provided in *Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland: Field Data Sheets. Version 1.4* (Eyre, et al., 2022b). Data from the assessments was used to inform LoO and significant impact assessments, to develop habitat mapping for relevant EVNT fauna.

WTS also conducted additional vegetation surveys in September 2024 for the purpose of rehabilitation monitoring in line with the *Methodology for surveying and mapping regional ecosystems and vegetation communities in Queensland. Version 7.0* (Neldner, et al., 2023).

Two subsequent years of BBUS were performed by WTS in 2024 and 2025, totalling four additional survey rounds. Four additional survey sites were included during these campaigns to provide a more comprehensive coverage of the Disturbance Footprint, bringing the total to 12 survey sites.

Level one bird surveys were conducted as per the approved method outlined in *Wind Farms and Birds: Interim Standards For Risk Assessment* by Brett Lane & Associates (Brett Lane & Associates Pty Ltd, 2005). Level one surveys are considered to be a minimum requirement to assess the potential impacts of a wind farm on birds during the pre-construction phase.

BBUS were performed to collect quantitative data on bird use within the Disturbance Footprint and its immediate vicinity. This can be used to estimate potential collision rates and provide a ranked abundance of species use of the Survey Area at varying heights. The BBUS involved a “Fixed-point Count” methodology where an observer is stationed at a fixed survey point for 20 minutes. During the 20 minutes, all bird species and number of birds observed were recorded. Observations of birds (and diurnally flying bats) during the survey periods were broken into BBUS and incidental observations. BBUS observations are those which include individuals observed to be flying above the predominant canopy. These observations do not include individuals that briefly fly out of the canopy layer at a low height. Birds recorded during EcoSmart’s BBUS’ and WTS initial BBUS were characterised as either occurring within or outside of the RSA. For the September 2024 and onwards BBUS surveys, the methodology was adjusted to specifically record an estimated maximum and minimum flight height for each record to provide finer scale data, should it be required. The BBUS method provides the following information:

- Species;

- Number of individuals;
- Estimated distance from observer;
- Estimated height above observer;
- Bearing to record;
- Direction of flight;
- Behaviour; and
- Notes on wind speed, cloud cover, rain, and other conditions that may affect bird activity.

All other observations not conforming to BBUS records, including positively identified bird calls were recorded as incidental observations.

Bats were monitored at each BBUS monitoring site using Anabat passive high-frequency sound recorders to capture microbats calls. Anabat units are deployed for two consecutive nights per monitoring period. Bat call analysis to identify microbat species present was undertaken by Greg Ford of Balance Environmental for EcoSmart surveys, and Prof. Simon Robson of Data Analytics for WTS surveys.

Surveys utilise a Before and After Control Impact (BACI) survey design as is recommended in Appendix 2 of State Code 23: Wind farm development utilising the methodology in the recommended *Wind Farms and Birds: Interim Standards for Risk Assessment* (Brett Lane & Associates Pty Ltd, 2005). A BACI design includes control sites placed at a sufficient distance (>500m), from the proposed turbine locations to obtain data outside the zone of influence of the turbines. As per the above standards, prior to commencement of construction and operation impact and control sites are to be monitored twice yearly, once in the post-wet season and once in the pre-wet season, to account for seasonal variation.

Table 7 summarises the complete BBUS survey effort.

Table 7. Complete Survey Effort of Control and Impact BBUS sites

Site (status)	Survey Periods					
	EcoSmart Ecology		WTS			
	March 2023	September 2023	April (16th – 21st) 2024	September (11th – 16th) 2024	March (18th – 22nd) 2025	September (24th – 29th) 2025
C1 (control)	X	X	X	X	X*	X
C2 (Impact)	X	X	X	X	X*	X
C3 (Control)	X	X	X	X	X*	X
CN1 (Control)	X	X	X	X	X*	X
CN2 (Impact)	X	X	X	X	X*	X
CN3 (Impact)	X	X	X	X	X*	X
N1 (Control)	-	-	X	X	X*	X
N2 (impact)	X	X	X	X	X*	X
S1 (Control)	X	X	X	X	X	X
S2 (Control)	-	-	X	X	X	X
SW1 (impact)	-	-	X	X	X	X
SW3 (impact)	-	-	X	X	X	X

*sites not completely surveyed due to adverse weather conditions. Survey effort not undertaken in March 2025 is as follows:
C sites – Midday
CN sites – Midday
N sites- Sunrise and Sunset
It should be noted that the S and SW sites (added in 2024) were fully surveyed and therefore every site meets the survey requirement specified in the standards.

2.3. Habitat Spatial Analysis

Spatial habitat analyses were undertaken to inform habitat values and LoO within the Disturbance Footprint using available existing data with regard to species habitat preferences, records, and habitat values for relevant threatened species and species of interest.

Known occurrences of PNRW within the Knapdale Range, along with the 18 confirmed PNRW active denning locations, were used to infer denning, foraging, and dispersal habitat across the lesser surveyed portions of the Knapdale Range intersected by the Disturbance Footprint. Dens were found to be located in rocky gorges in the upper reaches of drainage lines of the Knapdale Range. Potential denning habitat was modelled using a combination of slope (>35%), derived from a digital elevation model (DEM), underlying geology (presence of potentially heat retaining features) and apparent roughness of terrain derived from the available DEM. This was then compared against the known locations to ensure the model fit. An average linear dispersal distance limit of 250 m was added as a buffer around the known and modelled potential denning habitat representing a 16 ha home range (foraging area) from any single point within the potential denning habitat, based on known home ranges from closely related and morphologically similar rock-wallaby species (Horsup, 1994). PNRW rarely venture into flat plains due to a lack of shelter (Mittermeier & Wilson, 2015) and it is therefore assumed that any areas adjacent to habitat and of medium to high slope is possible dispersal habitat for the species. The results of this analysis are discussed in Section 3.2.3.2.

Additional habitat spatial analysis was undertaken for the Merten's water monitor (*Varanus mertensi*), which is known to occur approximately 2 km east of the Disturbance Footprint in Longamundi Waterhole in the Dugald

River. This analysis similarly used records and information on species home range to infer habitat. A home range buffer of 10 m was applied to the Dugald River as the species seldom ventures more than 5 – 10 m from the edge of the water except when transiting among core aquatic activity areas (Mayes P. , 2006). The results of this analysis are discussed in Section 3.2.3.2.

2.4. Migratory Flight Path Modelling

Flight path modelling for migratory birds was undertaken by WTS Ecologists. Whilst the migratory listing is under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), migratory species are also listed as Special Least Concern (SL) under the NC Act and as such are relevant to this report. The results of this modelling have been used to assess the LoO for migratory species that are listed under the NC Act.

Using the relevant East Asian-Australasian Flyway Partnership (EAAFP) flyway sites, species records were extracted from the available information sheets for each relevant site to develop an overall species list. Two sites, EAF017 and EAF136 were disregarded for the analysis. Due to the position of these sites on the western coast it is likely species using these sites will migrate north-south following the coastline and thus not relevant to the Disturbance Footprint.

For each species, flight paths were drawn between each site in which they are recorded creating the shortest possible flight paths between known occurrences. While it is more than likely that individuals divert to some degree from the straight flight paths to seek suitable refugia, the drawn flight paths serve as a measure of likelihood for presence in the region of the Project. Additionally, BirdLife International reports that it is likely that only a minority of birds fly north-south across the Australian continent and that the most records and mapped migratory routes reflect a coastal or near coastal trend (BirdLife International). Atlas of Living Australia records were also overlayed to identify places of refugia during migration.

3. Results

3.1. Desktop Analyses

3.1.1.Geology and Soils

The geology of the Knapdale Range is characterized by the fine-grained pink and white Knapdale Quartzites. It is bordered to the west by Lady Clayre Formation siltstones and dolostone and Coocerina Formation mudstone and bound by Mount Roseby Schist intermingled with poorly consolidated sediment and to the east.

The rolling hills of the Knapdale Range reach maximum elevations of approximately 310 m AHD (Queensland Globe, 2023), declining in all directions into grassy plains. The wind farm is proposed to be located on the Knapdale Range at elevations between 270-310 m AHD.

3.1.2. Landzones

The Knapdale Range and immediate surrounding area is mapped as Land zone 11: Mesozoic/Proterozoic metamorphosed sediments and interbedded volcanics. At a local scale this is intersected by Land zone 3: alluvial soils associated with the smaller drainage line features associated with the range.

3.1.3. Flora and Vegetation Communities

3.1.3.1. Regional Ecosystems

The Project is located in the Northwest Highlands bioregion (Queensland Herbarium, 2023). State mapped Regional Ecosystems (REs) (*Biodiversity status of 2021 remnant regional ecosystems – Queensland – Version 13.1*) for the Disturbance Footprint are largely heterogeneous (mixed) polygons comprised of 1.11.2a/1.7.7a (at 70/30%) and 1.11.3a/1.3.13a (at 90/10%). Polygons of homogenous REs 1.11.3a and 1.11.2a are also mapped along the western and eastern edges of the range respectively. A large heterogeneous polygon of REs 1.11.2a/1.5.13/1.3.7b (at 70/25/5%) is mapped around the northern end and eastern side of the range.

One RE, 1.3.7b, has a BD status of Endangered. The BD status is used for a range of planning and management applications including the Biodiversity Planning Assessments and to determine environmentally sensitive areas that are used for regulation of the mining industry through provisions in the EP Act. The BD status is based on an assessment of the condition of remnant vegetation in addition to the criteria used to determine the class under the VM Act. The BD status is not relevant to the determination of MSES, and as this RE does not have an Endangered or Of Concern status under the VM Act, it is not considered an MSES.

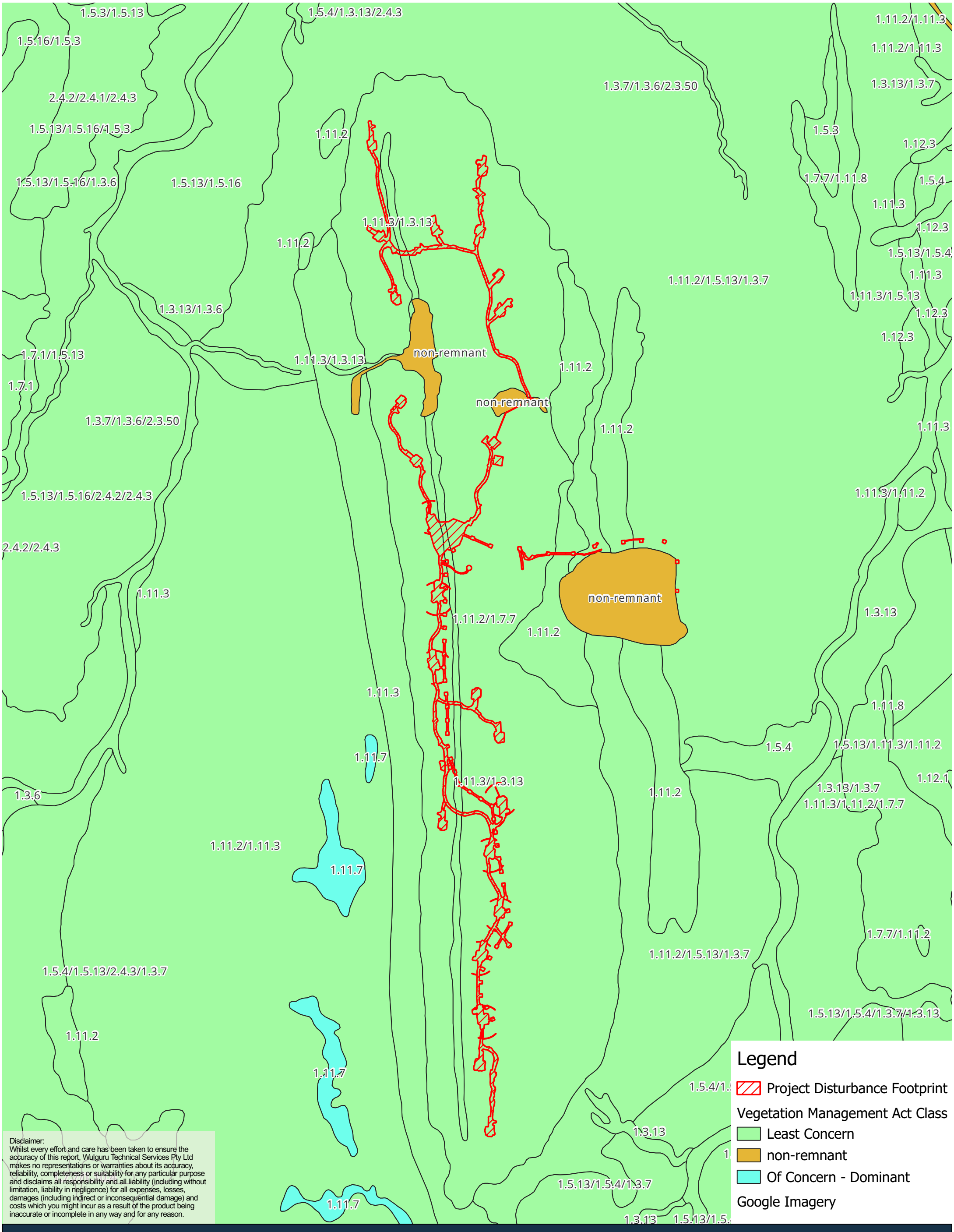
Table 8 provides descriptions of each RE, and any listed special values as per the Regional Ecosystem Description Database (Queensland Herbarium, 2023). Figure 4 shows the biodiversity status of mapped REs for the Disturbance Footprint. REs are each defined with a BD Status under the EP Act and a Vegetation Management (VM) Status under the VM Act. Each status can be classed as Endangered, Of Concern, or Least Concern/No Concern at Present.

Table 8: Regional Ecosystems mapped for the Disturbance Footprint

Regional Ecosystems	Long Description	VM Status*	BD Status#	Special Values
1.3.7b	*Eucalyptus camaldulensis fringing woodland, usually with Lophostemon grandiflorus and Melaleuca bracteata and/or M. dissitiflora. Occurs on recent levees and channel deposits of medium and smaller tributaries which are dry for most of the year; alluvial soils. Riverine.*	LC	E	1.3.7: Important seasonal water bird habitat; regional corridor for fauna.
1.11.2a	*Eucalyptus leucophloia* low open woodland or low woodland, sometimes with *Eucalyptus ludophilia*, *Corymbia terminalis*, *Corymbia aparrerinja* or *Eucalyptus normantonensis* usually with a *Acacia* spp. dominated shrub layer and *Triodia* spp. and/or tussock grass understorey. Treeless areas common. Occurs on hills and ranges on strongly folded metamorphic pre-Cambrian rocks; soils skeletal, some red earths. Not a Wetland. (BVG1M: 19a).	LC	NC	1.11.2: Potential habitat for NC Act listed species: *Eucalyptus nudicaulis*, *Ipomoea antonschmidii*, *Solanum carduiforme*, *Trachymene glandulosa*.
1.11.2e now 1.11.3a	See 1.11.3a	LC	NC	
1.11.2x1 now 1.7.7a	Low open woodland of *Corymbia capricornia*, commonly with *Eucalyptus leucophloia*. *Eucalyptus miniata*, *Eucalyptus herbertiana* and *Corymbia* ferruginea are commonly present in the north. Mixed shrub layer usually including *Grevillea wickhamii*. Ground layer of *Triodia* spp. and *Schizachyrium* fragile. Occurs on silcrete. Not a Wetland. (BVG1M: 19a).	LC	NC	1.7.7: Potential habitat for NC Act listed species: *Ipomoea antonschmidii*.
1.11.3a	Low open woodland of *Corymbia terminalis* and/or *Eucalyptus leucophylla* with *Acacia* spp. dominated shrub layer and ground layer of *Triodia* spp. and/or tussock grasses. Includes areas of *Acacia* spp. shrubland and *Triodia* spp. grassland. Occurs on metabasalts and dolerites; some felsic metavolcanics; skeletal soils, some shallow loams. Not a Wetland. (BVG1M: 19b).	LC	NC	1.11.3: Potential habitat for NC Act listed species: *Eucalyptus nudicaulis*.
1.11.3x1b now 1.11.3a	See 1.11.3a	LC	NC	
1.5.13	*Eucalyptus pruinosa* low open woodland often with *Corymbia terminalis, E. leucophylla*, *Acacia cambagei* or *Grevillea striata* and with a sparse mixed shrub layer and dense tussock grass ground layer dominated by *Aristida* spp. with *Triodia* spp. often present. Occurs on older alluvial and residual soils. Not a Wetland. (BVG1M: 19c).	LC	NC	No special values

VM Status = status under the Vegetation Management Act: BD Status# = Biodiversity Status: LC – Least Concern. NC – No concern at present, OC – Of concern, E – Endangered.*

Figure 4. VM Act class of mapped Regional Ecosystems of the Disturbance Footprint.



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Legend

- Project Disturbance Footprint

Vegetation Management Act Class

- Least Concern
- non-remnant
- Of Concern - Dominant

Google Imagery

FIGURE 4. VEGETATION MANAGEMENT ACT CLASS OF MAPPED REGIONAL ECOSYSTEMS

1 0 1 2 km

CRS: GDA94 / MGA zone 54
Scale: 1:40,000 @A3

Date: 2 April 2026
Author: M. Kaminski
Version: 0.01

Project Number: 2024.11004
Client: MMG

WULGURU TECHNICAL SERVICES

C:\Users\MichaelKaminski\OneDrive - Wulguru Tech Services\Dugald River\Dugald_20260401.qgz

3.1.4.Environmentally Sensitive Areas

A large area of Category B Environmentally Sensitive Area (ESA) is mapped around the north and west of the Knapdale range (APPENDIX C), but not within the Disturbance Footprint. The ESA relates to mapped heterogeneous RE 1.11.22/1.5.4x3/1.3.7b (at 70/25/5%) polygon of which 5% is estimated to be comprised of ERE 1.3.7b: *Eucalyptus* camaldulensis fringing woodland, usually with *Lophostemon grandiflorus* and *Melaleuca bracteata* and/or *M. dissitiflora*.

3.1.5. Matters of State Environmental Significance

MSES as referred to in Schedule 2 of the *Environmental Offsets Regulation 2014*, include the following:

- Regulated vegetation;
- Connectivity areas;
- Wetlands and watercourses;
- Designated precinct in a strategic environmental area;
- Protected wildlife habitat;
- Protected areas;
- Protected marine areas and habitat;
- Declared fish habitat areas;
- Waterways providing for fish passage;
- Marine plants; and
- Legally secured offset areas.

3.1.5.1. Regulated vegetation

3.1.5.1.1. Regulated Vegetation Mapping

Vegetation management regulated vegetation management map - version 7.00 maps the entire Disturbance Footprint as category B remnant vegetation.

3.1.5.1.2. Regulated vegetation – endangered or of concern regional ecosystem

No endangered or of concern REs as defined under the VM Act are mapped as present within Disturbance Footprint.

3.1.5.1.3. Regulated vegetation – Regional Ecosystem intersecting a wetland

No vegetation management wetlands are mapped within the Disturbance Footprint and therefore no wetlands are intersected by a wetland.

3.1.5.1.4. Regulated vegetation – Remnant vegetation within the defined distance of a watercourse

Stream order 1 and 2 regulated vegetation watercourses are mapped within the proposed Disturbance Footprint. Table 9 shows the distance from a defining bank that specifies the extent to which a prescribed RE is intersecting a regulated vegetation watercourse based on the bioregion and stream order (Department of Environment and Science, 2020).

Watercourses are mapped by the state as linear features rather than representative width of the defined bank which is described in the clearing for infrastructure code as:

- The bank that confines the seasonal flows, but which may be inundated by flooding from time to time, and can be either:
    - The bank or terrace that confines the water before the point of flooding; or
    - Where there is no bank, the seasonal high water line that represents the point of flooding (Department of Resources., 2023).

For the purposes of this report, watercourse defining banks were modelled utilising a digital elevation model (DEM) of the Knapdale Range and surrounding area. This was done by running an iterative python model within ArcGIS Pro that increased the depth of water in 2 cm increments, to determine the bank or terrace that confines the water before the point of flooding. This was done for every 1 m^2 of the drainage lines/watercourses to accurately capture the shape and to ensure changes in defining bank width were captured along the length of the drainage lines/watercourses.

The total approximate area of Remnant vegetation within the defined distance of a watercourse within the proposed Disturbance Footprint is 0.74 ha (Figure 5).

Table 9: Distance from the defining banks of watercourses based on bioregion and stream order

Watercourse steam order	Distance from the defining bank (m)
1 or 2	10
3 or 4	25
5 or greater	50

Table 10: Area of Remnant vegetation within the defined distance of a watercourse within the disturbance footprint

Stream order	Approximate Length (m)*	Area (ha)
1 and 2	370	0.74
Total	**370**	**0.74**

**approximate length derived by dividing calculated area from spatial data by twice the nominated width*

3.1.5.1.5. Regulated vegetation - Essential habitat

Essential habitat, for protected wildlife, is defined in section 20AC of the VM Act as:

- A category A area, a category B area or category C area shown on the regulated vegetation management map—
    - that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or
    - in which the protected wildlife, at any stage of its life cycle, is located.

With the exception of areas related to the DRM Tailings Storage Facility and the DRM Accommodation Camp in the northern section of the Knapdale Range, the entirety of the Knapdale Range and other locally connected areas are mapped as essential habitat on the *Vegetation management essential habitat map no attribute - version 12.09.* There is 135.70 ha of essential habitat for the PNRW mapped within the Disturbance Footprint (Figure 5).

Habitat spatial analysis for the PNRW was completed as outlined in Section 2.3. The results of this analysis were used in determining SRI for protected wildlife habitat.

Legend

Drainage Corridor from DEM

MSES regulated vegetation -essential habitat

Project Disturbance Footprint

Stage 1

Stage 2

Google Imagery

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DRM WINDFARM

FIGURE 5. REGULATED VEGETATION WATERCOURSES AND ESSENTIAL HABITAT

1 0 1 2 km

CRS: GDA94 / MGA zone 54
Scale: 1:40,000 @A3

Date: 7 April 2026

Author: M. Kaminski

WULGURU TECHNICAL SERVICES

Project Number: 2024.11004

Client: MMG Dugald River Pty Ltd

Version: 0.06

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3.1.5.2. Connectivity areas

The Knapdale Range consists largely of undisturbed habitat, occupying an area of approximately 6,000 ha of which only 136.82 ha (~2.3%) is proposed to be disturbed by the Project. Species dispersal along the Knapdale Range is unlikely to be hindered due to the availability of habitat surrounding the proposed disturbance. Moreover, the Project footprint will be linear and narrow, which is unlikely to inhibit crossing by most wildlife. As the Knapdale Range is located within a region of relatively undisturbed habitat, those species dispersing away other potential populations remain largely unhindered, with the potential exception of existing infrastructure relating to the DRM. Connectivity via riparian vegetation communities will remain largely unhindered as these areas will be avoided as far as practicable by the Project.

3.1.5.3. Wetlands and watercourses

The Disturbance Footprint lies on the boundary of the Leichhardt Basin and the Flinders Basin. Drainage from the Knapdale range flows to stream order 5 watercourse Cabbage Tree Creek of the Leichhardt River sub-basin to the north and west, and to stream order 5 watercourse Dugald River of the Cloncurry River sub-basin to the east and south. Watercourses in the Disturbance Footprint itself are unnamed stream order 1 and 2 drainage features and are typically ephemeral, though rocky waterholes that may persist through the dry season are known to occur in the upper catchments of these smaller drainage features (Figure 5).

There are no Ramsar internationally important wetlands or DIWA (Directory of Important Wetlands in Australia) nationally important wetlands mapped within the standard 2 km buffer from a central point within the Disturbance Footprint, or any of the tenure areas searched.

3.1.5.4. Designated precinct in a strategic environmental area

The Disturbance Footprint does not fall within a designated precinct in a strategic environmental area.

3.1.5.5. Protected wildlife and habitat

3.1.5.5.1. Protected plant habitat

The Flora Survey Trigger Mapping – version 10.0 displays no high-risk areas near the Disturbance Footprint.

3.1.5.5.2. Mapped habitat values

As described in section 3.1.5.1.5, the entire area of the Knapdale Range is mapped as essential habitat for the PNRW.

Modelled potential habitat (from the Modelled potential habitat for select threatened species V2 – Queensland spatial layer) for EVNT flora and fauna species is mapped to occur within 2 km of the Disturbance Footprint for the following EVNT fauna species:

- Australian painted-snipe (*Rostratula australis*): E, Ma (EPBC Act), E (NC Act)
- Carpentarian Grasswren (*Amytornis dorotheae*): E (EPBC Act), E (NC Act)
- Ghost Bat (*Macroderma gigas*): V (EPBC Act), E (NC Act)
- Gouldian Finch (*Erythrura gouldiae*): E (EPBC Act), E (NC Act)

- Painted Honeyeater (*Grantiella picta*): V (EPBC Act), V (NC Act)
- Purple-necked rock-wallaby (*Petrogale purpureicollis*): V (NC Act)
- Yellow Chat (*Epthianura crocea crocea*): V (NC Act)

3.1.5.6. Protected areas

There are no protected areas (including all classes of protected area except coordinated conservation areas) as defined under the NC ACT, mapped within the standard 2 km buffer from a central point within the Disturbance Footprint, or any of the tenure areas searched.

3.1.5.7. Protected marine areas and habitat

There are no protected marine areas or habitat mapped within the standard 2 km buffer from a central point within the Disturbance Footprint, or any of the tenure areas searched.

3.1.5.8. Declared fish habitat areas

There are no declared fish habitat areas mapped within the standard 2 km buffer from a central point within the Disturbance Footprint or any of the tenure areas searched.

3.1.5.9. Waterways providing fish passage

This MSES is not mapped within the Disturbance Footprint or its immediate vicinity. The Dugald River to the east (illustrated in Figure 8) represents the largest watercourse and potential waterway that could provide passage for fish in the vicinity of the Project. This water course does not cross the Disturbance Footprint at any point and therefore there is no potential for the Project to limit the passage of fish.

3.1.5.10. Marine plants

There are no marine plant habitat areas mapped within the standard 2 km buffer from a central point within the Disturbance Footprint, or any of the tenure areas searched.

3.1.5.11. Legally secured offset areas

There are no legally secured offset areas mapped within the standard 2 km buffer from a central point within the Disturbance Footprint, or any of the tenure areas searched.

3.1.5.12. Pre-survey Likelihood of Occurrence

A pre-survey LoO assessment was undertaken for listed threatened species using available desktop resources (APPENDIX D). Notes and discussion on habitat preference, ecology, and LoO for these species can be found in Appendix D of this Report. This assessment found the following EVNT species to have a pre-survey LoO of possible, likely, or known:

- *Ipomoea antonschmidii*: NT (NC Act) – Possible (10 km buffer)
- Purple-necked rock-wallaby (*Petrogale purpureicollis*): V (NC Act) – Likely (10 km buffer)
- Australian painted-snipe (*Rostratula australis*): E, Ma (EPBC), E (NC Act) – Possible (50 km buffer)
- Carpentarian Grasswren (*Amytornis dorotheae*): E (EPBC), E (NC Act) – Possible (50 km buffer)

- Purple-crowned Fairy-wren (*Malurus coronatus*): V (NC Act) – Possible (50 km buffer)
- Curlew Sandpiper (*Calidris ferruginea*): CE, M, Ma (EPBC Act), CE (NC Act) – Possible
- Great Knot (*Calidris tenuirostris*): CE, M, Ma (EPBC Act), CE (NC Act) – Possible
- Greater Sand Plover (*Charadrius leschenaultii*): V, M, Ma (EPBC Act), V (NC Act) – Possible (10 km buffer)
- Lesser Sand Plover (*Charadrius mongolus*): E, M, Ma (EPBC Act), E (NC Act) – Possible
- Red Knot (*Calidris canutus*): E, M, Ma (EPBC Act), E (NC Act) – Possible
- Ruddy Turnstone (*Arenaria interpres*): V, M, Ma (EPBC Act), V (NC Act) – Possible (10 km buffer)
- Terek Sandpiper (*Xenus cinereus*): V, M, Ma (EPBC Act), V (NC Act) – Possible (10 km buffer)
- Merten's Water Monitor (*Varanus mertensi*): E (EPBC Act), E (NC Act) – Possible (10 km buffer)
- Bar-tailed Godwit (*Limosa lapponica*): M, Ma (EPBC Act), E (NC Act) – Possible (10 km buffer)
- Black-tailed Godwit (*Limosa limosa*): E, M, Ma (EPBC Act), E (NC Act) – Possible (10 km buffer)
- Common Greenshank (*Tringa nebularia*): E, M, Ma (EPBC Act), E (NC Act) – Possible (50 km buffer)
- Grey Plover (*Pluvialis squatarola*): V, M, Ma (EPBC Act), V (NC Act) – Possible (10 km buffer)
- Latham's Snipe (*Gallinago hardwickii*): V, M, Ma (EPBC Act), V (NC Act) – Possible (10 km buffer)
- Sharp-tailed Sandpiper (*Calidris acuminata*): V, M, Ma (EPBC Act), V (NC Act) – Possible (50 km buffer)

This assessment also found the following SL species to have a pre-survey LoO of possible, likely, or known:

- Short-beaked Echidna (*Tachyglossus aculeatus*): SL (NC Act) – Likely (10 km buffer)
- Caspian Tern (*Hydroprogne caspia*): M, Ma (EPBC Act), SL (NC Act) – Possible (50 km buffer)
- Glossy Ibis (*Plegadis falcinellus*): M, Ma (EPBC Act), SL (NC Act) – Possible (50 km buffer)
- Grey-tailed Tattler (*Tringa brevipes*): M, Ma (EPBC Act), SL (NC Act) – Possible (10 km buffer)
- Marsh Sandpiper (*Tringa stagnatilis*): M, Ma (EPBC Act), SL (NC Act) – Possible (10 km buffer)
- Pacific Golden Plover (*Pluvialis fulva*): M, Ma (EPBC Act), SL (NC Act) – Possible (10 km buffer)
- Red-necked Stint (*Calidris ruficollis*): M, Ma (EPBC Act), SL (NC Act) – Possible (10 km buffer)
- Sanderling (*Calidris alba*): M, Ma (EPBC Act), SL (NC Act) – Possible (10 km buffer)
- Whimbrel (*Numenius phaeopus*): M, Ma (EPBC Act), SL (NC Act) – Possible (50 km buffer)

It should be noted that only non-migratory least concern species' habitat are classified as MSES. Hence, the only SL species assessed will be the Short-beaked Echidna. Migratory species not listed as threatened under the NC Act are assessed under the EPBC Act and are therefore not under the scope of this report.

3.2. Field Survey Results

3.2.1. Vegetation Communities

Table 11 provides details of the vegetation within the Disturbance Footprint, which comprises ground-truthed REs (GTREs) consistent with EcoSmart's 2021 PMAV and WTS's ground-truthing, and a summary of the total area of impact to each. The PMAV delineated the riparian vegetation (RE 1.3.7b). Outside of this, the certified vegetation mapping was maintained. Further ground-truthing by WTS aimed to identify the REs present across

polygons still mapped heterogeneously. The GTREs differ from the RE mapping as 1.3.7b has been accurately delineated and heterogeneous polygons have been identified and re-mapped as being consistent with the description for single REs. Figure 6 shows the GTREs in the Disturbance Footprint, as well as all ground-truthing points used for this assessment. The GTREs provide context on the habitat within the Disturbance Footprint and have been used to inform the Significant Residual Impact Assessments for EVNT species.

Table 11: Ground-truthed REs within the Disturbance Footprint

Regional Ecosystems	Long Description	Special Values	Area within phase 1 disturbance (ha)	Area within phase 2 disturbance (ha)
1.3.7b	*Eucalyptus camaldulensis* fringing woodland, usually with *Lophostemon grandiflorus* and *Melaleuca bracteata* and/or *M. dissitiflora*. Occurs on recent levees and channel deposits of medium and smaller tributaries which are dry for most of the year; alluvial soils. Riverine.	Important seasonal water bird habitat; regional corridor for fauna.	0.27	0
1.11.2a	*Eucalyptus leucophloia* low open woodland or low woodland, sometimes with *Eucalyptus leucophylla*, *Corymbia terminalis*, *Corymbia aparrerinja* or *Eucalyptus normantonensis* usually with an *Acacia* spp. dominated shrub layer and *Triodia* spp. and/or tussock grass understorey. Treeless areas common. Occurs on hills and ranges on strongly folded metamorphic pre-Cambrian rocks; soils skeletal, some red earths.	Potential habitat for NC Act listed species: *Eucalyptus nudicaulis*, *Ipomoea antonschmidii*, *Solanum carduiforme*, *Trachymene glandulosa*.	67.60	61.17
1.11.2e now 1.11.3a	Low open woodland of *Eucalyptus leucophylla* and *E. leucophloia* often with *Acacia cambagei* and *Corymbia terminalis* with a sparse ground layer of *Triodia pungens* and/or *Triodia longiceps*. Occurs on footslopes and lower slopes, broken by creeks and drainages. Not a Wetland. (BVG1M: 19b).	Potential habitat for NC Act listed species: *Eucalyptus nudicaulis*	5.02	0.48
1.5.4	*Eucalyptus leucophylla* and/or *Corymbia terminalis* low open woodland to low woodland over annual grasses with areas of *Triodia* spp. Occasional *Corymbia aparrerinja, Atalaya hemiglauca* and *Grevillea striata* and small areas of *Acacia cambagei* and *Eucalyptus leucophloia*. Occurs on plains and valley bottoms; red earths, shallow loams, clays and skeletal soils. Not a Wetland. (BVG1M: 19b).	Potential habitat for NCA listed species: *Ipomoea antonschmidii*.	0.83	0
1.7.7b	*Corymbia capricornia* and/or *Eucalyptus miniata* low open woodland often with *Eucalyptus herbertiana, Eucalyptus leucophloia* and/or *Corymbia ferruginea. Eucalyptus tetrodonta* may be present in the far north. A second tree layer of	Potential habitat for NCA listed species: *Ipomoea antonschmidii*.	0	0.52

Regional Ecosystems	Long Description	Special Values	Area within phase 1 disturbance (ha)	Area within phase 2 disturbance (ha)
	Terminalia canescens may be present. The shrub layer is mixed and includes Petalostig*ma quadriloculare, Grevillea dryandri, Terminalia canescens* and *Acacia calligera*. Ground layer of *Triodia* spp. and tussock grasses. Occurs on silcrete and lateritic surfaces. Not a Wetland. (BVG1M: 19a).			
Non-remnant			0.35	0.56
Total			74.07	62.73

VM Status = status under the Vegetation Management Act: BD Status# = Biodiversity Status: L – Least Concern. NC – No concern at present, OC – Of concern, E – Endangered.*

VM Status = status under the Vegetation Management Act: BD Status# = Biodiversity Status: L – Least Concern. NC – No concern at present, OC – Of concern, E – Endangered.*

3.2.2.Regulated Vegetation

3.2.2.1. Regulated Vegetation Mapping

Ground-truthing confirmed the Project will impact a maximum of 135.91 ha of category B remnant vegetation within the Disturbance Footprint.

3.2.2.2. Regulated vegetation – Intersecting a watercourse

Spatial analysis that was completed for the purpose of this report confirmed there is 0.74 ha of regulated vegetation intersecting a watercourse present within the Disturbance Footprint. Impacts to regulated vegetation intersecting a watercourse exceed criteria 1 and 3 of the significant residual impact test of table 1 of the guidelines (Department of the Environment, 2013). See section 4 for the impact assessment details.

3.2.2.3. Regulated vegetation – Essential habitat

Ground-truth surveys and records of the PNRW within the Knapdale Range confirm the presence of values meeting the criteria for essential habitat for the PNRW as per section 20AC (2b): a category A area, a category B area or category C area shown on the regulated vegetation management map— (b) in which the protected wildlife, at any stage of its life cycle, is located. The total approximate area of regulated vegetation essential habitat proposed to be impacted by the Project is 135.70 ha (Figure 5). Potential impacts to essential habitat and the PNRW are assessed against the significant residual impact criteria for protected wildlife habitat in section 4 of this Report.

3.2.2.4. EVNT flora

A Likelihood of Occurrence assessment was undertaken post ground-truthing of habitat within the Disturbance Footprint. No EVNT flora species were identified as having the potential to occur within the Disturbance Footprint (APPENDIX E).

Legend

Project Disturbance Footprint

RE Ground Truting Sites

Quaternary

Secondary

GTRE

1.11.2/1.5

1.11.2a

1.11.2a/1.

1.11.2e/1.

1.11.3a

1.11.3b

1.11.7

1.3.13a

1.3.7b

1.5.4x2

Non-remnan

Google Imagery

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FIGURE 6. GROUNDTRUTHED REGIONAL ECOSYSTEM

1 0 1 2 km

CRS: GDA94 / MGA zone 54
Scale: 1:40,000 @A3

Date: 2 April 2026

Author: M. Kaminski

Version: 0.01

Project Number: 2024.1104

Client: MMG

WULGURU TECHNICAL SERVICES

3.2.3.Fauna and Habitat

3.2.3.1. Ground-truthed Habitat Values

Regional Ecosystems	Long Description	Special Values	Habitat Features	Area within the Disturbance Footprint (ha)
1.3.7b	*Eucalyptus camaldulensis* fringing woodland, usually with *Lophostemon grandiflorus* and *Melaleuca bracteata* and/or *M. dissitiflora*. Occurs on recent levees and channel deposits of medium and smaller tributaries which are dry for most of the year; alluvial soils. Riverine.	Important seasonal water bird habitat; regional corridor for fauna.	Provides suitable nesting habitat for both small and large birds. Provides suitable foraging habitat for most bird species, excluding waterbirds. Larger eucalypts may provide roosting opportunities for some bat species.	0.27
1.5.4	*Eucalyptus leucophylla and/or Corymbia terminalis low open woodland to low woodland over annual grasses with areas of Triodia spp. Occasional Corymbia aparrerinja, Atalaya hemiglauca and Grevillea striata and small areas of Acacia cambagei and Eucalyptus leucophloia. Occurs on plains and valley bottoms; red earths, shallow loams, clays and skeletal soils.*	Potential habitat for NC Act listed species: *Ipomoea antonschmidii*.	Provides suitable nesting habitat for both small and large birds, excluding raptors and waterbirds. Provides suitable foraging habitat for most bird species, excluding waterbirds. Larger eucalypts may provide roosting opportunities for some bat species.	0.83
1.7.7b	*Corymbia capricornia and/or Eucalyptus miniata low open woodland often with Eucalyptus herbertiana, Eucalyptus leucophloia and/or Corymbia ferruginea. Eucalyptus tetrodonta may be present in the far north. A second tree layer of Terminalia canescens may be present. The*	Potential habitat for NC Act listed species: *Ipomoea antonschmidii*.	Provides suitable nesting habitat for both small and large birds, excluding raptors and waterbirds. Provides suitable foraging habitat for most bird	0.52

	shrub layer is mixed and includes Petalostigma quadriloculare, Grevillea dryandri, Terminalia canescens and Acacia calligera. Ground layer of Triodia spp. and tussock grasses. Occurs on silcrete and lateritic surfaces.		species, excluding waterbirds. Larger eucalypts may provide roosting opportunities for some bat species.	
1.11.2a	*Eucalyptus leucophloia* low open woodland or low woodland, sometimes with *Eucalyptus leucophylla*, *Corymbia terminalis*, *Corymbia aparrerinja* or *Eucalyptus normantonensis* usually with an *Acacia* spp. dominated shrub layer and *Triodia* spp. and/or tussock grass understorey. Treeless areas common. Occurs on hills and ranges on strongly folded metamorphic pre-Cambrian rocks; soils skeletal, some red earths.	Potential habitat for NC Act listed species: *Eucalyptus nudicaulis*, *Ipomoea antonschmidii*, *Solanum carduiforme*, *Trachymene glandulosa*.	Provides suitable nesting habitat for both small and large birds, excluding raptors and waterbirds. Provides suitable foraging habitat for most bird species, excluding waterbirds. Larger eucalypts may provide roosting opportunities for some bat species.	128.77
1.11.3a	Low open woodland of *Corymbia terminalis* and/or *Eucalyptus leucophylla* with *Acacia* spp. dominated shrub layer and ground layer of *Triodia* spp. and/or tussock grasses. Includes areas of *Acacia* spp. shrubland and *Triodia* spp. grassland. Occurs on metabasalts and dolerites; some felsic metavolcanics; skeletal soils, some shallow loams.	Potential habitat for NC Act listed species: *Eucalyptus nudicaulis*.	Provides suitable nesting habitat for small and medium birds. Provides suitable foraging habitat for most bird species, excluding waterbirds. Larger eucalypts may provide roosting opportunities for some bat species.	5.54
Non-remnant				0.91
Total				136.8

VM Status = status under the Vegetation Management Act: BD Status[#] = Biodiversity Status: L – Least Concern. NC – No concern at present, OC – Of concern, E – Endangered.*

3.2.3.2. Habitat Spatial Analysis

3.2.3.2.1. Habitat Spatial Analysis for the PNRW:

Spatial analysis of the ground-truthed habitat values for the PNRW extrapolated denning and foraging/dispersal habitat across and immediately adjacent to the Knapdale Range. No known denning locations, and very little modelled potential denning habitat occurs within the Disturbance Footprint. This is because the Disturbance Footprint is located almost entirely within the flat habitat present on the top of the range, whereas the denning habitat is limited to the sloped areas that skirt the range or along drainage lines and gullies. The total area of PNRW habitat (modelled as per the methodology in Section 0) impacted by the proposed Disturbance Footprint amounts to 2.37 ha of modelled potential denning habitat and 133.25 ha of modelled potential foraging/dispersal habitat. This amounts to approximately 0.7 % of the available 299.22 ha of modelled potential denning habitat and 1.8 % of the available 7124.15 ha of modelled potential foraging/dispersal habitat on and adjacent to the Knapdale Range. Modelled potential habitat is illustrated in Figure 7.

3.2.3.2.2. Habitat Spatial Analysis for Mertens Water Monitor:

To date the Mertens Water Monitor has not been recorded within MMG's Dugald River mining lease and no suitable habitat for it has been identified, despite extensive ecological surveys (detailed in Section 2.2) including surveys for aquatic habitat done by AARC. Spatial analysis of the habitat values for Merten's water monitor was extrapolated habitat from records at Longamundi Waterhole approximately 2 km east of the Disturbance Footprint, within the Dugald River. This analysis has determined that whilst the sandy banks of the waterhole itself represent the most likely nesting habitat, the entirety of Dugald River and adjacent areas out to 10 m can be considered suitable foraging and dispersal habitat (Figure 8). The Disturbance Footprint itself contains no habitat which would be considered suitable habitat for this species.

3.2.3.3. Post-survey Likelihood of Occurrence

A post survey Likelihood of Occurrence (LoO) assessment was undertaken post ground-truthing of habitat within the Disturbance Footprint.

The Knapdale Range is confirmed suitable habitat for the vulnerably listed (NC Act) PNRW. Large bouldery rocky gorges form suitable habitat for denning and contain potentially perennial rocky waterholes. Surrounding areas are grassy woodland suitable for foraging. EcoSmart Ecology estimate the current PNRW population within the Knapdale range could be as high as 270 (Ecosmart Ecology, 2023).

EcoSmart describe the habitat within the range as suboptimal for other potential species: the grey falcon and painted honeyeater, due to the lack of sparsely treed areas preferred by the grey falcon and the lack of suitable mistletoe species of which the honeyeater is a specialist. Additionally, the Carpentarian grasswren is typically associated with hummocking spinifex grasslands which have not been recorded on the Knapdale Range. None of these species have been observed during the many years of survey effort in the area (Ecosmart Ecology, 2023).

A post-survey LoO assessment was undertaken for listed threatened species using available desktop resources (APPENDIX D). Notes and discussion on habitat preference, ecology, and LoO for these species can be found in section 5 and in Appendix E of this Report. This assessment found the following fauna species to have a post-survey LoO of possible, likely or known:

- PNRW (*Petrogale purpureicollis*): V (NC Act) – Known* (10 km buffer)
- Australian painted-Snipe (*Rostratula australis*): E, Ma (EPBC), E (NC Act) – Possible (50 km buffer)
- Purple-crowned Fairy-wren (*Malurus coronatus*): V (NC Act) – Possible (50 km buffer)
- Curlew Sandpiper (*Calidris ferruginea*): CE, M, Ma (EPBC Act), CE (NC Act) – Possible
- Great Knot (*Calidris tenuirostris*): CE, M, Ma (EPBC Act), CE (NC Act) – Possible
- Greater Sand Plover (*Charadrius leschenaultii*): V, M, Ma (EPBC Act), V (NC Act) – Possible (10 km buffer)
- Lesser Sand Plover (*Charadrius mongolus*): E, M, Ma (EPBC Act), E (NC Act) – Possible
- Red Knot (*Calidris canutus*): E, M, Ma (EPBC Act), E (NC Act) – Possible
- Ruddy Turnstone (*Arenaria interpres*): V, M, Ma (EPBC Act), V (NC Act) – Possible (10 km buffer)
- Terek Sandpiper (*Xenus cinereus*): V, M, Ma (EPBC Act), V (NC Act) – Possible (10 km buffer)
- Bar-tailed Godwit (*Limosa lapponica*): M, Ma (EPBC Act), E (NC Act) – Possible (10 km buffer)
- Black-tailed Godwit (*Limosa limosa*): E, M, Ma (EPBC Act), E (NC Act) – Possible (10 km buffer)
- Common Greenshank (*Tringa nebularia*): E, M, Ma (EPBC Act), E (NC Act) – Possible (50 km buffer)
- Grey Plover (*Pluvialis squatarola*): V, M, Ma (EPBC Act), V (NC Act) – Possible (10 km buffer)
- Latham's Snipe (*Gallinago hardwickii*): V, M, Ma (EPBC Act), V (NC Act) – Possible (10 km buffer)
- Sharp-tailed Sandpiper (*Calidris acuminata*): V, M, Ma (EPBC Act), V (NC Act) – Possible (50 km buffer)

This assessment also found the following SL species to have a post-survey LoO of possible, likely, or known:

- Short-beaked Echidna (*Tachyglossus aculeatus*): SL (NC Act) – Known* (10 km buffer)
- Caspian Tern (*Hydroprogne caspia*): M, Ma (EPBC Act), SL (NC Act) – Possible (50 km buffer)
- Glossy Ibis (*Plegadis falcinellus*): M, Ma (EPBC Act), SL (NC Act) – Known* (50 km buffer)
- Grey-tailed Tattler (*Tringa brevipes*): M, Ma (EPBC Act), SL (NC Act) – Possible (10 km buffer)
- Little Tern (*Sternula albifrons*): M, Ma (EPBC Act), SL (NC Act) – Possible* (10 km buffer)
- Marsh Sandpiper (*Tringa stagnatilis*): M, Ma (EPBC Act), SL (NC Act) – Possible (10 km buffer)
- Pacific Golden Plover (*Pluvialis fulva*): M, Ma (EPBC Act), SL (NC Act) – Possible (10 km buffer)
- Red-necked Stint (*Calidris ruficollis*): M, Ma (EPBC Act), SL (NC Act) – Possible (10 km buffer)
- Sanderling (*Calidris alba*): M, Ma (EPBC Act), SL (NC Act) – Possible (10 km buffer)
- Whimbrel (*Numenius phaeopus*): M, Ma (EPBC Act), SL (NC Act) – Possible (50 km buffer)

Merten's Water Monitor (*Varanus mertensi*) was determined to be unlikely to occur within the Disturbance Footprint however, this species has still been assessed for SRIs due to the potential for indirect impacts to this species resulting from the Project occurring in an area 'upstream' to the identified habitat in Dugald River.

Figure 7a. Purple-necked Rock-wallaby Potential Habitat (North)

Legend

- Known PNRW Sites
- Potential PNRW
- Potential_PNRW_250m_buff

Project Disturbance

- Stage 1
- Stage 2

Google Imagery

0 0.5 1 1.5 2

Kilometers

Scale: 1:25,000 @A3

CRS: GDA94 / MGA zone 54

Project: 2024.11004	
Client: MMG Dugald River Pty Ltd	
Author: M. Kaminski	Date: 2 April 2026

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Figure 7b. Purple-necked Rock-wallaby Potential Habitat (South)

Legend

- Known PNRW Sites
- Potential PNRW
- Potential_PNRW_250m_buff

Project Disturbance

- Stage 1
- Stage 2

Google Imagery

0 0.5 1 1.5 2

Kilometers

Scale: 1:25,000 @A3

CRS: GDA94 / MGA zone 54

Project: 2024.11004	
Client: MMG Dugald River Pty Ltd	
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Legend

Project Disturbance Footprint

EcoSmart Varanus mertensi records

Varanus mertensi modelled habitat (DR10m buffer)

Google Imagery

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FIGURE 8. MERTEN'S WATER MONITOR HABITAT

1 0 1 2 km

CRS: GDA94 / MGA zone 54
Scale: 1:40,000 @A3

Date: 2 April 2026

Author: M. Kaminski

WULGURU TECHNICAL SERVICES

Project Number: 2024.1104

Client: MMG

Version: 0.01

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3.2.4. Bird and Bat Utilisation Surveys

No threatened bird or bat species listed under the NC Act have been identified during the four rounds of BBUS that were undertaken by EcoSmart in 2023 and WTS in 2024 and 2025.

4. Potential Impacts of the Project

The Project has the potential to have both direct and indirect impacts on MSES within the Disturbance Footprint during the construction, operation, and decommissioning phases. Specific impacts for MSES identified as known, likely or possibly occurring within the Disturbance Footprint are discussed with the relevant species in Section 5.

The impact assessment considers all stages of the Project. At the end of decommissioning, the impacted areas will be rehabilitated in accordance with Approval Conditions at a Local, State and Federal level. As such, no actual or potential impacts beyond completion of the rehabilitation stage are likely to occur.

The potential general impacts during construction (Table 12), operation (Table 13 and Table 14), and decommissioning (Table 15) have been identified and evaluated, with proposed management measures to avoid, minimise, and mitigate impacts. The Project employed environmental design philosophies during development of the Disturbance Footprint with a focus on avoiding sensitive environmental values. Importantly, a process of pre-clearance surveys prior to construction of the Project to support adjustments of infrastructure to further avoid ecological values is a key management strategy to be employed by MMG.

4.1.1. Clearing and Construction Phase

Table 12. Clearing and Construction Phase Potential Impacts

Threat	Impact
Introduction and/or spread of weed species due to vehicle and machinery movements across the landscape.	Modification of native habitats.
Introduction of pest species or increase of their populations.	Competing with, predating on, or otherwise harming native species.
	Facilitating the infection of native species with diseases/parasites.
	Indirectly modifying the habitat of native species.
Contaminants and waste (including litter).	Direct harm to native fauna (e.g. ingestion of waste by a native animal).
	Indirect harm to native fauna through degradation of their habitat.
Noise and light pollution, and vibrations (particularly during night-time works).	Confusion of birds by light causing increased risk of interactions.
	Disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns
Construction or clearing activities.	Injury/fatality of fauna.
	Destruction of native habitat (specifically important in the case of rocky habitat/sub-habitat utilised by the PNRW)
	Creating barriers to distribution of native fauna (namely the PNRW).
	Creating barriers damming flow to downstream water holes.
	Generating dust or creating areas prone to erosion that may lead to sedimentation of downstream areas
Active work areas, pits, trenches, and other hazardous disturbed areas.	Injury/fatality of fauna.

4.1.2. Operation Phase

4.1.2.1. Terrestrial fauna

Table 13. Operation Phase Potential Impacts to Terrestrial Fauna

Threat	Impact
Noise pollution, and vibrations.	Disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.
Vehicle movements	Generating dust that may lead to sedimentation of downstream areas (specifically important in the case of Merten's water monitor)

4.1.2.2. Aerial fauna

Table 14. Operation Phase Potential Impacts to Aerial Fauna

Threat	Impact
Wind turbine structures, primarily rotor blades and associated RSA.	Collisions between flying fauna and WTGs or other structures, or barotrauma as a result of flight close to rotors, resulting in injury or fatality.
	Displacement and barrier effects resulting in greater energetic cost to fauna flying through the area.
Noise, pressure, and vibrations from the operation of the WTGs.	Disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

4.1.3.Decommissioning Phase

Table 15. Decommissioning Phase Potential Impacts

Threat	Impact
Introduction and/or spread of weed species due to vehicle and machinery movements across the landscape.	Modification of native habitats.
Introduction of pest species or increase of their populations.	Competing with, predating on, or otherwise harming native species.
	Facilitating the infection of native species with diseases/parasites.
	Indirectly modifying the habitat of native species.
Contaminants and waste (including litter).	Direct harm to native fauna (e.g. ingestion of waste by a native animal).
	Indirect harm to native fauna through degradation of their habitat.
Noise and light pollution, and vibrations (particularly during night-time works).	Confusion of birds by light causing increased risk of interactions.
	Disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns
Active work areas, pits, trenches, and other hazardous disturbed areas.	Injury/fatality of fauna.

5. Impact Assessment

An assessment for significant impacts was undertaken for ground-truthed MSES with a LoO of possible, likely, or known within the Disturbance Footprint. Species were assessed against impact criteria relevant to their status and the relevant governing legislation to the determined potential impacts of the Project. The purpose of this assessment is to determine whether or not the Project is likely to have a significant impact on the MSES, and to inform the Preliminary Impact Management Plans.

Impacts to Regulated Vegetation were assessed in accordance with the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014).

Protected wildlife habitat, also a prescribed environmental matter, is defined as a habitat for an animal that is 'endangered' or 'vulnerable' wildlife or a special least concern animal, including areas or features used by an animal for foraging, roosting, nesting or breeding. Where potential habitat has been identified, namely for the PNRW and Short-beaked Echidna the presence of SRIs as a result of the Disturbance were determined using the criteria outlined *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014).

Whilst the Migratory listing is under the EPBC Act, migratory species are also listed as Special Least Concern under the NC Act. However, Special Least Concern species that are migratory are not MSES as per Schedule 2 of the Environmental Offsets Regulation 2014 and as such are not relevant to this Report. A spatial analysis of potential flight paths for migratory birds was conducted as per the methodology detailed in Section 2.4. The results of the spatial analysis informed impact assessments for species with potential to fly within the Disturbance Footprint. Mapping is provided in APPENDIX F. There is no suitable habitat within the Disturbance Footprint for any of the migratory species identified, of particular note is the absence of local perennial water sources in close proximity to the Disturbance Footprint. However there is potential for the species to transit through the site to reach suitable habitat elsewhere and as such SRI assessments could be undertaken for the species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). It should be noted that limited information is available regarding the flight heights for most species and more particularly with regard to the location of the Project itself.

Impacts were classified as permanent and temporary. Wind farms are Temporary impacts are impacts to the species that occur during the construction, operation and decommissioning of the Project. Any impacts that would continue to affect the species beyond the decommissioning of the Project are considered permanent.

The relevant POs under the *State Code 23: Wind Farm Development* outlined in Section 1.4 were considered as part of this impact assessment.

5.1. Summary of Findings

17 threatened species and 1 SL species were subject to Significant Residual Impact assessments. A summary of the findings is presented in Table 16.

Table 16. Summary of Significant Residual Impact Assessment Findings

Species	Status EPBC Act	Status NC Act	Likelihood of SRI
Regulated Vegetation			
Regulated Vegetation intersecting a watercourse	N/A	N/A	Unlikely
Regulated Vegetation Essential Habitat	N/A	N/A	Possible
Avian Fauna			
Australian Painted Snipe *(Rostratula australis)*	E	E	Unlikely
Purple-crowned Fairy-wren (*Malurus coronatus*)	NL	V	Unlikely
Curlew Sandpiper (*Calidris ferruginea*)	CE, M, Ma	CE	Unlikely
Great Knot (*Calidris tenuirostris*)	CE, M, Ma	CE	Unlikely
Greater Sand Plover (*Charadrius leschenaultii*)	V, M, Ma	V	Unlikely
Red Knot (*Calidris canutus*)	E, M, Ma	E	Unlikely
Lesser Sand Plover (*Charadrius mongolus*)	E, M, Ma	E	Unlikely
Ruddy Turnstone (*Arenaria interpres*)	V, M, Ma	V	Unlikely
Terek Sandpiper (*Xenus cinereus*)	V, M, Ma	V	Unlikely
Bar-tailed Godwit (*Limosa lapponica*)	E, M, Ma	E	Unlikely
Black-tailed Godwit (*Limosa limosa*)	E, M, Ma	E	Unlikely
Common Greenshank (*Tringa nebularia*)	E, M, Ma	E	Unlikely
Grey Plover (*Pluvialis squatarola*)	V, M, Ma	V	Unlikely
Latham's snipe (*Gallinago hardwickii*)	V, M, Ma	V	Unlikely
Sharp-tailed sandpiper (*Calidris acuminata*)	V, M, Ma	V	Unlikely
Terrestrial Fauna			
Purple-necked Rock-wallaby (*Petrogale purpureicollis*)	NL	V	Possible
Short-beaked Echidna (*Tachyglossus aculeatus*)	NL	SL	Unlikely
Merten's Water Monitor (*Varanus mertensi*)	E	E	Unlikely

5.2. Regulated Vegetation

5.2.1. Regulated Vegetation – Remnant vegetation within the defined distance of a watercourse

An action is **LIKELY** to have an SRI on remnant vegetation within the defined distance (as per Table 9) of a watercourse if the action will result in:

a) permanent removal of vegetation within the defined distance of a stream order 2 or higher where no rehabilitation is proposed;
b) building of an online detention basin greater than 1 ha in size or other similar works that result in the clearing of vegetation which fragments up and downstream remnant areas on any stream order; OR
c) permanent clearing of more than 0.5ha of an endangered or of concern RE, within the defined distance of a watercourse.

Notwithstanding the above, an action is **UNLIKELY** to have an SRI on remnant vegetation within the defined distance (as per Table 9) of a watercourse, if the action will result in:

a) lineal clearing of vegetation (that is for a purpose under section 22A of the VMA) less than 25m in width on a stream order 1 or 2 mapped watercourse, where the works include:
    I. revegetation of exposed embankment areas (e.g. from a new road crossing and culvert installation) in accordance with a vegetation management or rehabilitation plan,
    II. temporary erosion and sediment control until construction is completed or stream banks have been stabilised, AND
    III. a crossing design which can be demonstrated (through a site specific study or similar) not to interfere with existing aquatic and terrestrial habitat of the watercourse;
b) temporary clearing of 'least concern' RE of up to 1 ha on a stream order 1 or 2 where erosion and sediment measures are in place and the area is to be rehabilitated on the subject site;
c) removal of vegetation from a partially vegetated / degraded stream order 1 or 2 where revegetation greater than the area removed occurs on other stream order areas within or adjoining the site;
d) clearing of 'least concern' RE not containing Essential Habitat up to 1ha for lineal infrastructure (e.g. roads and rail); OR
e) removal of understorey vegetation of up to 3 ha within a remnant area (excluding clearing within the high bank of the watercourse) for the purposes of open space or safety where not removing any trees with a trunk Diameter at Breast Height (DBH) greater than 150mm in diameter.

Whilst the project works will result in permanent removal of vegetation within the defined distance of a stream order 2 or higher watercourses due to the establishment of tracks and associated crossings, the project works will be **Unlikely** to result in an SRI as the works will:

- result in clearing less than 25 m in width;
- include revegetation of exposed embankments as per the project's Rehabilitation Plan;
- include temporary erosion and sediment control outlined in Section 6.2 and the project's Erosion and Sediment Control Plan;

- include a crossing design, through the use of culverts as outlined in Section 6.2, to avoid interference with the existing aquatic and terrestrial habitat of the watercourse; and
- Result in less than 1 ha (0.74 ha) of clearing of 'least concern' REs on stream order 1 and 2 watercourses and include sediment and rehabilitation measures as described above.

The above measures will preserve the composition, structure, and function of the watercourse and the vegetation associated with the watercourse. Due to the Disturbance Footprint being located almost entirely within the flat habitat present on the top of the range there is minimal disturbance to watercourses/drainage lines, which are limited to the sloped areas that skirt the range or it's gullies. Watercourses/drainage lines across the Knapdale Range are highly ephemeral, and as such they provide limited value as aquatic habitat. Downstream impacts have been considered where relevant, such as for the Merten's Water Monitor (impact assessment completed in Section 5.4.3).

5.2.1.1. Performance outcomes in relation to State Code 16: Native vegetation clearing

The relevant clearing purpose associated with the Dugald River Wind Farm is 'Material change of use and / or reconfiguring a lot for all other purposes', as described in Table 16.1 of State Code 16.

All the listed General Performance outcomes as listed in Table 16.2 of State Code 16 (PO1, PO2 and PO3) are met. There are no notices requiring compliance on the land, no particular regulated areas and no offset areas within the Disturbance Footprint, as defined within the code. The Project complies with the code in this regard.

The Project has a Preliminary Construction and Environment Management Plan, that complies with PO80 and addresses avoiding and minimising clearing where possible.

The Project complies with the Performance Outcome PO83 in relation to clearing associated with watercourses and drainage features.

In complying with PO83, the clearing maintains the composition, structure and composition of the RE associated with the watercourses (which are all classified as LC under the VM Act), and addresses all of the following:

1. bank stability by protecting against bank erosion; The Project includes temporary erosion and sediment control during the construction phase as outlined in Section 6.2 and the Project's Stormwater and Erosion Risk Assessment Report.
2. water quality by filtering sediments, nutrients and other pollutants; Sediment risks have been outlined and assessed in the Stormwater and Erosion Risk Assessment Report and potential controls have been outlined in section 6.2.
3. aquatic habitat; Watercourses/drainage lines across the Knapdale Range are highly ephemeral, and as such they provide limited value as aquatic habitat. Downstream impacts have been considered where relevant, such as for the Merten's Water Monitor (impact assessment completed in Section 5.4.3). The Project will include a crossing design, through the use of culverts as outlined in Section 6.2, to avoid interference with the existing aquatic and terrestrial habitat of the watercourse

4. terrestrial habitat: There is minimal amount of clearing (0.74 ha) across the entire Disturbance Footprint and therefore terrestrial habitat is minimally affected. The Project will also include a crossing design, through the use of culverts as outlined in Section 6.2, to avoid interference with the existing aquatic and terrestrial habitat of the watercourse.

Therefore, the clearing within vegetation associated with a watercourse or drainage feature complies with PO83 as describes above and PO84. The SRI assessment resulted in an **unlikely** impact.

5.2.2. Regulated Vegetation – Essential Habitat

An action is **LIKELY** to have a SRI on essential habitat if the action will result in:

(a) clearing of essential habitat exceeding the thresholds specified in Table 17 and resulting in a greater than 10% permanent reduction in the extent of essential habitat mapped on site.

Notwithstanding the above, an action is **UNLIKELY** to have a SRI on essential habitat if the action will result in:

(a) lineal clearing (that is for a purpose under section 22A of the VMA) within essential habitat not exceeding the width and area thresholds specified in Table 17 by more than 25%, and where an equivalent area which can be mapped as essential habitat in the future is rehabilitated on the subject site;
(b) clearing of less than 10% of the total mapped areas of essential habitat on-site; where the remaining 90% is protected through a legally binding agreement (or similar) in order to maintain ecosystem function (e.g. to continue to support the species for which the essential habitat is derived);
(c) temporary clearing of essential habitat vegetation not exceeding the width thresholds specified in Table 17 by more than 100% or the area threshold by more than 50%; where cleared essential habitat vegetation is rehabilitated, on the subject site;
(d) clearing of essential habitat vegetation complying with the width thresholds specified in Table 17 and exceeding the area threshold by less than 50%;
(e) removal of essential habitat vegetation exceeding the width and area thresholds specified in Table 17 and where through the remapping of other vegetation the site results in an increase in the extent of mapped essential habitat vegetation; OR
(f) removal of fragmented or isolated areas of essential habitat where the equivalent area of essential habitat can be added to a larger retained vegetated area displaying the same essential habitat factors, by revegetation.

Table 17. Clearing limits per regional ecosystem structure category

Structure Category*	Width (metres)	Area (hectares)
Dense and mid-dense	10	0.5
Spare and very sparse	20	2
Grassland	25	5

* Refer to the structure category within the Regional Ecosystem Description Database

A significant residual impact assessment for the PNRW protected wildlife habitat has been provided in section 5.4.1. The below assessment relates to impacts to essential habitat and determines that significant residual impacts to the PNRW as a result of the Project will be possible based on the disturbance of essential habitat alone.

Whilst the Project will result in clearing of essential habitat exceeding the thresholds specified in Table 17, this does not constitute a greater than 10% permanent reduction in the extent of essential habitat mapped on site. However, the *Significant Residual Impact Guideline* (DSDIP, 2014) specifies that SRI criteria are not exclusive, and therefore the **LIKELY** SRI criteria does not automatically mean everything below these thresholds will not have an SRI. As none of the condition of the **UNLIKELY** criteria can be met, the Project must therefore be considered as being **POSSIBLE** to result in an SRI to essential habitat for the PNRW.

5.3. Potential Threatened Birds: Protected Wildlife Habitat

5.3.1. Australian Painted Snipe *(Rostratula australis)*

EPBC – Endangered, Marine. NC Act – Endangered

The Australian Painted Snipe *(Rostratula australis*) is a cryptic species that is largely seasonal, following wet season inundations. It is a stocky, wading shore bird with a shorter beak than other snipe species and distinctive white comma-shaped eye markings (Pizzey & Knight, 2012). Unlike other snipe species in Australia, the Australian painted snipe does not seasonally migrate outside of Australia, though migration within the country does occur. The species generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms, and bore drains. Typical sites include those with emergent tussocks of grass, sedges, rushes or reeds, or samphire, often with scattered clumps of lignum, Muehlenbeckia, canegrass, or sometimes tea-tree (Melaleuca). The Australian Painted Snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber (Marchant & Higgins, 1993).

Australian Painted Snipe breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and mixed heights of low vegetation. Nest records are all, or nearly all, from or near small islands in freshwater wetlands, with a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover (Rogers, et al., 2005). Gilgai micro relief, comprising extensive systems of small mounds (e.g. 1 to 3 m in diameter) and hollows (e.g. up to 0.5 m deep), is especially suitable; wetlands with gilgai are abundant in seasonal and other temporary wetlands of Australia, especially in the Murray Darling, arid and savannah regions on clay soils. The Australian Painted Snipe can use modified habitats, such as low-lying woodlands converted to grazing pasture, rice farms, sewage farms, dams, bores, and irrigation schemes, however they do not necessarily breed in such habitats (Marchant & Higgins, 1993).

The Australian painted snipe is well distributed across the country, though the bulk of the records for this species are along the southeast coast of Australia, from Brisbane to Adelaide (Atlas of Living Australia, 2023). The species has a historical population stronghold in the Murray-Darling basin, with a much patchier distribution in the north of its range, generally relying on water and rainfall events (TSSC, 2013; Pizzey & Knight, The Field Guide to the Birds of Australia, 2012). The Australian painted snipe has previously been included as a subspecies of the greater painted snipe (*Rostratula benghalensis*), a related species that occurs in Africa and Asia. The species is listed “marine” under this alternate naming. The name *Rostratula australis* is considered most appropriate here, as the species is distinguishable from *R. benghalensis* on morphology (TSSC, 2013). The Australian painted snipe is cryptic, secretive, and usually difficult to detect. Appearance in northern Australia is considered seasonal, following wet season inundations.

One record of the Australian painted snipe exists approximately 40 km southwest of the site. There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species’ habitat under the

Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009 (DSDIP, 2014).

The Australian painted snipe is primarily threatened by habitat degradation. This is particularly evident in one of the most important habitat areas for this species, the Murray-Darling basin. A history of water mismanagement for irrigation, wetland degradation, and drought in recent years has significantly reduced suitable habitat for the species. Climate change is also implicated is exacerbating these negative effects and is predicted to increase in severity. This species is also threatened by grazing, introduced predators, and invasion of weeds in wetland habitats (TSSC, 2013).

The threats discussed above were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;
    - WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
    - Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 18: SRI assessment for the Australian painted snipe (*Rostratula australis*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. There is a record of a single individual ~40 km southwest of the site. There is no local population, individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the site and connectivity of the surrounding habitat, works within the site are unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European red foxes are recognised threats to this species and have been detected on site. Several species of invasive flora have been detected on site and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the General Biosecurity Obligation (GBO) to identify and manage any potential invasive species.
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the site. There are currently no known diseases that may cause the species to decline.

Is there a chance or possibility that an action will?	Response
	The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient Due to the absence of suitable habitats within the Disturbance Footprint, the Project is unlikely to be disruption to any ecologically significant locations.

5.3.2. Purple-crowned Fairy-wren (*Malurus coronatus*)

EPBC – Not listed. NC Act – Vulnerable.

The Purple-crowned Fairy-wren (*Malurus coronatus*) is a small bird that is warm-brown above, and white below, with a long blue tail, dark bill, dark eyes, and brownish legs and feet (Higgins, Peter, & Steel, 2001). Adult females have a dark grey forehead, crown, and nape, and a chestnut mask around the bill and eyes with contrasting white eye-rings. During the non-breeding season, adult males look much the same, except the mask is usually dark and the eye-rings more grey than white. In the breeding season, males develop a purple colouring on the forehead, crown, and nape, with a black spot in the centre of the crown and the mask becoming completely black (Higgins, Peter, & Steel, 2001) (Rowley & Russel, 2016). Fairy-wren's have short, rounded wings that provide good initial lift and are useful for short flights but are not suitable for extended jaunts of flight. Their movement is a series of hops and bounces, and as such it is not probable this species occurs within the RSA.

It is probable the record ~42 km north of the Disturbance Footprint was the eastern subspecies (*Malurus coronatus macgillivrayi*), which occurs along most rivers draining into south-western and southern Gulf of Carpentaria from Roper River in Northern Territory to the Leichhardt and Flinders Rivers in Queensland. A natural biogeographic barrier of approximately 300 km of unsuitable habitat separates this subspecies from the western subspecies (*Malurus coronatus coronatus*).

The Purple-crowned Fairy-wren inhabits riparian habitat with dense midstoreys of shrubs or thickets of tall river grass and do not venture far from water.

Livestock grazing, fires, and invasive species are the primary threats for this species.

Potential impacts were determined for this species. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 19: SRI assessment for the Purple-crowned Fairy-wren (*Malurus coronatus*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of an important population of the species. There were no individuals observed during the last 10 years of surveys. There is a record of a single individual within 50 km of the Disturbance Footprint. There is no population within the Disturbance Footprint, and no densely vegetated riparian habitat is present that could facilitate one. Due to the size of the Disturbance Footprint, and absence of a population or suitable habitat, the Project is unlikely to lead to a decrease in a local population.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the area of occupancy of an important population. There were no individuals observed during the last 10 years of surveys. There is a record of a single individual within 50 km of the Disturbance Footprint. There is no population within the Disturbance Footprint, and no densely vegetated riparian habitat is present that could facilitate one. Due to the size of the Disturbance Footprint, and absence of a population or suitable habitat, the Project is unlikely to reduce the extent of occurrence of the species.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. There is a record of a single individual within 50 km of the Disturbance Footprint. There is no population within the Disturbance Footprint, and no densely vegetated riparian habitat is present that could facilitate one. Due to the size of the Disturbance Footprint, and absence of a population or suitable habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to result in genetically distinct populations forming as a result of habitat isolation. There were no individuals observed during the last 10 years of surveys. There is a record of a single individual within 50 km of the Disturbance Footprint. There is no population within the Disturbance Footprint, and no densely vegetated riparian habitat is present that could facilitate one. Due to the size of the Disturbance Footprint, and absence of a population or suitable habitat, the Project is unlikely to result in genetically distinct populations forming as a result of habitat isolation.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European red foxes are recognised threats to this species and have been detected within the Disturbance Footprint. Several species of invasive flora have been detected within the Disturbance Footprint and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species.
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual within 50 km of the Disturbance Footprint, which will not be affected by the Project.

Is there a chance or possibility that an action will?	Response
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere substantially with the recovery of the species. There were no individuals observed during recent surveys. There is a record of a single individual within 50 km of the Disturbance Footprint. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. There is a record of a single individual within 50 km of the Disturbance Footprint. There is no population within the Disturbance Footprint, and no densely vegetated riparian habitat is present that could facilitate one. Due to the size of the Disturbance Footprint, and absence of a population or suitable habitat, the Project is unlikely to disrupt ecologically significant locations.
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** The Project is unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. There is a record of a single individual within 50 km of the Disturbance Footprint. There is no population within the Disturbance Footprint, and no densely vegetated riparian habitat is present that could facilitate one. Due to the size of the Disturbance Footprint, and absence of a population or suitable habitat, the Project is unlikely to lead to a long-term decrease in the size of a local population of the species.

5.3.3. Curlew Sandpiper (*Calidris ferruginea*)

EPBC – Critically endangered, Migratory, Marine. NC ACT – Critically endangered

The Curlew Sandpiper (*Calidris ferruginea*) is a migratory species of wading shorebird. It has a downward curving dark bill and an obvious white eyebrow. The curlew sandpiper migrates in the summer months to the southern hemisphere, including Australia, with some individuals known to occasionally overwinter here. In Australia, the curlew sandpiper is known predominantly from coastal reaches, though it does travel further inland given suitable conditions. It prefers mudflats, wetlands, marshes, and similar wading habitats across its range. They are known to congregate at Lake Moondarra and around Mt Isa City approximately 70 km southwest of the Disturbance Footprint (ALA, 2023).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

The curlew sandpiper has undergone a significant reduction in population recently, leading to it being listed as critically endangered. A population decline of over 80% across Australia in the last three decades (Department of the Environment, 2015). The driving factors for these extensive declines are not entirely known, though habitat degradation both in Australia and elsewhere in the species migration route is considered to be the most significant threat to this species. In particular, large-scale loss of mudflats and other habitats in the Yellow Sea of eastern Asia is of concern with regards to the curlew sandpiper (Department of the Environment, 2015). Habitat degradation significant to the curlew sandpiper may be caused by human development, water course modification, pollution, and invasion of habitats by introduced weeds.

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;
    - WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
    - Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 20: SRI assessment for the Curlew Sandpiper (*Calidris ferruginea*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European red foxes are recognised threats to this species and have been detected within the Disturbance Footprint. Several species of invasive flora have been detected within the Disturbance Footprint and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species.

Is there a chance or possibility that an action will?	Response
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the absence of suitable habitats within the Disturbance Footprint, the Project is unlikely to result in a disruption of ecologically significant locations.

5.3.4. Great Knot (Calidris tenuirostris)

EPBC – Critically Endangered, Migratory, Marine. NC ACT – Critically Endangered

The Great Knot (*Calidris tenuirostris*) is the largest of its genus. It has a black, very slightly down-curved bill with a green tinge on the tip, brown eyes, and dark greenish-grey legs and feet (Higgins & Davies, 1996). The Great Knot breeds in north-east Siberia. During the non-breeding season, most of the Great Knot population migrates to Australia to avoid the northern hemisphere winter. Large numbers arrive to the north-west of Australia between late August and September, most birds remain at or close to their arrival destinations throughout the non-breeding season (Lane, 1987). The Great Knot has been recorded around the entirety of the Australian coast, with a few scattered records inland (Garnett, Szabo, & Dutson, The Action Plan for Australian Birds 2010, 2011). In Australia, the species is associated with sheltered coastal habitats with large intertidal mudflats, including inlets, bays, harbors, estuaries, and lagoons. They rarely occur on inland lakes (Higgins & Davies, 1996). There is a single record in the vicinity of the Disturbance Footprint, at Lake Moondarra (ALA, 2023).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

The greatest threat facing waders, including the Great Knot, is habitat loss. Staging areas such as mudflats are being reclaimed for future development. Indirectly, habitat is being degraded by oil exploration, water regulation and diversion infrastructure and rises in sea level as a result of climate change (Barter M, 2002).

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;
    - WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
    - Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 21: SRI assessment for the Great Knot (*Calidris tenuirostris*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European red foxes are recognised threats to this species and have been detected on site. Several species of invasive flora have been detected on site and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species.

Is there a chance or possibility that an action will?	Response
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the site. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the absence of suitable habitats within the Disturbance Footprint, the Project is not likely to be disruption to any ecologically significant locations.

5.3.5. Greater Sand Plover (Charadrius leschenaultii)

EPBC – Vulnerable, Migratory, Marine. NC Act – Vulnerable

The Greater Sand Plover (*Charadrius leschenaultii*) is a medium-sized brown and white plover. The Greater Sand Plover breeds in central Asia and spend the non-breeding season in coastal Australia as well as on some islands in the south-western Pacific Ocean. In Australia, the Greater Sand Plover occurs in coastal areas in all states, though the greatest numbers occur in the north and especially the north-west (Marchant & Higgins, 1993). They arrive in northern Australia in late July. In Australia, they mainly occur on sheltered sandy, shelly, or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons. From October to December, some birds will disperse from the north to sites around the coast of Australia. The scarcity of inland records within Australia suggests that movements to southern and eastern areas occur around the coastline rather than across the continent (Bamford, 1988) (Blakers, Davies, & Reilly, 1984) (Lane, 1987) (Sibson, 1948) (Stewart, Rogers, & Rogers, 2007). There is a single record in the vicinity of the Disturbance Footprint, at Lake Moondarra (ALA, 2023). In March they begin to congregate in northern Australia before departing for Asia by late April (Barter M. , 2002) (Lane, 1987) (Marchant & Higgins, 1993).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

In Australia there are several threats common to most migratory shorebirds, including this species, such as habitat loss due to land clearing, inundation, infilling or draining; disturbance from residential and recreational activities including boating, noise, and night lighting; and direct mortality as a result of human activities around migration pathways and at foraging and roosting sites (DEWHA, 2009).

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;
    - WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and

- Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 22: SRI assessment for the Greater Sand Plover (*Charadrius leschenaultii*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, The Project is unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European red foxes are recognised threats to this species and have been detected within the Disturbance Footprint. Several species of invasive flora have been detected within the Disturbance Footprint and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species.

Is there a chance or possibility that an action will?	Response
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the site and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. There is a single record ~60 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the absence of suitable habitats within the Disturbance Footprint, the Project is unlikely to cause a disruption to any ecologically significant locations.

5.3.6.Red Knot (Calidris canutus)

EPBC – Endangered, Migratory, Marine. NC Act – Endangered

The Red Knot (*Calidris canutus*) is a robust small to medium-sized wader with a short neck and a short straight bill, short legs, and long wings that extend beyond the tail. The species breeds in the Arctic and migrates to non-breeding areas that extend to south America, Africa, and Australasia (del Hoyo, Elliott, & Sargatal, 1996). They arrive on the north coast of Australia from late August, feed, and gain weight before moving east in November to the Gulf of Carpentaria. Some birds continue flying east and then south to south-eastern Australia or New Zealand, the majority remain in northern Australia (Barter M. , 1992). In Australia, Red Knots mainly inhabit intertidal mudflats, sandflats, and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbors. They rarely use inland lakes or swamps (Higgins & Davies, 1996). New Zealand and south-east Australian birds depart to return north from February to April and might move through the Gulf of Carpentaria, or overland as suggested by inland records. However, there are no records in the vicinity of the Disturbance Footprint (ALA, 2023). Birds in the north depart in late March to April (Higgins & Davies, 1996) (Barter M. , 2002).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

The greatest threat facing migratory shorebirds, including the Red Knot, is habitat loss. Staging areas such as mudflats are being reclaimed for future development. Indirectly, habitat is being degraded by oil exploration, water regulation and diversion infrastructure and rises in sea level as a result of climate change (Barter M. , 2002). Other significant threats include disturbance from residential and recreational activities including boating, noise, and night lighting; and direct mortality as a result of human activities around migration pathways and at foraging and roosting sites, such as the construction of Wind Farms in migration or movement pathways (DEWHA, 2009).

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;

- WTG creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
- Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 23: SRI assessment for the Red Knot (*Calidris canutus*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, works within the site are unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European red foxes are recognised threats to this species and have been detected within the Disturbance Footprint.

Is there a chance or possibility that an action will?	Response
	Several species of invasive flora have been detected on site and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species.
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the absence of suitable habitats within the Disturbance Footprint, the Project is unlikely to cause a disruption to any ecologically significant locations.

5.3.7. Lesser Sand Plover (*Charadrius mongolus*)

EPBC – Endangered, Migratory, Marine. NC ACT – Endangered.

The Lesser Sand Plover (*Charadrius mongolus*) is a small to medium-sized grey-brown and white plover with a dark eye stripe. Two Lesser Sand Plover subspecies migrate to Australia for the boreal winter; *Charadrius mongolus mongolus,* which breeds in Siberia and Mongolia, and *Charadrius mongolus stegmanni,* which breeds in Russia (Marchant & Higgins, 1993). Birds arrive in Australia between August and October and move along the northern and eastern coasts until November (Alcorn, Alcorn, & Fleming, 1994) (Marchant & Higgins, 1993) (Starks & Lane, 1987). In Australia, this species is present in coastal regions in all states but are most common in northern and eastern Australia. They are associated with large intertidal sandflats or mudflats in sheltered bays, harbors and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. They are rarely recorded inland; however, they have been recorded at margins of lakes and soaks and swamps associated with artesian bores (Marchant & Higgins, 1993). Within the vicinity of the Disturbance Footprint, there are three records around Mt Isa City (ALA, 2023). Most birds depart Australia for their northern breeding grounds by April and June (White & Bruce, 1986).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

The greatest threat facing migratory shorebirds, including the Grey-tailed Tattler, is habitat loss. Staging areas such as mudflats are being reclaimed for future development. Indirectly, habitat is being degraded by oil exploration, water regulation and diversion infrastructure and rises in sea level as a result of climate change (Barter M. , 2002). Other significant threats include disturbance from residential and recreational activities including boating, noise, and night lighting, which can drain the birds' energy reserve required for successful migration north; and direct mortality as a result of human activities around migration pathways and at foraging and roosting sites (DEWHA, 2009).

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;

- WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
- Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 24. SRI assessment for the Lesser Sand Plover (*Charadrius mongolus*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. There are records ~90 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. There are records ~90 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. There are records ~90 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. There are records ~90 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.

Is there a chance or possibility that an action will?	Response
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European red foxes are recognised threats to this species and have been detected within the Disturbance Footprint. Several species of invasive flora have been detected within the Disturbance Footprint and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species.
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. There are records ~90 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. There are records ~90 km southeast of the Disturbance Footprint. There is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the absence of suitable habitats within the Disturbance Footprint, there is not likely to be disruption to any ecologically significant locations as a result of the Project.

5.3.8. Ruddy Turnstone (*Arenaria interpres*)

EPBC – Vulnerable, Migratory, Marine. NC Act – Vulnerable.

The Ruddy Turnstone (*Arenaria interpres*) is a stocky medium-sized wader with a short, wedge-shaped bill, and distinctive black or dark brown chest with pale patches extending from the back of the neck. It has a very distinctive white flight pattern with a stripe of white up the center of the back, along the base of the flight feathers and along the top of the wing. Ruddy Turnstones breed in coastal Europe, Asia, and North America. Their non-breeding distribution is almost cosmopolitan, they are common throughout Australasia and are widespread in Australia (Higgins & Davies, 1996). The majority of birds arrive in northern and western Australia in August and disperse around the country through October. In Australia, they are found in most coastal regions with exposed rock coastlines or coral reefs, with occasional records of inland populations in habitats such as riverbeds, and on inland lakes and adjacent farmland (Higgins & Davies, 1996). In the vicinity of the Disturbance Footprint, there are several records at Lake Moondarra (ALA, 2023). Birds depart from Australia from March to April and often don't stop in northern Australia but continue to South-East Asia (Higgins & Davies, 1996).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

The greatest threat facing migratory shorebirds, including the Ruddy Turnstone, is habitat loss. Staging areas such as mudflats are being reclaimed for future development. Indirectly, habitat is being degraded by oil exploration, water regulation and diversion infrastructure and rises in sea level as a result of climate change (Barter M. , 2002). Other significant threats include disturbance from residential and recreational activities including boating, noise, and night lighting; and direct mortality as a result of human activities around migration pathways and at foraging and roosting sites, such as the construction of wind farms in migration or movement pathways (DEWHA, 2009).

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;

- WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
- Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 25: SRI assessment for the Ruddy Turnstone (*Arenaria interpres*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population by works in the site as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the site and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species.

Is there a chance or possibility that an action will?	Response
vulnerable species becoming established in the vulnerable species' habitat; or	Feral cats and European red foxes are recognised threats to this species and have been detected within the Disturbance Footprint. Several species of invasive flora have been detected within the Disturbance Footprint and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species.
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, this will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the absence of suitable habitats within the Disturbance Footprint, there is not likely to be disruption to any ecologically significant locations as a result of the Project.

5.3.9.Terek Sandpiper (*Xenus cinereus*)

EPBC – Vulnerable, Migratory, Marine. NC Act – Vulnerable.

The Terek Sandpiper (*Xenus cinereus*) is a small migratory wader that is a pale brownish-grey, and has fine dark streaking on the upper body, head, and sides of the breast. They have orange-yellow feet, brown eyes, and black bill which is evenly upcurved (Geering A, 2007) (Hayman, Marchant, & Prater, 1986). Terek Sandpipers breed in the northern hemisphere, specifically Russia, Ukraine, Finland, and northern Estonia. They migrate south for the boreal winter, occurring in coastal Africa, throughout southern Asia from the Persian Gulf east to Japan, Indomalaya and Indochina, New Guinea, Australia, and New Zealand (Marchant & Higgins, 1993). The global population is estimated at 187,000, with approximately 60,000 using the East Asian-Australasian Flyway and 23,000 spending the non-breeding season in Australia (Geering A, 2007). Birds arrive in Cairns and Darwin in August and north-western Australia in September. In Australia, Tereks Sandpipers are associated with coastal areas and prefer mangroves for roosting and soft wet intertidal mudflats or sheltered estuaries, embayments, harbors or lagoons for foraging (Marchant & Higgins, 1993). Most individuals remain on Australia's north coast; however, some travel south along the eastern coast and inland records suggest there is some overland migration (Blakers, Davies, & Reilly, 1984). There is a single record approximately 70 km southwest of the Disturbance Footprint at Lake Moondarra (ALA, 2023). Terek Sandpipers in New Zealand and Australia congregate in north-western Western Australia before departing in late April.

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

The greatest threat facing migratory shorebirds, including Terek Sandpipers, is habitat loss. Staging areas such as mudflats are being reclaimed for future development. Indirectly, habitat is being degraded by oil exploration, water regulation and diversion infrastructure and rises in sea level as a result of climate change (Barter M. , 2002). Other significant threats include disturbance from residential and recreational activities including boating, noise, and night lighting; and direct mortality as a result of human activities around migration pathways and at foraging and roosting sites (DEWHA, 2009).

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:

- Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;
- WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
- Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 26: SRI assessment for the Terek Sandpiper (*Xenus cinereus*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the site and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the small size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.

Is there a chance or possibility that an action will?	Response
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European red foxes are recognised threats to this species and have been detected within the Disturbance Footprint. Several species of invasive flora have been detected within the Disturbance Footprint and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species.
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the absence of suitable habitats within the Disturbance Footprint, there is not likely to be disruption to any ecologically significant locations as a result of the Project.

5.3.10. Latham's Snipe (Gallinago hardwickii)

EPBC – Vulnerable, Migratory, Marine. NC Act – Vulnerable

Latham's Snipe *(Gallinago hardwickii)* is only a medium sized wading bird, though it is the largest wader in Australia. Latham's Snipes are typically found singularly or in small, loose groups of less than a dozen birds (Higgins & Davies, 1996). They are a non-breeding visitor to Australia. They arrive from overseas breeding sites to northern Australia and move slowly down to south-eastern Australia, over coastal and near coastal areas, where they spend the non-breeding season. They typically inhabit soft wet ground, or shallow waters with green or dead growth, sometimes tussocks, including wet parts of paddocks, dam seepage, irrigation, mangrove fringes, saltmarshes (Pizzey & Knight, The Field Guide to the Birds of Australia, 2012). In the vicinity of the Disturbance Footprint, they are known to occur at Lake Moondarra and there are scattered records in and around Mt Isa (~70 km from site) and at Chinaman Dam in Cloncurry (~62 km from site) (ALA, 2023).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

Threats include habitat loss caused by the drainage and modification of wetlands (Naarding, 1984).

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;
    - WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
    - Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 27: SRI assessment for the Latham's Snipe (*Gallinago hardwickii*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the site and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the small size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European Red Foxes are recognised threats to several similar species and have been detected within the Disturbance Footprint. Several species of invasive flora have been detected within the Disturbance Footprint and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species. There is not likely to be an introduction and establishment of a harmful invasive species in the habitat of the species as a result of the Project.

Is there a chance or possibility that an action will?	Response
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the absence of suitable habitats within the Disturbance Footprint, there is not likely to be disruption to any ecologically significant locations as a result of the Project.

5.3.11. Common Greenshank/ Greenshank (*Tringa nebularia*)

EPBC – Endangered, Migratory, Marine. NC Act – Endangered

The Common Greenshank (*Tringa nebularia*) is a heavily built wading bird with a long bill that is slightly upturned. This species is seen both singly and in large flocks in coastal and inland wetlands. It does not breed within Australia but does occur in all types of wetlands and has the widest distribution of any shorebird (Higgins & Davies, 1996). Long distance flight within and across Australia is generally limited to arrival from or departure to overseas breeding sites. Typical habitat includes large mudflats and saltmarsh, mangroves, or seagrass. They can also utilize permanent and ephemeral terrestrial wetlands including swamps, lakes, dams, rivers, creeks, and billabongs as well as artificial wetlands. In the vicinity of the Disturbance Footprint, they are known to congregate at Lake Moondarra, Corella Dam and around Mt Isa City; additionally, there are records at Chinaman Dam and around Cloncurry (ALA, 2023).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

Threats include loss and modification of habitat and silt pollution, weeds, and pest invasion (AGDEH, 2005).

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;
    - WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
    - Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 28: SRI assessment for the Common Greenshank (*Tringa nebularia*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the site and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the small size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European red foxes are recognised threats to several similar species and have been detected within the Disturbance Footprint. Several species of invasive flora have been detected within the Disturbance Footprint and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species. There is not likely to be an introduction and establishment of a harmful invasive species within habitat for the species as a result of the Project

Is there a chance or possibility that an action will?	Response
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the absence of suitable habitats within the Disturbance Footprint, there is not likely to be disruption to any ecologically significant locations as a result of the Project.

5.3.12. Sharp-tailed Sandpiper *(Calidris acuminata)*

EPBC – Vulnerable, Migratory, Marine. NC Act – Vulnerable

The sharp-tailed Sandpiper (*Calidris acuminata*) is a small-medium wader that spends the non-breeding season in Australia. The Australian population migrates mostly to the south-east and is widespread both inland and in coastal locations. Most records in Queensland are along the coast with scattered records inland, particularly in central and south-western regions (Higgins & Davies, 1996). Many of the inland records are birds on passage. In the vicinity of the Disturbance Footprint, they are known to congregate at Lake Moondarra and there are abundant records in and around Mt Isa City, as well as at Rifle Creek Dam, Corella Dam, and Chinaman Dam (ALA, 2023). The species typically inhabits tidal mudflats, saltmarshes, mangroves, wetlands, floodwater, irrigated agricultural land, ponds. It has a strong association with water (Pizzey & Knight, The Field Guide to the Birds of Australia, 2012).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

Threats to this species within Australia are mostly from habitat degradation due to water pollution, invasion of mudflat weeds, changes to the hydrological regime and exposure to acid sulphate soils (Department of the Environment, Water, Heritage and the Arts, 2009).

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;
    - WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
    - Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 29: SRI assessment for the Sharp-tailed Sandpiper (*Calidris acuminata*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the site and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the small size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European Red Foxes are recognised threats to several similar species and have been detected within the Disturbance Footprint. Several species of invasive flora have been detected within the Disturbance Footprint and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species. There is not likely to be an introduction and establishment of a harmful invasive species in the habitat of the species as result of the Project.

Is there a chance or possibility that an action will?	Response
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the absence of suitable habitats within the Disturbance Footprint, there is not likely to be disruption to any ecologically significant locations as a result of the Project.

5.3.13. Black-tailed Godwit (*Limosa limosa*)

EPBC – Migratory, Marine. NC Act – Endangered

The Black-tailed Godwit (*Limosa limosa*) is a large, long legged wading shorebird with a long, slightly upturned bill that is pink in colour with a black tip. The species breeds in the northern hemisphere from Mongolia to Siberia, migrating to Australia in September before leaving again in May. It utilises a wide range of habitats, both coastal and inland, including estuaries, beaches, mudflats, swamps, and larger inland water bodies (Pizzey & Knight, The Field Guide to the Birds of Australia, 2012). Scattered records in inland areas suggests the species uses inland waterways during passage. Most birds that arrive in Australia after migrating from the breeding grounds in the northern hemisphere stay in the north of Australia. The few that travel south may cross the continent, often through the Mt Isa region (DCCEEW, 2023). In the vicinity of the Disturbance Footprint, they are known to congregate at Lake Moondarra, and there are records at Rifle Creek Dam, and to the northeast of Cloncurry near Taldora (ALA, 2023).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

This species may be susceptible to a range of threats, though habitat degradation is considered to be the most significant. This is particularly evident at staging areas in the east Asian region, where large scale loss of mudflats is implicated in the declines of many migratory shorebirds. Direct mortality as a result of human activities, such as the construction of Wind Farms in migration or movement pathways, is also a recognised threat to this species (DCCEEW, 2023).

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;
    - WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
    - Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 30: SRI assessment for the Black-tailed Godwit (*Limosa limosa*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the site and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the small size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European red foxes are recognised threats to several similar species and have been detected within the Disturbance Footprint. Several species of invasive flora have been detected within the Disturbance Footprint and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species. There is not likely to be an introduction and establishment of a harmful invasive species within habitat for the species as a result of the Project.

Is there a chance or possibility that an action will?	Response
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to disrupt ecologically significant locations. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the absence of suitable habitats within the Disturbance Footprint, there is not likely to be disruption to any ecologically significant locations as a result of the Project.

5.3.14. Bar-tailed Godwit (*Limosa lapponica*)

EPBC – Migratory, Marine. NC Act – Endangered

The Bar-tailed Godwit (*Limosa lapponica*) is a large wader with a long neck and very long upturned bill. They are slightly larger and stockier than the Black-tailed Godwit, with a shorter neck and legs and a more upturned and pointier bill. They are distinguishable from other Godwits by the dark barring on the lower white rump, uppertail, and lining of the underwing. They have been recorded in the coastal areas of all Australian states. The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbors, coastal lagoons, and bays. It is rarely found on inland wetlands (Marchant & Higgins, 1993). However, in the vicinity of the Disturbance Footprint, they are known to occur at Lake Moondarra (ALA, 2023). The Bar-tailed Godwit breeds in the Northern hemisphere and moves south for the Northern hemisphere winter. The subspecies *Limosa lapponica baueri* and *Limosa lapponica menzbieri* are migrants to Australia. They arrive in northern Australia in August. The majority move to the east coast and travel down to south-east Australia, which they reach by September, however some remain on the north coast. Inland records suggest there is some passage overland from October-December. Generally, numbers slowly decline between February and April as birds leave to return to breeding sites in the northern hemisphere (Marchant & Higgins, 1993).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

In Australia there are several threats common to most migratory shorebirds, including this species, such as Habitat loss due to land clearing, inundation, infilling or draining; disturbance from residential and recreational activities including boating, noise and night lighting; and direct mortality as a result of human activities around migration pathways and at foraging and roosting sites, such as the construction of Wind Farms in migration or movement pathways (DEWHA, 2009).

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;

- WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and
- Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 31: SRI assessment for the Bar-tailed Godwit (*Limosa lapponica*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the site and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the small size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a vulnerable species becoming established	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European red foxes are recognised threats to several similar species and have been detected within the Disturbance Footprint.

in the vulnerable species' habitat; or	Several species of invasive flora have been detected within the Disturbance Footprint and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species. There is not likely to be an introduction and establishment of a harmful invasive species within habitat for the species as a result of the Project.
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species. No information regarding flight heights is available for this species. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint, these do not represent an ecologically significant proportion of the population. Therefore it is unlikely works associated with the Project will Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species

5.3.15. Grey Plover (*Pluvialis squatarola*)

EPBC – Vulnerable, Migratory, Marine. NC Act – Vulnerable.

The Grey Plover (*Pluvialis squatarola*) is a medium-sized plover with long legs and a short, stout bill. Grey Plovers breed in the far northern hemisphere and spend the non-breeding season on the coasts of America, southern Europe, Africa, southern Asia, and Australia (Cramp & Simmons, 1983) (de Schauensee, 1970) (de Schauensee, The Birds of China, 1984) (Grimmett, Inskipp, & Inskipp, 1999b) (Orn. Soc. Japan, 2000) (Urban, Fry, & Keith, 1986) (Wiersma, 1996). Birds arrive in northern Australia in August and September, many then move further south in October (Lane, 1987) (Marchant & Higgins, 1993). Some of these southerly movements are overland. In Australia, Grey Plovers occur almost entirely in coastal areas, inhabiting sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons (Marchant & Higgins, 1993). Birds begin to move northward in March (Amiet 1957; Lane 1987). There is a single record in the vicinity of the Disturbance Footprint, at Lake Moondarra (ALA, 2023).

There is no suitable habitat for the species within the Disturbance Footprint as defined in the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). However, as there is the potential for the species to transit through the site to reach suitable habitat elsewhere, a SRI assessment was undertaken for this species' habitat under the *Significant Residual Impact Guideline for matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (DSDIP, 2014). The impact assessment relies on an understanding of flight height which varies depending on the phase of flight however, no information regarding flight heights is available for this species.

The greatest threat facing waders, including the Grey Plover, is habitat loss. Staging areas such as mudflats are being reclaimed for future development. Indirectly, habitat is being degraded by oil exploration, water regulation and diversion infrastructure and rises in sea level as a result of climate change (Barter M. , 2002). Additionally, disturbance of birds at roosting and feeding sites as a result of human recreation is also a significant threat.

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
- Temporary:
    - Collisions between the species and wind turbine rotor blades or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;
    - WTGs creating displacement and barrier effects resulting in greater energetic cost to fauna flying through the area; and

- Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 32: SRI assessment for the Grey Plover (*Pluvialis squatarola*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a local population of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on a local population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. There is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the site and connectivity of the surrounding habitat, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to isolate a population to the point that genetically distinct populations form. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the small size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to isolate a population to the point that genetically distinct populations form.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European Red Foxes are recognised threats to several similar species and have been detected within the Disturbance Footprint. Several species of invasive flora have been detected and have the potential to modify the species' habitat.

Is there a chance or possibility that an action will?	Response
	The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species. There is not likely to be an introduction and establishment of a harmful invasive species in the habitat of the species as a result of the Project.
Introduce disease that may cause the species to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. There are currently no known diseases that may cause the species to decline. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There were no individuals observed during recent surveys. There is a record of a single individual ~40 km southwest of the Disturbance Footprint, which will not be affected by the Project.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There were no individuals observed during the last 10 years of surveys. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint there is no local population, and not likely to be due to lack of suitable habitat. Any waterholes within the Disturbance Footprint are ephemeral, fed by streams flowing from the ridgeline, are small and surrounded by rocks, and therefore unsuitable habitat for the species. Any individuals that may occur within the Disturbance Footprint will be transient. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Unlikely:** Project works are unlikely to Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species. No information regarding flight heights is available for this species. Whilst there are several records and mapped flightpaths within the vicinity of the Disturbance Footprint, these do not represent an ecologically significant proportion of the population. Therefore, it is unlikely that works associated with the Project will Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species

5.4. Known Terrestrial Fauna: Protected Wildlife Habitat

5.4.1. Purple-necked Rock-wallaby (*Petrogale purpureicollis*)

EPBC – Not listed. NC Act - Vulnerable

The PNRW is a comparatively small wallaby species. Their weight ranges from 4.7 to 7.0 kg, their head-body length ranges from 500 – 610 mm, and their tail length ranges from 450 – 600 mm (Menkhorst & Knight, A Field Guide to the Mammals of Australia, 2011). Their body is light brown, with a paler underside and a characteristic purple-mauve colouration over the neck, face, head, and sometimes upper chest and shoulders. They have a dark brown stripe extending from the eyes to between the ears along the midline of the top of the head (Menkhorst & Knight, 2011). The PNRW favours habitat which includes boulder piles, rocky slopes, cliffs and gorges in limestone areas, and sandstone and quartzite outcrops amongst dry Eucalyptus and Acacia woodlands. It also inhabits spinifex grasslands in association with the rocky areas (Rowland, 2012). They are largely nocturnal in summer, crepuscular or partially diurnal in other months. The PNRW shelters during the day among rocks or within boulder piles. In cooler months, they tend to sit in regular sites on rocks to bask in the sun in early morning and sometimes in afternoon. They move off the rocks in late afternoon or evening to feed in surrounding woodland (Mittermeier & Wilson, 2015). They are known to occur in the vicinity of the Disturbance Footprint due to the presence of nearby records, and hummock grassland and mulga, which are preferable to the species (Menkhorst & Knight, 2011).

No known denning locations, and very little modelled potential denning habitat occurs within the Disturbance Footprint. This is because the Disturbance Footprint is located almost entirely within the flat habitat present on the top of the range, whereas the denning habitat is limited to the sloped areas that skirt the range or along drainage lines and gullies. The total area of PNRW habitat (modelled as per the methodology in Section 2.3) impacted by the proposed Disturbance Footprint amounts to 2.37 ha of modelled potential denning habitat and 133.25 ha of modelled potential foraging/dispersal habitat. This amounts to approximately 0.7 % of the available 299.22 ha of modelled potential denning habitat and 1.8 % of the available 7124.15 ha of modelled potential foraging/dispersal habitat on and adjacent to the Knapdale Range.

Specific potential impacts on this species from the Project are:

- Permanent:
    - The introduction and/or spread of invasive fauna such as feral cats that may predate on the species.
    - Destruction of potential foraging/dispersal habitat.
- Temporary:
    - Noise pollution, pressure, and vibrations from the operation of the WTGs disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.

Table 33. SRI assessment for the Purple-necked Rock-wallaby (*Petrogale purpureicollis*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Possible:** Project works in the Disturbance Footprint have the potential to lead to a long-term decrease in the size of a local population of the species. There are 611 records of the PNRW on the DRM site over 12 years. There are multiple confirmed and multiple speculated dens around the mine site, including several along the Knapdale Range near the Disturbance Footprint. The Knapdale Range occupies an area of approximately 6,000 ha of which only 136.8 ha is proposed as total disturbance. No known denning locations, and very little modelled potential denning habitat occurs within the Disturbance Footprint. This is because the Disturbance Footprint is located almost entirely within the flat habitat present on the top of the range, whereas the denning habitat is limited to the sloped areas that skirt the range or along drainage lines and gullies. Due to the possibility of disrupting denning habitat, the Project is deemed to have the potential to reduce the size of the population of the species across the Knapdale Range.
Reduce the extent of occurrence of the species; or	**Possible:** Project works in the Disturbance Footprint have the potential to reduce the extent of occurrence of the species. There are 611 records of the PNRW on the DRM over 12 years. There are multiple confirmed and multiple speculated dens around the mine site, including several along the Knapdale Range near the Disturbance Footprint. The Knapdale Range occupies an area of approximately 6,000 ha of which only 136.8 ha is proposed as total disturbance (both permanent and temporary). Due to the possibility of the disrupting denning habitat, the Project is deemed to have the potential to reduce the extent of occurrence of the species across the Knapdale Range.
Fragment an existing population; or	**Unlikely:** Project works in the Disturbance Footprint are unlikely to fragment an existing important population. There are 611 records of this species on the DRM over 12 years. There are multiple confirmed and multiple speculated dens around the DRM, including several along the Knapdale Range within the Disturbance Footprint. The small subpopulations in the denning habitat areas confirmed along the Knapdale Range can be collectively considered as a single population. Temporary disturbance to a subpopulation associated with the clearance and construction phase of the Project is unlikely to significantly impact the population as a whole. The majority of the Disturbance Footprint is located centrally on the Knapdale Range meaning the primary habitat has largely been avoided and remains intact along the gullies and slopes that skirt the edges of the range. The linear impacts may be as wide as 7 m in sections, and therefore they are unlikely to restrict movement of the PNRW across the landscape once construction has been completed as this distance is unlikely to impede movement and traffic will be limited to maintenance activities with speed limits imposed. The edges of the larger tracks will be maintained with a low vegetation cover allowing for greater refuge and reducing the overall width unsheltered roads. The PNRW is likely to traverse the area using existing drainage lines and rocky features in the landscape which remain relatively unimpacted. The drainage lines over which the tracks will be constructed will include the installation of culverts. Culverts may vary in size depending on the size of the drainage feature though, owing to the specifications required to support the weight of large machinery and equipment, will be sufficient in height below to allow for the PNRW and other fauna to traverse beneath the road. Due to the relatively low ground disturbance associated with the Project, the size of the Disturbance Footprint, the connectivity of the surrounding habitat,

Is there a chance or possibility that an action will?	Response
	the factors discussed above, and the small range of the PNRW, the Project is unlikely to fragment any existing populations.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to result in genetically distinct populations forming as a result of habitat isolation. There are 611 records of this species on the DRM site over 12 years. There are multiple confirmed and multiple speculated dens around the DRM, including several along the Knapdale Range near the Disturbance Footprint. The small subpopulations in the denning habitat areas confirmed along the Knapdale Range can be collectively considered as a single population. Temporary disturbance to a subpopulation associated with the clearance and construction phase of the Project is unlikely to significantly impact the population as a whole. Due to the relatively low ground disturbance associated with the Project, the size of the Disturbance Footprint, the connectivity of the surrounding habitat, and the small range of rock-wallabies, the Project is unlikely to isolate any existing populations.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Feral cats and European Red Foxes are recognised threats to several similar species and have been detected on the DRM. Several species of invasive flora have been detected on the DRM and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species. Weed and seed and pest management processes are well established for the DRM and will be implemented for the Project. There is not likely to be an introduction and establishment of a harmful invasive species in the habitat of the species as result of the Project.
Introduce disease that may cause the population to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the Disturbance Footprint. Hydatid disease (*Echinococcus granulosus*) and Toxoplasmosis (*Toxoplasmosis gondii*) are both recognised diseases that have the potential to threaten rock-wallaby populations. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present. There is not likely to be an introduction of a novel diseases to the rock-wallaby population within or adjacent to the Disturbance Footprint as result of the Project.
Interfere with the recovery of the species; or	**Possible:** Project works in the site have the potential to interfere with the recovery of the species. There are 611 records of this species on the site over 12 years. There are multiple confirmed and multiple speculated dens around the DRM, including several along the Knapdale Range near the Disturbance Footprint. Due to the possibility of the Project to disrupt denning, the Project is deemed to have the potential to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Possible:** Project works have the potential to disrupt denning sites. There are 611 records of this species on the DRM over 12 years. There are multiple confirmed and multiple speculated dens around the site, including several along the Knapdale Range near the Disturbance Footprint. There is unknown potential for these dens to be impacted by both the construction and operation of WTGs in their vicinity through noise and vibrations. Due to the unknown impacts of the Project on denning locations, there is potential for the Project to cause disruption to ecologically significant locations.

5.4.2.Short-beaked Echidna (Tachyglossus aculeatus)

EPBC – Not listed. NC Act – Special Least Concern

The Short-beaked Echidna (*Tachyglossus aculeatus*) is one of Australia's five monotreme species. It is highly specialised and feeds exclusively on ants and termites with an elongated, protrusible tongue. It is Australia's most widely distributed mammal, inhabiting almost every terrestrial environment on the continent (Menkhorst & Knight, A Field Guide to the Mammals of Australia, 2011). They rely on fallen logs, tree stumps and understory vegetation for cover.

Threats to echidnas include predation by feral carnivores such as domestic dogs, foxes, and feral cats, as well as habitat loss.

Table 34: SRI assessment for the Short-beaked Echidna (*Tachyglossus aculeatus*)

Is there a chance or possibility that an action will result in?	Response
A long-term decrease in the size of a local population; or	**Unlikely:** Project works are unlikely to cause a long-term decrease in the size of a local population. There are four records within a 50 km radius of the Disturbance Footprint. The species is solitary and has a very wide distribution, therefore it is not likely a local population will be impacted by the Project.
A reduced extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. Due to the wide distribution and range of habitats occupied, it is not likely the extent of occurrence will be impacted by the Project.
Fragmentation of an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There are four records within a 50 km radius of the Disturbance Footprint. Due to the small size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project is very unlikely to fragment any existing populations.
Reduce gene flow among populations; or	**Unlikely:** Project works are unlikely to create habitat isolation. Due to the size of the Disturbance Footprint and connectivity of the surrounding habitat, the Project will not result in habitat isolation and therefore will not result in reduced gene flow.
Disruption to ecologically significant locations (breeding, feeding, or nesting sites) of the species	**Unlikely:** Project works are unlikely to disrupt an ecologically significant location for this species. Due to the wide distribution and range of habitats occupied, it is not likely any significant locations will be impacted by the Project.

5.4.3. Merten's Water Monitor (*Varanus mertensi*)

EPBC – Endangered. NC Act – Endangered

Merten's Water Monitor (MWM) (*Varanus mertensi*) is a moderately large semi-aquatic monitor. It has a broad distribution that encompasses coastal and inland waters across far north Australia from the Kimberley to Cape York. Merten's Water Monitor seldom ventures more than 5–10 m from the edge of the water except when transiting among core aquatic activity areas (Mayes P. , 2006). This species is often seen basking on branches overhanging water or on rocks in the middle of streams in the following areas:

- Perennial and semi-permanent pools in upper catchment areas, including springs, seeps, swamps, creeks and gorges;
- The margins of permanent streams, rivers and lakes in lower catchment areas;
- Floodplain billabongs, lagoons, swamps and soaks;
- Perennial waterholes in woodlands; and
- Man-made irrigation channels and the margins of dams.

(Shine, 1986) (Mayes, Thompson, & Withers, 2005) (Smith & Griffiths, 2009) (Wilson & Swan, 2021)

As such, the highly ephemeral stream order 1 and 2 watercourses within the Disturbance Footprint are not suitable for this species. The species has been recorded in the Dugald River, which is over two km from the Disturbance Footprint. To date this species has not been recorded within MMG's Dugald River mining lease and no suitable habitat for it has been identified, despite extensive ecological surveys (detailed in Section 2.2).

The primary threat to this species is toxicity from ingesting cane toads (*Rhinella marina*). MWM can easily consume a cane toad large enough to result in death of the monitor (Smith & Phillips, 2006). The feral pig (*Sus scrofa*) can predate on water monitor eggs, and cause significant damage to wetlands, including increased turbidity and prolonged anoxia which may reduce the availability and accessibility of aquatic prey for the water monitor monitor (Woinarski & Winderlich, 2014) (Doupe, Schaffer, Knott, & Dicky, 2012).. Trampling by cattle (*Bos taurus, B. indicus*) and Asian water buffalo (*Bubalus bubalis*) silts water bodies, removes vegetation and damages earthen banks (Mihailou & Massaro, 2021), all of which are used by MWM for nesting, basking and feeding. The MWM's ground-water dependant ecosystems (GDEs) are susceptible to threats from excessive surface and ground-water extraction, which can draw down the water table and dry out these GDEs (Younger & Wolkersdorfer, 2004) (Leblanc, Tweed, van Dijk, & Timbal, 2012) (Currell, Werner, McGrath, Webb, & Berkman, 2017). Other threats include direct clearing of habitat for development or mining, frequent severe fires, and direct harvesting as a traditional food source for indigenous people.

The Disturbance Footprint itself contains no habitat which would be considered suitable habitat, and it is unlikely that the species would use this area for dispersal. This species has been included in the assessment primarily to assess whether they would be indirectly affected by the Project, as their habitat is located downstream of the Disturbance Footprint.

The above threats were examined in the context of works proposed for this Project, and potential impacts were determined. They have been classified as either permanent or temporary.

Specific potential impacts on this species from the Project works proposed are:

- Permanent:
    - Introduction and/or spread of invasive fauna such as cane toads that threaten the Merten's Water Monitor directly, or feral pigs and cattle that threaten the structure and quality of the Merten's Water Monitor's habitat.
- Temporary:
    - Sedimentation of the watercourse caused by upstream construction.

Table 35: SRI assessment for Merten's Water Monitor (*Varanus mertensi*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a local population of the species; or	**Unlikely:** Project works are unlikely to lead to a long-term decrease in the size of a population of the species. There are two records of this species along Dugald River within the last 12 years. These records are not within the Disturbance Footprint. Due to the low potential for the Project to impact the species' habitat and the connectivity of the surrounding habitat outside of the DRM, there is not likely to be an impact on the population as a result of the Project.
Reduce the extent of occurrence of the species; or	**Unlikely:** Project works are unlikely to reduce the extent of occurrence of the species. There are two records of this species along Dugald River within the last 12 years. Due to the low potential for the Project to impact the species' habitat, and the connectivity of the surrounding habitat outside of the DRM, there is not likely to be an impact on the population as a result of the Project.
Fragment an existing population; or	**Unlikely:** Project works are unlikely to fragment an existing population. There are two records of this species along Dugald River within the last 12 years. These records are not within the Disturbance Footprint. Due to the low potential for the Project to impact the species' habitat, and the connectivity of the surrounding habitat outside of the DRM, there is not likely to be an impact on the population as a result of the Project.
Avoid genetically distinct populations forming as a result of habitat isolation; or	**Unlikely:** Project works are unlikely to form genetically distinct populations as a result of habitat isolation. There are two records of this species along Dugald River within the last 12 years. These records are not within the Disturbance Footprint. Due to the low potential for the Project to impact the species' habitat, and the connectivity of the surrounding habitat outside of the DRM, there is not likely to be an impact on the population as a result of the Project.
Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat; or	**Unlikely:** Project works are unlikely to introduce and/or allow a harmful invasive species to become established in the habitat of the species. Ingestion of cane toads is a recognised threat to this species. Cane toads have been detected within the Project area. Additionally, cattle and feral pigs are recognised threats to the species' habitat. Several species of invasive flora have been detected on site and have the potential to modify the species' habitat. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage any potential invasive species. There is not likely to be an introduction and establishment of a harmful invasive species in the habitat of the species.

Is there a chance or possibility that an action will?	Response
Introduce disease that may cause the population to decline; or	**Unlikely:** Project works are unlikely to introduce novel diseases to the site. There are no recognised diseases that threaten this species. The Project will operate under the *Biosecurity Act 2014* and follow the GBO to identify and manage detrimental diseases or pathogens if present.
Interfere with the recovery of the species; or	**Unlikely:** Project works are unlikely to interfere with the recovery of the species. There are two records of this species along Dugald River within the last 12 years. These records are not within the Disturbance Footprint however, and are from the Dugald River, which is located east of the Project. Due to the low potential for the Project to impact the species' habitat, and the connectivity of the surrounding habitat outside of the Project area, there is not likely to be an impact on the species' recovery as a result of the Project.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	**Unlikely:** Project works are unlikely to cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species. There are two records of this species along Dugald River within the last 12 years. These records are not within the Disturbance Footprint, but are from Dugald River. Similar habitat does not exist within the Disturbance Footprint as the records are associated with Dugald River and only highly ephemeral streams exist in the Disturbance Footprint which is not habitat for the species. Potential downstream impacts to habitats due to sedimentation will be mitigated and monitored in a SWMP (Surface Water Management Plan) and ESCP (Erosion and Sediment Control Plan). Due to the low potential for the Project to impact the species' habitat, and the connectivity of the surrounding habitat outside of the Project area, there is not likely to be an impact on the population's ecologically significant locations as a result of the Project.

6. Preliminary Impact Management Plans

6.1. Design Phase

The Project has implemented environmental design philosophies during development of the Disturbance Footprint and the Disturbance Footprint. Specific controls implemented include:

- Strategic positioning of WTGs on the Knapdale Range to maximise access to the wind resource with fewest possible WTGs;
- Positioning the WTGs on the Knapdale Range to avoid habitat for MSES species where possible; and
- Minimising lighting from WTGs to avoid attraction of aerial fauna.

6.2. Clearing and Construction Phase (also applicable to decommissioning phase)

Table 36: Preliminary Impact Management Plan - Clearing and Construction Phase

Threat	Impact	Controls/Management			
		Avoid	Minimise	Mitigate	Monitor
Introduction and/or spread of weed species due to vehicle and machinery movements across the landscape.	Modification of native habitats.	Where possible, activities must be planned to avoid movement of vehicles or machinery between properties, corridors, or areas with weed infestations. All equipment that enters site must be washed down on each occasion (including vehicles, earthmovers, generators, etc.) in accordance with Weed and Pest Management Plan (WPMP).	General vehicle and machinery hygiene procedures implemented to minimise spreading of seeds.	Implement WPMP. Weed management and control methods will be implemented based on infestation size, location, and species of which it is comprised.	Monitoring and management performed as per WPMP.
Introduction of pest species or increase of their	Competing with, predating on, or otherwise harming native species.	All equipment that enters site must be washed down on each occasion (including vehicles, earthmovers,	Not applicable.	Implement WPMP.	Monitoring and management performed as per WPMP.

Threat	Impact	Controls/Management			
		Avoid	Minimise	Mitigate	Monitor
populations in the Project area.	Facilitating the infection of native species with diseases/parasites.	generators, etc.) in accordance with WPMP.			
	Indirectly modifying the habitat of native species.				
Contaminants and waste (including litter).	Direct harm to native fauna (e.g. ingestion of waste by a native animal).	All waste generated must be stored, handled, and transported in sealed containers. Project area to be kept free of litter.	Not applicable.	Not applicable.	Development of Environmental Management Plans for the construction and operation phases of the Wind Farm.
	Indirect harm to native fauna through degradation of their habitat.	All waste generated must be stored, handled, and transported in sealed containers.	Not applicable.	Green waste produced may be used on site for rehabilitation, sediment, or erosion control.	
Noise and light pollution, and vibrations (particularly during night-time works).	Confusion of birds by light causing increased risk of interactions.	Implement BBMP. Lighting will be shielded so as not to be seen from casual observers (this refers to people but will provide the same cover from passing birds) unless necessary.	Hours and amount of artificial light will be minimised wherever practical.	Not applicable.	Light meters can be used to monitor light pollution and ensure it stays at or below acceptable levels during works.

Threat	Impact	Controls/Management			
		Avoid	Minimise	Mitigate	Monitor
	Disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns	Lights directed away from habitat, or shields used to block light from habitat.	Hours and amount of artificial light and noisy machine operation will be minimised wherever practical to reduce impact on surrounding habitat.		Light meters can be used to monitor light pollution and ensure it stays at or below acceptable levels during works. Development of an Environmental Management Plan for the construction and operation of the Wind Farm.
Construction or clearing activities.	Injury/fatality of fauna.	Implement Construction Environmental Management Plan (CEMP) and permit to clear system. Pre-clearance surveys to be undertaken by qualified fauna spotter/catchers to avoid unintentional tampering of animal breeding places. Clearing will be performed sequentially to direct fauna towards adjacent habitat and away from work sites.	All people driving on site to stay on roads to lower risk of hitting an animal. Vehicle speed limits will be in place to further lower risk.	Fauna spotter/catchers operating under an approved rehabilitation permit to check areas prior to work commencing, and to be present during clearing. Fauna will preferably be allowed to move on their own accord, but if this does not occur and access is required immediately then fauna spotter/catchers operating under an approved rehabilitation permit will relocate them. Injured wildlife can be brought to local wildlife carers: **Western Qld Wildlife Rehabilitation Centres: Cloncurry – 0419 422 900**	Maintaining records of any fauna interactions on site to inform management adjustments as per CEMP.

Threat	Impact	Controls/Management			
		Avoid	Minimise	Mitigate	Monitor
	Destruction of native habitat (specifically important in the case of rocky habitat/sub-habitat due to importance of native fauna species reliant on such habitat).	Where possible, avoid the clearing of areas of rocky habitat due to the importance of native fauna species reliant on such habitat.	Not applicable.	Progressively rehabilitate cleared areas that are no longer required after construction has finished.	Monitor and maintain rehabilitated sites to ensure they are progressing as required (control of weeds, etc.).
	Creating barriers to distribution of native fauna (namely the Purple-necked Rock-wallaby).	Where possible, avoid the creation of barriers within Purple-necked Rock-wallaby habitat.	Fauna ramps implemented along barriers to allow animals to cross.	Not applicable.	Maintaining records of any fauna interactions on site to inform management adjustments.
	Creating barriers damming flow to downstream water holes.	Install culverts in drainage lines to allow continued flow of water.	Not applicable.	Not applicable.	Ensure any works within proximity to waterways are completed in accordance with Accepted Development requirements at the State Level.
	Generating dust that may lead to sedimentation of downstream areas.	Implementation of diversion banks/drains to divert clean runoff waters away from disturbed areas to reduce erosion and the potential for contamination of clean runoff. Implement a SWMP and ESCP.	Minimise the area of disturbance, thus minimising the volume of dirty or contaminated Runoff. Vehicle speed limits will be in place to reduce dust generation. Deploy water carts to reduce dust generation.	Deploy rocking in high erosion risk areas to provide protection against erosive forces acting to mobilise sediment.	Monitoring and management as per SWMP and ESCP.

Threat	Impact	Controls/Management			
		Avoid	**Minimise**	**Mitigate**	**Monitor**
	Creation of exposed areas with high potential for erosion by surface water that may cause sedimentation of downstream areas;		Minimise the area of disturbance, thus minimising the volume of dirty or contaminated Runoff.	Deploy rocking in high erosion risk areas to provide protection against erosive forces acting to mobilise sediment. Vegetation of exposed areas to stabilise soil.	
Active work areas, pits, trenches, and other hazardous disturbed areas.	Injury/fatality of fauna.	Fencing or coverings should be used to restrict access to all fauna.	Fauna ramps implemented in any pits or trenches to allow animals to escape.	Injured wildlife can be brought to local wildlife carers: **Western Qld Wildlife Rehabilitation Centres: Cloncurry – 0419 422 900**	Maintaining records of any fauna injuries/fatalities on site resulting from human activities to inform management adjustments. Open pits and trenches will be checked daily to identify and relocate trapped fauna.

Threat	Impact	Controls/Management			
		Avoid	Minimise	Mitigate	Monitor
Bushfire	Injury/ fatality of fauna and or loss of habitat	No smoking on site (particularly around combustible gas/fluids or dry vegetation which may act as kindling) Ensure combustible items are stored in suitable conditions. Do not park hot vehicles in long grass (particularly during the dry season). All vehicles are to be fitted with 4 L DCP fire extinguishers in accordance with DRM site access protocols. All vehicles must stick to graded roads (i.e., no off-roading) All vehicles and machinery must have adequate shielding for exhaust fumes.	Reduce fuel load in and around construction areas.	Ensure emergency protocols are in place in case of fire. Maintain vigilance, report smoke/ fire if observed. Extinguish if safe to do so.	Any fires within the vicinity of construction/clearing activities is to be reported. Maintain vigilance.

6.3. Operation Phase – Terrestrial Fauna

Table 37: Preliminary Impact Management Plan - Operation Phase - Terrestrial Fauna

Threat	Impact	Controls/Management			
		Avoid	Minimise	Mitigate	Monitor
Noise pollution, and vibrations.	Disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.	Implement Vegetation and Fauna Management Plan (VFMP).	Not applicable.	Not applicable.	Development of Air Quality, Noise and Vibration Management Plan. Develop Purple-necked Rock-wallaby Monitoring Program.
Vehicle movements	Generating dust that may lead to sedimentation of downstream areas	Maintenance of diversion banks/drains to divert clean runoff waters away from disturbed areas to reduce erosion and the potential for contamination of clean runoff.	Vehicle speed limits will be in place to reduce dust generation. Deploy water carts to reduce dust generation.	Deploy rocking in high erosion risk areas to provide protection against erosive forces acting to mobilise sediment.	Development of a SWMP and ESCP.

6.4. Operation Phase – Aerial Fauna

Table 38: Preliminary Impact Management Plan - Operation Phase - Aerial Fauna

Threat	Impact	Controls/Management			
		Avoid	Minimise	Mitigate	Monitor
Wind turbine structures, primarily rotor blades and associated RSA.	Collisions between flying fauna and wind turbine rotors or other structures, or barotrauma as a result of flight close to rotors, resulting in injury or fatality.	Implement Bird and Bat Management Plan (BBMP). Should carrion monitoring detect a trend in fatalities of a significant aerial fauna species, targeted monitoring should be implemented to inform the requirement for adaptive management strategies such as use of the examples below. E.g. Temporary curtailment of turbines during known or observed migration periods and/or aligning the rotor plane parallel to the direction of migration to reduce the profile of the turbine.	Should carrion monitoring detect a trend in fatalities of a significant aerial fauna species, targeted monitoring should be implemented to inform the requirement for adaptive management strategies such as use of the examples below. E.g. Automated curtailment systems have been developed to reduce the risk of collisions. The IdentiFlight® system uses AI to detect, identify, and track the movement of large birds and assess the probability the bird will enter the RSA, which is used to trigger a curtailment. The IdentiFlight® system was shown to result in an 82% reduction in fatality rate between a control site and a treatment site at the Top of the World Windpower Facility in Wyoming, USA (McClure, et al., 2021).	Removal of carrion and carrion from the Project area to reduce scavenge opportunities for raptors. It is assumed that a fauna collision with the turbine will be fatal. However, injured wildlife will be referred to local wildlife carers: **Western Qld Wildlife Rehabilitation Centres: Cloncurry – 0419 422 900**	Maintaining records of any fauna interactions on site, through vigilance, and carcass surveying, to inform management adjustments. Maintaining records of aerial fauna movement through the Project area to inform curtailment. Continuing the BBUS throughout the mining/operational life. All monitoring as per BBMP.

Threat	Impact	Controls/Management			
		Avoid	Minimise	Mitigate	Monitor
			The Robin MAX® radar paired with an automatic turbine shutdown module can achieve the same result, however it lacks the ability to recognise specific bird species. Acoustic or visual deterrents that are activated constantly, periodically, or when triggered by a detection system can also be used to reduce the risk of collisions. The NRG ultrasonic acoustic Bat Deterrent System showed a 50% reduction in bat fatalities between turbines with 5 modules and turbines with none over a two year study in Texas (NRG Systems, 2020). The Scarecrow 180™ is a well-researched bio-acoustic bird dispersal system. When coupled with a Scarecrow 360™ 'slave' unit it creates a system that provides 360^{o} of dispersal. Passive deterrents such as increasing the visibility of the wind turbine tower		

Threat	Impact	Controls/Management			
		Avoid	Minimise	Mitigate	Monitor
			and blades can also reduce the risk of collisions. There is evidence that painting one blade black can reduce the fatality rate by 70% compared to unpainted turbines (May, et al., 2020).		
	Displacement and barriers effects resulting in greater energetic cost to fauna flying through the area.	Should carrion monitoring detect a trend in fatalities of a significant aerial fauna species, targeted monitoring should be implemented to inform the requirement for adaptive management strategies such as use of the examples below. E.g. Temporary curtailment of turbines during known or observed migration periods and/or aligning the rotor blade plane parallel to the direction of migration to reduce the profile of the turbine.	Not applicable.	Not applicable.	Ongoing fauna monitoring location data, as well as radar and cameras, can be used to collect data on avoidance/displacement of the Project area by aerial fauna. Ongoing BBUS.
Noise, pressure, and vibrations from the operation of the WTGs.	Disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal	Implement AQNVMP	Not applicable.	Not applicable.	Development of an Air Quality, Noise and Vibration Management Plan.

Threat	Impact	Controls/Management			
		Avoid	Minimise	Mitigate	Monitor
	distribution patterns.				

7. Conclusion, Commitments, and Recommendations

The Disturbance Footprint has been extensively surveyed by several Suitably Qualified and Experienced personnel represented by multiple organisations over the last 16 years. This is considered to be a robust dataset for the Project and more than sufficient to adequately assess potential impacts.

7.1. Summary of Potential Impacts

The Project will result in a total area of disturbance of 136.8 ha.

Potential ongoing threats posed by the Project, and their associated impacts, are:

- Construction or clearing activities resulting in;
    - Destruction of native habitat (specifically important in the case of rocky habitat/sub-habitat due to importance of native fauna species reliant on such habitat, namely the NC Act listed Vulnerable, PNRW);
    - Creation of exposed areas with high potential for erosion by surface water that may cause sedimentation of downstream areas;
- WTGs, primarily rotor blades and associated RSA, causing;
    - Collisions between flying fauna and WTGs, or other structures, or barotrauma as a result of flight close to rotor blades, resulting in injury or fatality;
    - Displacement and barrier effects resulting in greater energetic cost to fauna flying through the area;
- Noise, pressure, and vibrations from the operation of the WTGs;
    - Potential for disturbing surrounding habitat making it less preferable for native species or conditioning avoidance and affecting normal distribution patterns.
- Generation of dust from vehicle movements over disturbed areas;
    - Potential to cause sedimentation of surface water in downstream areas which has the potential to reduce habitat quality for the NC Act listed Endangered Merten's Water Monitor.

The Significant Residual Impact Assessments concluded that the Project is unlikely to have a significant impact on any additional conservation significant species assessed, except for the PNRW. An SRI is Possible for Regulated Vegetation - Essential Habitat for the PNRW, which is mapped across the Knapdale Range and for Protected Wildlife Habitat for the PNRW. The analysis of SRI for the Protected Wildlife Habitat for the PNRW utilises the habitat spatial analysis to assess the difference between denning and foraging/dispersal habitat. The impacts to Essential Habitat are assessed in section 5.2.2 of this report and for Protected Wildlife Habitat for PNRW in section 5.4.1.

7.2. Commitments

The following management strategies have been committed to in order to monitor the impacts of the Project and inform the implementation and adjustment of control measures:

- **Ongoing Fauna Monitoring and Record-Keeping**: Regular monitoring of fauna and maintenance of records regarding any fauna interactions, achieved through vigilance and carrion surveys.
- **Bird and Bat Management Plan (BBMP)**: A comprehensive BBMP outlining the species that may be impacted by the operation of the wind farm, and detailing how these species will be managed and monitored throughout the operational phase. This plan will be subject to continuous assessment and will be refined based on ongoing monitoring of bird and bat activity.
- **Vegetation and Fauna Management Plan (VFMP)**: A VFMP identifying the non-bird and bat species potentially impacted during the construction, operation, and decommissioning phases of the Project, along with strategies to minimize and mitigate impacts on these species during each phase.
- **Weed and Pest Species Management Plan (WPMP)**: A WPMP that outlines the management of weed and pest species, in accordance with the *Biosecurity Act 2014*, tailored specifically for the proposed wind farm.
- **Preliminary Rehabilitation Plan (PRP)**: The implementation of a Preliminary Rehabilitation Plan (PRP) to support the restoration and rehabilitation of disturbed areas.
- **Construction Environmental Management Plan (CEMP)** for the Project Area, which includes:
    - **Preliminary Rehabilitation Plan**: This plan outlines how areas cleared for construction will be:
        - **Rehabilitated**: Returned over time to their pre-disturbance regional ecosystem or condition.
        - **Restored**: Replanted with grasses, groundcovers, and other indigenous species consistent with the surrounding vegetation communities.
        - **Stabilized**: Using hard engineering measures complemented by landscaping.
        - Prepared in alignment with and complementary to the existing Site Stabilisation Plan – Operations (SSPO) for the wind farm.
        - Reflecting agreements to restore parts of the disturbance footprint to conditions requested by landowners.
    - **Air Quality, Noise, and Vibration Management Plan**: A plan to address:
        - Dust generation that may cause sedimentation in downstream areas due to construction and vehicle movement.
        - Disturbances to surrounding habitats, potentially making them less suitable for native species or leading to avoidance and disruption of normal species distribution patterns.
        - General management of air quality, noise, and vibration to meet environmental obligations.
- **Operational Environmental Management Plan (OEMP)**: A comprehensive plan to manage the environmental impacts during the operational phase.

These management strategies will be implemented to ensure the monitoring and mitigation of any environmental impacts arising from the Project.

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APPENDIX A: EcoSmart Fauna Survey Report



DUGALD RIVER WIND FARM FAUNA SURVEY RESULTS

Dugald River Mine

PREPARED FOR MMG AUSTRALIA PTY LTD
November 2023

Dugald River Wind Farm Fauna Survey Results

Dugald River Mine

Prepared for MMG Australia Ltd

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1.0 INTRODUCTION

1.1 Background

EcoSmart Ecology has been engaged by MMG Ltd to report on terrestrial fauna surveys conducted on the Knapdale Range between 2013 and 2023. The purpose of the report is to provide baseline information for a proposed wind farm on the Knapdale Range within the existing Dugald River Mine lease footprint (Figure 1.1). In addition to baseline reporting, EcoSmart Ecology have been engaged to conduct Bird and Bat Utilisation Surveys (BBUS) to assess the potential collision risk of bird and bat species with wind turbines. This report includes preliminary results from two BBUS monitoring periods.

Nine locations across the Knapdale Range have been selected for potential installation of wind turbines. Construction of turbine pads and access tracks requires 75.05 ha of additional land clearing within the lease footprint. Final turbine selection remains unconfirmed, so all analysis is based on the precautionary principle and assumes that the largest possible turbines will be installed. Presently these are Goldwind GW 165-5.2/5.6/6.0MW turbines, with a hub height above the ground of 130 m and a turbine blade diameter of 165m.

1.2 Survey Location

The Knapdale Range is located approximately 20 km to the north-west of Quamby in the Mount Isa Inlier bioregion in north-west Queensland. The range occupies approximately 295 km^2 and runs north-south for a distance of approximately 12 km, rising to a peak of 85 m above the surrounding plains at its highest point. At its widest point the range is approximately 2 km wide, though for most of its length it is closer to 1.5 km in width. The top of the range is characterised by a rocky undulating plateau. Along the range small gullies and waterlines drop from the plateau, forming broken rocky slopes with scattered large boulders or cliff-faces. Other steep rocky areas are also present, particularly along the western slopes. Steep slopes with large rock outcrops are less abundant in the southern third of the range, and along the very north-east tip, though small isolated rock outcrops can be present.

The Knapdale Range is a prominent range of hills formed by Knapdale Quartzite. The Dugald River deposit is located within the Mt Roseby Corridor (3-4 km wide north-to-south trending high strain domain) and is comprised of the Mt Roseby Schist Formation (1686±7 Ma) that includes the local Hangingwall Calc-silicates, Dugald River Slate (DRS) and the Footwall Limestone. It is situated within the Mt Albert Group between the older Knapdale Quartzite (1728±5 Ma) and the younger Coocerina Formation that outcrop to the west of the Knapdale Range (R. Cooper pers. comm.).

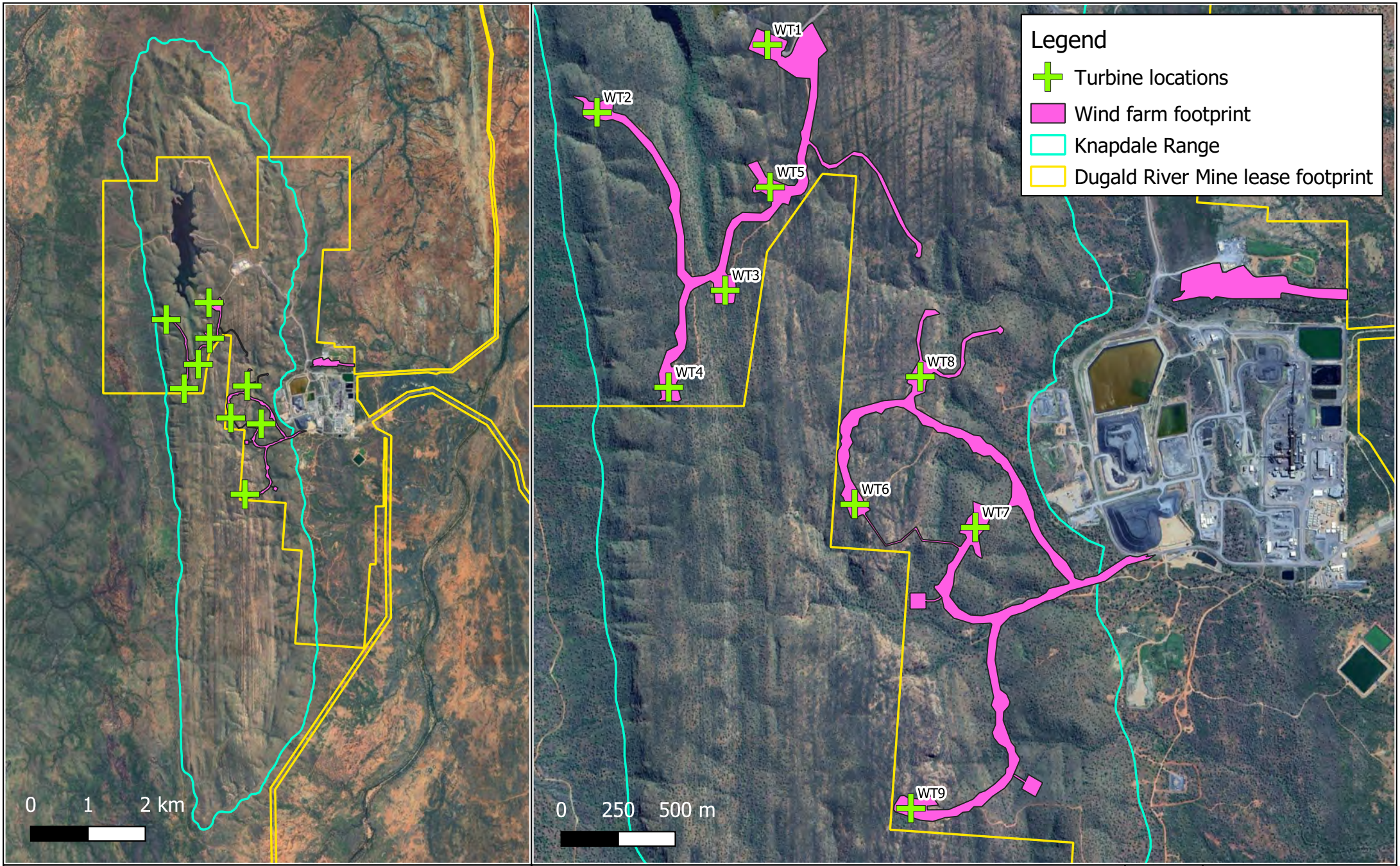


Figure 1
The Knapdale Range, existing Dugald River Mine lease footprint, and additional proposed wind farm footprint and turbine locations

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1.3 Study Team and Qualifications

Consistent with Eyre et al. (2014), Table 1.1 outlines the study team, their qualifications, and respective tasks.

Table 1.1. Study team and qualifications

Personnel	Qualifications	Experience	Tasks
Mark Sanders	BSc (Hons)	20+ yrs	Field monitoring, report preparation, data analysis, project management (2014 – 2023)
Angus McNab	MSc	10+ years	Field monitoring, report preparation, data analysis (2014 – 2016, 2019)
Katrin Lowe	PhD	10+ years	Field monitoring, report preparation (2016 - 2017, 2023)
Jarrad Barnes	BSc	7+ years	Field monitoring, report preparation, data analysis (2018 – 2023)
Anders Zimny	BSc	10+ years	Field monitoring (2015)
Jesse Rowland	MSc	10+ years	Field monitoring (2017)
Nick Kilvert	BSc	10+ years	Field monitoring (2014)
Henry Jackson	N/A	10 years	Field monitoring (2021)

2.0 METHODS

2.1 Desktop Assessment

A desktop assessment has conducted in the form of a WildNet fauna search, Protected Matters fauna search and an Atlas of Living Australia fauna search using a 25 km buffer around a central point on the Knapdale Range. This information was used to identify locally known EVNT (Endangered, Vulnerable and Near Threated) species which formed the basis for the habitat suitability assessment. An assessment of the likelihood of each of these species inhabiting and/or utilising the Knapdale Range was determined from local records and perceived habitat amenity determined through the field survey.

2.2 Fauna Survey Methods

2.2.1 Overall Survey Effort

A variety of survey techniques have been used across the Knapdale Range to survey fauna species. Most effort has been directed toward monitoring the effect, if any, of mining activities on populations of Purple-necked Rock-wallaby (*Petrogale purpureicollis*) and Carpentarian Pseudantechinus (*Pseudantechinus mimulus,* which was listed as a Matter of National Environmental Significance until 2021). These monitoring surveys have relied heavily on white-flash remote cameras. Over the years other methods have been used haphazardly to supplement the work. These activities, along with extensive traverses exploring the range, has provided a robust understanding of vertebrate species (noting some exceptions as detailed in Section 2.4) and habitat features present.

A summary of overall survey effort by year and survey method is provided in Table 2.1. Further information on each methodology is provided in the following sections. A list of all previous and ongoing monitoring locations is provided in Appendix A. Survey timing and monitoring conducted during each survey is provided in Appendix B.

2.2.2 White-flash Remote Camera Surveys

2.2.2.1 Purple-necked Rock-wallaby Monitoring

Purple-necked Rock-wallaby ("PNRW") populations on the Knapdale Range have been monitored by EcoSmart Ecology since 2014. Populations are monitored using a single white-flash PIR camera ("camera trap"). Between 2014 and 2015 only eight PNRW populations were monitored. Nine further sites were established in 2016, and a final site in 2017. All 18 sites (Figure 2.1) have been monitored twice yearly since 2017, once post-wet season and once pre-wet season. Since 2014, attractants including specialised macropod pellets, peanut butter/oat bait balls and lucerne have been used to increase rock-wallaby activity at the cameras. Prior to 2014 only lucerne was used as an attractant. Total trap effort to date is 1,525 trap-nights (Table 2.1).

Table 2.1. Survey effort by year and survey method

Method	Unit	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	TOTAL
BBUS – Anabat	Anabat-nights											16	16 Anabat-nights
BBUS – Bird Survey	Person hours											16	16 person hours
Bird Survey Transect	Person hours							3	6	4.5	6	9	28.5 person hours
PNRW white-flash camera	Trap-nights		80	80	115	170	180	180	180	180	180	180	1525 trap-nights
PSEUD white-flash camera	Trap-nights			269	480	480	480	480	480	480			3149 trap-nights
Pest black-flash camera	Trap-nights	20	20	20	20	20	20	20	20	20	20	20	200 trap-nights
Elliott Trap	Trap-nights			2000									2000 trap-nights
Pitfall Trap	Trap-nights										15	15	30 trap-nights
Foot traverses	Person hours		168	408	240	240	240	240	240	240	168	240	2424 person hours

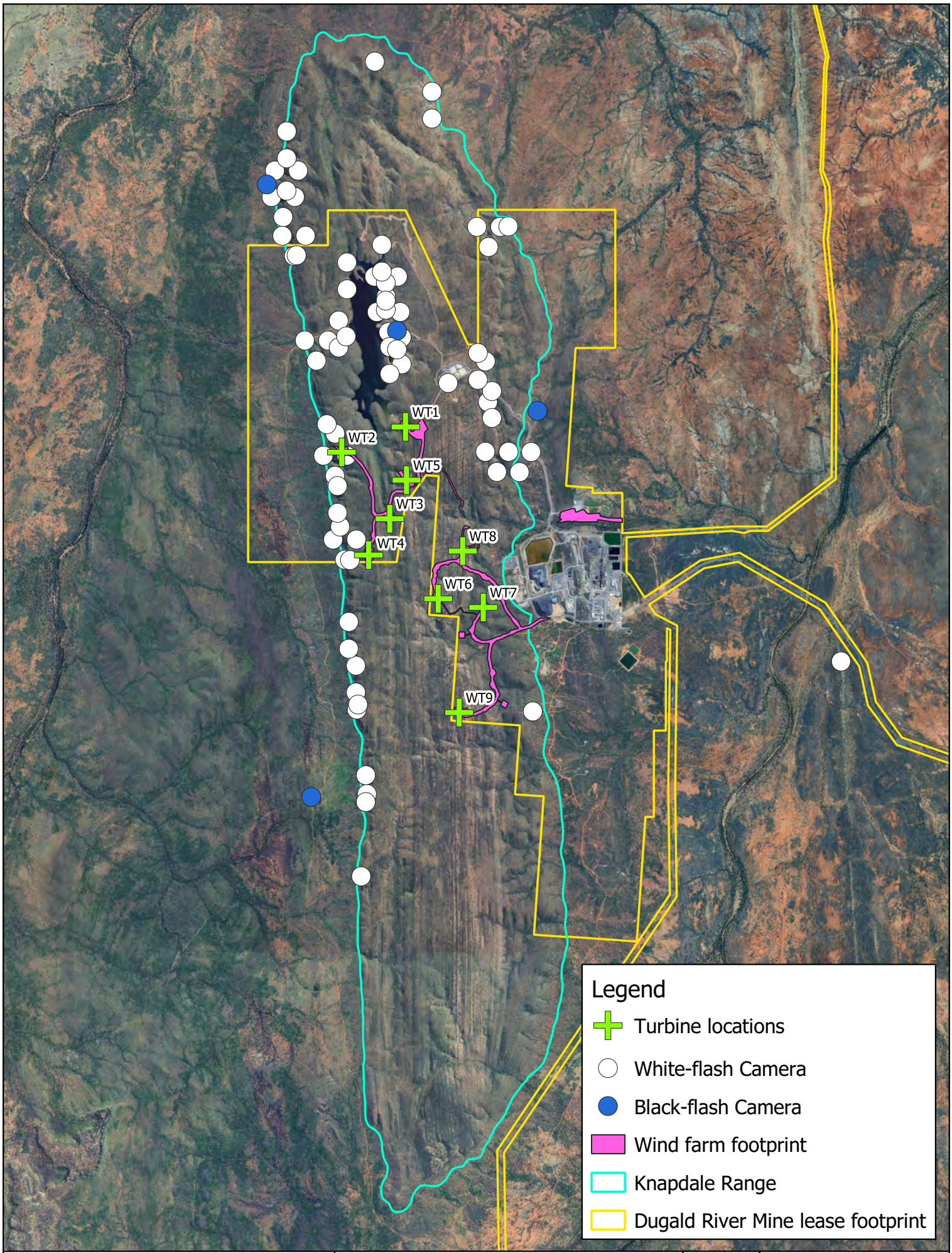


Figure 2.1
Remote field camera survey locations

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The number of recognisable individuals is recorded for each night, and for the survey duration, using indicators such as size, sex, reproductive status (i.e., pouch young), pelt/ear marks or damage. Juveniles at foot and pouch young (only if observed) are included in the count. Observers also record the total number of PNRW observed when setting and retrieving cameras. The highest number of PNRW observed by either method (camera or direct observation) is recorded as the population size for a given survey.

While the methodology targeted PNRW, the selected attractants (pellets, peanut butter/oat bait balls) will have been suitable to attract a wide variety of other vertebrate species and incidental records of all fauna species were noted.

2.2.2.2 Pseudantechinus targeted surveys

Following the unexpected appearance of Pseudantechinus during PNRW monitoring, a targeted survey for the species was conducted in 2015. The survey utilised both camera and Elliot trap methods with ten cameras located in close proximity to the Dugald River Mine, and a further 21 across the broader Knapdale Range.

Each camera was baited by smearing peanut butter over the rocks 2-3 m in front of the camera. Cameras were left in-situ and operational for a minimum of eight nights, though some were left for longer. Total white-flash camera effort in 2015 was 269 camera-trap-nights.

2.2.2.3 Ongoing Carpentarian Pseudantechinus Monitoring

Ongoing Carpentarian Pseudantechinus (*Pseudantechinus mimulus*) monitoring across the Knapdale Range was conducted using white-flash camera traps between 2016 and 2021. Two surveys were undertaken each year, once post-wet season and once pre-wet season. Each survey utilised 30 cameras located at independent locations in rocky habitats within the Knapdale Range (Figure 2.1). All cameras were operational for eight consecutive nights and baited by smearing peanut butter on the rocks. Cameras were checked and rebaited after the fourth or fifth night. Carpentarian Pseudantechinus was recorded as present or absent on each night. A supplementary list of other vertebrate species recorded on cameras was also recorded. Total camera trap effort across all monitoring years was 3,149 trap-nights.

2.2.3 Estimating Purple-necked Rock-wallaby abundance

An initial population estimate was calculated in 2014 by determining the mean number of rock-wallabies at 26 known sub-populations, and extrapolating this to an estimated 56 sub-populations based on interpretation of aerial imagery. Population sizes were not subsequently calculated in future surveys; however, a population estimate has been made in this report based on this same methodology using the most recent mean population size of the 18 permanently-monitored sub-populations across the Knapdale Range.

Trends in Purple-necked Rock-wallaby abundance between 2014 and 2022 at each sub-population have previously been determined by calculating the regression slope (i.e., number of recorded individuals over time) for each sub-population. Regression slopes >0 are were considered to be associated with an increase in sub-population size, and regression slopes <0 are with a decrease in sub-population size. While calculating a regression slope across the entire survey duration is useful in determining an overall change since monitoring began, it

does not provide information on the stability of a population; large, anomalous fluctuations in either a reduction or increase in PNRW numbers in a monitoring year may considerably impact the regression slope and lead to misinterpretation of the population dynamics at a colony.

Therefore, to determine if populations appear to be decreasing, increasing or stable over time, a regression slope was calculated for every monitoring period. The average of these slopes was then calculated with a 95% confidence interval. If the confidence interval includes 0, a population is considered likely to be stable, if the lower bound of the confidence interval is >0, the population is considered likely to be increasing, and if the upper bound of the confidence interval is <0, the population is considered likely to be decreasing.

2.2.4 Small Mammal (Elliot) Trapping

Elliot trapping to confirm the occurrence of Carpentarian Pseudantechinus was conducted in July 2015. Trapping was conducted at 20 locations, ten within close proximity to the Dugald River Mine and ten within the broader Knapdale Range (Figure 2.2).

At each site 25 Elliot traps were positioned approximately 5-10 m apart, in a straight line, U-shaped or circular fashion to maximise the rock area sampled. The traps, which were operational for four consecutive nights, were baited with peanut butter, oats and vanilla essence. All sites were visited daily to identify and release captured animals, as well as to rebait and maintain the traps. Total Elliott trap effort was 2000 trap-nights (Table 2.1).

2.2.5 Black-flash Camera Surveys

Black-flash surveys to observe pest predator species (cat, fox and dingo) have been conducted twice yearly since 2013, once post-wet season and once pre-wet season. The surveys utilise four black-flash ("covert") camera traps positioned at various locations around the Knapdale range (Figure 2.2). Chicken necks is used as an attractant. Cameras are operational for five nights per survey. Total pest camera survey effort to date is 200 trap-nights (Table 2.1).

2.2.6 Bird Surveys

Three permanent bird survey transects were established in October 2019. All three transects are located on the western edge of the Knapdale Range in three distinct vegetation types (Table 2.2). Transects are 500 m in length and have been surveyed twice per year since bird monitoring commenced. Two observers meander along the transect for a total duration of ~30 minutes. All bird species and the total number of individuals of each species heard or seen within 50 m of the transect are recorded. Species beyond 50 m are recorded but no counts are taken. Total bird survey effort to date is 28.5 person hours (Table 2.1).

Table 2.2. Vegetation descriptions of bird survey transects

Transect	Description
BRD01	Low, open eucalypt woodland with dense tussock grass and *Triodia pungens* ground layer
BRD02	Low, open eucalypt woodland with *Acacia* spp. shrub layer and *Triodia pungens* ground layer, adjacent ephemeral creek lined with *Lophostemon grandiflora*
BRD03	Low, open eucalypt woodland with *Acacia* spp. shrub layer, tussock grass and *Triodia pungens* ground layer and localised patches of *Acacia cambagei*; transitioning in north of transect to tall eucalypt woodland of *Corymbia aparrerinja* with *Acacia* spp. shrub layer and *Triodia pungens* ground layer

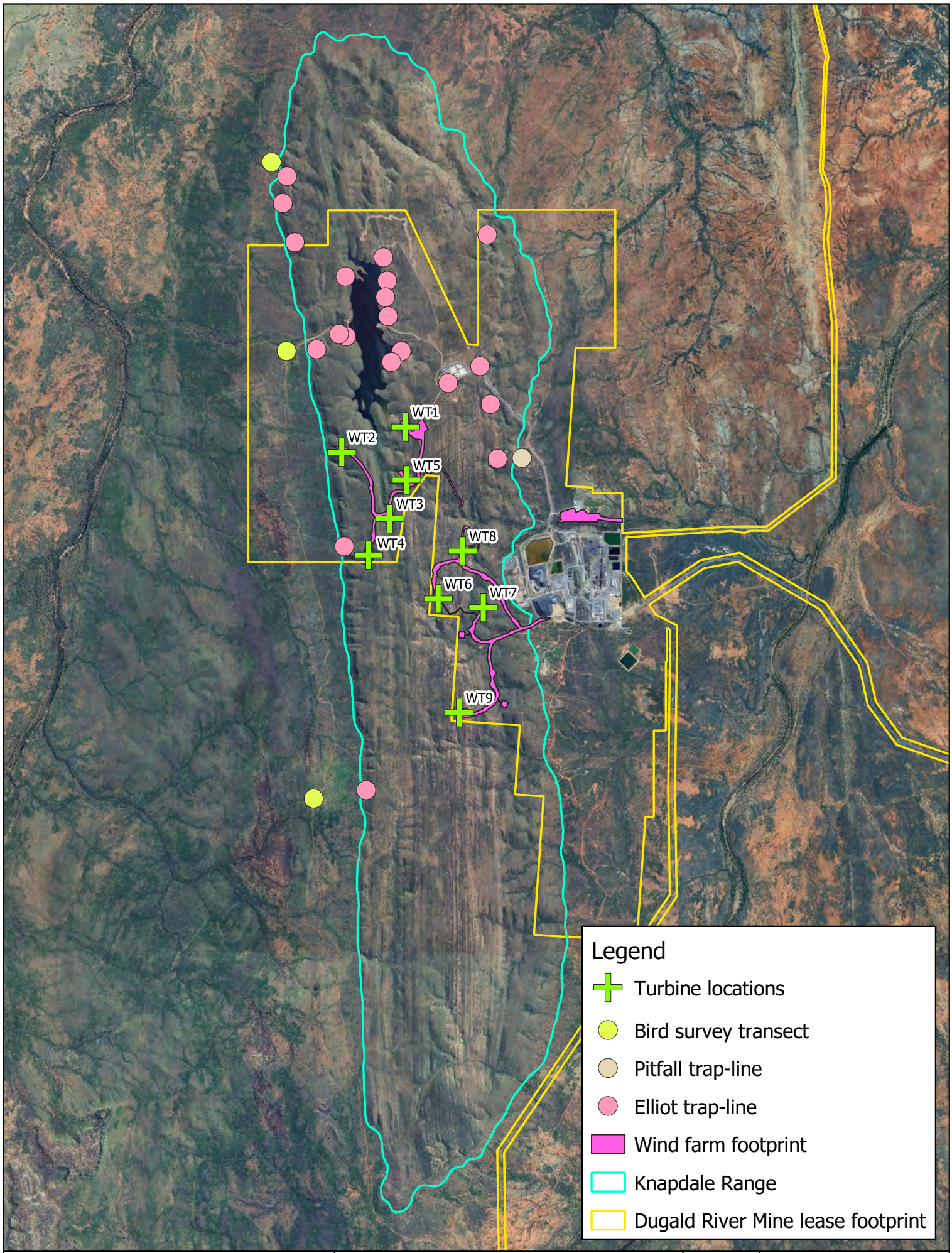


Figure 2.2
Elliot trap, pitfall trap, and bird survey locations

0 0.5 1 km

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2.2.7 Pitfall Traps

A single pitfall trap-line was established in 2022 (Figure 2.2) The trap-line consists of three 10L buckets spaced approximately 3 m apart. Pitfall traps are open for five nights and are checked within two hours of sunrise and two hours of sunset. Total pitfall trap effort to date is 30 trap-nights (Table 2.1).

2.2.8 Incidental Observations / Active Searches

Across all surveys, ecologists remain vigilant for all species seen or heard while traversing the Knapdale Range. Specific time spent traversing the range has not been recorded; however, a conservative estimate of six hours per person per day has been assumed to calculate overall effort (Table 2.1). Most incidental observations have been made while traversing between permanent monitoring locations; however, particular attention has also been paid to rocky gullies and waterholes which provide important water and foraging resources as well as daytime refugia for a wide range of species, especially birds and Purple-necked Rock-wallabies. Exact coordinates are recorded for EVNT and locally rare or significant fauna, but most incidental observations are supplied with a generic GPS coordinate.

2.2.9 Bird and Bat Utilisation Surveys (BBUS)

Nine potential turbine locations were considered for bird and bat utilisation surveys (BBUS). From these, four impact sites were selected for ongoing BBUS monitoring, in conjunction with four control sites (Figure 2.3). Each control site was set in a similar landscape position to turbine locations (i.e., a high point on the edge of the range), and a minimum of 500 m from any turbine location. Each impact and control site will be monitored twice yearly, once post-wet season and once pre-wet season. Two surveys have so far been conducted, one in May 2023, and one in September 2023. Surveys include bird monitoring and bat monitoring. Reporting guidelines largely follow those recommended by Lane and Associates (2005).

2.2.9.1 Bird Monitoring

Bird monitoring consists of three surveys conducted at each control and impact suite during the survey period, one within two hours after sunrise ("morning"), one within one hour 1 h either side of midday ("midday") and one within two hours before sunset ("afternoon"). No two surveys are conducted at any given location on the same day. Bird Utilisation Surveys (BUS) consist of 20 min of monitoring for all bird species flying above the canopy, with the following parameters recorded:

- Number of individuals
- Time first observed
- Distance from observer (in metres) when first observed
- Bearing (i.e., direction of bird/s relative to observer) when first observed
- Height relative to observer (in metres) when first observed
- Direction of flight when first observed

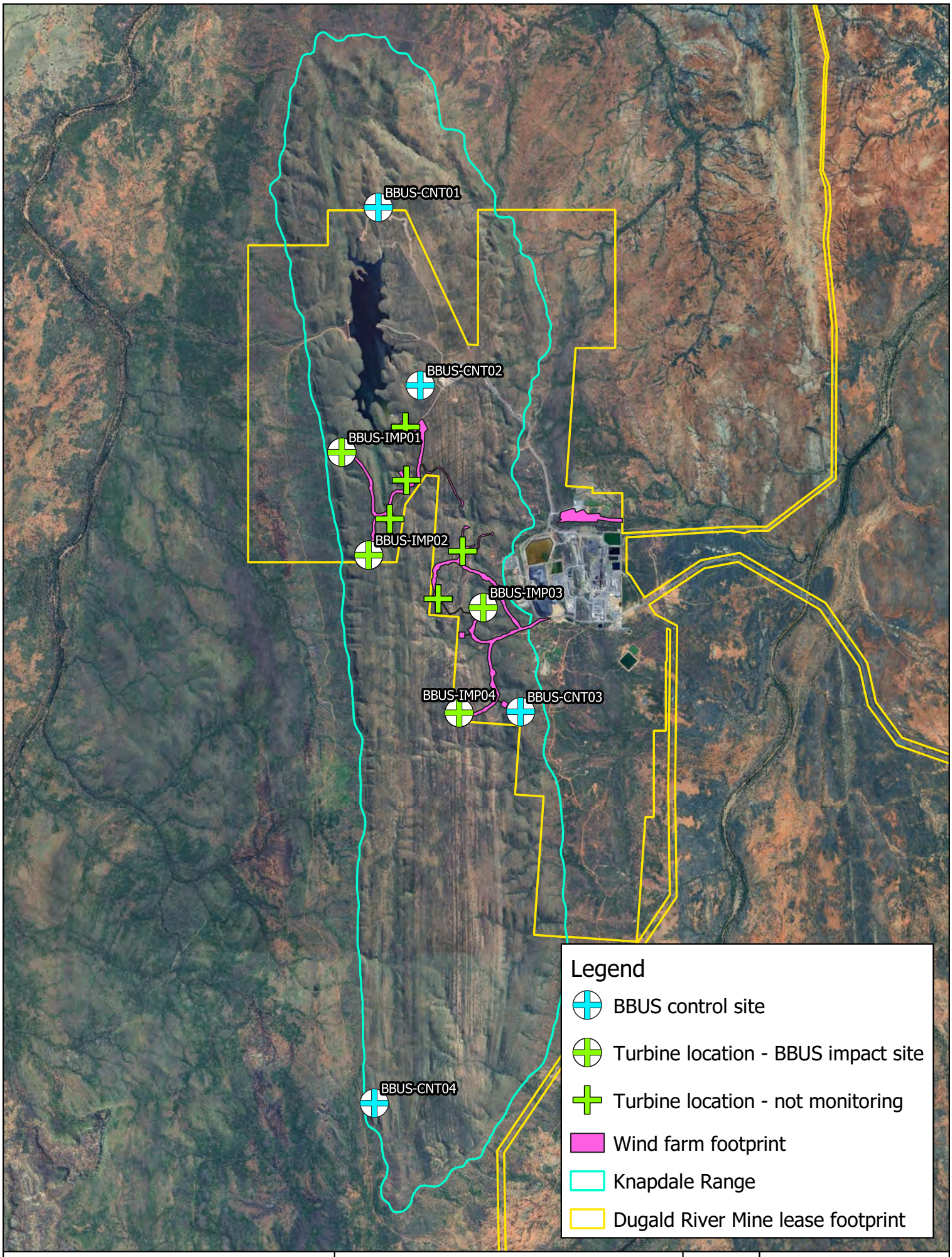


Figure 2.3
Bird and bat utilisation survey (BBUS) locations

0 0.5 1 km

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- Behaviour, categorised as one of:
  - Powered flight (i.e., flapping)
  - Gliding (i.e., directional unpowered glide)
  - Foraging (i.e., circular hunting pattern observed in raptors and woodswallows and/or hovering observed in some raptors e.g., Black-shouldered Kite)
  - Soaring/Thermaling (i.e., use of air currents to increase altitude)
- Minimum distance from observer (in metres) over the entire sub-survey
- Maximum height relative to observer (in metres) over the entire sub survey

A complete list of all other bird species observed below the canopy or heard calling within each survey is also recorded; however, only bird species flying above the canopy are considered in further analysis. Total BUS bird monitoring effort to date is 16 person-hours (Table 2.1).

2.2.9.2 Data Analysis

To determine which species are of greatest concern, species were sorted into two groups:

1. Species recorded within the rotor-swept area (RSA; i.e., the area of influence of the rotor specified as a range in metres above the ground). The RSA was considered for the largest possible turbine, the Goldwind GW 165-5.2/5.6/6.0MW. This rotor has a blade diameter of 165 m and a hub height of 130 m, for an RSA of 35 – 165 m above the ground.
2. Species recorded outside the RSA of the largest possible turbine

Species were then ranked based on the total number of individuals observed across all 48-surveys across May and September 2023.

To determine if most species likely to be present have been detected, a species accumulation curve (SACs) was produced using the *specaccum* function in the R package '*vegan*'. The SAC was produced using the "random" method, which randomly permutes the order of sub-survey blocks and, therefore, the order in which species are accumulated, and determines an average SAC (± standard deviation). Calculating an SAC using random permutations provides a more robust method of determining survey adequacy than a chronological "collector" method by minimising the effect of daily variation in occurrence (Thompson and Thompson 2007). The data informing the SAC were analysed to determine if the SAC showed signs of reaching an asymptote, or "levelling off". This was determined based on the suggested guidelines in Lane and Associates (2005) that a curve shows signs of levelling off if the final 10% of counts increase species richness by <10%.

2.2.9.3 Bat Monitoring

Bat monitoring utilises Anabat passive high-frequency sound recorders to capture the calls of microbats at each BBUS monitoring site. One Anabat unit is deployed at each site for a total of two consecutive nights per survey. A single recorder deployed at site BBUS-CNT02 failed to record during initial deployment in September 2023. This unit was redeployed for a single night at the end of the survey to accumulate one Anabat-night of data. Total BBUS Anabat effort to date is 16 Anabat-nights (Table 2.1).

2.3 FLORA SURVEYS

2.3.1 BBUS Site Assessment

Under the Regional Ecosystem (RE) framework the Knapdale Range is mapped as a heterogeneous polygon consisting of two RE types, 1.11.2a and 1.7.7a. Vegetation at each BBUS impact and control site was therefore categorised to verify which of these, or possibly alternative, REs are present at each monitoring location. The following were recorded at each site:

- Landform
- Dominant species within ground, shrub and tree strata
- Percent cover estimate of each stratum
- Height estimate (range) of shrub and tree strata

This is sufficient to exceed a Quaternary assessment; however, does not include all necessary data (basal area abundance, complete list of all woody species present) to attain a Tertiary assessment of the vegetation at each site (Neldner *et al.* 2019). Four photographs were taken at each site, one each facing north, east, south, and west to provide a visual representation of each site.

2.3.2 Weed Surveys

Weed surveys have not been systematically undertaken across the site; however, incidental notes and observations over 10 years have been collated. Observers are also vigilant for weeds at newly constructed turbine pads.

2.4 Survey Limitations

The following limitations have affected all surveys conducted by EcoSmart Ecology within the Knapdale Range and surrounding areas:

- No spotlighting effort has been undertaken, meaning nocturnal species are generally underrepresented unless they are rock-dwelling and thus have a higher likelihood of being recorded by camera traps or during sporadic opportunistic habitat searches;
- No searching has been conducted in wet conditions, so amphibians are likely underrepresented with only chance sightings recorded on camera or sporadic opportunistic habitat searches;
- Surveys have all been conducted either pre- or post-wet season (typically within Sept/Oct and Apr/May). Some species which may only occur after large rain events (e.g., some wading birds) may be underrepresented;
- Pitfall trapping has only recently commenced at a single location, so survey effort using this method is limited. While pitfall trapping may increase overall species inventory, many species likely to be detected by this method have been detected using other methods.

None of these limitations need to be overcome to detect EVNT species with the potential to occur across the Knapdale Range. Therefore, while addressing these limitations may increase overall species inventory, it will not increase the likelihood of detecting any EVNT species.

3.0 RESULTS AND DISCUSSION

3.1 Desktop Assessment

A desktop assessment identified 17 EVNT species known or with the potential to occur within 25 km of the Knapdale Range. A likelihood assessment was conducted to determine the potential for these species to occur on the Knapdale Range. One species was determined as present, the Purple-necked Rock-wallaby. Short-beaked Echidna, a species of special least concern under the Nature Conservation Act (NC Act) has also been recorded from the range.

Two other species are not expected to occur except as perhaps vagrant individuals; these species, The Painted Honeyeater and Grey Falcon, are considered to be 'Transient'.

All other species were categorised as "Will Not Occur" on the Knapdale Range. One species, the Mertens' Water Monitor, has been recorded in surveys at Longamundi Waterhole, but was categorised as "Will Not Occur" due to the lack of suitable habitat on the Knapdale Range. The complete assessment is provided in Appendix D.

3.2 Fauna

Fauna surveys since from 2014–2023 have recorded 153 vertebrate species across the Knapdale Range (Appendix C) including four native amphibians, 23 native reptiles, 104 native birds, and 18 native mammals. This includes several species notable under the NCA including a Vulnerable mammal (Purple-necked Rock-wallaby) and one Special Least Concern mammal (Short-beaked Echidna).

The NCA Endangered reptile, Mertens' Water Monitor (*Varanus mertensi*), has been recorded in the surrounding areas (i.e., the nearby Dugald River) but is not known from the Knapdale Range. To date this species has not been recorded within MMG's Dugald River mining lease and no suitable habitat for it occurs. No threatened species under the EPBC Act have been identified.

A single migratory species (Glossy Ibis) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) has been recorded.

Two introduced mammals and one introduced amphibian have been regularly recorded.

3.2.1 Known Special Conservation Vertebrate Fauna

Following considerable survey and time spent traversing the Knapdale range, only two species of special conservation significance have been identified as present, the Purple-necked Rock-wallaby and Short-beaked Echidna. These species are discussed in further detail below.

3.2.1.1 Purple-necked Rock-wallaby

NCA: Vulnerable | EPBC: Not listed | Likelihood Assessment: Present

Occurrence and habitat

PNRW are known from multiple locations across the Knapdale Range in association with large rocky features. Purple-necked Rock-wallaby habitat is not uniform and instead occurs in discrete locations associated with complex rocky scree slopes, cliffs and gullies. This significantly influences PNRW distribution, with colonies occurring as discrete units of variable size across the landscape. Colony size is closely correlated with habitat quality; larger, more complex rocky features with more abundant sheltering opportunities support greater numbers than smaller, less complex features. Mixing between colonies within the Knapdale range is likely to be frequent. Larger more secure colonies probably act as 'source' populations, allowing dispersal to nearby habitats and facilitating recolonisation following local extinction of more marginal areas. Natural fluctuation of numbers within each colony is therefore expected.

Population size and trends

Initial estimates of the Purple-necked Rock-wallaby population on the Knapdale Range calculated in 2014 were for a total population size of 137 individuals (EcoSmart Ecology 2014). This was based on an average of 2.45 individuals per colony across 56 possible locations (both known populations, and populations hypothesised to be present based on aerial imagery interpretation). Purple-necked Rock-wallaby sub-population sizes have fluctuated over 10 years of monitoring (Table 3.1); however, average population size across the Knapdale Range was at its highest ever-recorded value (4.83±2.12 individuals per colony) in September 2022 (EcoSmart Ecology 2022). Based on these most recent estimates and on the 56 sub-populations assumed in 2014, the current total population size on the Knapdale Range may be as high as 270 individuals. As noted in 2014, this estimate should be used conservatively as 30 locations were only hypothesised to support populations, with no visual inspection of these locations conducted. Some locations have become or will soon be inundated by the filling of the tailings storage facility (TSF) dam, meaning the actual number of potential colonies is likely fewer than estimated in 2014. The average population size per colony across all monitoring periods (i.e., average population size from Apr 2014 to Sep 2022) is 3.3±1.07 individuals (Table 3.1).

Table 3.1. Purple-necked Rock-wallaby abundance recorded using trail cameras from 2014 to 2022

Site	2014		2015		2016		2017		2018		2019		2020		2021		2022		Mean	Slope
	Apr	Aug	May	Sep	May	Aug	May	Aug	May	Oct	Apr	Oct	Apr	Sep	Apr	Sep	May	Oct		
CNT01	1	2	1	2	3	1	3	4	0	2	1	2	1	3	2	3	3	3	1.9	0.0004
CNT02	4	3	5	5	4	3	3	2	2	4	3	3	3	5	2	4	3	5	3.5	0.0000
CNT03	2	3	5	6	3	3	3	3	2	1	2	1	3	4	2	2	2	3	2.9	-0.0004
CNT04	1	4	6	6	2	3	3	4	3	5	1	6	2	9	9	8	14	11	3.9	0.0024
IMP01	3	3	4	5	3	4	4	4	4	2	5	3	2	4	4	4	2	4	3.7	-0.0001
IMP02	1	3	#	4	4	3	2	3	#	4	2	4	4	3	2	3	3	4	3.1	0.0003
IMP03	2	3	1	3	3	3	4	4	2	4	3	2	3	3	#	4	4	6	2.9	0.0007
IMP04	0	0	0	0	0	0	0	1	2	0	1	2	2	0	0	0	1	2	0.6	0.0006
KR01					4	4	2	4	3	3	3	1	1	#	3	4	4	5	2.8	0.0004
KR05						3	3	1	3	0	2	3	0	4	1	4	4	4	2.1	0.0008
KR07						4	3	4	4	5	6	3	4	4	2	5	3	4	4.1	-0.0002
KR10						2	3	1	4	4	5	2	3	4	2	6	4	5	3.2	0.0008
KR13						4	4	4	3	4	3	4	2	4	0	5	4	7	3.6	0.0007
KR14						3	2	#	5	4	3	0	3	6	2	4	7	7	3.3	0.0019
KR16						2	2	2	1	3	0	1	1	2	0	3	4	2	1.6	0.0004
KR18							4	4	3	1	2	4	1	5	1	4	4	6	3.4	0.0011
KR19							3	5	5	5	0	0	2	2	2	4	2	5	2.7	-0.0006
KR20							3	#	2	4	4	5	3	5	3	4	2	4	3.8	-0.0001

equipment failure

Purple-necked Rock-wallaby sub-population sizes have varied between 2014 and 2022, and not all sub-populations have varied at the same rate. Regression slopes calculated in 2022 are shown in Figure 3.1. As of September 2022, most locations showed an overall increase in population. However, recent surveys have occurred following exceptional rainfall years due to La Niña and likely reflect increased forage resource availability supporting larger numbers of PNRW.

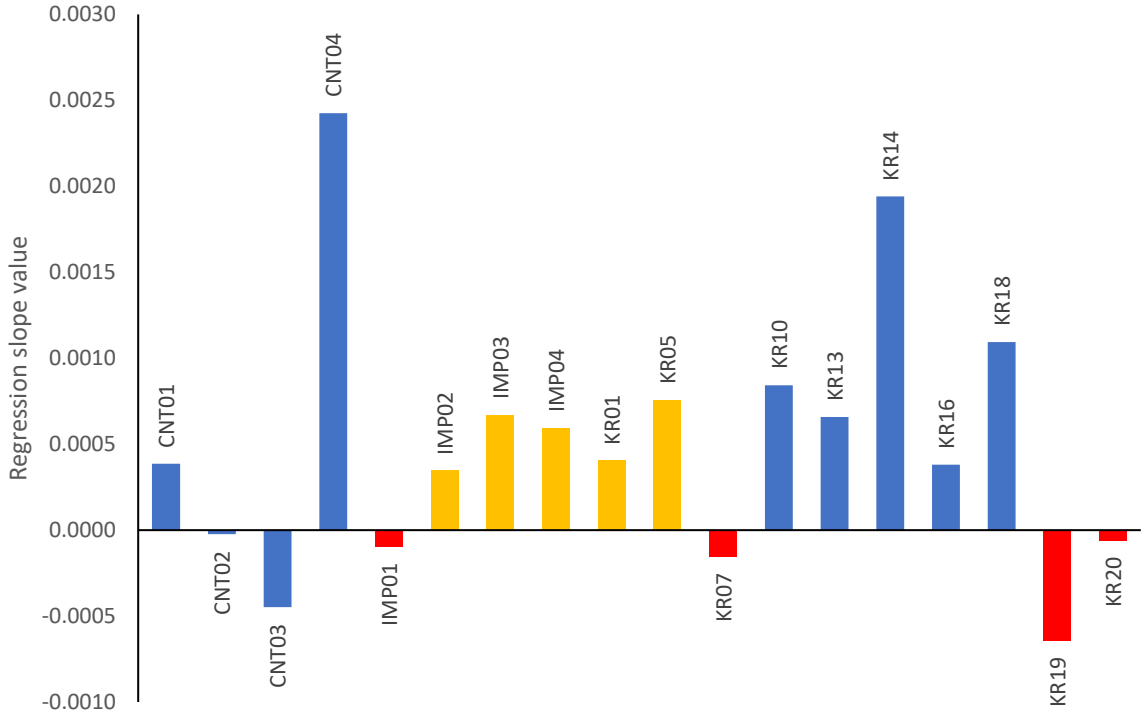


Figure 3.1. Regression slopes for PNRW colonies. Positive regression values suggest an increase in PNRW numbers, negative values suggest a decline – the greater the value the more abrupt the change. Sites coloured blue are located considerable distance from the effects of mining (> 1 km), sites coloured red are immediately adjacent the TSF, sites coloured yellow are near to other mining impacts (village, access roads, exploration etc).

Monitoring camera KR19 was the first to be inundated by rising water levels in the TSF dam and shows a strong decreasing population trend. This perhaps supports the understanding that PNRW are unable to tolerate direct loss of shelter habitat.

Since 2022, a new vehicle track made conducting watches at one known colony easier, and this location has had colony watches conducted on it across three monitoring periods. While not sufficient effort to determine population trends, this colony is known to contain at least 6–8 individual PNRW, well above the average population size as of September 2022. Given the size of this colony and its position in relation to the proposed wind farm footprint (~600 m south of WT7, see Figure 3.2) it may act as a source population from which individuals may return if disturbance occurs during construction.

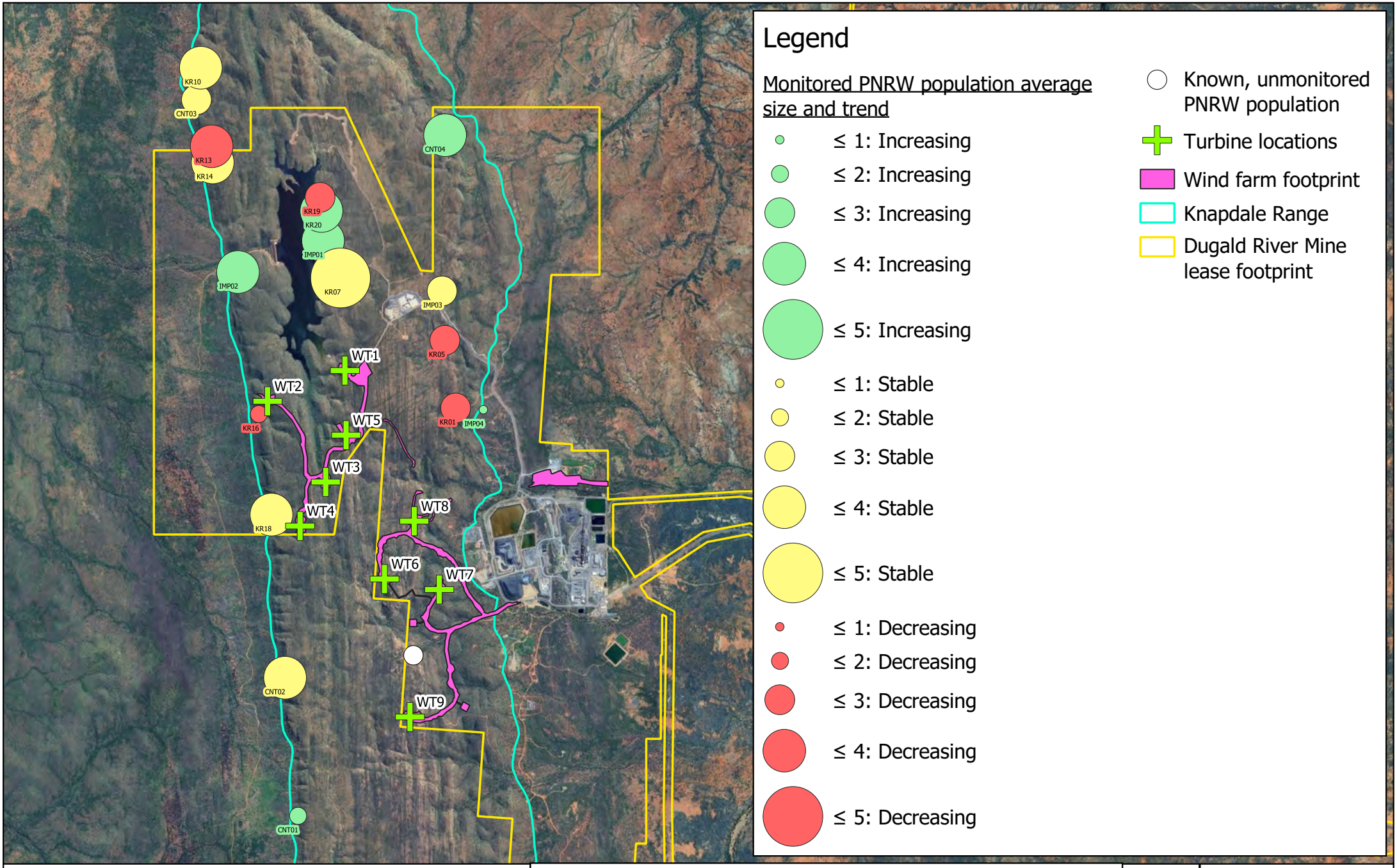


Figure 3.2
Monitored Purple-necked Rock-wallaby (PNRW) colony average population size and trend. A known, unmonitored population is also shown; however, no average population size estimate is available for this location. Further detail in Section 3.2.1.1.

0 1 2 km

Client: MMG Ltd.
Project: Dugald River Wind Farm Vertebrate Fauna Assessment

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Impact considerations

Shelter habitat, rather than forage habitat, is the limiting resource for PNRW across the Knapdale Range. Construction activities across the Knapdale Range therefore need to consider the impacts of any proposed activities on PNRW shelter habitat, rather than on foraging habitat.

The currently proposed turbine locations are not located at any known PNRW colonies; however, some are nearby. Turbine pads WT2 and WT4 are ~150 m NE and ~300 m ESE of PNRW populations at monitoring sites KR16 and KR18. The colony at KR16 is below average in size (1.6 individuals) and is in decline. Reasons for decline at this location are not fully understood. Site KR18 is a larger colony with an above average population size across monitoring periods (3.4 individuals), a population trend currently indicated as stable. This site is also more rugged and has more shelter opportunities than KR16 and may therefore provide greater protection from predators and any perceived disturbance from construction.

Currently proposed tracks and 5 m buffer footprint do not traverse any known or visually suitable PNRW shelter habitat. Two PNRW vehicle deaths have occurred on the Dugald River Mine village road since its operation. Risks associated with vehicle strike on access roads to the turbines is considerably less, probably negligible, due to lower vehicle speed and less frequent use (especially during operation).

3.2.1.2 Short-beaked Echidna

NCA: Special Least Concern | EPBC: Not listed | Likelihood Assessment: Present

Short-beaked Echidna is infrequently recorded across the Knapdale Range, by both direct and indirect (e.g., scats) observation, and the entire range constitutes high amenity shelter and foraging habitat. The construction of turbine pads and associated infrastructure, especially roads has the potential to impact on Short-beaked Echidna shelter and foraging habitat via direct disturbance of this habitat. However, the spatial extent of impacts are minor constituting ~0.17% of the Knapdale Range. Impacts are not expected to prevent the species from utilising remaining habitat outside the construction footprint.

3.2.2 Other Special Conservation Fauna

Two species identified within the desktop assessment, the Grey Falcon and Painted Honeyeater, are highly mobile and able to traverse large expanses of unsuitable or sub-optimal habitats. These species have been recorded within the local area and have some chance to occur, at least theoretically. However habitats on the Knapdale Range are suboptimal at best and resident populations do not occur, nor could the possibly occur due to low or no habitat amenity. These species are considered 'transient' in nature and discussed below.

A third species, the Carpentarian Grasswren, is also discussed below for greater clarity but will not occur on the Knapdale Range.

3.2.2.1 Grey Falcon

NCA: Vulnerable | EPBC: Vulnerable | Likelihood Assessment: Transient

The Grey Falcon (*Falco hypoleucos*) has never been recorded on site and is considered unlikely to occur. Nearby records are sparse and infrequent, indicating transiency rather than residency in the broader region. The Grey Falcon is most commonly observed on vast, featureless plains with scattered trees, ecosystems which typically predominate further south and west of the Knapdale Range. Even during irruptive events of other birds favoured as prey by the Grey Falcon (e.g., Budgerigars), the species has never been observed. Future observations of the species across the Knapdale Range cannot be discounted, but the area is unlikely to support a resident pair or to have any other significant conservation value for the species.

3.2.2.2 Painted Honeyeater

NCA: Vulnerable | EPBC: Vulnerable | Likelihood Assessment: Unlikely

The Painted Honeyeater (*Grantiella picta*) has never been recorded on site in 10 years of survey and is considered unlikely to occur. This species is a mistletoe specialist, relying heavily on mistletoe plants for its entire life cycle. Painted Honeyeaters typically inhabit *Eucalyptus* and *Acacia* forests and woodlands where mistletoe, particularly Grey Mistletoe (*Amyema quandang*), is abundant. Despite the presence of suitable host trees for Grey Mistletoe, particularly Gidgee (*Acacia cambagei*), on the flat lands at the base of the Knapdale Range, this mistletoe has not been observed on site. While detailed mistletoe surveys have not been conducted, only one species has been observed on the Knapdale Range, Collared Mistletoe (*Lysiana spathulata*). This species has been observed parasitising several tree and shrub species, notably Arid Peach (*Terminalia aridicola*), False Sandalwood (*Santalum lanceolatum*) and Red Wattle (*Acacia monticola*) and appears to occur only sparsely across the Knapdale Range. Combined with the geographic location of the Knapdale Range towards the northwestern edge of the Painted Honeyeater's range, the presence and scarceness of a single, unfavoured mistletoe species indicates that Painted Honeyeaters are highly unlikely to occur on site, even as a vagrant.

3.2.2.3 Carpentarian Grasswren

NCA: Endangered | EPBC: Endangered | Likelihood Assessment: Will Not Occur

In ten years of survey, monitoring and observations, the Carpentarian Grasswren (*Amytornis dorotheae*) has never been recorded on the Knapdale Range. The related Kalkadoon Grasswren (*Amytornis ballarae*) is frequently recorded across the entire Knapdale Range during targeted surveys and monitoring as well as through incidental observations. The prevalence of records of Kalkadoon Grasswren across multiple years indicates that survey methods utilised over the past ten years are suitable for recording this genus of birds, and provides further support for the assertion that Carpentarian Grasswren will not occur on the range. Kalkadoon and Carpentarian Grasswren are known to occur in close proximity in certain locations north of Mount Isa. At these locations, the two species appear to separate by habitat type, with Kalkadoon Grasswren occurring at higher elevations on massive, rocky outcrops, hills and ranges (e.g. locations similar to the Knapdale Range), and Carpentarian Grasswren occurring at lower elevations on stony, skeletal soils among large, mature hummock grass (*Triodia* spp.).

Low to moderate amenity habitat for Carpentarian Grasswren occurs on the rolling plains to the east of the Knapdale Range (i.e., between the Knapdale Range and Dugald River). However, this area has been traversed by EcoSmart ecologists and no Carpentarian Grasswrens have been recorded. Importantly, these habitats are considerably different from the Knapdale Range where turbine impacts are expected. Habitat on the Knapdale Range is unsuitable.

3.2.3 Migratory Species

NCA: Special Least Concern | EPBC: Migratory | Likelihood Assessment: Will Not Occur

A single record of Glossy Ibis (*Falcinellus plegadis*) is known from the Knapdale Range from 2021. An individual bird was observed on beached tailings in the TSF dam among a small flock of Pied Stilts (*Himantopus leucocephalus*). This observation followed a significant rainfall event (>40mm) on the Range, and this may have contributed to the presence of this species at this location. It is unlikely that the TSF dam provided suitable foraging resources due to the composition of tailings sediments, and this location was more likely utilised as a staging area (i.e., rest site) than a long-term foraging location. Glossy Ibis has not been subsequently recorded on the Knapdale Range and is unlikely to occur in the future.

3.2.4 Pest Species

A total of four terrestrial vertebrate pests have been historically recorded on camera across the Knapdale Range: Feral Cat (*Felis catus*), Dingo/Dog (*Canis familiaris/C. dingo*), Feral Pig (*Sus scrofa*). A fourth, Cane Toad (*Rhinella marina*), has been incidentally observed during surveys.

3.2.5 Bird Utilisation

A total of 30 bird species have been recorded flying above the canopy across four impact and four control sites (Table 3.2). Aerial insectivores and raptors are the most commonly observed birds observed at bird utilisation monitoring locations. These groups form largely permanent populations on the Knapdale Range and are frequently observed thermaling (i.e., using warm updrafts to rise through the air column) and actively foraging within the potential RSA. To date ten species of bird have been identified as species of concern due to observations within the potential rotor-swept area (RSA). These include (in decreasing order of number of individuals recorded):

- Little Woodswallow (Artamus minor)
- Black-faced Woodswallow (Artamus cinereus)
- Fairy Martin (Petrochelidon ariel)
- Brown Falcon (Falco berigora)
- White-necked Heron (Ardea pacifica)
- Wedge-tailed Eagle (Aquila audax)
- Black-shouldered Kite (Elanus axillaris)
- Whistling Kite (Haliastur sphenurus)
- Black Kite (Milvus migrans)
- Varied Lorikeet (Psitteuteles versicolor)

Of these species, >10 individuals of all three aerial insectivores (Woodswallows and Fairy Martin) have been recorded during BUS monitoring, while most raptor observations are singletons with the exception of Brown Falcon (3 individuals recorded).

In addition to these species, other birds at risk (due to similar behaviour) which have been observed on the Knapdale Range but not during BUS surveys include:

- Masked Woodswallow (Artamus personatus)
- White-browed Woodswallow (Artamus superciliosus)
- White-breasted Woodswallow (Artamus leucorhynchus)
- Collared Sparrowhawk (Accipiter cirrocephalus)
- Brown Goshawk (Accipiter fasciatus)
- Spotted Harrier (Circus assimilis)
- Nankeen Kestrel (Falco cenchroides)
- Australian Hobby (Falco longipennis)
- Black Falcon (Falco subniger)
- Black-breasted Buzzard (Hamirostra melanosternon)

Of these species, Black Falcon has only been observed once during ten years and is unlikely to be a regular occurrence across the Knapdale Range. All other species have been observed in multiple years and have the potential to occur within the potential RSA at any time during daylight operation and should also therefore be considered species of concern.

A species accumulation curve for all 48 surveys is shown in Figure 3.3. The curve shows species accumulation approaching an asymptote with fewer than three new species added in the final ten surveys (i.e., the final 20% of counts increased the total count by less than 10%).

Table 3.2. Ranked list of bird species recorded across impact and control sites within and outside the rotor-swept area (RSA). Species are ranked by total count across two surveys.

Within/Outside Rotor-swept Area (RSA)	*Scientific Name* Common Name	Status*		Count		
		NCA	EPBC	May 2023	Sep 2023	Total
Within RSA	*Artamus minor* Little Woodswallow	LC		5	28	33
	Artamus cinereus Black-faced Woodswallow	LC			18	18
	Petrochelidon ariel Fairy Martin	LC			12	12
	Falco berigora Brown Falcon	LC		2	1	3
	Ardea pacifica White-necked Heron	LC		2		2
	Aquila audax Wedge-tailed Eagle	LC		1		1
	Elanus axillaris Black-shouldered Kite	LC		1		1
	Haliastur sphenurus Whistling Kite	LC		1		1
	Milvus migrans Black Kite	LC			1	1
	Psitteuteles versicolor Varied Lorikeet	LC			1	1

Within/Outside Rotor-swept Area (RSA)	*Scientific Name* Common Name	Status*		Count		
		NCA	EPBC	May 2023	Sep 2023	Total
Outside RSA	*Geopelia cuneata* Diamond Dove	LC			43	43
	Melopsittacus undulatus Budgerigar	LC		22	15	37
	Artamus minor Little Woodswallow	LC		4	21	25
	Psitteuteles versicolor Varied Lorikeet	LC		6	18	24
	Petrochelidon ariel Fairy Martin	LC		1	18	19
	Ptilotula plumula Grey-fronted Honeyeater	LC		7	7	14
	Coracina novaehollandiae Black-faced Cuckoo-shrike	LC		1	11	12
	Philemon citreogularis Little Friarbird	LC		7	3	10
	Dicaeum hirundinaceum Mistletoebird	LC		1	8	9
	Nymphicus hollandicus Cockatiel	LC			7	7
	Taeniopygia guttata Zebra Finch	LC		6	1	7
	Ptilotula keartlandi Grey-headed Honeyeater	LC		2	3	5
	Hamirostra melanosternon Black-breasted Buzzard	LC			2	2
	Artamus cinereus Black-faced Woodswallow	LC		1	1	2
	Accipiter fasciatus Brown Goshawk	LC		2		2
	Ardea alba Eastern Great Egret	LC		2		2
	Conopophila rufogularis Rufous-throated Honeyeater	LC			2	2
	Corvus coronoides Australian Raven	LC		1	1	2
	Eolophus roseicapilla Galah	LC			2	2
	Falco berigora Brown Falcon	LC		2		2
	Emblema pictum Painted Finch	LC		2		2
	Cracticus nigrogularis Pied Butcherbird	LC		1		1
	Elanus axillaris Black-shouldered Kite	LC			1	1
	Merops ornatus Rainbow Bee-eater	LC			1	1
	Philemon argenticeps Silver-crowned Friarbird	LC		1		1
	Rhipidura leucophrys Willie Wagtail	LC			1	1

* NCA = *Nature Conservation Act 1992*; EPBC = *Environment Protection and Biodiversity Conservation Act 1999*; CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; SLC = Special Least Concern; LC = Least Concern; Mig = Migratory

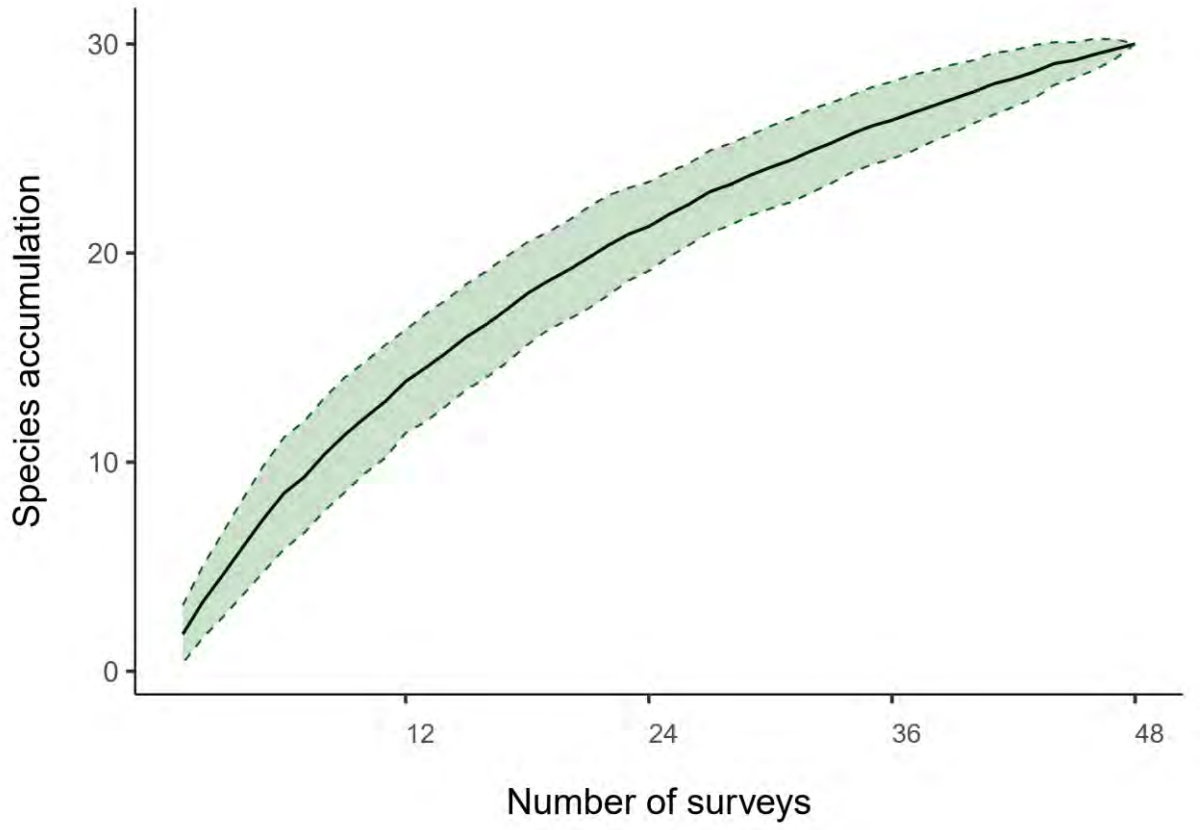


Figure 3.3. Species accumulation curve (SAC) based on bird monitoring undertaken during bird and bat utilisation surveys (BBUS) across four impact and four control sites in May and September 2023. SAC is based on "random" method, utilising random subsampling without replacement (±s.d.).

3.2.6 Bat Utilisation

A total of 13 bat calls were positively identified to genus level in at least one recording across two surveys at four impact and four control sites. A further six profiles could not be positively determined; however, possible species for all six call profiles were positively identified in other calls during surveys. Of the 13 bat taxa identified on Anabat, two taxa (*Chalinolobus gouldii* and *Taphozous* sp.) accounted for over 60% of identified calls, and 98% of calls were attributable to just six taxa.

While no data is available on how high these species fly, most microbat species are typically thought to forage within or just above the canopy. In most cases this places bat activity below the RSA, especially when turbines are as high as those proposed for Dugald River[1]. However, pilot studies using acoustic recorded attached to weather balloons tethered at 100 m have detected Eastern Bent-winged Bats (*Miniopterus orianae oceanensis*), indicating this species is at risk of collision from wind turbines (Pennay & Mills 2018 cited in Van Harten *et al.* 2022). It is conceivable other microbat species may fly at similar altitudes and will therefore occur within the RSA, at least occasionally. This is likely especially true of *Taphozous* spp. and Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*), which often forage relatively high above the canopy

[1] Assuming final turbine size is as defined in Section 1.1.

(G. Ford pers. comm.). These taxa were also among the most recorded calls on Anabat at BBUS monitoring sites. The death of Gould's Wattled Bat (*Chalinolobus gouldii*) and White-striped Freetail Bat (*Austronomus australis*) have also been recorded at wind turbines in Victorian (Moloney *et al.* 2019), and both species are present on the Knapdale Range.

Table 3.3. Ranked list of bat species recorded across four impact and four control sites. Species are ranked by total number of calls across two surveys (NB: this is not equivalent to a total count of individuals).

Confidence	*Scientific Name* Common Name	Status*		Number of calls		
		NCA	EPBC	May	Sep	Total
Positive Identification	*Chalinolobus gouldii* Gould's Wattled Bat	LC		1204	2349	3553
	Taphozous sp.			352	1114	1466
	Chaerephon jobensis Northern Freetail Bat	LC		749	465	1214
	Saccolaimus flaviventris Yellow-bellied Sheathtail Bat	LC		79	698	777
	Scotorepens greyii Little Broad-nosed Bat	LC		51	571	622
	Vespadelus baverstocki Inland Forest Bat	LC		21	254	275
	Chalinolobus nigrogriseus Hoary Wattled Bat	LC		21	36	57
	Vespadelus finlaysoni Finlayson's Cave Bat	LC		31	10	41
	Ozimops lumsdenae Northern Free-tailed Bat	LC		30	10	40
	Scotorepens balstoni Inland Broad-nosed Bat	LC		8	14	22
	Ozimops sp.			13	3	16
	Austronomus australis White-striped Freetail Bat	LC		4	1	5
	Nyctophilus sp.			1	3	4
Uncertain Identification	*C. gouldii* or *Ozimops* sp.			505	133	638
	C. nigrogriseus or *S. greyii*			11	73	84
	S. greyii or *V. baverstocki*			21	51	72
	C. gouldii or *S. balstoni*			30	10	40
	O. lumsdenae or *Taphozous* sp.			2	6	8
	S. balstoni or *Ozimops* sp.			3	5	8

* NCA = *Nature Conservation Act 1992*; EPBC = *Environment Protection and Biodiversity Conservation Act 1999*; CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; SLC = Special Least Concern; LC = Least Concern; Mig = Migratory

Four bat roosts are known on the Knapdale Range (Figure 2.2), although there may be more to be discovered. Two are abandoned mine shafts (not associated with the DRM operation) and two are natural caves. While there has been no attempt to estimate the number of bats in these features, incidental observation suggests the two artificial roosts contain far fewer bats, possibly not exceeding 20-30 individuals. In contrast, the natural structures have many individuals, likely numbering in the low 100s. Most bats within these roosts are *Taphozous* spp., although the appearance of Finlayson's Cave Bat (*Vespadelus finlaysoni*) on Anabat recorders indicates it too is likely present.

One of the natural cave roosts is located ~300 m ENE of turbine WT4 while the second is located near PNRW monitoring site CNT04 ~2.4 km from the nearest turbine. While bats from both roosts are likely to fly through the turbine field during nighttime foraging bouts, individuals using the roost near WT4 are at far greater risk.

The presence on the Knapdale Range of potentially high-flying bat species, and unknown population sizes suggests a need for further data collection around bat presence and site utilisation.

3.3 Flora and Vegetation

3.3.1 BBUS Sites

All BBUS impact and control sites consist of open *Eucalyptusl Corymbia* woodland, typically with an *Acacia* spp. shrub layer, and are dominated by a ground cover of *Triodia pungens*. Complete descriptions and photos of each site are provided in Appendix E. Following comparison with Regional Ecosystem technical descriptions (Queensland Herbarium 2023), all sites have been classified as RE1.11.2a.

3.3.2 Weeds

Several weedy species have been observed or recorded across the Knapdale Range and surrounding areas. No systematic surveys have been conducted for weedy species; however, the following are the most commonly observed:

- Kapok Weed (*Aerva javanica*). Common along roadside disturbance areas and drill pads, particularly within the Dugald River Mine footprint.
- Prickly Acacia (Vachellia nilotica). An obvious feature of flat lands at the southern edge of the Knapdale Range, typically in association with drainage lines and grazing country. This species does not appear to have become established on the rocky hills of the Knapdale Range.
- Buffel Grass (*Cenchrus* spp.). Most prolific on the western side of the range, particularly in association with drainage channels and grazing country; however, occasionally occurs higher up on rocky hills. This is a similar pattern to the spread of this species that has been observed by EcoSmart Ecology within the broader Mount Isa and Cloncurry region over the past decade.
- Farmer's Friends/Cobbler's Pegs (*Bidens* spp.). Typically seen in association rocky gullies and adjacent slopes. Generally sparsely distributed but may form dense localised patches.

Weedy species are not typically observed on the rocky upper slopes and plateaux of the Knapdale Range, nor have they been recorded in association with proposed turbine pads.

3.4 Survey Adequacy

3.4.1 Fauna Surveys

Surveys conducted between 2013–2023 meet or exceed the survey effort requirements for most survey methods recommended by Eyre *et al.* (2022). Noted exceptions to this include all direct nocturnal survey methods (spotlighting, nocturnal bird call playback, nocturnal active

search), and funnel trapping, which has not been conducted. As noted in Section 2.4, while these methods may increase overall species inventory, they will not increase the likelihood of detecting any EVNT species with the potential to occur on the Knapdale Range. The surveys are adequate to assess fauna values specially protected under legislation.

3.4.2 Bird and Bat Utilisation Surveys

The species accumulation curve (SAC) indicates the rate of accumulation of bird species during BBUS monitoring at the turbine locations is approaching an asymptote. However visual inspection of the SAC suggests further species may yet be recorded. This is supported by cross-examination records from bird surveys and foot traverses (i.e., incidental observations) collected over years of ecological work at Dugald River. Not all of concern species (raptors and aerial insectivores) known from the Knapdale Range have been recorded during BBUS monitoring. However, at risk species not yet detected during BBUS have been considered on the basis of their known presence along the Knapdale Range. Due to this approach it seems unlikely any at risk species has been overlooked.

Acoustic bat monitoring provides evidence of which species are utilising a given site and provides no information on how these species use the site, specifically at what altitudes each species is foraging. Further, Anabat is not useful for estimating the abundance of species.

3.5 FURTHER WORKS

Targeted surveys from 2014-2023 have likely recorded all potential resident vertebrate fauna species across the Knapdale Range, and a high proportion of vagrants to date. No further survey effort is strictly necessary to improve understanding of which species occur at the Knapdale Range. However, ongoing bird utilisation surveys would clarify which bird species most commonly utilise the RSA airspace. Specifically, the species accumulation curve may not yet have reached an asymptote, so at least one additional monitoring period is required, although two additional monitoring periods is preferable. Two additional periods (i.e., one additional year of monitoring) will give extra power to determine which bird species most commonly occur within the potential RSA and will provide firmer insight into which species are likely to be affected by year-round operation of turbines (i.e., resident species vs. nomadic/vagrant species).

Further information is also required on how bat species utilise the airspace at future wind turbine locations. Ideally, radar telemetry would be employed to determine how bats move in 3D space at turbine sites; however, additional information may still be gained by deploying Anabat units on temporary masts at monitoring sites, ideally at heights within the RSA, or else as high as possible. Deploying Anabat detectors in such a manner will provide greater insight into which bat species, if any, are utilising the airspace within the RSA and, subsequently, determine which species, if any, are at greatest collision risk.

4.0 REFERENCES

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Appendix A: Location of all past and ongoing monitoring locations across the Knapdale Range between 2013 and 2023

Method (Years Conducted)	Monitoring Location	Latitude (dec. deg.)	Longitude (dec. deg.)
Pest Monitoring Camera (2013 - Ongoing)	PEST1	-20.2732	140.1249
	PEST2	-20.2326	140.1503
	PEST3	-20.2088	140.1199
	PEST4	-20.2242	140.1345
Purple-necked Rock-wallaby Monitoring Camera (2014 - Ongoing)	CNT01	-20.2729	140.1312
	CNT02	-20.2609	140.1300
	CNT03	-20.2108	140.1218
	CNT04	-20.2139	140.1448
	IMP01	-20.2230	140.1335
	IMP02	-20.2257	140.1256
	IMP03	-20.2274	140.1445
	IMP04	-20.2377	140.1483
	KR01	-20.2375	140.1457
	KR05	-20.2317	140.1447
	KR07	-20.2262	140.1351
	KR10	-20.2080	140.1222
	KR13	-20.2148	140.1232
	KR14	-20.2162	140.1233
	KR16	-20.2381	140.1275
	KR18	-20.2468	140.1287
	KR19	-20.2193	140.1332
	KR20	-20.2204	140.1333
Carpentarian Pseudantechinus Initial Survey (2015)	DRM01	-20.2164	140.1330
	DRM02	-20.2189	140.1334
	DRM03	-20.2185	140.1287
	DRM04	-20.2206	140.1332
	DRM05	-20.2226	140.1335
	DRM06	-20.2263	140.1350
	DRM07	-20.2248	140.1288
	DRM08	-20.2275	140.1339
	DRM09	-20.2297	140.1403
	DRM10	-20.2245	140.1280
	KNAP01	-20.2141	140.1447
	KNAP02	-20.2279	140.1438
	KNAP03	-20.2319	140.1450
	KNAP04	-20.2376	140.1458
	KNAP05	-20.2261	140.1255

Method (Years Conducted)	Monitoring Location	Latitude (dec. deg.)	Longitude (dec. deg.)
	KNAP06	-20.2079	140.1222
	KNAP07	-20.2107	140.1217
	KNAP08	-20.2148	140.1231
	KNAP09	-20.2468	140.1286
	KNAP10	-20.2725	140.1311
	KNAP11	-20.2004	140.1385
	KNAP12	-20.1958	140.1320
	KNAP13	-20.2635	140.1302
	KNAP14	-20.2816	140.1305
	KNAP15	-20.2642	140.1498
	KNAP16	-20.2340	140.1267
	KNAP17	-20.2418	140.1279
	KNAP18	-20.2382	140.1276
	KNAP19	-20.2562	140.1291
	KNAP20	-20.2376	140.1483
	KNAP21	-20.2046	140.1221
	REG01	-20.3127	140.2463
	REG02	-20.3140	140.2455
	REG03	-20.3553	140.2685
	REG04	-20.3644	140.2781
	REG05	-20.2590	140.1843
	REG06	-20.3466	140.2579
	REG07	-20.3639	140.2712
	REG08	-20.7216	140.4780
	REG09	-20.7126	140.4803
Carpentarian Pseudantechinus Monitoring Camera (2016 - 2021)	PSEUD01	-20.2166	140.1327
	PSEUD02	-20.2193	140.1333
	PSEUD03	-20.2183	140.1291
	PSEUD04	-20.2210	140.1333
	PSEUD05	-20.2231	140.1338
	PSEUD06	-20.2261	140.1345
	PSEUD07	-20.2258	140.1254
	PSEUD08	-20.2271	140.1335
	PSEUD09	-20.2469	140.1287
	PSEUD10	-20.2245	140.1279
	PSEUD11	-20.2377	140.1457
	PSEUD12	-20.2320	140.1453

Method (Years Conducted)	Monitoring Location	Latitude (dec. deg.)	Longitude (dec. deg.)
	PSEUD13	-20.2279	140.1434
	PSEUD14	-20.2448	140.1282
	PSEUD15	-20.2483	140.1293
	PSEUD16	-20.2350	140.1276
	PSEUD17	-20.2420	140.1278
	PSEUD18	-20.2377	140.1276
	PSEUD19	-20.2562	140.1291
	PSEUD20	-20.2376	140.1483
	PSEUD21	-20.2607	140.1299
	PSEUD22	-20.2722	140.1310
	PSEUD23	-20.2640	140.1300
	PSEUD24	-20.2149	140.1227
	PSEUD25	-20.2109	140.1218
	PSEUD26	-20.2081	140.1220
	PSEUD27	-20.2046	140.1222
	PSEUD28	-20.2132	140.1470
	PSEUD29	-20.2004	140.1385
	PSEUD30	-20.2139	140.1450
Bird Survey Transect (2019 - Ongoing)	BRD01	-20.2734	140.1252
	BRD02	-20.2263	140.1221
	BRD03	-20.2064	140.1205
BBUS Monitoring Site (Bird and Bat Monitoring) (2023 - Ongoing)	BBUS-CNT01	-20.2112	140.1324
	BBUS-CNT02	-20.2299	140.1372
	BBUS-CNT03	-20.2642	140.1484
	BBUS-CNT04	-20.3054	140.1320
	BBUS-IMP01	-20.2369	140.1283
	BBUS-IMP02	-20.2478	140.1313
	BBUS-IMP03	-20.2533	140.1442
	BBUS-IMP04	-20.2643	140.1415

Appendix B: Timing of vertebrate fauna surveys across the Knapdale Range from 2014–2023

All monitoring conducted during each survey was conducted between the dates shown under "Start" and "End", but were not necessarily conducted over this entire period (e.g., bird surveys typically only conducted on one morning per survey).

Year	Period	Monitoring conducted*	Start	End
2014	Post-Wet Season	PNRW, PEST	11/04/2014	17/04/2014
	Pre-Wet Season	PNRW, PEST	7/08/2014	13/08/2014
2015	Post-Wet Season	PNRW, PEST	7/05/2015	14/05/2015
	Carpentarian Pseudantechinus Initial Survey		30/06/2015	10/07/2015
	Pre-Wet Season	PNRW, PEST	7/09/2015	14/09/2015
2016	Post-Wet Season	PNRW, PEST, PSEUD	11/05/2016	18/05/2016
	Pre-Wet Season	PNRW, PEST, PSEUD	18/09/2016	25/09/2016
2017	Post-Wet Season	PNRW, PEST, PSEUD	2/05/2017	11/05/2017
	Pre-Wet Season	PNRW, PEST, PSEUD	14/08/2017	23/08/2017
2018	Post-Wet Season	PNRW, PEST, PSEUD	2/05/2018	11/05/2018
	Pre-Wet Season	PNRW, PEST, PSEUD	10/10/2018	19/10/2018
2019	Post-Wet Season	PNRW, PEST, PSEUD	8/04/2019	17/04/2019
	Pre-Wet Season	PNRW, PEST, PSEUD, BIRD	1/10/2019	11/10/2019
2020	Post-Wet Season	PNRW, PEST, PSEUD, BIRD	7/04/2020	16/04/2020
	Pre-Wet Season	PNRW, PEST, PSEUD, BIRD	8/09/2020	17/09/2020
2021	Post-Wet Season	PNRW, PEST, PSEUD, BIRD	7/04/2021	16/04/2021
	Pre-Wet Season	PNRW, PEST, PSEUD, BIRD	27/08/2021	5/09/2021
2022	Post-Wet Season	PNRW, PEST, BIRD	17/05/2022	23/05/2022
	Pre-Wet Season	PNRW, PEST, BIRD, PIT	27/09/2022	3/10/2022
2023	Post-Wet Season	PNRW, PEST, BIRD, BBUS, PIT	2/05/2023	11/05/2023
	Pre-Wet Season	PNRW, PEST, BIRD, BBUS	5/09/2023	16/09/2023

* PNRW = Purple-necked Rock-wallaby monitoring; PEST = Pest monitoring; PSEUD = Carpentarian Pseudantechinus monitoring; BIRD = Bird survey transects; PIT = Pitfall traps; BBUS = Bird and Bat Utilisation Survey monitoring

Appendix C: Species recorded across the Knapdale Range and surrounding areas during surveys conducted between 2013 and 2023

Method of detection for each species is denoted by an 'X' in the relevant "Survey Method" column(s).

Scientific Name Common Name	Conservation Status*		Survey Method^					
	NCA	EPBC	BBUS	Bird Survey	Elliot Trap	Incidental	White-flash Camera	Black-flash Camera
AMPHIBIANS								
Cyclorana sp.							X	
Litoria caerulea Green Tree Frog	LC					X	X	
Litoria rubella Little Red Tree Frog	LC					X	X	
Litoria spaldingi Spalding's Rocket Frog	LC					X		
Rhinella marina *Cane Toad*	I	I				X	X	
REPTILES								
Aspidites melanocephalus Black-headed Python	LC					X		
Carlia amax Bauxite Rainbow-skink	LC					X		
Ctenophorus slateri Slater's Ring-tailed Dragon	LC					X	X	
Ctenotus lateralis Gravelly-soil Ctenotus	LC					X	X	
Ctenotus pantherinus Leopard Ctenotus	LC					X		
Ctenotus saxatilis Stony-soil Ctenotus	LC					X		
Delma borea Rusty-topped Delma	LC					X		
Delma nasuta Sharp-snouted Delma	LC					X		
Demansia quaesitor Sombre Whipsnake	LC					X		
Egernia hosmeri Hosmer's Skink	LC					X	X	

Scientific Name Common Name	Conservation Status*		Survey Method^					
	NCA	EPBC	BBUS	Bird Survey	Elliot Trap	Incidental	White-flash Camera	Black-flash Camera
Eremiascincus isolepis Northern Bar-lipped Skink	LC						X	
Gehyra robusta Robust Dtella	LC						X	
Heteronotia binoei Bynoe's Gecko	LC					X		
Lialis burtonis Burton's Legless Lizard	LC					X		
Liasis olivaceus Olive Python	LC					X	X	
Lophognathus horneri Horner's Dragon	LC					X		
Morethia ruficauda Lined Firetail Skink	LC					X	X	
Morethia taenioplura Firetail Skink	LC					X		
Proablepharus tenuis Northern Soil-crevice Skink	LC					X		
Pseudechis australis Mulga Snake	LC					X	X	
Pygopus steelescotti Northern Hooded Scaly-foot	LC					X		
Varanus acanthurus Ridge-tailed Monitor	LC						X	
Varanus glebopalma Black-palmed Rock Monitor	LC						X	
Varanus mertensi Mertens' Water Monitor	EN					X		
Varanus panoptes Yellow-spotted Monitor	LC					X		
Varanus sp.							X	
Varanus tristis Black-headed Monitor	LC					X	X	
AVES (birds)								

Scientific Name Common Name	Conservation Status*		Survey Method^					
	NCA	EPBC	BBUS	Bird Survey	Elliot Trap	Incidental	White-flash Camera	Black-flash Camera
Acanthagenys rufogularis Spiny-cheeked Honeyeater	LC					X	X	
Acanthiza chrysorrhoa Yellow-rumped Thornbill	LC			X		X		
Accipiter cirrocephalus Collared Sparrowhawk	LC					X		
Accipiter fasciatus Brown Goshawk	LC		X[B]	X		X		
Aegotheles cristatus Australian Owlet-nightjar	LC		X[B]			X	X	
Amytornis ballarae Kalkadoon Grasswren	LC		X[B]			X	X	
Anhinga novaehollandiae Australasian Darter	LC					X		
Aprosmictus erythropterus Red-winged Parrot	LC		X[B]	X		X		
Aquila audax Wedge-tailed Eagle	LC		X[B]	X		X		
Ardea alba Eastern Great Egret	LC		X[B]					
Ardea pacifica White-necked Heron	LC		X[B]					
Ardeotis australis Australian Bustard	LC					X		
Artamus cinereus Black-faced Woodswallow	LC		X[B]	X		X	X	
Artamus minor Little Woodswallow	LC		X[B]	X		X		
Artamus personatus Masked Woodswallow	LC			X		X		
Artamus superciliosus White-browed Woodswallow	LC			X		X		
Barnardius zonarius macgilvrayi Cloncurry Ringneck	LC			X		X		

Scientific Name Common Name	Conservation Status*		Survey Method^					
	NCA	EPBC	BBUS	Bird Survey	Elliot Trap	Incidental	White-flash Camera	Black-flash Camera
Cacatua galerita Sulphur-crested Cockatoo	LC		X[B]	X		X		
Cacomantis pallidus Pallid Cuckoo	LC			X				
Centropus phasianinus Pheasant Coucal	LC			X				
Certhionyx variegatus Pied Honeyeater	LC					X		
Chalcites basalis Horsefield's Bronze Cuckoo	LC			X				
Chlamydera maculata Spotted Bowerbird	LC		X[B]	X		X		
Circus assimilis Spotted Harrier	LC			X		X		
Cissomela pectoralis Banded Honeyeater	LC		X[B]	X		X		
Climacteris melanurus Black-tailed Treecreeper	LC		X[B]	X		X		
Colluricincla harmonica Grey Shrike-thrush	LC		X[B]	X		X	X	
Colluricincla megarhyncha Little Shrike-thrush	LC			X				
Conopophila rufogularis Rufous-throated Honeyeater	LC		X[B]	X		X		
Coracina novaehollandiae Black-faced Cuckoo-shrike	LC		X[B]	X		X		
Coracina papuensis White-bellied Cuckoo-shrike	LC			X		X		
Corvus coronoides Australian Raven	LC		X[B]	X		X	X	
Corvus sp.							X	
Cracticus nigrogularis Pied Butcherbird	LC		X[B]	X		X	X	
Cracticus torquatus Grey Butcherbird	LC			X				

Scientific Name Common Name	Conservation Status*		Survey Method^					
	NCA	EPBC	BBUS	Bird Survey	Elliot Trap	Incidental	White-flash Camera	Black-flash Camera
Cygnus atratus Black Swan	LC					X		
Daphoenositta chrysoptera Varied Sittella	LC					X		
Dicaeum hirundinaceum Mistletoebird	LC		X[B]	X		X		
Dromaius novaehollandiae Emu	LC			X				
Egretta novaehollandiae White-faced Heron	LC					X		
Elanus axillaris Black-shouldered Kite	LC		X[B]	X		X		
Elseyornis melanops Black-fronted Dotterel	LC					X		
Emblema pictum Painted Finch	LC		X[B]	X		X	X	
Eolophus roseicapilla Galah	LC		X[B]	X		X		
Epthianura tricolor Crimson Chat	LC					X		
Eudynamys orientalis Common Koel	LC					X		
Eurostopodus argus Spotted Nightjar	LC					X		
Falco berigora Brown Falcon	LC		X[B]	X		X		
Falco cenchroides Nankeen Kestrel	LC					X		
Falco longipennis Australian Hobby	LC					X		
Falco subniger Black Falcon	LC					X		
Gavicalis virescens Singing Honeyeater	LC			X		X		

Scientific Name Common Name	Conservation Status*		Survey Method^					
	NCA	EPBC	BBUS	Bird Survey	Elliot Trap	Incidental	White-flash Camera	Black-flash Camera
Geopelia cuneata Diamond Dove	LC		X[B]	X		X	X	
Geopelia placida Peaceful Dove	LC		X[B]	X		X	X	
Geophaps plumifera Spinifex Pigeon	LC		X[B]	X		X	X	
Gerygone fusca Western Gerygone	LC					X		
Grallina cyanoleuca Magpie Lark	LC		X[B]	X		X		
Gymnorhina tibicen Australian Magpie	LC		X[B]	X		X		
Haliastur sphenurus Whistling Kite	LC		X[B]			X		
Hamirostra melanosternon Black-breasted Buzzard	LC		X[B]			X		
Heteromunia pectoralis Pictorella Mannikin	LC					X		
Himantopus leucocephalus Pied Stilt	LC					X		
Lalage tricolor White-winged Triller	LC			X		X		
Lichenostomus penicillatus White-plumed Honeyeater	LC					X		
Lichmera indistincta Brown Honeyeater	LC		X[B]	X		X		
Malurus assimilis Purple-backed Fairy-wren	LC		X[B]	X		X		
Malurus melanocephalus Red-backed Fairy-wren	LC			X		X		
Manorina flavigula Yellow-throated Miner	LC			X		X		
Megalurus mathewsi Rufous Songlark	LC		X[B]	X		X		

Scientific Name Common Name	Conservation Status*		Survey Method^					
	NCA	EPBC	BBUS	Bird Survey	Elliot Trap	Incidental	White-flash Camera	Black-flash Camera
Melanodryas cucullata picata Northern Inland Hooded Robin	LC			X		X		
Melithreptus brevirostris Brown-headed Honeyeater	LC					X		
Melithreptus gularis Black-chinned Honeyeater	LC		X[B]	X		X		
Melopsittacus undulatus Budgerigar	LC		X[B]	X		X		
Merops ornatus Rainbow Bee-eater	LC		X[B]	X		X		
Microeca fascinans Jacky Winter	LC			X		X		
Milvus migrans Black Kite	LC		X[B]			X		
Myiagra nana Paperbark Flycatcher	LC			X		X		
Ninox boobook Southern Boobook	LC						X	
Nymphicus hollandicus Cocaktiel	LC		X[B]	X		X		
Ocyphaps lophotes Crested Pigeon	LC			X		X		
Oreoica gutturalis Crested Bellbird	LC		X[B]	X		X		
Oriolus sagittatus Olive-backed Oriole	LC		X[B]	X				
Pachycephala rufiventris Rufous Whistler	LC		X[B]	X		X		
Pardalotus rubricatus Red-browed Pardalote	LC		X[B]	X		X		
Pardalotus striatus Striated Pardalote	LC			X		X		
Petrochelidon ariel Fairy Martin	LC		X[B]			X		

Scientific Name Common Name	Conservation Status*		Survey Method^					
	NCA	EPBC	BBUS	Bird Survey	Elliot Trap	Incidental	White-flash Camera	Black-flash Camera
Petroica goodenovii Red-capped Robin	LC					X		
Phaps chalcoptera Common Bronzewing	LC		X[B]	X		X		
Philemon argenticeps Silver-crowned Friarbird	LC		X[B]	X		X		
Philemon citreogularis Little Friarbird	LC		X[B]	X		X		
Plegadis falcinellus Glossy Ibis	SLC	Mig				X		
Podargus strigoides Tawny Frogmouth	LC						X	
Poephila acuticauda Long-tailed Finch	LC			X		X		
Pomatostomus temporalis Grey-crowned Babbler	LC		X[B]	X		X		
Poodytes carteri Spinifexbird	LC		X[B]	X		X		
Psitteuteles versicolor Varied Lorikeet	LC		X[B]	X		X		
Ptilotula flavescens Yellow-tinted Honeyeater	LC					X		
Ptilotula keartlandi Grey-headed Honeyeater	LC		X[B]	X		X	X	
Ptilotula plumula Grey-fronted Honeyeater	LC		X[B]	X		X		
Rhipidura fuliginosa Grey Fantail	LC			X				
Rhipidura leucophrys Willie Wagtail	LC		X[B]	X		X	X	
Smicrornis brevirostris Weebill	LC		X[B]	X		X		
Synoicus ypsilophorus Brown Quail	LC			X		X		

Scientific Name Common Name	Conservation Status*		Survey Method^					
	NCA	EPBC	BBUS	Bird Survey	Elliot Trap	Incidental	White-flash Camera	Black-flash Camera
Tachybaptus novaehollandiae Australasian Grebe	LC					X		
Taeniopygia bichenovii Double-barred Finch	LC			X		X		
Taeniopygia guttata Zebra Finch	LC		X[B]	X		X		
Todiramphus pyrrhopygius Red-backed Kingfisher	LC		X[B]	X		X		
Turnix velox Little Button-quail	LC					X		
Tyto alba Eastern Barn Owl	LC					X		
MAMMALS								
Austronomus australis White-striped Freetail Bat	LC		X[A]					
Canis dingo Dingo	LC					X	X	X
Chaerephon jobensis Northern Freetail Bat	LC		X[A]					
Chalinolobus gouldii Gould's Wattled Bat	LC		X[A]					
Chalinolobus nigrogriseus Hoary Wattled Bat	LC		X[A]					
Felis catus Feral Cat	I	I					X	X
Notamacropus agilis Agile Wallaby	LC					X		
Nyctophilus sp.	LC		X[A]					
Osphranter robustus Common Wallaroo	LC					X	X	
Osphranter rufus Red Kangaroo	LC					X		
Ozimops lumsdenae Northern Free-tailed Bat	LC		X[A]					

Scientific Name Common Name	Conservation Status*		Survey Method^					
	NCA	EPBC	BBUS	Bird Survey	Elliot Trap	Incidental	White-flash Camera	Black-flash Camera
Ozimops sp.			X[A]					
Petrogale purpureicollis Purple-necked Rock-wallaby	NT					X	X	
Pseudantechinus mimulus Carpentarian False Antechinus	LC				X	X	X	
Saccolaimus flaviventris Yellow-bellied Sheathtail Bat	LC		X[A]					
Scotorepens balstoni Inland Broad-nosed Bat	LC		X[A]					
Scotorepens greyii Little Broad-nosed Bat	LC		X[A]					
Sus scrofa Feral Pig	I	I				X	X	X
Tachyglossus aculeatus Short-beaked Echidna	SLC					X	X	
Taphozous sp.			X[A]			X		
Taphozous troughtoni Troughton's Sheath-tailed Bat	LC					X		
Vespadelus baverstocki Inland Forest Bat	LC		X[A]					
Vespadelus finalysoni Finlayson's Cave Bat	LC		X[A]					
Zyzomys argurus Common Rock Rat	LC				X		X	

Appendix D: Likelihood assessment for threatened vertebrate species

Likelihood assessment for threatened vertebrate species either known from within 25 km of the Knapdale Range or identified as having the potential to occur within 25 km of the Knapdale Range based on EPBC Protected Matters search, Wildnet search, and Atlas of Living Australia search. The likelihood assessment relates directly to the species likelihood of occurrence on the Knapdale Range, not within 25 km of the Knapdale Range. Mobile fauna species which could occur on the Knapdale Range but are unlikely to represent a permanent population or a population relying on the site for long-term viability (vagrants) are assessed as 'Transient'.

Scientific Name Common Name	STATUS		Typical Habitat	Habitat at Knapdale Range	Local Records	Likelihood Assessment
	NCA	EPBC				
FISH						
Pristis pristis Freshwater Sawfish	LC	Vul	Channels of large freshwater rivers with permanent water	None present	No records within 25km of the Knapdale Range	Will not occur
REPTILES						
Acanthophis hawkei Plains Death Adder	Vul	Vul	Cracking soils on treeless floodplains across northern Australia	None present	No records within 25km of the Knapdale Range	Will not occur
Elseya lavarackorum Gulf Snapping Turtle	Vul	End	Deep, permanent pools of the Gregory and Nicholson River systems	None present	No records within 25km of the Knapdale Range	Will not occur
Varanus mertensi Mertens' Water Monitor	End		Freshwater bodies such as rivers, swamps and rocky waterholes, with overhanging trees and large rocks for basking	None present. Known suitable habitat exists on the Dugald River ~5km E.	Recorded during surveys at Longamundi on the Dugald River	Will not occur
AVES (birds)						

Scientific Name Common Name	STATUS		Typical Habitat	Habitat at Knapdale Range	Local Records	Likelihood Assessment
	NCA	EPBC				
Amytornis dorothaea Carpentarian Grasswren	End	End	Long-unburnt open woodland or grassland dominated by hummock grass (*Triodia* spp.) on stony soils or, in the north of its distribution, rocky outcrops. Appears to preference large, dense, mature clumps of hummock grass rather than small, sparse clumps.	None present. While visually suitable, the species preferred *Triodia longiceps* is not present and habitat is not representative of the species' typical habitat in the south of its range (i.e. stony, skeletal soils on valley floors).	No records within 25km of the Knapdale Range, nor within 10 y of survey effort	Will not occur
Calidris ferruginea Curlew Sandpiper	End	Cr End	Saline and freshwater wetlands, saltmarshes, estuaries, mudflats. Prefers areas with exposed mud for foraging.	None present	No records within 25km of the Knapdale Range. Only very rarely recorded in the broader region, most records associated with Lake Moondarra near Mount Isa	Will not occur
Erythrotriorchis radiatus Red Goshawk	End	Vul	Open forests, woodlands, wetlands, rainforest fringes, particularly along watercourses with large trees suitable for nesting	None suitable. Potential habitat may be present on the Dugald River.	No records within 25km of the Knapdale Range. Sparse regional records, almost always in association with major waterways, but all very old or undated, typically with poor spatial resolution.	Will not occur

Scientific Name Common Name	STATUS		Typical Habitat	Habitat at Knapdale Range	Local Records	Likelihood Assessment
	NCA	EPBC				
Erythrura gouldiae Gouldian Finch	End	End	Grassy *Eucalyptus* woodland close to water. Native grasses form important foraging habitat, and hollow-bearing eucalypts are used for breeding.	The entire Knapdale Range theoretically provides suitable foraging, breeding and watering habitat; however, most waterholes are ephemeral and hollow-bearing trees are relatively sparse. Large, persistent waterholes on the Dugald River (e.g., Longamundi), probably provide the most likely habitat for any vagrant birds.	No records within 25km of Knapdale Range. All QLD records have been subject to coordinate rounding, and the majority are undated. The most reliable recent records are >10y old from Chidna Station, near Gunpowder ~125km northwest of the Knapdale Range.	Will not occur
Falco hypoleucos Grey Falcon	NT	-	Lightly treed inland plains, gibber deserts, pastoral lands	Potential to occur across the entire Knapdale Range; however, the Range is more heavily treed, has more topographical relief, and is less arid than those habitats in which the species is typically recorded.	No records within 25km of the Knapdale Range. Many records undated, nearest recent record from 2019 near Cloncurry; however, other *Falco* species are often be confused by inexperienced observers for *F. hypoleucos* and records by inexperienced observers and/or without photographic evidence should be treated as circumspect.	Transient

Scientific Name Common Name	STATUS		Typical Habitat	Habitat at Knapdale Range	Local Records	Likelihood Assessment
	NCA	EPBC				
Grantiella picta Painted Honeyeater	Vul	Vul	Found mainly in dry open woodlands and forests, particularly box-ironbark woodlands. It may also occur in riparian forest, on plains with scattered eucalypts and in remnant trees on farmland and their occurrence is strongly associated with mistletoe.	Sparse trees with collared mistletoe (*Lysiana spathulata*), but these are scarce and neither *L. spathulate* nor its host trees are reported as being known habitat values for Painted Honeyeater	A single record from 2012 at Quamby Rodeo Grounds ~20km southeast. More distant records in the region are sparse and mostly >10y old, suggesting the species does not occur with any regularity in the broader region.	Unlikely
Numenius madagascariensis Eastern Curlew	End	Cr End	Coastal and intertidal zone	None present	No records within 25km of the Knapdale Range.	Will not occur
Plegadis falcinellus Glossy Ibis	SLC	Mig	Natural and artificial freshwater waterbodies including lakes, rivers, swamps, sewage ponds and irrigated crop fields. Can also occur on coastal water bodies e.g., estuaries, deltas and lagoons	TSF provided wading habitat in 2021 on beached tailings. Tailings were unlikely to support foraging resources and have since been inundated. It is highly unlikely that this area continues to provide habitat amenity.	A single record from the TSF dam in 2021 on beached tailings.	Present (Unlikely post-2021)
Pezoporus occidentalis Night Parrot	End	End	Relatively poorly understood, generally considered to favour spinifex grassland and chenopod shrubland on sandy or skeletal soils. In QLD known from breakaway habitats in and around Diamantina NP and Pullen Pullen Nature Refuge	Unlikely to be any present. Spinifex abounds but species is not known from rocky range country.	No records within 25km of the Knapdale Range. Nearest records from Diamantina NP and Pullen Pullen Nature Refuge >350km south.	Will not occur

Scientific Name Common Name	STATUS		Typical Habitat	Habitat at Knapdale Range	Local Records	Likelihood Assessment
	NCA	EPBC				
Rostratula australis Australian Painted Snipe	Vul	End	Found in a wide range of habitats including ephemeral swamps, dams, rice paddocks, waterlogged grasslands, roadside drains and even brackish waterways (Marchant and Higgins 1993).	None present	No records within 25km of the Knapdale Range	Will not occur
MAMMALS						
Macroderma gigas Ghost Bat	End	Vul	Habitats used for foraging vary from dry open woodlands to tropical rainforests (Wilmer 2012). Caves, rock crevices and old mines are used for roosting.	Two known abandoned mines within close proximity to the Range, and two known bat roosts in narrow caves. All locations are known to be inhabited by other microchiropterans, notably *Taphozous* spp.	No records within 25km of the Knapdale Range. Very sparse regional records, all >10y, most much older. Cluster of records associated with Camooweal Caves, and most recent regional record from 2011 just south of Chidna Station, ~125km northwest of the Knapdale Range. Species is likely regionally extinct.	Will not occur
Macrotis lagotis Greater Bilby	Vul	End	Soils which can be excavated for deep burrows. Largely confined to inland sandy deserts in NT and WA, with a restricted distribution in QLD on clay and stony soils in the Channel Country.	None present. Soils are skeletal and rocky, not suited to excavation.	No records within 25km of Knapdale Range	Will not occur
Petrogale purpureicollis Purple-necked Rock-wallaby	Vul	-	Massive rocky landforms, especially boulder piles, cliffs and gorges, with abundant caves and overhangs for daylight sheltering.	All large rocky outcrops, especially cliffs and rocky gullies dropping off the edge of the Range	Recorded annually during surveys at multiple known, monitored locations across the Knapdale Range	Present

Scientific Name Common Name	STATUS		Typical Habitat	Habitat at Knapdale Range	Local Records	Likelihood Assessment
	NCA	EPBC				
Sminthopsis douglasi Julia Creek Dunnart	End	Vul	Restricted to blacksoil clays with deep, wide cracks in Mitchell grass (*Astrebla* spp.) grasslands	None present	No records with 25km of the Knapdale Range	Will not occur
Tachyglossus aculeatus Short-beaked Echidna	SLC	-	Occurs in almost all terrestrial habitats except intensively managed farms.	Entire Knapdale Range	Regularly recorded on the Knapdale Range on survey cameras and during foot traverses	Present

Appendix E: Vegetation and landscape descriptions of impact (IMP) and control (CNT) BBUS survey sites

Vegetation and landscape descriptions of impact (IMP) and control (CNT) BBUS survey sites. Crown cover percentage and height range of trees and shrubs and percent cover of the ground stratum is given in parentheses after species list. Relevant notes pertaining to each site is given in square brackets after the description. Regional Ecosystem (RE) is provided based on the recorded description and comparison with technical descriptions in Kelman (2019).

<table>
<tr><th>Site</th><th>Description</th><th>RE</th></tr>
<tr><td rowspan="3">BBUS-IMP01</td><td colspan="2">Open woodland of Corymbia capricornia/terminalis and occasional Eucalyptus leucophloia (25%, 3–5m) with Acacia monticola and sparse A. holosericea, Grevillea dryandri and Dodonaea dodecandra shrubs (30%, 0.5–3m) and Triodia pungens ground cover (90%) on rocky hill.</td><td rowspan="3">1.11.2a</td></tr>
<tr><td>North</td><td>East</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td rowspan="3">BBUS-IMP02</td><td colspan="2">Open woodland of Eucalyptus leucophloia and occasional Corymbia capricornia/terminalis (15%, 4–5m) with Acacia monticola and sparse Santalum lanceolatum, Grevillea dryandri and A. gonoclada shrubs (25%, 1–2m) and Triodia pungens ground cover (80%) on rocky hill.</td><td rowspan="3">1.11.2a</td></tr>
<tr><td>North</td><td>East</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td></td><td>South</td><td>West</td><td></td></tr>
<tr><td></td><td>  </td><td>  </td><td></td></tr>
<tr><td></td><td>South</td><td>West</td><td></td></tr>
<tr><td></td><td>  </td><td>  </td><td></td></tr>
</table>

<table>
<tr><th>Site</th><th>Description</th><th>RE</th></tr>
<tr><td>BBUS-IMP03</td><td>Open woodland of Corymbia capricornia/terminalis, Eucalyptus leucophloia and sparse Grevillea mimosoides (15%, 4–6m) with Acacia monticola, A. holosericea, Tephrosia sp. and Santalum lanceolatum shrubs (15%, 2–4m) and ground cover of Triodia pungens and Cassytha sp. (90%) with sparse Cymbopogon bombicynus and Trichodesma zeylanicum on rocky hill.
<table>
<tr><th>North</th><th>East</th><th>South</th><th>West</th></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
</table></td><td>1.11.2a</td></tr>
<tr><td>BBUS-IMP04</td><td>Open woodland of Corymbia capricornia/terminalis and occasional Eucalyptus leucophloia (15%, 4–6m) with Acacia monticola and sparse A. retivenea, Tephrosia sp. and A. asperulacea shrubs (35%, 0.5–3m) and Triodia pungens ground cover (80%) on rocky hill adjacent steep gorge. [Vegetation gives way to open woodland of E. leucophloia, A. retivenea and T. pungens just south of turbine pad.]
<table>
<tr><th>North</th><th>East</th><th>South</th><th>West</th></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
</table></td><td>1.11.2a</td></tr>
</table>

<table>
<tr><th>Site</th><th>Description</th><th>RE</th></tr>
<tr><td>BBUS-CNT01</td><td>Open woodland of Corymbia capricornia/terminalis (10%, 4–5m) with Acacia monticola, A. retivenea and sparse Eremophila latrobei, Tephrosia sp., Grevillea dryandra and A. asperulacea shrubs (20%, 0.5–3m) and Triodia pungens ground cover (75%) on rocky hill.
<table>
<tr><th>North</th><th>East</th><th>South</th><th>West</th></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
</table></td><td>1.11.2a</td></tr>
<tr><td>BBUS-CNT02</td><td>Open Corymbia capricornia/terminalis woodland (10%, 2–4m) with Acacia monticola, Dodonaea dodecandra, Eremophila latrobei, Grevillea dryandri and sparse A. retivenea and Santalum lanceolatum shrubs (60%, 0.5–3m) and Triodia pungens ground cover (75%) on rocky hill.
<table>
<tr><th>North</th><th>East</th><th>South</th><th>West</th></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
</table></td><td>1.11.2a</td></tr>
<tr><td>BBUS-CNT03</td><td>Open woodland of Eucalyptus leucophloia (15%, 4–6m) with Acacia retivenea and Tephrosia sp. shrubs (5%, 1–2m) and Triodia pungens ground cover (90%) on rocky hill. [A. monticola dominates shrub layer on slopes just east of turbine pad.]
<table>
<tr><th>North</th><th>East</th><th>South</th><th>West</th></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
</table></td><td>1.11.2a</td></tr>
</table>

<table>
<tr><th>Site</th><th>Description</th><th>RE</th></tr>
<tr><td rowspan="3">BBUS-CNT04</td><td colspan="3">Open woodland of Eucalyptus leucophloia (30%, 4–5m) with Acacia retivenea and Crotalaria sp. shrubs (15%, 1-3m) and Triodia pungens ground cover (80%) on rocky ridge. [Tephrosia sp. occurs in nearby gully, Acacia monticola joins shrub/tree strata on eastern slope of ridge.]</td><td rowspan="3">1.11.2a</td></tr>
<tr><td>North</td><td>East</td><td>South</td><td>West</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
</table>

APPENDIX B: AARC Flora and Fauna Report






Dugald River Project

Terrestrial Flora and Fauna Assessment

Prepared for:
MMG Australia Limited

July 2011

AustralAsian Resource Consultants

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LIST OF ABBREVIATIONS

°C	-	degrees Celsius
AARC	-	AustralAsian Resource Consultants Pty Ltd
DEEDI	-	Department of Employment, Economic Development and Innovation
DERM	-	Department of Environment and Resource Management
EPBC Act	-	*Environment Protection and Biodiversity Conservation Act 1999*
ERE	-	Endangered Regional Ecosystem
ESA	-	Environmentally Sensitive Area
ha	-	hectares
km	-	kilometres
LP Act	-	*Land Protection (Pest and Stock Route Management) Act 2002*

m	-	metres
MLA	-	Mining Lease Application
mm	-	millimetres
MMG	-	MMG Australia Limited
Mt	-	Million tonnes
NC Act	-	*Nature Conservation Act 1992*
NCWR	-	*Nature Conservation (Wildlife) Regulation 2006*
NSW	-	New South Wales
QGEOP	-	*Queensland Government Environmental Offsets Policy*
RE	-	Regional Ecosystem
REDD	-	Regional Ecosystem Description Database
TSF	-	Tailings Storage Facility
VM Act	-	*Vegetation Management Act 1999*
VMR	-	*Vegetation Management Regulation 2000*
WoNS	-	Weed of National Significance

EXECUTIVE SUMMARY

AustralAsian Resource Consultants Pty Ltd was commissioned by the MMG Australia Limited to conduct a Terrestrial and Aquatic Flora and Fauna Assessment for the proposed Dugald River Project site. The survey also included environmental assessment of three infrastructure corridors associated with the Project: the powerline, access road and water pipeline.

A total of five surveys were conducted on the Project site and associated corridors. The initial wet season survey was undertaken over nine consecutive days between the 27th of March and the 4th of April 2008. The dry season survey and an initial assessment of the corridors was undertaken over ten consecutive days between the 4th and 13th of August 2008. An additional three day assessment of the powerline corridor was conducted from the 1st to the 3rd of October 2008. A three day assessment of modifications to the alignment of the water pipeline corridor and access road corridor was conducted from the 7th to 9th of April 2010. An additional wet season survey occurred between 21st to 31st of March 2011, to capture additional ephemeral floral species and supplement the existing fauna catalogue from previous surveys.

To assess the environmental values of flora and fauna communities on the Project site and corridors, AARC undertook the following scope of works:

- A literature and database review to identify species of conservation significance known from the region. This enabled these species to be targeted during the field survey components of the study;
- Standard field survey methodologies to determine the composition of species inhabiting the Project site and corridors, particularly species of conservation significance; and
- Preparation of a report describing significant ecological factors and outlining possible management strategies to reduce any foreseeable impacts associated with the proposed activities.

SITE DESCRIPTION

The Project site is located approximately 85 kilometres north-east of Mount Isa and 65 kilometres north-west of Cloncurry, in north-western Queensland. The Project is located adjacent to the proposed Roseby Copper Project.

MMG Australia Limited is proposing to develop a zinc/lead and copper mining and processing operation at the Project site. The Dugald River Project will process approximately 2 million tonnes of zinc/lead ore per year, and an additional 1 million tonnes of copper ore per year. Mining will be conducted using underground techniques with portals near the proposed ore processing plant.

FIELD SURVEY METHODS

Scoping of the Project site and corridors was conducted using aerial photography and broad ground-truthing using four-wheel drive vehicles and where terrain proved impassable, on-foot. Site scoping also allowed for the identification of boundaries of Regional Ecosystems, so that mapping of the Regional Ecosystems could be produced.

A number of Secondary transects were surveyed to obtain a detailed floristic inventory of the dominant and associated woody plants within each vegetation type. In order to map and confirm the extent of the vegetation communities, Quaternary plots were used along the boundaries of the

communities. The quality of communities was assessed with regard to their likely value and viability as a representative vegetation type.

Primary fauna transects and additional secondary sites were located in areas representative of the Project"s vegetation types and habitat types. In addition, habitats potentially inhabited by species of conservation significance were targeted and thoroughly assessed for species occurrence. A range of trapping and survey techniques were employed at each study site including but not limited to pitfall trapping, Elliottt trapping, funnel trapping, harp trapping, habitat searching, avian observation, ANABAT recording and spotlighting. Incidental/opportunistic records were included in the species list to produce a comprehensive fauna species list for the Project site and corridors.

SURVEY RESULTS – PROJECT SITE

Flora

In summary, eight vegetation communities comprise the Project site with a total of 222 flora species identified. No flora species identified are of conservation significance and 17 species are introduced.

All eight vegetation communities were classed as Remnant Vegetation as defined in the *Queensland Vegetation Management Act 1999*. A summary of the conservation significance of all distinct vegetation communities occurring on the Project site and their equivalent Regional Ecosystems is provided in the table below.

Summary of the Conservation Significance of Vegetation Communities – Project site

Vegetation Community	Regional Ecosystem Equivalents	Environment Protection and Biodiversity Conservation Act 1999 Status	Queensland Vegetation Regulation 2000	Department of Environment and Resource Management Biodiversity Status
Snappy Gum Open Woodland on steep hills and strike ridges	1.11.2a	Not Listed	Least Concern	No Concern at Present
Snappy Gum Open Woodland on foothills	1.11.2e	Not Listed	Least Concern	No Concern at Present
Cloncurry Box Open Woodland on low broad hills	1.11.3a	Not Listed	Least Concern	No Concern at Present
Cloncurry Box Open Woodland on hills	1.11.3x1	Not Listed	Least Concern	No Concern at Present
Mixed Bloodwood Riparian Woodland	1.3.6b	Not Listed	Least Concern	Of Concern
River Red Gum Riparian Woodland	1.3.7b	Not Listed	Least Concern	Endangered
Gidgee Open Woodland	1.11.2x2	Not Listed	Least Concern	No Concern at Present

Silver Box/ Cloncurry Box Open Woodland on red earths	1.5.4x3	Not Listed	Least Concern	Of Concern

One vegetation community on the Project site (1.3.7b – River Red Gum Riparian Woodland) is listed as „Endangered" under the *Department of Environment and Resource Management Biodiversity Status* due to severe degradation and high grazing pressure. The overall condition of this community on the Project site is reduced by cattle grazing and weed invasion, in particularly alteration of groundcover by a dominant Buffel Grass (*Pennisetum ciliare*). Based on proposed disturbance plans for the Project and current infrastructure, an additional area of 16.72 ha will necessitate clearing of this community.

The Silver Box/Cloncurry Box Open Woodland (1.5.4x3) is listed as „Of Concern" under the *Department of Environment and Resource Management Biodiversity Status* due to high grazing pressure and weed invasion. The overall condition of this community within the Project site is relatively healthy, with little invasion of introduced species. Based on proposed disturbance plans for the Project, 23.57 ha will be cleared within this community.

The Mixed Bloodwood Riparian Woodland (1.3.6b) is listed as „Of Concern" under the *Department of Environment and Resource Management Biodiversity Status* due to high grazing pressure, changed fire regimes and weed invasion. Based on the proposed plans for the Project no clearing is required. Assuming mitigation strategies are implemented, and disturbance is minimised, the community is unlikely to be significantly impacted at a regional scale.

Fauna

A combined total of 113 vertebrate fauna species were identified on the Project site during the flora and fauna assessment, comprising 16 reptiles, 65 birds, 26 mammals and 6 amphibians.

Three bird species listed as Migratory and/or Marine under the *Environment Protection and Biodiversity Conservation Act 1999* were observed on the Project site, the Whistling Kite (*Haliastur sphenurus*), Rainbow Bee-eater (*Merops ornatus*) and Sacred Kingfisher (*Todiramphus sanctus*). Although common throughout their respective ranges within Australia, they are protected under international agreements incorporated by the *Environment Protection and Biodiversity Conservation Act 1999*. The distribution of each listed species identified is widespread throughout northern and eastern Australia, and the local populations on the Project site are unlikely to constitute an „ecologically significant proportion" of the total population of these species. Furthermore, the Project site is not at the limit of these species" range, nor are these species considered to be declining within the region. Therefore, it is unlikely the Project will have a significant impact on the regional populations of these species. Mining activities involved with the Project are not expected to have a significant impact on matters of national environmental significance.

The Purple-necked Rock-wallaby (*Petrogale purpureicollis*) was identified along the Knapdale Range within the Project site. This species is listed as „Vulnerable" under the Nature Conservation (Wildlife) Regulation 2006.

Four introduced species were identified on the Project site including the House Mouse (*Mus musculus*), Feral Cat (*Felis catus*), Feral Pig (*Sus scrofa*) and Dingo (*Canis familiaris dingo*), the latter three of which are declared as Class 2 pests under the *Land Protection (Pest and Stock Route Management) Act 2002*.

SURVEY RESULTS – POWERLINE CORRIDOR

The Minerals and Metals Group propose to construct a powerline from the Project site to Chumvale Substation, which is located approximately 10 kilometres west of Cloncurry on the Barkly Highway. The powerline corridor will be approximately 60 kilometres in length and a width of 400 metres was surveyed along the corridor.

Six vegetation communities inhabit the powerline corridor. Communities are listed and described in the table below, each with their corresponding conservation status.

Vegetation Communities and Corresponding Conservation Status within the Powerline Corridor

Vegetation Community / Regional Ecosystem	Environment Protection and Biodiversity Conservation Act 1999 Status	Queensland Vegetation Management Regulation 2000	Department of Environment and Resource Management Biodiversity Status
Snappy Gum Open Woodland / 1.11.2a	Not Listed	Least Concern	No Concern at Present
Cloncurry Box Open Woodland / 1.11.3x1	Not Listed	Least Concern	No Concern at Present
River Red Gum Riparian Woodland / 1.3.7a / 1.3.7b	Not Listed	Least Concern	Endangered
Gidgee Open Woodland / 1.11.2x2	Not Listed	Least Concern	No Concern at Present
Mixed Bloodwood Riparian Woodland / 1.3.6b	Not Listed	Least Concern	Of Concern
Non-remnant Grassland	Not Listed	Not Listed	Not Listed

Based on proposed disturbance plans for the Project it is estimated that clearing will be required within all vegetation communities identified. The *Policy for Vegetation Management Offsets* can be applied to the River Red Gum Riparian Woodland however assuming appropriate mitigation measures are implemented it is unlikely the Project will adversely affect the health or abundance of this community. It is unlikely that disturbance within the powerline corridor will significantly impact on the regional occurrence of the other five vegetation communities.

Two features of conservation significance inhabit the powerline corridor. These include:

- River Red Gum riparian community (1.3.7a); and
- Rocky outcrops containing Purple-necked Rock-wallaby (*Petrogale purpureicollis*) habitat.

Seven River Red Gum Riparian Woodland creek crossings were identified within the powerline corridor. The River Red Gum riparian community is listed as „Endangered" under the *Department of Environment and Resource Management Biodiversity Status*. This community is considered the most diverse within the local area of the Project site and helps maintain the environmental integrity of

watercourses in the region. The estimated area of vegetation disturbance from construction of the powerline within the River Red Gum riparian community, assuming a footprint width of 80 m, is approximately 23 ha.

Six rocky outcrops that could potentially provide Purple-necked Rock-wallaby (*Petrogale purpureicollis*) habitat were identified within the powerline corridor. The Purple-necked Rock-wallaby (*Petrogale purpureicollis*), listed as Vulnerable under Schedule 3 of the *Nature Conservation (Wildlife) Regulation 2006* but not listed under the *Environment Protection and Biodiversity Conservation Act 1999,* was observed during the powerline corridor survey at two rocky outcrops and potential habitat and/or foraging sites were observed at most other rocky outcrop locations.

Six introduced flora species were identified within two areas of the powerline corridor. Species identified included Mimosa Bush (*Acacia farnesiana*), Kapok Bush (*Aerva javanica*), Calotrope (*Calotropis procera*), Buffel Grass (*Pennisetum ciliare*), Colocynth (*Citrullus colocynthis*) and Downy Thornapple (*Datura inoxia*). Although none of these species are listed under the *Land Protection (Pest and Stock Route Management) Act 2002*, many of these species establish rapidly and out-compete existing native plants.

SURVEY RESULTS – WATER PIPELINE CORRIDOR

The water pipeline route commences at the T-intersection of the Ernest Henry / Lake Julius Pipeline and travels south and then west to the proposed process plant area within Project site. The corridor is approximately 10 kilometres long and a corridor width of 40 metres was surveyed.

Four vegetation communities are present along the water pipeline corridor. Communities are listed and described in the table below, each with their corresponding conservation status.

Vegetation Communities on the Water Pipeline Corridor

Vegetation Community / Regional Ecosystem	Environment Protection and Biodiversity Conservation Act 1999 Status	Queensland Vegetation Management Regulation 2000	Department of Environment and Resource Management Biodiversity Status
Snappy Gum Open Woodland / 1.11.2a	Not Listed	Least Concern	No Concern at Present
Cloncurry Box Open Woodland / 1.3.11x1	Not Listed	Least Concern	No Concern at Present
Snappy Gum / Cloncurry Box Open Woodland / 1.11.2e	Not Listed	Least Concern	No Concern at Present
Mixed Bloodwood Riparian Woodland / 1.3.6b	Not Listed	Least Concern	Of Concern

Based on proposed disturbance plans for the Project, clearing will be required within all vegetation communities.

The Mixed Bloodwood Riparian Woodland is listed as Of Concern" under the *Department of Environment and Resource Management Biodiversity Status.* Although minor clearing will be required within this community it is unlikely the Project will affect the health or abundance this community at a

regional scale, if appropriate control strategies are implemented. It is unlikely that disturbance within the water pipeline corridor will significantly impact on the regional occurrence of the other three vegetation communities.

One rocky outcrop is located within the water pipeline corridor. A few small crevices are present in this rock system however the site was considered of low rock-wallaby habitat value. Furthermore no marsupial scats were present at the outcrop indicating the Purple-necked Rock-wallaby (*Petrogale purpureicollis*) does not reside at the location.

SURVEY RESULTS – ACCESS ROUTE

The access route corridor is approximately 10 kilometres long and follows along an existing track for the majority of the length. An alternate access road and a temporary access road deviation were also surveyed. A 50 metre corridor was surveyed along all proposed access routes and deviations.

A total of five vegetation communities inhabit the access route corridor area. These communities and their corresponding conservation status are detailed in the table below.

Vegetation Communities on the Access Route Corridor

Vegetation Community / Regional Ecosystem	Environment Protection and Biodiversity Conservation Act 1999 Status	Queensland Vegetation Management Regulation 2000	Department of Environment and Resource Management Biodiversity Status
Snappy Gum Open Woodland / 1.5.3	Not Listed	Least Concern	No Concern at Present
Cloncurry Box Open Woodland / 1.3.11x1	Not Listed	Least Concern	No Concern at Present
River Red Gum Riparian Woodland / 1.3.7a / 1.3.7b	Not Listed	Least Concern	Endangered
Gidgee Open Woodland / 1.11.2x2	Not Listed	Least Concern	No Concern at Present
Mixed Bloodwood Riparian Woodland / 1.3.6b	Not Listed	Least Concern	Of Concern

Based on proposed disturbance plans for the Project, clearing will be required within the Snappy Gum Open Woodland, Cloncurry Box Open Woodland, Gidgee Open Woodland and Mixed Bloodwood Riparian Woodland communities. It is unlikely disturbance within the access route corridor will significantly impact on the regional occurrence of these communities.

Three major River Red Gum Riparian Woodland (RE 1.3.7) creek crossings exist within the access route corridor. Four minor creek crossings are present along the alternate access road and temporary access road deviation.

Although communities of conservation significance are present, no individual flora or fauna species of conservation significance occur. No weeds classified under the *Land Protection (Pest and Stock Route Management) Act 2002* inhabit the access route corridor.

POTENTIAL ENVIRONMENTAL IMPACTS

A range of potential impacts on nature conservation values may occur as a result of the Project. These include:

- Land clearing will reduce the current extent of vegetation communities and associated faunal habitats;
- Fauna injury or death may occur during the Project;
- Additional noise from mine operations may disturb fauna;
- Loss of vegetation may cause fragmentation or loss of individual species" local population;
- Loss of habitat may result in a loss of biological diversity;
- Land clearing and mineral processing activities associated with the Project may increase soil erosion, inadvertently causing silting, sedimentation or contamination of riverine habitats and waterholes downstream;
- An increase of pest fauna species identified as utilising the Project site may occur; and
- The introduction of additional weed species and spread of weeds on the Project site.

MANAGEMENT RECOMMENDATIONS

After assessment of terrestrial and aquatic flora and fauna desktop and field data, it has been determined that there is no significant impediment, in regards to terrestrial flora and fauna, to the development of the Dugald River Project. The following mitigation strategies are recommended to reduce the potential environmental impacts of the proposed activities.

Mitigation strategies for the Project site and associated corridors may include, but are not limited to:

- Avoid environmental impacts through appropriate design and planning of Project infrastructure and layout;
- In recognition of the intrinsic value of native vegetation, every effort should be made to keep proposed disturbance areas to a minimum;
- To maintain the integrity of vegetated land that is not cleared, appropriate erosion and sediment controls are recommended to prevent sediment deposition in remaining habitat.
- The River Red Gum Riparian Woodland community (1.3.7a and 1.3.7b) should be managed using relevant strategies suggested in the Queensland Government Environmental Offsets Policy and Policy for Vegetation Management Offsets;
- Rocky outcrops that could provide potential Purple-necked Rock-wallaby (*Petrogale purpureicollis*) should be avoided and a 150 m buffer should be implemented around these sites;
- Native vegetation removal should be conducted only after:

  - the areas to be cleared have been clearly delineated and identified to equipment operators and supervisors; and

  - Appropriate erosion and sediment control structures are in place.

- It is recommended that the methodologies for the rehabilitation/re-vegetation works for the Project use the most appropriate species for the landscape elements of the site. Such methodologies should include habitat matching of species to ensure rehabilitation success.

- It is recommended that recreated landforms are contoured to resemble the original local topography, and include hill slopes and rocky drainage lines;

- A segment of the Staff Induction Program should be allocated to informing staff of the conservation values on the Project site to increase staff awareness of the species present. This could include photographs, brief descriptions and management requirements of native species; and

- A rehabilitation strategy should be developed for the Project site. This strategy should embody the concepts and recommendations presented above and include provision for monitoring of rehabilitation progress over the life of the operation.

Additional specific mitigation strategies should be applied to features of conservation and management significance, including the River Red Gum Riparian Woodland (RE 1.3.7a and RE 1.3.7b) community, rocky outcrops that provide potential habitat for the Purple-necked Rock-wallaby (*Petrogale purpureicollis*), and introduced pest and weed species.

1.0 INTRODUCTION

AustralAsian Resource Consultants Pty Ltd (AARC) was commissioned by MMG Australia Limited (MMG) to conduct a Terrestrial Flora and Fauna Assessment for the proposed Dugald River Project (the Project site). The assessment also included an environmental assessment of three infrastructure corridors associated with the Project: the powerline, access road and water pipeline.

1.1 SCOPE OF STUDY

To assess the environmental values of flora and fauna communities on the Project site, AARC undertook the following scope of works:

- A literature and database review to identify species of conservation significance known from the region. This enabled these species to be targeted during the field survey components of the study;
- Standard field survey methodologies to determine the composition of dry season and wet season flora and fauna species inhabiting the Project site, particularly species of conservation significance[1]; and
- Preparation of a report describing significant ecological factors and outlining possible management strategies to reduce any foreseeable impacts associated with the proposed activities.

[1] References to "species of conservation significance" or "threatened species" refer to those species listed as extinct in the wild, endangered, vulnerable or near threatened under the *Nature Conservation (Wildlife) Regulation 2006* (Qld) or extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependent under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

2.0 PROJECT AND SITE DESCRIPTION

2.1 PROJECT LOCATION

The Project is located approximately 85 kilometres (km) north-east of Mount Isa and 65 km north-west of Cloncurry (Figure 1), in north-western Queensland. The Project is located adjacent to the proposed Roseby Copper Project.

2.2 PROJECT LAYOUT

MMG is proposing to develop a zinc/lead and copper mining and processing operation at the Project site. The Project will process approximately 2 million tonnes (Mt) of zinc/lead ore per year, and an additional 1 Mt of copper ore per year. Mining will be conducted using underground techniques with portals near the proposed ore processing plant. The proposed Project infrastructure and pit layout is shown in Figure 2.

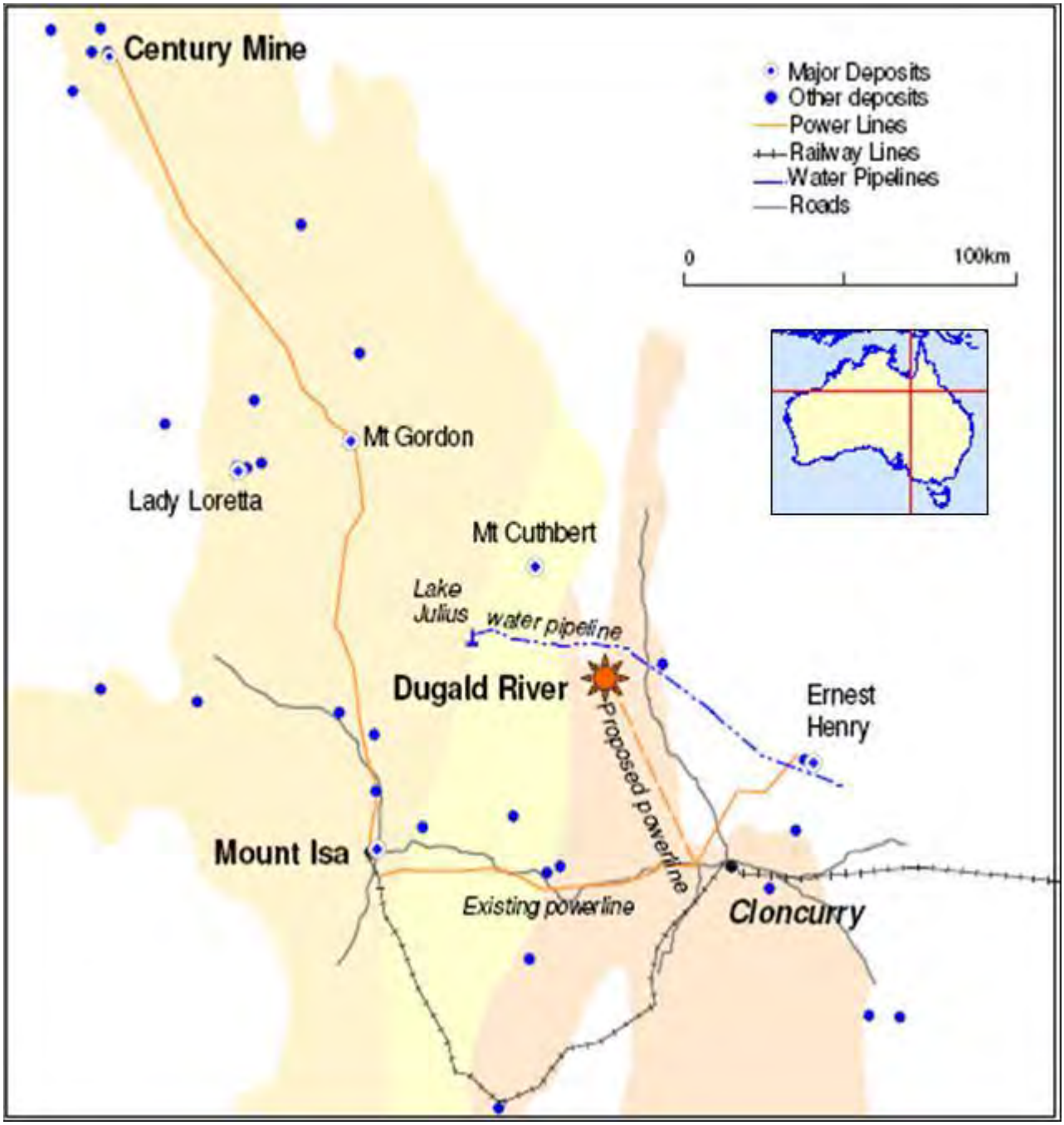


Figure 1 Project Location

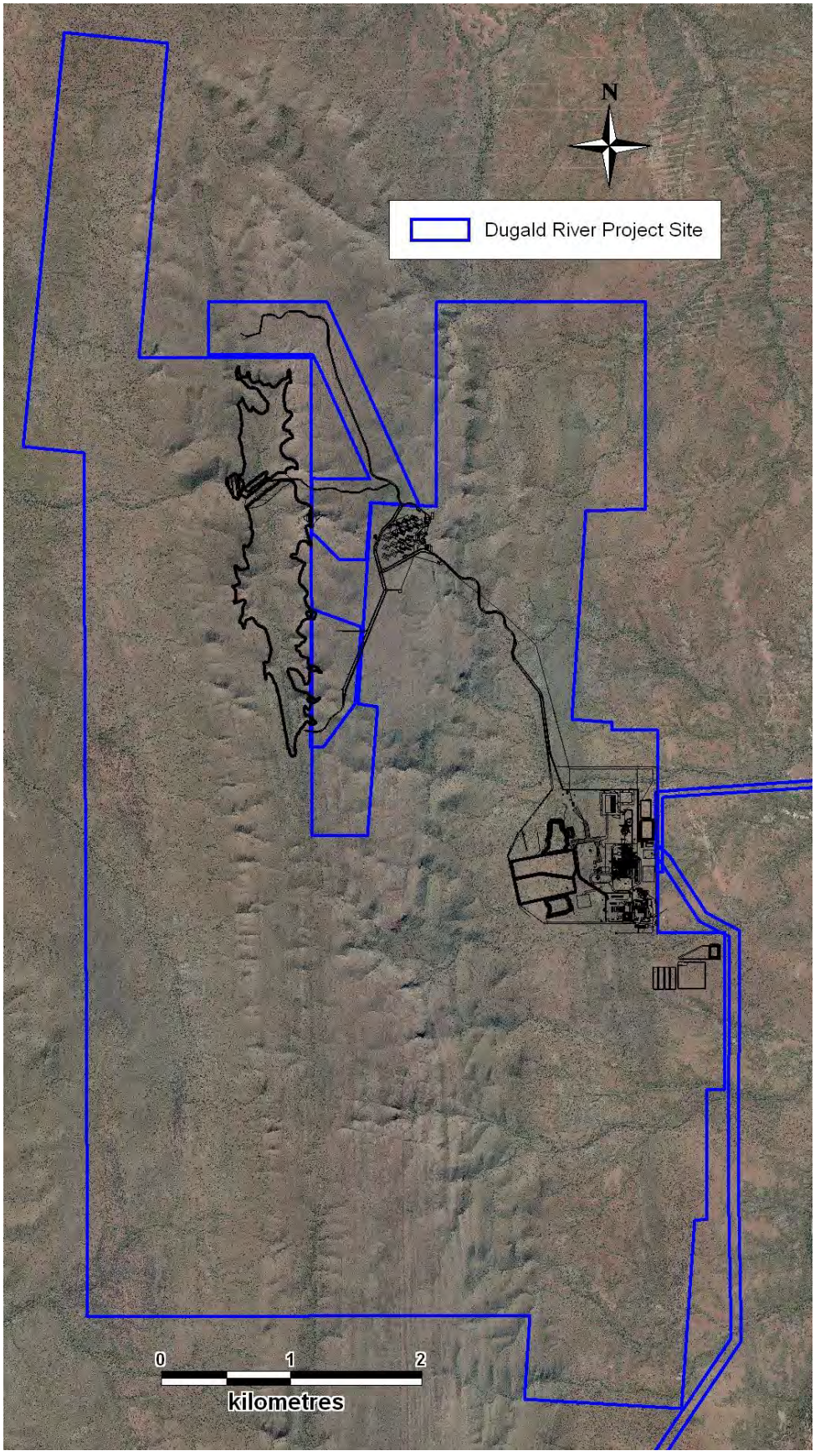


Figure 2 Dugald River Project site Infrastructure Layout

2.3 LOCAL WATERWAYS AND TOPOGRAPHY

There are no major watercourses on the Project site; however there are several minor, ephemeral tributaries which run through the site. Ephemeral watercourses on the eastern side of the site drain in an easterly direction to the Dugald River. On the western side of the Project, ephemeral creeks drain into Cabbage Tree Creek, which is a tributary of the Leichhardt River. Corella Creek is located south of the Project site, which traverses the proposed powerline corridor.

The Dugald River runs adjacent to the Project site and is a tributary of the Flinders River which flows 450 km north into the Gulf of Carpentaria. Water use downstream of the site primarily consists of stock watering.

The topography of the Project site is undulating with a dominant ridgeline (the Knapdale Range) running through the central portion of site in a north-south direction. The orebody is located on the east of this ridgeline; subsequently the proposed mining and processing activities are located to the east of this ridgeline, with only the proposed Tailings Storage Facility (TSF) located west of the ridgeline.

2.4 LOCAL GEOLOGY

The Project site is located in the transition zone between two major physiographic divisions, the Mount Isa highlands and the Carpentaria plains. Similarly, its bio-geographic location is near the boundary of the Gulf plains regions and the North West Highlands region.

The Dugald River deposit was discovered before 1881 and is an example of a stratabound base-metal deposit in a black shale environment. It forms part of a sedimentary basin within the Carpentarian Corella Formation (calc-silicate rocks). It strikes north-south and dips steeply to the west, with the grade of metamorphism low.

Two dominant and six minor ore types have been recognised. Oxidation is reported to be complete to 12 metres (m). The primary sulphides are pyrrhotite, pyrite, sphalerite, and galena, while at least four offshoots are thought to stem from the main lode. Sulphides are often seen as recrystallised bands and veins.

Sporadic copper mineralisation is observed and occurs as chalcopyrite mineralisation at the schist/calc-silicate - slate contact in the hanging wall of the Dugald zinc/lead/silver lode. Copper is also observed with mafic-intermediate porphyry dykes.

2.5 REGIONAL CLIMATE

Information from the Bureau of Meteorology website (www.bom.gov.au) was used to give mean annual maximum and minimum rainfall and temperatures for the Project region (based on data from the Cloncurry AERO weather station (in operation from 1939 – 1975) and the Cloncurry Airport weather station (operating since 1978).

The rainfall data shows that January and February exhibit the highest mean monthly rainfall, averaging 140.35 millimetres (mm) and 117.6 mm respectively. These months also experience the most rainy days, with more than eight rainy days per month. The driest month of the year is July, recording an average of just 3.45 mm with less than one day of rain for the month. A distinctive wet season (between November and April) is noted with very little rain falling in the remaining months of the year. The average annual rainfall for the region is 512.95 mm per year.

The mean annual maximum temperature is 32.8 degrees Celsius (ºC) with the hottest months November through to January (37 – 38.4 ºC). The mean annual minimum temperature is 18.6 ºC with the coolest months June through to August (10.4 – 12 ºC).

2.6 WEATHER CONDITIONS LEADING UP TO SURVEYS

Seasonal surveys are imperative for a methodical and scientifically valid ecological assessment. Complementing wet season and dry season surveys are conducted to ensure species which are migratory, transient or responsive to particular environmental conditions are captured, in addition to identifying seasonal variation in both species diversities and abundances. In AARC"s experience, survey timing is based on conceptual seasonal months. That is, they correspond to historic rainfall data and known weather patterns. Often however, the yearly weather cycle is more than wet and dry and includes the build-up period before the wet season that brings high humidity as moisture builds up in the air and post wet season as waterholes and creeks slowly dry up and dry winds strengthen. These transitional periods in combination with localised ecological response produce an environment that is continually adapting and adjusting. It is imperative that these periods be included, in combination with consideration to changing weather pattern behaviours when determining timing of wet and dry surveys as part of any seasonal flora and fauna assessment. The window of survey often needs to be adjusted to suit local conditions.

Survey timing for the Dugald River Project is considered to be scientifically sound and more than adequate to detect a comprehensive species list and highlight seasonal variation. Ecological variation is not strictly dictated by the black and white seasons suggested by textbook „wet" and „dry" labels. Survey timing falls within the Guidelines titled *Recommended Fauna Survey Methodology for Environmental Impact Assessments* (DERM, 2009) and *Guidelines for Flora Survey and Assessment in North Queensland (DERM*)

April 2008

Climate data abutting the (dry) 2008 survey describes average temperatures for January 2008 to be between 24.8^{o}C and 37.9^{o}C, with total rainfall equating 54 mm. February 2008 had higher temperatures accompanied with less rainfall, with the average temperature ranging between 25.4^{o}C to 38.5^{o}C and a total rainfall of 9.8 mm for the month.

The average rainfall in March 2008 was, however, substantially higher than previous months with 75.1mm of rain established beside average temperatures of 22.9^{o}C to 36.3^{o}C.

The recorded average rainfall in April 2008 was 22.1 mm with average temperatures ranging from 17.3^{o}C to 33.4^{o}C.

Average temperatures of 23.7^{o}C to 38.2^{o}C were recorded the week prior to the survey period (27th March to 4th of April) with data indicating total rainfall of 5.4 mm between the dates 20th of March through to 26th March 2008.

During the survey period (average) temperatures ranged from 19.1 ^{o}C to 32.8^{o}C and little rainfall was recorded between 27th March and 4th April 2008, with a total of 0.2 mm falling.

August 2008

The dry season survey of the Project site was conducted towards the end of the season (4th - 13th August 2008). Conditions were typical for the season, with a mean minimum temperature of 12.3 ºC

and a mean maximum of 28.7 ºC during the weeks leading up to the survey. No rain fell during the survey period, and a total of 19.4 mm fell during the 4 months prior to the survey.

March 2011

Climate data contiguous with the most recent (wet) survey, conducted between 21st to 31st March 2011, showed mean temperatures for January 2011 to be between 24.4°C to 36.6°C with total rainfall equating 71.2mm. Data pertaining to February 2011 showed average temperatures between 24.1°C to 34.5°C with rainfall reaching a total of 158.6 mm for the month.

Total rainfall again increased for the month of March 2011, when the survey was conducted, reaching a staggering 243 mm and returning average temperatures ranging from 22.5°C to 31.3°C.

A week prior to the survey period (14th to 20th March 2011) rainfall had subsided to a total of 6.6 mm with average temperatures ranging from 23.7°C to 33.4°C. During the survey period between 21st to 31st of March 2011, rainfall had decreased to 5 mm, allowing for the survey to proceed, and average temperatures ranged between 20.6°C to 31°C. Figure 3 indicates the intense rainfall that was experienced during February and March (2011) in comparison to previous years.

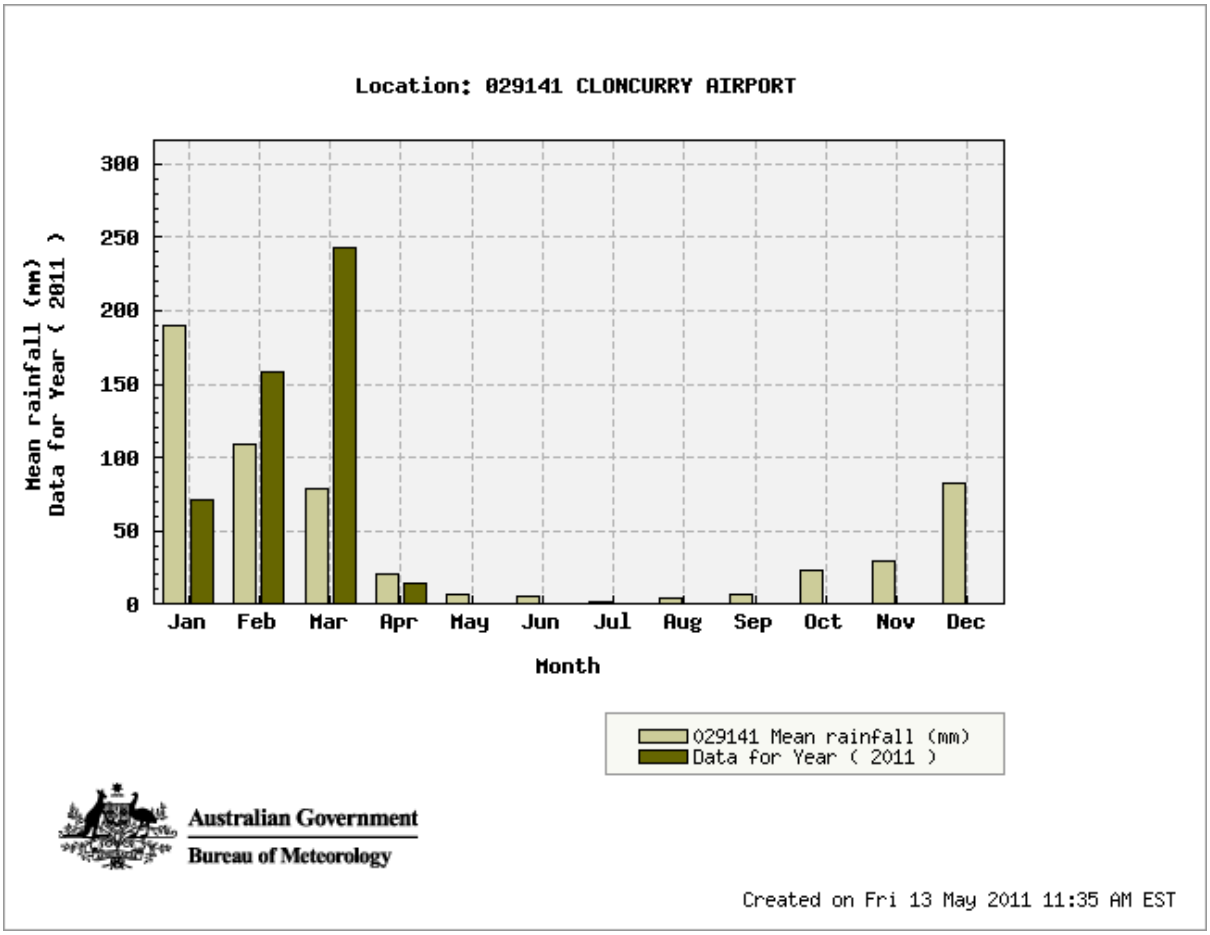


Figure 3 Comparison of long-term and recent (2011) rainfall data

2.7 CURRENT LAND USE

The predominant land use on the Project site is mineral exploration activities and low-intensity cattle grazing. Historically, mining activities and cattle grazing have dominated the land-use, evidence of

this is noted throughout the site, with cattle yards, feeding stations, muster assembly points and disused mine shafts obvious.

3.0 RELEVANT LEGISLATION AND POLICIES

Legislation relevant to the assessment of flora, fauna and biodiversity on the Project site and corridors is discussed below.

3.1 QUEENSLAND NATURE CONSERVATION ACT 1992

The most relevant portions of the *Nature Conservation Act 1992* (NC Act) to the Project are the sections which pertain to Wildlife and Habitat Conservation. The class of wildlife[2] to which the NC Act applies includes protected wildlife, which is defined as:

- Extinct wildlife;
- Endangered wildlife;
- Vulnerable wildlife;
- Near Threatened; and
- Least Concern wildlife.

Species listed under the above classes are published in the associated *Nature Conservation (Wildlife) Regulation 2006* (NCWR).

The NC Act defines „threatening processes" as:

a) Threatening the survival of any protected area, area of major interest, protected wildlife, community of native wildlife or native wildlife habitat; or

b) Affecting the capacity of any protected area, area of major interest, protected wildlife, community of native wildlife or native wildlife habitat to sustain natural processes.

The NC Act is relevant to the Project should any flora or fauna species of conservation significance (as detailed in the NCWR) be found on the Project.

3.2 COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), an action will require approval from the Federal Environment Minister if the action has, will have, or is likely to have a significant impact on a Matter of National Environmental Significance, where Matters of National Environmental Significance are:

- World Heritage properties;
- National Heritage places;

[2] Under the *Nature Conservation Act 1992*, wildlife is defined to be any taxon of an animal, plant, protista, procaryote or virus.

- Wetlands of international importance (Ramsar wetlands);
- Nationally threatened species and ecological communities;
- Migratory species;
- The environment where nuclear actions are involved (including uranium mines);
- Great Barrier Marine Park; and
- Commonwealth marine areas.

Of the above Matters of National Environmental Significance, only two are applicable to the Project site:

- Nationally threatened species and ecological communities; and
- Migratory species.

Consequently, should any species/communities listed as Threatened or Migratory be found on the Project site, the Project will be assessed under guidelines provided in the EPBC Act.

In addition, the EPBC Act provides for the identification and listing of key threatening processes. Based on the information provided to AARC by MMG, key threatening processes are not associated with the Project.

3.3 QUEENSLAND VEGETATION MANAGEMENT ACT 1999

The *Vegetation Management Act 1999* (VM Act) was proclaimed on Thursday the 14th of September 2000 as part of a planning framework for the management of native vegetation across Queensland. The *Vegetation Management Regulation 2000* (VMR) prescribes the status of each of the Regional Ecosystems (RE) identified to occur within Queensland.

Although the VM Act does not apply to the clearing of vegetation on the Project, the scientific basis for biodiversity conservation is still valid and can be used to assess the conservation significance of the vegetation communities on the Project. This includes the conservation status categories of each RE under the VM Act, which are listed below as is the definition of Remnant Vegetation:

Endangered Regional Ecosystems:

- <10% of pre-clearing extent remaining; and
- 10-30% of pre-clearing extent remaining and remnant <10,000 hectares (ha).

Of Concern Regional Ecosystems:

- 10-30% of its pre-clearing distribution remains; and
- 30% of the pre-clearing extent remains and the remnant vegetation remaining is <10,000 ha.

Least Concern Regional Ecosystems:

- >30% of the pre-clearing distribution remains and remnant vegetation remaining is >10,000 ha.

Remnant Vegetation:

„Remnant Vegetation" for an area of Queensland for which there is no RE map or remnant vegetation map, means any vegetation where the predominant canopy:

- Covers more than 50% of the undisturbed predominant canopy;
- Averages more than 70% of the vegetation"s undisturbed height; and
- Is composed of species characteristic of the vegetation"s undisturbed predominant canopy.

3.4 QUEENSLAND LAND PROTECTION (PEST AND STOCK ROUTE MANAGEMENT) ACT 2002

The objectives of the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) are to consolidate, amend and provide laws for the management, control, prohibition, and regulation of the introduction, spread and keeping of certain plants and animals declared under the Act. The LP Act is relevant to the Project with regard to the control and management of declared pest plant (weed) and animal species.

3.5 DEPARTMENT OF ENVIRONMENT AND RESOURCE MANAGEMENT BIODIVERSITY STATUS

The Queensland Department of Environment and Resource Management (DERM) Biodiversity Status is the status assigned by the DERM to REs to assist with biodiversity planning in Queensland. Unlike the status of REs under the VM Act, the DERM Biodiversity Status is based on an assessment of the condition of remnant vegetation in addition to the pre-clearing and extent of an RE. It takes into account other threatening processes in addition to land clearing. These other processes include:

- The reduction in biodiversity within the REs;
- Weed invasion;
- Grazing pressures;
- Inappropriate fire management;
- Fragmentation; and
- Infrastructure development.

3.6 QUEENSLAND GOVERNMENT ENVIRONMENTAL OFFSETS POLICY

The *Queensland Government Environmental Offsets Policy* (QGEOP) is a guide for appropriate use of environmental offsets across terrestrial and aquatic ecosystems in Queensland, based on the principles of ecologically sustainable development. It provides generic framework for environmental offsets and guidance on when specific-issue offsets (refer to Section 3.7) should and should not be considered.

An environmental offset is an action taken to counterbalance unavoidable, negative environmental impacts that result from an activity or development that supports a growing economy and population. Environmental offsets are only applicable when the impacts cannot be avoided or minimised, and if all other Government environmental standards have been met.

Environmental offsets should be considered (where there may be a remaining environmental impact) as part of an Environmental Impact Statement and in the development of an Environmental Management Plan. Consideration of specific-issue offsets policies, consistent with the QGEOP, should be included as one of the content requirements of an Environmental Management Plan for *Level 1 mining or petroleum activity* (excluding level 1 mining claims). If the activity will have a remaining environmental impact on an environmental value that is addressed by a specific-issue offsets policy, an environmental offset should be required as a condition of the Environmental Authority.

3.7 POLICY FOR VEGETATION MANAGEMENT OFFSETS

The *Policy for Vegetation Management Offsets* applies to an offset proposed to meet a performance requirement in an applicable VM Act code, and is administered by the Queensland DERM. This policy is applicable for any RE listed as „Endangered", „Of Concern", „Essential Habitat", „Natural Wetland" or „vegetation associated with watercourses" under the VM Act *Vegetation Management Status*.

A vegetation management offset is a legal arrangement or agreement that, over time, guarantees to maintain the extent, structure and function of:

- Regional ecosystems;
- Essential habitat; and
- Vegetation associated with:
    - Watercourses;
    - Natural wetlands; and
    - Natural significant wetlands.

Seven criterions apply to a vegetation management offset, which are listed in Table 1 below.

Table 1 Vegetation Management Offset Criterions and Descriptions

Offset Criteria	Criteria Description
Limitations on offset vegetation	The proposed offset must be mapped as non-remnant vegetation or is expected to fall below criteria for remnant vegetation
Selection and location of RE	The proposed offset must maintain ecological processes at a subregional level and ideally be within the same bioregion and subregion as area proposed to be cleared
Remnant mapping	The proposed offset must be an area which is large enough to be mapped as remnant vegetation
Obtaining ecological equivalence	The proposed offset must become ecologically equivalent to the proposed area for clearing
Ensuring ongoing management	The proposed offset must include a management plan that specifies how the offset will be managed to ensure it achieves or maintains remnant RE status and ecological equivalence
Ensuring offset is legally secured	The offset area and arrangements for securing the future protection of the offset area must be proposed as part of the development application
Other requirements	The offset is not required to be on land owned by the applicant. The offset must be protected and managed under agreement with the landholder
	The proposed offset cannot be a financial donation or contribution, although a contribution may be made to a third party for the management of an approved offset

4.0 DATABASE SEARCH AND LITERATURE REVIEW

Database searches collate information on flora and fauna species identified in the region from previous surveys, community records and other sources. A review of such databases facilitates the formulation of specific field survey techniques for flora and fauna species of special interest. The database searches revealed that several flora and fauna species of conservation significance have been identified in the Cloncurry region.

4.1 FLORA

Review of the EPBC Act Online Database, the Queensland Herbarium HERBREC Database and Wildlife Online indicated six species of conservation significance has been identified in the vicinity of the Project site (Appendix A).

The EPBC Act Online Database search contained a 25 km buffer surrounding a central point within the Project site and another along the powerline corridor. The Wildlife Online search contained a 20 km radius at a central point within the Project site and at a central point within the powerline corridor. No species of conservation significance were identified in either of these searches.

The HERBREC Database search was conducted in October 2008 with a radius of 20 km from a central location on the Project site and with a 10 km radius along the powerline corridor. An additional HERBREC database search was conducted for the Project site in March 2011, with a radius of 150 km.

Table 2 summarises all flora species and corresponding conservation significance identified from database searches.

Table 2 Threatened Flora Species known from the Region

Botanical Name	Habitat	Conservation Status	
		EPBC Act	NC Act
Brachychiton collinus	Inhabits rocky outcrops and granite country with little other understory present	Not Listed	Least Concern (current status) Rare (prior to May 2010)
Fimbristylis distincta	One record from Undilla homestead, Queensland. Occurred along a stream bank.	Not Listed	Near Threatened
Goodenia angustifolia	Occurs within *Corymbia terminalis* low woodland, on sandy loam soils with *Triodia pungens.* Records from Malbon and Duchess, northwest Queensland	Not Listed	Near Threatened

Botanical Name	Habitat	Conservation Status	
		EPBC Act	NC Act
Ipomoea antonschmidii	*Eucalyptus leucophloia, Corymbia capricornia, Corymbia aparrerinja* and *Eucalyptus camaldulensis* woodlands. Grows in a variety of habitats, including rocky, sandy and red clay substrates. Occurs along the Lake Julius pipeline, Gunpowder and north of Mount Isa	Not Listed	Near Threatened
Ptilotus maconochiei	*Eucalyptus leucophloia* and *Corymbia aspera* woodland, with *Triodia pungens* groundcover. On quartzite ridge tops, hillsides, slopes and shale	Not Listed	Near Threatened
Rhamphicarpa australiensis	Riparian Eucalypt open woodland, small creek channels, *Eucalyptus camaldulensis* woodland; occurs in clay soils and ferruginous/calcrete rock. Patchy distribution from Julia Creek, Gunpowder to Burk and Wills	Not Listed	Near Threatened

To ensure the survey team were familiar with these species of conservation significance, research into their growth form, ecology and appearance was undertaken prior to field surveys. The likelihood of these species of occurring on the Project site is discussed in Section 6.9.1.

Weeds of national significance (WoNS), along with other introduced plants considered by the State to pose a significant threat to biodiversity, were included in the EPBC database search. These species are summarised in Table 3 below.

Riverine areas are known to be an important dispersal corridor for weeds, as these areas create ideal conditions for many weeds to extend their range and invade new areas. Riverine areas are prone to weed invasion. Most common scenarios which contribute towards this are water transport of seeds downstream along watercourses, stock and other wildlife transport of seeds in their digestive system or coat or eroded or exposed areas of soil providing opportunities for new weed infestations by reducing competition from existing native plants.

The WoNS program coordinates the national effort against 20 of Australia"s worst invasive plants. A national strategy for each WoNS nominated weed specifies actions to better manage each weed. The Australian Government initiated program funding with commitments from state agencies and collaborative arrangements with other stakeholders. State legislation includes the LP Act, which classes weeds from class 1 – 3. Class 2 pests are established in Queensland and have, or could have, an adverse economic, environmental or social impact. Declaration under the LP Act imposes a legal responsibility for control by all landowners on land under their management.

Table 3 Weed Species Identified in Database Searches

Scientific Name	Common Name	Preferred Habitat	Conservation Status	
			Commonwealth	State
Acacia nilotica subsp. *indica*	Prickly Acacia	Mitchell grass plains most commonly infested, potential to invade Project region	WoNS	Class 2
Pennisetum ciliare	Buffel Grass	Grows on all types of soil, commonly on sandy and stony soils. Regarded as a weed of alluvial flats and riverine sites. Well established in north west Qld	Not Listed	Not Listed
Cryptostegia grandiflora	Rubber Vine	Initially invades waterways, expanding outward to hillsides and pastures. Rubber Vine is established throughout most of Queensland, including north west Qld	WoNS	Class 2
Hymenachne amplexicaulis	Hymenachne	Semi-aquatic grass which can thrive in waters up to 2 m deep. Potential to invade Project region	WoNS	Class 2
Parkinsonia aculeata	Parkinsonia	Adapted to a wide range of soil types, found along water courses in sub-humid and semi-arid areas of Qld	WoNS	Class 2
Parthenium hysterophorus	Parthenium	Invades pastures, disturbed areas along roadsides, watering points and cattle yards, grows in most soil types, most dominant in alkaline, clay and loam soils. Smaller outbreaks in north west Qld, with state level initiative to control	WoNS	Class 2
Prosopis spp.	Mesquite	Well adapted to hot climates and a wide range of soil types and annual rainfall of 150 – 1200 mm. Current distribution includes north west Qld	WoNS	Class 2

A review of the DERM Regional Ecosystems Descriptions Database (REDD) indicates the potential presence of twenty REs of conservation significance within the Bioregion 1, the Northwest Highlands, under the EPBC Act, Queensland VM Act and DERM Biodiversity Status (Table 4). The occurrence of these REs on the Project site is discussed in Section 6.9.2.

Table 4 Regional Ecosystems of Conservation Significance Potentially on the Project site

Regional Ecosystem	Description	Conservation Status		
		EPBC Act	Queensland VMR	DERM Biodiversity Status
1.3.2	*Eucalyptus microtheca* low open woodland to woodland on alluvial floodplains and channels	Not Listed	Least Concern	Of Concern
1.3.3	*Acacia georginae* low open woodland – low woodland on clay plains	Not Listed	Of Concern	Of Concern
1.3.4	*Acacia cambagei* low open woodland to woodland on earths in valleys	Not Listed	Least Concern	Of Concern
1.3.5	Mixed eucalypt open woodland on sandy alluvial terraces	Not Listed	Least Concern	Of Concern
1.3.6	*Corymbia aparrerinja* and *Corymbia terminalis* open woodland on sandy terraces	Not Listed	Least Concern	Of Concern
1.3.7	*Eucalyptus camaldulensis* woodland on channels and levees	Not Listed	Least Concern	Endangered
1.3.9	Perennial watercourses and associated alluvium	Not Listed	Of Concern	Of Concern
1.5.1	*Eucalyptus miniata* woodland on red earths on laterised plateaus	Not Listed	Of Concern	Of Concern
1.5.4	*Eucalyptus leucophylla* low open woodland on red earths in valleys	Not Listed	Least Concern	Of Concern
1.5.5	*Eucalyptus pruinosa* low open woodland on red earth plains	Not Listed	Least Concern	Of Concern
1.5.6	*Atalaya hemiglauca*, *Ventilago viminalis,* and *Grevillea striata* low open woodland on red earth plains	Not Listed	Least Concern	Of Concern
1.5.9	*Ventilago viminalis* low open woodland on loams on sand sheet margins	Not Listed	Least Concern	Of Concern
1.7.2	*Eucalyptus pruinosa* low open woodland on calcareous red/brown earths	Not Listed	Least Concern	Of Concern

Regional Ecosystem	Description	Conservation Status		
		EPBC Act	Queensland VMR	DERM Biodiversity Status
1.9.2	Mixed shrubby woodland on low rocky hills on Tertiary limestones	Not Listed	Of Concern	Of Concern
1.9.8	Spring wetlands on undeformed fine-grained sedimentary rock	Not Listed	Of Concern	Of Concern
1.10.6	Springs mostly associated with quartzose sandstone and fine-grained sedimentary rocks	Not Listed	Of Concern	Endangered
1.11.1	Mixed shrubby woodland of folded limestone	Not Listed	Of Concern	Of Concern
1.11.4	*Eucalyptus pruinosa* low open woodland on shallow soils in valleys below folded sediments	Not Listed	Least Concern	Of Concern
1.11.5	Springs associated with metamorphic rocks	Not Listed	Of Concern	Of Concern
1.12.2	*Eucalyptus melanophloia* low open woodland on low hills and torfields on biotite granites	Not Listed	Of Concern	Of Concern

4.2 FAUNA

The following databases were searched for historical records of fauna within the vicinity of the Project site:

- Wildlife Online Database (DERM): This database uses records collected from previous surveys, including the Queensland Museum surveys as well as records from the public. A 20 km search radius was used to cover the Project site (including corridor routes);
- EPBC Act Online Database: The search includes species if their distribution overlaps the broader Cloncurry region and it is likely that suitable habitat is nearby. The database only pertains to species listed under the EPBC Act. A 30 km search radius was used to cover the Project site (including corridor routes);
- Historic flora and fauna survey report conducted by Woodward-Clyde (Holmes 1991);
- Roseby Copper Project Terrestrial Flora and Fauna Assessment, prepared for Universal Resources Limited by AARC (2006b); and
- Roseby Copper Project Aquatic Flora and Fauna Assessment, prepared for Universal Resources Limited by AARC (2006a).

Search results indicate a number of species of conservation significance have been identified in the region of the Project site. These are listed in Table 5 below.

Search results from the DERM Wildlife Online Database and the EPBC Act Online Database are listed in Appendix A.

Table 5 Potential Threatened Fauna of the Project site

Species Identification		Conservation Status	
Scientific Name	**Common Name**	**EPBC Act**	**NCWR**
Heteromunia pectoralis	Pictorella Mannikin	Not Listed	Near Threatened
Ephippiorhynchus asiaticus	Black-Necked Stork	Not Listed	Near Threatened
Melithreptus gularis	Black Chinned Honeyeater	Not Listed	Near Threatened
Petrogale purpureicollis	Purple-Necked Rock-wallaby	Not Listed	Vulnerable
Rostratula australis	Australian Painted Snipe	Vulnerable/ Migratory/ Marine	Vulnerable
Sminthopsis douglasi	Julia Creek Dunnart	Endangered	Endangered
Pristis microdon	Freshwater Sawfish	Vulnerable	Not Listed
Haliaeetus leucogaster	White-bellied Sea-Eagle	Migratory/Marine	Not Listed
Merops ornatus	Rainbow Bee-eater	Migratory/Marine	Not Listed
Ardea alba	Great Egret, White Egret	Migratory/Marine	Not Listed
Ardea ibis	Cattle Egret	Migratory/Marine	Not Listed
Charadrius veredus	Oriental Plover, Oriental Dotterel	Migratory/Marine	Not Listed
Glareola maldivarum	Oriental Pratincole	Migratory/Marine	Not Listed
Numenius minutes	Little Curlew, Little Whimbrel	Migratory/Marine	Not Listed
Rostratula benghalensis s. lat	Painted Snipe	Migratory/Marine	Not Listed
Apus pacificus	Fork-tailed Swift	Migratory/Marine	Not Listed
Crocodylus johnstoni	Freshwater Crocodile	Marine	Not Listed

Note: The above table contains database search results from Wildlife Online Database (DERM) and EPBC Act Online Database where it was indicated that species of conservation significance may be known from the Project Region.

4.3 ENVIRONMENTALLY SENSITITVE AREAS

Environmentally Sensitive Area (ESA) mapping presents Category A, B, and C areas of conservation significance, National Parks, Conservation Parks, Forest Reserves, Nature Refuges, Resource Refuges, Endangered Regional Ecosystems (ERE) and areas listed under the Directory of Important Wetlands.

Figure 4 presents ESAs within and adjacent to the Project site. A Category B ESA, an ERE, is presented on the Figure. This ERE is classed as RE 1.3.7 – *Eucalyptus camaldulensis* watercourses. No other ESAs are present adjacent to the Project site.

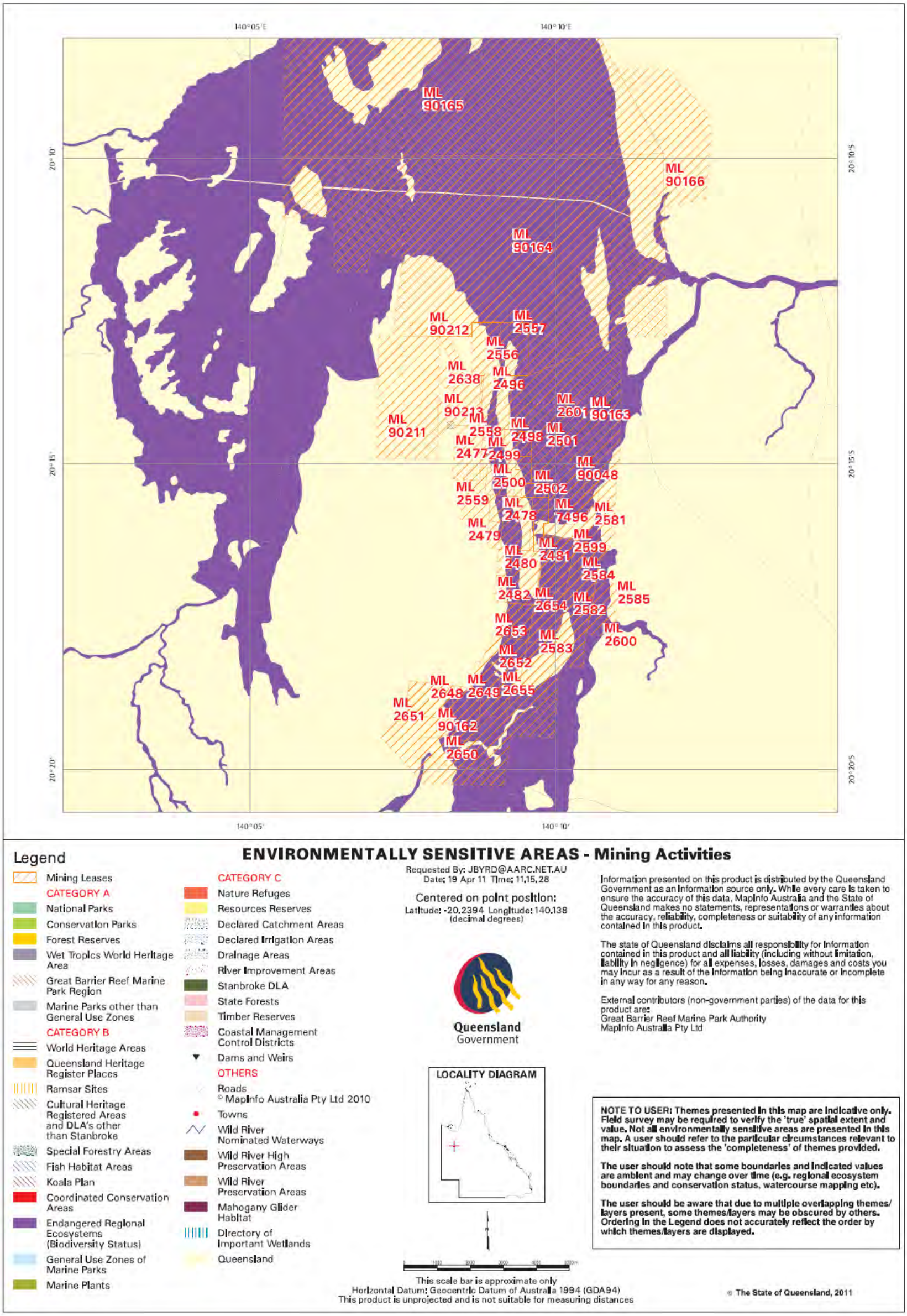


Figure 4 Environmentally Sensitive Areas for the Project site

5.0 FIELD SURVEY METHODOLOGY

The initial wet season survey on the Project site was undertaken over nine consecutive days between the 27th of March and the 4th of April 2008. The dry season survey on the Project site and an initial assessment of the corridors was undertaken over ten consecutive days between the 4th and 13th of August 2008. An additional three day assessment of the powerline corridor was conducted from the 1st to the 3rd of October 2008. A final three day assessment of modifications to the alignment of the access road and water pipeline was conducted between the 7th and 9th of April 2010. An additional wet season survey occurred between the 21st and 31st of March 2011, to capture ephemeral floral species and to supplement the existing fauna catalogue from previous surveys.

The methodology for assessing the flora and fauna on the Project site is described in Sections 5.1 to 5.3. The methodology for assessing the corridors is discussed separately in Section 5.4.

5.1 INITIAL SITE SCOPING

Site scoping was conducted using three methods. Firstly, aerial photography of the Project region was reviewed to gain an overall perspective of the vegetation distribution and landform variation.

Secondly, the Project site was broadly surveyed from vehicle. This enabled survey transects to be located in areas that maximised the sampling of representative vegetation types and fauna habitats. This also allowed for the targeting of habitats potentially occupied/utilised by species of conservation significance.

Thirdly, areas of potential sensitivity (for example, creek lines and rocky outcrops) were surveyed on foot. This allowed further ecological familiarisation and comprehensive survey coverage.

5.2 FLORA

5.2.1 Overall Approach

The field survey involved a baseline study of the Project using all 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* 1:25,000 Scale Vegetation Mapping.

The Queensland Herbarium Recommendations for mapping regional ecosystems 1:25,000 Scale Vegetation Mapping allows for four levels of sampling:

- *Primary* – Consists of permanently marked plots where individual tree and shrub species are marked to allow for individual monitoring. This technique is only used for monitoring or research;

- *Secondary* – Consists of 10 x 50 m plots. Data recorded at these sites 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;

- *Tertiary* – Consists of 20 x 50 m plots in which all of the woody species in the plot are recorded. Data collected includes limited structural information (e.g. heights and basal area); and

- *Quaternary* or observation site – These plots include Global Positioning System (GPS) location, the dominant species in the characteristic layer with some landform and structural data. An intuitive classification of the vegetation is also recorded. These plots are commonly used in the ground truthing of mapping previously completed for the local area.

5.2.2 Regional Ecosystem Mapping

The flora survey employed a desktop assessment of floral taxa and vegetation communities of the Project site prior to the commencement of field work. Preliminary identification included vegetation community definition from aerial photography. This preliminary community identification was used to target locations for representative field survey sample plots to obtain floristic and structural data and ground truth communities.

A survey of all REs on the Project was conducted to supplement the Queensland Herbarium RE mapping. Consequently, the following methods were used:

- A total of 37 representative Secondary transects (50 x 10 m plot) in each vegetation type were selected 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, 245 Quaternary transects were also surveyed. Quaternary transects were conducted to capture any variation in species composition, community structure and to search for threatened species known to occur in the region;

- An assessment of the condition of the vegetation type with regard to quality and conservation value was undertaken at each transect; and

- The mapping of the REs was undertaken through the use of aerial photographs, geological maps, and the use of a GPS in association with the findings of the field survey. Vegetation transects were done until additional transects yielded no significant additional species or structural variation.

The RE mapping methodology recommends a minimum number of three s=Secondary sites per Regional Ecosystem type. It is noted in the methodology that sampling adequacy can be determined, when additional sites do not add substantial new species or show significant structural variation to the mapping process. .

5.2.3 Air Photo Interpretation

Aerial photo interpretation was conducted to delineate stands of potentially homogenous vegetation structure and composition, and to annotate those stands with data attributes that can be used to quantify and describe the current condition of vegetation. Aerial photography was interpreted and classed into visually identifiable patterns over the Project site as an initial, broad scale interpretation prior to the commencement of the initial field survey. The 1:25,000 scale of polygon definitions are consistent with the *Methodology for survey and mapping of regional ecosystems and vegetation*

communities in Queensland (Nelder et al., 2005) of 1.2 ha for a uniform occurrence and 1.7ha for an elongated occurrence.

The field assessment was then designed to sample the different classes identified in the aerial photograph interpretation. Secondary and Quaternary transects were surveyed within these polygons to sample the variation within and between aerial photo classes and to interpret the relationship between variation in the aerial photo and floristic variation

5.2.4 Survey for Species of Conservation Significance

When a habitat suitable for a species of conservation significance was located, a specific survey for that species was undertaken. This specific search involved the use of methods discussed in the draft New South Wales (NSW) *Threatened Species Survey and Assessment Guidelines* (NSW National Parks and Wildlife Service 2001).

The method that was used in this survey was the random meander technique. 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 specimen is collected for confirmation by the Queensland Herbarium. Random meanders were conducted in all ecological communities found on the Project site, as well disturbed areas such as roadsides and old mining works.

5.2.5 Plant and Regional Ecosystem Identification

All dominant plants representative of each vegetation community were identified using a number of taxonomic keys and other reference materials. All REs were described in accordance with the REDD and Sattler and Williams (1999). The use of the terms „Remnant" and „Non-remnant" vegetation" are used as per the VM Act. For any plant species that could not be identified in the field, a sample was collected and sent to the Queensland Herbarium for identification.

5.2.6 Mixed Polygons

On vegetation and RE maps, a polygon usually denotes a discrete area of one type of vegetation community. The scale at which an RE map is produced dictates the minimum area of continuous vegetation type that can be represented by one polygon. This is known as the "minimum mappable area". If distinct vegetation communities are smaller than this minimum area, then vegetation communities are put together in "mixed polygons". This has the consequence that when Land zone maps are combined with vegetation maps to produce REs, mixed polygons containing more than one RE can be produced. Where mixed polygons are represented on an RE map, all REs represented within the polygon are denoted.

5.2.7 Flora Transects Locations

Flora transects were conducted in each community found within the Project site. The locations of these transects are shown in Figure 5. 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 and creek crossings were also investigated as they often provide a foothold for a number of different species, particularly invasive weeds. In total, 37 Secondary vegetation transects were conducted, with a minimum of 3 transects within each RE. Thirteen of the 37 transects were conducted within the two riverine communities (RE 1.3.6b and RE 1.3.7b), as these communities are most diverse in species.

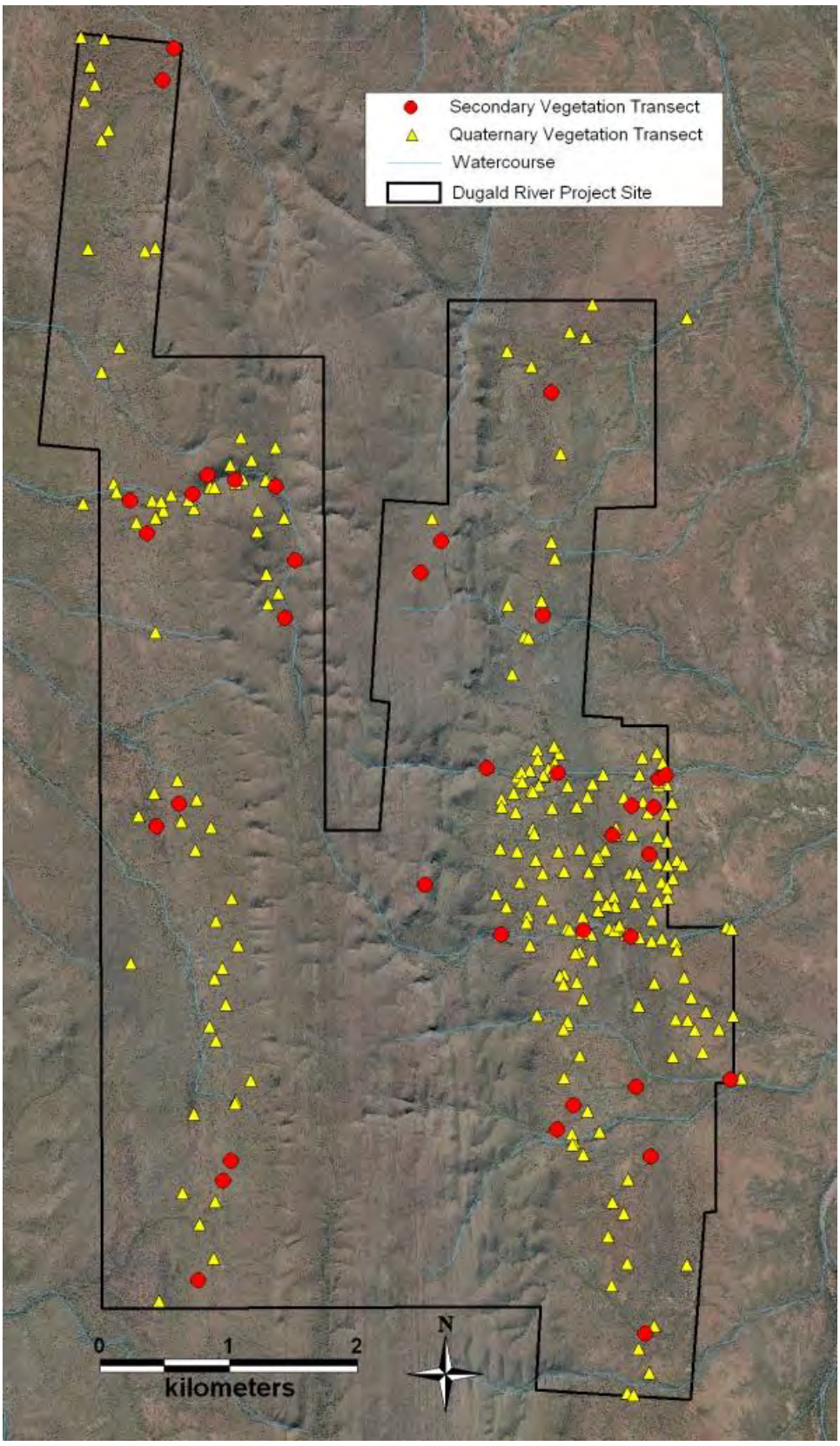


Figure 5 Flora Transect Locations on the Project site

5.3 FAUNA

The fauna sampling methodology for the Project site was based on survey techniques provided by DERM (2009), titled *Recommended Fauna Survey Methodology for Environmental Impact Assessments*. Sampling of vertebrate fauna was conducted primarily along transects established in each of the major fauna habitat types and at changes in vegetation community groups. Secondary sites were established to provide important information on fauna species associated with preferred habitat, as well as increasing the chances of finding species of conservation significance. Their inclusion in the assessment provides a more robust survey methodology and greater survey coverage. Study locations were replicated throughout the dry and wet season surveys where possible, to aid the identification of seasonal variation in species diversities and abundances. Sampling locations are described and shown in Section 5.3.3.

Observations of species outside the specific study locations were noted as incidental observations.

5.3.1 Nomenclature

Many fauna species, particularly frogs and reptiles, do not have widely accepted common names. Where possible, the accepted common names of wildlife are used preferentially in this report, with scientific names stated on all other occasions.

Taxonomy within this report follows the following references:

- DERM Wildlife Online database (2010) for reptile and amphibian species;
- Tyler and Knight (2009) for amphibians (as secondary reference);
- Wilson (2005) for reptiles (as secondary reference);
- Simpson and Day (2010) for birds; and
- Menkhorst and Knight (2011) for mammals.

5.3.2 Detection Methods

A description of the techniques employed to survey the fauna occurring on the Project site is provided below. Trapping was conducted over four consecutive nights plus two additional nights during the sampling efforts, unless otherwise stated. Appropriate combinations of the listed trapping methods were used to maximise chances of surveying all fauna.

Elliottt trapping

Type A Elliottt traps were used to target small ground-dwelling mammals inhabiting the Project region. Traps were baited with a mixture of honey-soaked oats, peanut butter and vanilla essence. A small portion of bait was placed at the entrance of each trap to entice target species and improve capture rates.

During the wet season survey, 5 Elliottt traps were positioned either side of the central transect line, for two transects, resulting in a total of 10 Elliottt traps per transect. At the remaining four transects, 15 Elliott traps were placed either side of the central transect line (7 on one side and 8 on the other). At the secondary site 15 Elliottt traps were placed in positions thought to be representative of habitat

diversity. Additional Elliottt traps were placed along creek lines during the wet season of 2011. Six trap sites were established, with 16 traps at each site. This yields a wet season survey effort of 762 Elliottt trap nights.

During the dry season survey, 16 Elliottt traps were positioned at each study location in areas considered to be of increased habitat value. As each study site was operational for six nights during the survey, the dry season effort was 672 Elliottt trap nights.

The overall Elliottt trap survey effort for the Flora and Fauna Assessment was 1,434 Elliottt trap nights.

Pitfall trapping

A pitfall trap-line was established at each transect to target small ground-dwelling fauna (reptiles, mammals and amphibians). Each line consisted of a 20 centimetre (cm) tall wire-mesh drift fence running along the ground and crossing the middle of five 10-litre buckets buried flush with the soil surface. The bottoms of the drift fences were buried slightly to guide target species towards a bucket. A small amount of soil, vegetation litter, polystyrene block and a damp sponge were placed in the bottom of each bucket to provide a floating device in case of significant rain, shelter and moisture for captured wildlife. Trap-lines were checked each morning and evening. Each pitfall-line was operational for four consecutive nights plus two additional nights during both surveys, yielding an overall survey effort of 84 trap nights.

Funnel trapping

Funnel traps were placed along fallen logs or at the end of rock crevices and fallen tree hollows to capture small vertebrates. Eight funnel traps were used at each fauna site during the 2011 wet season, giving a total survey effort of 96 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. The following technique was adopted to survey the diversity of micro-bats occurring on the Project site:

ANABAT recordings: 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 recorder was used to record micro-bat calls at specific sites determined to be potential bat habitat. Recordings were sent to an expert ANABAT call analyst (Mr Greg Ford – Toowoomba, Queensland) for species identification.

A total of six ANABAT sites, selected primarily on an assessment of bat habitat value, were used to position the ANABAT unit during the wet season survey in 2008. Two sites yielded bat echolocation calls and were analysed to provide a species list.

While an additional six ANABAT sites were used during the dry season survey, a faulty ANABAT unit corrupted the stored files and no readable data was recorded.

An additional ANABAT survey was conducted during the wet season of 2011. Two ANABATS were placed in various locations over a week, equating to a total of 14 recording nights.

Harp trapping was also conducted along riparian areas during the wet season 2011 survey. This method of trapping aimed to complement the data from ANABAT recordings, as well as increase the potential to identify more cryptic species with lower frequency vocalisation. The harp trap was in operation for 9 evenings along riparian areas

Bird surveying

A dedicated search for diurnal birds was conducted visually and aurally on each morning of the surveys in the immediate vicinity of each study site. In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated watercourses), or to contain cryptic or threatened bird species.

Spotlighting

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

Walk searches: Various habitats within the Project site 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 wearing headlamps and hand held spotlights, and where possible, rock fissures, bark crevices and tree hollows were investigated. A slow walking speed (approximately 1 km/hr) 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. A total of 19 spotlight hours were undertaken on foot within the Project site during the dry and wet surveys.

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 vegetation for arboreal and ground-dwelling wildlife. An advantage of this survey technique is the efficiency with which large areas can be covered. A total of 14 hours of vehicle spotlighting were undertaken on the Project site during the dry and wet 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, secondary site and in other selected areas of the Project site. Searches involved the rolling of rocks and logs, rustling through leaf litter and the peeling of exfoliating bark from standing trees. Observed animals were caught where possible to aid positive species identification.

Scat/Track searching

At each transect and secondary site 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 (e.g. tree trunk scratchings).

Incidental recordings

Throughout survey periods numerous wildlife species were observed or heard on the Project site during the course of routine activities, such as setting and checking trap-lines, or driving between study locations. 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.

5.3.3 Fauna Transect Locations

In total, six primary transects and eight secondary transects (one secondary transect was used during each survey in 2008, with an additional six sites established in 2011) were established for terrestrial fauna monitoring on the Project site. Transects were positioned to maximise the potential for sampling all wildlife present by targeting the full range of habitat types present on Site.

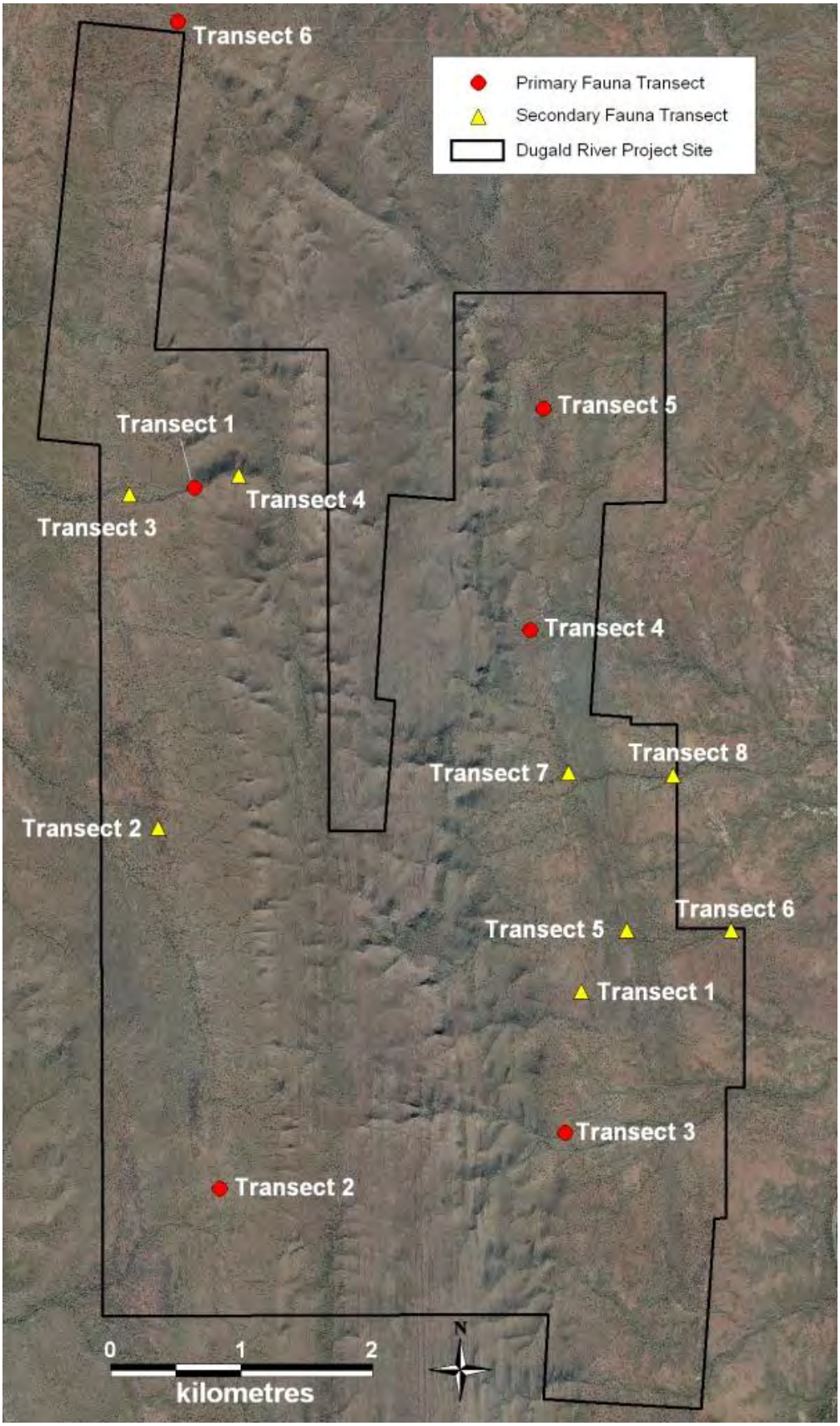


Figure 6 Terrestrial Fauna Study Locations on the Project site

5.4 CORRIDORS

Three infrastructure corridors were assessed by AARC: the access route, water pipeline and powerline corridor. Each corridor was fully traversed, with specific widths listed below. Features of conservation significance were noted at each site in particular:

- Purple-necked Rock-wallaby (*Petrogale purpureicollis*) habitat; and
- River Red Gum crossings (RE 1.3.7 a).

5.4.1 Powerline

The Proponent proposes to construct a powerline from the Project site to Chumvale Substation, which is located approximately 10 km west of Cloncurry on the Barkly Highway. The powerline corridor will be approximately 60 km in length.

AARC"s survey scope included a 400 m wide assessment of vegetation condition with regard to features of conservation significance, in particular Purple-necked Rock-wallaby (*Petrogale purpureicollis*) habitat and River Red Gum (*Eucalyptus camaldulensis*) creek crossings. Any areas of conservation significance were surveyed on foot along the 400 m wide corridor, while areas not of conservation significance were surveyed from a vehicle. In addition, a weed survey was conducted, which entailed identifying any LP Act listed weeds or introduced flora species found along the corridor.

5.4.2 Access Route

The primary proposed Access Route follows an existing track for approximately 9 km from the Project site. At the eastern end of the primary access route it diverts from the existing track from 1 km along a straight route across open terrain to join up with the Burke Developmental Road. The proposed primary route crosses the Dugald River and Silvermine Creek.

An alternate access road route is being proposed and may be used in the foreseeable future. This route follows the primary access road route from the Project site for 4 km, and then diverts directly east for 5 km, ultimately joining the Burke Developmental Road.

It may also be necessary to use a temporary access road deviation (called the Longamundi Deviation), if mining activity occurs on adjacent tenures. This deviation will divert the access road from the Project site around the Longamundi mineral deposit. The deviation will commence at the Project site approximately 850 m north of the primary access route. The deviation is approximately 2 km in length and connects with the primary access track before the alternate access road diversion.

The scope of the Access Route was to survey a 50 m wide corridor, assessing of the condition of the vegetation type with regard to quality and conservation value. Mapping of the REs was undertaken through the use of aerial photographs, geological maps, and the use of a Geographic Positioning System in association with the findings of the field survey.

5.4.3 Water Pipeline

The water pipeline route commences at the T-intersection of the Ernest Henry / Lake Julius Pipeline and travels south and then west to the proposed process plant area within the Dugald River Project site. The corridor is approximately 10 km long.

AARC"s scope of works for the water pipeline corridor included a 40 m wide assessment of the condition of the vegetation type with regard to quality and conservation value and the mapping of the REs through the use of aerial photographs, geological maps, and the use of a GPS in association with the findings of the field survey. As the water pipeline corridor travels close to the base of Mount Rose Bee, potential Purple-necked Rock-wallaby (*Petrogale purpureicollis*) habitat, scats were collected for analysis and outcrops were walked to determine extent of habitat.

6.0 PROJECT SITE FLORA RESULTS AND DISCUSSION

In summary, eight vegetation communities inhabited the Project site with a total of 222 flora species. No flora species identified are of conservation significance and 17 species are introduced.

The following sections describe the vegetation communities occurring on the Project site. This includes a description of the vegetation structure and the dominant species of the canopy, mid-storey and ground layer. Section 8.0 discusses the vegetation communities and species of significance found on the corridors.

Eight distinct vegetation communities were identified on the Project site. All of these communities were classed as Remnant Vegetation as defined in the VM Act. Associations within the communities reflect different vegetation structures and compositions, which occur on different geophysical locations. The corresponding Queensland Herbarium RE classifications are noted for each of the described remnant vegetation communities.

The eight vegetation communities include:

- Community 1 – Snappy Gum Open Woodland on steep hills and strike ridges (RE 1.11.2a);
- Community 2 – Snappy Gum Open Woodland on foothills (RE 1.11.2e);
- Community 3 – Cloncurry Box Open Woodland on low broad hills (RE 1.11.3a);
- Community 4 – Cloncurry Box Open Woodland on hills (RE 1.11.3x1);
- Community 3 – Mixed Bloodwood Riparian Woodland (RE 1.3.6);
- Community 4 – River Red Gum Riparian Woodland (RE 1.3.7b);
- Community 5 – Gidgee Open Woodland (re 1.11.2x2); and
- Community 6 – Silver Box / Cloncurry Box Open Woodland on red earths (RE 1.5.4x3).

Figure 7 maps the location of vegetation communities on the Project site.

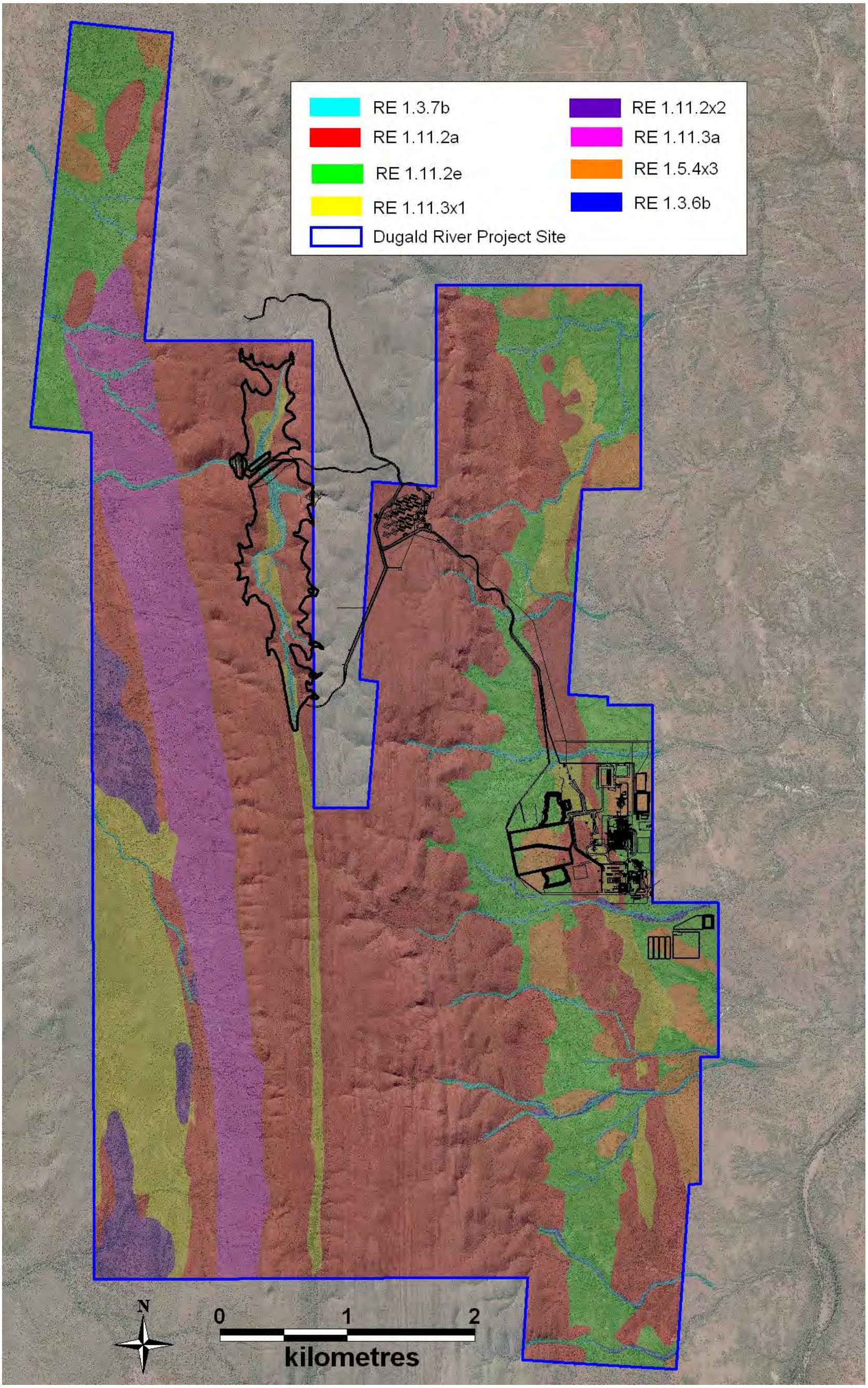


Figure 7 Vegetation Communities on the Project site

6.1 COMMUNITY 1 – SNAPPY GUM OPEN WOODLAND ON STEEP HILLS AND STRIKE RIDGES (RE 1.11.2A)

6.1.1 Location

The Snappy Gum woodland on steep hills and strike ridges (RE 1.11.2a) community is located on skeletal soils forming the Knapdale Range and smaller hillocks on the Project site (refer to Figure 7). Snappy Gum was the dominant community on the Project site, spanning over approximately 52.9% (1,816 ha).

6.1.2 Community Description

The Snappy Gum Open Woodland (RE 1.11.2a) is dominated by a Snappy Gum (*Eucalyptus leucophloia*) open canopy, a moderate to dense shrub layer of Turpentine (*Acacia chisholmii*) and a grassy layer of Soft Spinifex (*Triodia pungens)* (Photo Plate 1 and Photo Plate 2). Other canopy trees include the Western Bloodwood (*Corymbia terminalis*), *Eucalyptus herbertiana* and Cloncurry Box (*Eucalyptus leucophylla*), with an occasional sparse understory of Arid Peach (*Terminalia aridicola*). Groundcover consists of 45% grass and forbs, 4% bare ground, 1% leaf litter and 50% rock. Canopy cover is approximately 3% with an average height of 4 m. Average species recorded along a Secondary transect in the Snappy Gum Open Woodland is 9 in the dry season and 44 in the wet season.



Photo Plate 1 Snappy Gum Open Woodland – RE 1.11.2a



Photo Plate 2 Snappy Gum Open Woodland – RE 1.11.2a

Species presented within Table 6 are indicative of the dominant species recorded within this community. A full list of species is presented in Appendix B. RE 1.11.2a occurs on strongly folded metamorphic pre-Cambrian rock, along the Knapdale Quartzite geological sequence, with associated mudstone, sandstone, siltstone and shale.

Table 6 Community 1 (RE 1.11.2a)- Vegetation Community Description

Community	Snappy Gum Open Woodland on steep hills and strike ridges
Regional Ecosystem	1.11.2a : Low open-woodland of *Eucalyptus leucophloia* often with *Corymbia spp., Terminalia aridicola* and *Eucalyptus leucophylla* with shrub layer of *Acacia spp.* and ground layer of *Triodia spp*. Occurs on steep hills and strike ridges (BVG1M: 19a)
Biodiversity Status	No concern at present
VM Act Status	Least concern
EPBC Act	Not listed
Tree Layer	3 – 6 metres *Eucalyptus leucophloia, Eucalyptus herbertiana, Corymbia terminalis, Terminalia aridicola, Corymbia aspera*

Shrub Layer	1 – 3 metres *Acacia monicola, Acacia chisholmii, Acacia elachantha, Acacia chippendalei, Grevillea dryandri, Euphorbia tannensis*
Groundcover	0 – 0.6 metre *Triodia pungens, Fimbristylis tetragona, Fimbristylis dichotoma, Cymbopogon bombycinus, Indigofera linnaei, Hybanthus enneaspermus, Stackhousia intermedia, Cheilanthes brownii, Chamaecrista symonii, Bonamia media, Polycarpaea corymbosa*
Structure Category	Very sparse

6.1.3 Conservation Value

6.1.3.1 Species

Targeted searches for species of conservation significance were conducted. Ground-truthing identified no species of conservational significance within RE 1.11.2a. The potential on site occurrence of threatened species identified in database searches is described in Table 14

Introduced flora species within RE 1.11.2a include Kapok Bush (*Aerva javanica*), Tickweed (*Cleome viscosa*) and Buffel Grass (*Pennisetum ciliare*). Weed diversity and abundance is relatively low within this RE, as seed dispersal would be limited to wind transport and bird droppings. No weeds of national significance were found within RE 1.11.2a.

6.1.3.2 Community

Snappy Gum Open Woodland on steep hills and strike ridges (RE 1.11.2a), is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status. This ecological community is not listed under the EPBC Act. Areas in which RE 1.11.2 is under reserve include Lawn Hill (Gregory) Resources Reserve and the Boodjamulla (Lawn Hill) National Park.

Overall, the condition of Snappy Gum Open Woodland (RE 1.11.2a) on the Project site is healthy. Intact stands of this community are abundant in the region and it is unlikely disturbance within the Project site will significantly impact on the regional occurrence of this community.

6.2 COMMUNITY 2 – SNAPPY GUM OPEN WOODLAND ON FOOTHILLS (RE 1.11.2E)

6.2.1 Location

The Snappy Gum Open Woodland on foothills (RE 1.11.2e) occurs on lower slopes of the Knapdale Range. This community covers approximately 16.2% (555.5 ha) of the Project site. Refer to Figure 7 for community distribution.

6.2.2 Community Description

The Snappy Gum Open Woodland (RE 1.11.2e) is dominated by a Snappy Gum (*Eucalyptus leucophloia*) open canopy, with associated Western Bloodwood (*Corymbia terminalis*) and Cloncurry Box (*Eucalyptus leucophylla*), a sparse shrub layer of Turpentine (*Acacia lysiphloia*) and a grassy layer of Soft Spinifex (*Triodia pungens)* (Photo Plate 3). Groundcover consists of 45% grass and forbs, 34% bare ground, 6% leaf litter and 15% ironstone cover. Canopy cover is approximately 3% with an average height of 5.5 m. Average species recorded along a Secondary transect in the Snappy Gum Open Woodland (RE 1.11.2e) is 12 in the dry season and 38 in the wet season.



Photo Plate 3 Snappy Gum Open Woodland – RE 1.11.2e

Species presented within Table 7 are indicative of the dominant species recorded within this community. A full list of species is presented in Appendix B. RE 1.11.2e occurs on strongly folded metamorphic Middle Proterozoic rock, along the Corella Formation and Knapdale Quartzite geological sequences, with associated laminated calcareous siltstone, limestone, scapolitic granofels and minor metabasalts at the top.

Table 7 Community 2 (RE 1.11.2e) - Vegetation Community Description

Community	Snappy Gum Open Woodland on foothills
Regional Ecosystem	1.11.2e : Low open-woodland of *Eucalyptus leucophylla* and *E. leucophloia* often with *Acacia cambagei* and *Corymbia terminalis* with a sparse ground layer of *Triodia pungens* and/or *Triodia longiceps*. Occurs on footslopes and lower slopes, broken by creeks and drainages (BVG1M: 19b)

Biodiversity Status	No concern at present
VMR Status	Least concern
EPBC Act	Not listed
Tree Layer	4 – 7 m *Eucalyptus leucophloia, Eucalyptus leucophylla, Corymbia terminalis*
Shrub Layer	1 – 3 metres *Acacia lysiphloia, Acacia monicola, Acacia bidwillii, Acacia holosericea, Acacia retivenea, Carissa lanceolata, Gossypium australe, Hakea cordophylla, Paratephrosia lantana, Tephrosia rosea var rosea, Tephrosia varians, Triumfetta rupestris*
Groundcover	0 – 1 metre *Triodia pungens, Pennisetum ciliare, Aristida contorta, Cymbopogon bombycinus, Enneapogon polyphyllus, Eriachne mucronata, Bulbostylis barbata, Cyperus vaginatus, Fimbristylis signata, Fimbristylis dichotoma, Crotalaria novae-hollandiae, Crotalaria dissitiflora,*
Structure Category	Very sparse

6.2.3 Conservation Value

6.2.3.1 Species

Targeted searches for species of conservation significance were conducted. Ground-truthing identified no species of conservational significance within RE 1.11.2e at the time of surveys. The potential on site occurrence of threatened species identified in database searches is described in Table 14.

Introduced flora species within RE 1.11.2e include Kapok Bush (*Aerva javanica*), Tickweed (*Cleome viscosa*), Tarvine (*Boerhavia paludosa*), Colocynth (*Citrullus colocynthis*), Buffel Grass (*Pennisetum ciliare*) and Cloncurry Buffel Grass (*Pennisetum pennisetiforme*). The Buffel Grass (*Pennisetum ciliare*) was co-dominant with Soft Spinifex (*Triodia pungens*) in areas adjacent to ephemeral watercourses. No weeds of national significance were found.

6.2.3.2 Community

Snappy Gum Open Woodland on foothills (RE 1.11.2e), is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status and is not classed as a listed ecological community under the EPBC Act. Areas in which RE 1.11.2 is under reserve include Lawn Hill (Gregory) Resources Reserve and the Boodjamulla (Lawn Hill) National Park.

Intact stands of this community are abundant in the region, with greater than 10,000 ha of the state-wide extent of this RE remaining. It is unlikely disturbance within the Project site will significantly impact on the regional occurrence or integrity of this community

6.3 COMMUNITY 3 – CLONCURRY BOX OPEN WOODLAND ON LOW BROAD HILLS (RE 1.11.3A)

6.3.1 Location

Cloncurry Box Open Woodland on low broad hills (RE 1.11.3a) occurred along the western foothills of the Knapdale Range. This community covers approximately 10.6% (365.5 ha) of the Project site (refer to Figure 7).

6.3.2 Community Description

The Cloncurry Box Open Woodland on low broad hills (RE 1.11.3a) is dominated by a low canopy of Cloncurry Box (*Eucalyptus leucophylla*), with associated Western Bloodwood (*Corymbia terminalis*), Ghost Gum (*Corymbia aparrerinjia*) and an infrequent understory of Whitewood (*Atalaya hemiglauca*) (Photo Plate 4). The shrub layer is sparsely dominated by Turpentine. Groundcover consists of 70% Soft Spinifex, 10% rock, 15% bare ground and 5% leaf litter. Canopy cover averages 11% with a height of 4 m. Floristic diversity was relatively lower than other communities, with an average of 6 species during the dry season and 32 species during the wet season were recorded along each Secondary transect.



Photo Plate 4 Cloncurry Box Open Woodland – RE 1.11.3a

Species presented within Table 8 are indicative of the dominant species recorded within this community. A full list of species is presented in Appendix B. This community occurs on the Knapdale Quartzite geological sequence on siltstone, shale, metabasalts and dolerites.

Table 8 Community 3 (RE 1.11.3a) - Vegetation Community Description

Community	Cloncurry Box Open Woodland on low broad hills
Regional Ecosystem	1.11.3a: Low open-woodland *Eucalyptus leucophylla* often with *Corymbia terminalis*, *Corymbia aparrerinja* and *Atalaya hemiglauca* with scattered shrubs of *Acacia chisholmii* and a sparse ground layer of *Triodia pungens*. Occurs on broad low hills; metamorphosed igneous rocks (BVG1M: 19b)
Biodiversity Status	No concern at present
VMR Status	Least concern
EPBC Act	Not listed
Tree Layer	3 – 5 metres *Eucalyptus leucophylla, Corymbia terminalis, Corymbia aparrerinja, Atalaya hemiglauca*
Shrub Layer	1 – 3 metres *Acacia chisholmii, Acacia retivena, Acacia monitcola, Grevillea striata, Acacia holosericea, Carissa lanceolata, Eremophila latrobei, Eremophila longifolia, Sesbania campylocarpa, Tephrosia flagellaris*
Groundcover	0 – 0.7 metre *Triodia pungens, Pennisetum ciliare, Aristida inaequiglumis, Enneapogon polyphyllus, Eragrostis fallax, Eulalia aurea, Heteropogon contortus, Fimbristylis microcarya, Crotalaria aridicola, Sida cordifolia, Hybanthus enneaspermus, Vigna radiata var subobata, Indigofera colutea, Pterocaulon sphacelatum, Boerhavia schomburgkiana, Chamaesyce coghlanii, Zornia muriculata*
Structure Category	Very sparse

6.3.3 Conservation Value

6.3.3.1 Species

Targeted searches for species of conservation significance determined that no species of conservation significance inhabit the Cloncurry Box Open Woodland.

No weed species, listed under the LP Act or listed as of national significance, were observed within Cloncurry Box Open Woodland on low broad hills (RE 1.11.3a). Introduced species identified within this community include Mimosa (*Acacia* farnesiana), Kapok Bush (*Aerva javanica*), Cockroach Bush (*Senna notabilis*), Buffel Grass (*Pennisetum ciliare*), Cloncurry Buffel (*Pennisetum pennisetiforme*) and Flannel Weed (*Sida cordifolia*).

6.3.3.2 Community

As detailed in Table 7, Cloncurry Box Open Woodland (RE 1.11.3a) is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status and is not listed under the EPBC Act.

Although RE 1.11.3 is not protected within the Northwest Highlands bioregion, intact stands are abundant throughout this Queensland bioregion. The Cloncurry Box Open Woodland on low broad hills (RE 1.11.3a) is not under threat from clearing and is considered abundant within the region, with the state-wide remnant extent greater than 10,000 ha.

6.4 COMMUNITY 4 – CLONCURRY BOX OPEN WOODLAND ON HILLS (RE 1.11.3X1)

6.4.1 Location

The Cloncurry Box Open Woodland on hills (RE 1.11.3x1) occurred within the valley of the Knapdale Range and along the eastern sections of the Project site (refer to Figure 7). This community covered approximately 9.7% (331.6 ha) of the entire site.

6.4.2 Community Description

This community consists of an open canopy of Cloncurry Box (*Eucalyptus leucophylla*), with associated Western Bloodwood (*Corymbia terminalis*) (Photo Plate 5). Ground cover consisted of 30% bare ground, 20% rock, 10% leaf litter and 35% tussock grass. Trees and shrubs cover approximately 5%, with an average crown cover of 8%. The average number of flora species identified along a Secondary transect within this community is 8 in the dry season and 29 in the wet season.



Photo Plate 5 Cloncurry Box Open Woodland on hills – RE 1.11.3x1

Species presented within Table 9 are indicative of the dominant species recorded within this community. A full list of species is presented in Appendix B. This RE is located along the Corella Formation geological sequence, with associated calcareous siltstone, limestone and minor metabasalts at the top.

Table 9 Community 4 (RE 1.11.3x1) – Vegetation Community Description

Community	Cloncurry Box Open Woodland on hills
Regional Ecosystem	RE 1.11.3x1: Low open-woodland of *Eucalyptus leucophylla* often with *Corymbia terminalis* and Eucalyptus *leucophloia* with *Acacia spp.* dominated shrub layer and ground layer of *Triodia spp.* and/or tussock grasses. Includes areas of *Acacia spp.* shrubland and *Triodia spp. grassland*. Occurs on hills on strongly folded pre-Cambrian rocks; skeletal soils, some shallow loams. (BVG1M: 19b)
Biodiversity Status	No concern at present
VMR Status	Least concern
EPBC Act	Not listed
Tree Layer	5 – 7 metres *Eucalyptus leucophylla, Corymbia terminalis, Eucalyptus leucophloia*
Shrub Layer	0.5 – 2.5 metres *Acacia chisholmii, Acacia monitcola, Acacia lysiphloia, Grevillea striata, Carissa lanceolata, Acacia torulosa*
Groundcover	0 – 0.5 metre *Triodia pungens, Enneapogon polyphyllus Aristida contorta, Fimbristylis dichotoma, Fimbristylis microcarya, Crotalaria novae-hollandiae,*
Structure Category	Very sparse

6.4.3 Conservation Status

6.4.3.1 Species

Targeted searches for species of conservation significance determined that no species of conservation significance inhabit the Cloncurry Box Open Woodland on hills (RE 1.11.3x1) during survey periods.

Non-native species identified within RE 1.11.3x1 include the Kapok Bush (*Aerva javanica*), Cockroach Bush (*Senna notabilis*), Buffel Grass (*Pennisetum ciliare*), Cloncurry Buffel (*Pennisetum pennisetiforme*) and Flannel Weed (*Sida cordifolia*). No weed species, listed under the LP Act or listed as of national significance, were observed within RE 1.11.3x1.

6.4.3.2 Community

As detailed in Table 7, Cloncurry Box Open Woodland (RE 1.11.3x1) is listed as „Least Concern‟ under the VMR, „No Concern at Present‟ under the DERM Biodiversity Status and is not listed under the EPBC Act.

Although RE 1.11.3 is not protected within the Northwest Highlands bioregion, intact stands are abundant throughout this Queensland bioregion. The Cloncurry Box Open Woodland on low broad hills (RE 1.11.3e) is not under current threat from clearing or non-native species encroachment. RE 1.11.3 is considered abundant within the region, with the state-wide remnant extent greater than 10,000 ha.

6.5 COMMUNITY 5 - MIXED BLOODWOOD RIPARIAN WOODLAND (RE 1.3.6B)

6.5.1 Location

The Mixed Bloodwood Riparian Woodland community occurred on all watercourses within the Project site (refer to Figure 7), covering approximately 0.3% (11.2 ha) of the entire site.

6.5.2 Community Description

This community is dominated by the Western Bloodwood (*Corymbia terminalis*) and North-west Ghost Gum (*Corymbia aparrerinjia*), with associated Cloncurry Box (*Eucalyptus leucophylla*) (Photo Plate 6). Ground cover consisted of 10% bare ground, 20% rock, 5% leaf litter and 55% groundcover. Trees and shrubs cover approximately 10%, with an average crown cover of 24%. The average number of flora species identified along a Secondary transect within this community is 11 in the dry season and 41 in the wet season.



Photo Plate 6 Mixed Bloodwood Riparian Woodland – RE 1.3.6b

Species presented within Table 10 are indicative of the dominant species recorded within this community. A full list of species is presented in Appendix B. This community occurs along the Corella formation geological sequence. It occurs on terraces and floodplains on Quaternary alluviums. Soils consist of rock, gravel and shallow loams.

Table 10 Community 5 (RE 1.3.6b) – Vegetation Community Description

Community	Mixed Bloodwood Riparian Woodland
Regional Ecosystem	RE 1.3.6b: Floodplain (other than floodplain wetlands). Woodland of *Corymbia aparrerinja* often with *Corymbia terminalis, Eucalyptus leucophylla, Eucalyptus camaldulensis, Lysiphyllum cunninghamii* and/or *Acacia cambagei* with a sparse ground layer of tussock grasses with *Triodia longiceps* in some places. Occurs on river terraces. (BVG1M: 16c)
Biodiversity Status	Of Concern
VMR Status	Least concern
EPBC Act	Not listed
Tree Layer	*Corymbia terminalis, Corymbia aparrerinjia, Eucalyptus leucophylla, Eucalyptus camaldulensis*
Shrub Layer	1 – 3 metres *Acacia holosericea, Acacia monticola, Acacia retivena, Sesbania javanicea, Ocimum tenuiflorum*
Groundcover	0 – 0.7 metre *Pennisetum ciliare, Indigofera colutea, Heteropogon contortus, Eragrostis elongata, Eragrostis basedowii, Themeda triandra, Cyperus difformis, Cyperus pulchellus, Fimbristylis microcarya, Alternanthera denticulata, Bonamia media, Crotalaria novae-hollindiae, Evolvulus alsinoides, Vigna radiate var sublobata*
Structure Category	Very sparse

6.5.3 Conservation Status

6.5.3.1 Species

Targeted searches for species of conservation significance determined that no species of conservation significance inhabit the Mixed Bloodwood Riparian Woodland (RE 1.3.6b) at the time of surveys.

No weed species, listed as a weed of national significance or listed under the LP Act, were observed within Mixed Bloodwood Riparian Woodland (RE 1.3.6b). However non-native species which inhabit this community include Mimosa (*Acacia farnesiana*), Kapok Bush (*Aerva javanica*), Khaki Weed (*Alternanthera pungens*), Spiked Malvastrum (*Malvastrum americanum var americanum*), Buffel

Grass (*Pennisetum ciliare*), Cloncurry Buffel (*Pennisetum pennisetiforme*), Cockroach Bush (*Senna notabilis*) and Flannel Weed (*Sida cordifolia*).

6.5.3.2 Community

As detailed in Table 10, Mixed Bloodwood Riparian Woodland (RE 1.3.6b) has been given an „Of Concern" DERM Biodiversity status due to a high grazing pressure, changed fire regimes and subjection to Buffel Grass (*Pennisetum ciliare*) invasion. It is listed as being „Least Concern" under the VMR and is not classed as a threatened ecological community under the EPBC Act. Areas within the Northwest Highlands bioregion where RE 1.3.6 is protected include the Boodjamulla (Lawn Hill) National Park, Lawn Hill (Gregory) Resources Reserve, Camooweal Caves National Park and Lawn Hill (Gregory River Base) Resources Reserve.

Overall, the condition of Mixed Bloodwood Riparian Woodland on the Project site is healthy, with a relatively diversity of species comprising the community. Intact stands of this community are abundant within this Queensland bioregion, with the total regional mapped extent of this RE compromising of greater than 10,000 ha. Assuming mitigation strategies are in place, it is unlikely the Project will have impact on the regional extent and health of this community.

6.6 COMMUNITY 6 – RIVER RED GUM RIPARIAN WOODLAND (RE 1.3.7B)

6.6.1 Location

The River Red Gum Riparian Woodland (RE 1.3.7b) fringes most watercourses on the Project site. This community comprises 2.9% (98.4 ha) of the Project site (refer to Figure 7).

6.6.2 Community Description

The River Red Gum Riparian Woodland (RE 1.3.7b) is dominated by the River Red Gum (*Eucalyptus camaldulensis*), with associated Northern Swamp Box (*Lophostomon grandiflorus subsp. riaparius*), and North-west Ghost Gum (*Corymbia aparrerinjia*) (Photo Plate 7 and Photo Plate 8). Unlike the RE description for 1.3.7b, no *Melaleuca spp.* are established within this community on the Project site. Larger watercourses with more frequent surface water inundation, such as the Dugald River, contained *Melaleuca spp.*. A shrubby understory was present. Groundcover averages 60% grasses and vines, 20% leaf litter and 10% gravel and sand. Trees and shrubs comprise 10% of the community coverage, with approximate canopy coverage of 19%. The average number of species recorded in a Secondary transect is 12 during the dry season and 50 during the wet season.



Photo Plate 7 River Red Gum Riparian Woodland - RE 1.3.7b – Swamp Box dominant along upper reaches of watercourse



Photo Plate 8 River Red Gum Riparian Woodland - RE 1.3.7b

Species presented within Table 11 are indicative of the dominant species recorded within this community. A full list of species is presented in Appendix B. This community is located along the

Knapdale Quartzite and Corella Formation geological sequence, within small eroded sections of sand, gravel and colluviums.

Table 11 Community 6 (RE 1.3.7b) – Vegetation Community Description

Community	River Red Gum Riparian Woodland
Regional Ecosystem	RE 1.3.7b: Riverine wetland or fringing riverine wetland. Fringing woodland of *Eucalyptus camaldulensis*, usually with *Lophostomon grandiflorus* and *Melaleuca bracteata* and/or *Melaueca dissitiflora*. Occurs on recent levees and channel deposits of medium and smaller tributaries which are dry for most of the year; alluvial soils. (BVG1M: 16a)
Biodiversity Status	Endangered
VMR Status	Least concern
EPBC Act	Not listed
Tree Layer	12 – 18 metres *Eucalyptus camaldulensis, Lophostomon grandiflorus subsp. riparius, Corymbia aparrerinjia, Corymbia terminalis, Terminalia aridicola, Lysiphyllum cunninghamii, Eucalyptus leucophylla*
Shrub Layer	1 – 3 metres *Acacia holosericea, Flueggea virosa subsp melanthesoides Vitex trifolia var trifolia Acacia monticola, Acacia retivenea, Acacia torulosa,Carissa lanceolata, Sesbania javacina, Ficus aculeata, Hakea aborescens,*
Groundcover	0 – 1 metre *Pennisetum ciliare, Aristida latifolia, Cymbopogon bombycinus, Dicanthium sericeum, Eragrostis basedowii, Triodia pungens, Cyperus conicus car conicus, Cyperus difformis, Cyperus pulchellus, Cyperus microcephalus, Fimbristylis littoralis, Frimbristylis microcarya, Alternanthera denticulata, Anisomeles malabartica, Bonamia media, Corchorus pascuorum, Crotalaria dissitiflora, Cyanotis axillaris,Evolvulus alsinoides, Indigofera colutea, Iphigenia indica,*
Structure Category	Sparse

6.6.3 Conservation Value

6.6.3.1 Species

Targeted searches for species of conservation significance identified no species of conservation significance present at the time of surveys within River Red Gum Riparian Woodland (RE 1.3.7b).

No weed species, listed under the LP Act or listed as of national significance, were observed within the River Red Gum Riparian Woodland (RE 1.3.7b). However 14 non-native species, including Buffel Grass (*Pennisetum cilare*), Cabbage Tree (*Calotropis procera*), Mimosa (*Acacia farnesiana*),Kapok Bush (*Aerva javanica*), Khaki Weed (*Alternanthera pungens*), Awnless Barnyard Grass (*Echinochloa crebra*), Small Stinkgrass (*Eragrostis minor*), Tickweed (*Cleome viscosa*), Spiked Malvastrum

(*Malvastrum americanum var. americanum*), Cloncurry Buffel (*Pennisetum pennisetiforme*), Cockroach Bush (*Senna notabilis*), Flannel Weed (*Sida cordifolia*), Spiny Sida (*Sida spinosa*) and Noogoora Burr (*Xanthium strumianum*) were noted to inhabit this community. In most cases, the larger the watercourse, the more dominant Buffel Grass (*Pennisetum ciliare*) occurred. Transects within creeklines would comprise of 100% groundcover composition of Buffel Grass (*Pennisetum cilare*) in the wet season.

6.6.3.2 Community

As detailed in Table 11, River Red Gum Riparian Woodland (RE 1.3.7b) is listed as „Least Concern" under the VMR and is not listed as a threatened ecological community under the EPBC Act. The DERM Biodiversity Status lists this RE as being „Endangered". The Endangered listing is due to severe degradation from high grazing pressure and invasion of Buffel Grass (*Pennisetum ciliare*). Protected areas within Queensland for this community occurs include the Boodjamulla (Lawn Hill) National Park, Lawn Hill (Gregory) Resource Reserve and Lawn Hill (Gregory River Base) Resource Reserve. These protected areas assist in preserving the diversity and health of floral and faunal species which thrive in this riverine community.

Overall the condition of River Red Gum Riparian Woodland (RE 1.3.7b) is reduced by grazing and weed invasion. The River Red Gum Riparian Woodland, and much of the surrounding vegetation, is subject to low intensity cattle grazing. The impact of disturbance is obvious in the ground flora that inhabits the community, which was heavily grazed during the dry season survey. Based on proposed disturbance plans for the Project and current infrastructure, some additional clearing of this community will be required for the proposed access tracks and TSF. Assuming appropriate sediment and erosion control measures are in place, it is unlikely the community"s diversity or abundance would be impacted at a regional scale.

6.7 COMMUNITY 7 – GIDGEE OPEN WOODLAND (RE 1.11.2X2)

6.7.1 Location

The Gidgee Open Woodland (RE 1.11.2x2) is found in isolated patches, predominantly on the western side of the Project site (refer to Figure 7), covering approximately 2.9% (97.1 ha).

6.7.2 Community Description

The open canopy is comprised of Gidgee (*Acacia cambagei*) trees, with an understory consisting of the Limestone Cassia (*Senna artemisioides subsp. oligophylla*) and Crimson Turkey Bush (*Eremophila latrobei*) and seasonal grass layer of predominantly Buffel Grass (*Pennisetum ciliare*) (Photo Plate 9). Groundcover consists of 16% grass and forbs, 35% leaf litter, 25% rock and 21% bare ground. The remaining 6% is comprised of trees and shrubs. Canopy cover averages 22%. The community has a relatively low diversity of flora, averaging 5 species per Secondary transect in the dry season and 17 species in the wet season.



Photo Plate 9 Gidgee Open Woodland – RE 1.11.2x2

Species presented within Table 12 are indicative of the dominant species recorded within this community. A full list of species is presented in Appendix B This community is located on the Knapdale Quartzite geological sequence, along folded metamorphic sediments on skeletal soils. A layer of ironstone pebbles is prevalent on the surface soils.

Table 12 Community 7 (RE 1.11.2x2) – Vegetation Community Description

Community	Gidgee Open Woodland
Regional Ecosystem	RE 1.11.2x2: *Acacia cambagei* low woodland. Occurs on hills and ranges of fine grained metamorphic sediments. (BVG1M: 26a)
Biodiversity Status	No concern at present
VMR Status	Least concern
EPBC Act	Not listed
Tree Layer	5 – 8 metres *Acacia cambagei*
Shrub Layer	0.5 – 2 metres *Carissa lanceolata Acacia hemignosta, Salsola kali, Senna arteisioides subsp. oligophylla, Capparis lasiantha, Eremophila latrobei*

Groundcover	0 – 0.5 metre *Pennisetum cilare, Aristida contorta, Enneapogon oblongus, Triodia pungens, Enneapogon poilphyllus, Paspalidium rarum, Panicum decompositum, Pennisetum ciliare, Achyranthes aspera, Evolvulus alsinoides, Indigofera linifolia, Indigofera linnaei, Polycarpaea corymbosa, Sclerolaena bicornis, Solanum ellipticum*
Structure Category	Very sparse

6.7.3 Conservation Value

6.7.3.1 Species

Targeted searches for species of conservation significance determined that no listed species were present at the time of surveys within Gidgee Open Woodland (RE 1.11.2x2).

No weed species, listed under the LP Act or identified of national significance, were observed within this community. Non-native species identified within this community include Buffel Grass (*Pennisetum cilare*), Cloncurry Buffel (*Pennisetum pennisetiforme*), Mimosa (*Acacia farnesiana*), Kapok Bush (*Aerva javanica*), Downy Thornapple (*Datura inoxia*) and Spiked Malvastrum (*Malvastrum americanum var americanum*).

6.7.3.2 Community

The Gidgee Open Woodland (RE 1.11.2x2) is listed as „Least Concern" under the VMR and „No Concern at Present" under the DERM Biodiversity Status. This community is not classed as a threatened ecological community under the EPBC Act. RE 1.11.2 is represented within Lawn Hill (Gregory) Resource Reserve and Boodjamulla (Lawn Hill) National Park.

This community is subject to low intensity cattle grazing, as Gidgee (*Acacia cambagei*) is known to grow on fertile soils. The surface clay layer enables moisture to hold in the soils for a prolonged period of time following a rain event. The impact of disturbance is obvious in the ground flora that inhabits the community, as well as the evidence of recent cattle presence.

No infrastructure is proposed within or near, the Gidgee Open Woodland community (refer to Figure 7), therefore it is unlikely the Project will affect the regional occurrence or health of this community.

6.8 COMMUNITY 8 - SILVER BOX / CLONCURRY BOX OPEN WOODLAND ON RED EARTHS (RE 1.5.4X3)

6.8.1 Location

The Silver Box / Cloncurry Box Open Woodland on red earths (RE 1.5.4x3) occurs along the eastern portion of the Project site, as well as in the northwest portion of site (refer to Figure 7). Approximately 4.5% (155.1 ha) of the Project site are covered by this community.

6.8.2 Community Description

The Silver Box / Cloncurry Box Open Woodland on red earths (RE 1.5.4x3) consists of a dominant canopy of the Cloncurry Box (*Eucalyptus leucophylla*), with a patchy yet sometimes dominant layer of Silver Box (*Eucalyptus pruinosa*). Occasional Small-fruited Bloodwood (*Eucalyptus dichromophloia)* and North-west Ghost Gum (*Corymbia aparrerinjia*) are present (Photo Plate 10 and Photo Plate 11). The scattered shrub layer consists of Bootlace Oak (*Hakea cordophylla*), Conkerberry (*Carissa lanceolata)* and Turpentine (*Acacia lysiphloia*). Groundcover consists of 20% surface pebbles, 10% leaf litter, 20% bare ground and 40% tussock grasses. Trees and shrubs make up the remaining 10% and have an average canopy cover of 5%. The average number of flora species identified within a Secondary transect is 8 during the dry season and 37 during the wet season.



Photo Plate 10 Silver Box / Cloncurry Box Open Woodland on red earths



Photo Plate 11 RE 1.5.4x3 - Cloncurry Box dominant on red earths

Species presented within Table 13 are indicative of the dominant species recorded within this community. A full species list can be found in Appendix B. This community occurs within the Knapdale Quartzite and Corella Formation geological sequence. This community occurs on plains and valley bottoms with red earths, shallow loams, clays and skeletal soils.

Table 13 Community 8 (RE 1.5.4x3) – Vegetation Community Description

Community	Silver Box / Cloncurry Box Open Woodland on red earths
Regional Ecosystem	1.5.4x3: Open tussock grassland *of Aristida contorta, Aristida ingrata, Aristida inaequiglumis, Enneapogon spp., Eulalia aurea* often with *Triodia pungens* wooded with low trees including *Atalaya hemiglauca, Eucalyptus pruinosa, Lysiphyllum spp., Acacia cambagei, Eucalyptus leucophylla* and *Corymbia aparrerinja*. Includes substantial areas of bare ground. Occurs on gravelly red plains. (BVG1M: 31b)
Biodiversity Status	Of Concern
VMR Status	Least concern
EPBC Act	Not listed
Tree Layer	4 – 7 metres *Eucalyptus leucophylla, Eucalyptus pruinosa, Corymbia aparrerinjia, Corymbia terminalis, Atalaya hemiglauca, Corymbia capricornia*

Shrub Layer	0.5 – 2.5 metres *Carissa lanceolata, Salsola kali, Acacia monicola, Acacia lysiphlia Santalum lanceolatum, Acacia holosericea, Capparis lasiantha, Gossypium australe, Grevillea striata, Trema tomentosa var aspera, Hakea cordophylla*
Groundcover	0 – 0.6 metre *Aristida holathera,* Enneapogon polyphyllus*, Triodia pungens, Pennisetum pennisetiforme, Cymbopogon bombycinus, Dicanthium sericeum, Enneapogon oblongus, Eragrostis leptocarpa, Eulalia aurea, Aristida inaequiglumis, Chloris virgata, Setaria surgens, Sporobolus caroli, Crotalaria aridicola, Crotalaria novae-hollindiae, Evolvulus alsinoides, Neptunia gracilis, Fimbrostylis dichotoma, Fimbristylis microcarya, Phyllanthis maderaspatensis, Solanum echinatum, Solanum ellipticum*
Structure Category	Very sparse

6.8.3 Conservation Value

6.8.3.1 Species

Despite targeted searches, no flora species of conservation significance were identified within this community at the time of surveys.

The non-native species of Mimosa (*Acacia farnesiana*), Awnless Barnyard Grass (*Echinochloa colona*), Spiked Malvastrum (*Malvastrum americanum var americanum*), Flannel Weed (*Sida cordifolia*) and Cloncurry Buffel (*Pennisetum pennisetiforme*) inhabit the Silver Box / Cloncurry Box Open Woodland on red earths (Re 1.5.4x3) community. No weeds of national significance were identified.

6.8.3.2 Community

As detailed in Table 13, Silver Box / Cloncurry Box Open Woodland on red earths (Re 1.5.4x3) community is listed as „Least Concern" under the VMR and „Of Concern" under the DERM Biodiversity Status. The „Of Concern" listing is due to Cloncurry Buffel (*Pennisetum pennisetiforme*) invading the ecosystem and changing its floristics and structure. Protected areas within the Northwest Highlands bioregion in which this regional ecosystem occurs includes the Camooweal Caves National Park, Boodjamulla (Lawn Hill) National Park and Lawn Hill (Gregory) Resources Reserve.

The Silver Box / Cloncurry Box community is in a relatively healthy condition, with low density of non-native species. Intact stands of this community are abundant in the region, with the state wide remnant extent being greater than 10,000 ha. It is unlikely the Project will impact on the regional occurrence of this community.

6.9 SUMMARY OF SPECIES OF CONSERVATION SIGNIFICANCE AND PROJECT SITE VEGETATION COMMUNITIES

6.9.1 Species of Conservation Significance

Targeted searches revealed no species of conservation significance to be present within the Project site.

This section discusses species of conservation significance known from the broader region and the potential to occur on the Project site. These species have been identified from a literature review (refer to Section 4.0). Table 14 provides an assessment of the likelihood of these species utilising the Project site. The assessment is based on the knowledge and opinion of AARC staff, information obtained from current field surveys, scientific literature and communications with relevant experts or interest groups.

Table 14 Flora of Conservation Significance Known from the Region Not Identified on the Project site

Botanical Name	Habitat Description	Potential Presence on Site
Brachychiton collinus	Inhabits rocky outcrops and granite country with little other understory present	Habitat for this species is present on the Project site. Despite extensive searches, this conspicuous species was not identified on the Project site. Low potential for presence on site
Fimbristylis distincta	One record from Undilla Homestead, Queensland. Occurred along a stream bank	Habitat for this species is present on the Project site. This species is ephemeral and presence is reliant on water availability. Low Potential for presence on site
Goodenia angustifolia	Occurs within *Corymbia terminalis* low woodland, on sandy loam soils with *Triodia pungens.* Records from Malbon and Duchess, northwest Queensland	Habitat for this species is present on the Project site. Moderate potential for presence on site
Ipomoea antonschmidii	*Eucalyptus leucophloia, Corymbia capricornia, Corymbia aparrerinja* and *Eucalyptus camaldulensis* woodlands. Grows in a variety of habitats, including rocky, sandy and red clay substrates. Occurs along the Lake Julius pipeline, Gunpowder and north of Mount Isa	Habitat for this species is present on the Project site. Extensive searches for any species in the Convolvulaceae family were conducted; however this species was not identified. Moderate potential for presence on site
Ptilotus maconochiei	*Eucalyptus leucophloia* and C*orymbia aspera* woodland, with *Triodia pungens* groundcover. On quartzite ridge tops, hillsides, slopes and shale	Habitat for this species is available on the Project site; however it was not identified despite extensive field surveys for any species in the family Asteraceae. Moderate potential for presence on site

Botanical Name	Habitat Description	Potential Presence on Site
Rhamphicarpa australiensis	Riparian Eucalypt open woodland, small creek channels, *Eucalyptus camaldulensis* woodland; occurs in clay soils and ferruginous/calcrete rock. Patchy distribution from Julia Creek, Gunpowder to Burke and Wills	Some habitat for this species is located on the Project site. Low potential for presence on site

6.9.2 Communities of Conservation Significance

A summary all REs occurring on the Project site is provided below in Table 15.

Table 15 Summary of the Conservation Significance of Regional Ecosystems

Vegetation Community	Regional Ecosystem Equivalents	EPBC Status	Queensland VMR	DERM Biodiversity Status
Snappy Gum Open Woodland on steep hills and strike ridges	1.11.2a	Not Listed	Least Concern	No Concern at Present
Snappy Gum Open Woodland on foothills	1.11.2e	Not Listed	Least Concern	No Concern at Present
Cloncurry Box Open Woodland on low broad hills	1.11.3a	Not Listed	Least Concern	No Concern at Present
Cloncurry Box Open Woodland on hills	1.11.3x1	Not Listed	Least Concern	No Concern at Present
Mixed Bloodwood Riparian Woodland	1.3.6b	Not Listed	Least Concern	Of Concern
River Red Gum Riparian Woodland	1.3.7b	Not Listed	Least Concern	Endangered
Gidgee Open Woodland	1.3.4	Not Listed	Least Concern	Of Concern
Silver Box/ Cloncurry Box Open Woodland on red earths	1.5.4x3	Not Listed	Least Concern	Of Concern

One community (RE 1.3.7b – River Red Gum Riparian Woodland) is listed as „Endangered" under the DERM Biodiversity Status due to severe degradation from high grazing pressure. The overall condition of this community on the Project site is reduced by cattle grazing and weed invasion. Based on proposed disturbance plans and existing tracks within the Project, additional clearing of this

community will be required for Project corridors and TSF. The total area of clearing within this community for the TSF will be 16.72 ha.

The Silver Box/Cloncurry Box Open Woodland (RE 1.5.4x3) is listed as „Of Concern" under the DERM Biodiversity Status due to invasion by Cloncurry Buffel Grass (*Pennisetum pennisforme*). On the Project site the overall condition of this community is relatively healthy with little invasion of introduced species. Based on proposed disturbance plans for the Project, 23.57 ha of clearing will be required in this community.

The Mixed Bloodwood Riparian Woodland (RE 1.3.6b) is listed as „Of Concern" under the DERM Biodiversity Status due to high grazing pressure, changing fire regimes and weed invasion. Based on the proposed plans for the Project, no clearing of this community will be required. Assuming mitigation strategies are implemented, the community is unlikely to be significantly impacted at a regional scale.

7.0 PROJECT SITE FAUNA RESULTS AND DISCUSSION

A combined total of 113 vertebrate fauna species were identified on the Project site (or immediately downstream) during the dry and wet season surveys, comprising 16 reptiles, 65 birds, 26 mammals and 6 amphibians. One mammal species of listed under the NC Act was identified on the Project site. A complete list of all observed fauna species is provided in Appendix C.

Each of the major vertebrate groups observed on the Project site is discussed below in Sections 7.1 to 7.4.

Fauna species of conservation significance along the corridor routes are discussed in Section 8.0.

7.1 AMPHIBIANS

7.1.1 Habitat Values

Many amphibian species that occur in Australia"s drier regions are burrowing species capable of spending extensive periods underground awaiting heavy rain, after which they come to the soil surface to feed and breed. This behaviour is referred to as aestivation and assists in water preservation and survival during prolonged drought (Withers 1995). Consequently, the vast majority of amphibians from seasonally dry regions occur in areas where the ground is soft enough to allow digging during wet periods.

Non-burrowing frog species also inhabit Australia"s drier regions where they adopt different survival strategies, such as sheltering deep in tree hollows or cool rock crevices. These species are typically associated with permanent water sources.

Amphibian habitat on the Project site varies seasonally due to the ephemeral nature of creeks and associated drainage lines. During the dry season (May-October), sandy drainage lines offer the only potential habitat. During the wet season (November-April), habitat variation and suitability increases in response to increased rainfall.

7.1.2 Observed Species

Most common amphibian species identified on the Project site included the Green Tree Frog (*Litoria caerula*), Ornate Burrowing Frog (*Platyplectrum ornatum*) and the non-native Cane Toad (*Rhinella marina*). The Red Tree Frog (*Litoria rubella*) (Photo Plate 12) was frequently observed near current exploration camp facilities. Less commonly observed species included the Giant Frog (*Cyclorana australis*) and Pale Tree Frog (*Litoria pallida*).



Photo Plate 12 Red Tree Frog seeking refuge in an *Acacia holosericea* phyllode

7.1.3 Amphibians of Conservation Significance

No amphibians of conservation significance have been previously recorded within the region (Appendix A). It is considered unlikely that any amphibian species of conservation significance occur on the Project site.

7.2 REPTILES

7.2.1 Habitat Values

Australia"s environment supports an extremely diverse assemblage of reptile species which exploit a wide array of micro-habitats (e.g. tree hollows, soil cracks) and food sources (e.g. succulent leaves, termites, grasshoppers, birds, and other reptiles) (Pianka 1969a; 1969b). This diversity encompasses species of widely different body sizes (skinks v. monitors), and life history strategies (burrowing blind snakes v. arboreal geckos).

The Project site provides a variety of habitat types thought to be suitable for reptile species occurring in the region. Micro-habitats such as those associated with tree hollows, vegetated watercourses, open woodlands scattered with fallen timber and rocky outcrops may suit a variety of reptile species.

7.2.2 Observed Species

A total of 16 reptile species were observed on the Project site. All reptile species recorded on the Project site are listed in Appendix C.

Skinks were the most diverse reptile group encountered and was represented by six species, comprising *Cryptoblepharus plagiocephalus sensu lato*, Stout Ctenotus (*Ctenotus herbetior*), Gravelly-soil Ctenotus (*Ctenotus lateralis*), Leopard Ctenotus (*Ctenotus pantherinus*), Northern Soil-crevice Skink (*Proablepharus tenuis*) and the Centralian Blue-tongue (*Tiliqua multifasciata*).

Four gecko species were identified, predominantly whilst spotlighting in watercourses. These included the Fat-tailed Gecko (*Diplodactylus conspiculatus*), Spotted Gecko (*Gehyra nana*), Tree Dtella (*Gehyra variegata*) and Bynoe"s Gecko (*Heteronotia binoei*).

The remaining six reptile species observed on the Project site were the Gilbert"s Dragon (*Amphibolurus gilberti*), Two-lined Dragon (*Diporiphora australis*) (Photo Plate 13), Yellow-sided Two-lined Dragon (*Diporiphora magna*), Black-headed Python (*Aspidites melanocephalus*), Stimpson"s Python (*Antaresia stimsoni*) and Orange-naped Snake (*Furnia ornatus*).



Photo Plate 13 Two-lined Dragon observed on the Project site during the Wet Season Survey

7.2.3 Reptiles of Conservation Significance

No reptiles of conservation significance were observed on the Project site during the wet or dry season surveys and none have been previously recorded within the region (Appendix A). Therefore, it is considered unlikely that any reptile species of conservation significance occur on the Project site.

7.3 BIRDS

7.3.1 Habitat Values

Avian assemblages are generally determined by factors such as food sources (e.g. fruit, nectar, seeds, and insects), as well as a mosaic of habitat structures such as grasses, thick understorey, midstorey and canopy vegetation (i.e. vertical habitat complexity). Generally, the more food sources available and the more complex the structure of the vegetation, the more diverse the avifauna.

Food sources on the Project site are generally restricted to seeds, nectar, insects and vertebrate prey items (or carrion). The Project site largely lacked a permanent or abundant supply of fruit producing plant species, suggesting fructivorous species are less likely to occur.

7.3.2 Observed Species

A combined total of 65 bird species were recorded on the Project site during the wet and dry season surveys, with all species considered common throughout the region. All bird species recorded on the Project site are listed in Appendix C.

Granivorous birds were well represented on Project site with the Peaceful Dove (*Geopelia striata*), Spinifex Pigeon (*Geophaps plumiferal*), Crested/Spinifex Pigeon (*Ocyphaps lophotes*), Common Bronzewing (*Phaps chalcoptera*), Sulphur-crested Cockatoo (*Cacatua galerita*), Galah (*Cacatua roseicapilla*), Painted Finch (*Emblema pictum*), Double-barred Finch (*Taeniopygia bichenovii*) and Zebra Finch (*Taeniopygia guttata*) commonly observed.

Four raptor species were observed on the Project site during the surveys, including the Wedge-tail Eagle (*Aquila audax*), Black Falcon (*Falco subniger*), Whistling Kite (*Haliastur sphenurus*) and Black Kite (*Milvus migrans*). In addition to these species several other birds were detected that are known to feed on vertebrate species, including the Azure Kingfisher (*Alcedo azurea*), Laughing Kookaburra (*Dacelo novaeguineae*), and Tawny Frogmouth (*Podargus strigoides*) (Photo Plate 14).

7.3.3 Birds of Conservation Significance

No bird species of conservation significance under the NCWR were observed on the Project site during the wet or dry season surveys. Species of conservation significance known from the region which were not detected during the surveys are discussed in Section 7.6.

7.3.3.1 EPBC Act Listed Migratory and Marine Species

One Migratory species listed under the EPBC Act were observed on the Project site during the survey, the Rainbow Bee-eater (*Merops ornatus*). The Rainbow Bee-eater (*Merops ornatus*) inhabits all of mainland Queensland, as well as Indonesia, New Guinea and the Solomon Islands. This species is widespread and breeds throughout most of its range, with the exception of southern birds, which move north to breed. Species which utilise the Project site are not at the extent of their known range and the population in the area do not constitute an „ecologically significant proportion" of the total population of this species. Impacts from the Project are unlikely to have influence on the regional population the Rainbow Bee-eater (*Merops ornatus*).

Three Marine species listed under the EPBC Act were observed on the Project site, which included the Whistling Kite (*Haliastur sphenurus*), Sacred Kingfisher (*Todiramphus sanctus*) and Rainbow Bee-

eater (*Merops ornatus*). The Sacred Kingfisher (*Todiramphus sanctus*) is common throughout mainland Australia, as well as Indonesia and New Zealand. This species spends the winter in the north of its distributional range, returning south in the spring to breed. The number of species on site does not form an „ecologically significant portion" of the total species population. The distribution of the Whistling Kite (*Haliastur sphenurus*) includes most of Australia, as well as New Guinea, the Solomons and New Caledonia. The species is a resident to northern and western Australia. Therefore, it is unlikely the Project will have a significant impact on the regional populations of these species.The local populations of all three abovementioned species observed on the Project site are unlikely to constitute an „ecologically significant proportion" of the total population of each species. Furthermore, the Project site is not at the limit of these species" range, nor are these species considered to be declining within the region.



Photo Plate 14 The Tawny Frogmouth was observed on Site during a Spotlighting Activity

7.4 MAMMALS

7.4.1 Habitat Values

The morphology of mammal species varies widely from small rodents to larger kangaroos and even bats. The ecology of each of these groups is equally variable and they are assessed separately in the following sections.

7.4.1.1 Small Mammals

Habitats suitable for small mammals include areas that provide a plentiful food source and suitable shelter sites. The highest density of small mammal species is usually associated with reliable rainfall which is reflected in a reliable source of food and dense ground vegetation, particularly shrubs and grasses.

The diversity of small mammals is often limited by the lack of a predictable food supply and open ground vegetation. Consequently, small mammal populations can fluctuate dramatically in response to rain which increases seed production and insect abundance. During less favourable periods, small mammal populations can be very low.

The Project site provided a variety of habitat types suitable for small ground-dwelling mammals, including open woodlands, vegetated water courses and rocky outcrops and escarpments. Despite the range of habitat types, the presence of water was minimal during the survey which is a significant limiting factor regarding the abundance of small mammals.

7.4.1.2 Medium and Large Mammals

Factors affecting the occurrence of medium and large sized mammals are varied. Important factors can include land-clearing, feral animal predation and grazing pressures. Consequently, medium-sized mammals are considered to be highly populated in most of eastern Australia.

Habitats on the Project site do not include areas of dense native vegetation. Rather, the open grassy woodland is typical of the region, and this is likely to be reflected in the medium-sized mammal community. Rocky outcrops associated with the Knapdale Range provides habitat for rock-wallabies to roost and forage.

In contrast, larger mammals such as kangaroos have been much less affected by predation and land clearing activities. In fact, many species have flourished in response to increased areas of grassland and open vegetation. Habitat on the Project site for this mammal group is favourable.

7.4.1.3 Arboreal Mammals

The majority of arboreal mammals that occur in Australia utilise tree hollows for nesting and shelter (Menkhorst and Knight 2004). A shortage of nest hollows is likely to limit arboreal mammal populations where the density of hollow bearing trees is less than two to eight trees per ha (Smith and Lindenmayer 1988).

Hollow-bearing trees in the broader region generally occur along creek-lines, separated by open areas that would be difficult for arboreal mammals to cross without venturing onto the ground. This vegetation structure is comparable on the Project site, with hollow bearing trees noted in the River Red Gum Riparian Woodland (RE 1.3.7b).

7.4.1.4 Bats

The density and diversity of Australian bat species is determined primarily by the availability of suitable nesting and roosting sites. Roosting sites can include locations such as thick foliage, loose exfoliating bark, rock caves or cavities, tree hollows or even fabricated structures such as old buildings and culverts (Churchill 1998).

Consequently, areas with a large number of hollow-bearing trees that occur within remnant vegetation are of high value to many bat species. As bats have a small body size, these hollows can be much smaller in size than required by arboreal mammals. Possible roosting sites were present on the Project site and included tree hollows in the River Red Gum Riparian Woodland (RE 1.3.7b), caves and crevices in the rocky outcrop areas and disused mining shafts. Hollows were also observed in the Snappy Gum (*Eucalyptus leucophloia*) trees, in both RE 1.11.2a and RE 1.11.2e.

7.4.2 Observed Species

In total, 26 mammal species were observed on the Project site, comprising 22 native and four introduced species.

Three of the introduced species are classified as Class 2 pest animals under the LP Act, including the Dingo (*Canis familiaris dingo*), Feral Cat (*Felis catus*) and Feral Pig (*Sus scrofa*), with the House Mouse (*Mus musculus*) classified as a Class 1 pest. Discussion of these introduced species is provided in Section 7.6. All mammal species recorded on the Project site are listed in Appendix C.

Four mammal species observed on the Project site included the Desert Mouse (*Pseudomys desertor*), an unidentified mouse (*Pseudomys sp.*) Common Rock Rat (*Zyzomys argurus*), Common Wallaroo (*Macropus robustus*) and Red Kangaroo (*Macropus rufus*). The unidentified mouse (*Pseudomys sp.*) was captured in March 2008. Supplementary trapping was conducted during March 2011, within similar habitat types, but no small mammals were captured during this time.

A total of 14 micro-bat species were identified on the Project site, all of which are not listed under the EPBC Act or NCWR. Commonly identified species, with more than 20 positive calls recorded most nights, included Inland Broad-nosed Bat (*Scotorepens balstoni*), Inland Forest Bat (*Vespadelus baverstocki*) and Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*). Species identified less frequently include the Troughton"s Sheathtail Bat (*Taphozous troughtoni*), Common Sheathtail Bat (*Taphozous georgianus*) and unknown Freetail Bat (*Mormopterus sp.*). Additional species identified included the Beccari;s Freetail Bat (*Mormopeterus beccarii*), Eastern Little Freetail Bat (*Mormopterus loriae ridei*), Gould"s Wattled Bat (*Chalinolobus gouldii*), Northern Free-tailed Bat (*Chaerephon jobensis*), unknown Long-eared Bat (*Nyctophilus sp.*), Little Broad-nosed Bat (*Scotorepens greyii*), Northern Cave Bat (*Vespadelus courinus*) and Hoary Wattled Bat (*Chalinolobus nigrogriseus*). The Long-eared Bat *(Nyctophilus sp.)* could not be identified to species because it cannot be reliably differentiated from call data. Long-eared Bats generally produce distinctive calls. The species likeliest to be present in the Project area is *N. geoffroyi.* Three other species *(N. arnhemensis, N. daedelus and N. walkeri)* also occur in the far northwest of Queensland but are primarily restricted to moist habitats such as watercourses lined with pandanus and paperbark.

The River Red Gum Riparian Woodland (RE 1.3.7b) held the highest abundance of microbats, although areas such as rocky outcrops on hills, Snappy Gum (*Eucalyptus leucophloia*) hollows and manmade structures such as abandoned mine shafts and the current exploration camp provided ample roosting and feeding habitat.

Appendix D details the ANABAT analysis results.

7.4.3 Mammal Species of Conservation Significance

One mammal of conservation significance was observed on the Project site, the Purple-necked Rock-wallaby (*Petrogale purpureicollis*). The Rock-wallaby species is listed as Vulnerable under the NC Act. Species listed under the NC Act are published in the associated NCWR. This species is not listed under the Commonwealth EPBC Act.

This species inhabits steep hillsides with rocky outcrops, most of which were adjacent watercourses. The Purple-necked Rock-wallaby (*Petrogale purpureicollis*) inhabits areas along lower faces of the Knapdale Range and was observed within REs 1.11.2a and 1.3.7b. A total of five individuals were counted at three different outcrop structures, although it is expected many more individuals would be present along the Knapdale Range.

All Rock-wallabies favour habitat with cliffs, rocky slopes and outcrops or boulder piles. They are often found in outcrop formations, in association with dry Eucalypt (*Eucalytpus spp.*) and Wattle (*Acacia spp.*) woodlands and Spinifex (*Triodia spp.*) grasslands. Large successful populations generally have access to permanent freshwater and populations may wither without it during extended droughts. However, Purple-necked Rock-wallabies are highly adapted to dry conditions and can obtain their water from dew and by extracting it from herbage (Van Dyck and Strahan 2008). Rock-wallabies exhibit strong fidelity to home ranges and their movements between roosting sites and feeding areas are highly predictable (Horsup 1994).

Rocky habitat used by Rock-wallabies provides protection from predation by species such as Dingos (*Canis lupus dingo*), Foxes (*Vulpes vulpes*) and Wedge-tailed Eagles (*Aquila audux*) as well as temperature extremes during the day. At night they move over larger areas to feed on plants growing in deeper soils (Law and Dickman 1988). Caves within rocky outcrops provide a micro environment that buffers temperatures and maintain higher levels of humidity than outside the rocks (Short 1982).

Menkhorst and Knight (2011) describe Purple-necked Rock-wallaby (*Petrogale purpureicollis*) distribution as locally common in rocky areas of central western Queensland from Kajabbi south to Dajarra and from west of Mt Isa to the eastern end of Selwyn Range. AARC has recorded this species on a number of fauna surveys conducted in the region

Species of conservation significance known from the region which were not detected during the survey are discussed in Section 7.5.

7.5 OTHER THREATENED SPECIES FROM THE REGION

This section discusses species of conservation significance that are known from the broader region but that are considered unlikely to occur on the Project site. These species have been identified from wildlife database searches (Appendix A) and scientific literature searches. The assessment is based on the knowledge and opinion of AARC staff, information obtained from the current field surveys, scientific literature, and communications with relevant experts or interest groups.

Table 16 Threatened Fauna from the Region Not Observed on the Project site

Scientific Name Common Name	Conservation Status		Habitat	Notes
	EPBC Act	NCWR		
Heteromunia pectoralis Pictorella Mannikin	-	Near Threatened	Prefers tall grass in Acacia woodlands near water and grassy flats and occasionally Spinifex tuffs. Distributed in tropical northern Australia, noted to migrate coastward in dry season and inland in wet (Pizzey and Knight 2010).	Some suitable habitat may occur on Site. However given the amount of surrounding habitat it is unlikely the Site constitutes critical habitat range. Furthermore, given the species range, it is unlikely the Project will have an adverse impact on this species should it occur intermittently.
Ephippiorhynchus asiaticus Black-Necked Stork	-	Near Threatened	Prefers open freshwater environments, including the margins of swamps, shallow floodwaters over grasslands, wet shorelines, margins of mangroves, mudflats and estuaries (Morcombe 2002).	Limited habitat occurs on Site, furthermore given the habitat associated with major watercourses in the region such as the Dugald River, it is likely the species would prefer these sites given their habitat suitability.
Melithreptus gularis Black Chinned Honey Eater	-	Near Threatened	The Black-chinned Honeyeater is found on mainland Australia from the Gulf Country of Queensland south to Cloncurry and is widespread in central and eastern Queensland. It is found in the upper levels of open eucalypt forests and woodlands dominated by box and ironback eucalypts. It is often found along waterways, especially in arid and semi-arid areas (Birds in Backyards website).	Suitable habitat occurs on Site. Although unlikely, given its scarcity, it is possible that this species may intermittently occur on Site.
Rostratula australis Australian Painted Snipe	Vulnerable	Vulnerable	This species inhabits shallow inland wetlands, either permanent or temporary (Marchant and Higgins 1993).	Limited habitat occurs on Site, furthermore given the habitat associated with major watercourses in the region such as the Dugald River, it is likely the species would prefer these sites given their habitat suitability.

Scientific Name Common Name	Conservation Status		Habitat	Notes
	EPBC Act	NCWR		
Julia Creek Dunnart	Endangered	Endangered	Inhabits the Mitchell Grass Downs and Desert Uplands bioregion, sheltering in cracking clay soils during dry seasons and in low grasses during summer rain.	Cracking clays do not occur on or adjacent to the Project site, therefore it is unlikely this species would utilise the Project site.
Pristis microdon Freshwater Sawfish	Vulnerable	-	A bottom-dweller of estuaries and the lower reaches of large river systems; sometimes penetrating substantial distances upstream (Allen, Midgley and Allen 2003).	No suitable habitat occurs on the Project site nor is likely to occur in the event of seasonally high rainfall.
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory/Marine	-	White-bellied Sea-Eagles are a common sight in coastal and near coastal areas of Australia. Often seen perched high in a tree, or soaring over waterways and adjacent land (Birds in Backyards website).	Unlikely to occur on Site given the range of the species and Project distance from the coast.
Ardea alba Great Egret, White Egret	Migratory/Marine	-	Great Egrets occur throughout most of the world. They are common throughout Australia, with the exception of the most arid areas. Known to prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands (Birds in Backyards website).	Limited habitat occurs on Site, furthermore given the habitat associated with major watercourses in the region such as the Dugald River, it is likely the species would prefer these sites given their habitat suitability.
Ardea ibis Cattle Egret	Migratory/Marine	-	In Australia it is most widespread and common in north-eastern Western Australia across the Top End, Northern Territory, and in south-eastern Australia from Bundaberg, Queensland to Port Augusta, South Australia, including Tasmania. The species is found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. Will also forage at garbage dumps, and is often seen with cattle and other stock (Birds in Backyards website).	Limited habitat occurs on Site, furthermore given the habitat associated with major watercourses in the region such as the Dugald River, it is likely the species would prefer these sites given their habitat suitability.

Scientific Name Common Name	Conservation Status		Habitat	Notes
	EPBC Act	NCWR		
Charadrius veredus Oriental Plover, Oriental Dotterel	Migratory/Marine	-	The Oriental Plover has been recorded in all states but most common in coastal areas across northern Australia. The species is found generally inland; in open grasslands in arid and semi-arid zones; and less often in estuarine or littoral environments. Known to prefer flat inland plains, sparsely vegetated short grass with hard bare ground including claypans, playing fields, lawns and cattle camps (Birds in Backyards website).	May intermittently occur on Site, however given the species range, the Project is unlikely to constitute an ecologically proportion of its habitat.
Glareola maldivarum Oriental Pratincole	Migratory/Marine	-	The Oriental Pratincole prefers open country, and is often seen near water in the evening, hawking for insects. They are found in warmer parts of south and east Asia, breeding from northern India across to China and Europe, wintering in India, Indonesia and northern Australia (Birds in Backyards website).	Unlikely to occur on Site given the lack of preferred habitat and highly transient behaviour.
Numenius minutes Little Curlew, Little Whimbrel	Migratory/Marine	-	Prefers coastal grasslands, plains and often recreational areas. May forage in dry habitat but congregate at freshwater sources. Most commonly inhabits sheltered coastal and inshore waters, and migrates regularly across the region (Pizzey and Knight 2010)	Unlikely to occur on Site given the lack of permanent water and highly transient behaviour.
Rostratula benghalensis s. lat Painted Snipe	Migratory/Marine	-	Occurs in terrestrial shallow freshwater wetlands, ephemeral waterbodies, dams and permanent lakes etc (Marchant and Higgins 1993).	Limited habitat occurs on Site, furthermore given the habitat associated with major watercourses in the region such as the Dugald River, it is likely the species would prefer these sites given their habitat suitability

Scientific Name Common Name	Conservation Status		Habitat	Notes
	EPBC Act	NCWR		
Apus pacificus Fork-tailed Swift	Migratory/Marine	-	Pacific Swifts breeds from central Siberia eastwards through Asia, wintering south to Australia. They are aerial birds.	May seasonally occur on Site, however despite extensive searches during the dry season survey, no species were observed.
Crocodylus johnstoni Freshwater Crocodile	Marine	-	Known to inhabit freshwater lagoons, billabongs, lakes and ephemeral watercourses throughout northern Australia.	No suitable habitat occurs on Site and therefore is unlikely to occur on Site.

7.6 PEST SPECIES

Four introduced species, listed as pest species under the LP Act, were detected on the Project site during the wet and dry season surveys. Species observed included:

1. House Mouse (*Mus musculus*) listed as a Class 1 pest under the LP Act;
2. Dingo (*Canis lupus familiaris*) listed as a Class 2 pest under the LP Act;
3. Feral Cat (*Felis catus*) listed as a Class 2 pest under the LP Act; and
4. Feral Pig (*Sus scrofa*) listed as a Class 2 pest under the LP Act.

Each of the Class 2 pests are discussed below, while Appendix D details Department of Employment, Economic Development and Innovation (DEEDI) Pest Fact Sheets for all observed pest species.

Dingoes (*Canis lupus familiaris*) can carry diseases such as distemper, parvovirus as well as parasites and are known to prey on native fauna and farm species, causing both ecological and economic damage. Dingoes (*Canis lupus familiaris*) were observed during routine assessment activities during both daylight hours and during spotlighting events. They were considered common on Project site and are known from the broader region.

The Feral Cat (*Felis catus*) is listed as a Class 2 pest under the LP Act. Most active at night, with peak hunting occurring soon after sunset and in the early hours before sunrise, cats display a distinct green eye shine under spotlight. Feral Cats (*Felis catus*) were observed whilst spotlighting on the Project site. Known to cause ecological harm, via habitat destruction, disease distribution and native species predation, cats are present Australia wide, thriving under all climatic conditions and in vastly different types of terrain.

Feral Pigs (*Sus scrofa*) will eat almost any available plant material, but prefer succulent green herbage. They wallow in mud along watercourses, destroy habitat for native animals, and spread weed seeds. They damage almost all crops from sowing to harvest, damage pastures by grazing and rooting and carry many diseases and parasites. And their destructive nature is often a hindrance to any re-vegetation/ rehabilitation plans. Pigs were observed on Project site along and within watercourses. They were not considered a resident population given the lack of water and subsequent available habitat.

8.0 CORRIDOR RESULTS

8.1 POWERLINE

The powerline corridor spans 60 km, from the Chumvale sub-station near Cloncurry north to the Project site. A width of 400 m has been assessed to define vegetation communities, identify and map features of conservation significance and identify and locate weed species. Features of conservation significance inhabiting the powerline corridor include the River Red Gum Riparian Woodland (RE 1.3.7) community and Purple-necked Rock-wallaby (*Petrogale purpureicollis*) habitat.

8.1.1 Vegetation Communities

Six vegetation communities inhabit the powerline corridor (refer to Figure 8, Figure 9 and Figure 10 for community locations). Each of these are briefly described, with corresponding conservation status in Table 17 below. Sections 8.1.1.1 to 8.1.1.6 further describe each vegetation community.

Table 17 Vegetation Communities and Corresponding Conservation Status within the Powerline Corridor

Vegetation Community / RE	Community Description	EPBC Status	Queensland VMR	DERM Biodiversity Status
Snappy Gum Open Woodland / 1.11.2a	Low open-woodland of *Eucalyptus leucophloia* often with *Corymbia spp., Terminalia aridicola and Eucalyptus leucophylla* with shrub layer of *Acacia spp.* and ground layer of *Triodia spp.* Occurs on steep hills and strike ridges	Not Listed	Least Concern	No Concern at Present
Cloncurry Box Open Woodland / 1.11.3x1	Low open-woodland of *Eucalyptus leucophylla* often with *Corymbia terminalis* and *Eucalyptus leucophloia* with i. dominated shrub layer and ground layer of *Triodia spp*. and/or tussock grasses. Includes areas of *Acacia spp*. shrubland and *Triodia spp*. grassland. Occurs on hills on strongly folded pre-Cambrian rocks; skeletal soils, some shallow loams	Not Listed	Least Concern	No Concern at Present

Vegetation Community / RE	Community Description	EPBC Status	Queensland VMR	DERM Biodiversity Status
River Red Gum Riparian Woodland / RE 1.3.7a / RE 1.3.7b	Riverine wetland or fringing riverine wetland. Fringing woodland of *Eucalyptus camaldulensis*, usually with *Lophostemon grandiflorus* and *Melaleuca leucadendra* and/or *M. argentea*. Occurs on recent levees and channel deposits of major watercourses and larger tributaries.	Not Listed	Least Concern	Endangered
Gidgee Open Woodland / 1.11.2x2	Low open-woodland and low woodland of *Acacia cambagei* over annual grasses. Occasional *Atalaya hemiglauca, Hakea lorea subsp. lorea, Grevillea striata and Acacia excelsa*. Occurs on red or brown earths and clays.	Not Listed	Least Concern	No Concern at Present
Mixed Bloodwood Riparian Woodland / 1.3.6	Woodland and low woodland of *Corymbia aparrerinja* and *C. terminalis. Acacia victoriae* may dominate heavier soils. Occurs on terraces and floodplains on Quaternary alluvium; alluvial soils, some earths and deep yellow podzolics.	Not Listed	Least Concern	Of Concern
Non-remnant Grassland	Cleared woodlands with species composition different than prior to clearing.	Not Listed	Not Listed	Not Listed

8.1.1.1 Snappy Gum Open Woodland

The Snappy Gum Open Woodland (RE 1.11.2a) community is equivalent to the community found on the Project site. Refer to Section 6.1 for a detailed community description.

The Snappy Gum Open Woodland (RE 1.11.2a), is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status and is not listed under the EPBC Act.

Based on proposed disturbance plans for the Project, additional clearing of the Snappy Gum Open Woodland (RE 1.11.2a)will be required. The powerline easement is proposed to be 80 m in width; this width has been used to calculate the footprint disturbance within the Snappy Gum Open Woodland community. Estimated vegetation disturbance from construction of the powerline is approximately 54 ha. It is unlikely disturbance within this community will significantly impact on the regional occurrence of this community.

8.1.1.2 Cloncurry Box Open Woodland

The Cloncurry Box Open Woodland (RE 1.11.3x1) community is identical to the community found within the Project site. Refer to Section 6.4 for a detailed community description.

The Cloncurry Box Open Woodland (RE 1.11.3x1), is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status and is not listed under the EPBC Act.

Based on proposed disturbance plans for the Project and an assumed disturbance width of 80 m, the estimated additional vegetation disturbance within the Cloncurry Box Open Woodland (RE 1.11.3x1) is approximately 328 ha. It is unlikely disturbance within the powerline corridor will significantly impact on the regional occurrence of this community.

8.1.1.3 River Red Gum Riparian Woodland

Two variations of the River Red Gum Riparian Woodland (RE 1.3.7) exist along the powerline corridor; (i) vegetation associated with smaller creek lines (RE 1.3.7b), and (ii) vegetation associated with larger watercourses (Re 1.3.7a). The River Red Gum community along the smaller creek lines (variation a) is identical to the community within the Project site. Refer to Section 6.6 for a detailed community description. Dominant vegetation associated with larger watercourses (variation ii) is listed in Table 18 below.

The River Red Gum Riparian Woodland (RE 1.3.7a) is listed as „Least Concern" under the VMR and is not listed under the EPBC Act. However, the DERM Biodiversity Status lists this RE as being „Endangered".

Based on proposed disturbance plans for the Project and the assumed corridor width of 80 m, additional vegetation disturbance of the River Red Gum Riparian Woodland is estimated to be approximately 23 ha. As RE 1.3.7 is defined as a “riverine wetland” or “fringing riverine wetland”, the *Policy for Vegetation Management Offsets* may be applied (refer to Section 3.7). Assuming appropriate mitigation strategies are implemented, it is unlikely the Project will adversely affect the health or abundance of this community.

Table 18 Community 6 (RE 1.3.7a) – Vegetation Community Description

Community	River Red Gum Riparian Woodland
Regional Ecosystem	RE 1.3.7a: 1.3.7a: Riverine wetland or fringing riverine wetland. Fringing woodland of *Eucalyptus camaldulensis*, usually with *Lophostemon grandiflorus* and *Melaleuca leucadendra* and/or *Melaleuca argentea*. Occurs on recent levees and channel deposits of major watercourses and larger tributaries. (BVG1M: 16a)
Biodiversity Status	Endangered
VMR Status	Least concern
EPBC Act	Not listed
Tree Layer	15 – 18 metres *Eucalyptus camaldulensis, Melaleuca leucadendra, Lophostomon grandiflorus, Corymbia aparrerinjia*

Shrub Layer	1 – 3 metres *Acacia holosericea, Atalaya hemiglauca, Lysiphyllum cunninghamii Vitex trifolia var trifolia Acacia monticola, Acacia retivenea, Acacia torulosa,Carissa lanceolata, Sesbania javacina, Ficus aculeata, Hakea aborescens,*
Groundcover	0 – 1 metre *Pennisetum ciliare, Aristida latifolia, Cymbopogon bombycinus, Dicanthium sericeum, Eragrostis basedowii, Cyperus conicus car conicus, Cyperus difformis, Cyperus pulchellus, Cyperus microcephalus, Fimbristylis littoralis, Frimbristylis microcarya, Alternanthera denticulata, Anisomeles malabartica, Bonamia media, Crotalaria dissitiflora, Evolvulus alsinoides, Indigofera colutea, Iphigenia indica*
Structure Category	Sparse

8.1.1.4 Gidgee Open Woodland

The Gidgee Open Woodland (RE 1.11.2x2) inhabiting the power line corridor is synonymous with the community found on the Project site. Refer to Section 6.7 for a detailed description of this community.

The Gidgee Open Woodland (RE 1.11.2x2) community is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status and is not listed under the EPBC Act.

Based on the proposed powerline width being 80 m, additional vegetation disturbance of the Gidgee Open Woodland (RE 1.11.2x2) will be required. The estimated total area of disturbance within the Gidgee Open Woodland community caused by the powerline construction is estimated to be approximately 75 ha. It is unlikely disturbance within the power line corridor will significantly impact on the regional occurrence or health of this community.

8.1.1.5 Mixed Bloodwood Riparian Woodland

The Mixed Bloodwood Riparian Woodland (RE 1.3.6b) inhabiting the power line corridor is identical with the community found on the Project site. Refer to Section 6.5 for a detailed description of this community.

The Mixed Bloodwood Riparian Woodland (RE 1.3.6b) community is listed as „Least Concern" under the VMR and is not listed under the EPBC Act. However, the DERM Biodiversity Status lists this RE as being „Of Concern".

Based on proposed disturbance plans for the Project and a corridor footprint width of 80 m, the estimated additional vegetation disturbance of the Mixed Bloodwood Riparian Woodland (Re 1.3.6b) will be approximately 12 ha. It is unlikely disturbance within the powerline corridor will significantly impact on the regional occurrence of this community.

8.1.1.6 Non-remnant Grassland

One section of the powerline corridor area has been cleared and is primarily used for stock grazing. Based upon the proposed plans for the Project and an assumed footprint width of 80 m, the estimated

area of Non-remnant Grassland within the corridor is 15 ha. This community is not listed under any Queensland or Commonwealth legislation.

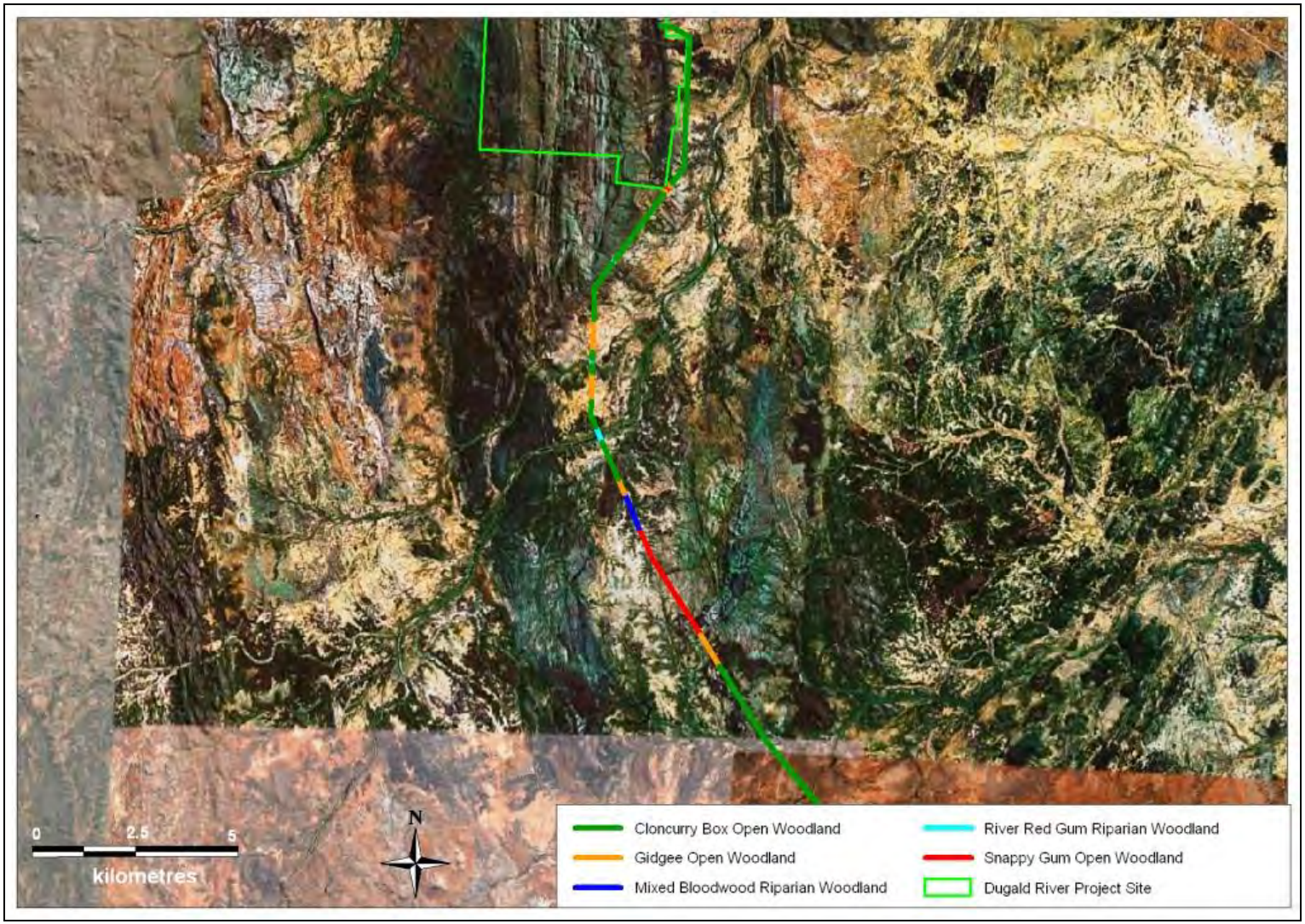


Figure 8 Vegetation Communities within the Northern Section of the Powerline Corridor

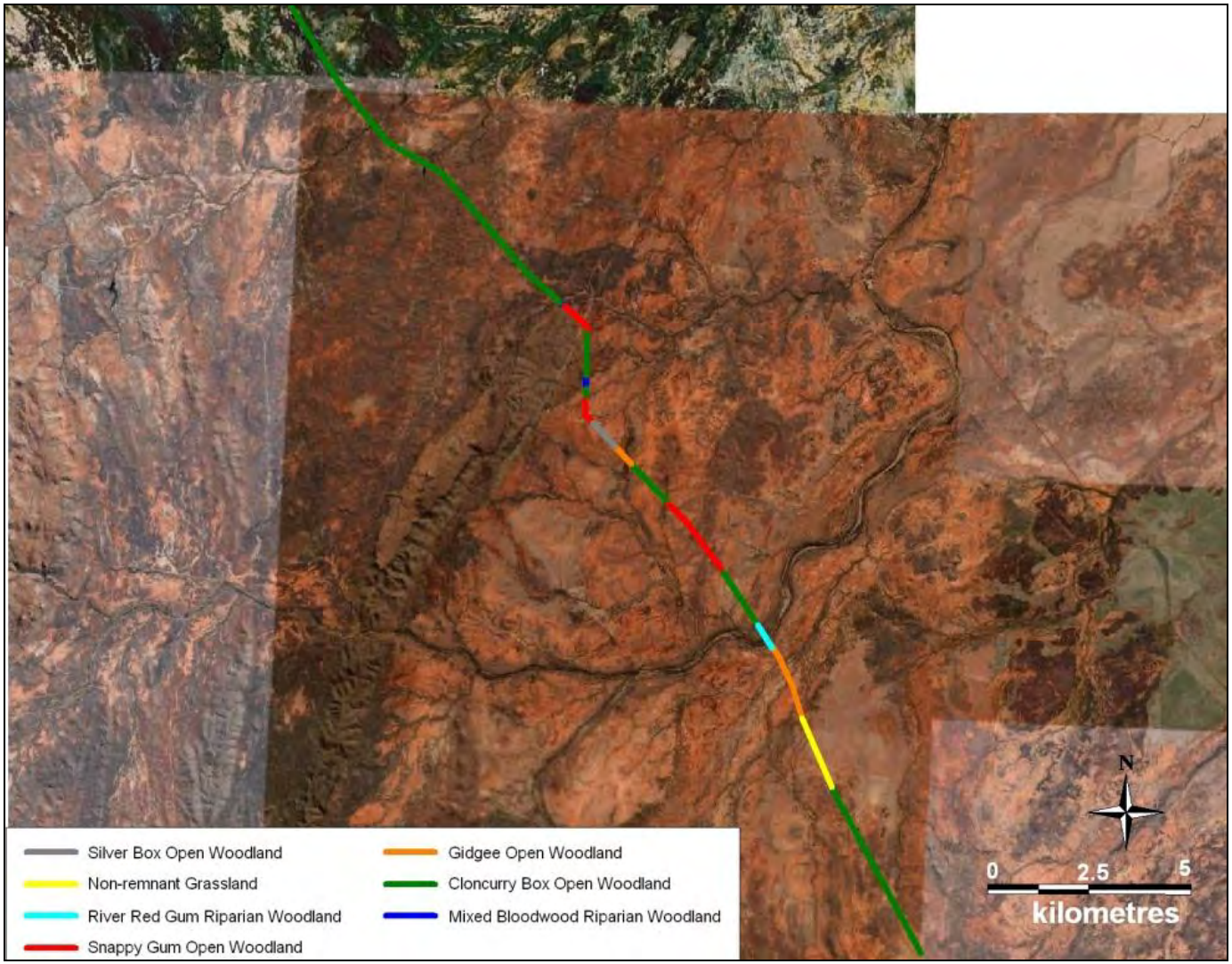


Figure 9 Vegetation Communities within the Central Section of the Powerline Corridor



Figure 10 Vegetation Communities within the Southern Section of the Powerline Corridor

8.1.2 Features of Conservation and Management Significance

Two features of conservation significance inhabit the powerline corridor. These include:

- River Red Gum Riparian community (RE 1.3.7). This community is listed as Endangered under the DERM Biodiversity Status; and
- Rocky outcrops containing Purple-necked Rock-wallaby (*Petrogale purpureicollis*) habitat. This Rock-wallaby species is listed as Vulnerable under the NCWR.

Two areas of weed management significance were also identified within the powerline corridor. These areas contain a high number of introduced species and are discussed further in Section 8.1.2.4.

Features of conservation and management significance are depicted in Figure 11, Figure 12 and Figure 13 below. Transect locations have been overlaid on aerial photographs and have been divided into three sections, northern, central and southern. The powerline corridor maps were divided in this manner due to the length making it difficult to distinguish features on a single map.

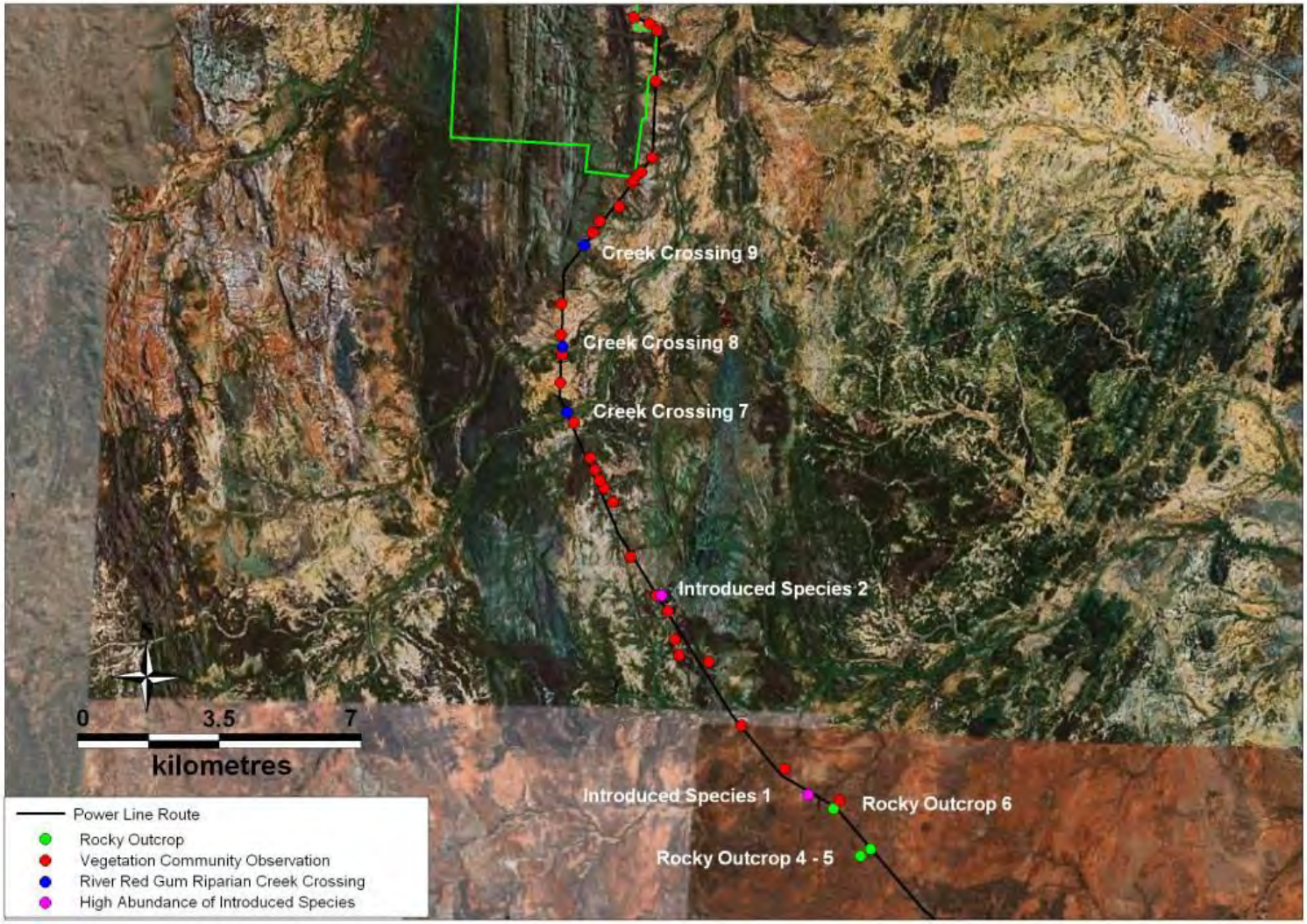


Figure 11 Northern Section of Powerline Corridor – Significant Features

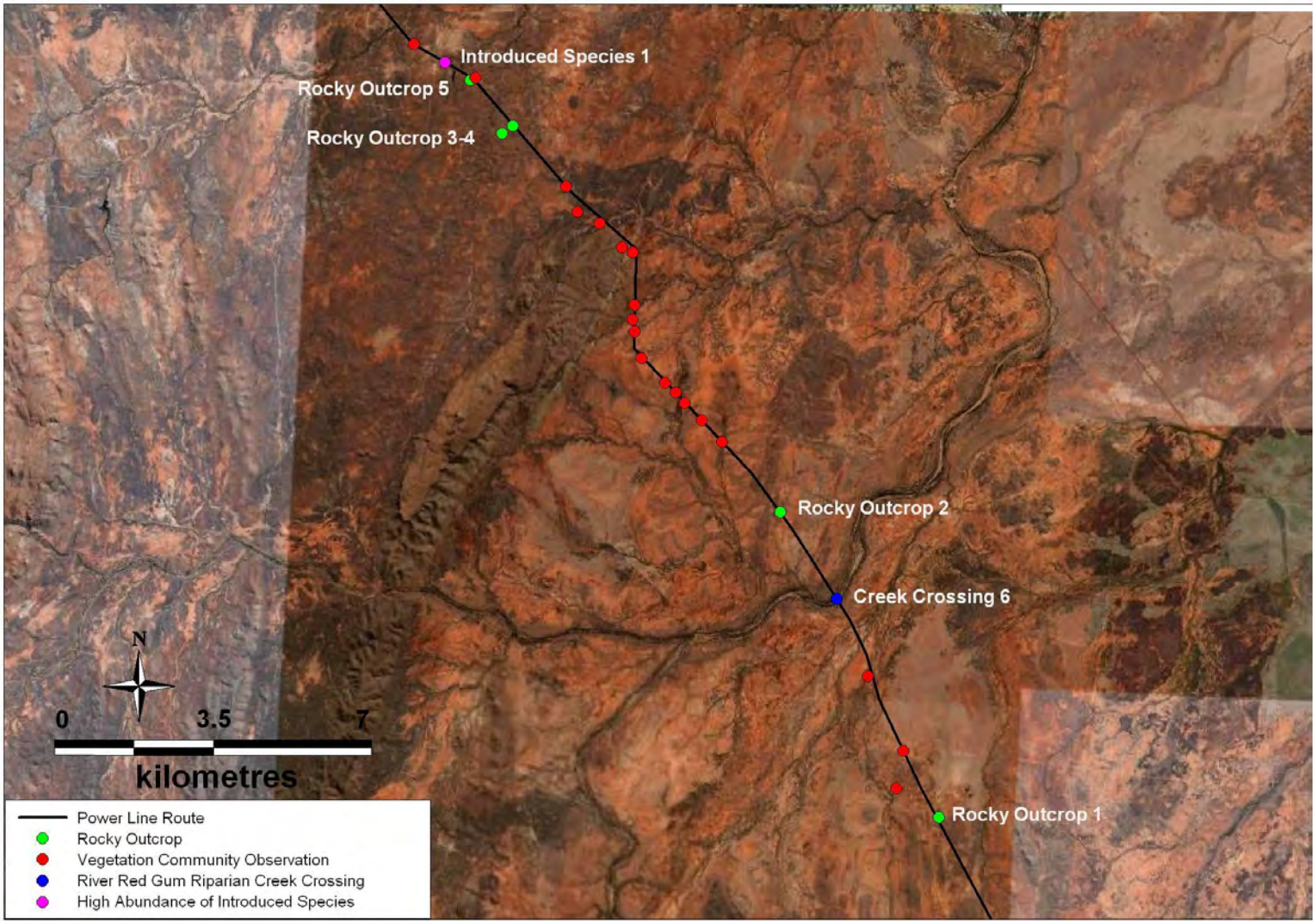


Figure 12 Central Section of Powerline Corridor – Significant Features

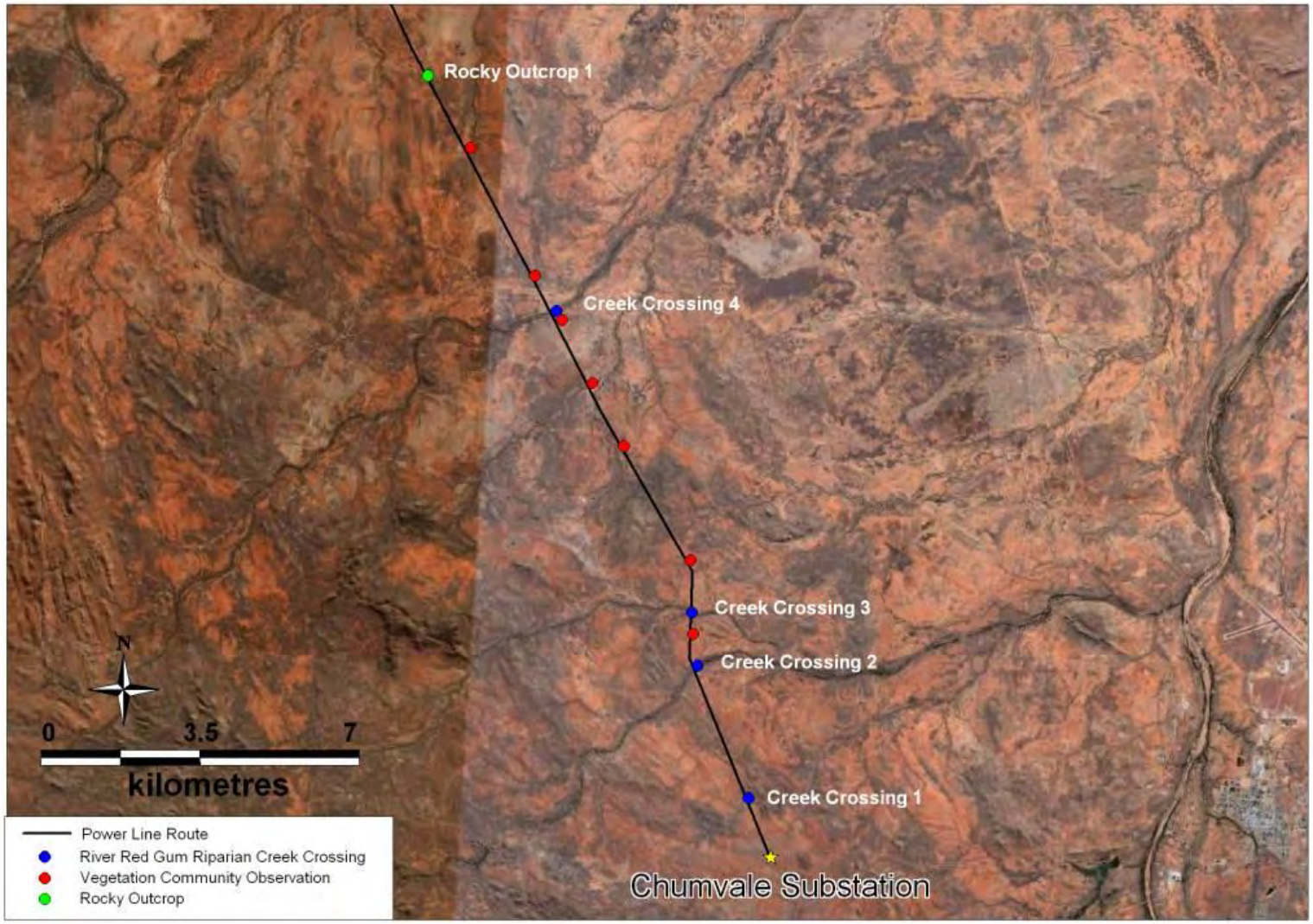


Figure 13 Southern Section of Powerline Corridor – Significant Features

8.1.2.1 River Red Gum Riparian Community

The River Red Gum Riparian Woodland (RE 1.3.7) community is valuable to the local fauna as it provides shelter around water holes and nesting holes within tree hollows. This community provides a shady and productive ecosystem for fauna in comparison to the arid, inhospitable communities surrounding the area. Floristically, it is the most diverse community within the local area of the Project site and helps maintain the environmental integrity of watercourses. The root system of the River Red Gum (*Eucalyptus camaldulensis*) helps stabilize the banks of a watercourse and prevents erosion during flooding events.

Seven creek crossing were identified within the powerline corridor. Table 19 below summarises GPS coordinates, creek width and photo plate numbers for each creek crossing of conservation significance.

Table 19 Summary of River Red Gum Riparian Communities Found within Powerline Route

Survey Site	Geographic Coordinates*		Estimated Creek Width (in m)	Photo Plate
Creek Crossing 1	0438476 mE	7709231 mN	50	25
Creek Crossing 2	0435959 mE	7712548 mN	50	26
Creek Crossing 3	0435991 mE	7713846 mN	40	27
Creek Crossing 4	0432436 mE	7720219 mN	100	28
Creek Crossing 5	0432090 mE	7720953 mN	25	29
Creek Crossing 6	0426561 mE	7729667 mN	200	30,31
Creek Crossing 7	0412381 mE	7753349 mN	70	32

* All coordinates are in AGD 84 Zone 54 projection.

Creek Crossing 1 (Photo Plate 15) was approximately 50 m in width. Vegetation was moderate in density with average canopy height of 7 m.



Photo Plate 15 Creek Crossing 1

Creek Crossing 2 (Photo Plate 16) averaged 50 m in width, with maturing vegetation. The River Red Gum (*Eucalyptus camaldulensis*) canopy height was up to 17 m. Along a 50 m long transect, 19 trees over 6 m in height were present.



Photo Plate 16 Creek Crossing 2

Creek Crossing 3 (Photo Plate 17) was a smaller creek line, averaging between 30 – 50 m in width.



Photo Plate 17 Creek Crossing 3

Creek Crossing 4 (Photo Plate 18) was a major drainage line approximately 100 m in width. River Red Gum (*Eucalyptus camaldulensis*) was the dominant canopy species. Buffel Grass (*Pennisetum ciliare*) was present and a moderate degree of cattle grazing effects were noted.



Photo Plate 18 Creek Crossing 4

Creek Crossing 5 (Photo Plate 19) was a minor drainage line 25 m in width. Effects from cattle grazing and erosion were noted. Few mature trees inhabited this survey point.



Photo Plate 19 Creek Crossing 5

Creek Crossing 6 consisted of two drainage lines, Corella River (Photo Plate 20) and a deep, yet narrow secondary drainage line (Photo Plate 21). This crossing is mature and well established.



Photo Plate 20 Creek Crossing 6 – Primary Drainage Line



Photo Plate 21 Creek Crossing 6 – Secondary Drainage Line

Creek Crossing 7 (Photo Plate 22) was a survey point which traversed the Dugald River. The creek averaged 70 m in width and was a mature riparian community.



Photo Plate 22 Creek Crossing 7

8.1.2.2 Rocky Outcrops

A total of 6 rocky outcrop areas were found along the powerline corridor. Rocky outcrops provide suitable habitat for the Purple-necked Rock-wallaby (*Petrogale purpureicollis*), listed as Vulnerable under Schedule 3 of the NCWR. Purple-necked Rock-wallabies (*Petrogale purpureicollis*) are known to inhabit suitable rocky outcrops in North-west Queensland, particularly in the Cloncurry region, and are known to regularly travel short distances, with animals often required to travel to neighbouring mobs for reproductive purposes (Clancy and Close 1997). Sightings were made at two of the six rocky outcrops.

A summary of outcrops, GPS coordinates, estimated size and photo plate numbers can be found below in Table 20. A brief description of each outcrop follows.

Table 20 Summary of Rocky Outcrops Found Within the Powerline Route

Survey Site	Geographic Coordinates*		Estimated Outcrop Length x Width (m)	Photo Plate Number	Comments
Rocky Outcrop 1	0429437 mE	7725139 mN	200 x 75	33,34	1 PNRW sighted, existing PNRW habitat
Rocky Outcrop 2	0425541 mE	7731717 mN	50 x 50	-	Minimal potential PNRW habitat
Rocky Outcrop 3	0423276 mE	7735328 mN	200 x 100	35,36	Potential PNRW habitat
Rocky Outcrop 4	0419128 mE	7739942 mN	100 x 50	37,38,39	1 PNRW sighted, existing PNRW habitat
Rocky Outcrop 5	0418906 mE	7739756 mN	30 x 50	40	Potential PNRW foraging habitat
Rocky Outcrop 6	0418151 mE	7740894 mN	Series of outcrops	41	Potential PNRW foraging habitat

*All coordinates are in AGD 84 Zone 54 projection.

Rocky Outcrop 1 (Photo Plate 23 and Photo Plate 24) was estimated to be 200 x 75 m in size and up to 12 m in height. Favourable habitat for the Purple-necked Rock-wallaby (*Petrogale purpureicollis*) was present with many crevices and cracks, and one Purple-necked Rock-wallaby (*Petrogale purpureicollis*) was observed.



Photo Plate 23 View North of Rocky Outcrop 1

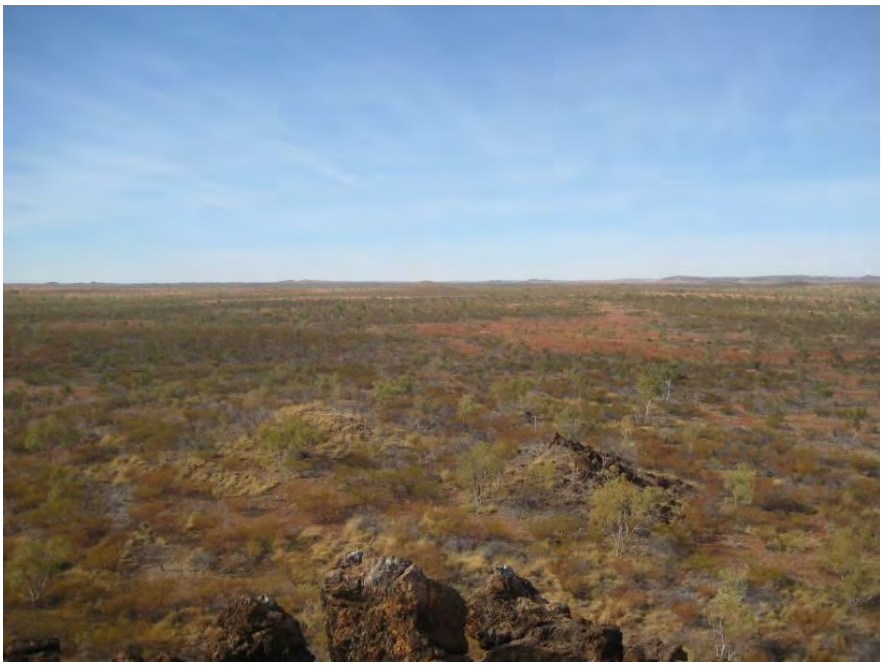


Photo Plate 24 View South of Rocky Outcrop 1

Rocky Outcrop 2 was a small rocky outcrop with an estimated size of 50 x 50 m and average elevation of 8 m. Many larger marsupial scats were observed within outcrop formation, but the smaller cylindrical shaped Rock-wallaby scat was absent. It is AARC"s opinion Rocky Outcrop 2 provides little

habitat for species of conservation significance, as the outcrop did not entail cavernous formations and held few crevices.

Rocky Outcrop 3 (Photo Plate 25) was estimated to be 200 x 100 m in size. Although the Purple-neck Rock-wallaby (*Petrogale purpureicollis*) was not observed, potential habitat was present.



Photo Plate 25 Rocky Outcrop 3

Rocky Outcrop 4 (Photo Plate 26) was estimated to be 100 x 50 m in size with an average elevation of 10 m. A Purple-necked Rock-wallaby (*Petrogale purpureicollis*) was sighted by AARC staff. Many crevices and caves presented favourable habitat for the rock-wallaby (Photo Plate 27). Scats were collected and sent to a specialist for confirmation. This outcrop holds high conservation significance. Areas to the west of this site were noted to be free of medium to large outcrops (Photo Plate 28).



Photo Plate 26 Rocky Outcrop 4



Photo Plate 27 Purple-necked Rock-wallaby Habitat within Rocky Outcrop 4



Photo Plate 28 View West of Rocky Outcrop 4

Rocky Outcrop 5 was found directly east of Rocky Outcrop 4. This outcrop was relatively small, estimated 25 x 50 m in size. No significant habitat for the Purple-necked Rock-wallaby (*Petrogale purpureicollis*) to reside in was identified within this outcrop; therefore the outcrop may be potentially used as a foraging site only. Photo Plate 29 presents a view looking eastward towards Rocky Outcrop 5.



Photo Plate 29 View East to Rocky Outcrop 5

Rocky Outcrop 6 (Photo Plate 30) was a series of 4 outcrops. Each section was approximately 20 m wide with 5 m in between each outcrop. Sparse areas were identified as Purple-necked Rock-wallaby

(*Petrogale purpureicollis*) habitat, including small crevices. It is AARC"s opinion that Rocky Outcrop 6 does not entail the significant structural complexity necessary to be a residence form the Rock-wallaby, but may potentially act as foraging habitat.



Photo Plate 30 Rocky Outcrop 6

8.1.2.3 Introduced Flora Species

Several introduced flora species were identified within the powerline corridor. Table 21below summarises which species were found predominantly in two areas; „Introduced Species 1" and „Introduced Species 2" (refer to Figure 11 and Figure 12).

Although no species are listed under the LP Act, many of these species establish rapidly and out-compete existing native plants. None of these species are listed as a weed of national significance.

Table 21 Summary of Introduced Flora Species within the Power-line Route

Scientific Name	Common Name	Geographic Coordinates*		Corresponding Survey Point
Acacia farnesiana	Mimosa Bush	Common throughout site, dominant patch at 0413907 mE	Common throughout site, dominant patch at 7745937 mN	Introduced Species 1
Aerva javanica	Kapok Bush	0417739 mE	7740988 mN	Introduced Species 2
Calotropis procera	Calotrope	0417739 mE	7740988 mN	Introduced Species 2
Pennisetum ciliare	Buffel Grass	Common throughout site	Common throughout site	--

Scientific Name	Common Name	Geographic Coordinates*		Corresponding Survey Point
Citrullus colocynthis	Colocynth	0417739 mE	7740988 mN	Introduced Species 2
Datura inoxia	Downy Thornapple	0417739 mE	7740988 mN	Introduced Species 2

* All coordinates are in AGD 84 Zone 54 projection.

The survey point „Introduced Species 1" (refer to Figure 11) held a high abundance of Mimosa (*Acacia farnesiana*). The estimated size of this patch was 50 x 100 m. Photo Plate 31 below portrays a section of this area.



Photo Plate 31 Mimosa Bush (Acacia farnesiana)

The survey point „Introduced Species 2" held an array of non-native species. „Introduced Species 2" was a previously disturbed area, a stock watering yard, which allowed establishment of non-native plants. Species included Calotrope (*Caltropsis procera*), Mimosa Bush (*Acacia farnesiana*), Kapok Bush (*Aerva javanica*), Downy Thornapple (*Datura inoxia)* and Colocynth (*Citrullus colocynthis)*. Photo Plate 32 shows the area.



Photo Plate 32 Survey Point 'Introduced Species 2'

8.2 ACCESS ROUTE

The primary access route corridor follows along an existing track for approximately 9 km from the Project site (see Figure 13). At the eastern end of the primary access route corridor, the primary access route diverts from the existing track for 1 km along a straight route across open terrain to join up with the Burke Developmental Road.

An alternate access road route is being proposed and may be used in the foreseeable future. This route follows the primary access road route from the Project site for 4 km, and then diverts directly east for 5 km, ultimately joining the Burke Developmental Road.

It may also be necessary to use a temporary access road deviation (called the Longamundi Deviation), if mining activity occurs on adjacent tenures. This deviation will divert the access road from the Project site around the Longamundi mineral deposit. The deviation will commence at the Project site approximately 850 m north of the primary access route. The deviation is approximately 2 km in length and connects with the primary access track at Creek Crossing 2 before the alternate access road diversion (see Figure 13).

The following sections will discuss vegetation communities and creek crossings existing on the corridor. Although communities of conservation significance are present, no individual floral or faunal species of conservation significance are present. No weeds classified under the LP Act inhabit the access route corridor.

8.2.1 Vegetation Communities

A total of five vegetation communities inhabit the access route corridor area (refer to Figure 14). These communities and corresponding conservation status is listed in Table 22.

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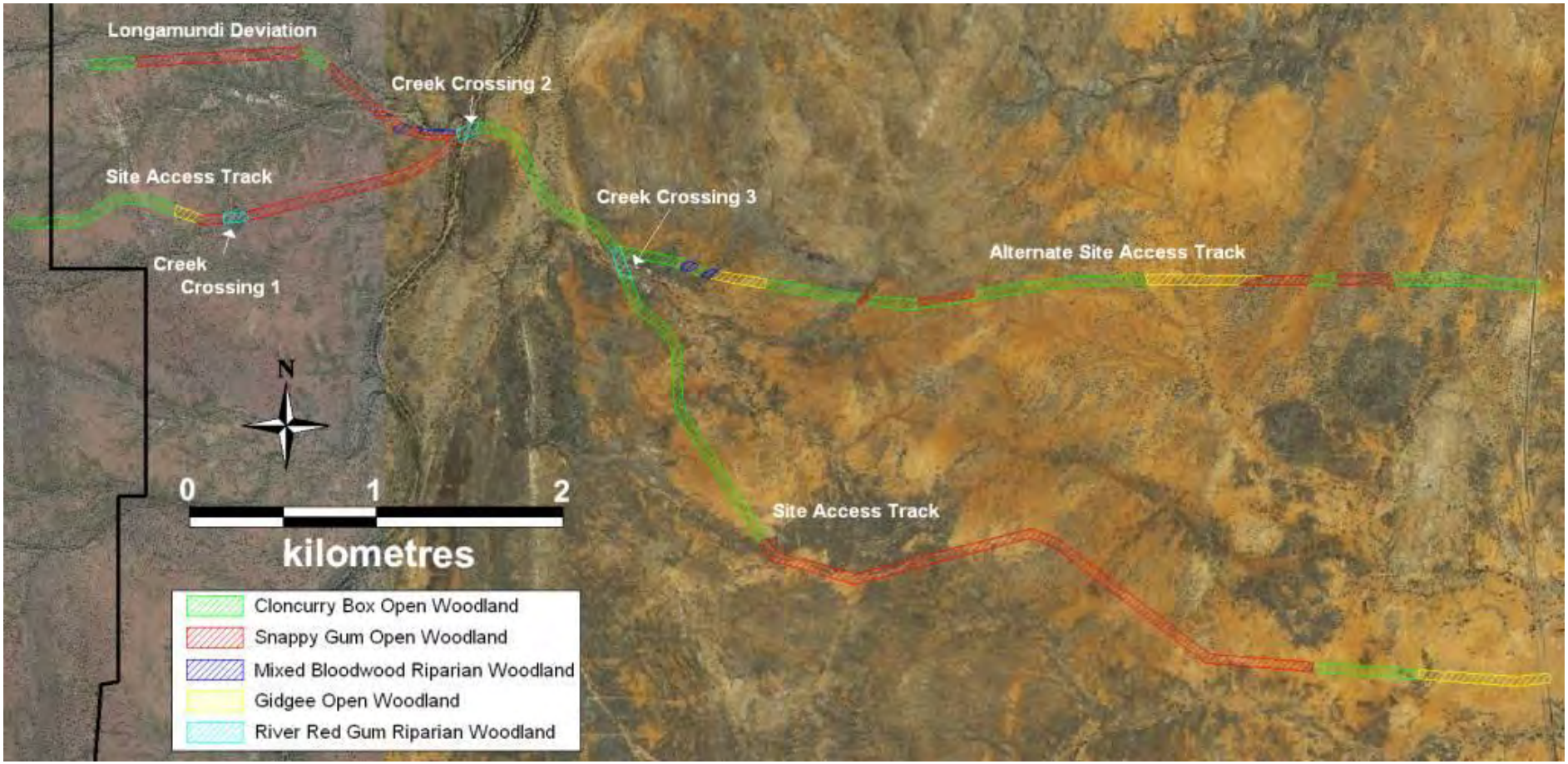


Figure 14 Access Route Corridor Vegetation Communities and Creek Crossing Locations

Table 22 Vegetation Communities on the Access Route Corridor

Vegetation Community / RE	Community Description	EPBC Status	Queensland VMR	DERM Biodiversity Status
Snappy Gum Open Woodland / 1.11.2e	Low open-woodland of *Eucalyptus leucophylla* and *Eucalyptus leucophloia* often *with Acacia cambagei* and *Corymbia terminalis* with a sparse ground layer of *Triodia pungens* and/*or Triodia longiceps*. Occurs on footslopes and lower slopes, broken by creeks and drainages	Not Listed	Least Concern	No Concern at Present
Cloncurry Box Open Woodland / 1.11.3x1	Low open-woodland of *Eucalyptus leucophylla* often with *Corymbia terminalis* and *Eucalyptus. leucophloia* with Acacia spp. dominated shrub layer and ground layer of *Triodia spp*. and/or tussock grasses. Includes areas of *Acacia spp*. shrubland and *Triodia spp*. grassland. Occurs on hills on strongly folded pre-Cambrian rocks; skeletal soils, some shallow loams	Not Listed	Least Concern	No Concern at Present
River Red Gum Riparian Woodland / 1.3.7a / RE 1.3.7b	Riverine wetland or fringing riverine wetland. Fringing woodland of *Eucalyptus camaldulensis*, usually with *Lophostemon grandiflorus* and *Melaleuca leucadendra* and/or *M. argentea*. Occurs on recent levees and channel deposits of major watercourses and larger tributaries.	Not Listed	Least Concern	Endangered
Gidgee Open Woodland / 1.11.2x2	Low open-woodland and low woodland of *Acacia cambagei* over annual grasses. Occasional *Atalaya hemiglauca, Hakea lorea subsp. lorea, Grevillea striata and Acacia excelsa*. Occurs on red or brown earths and clays.	Not Listed	Least Concern	No Concern at Present

Vegetation Community / RE	Community Description	EPBC Status	Queensland VMR	DERM Biodiversity Status
Mixed Bloodwood Riparian Woodland / 1.3.6b	Woodland and low woodland of *Corymbia aparrerinja* and *Corymbia terminalis. Acacia victoriae* may dominate heavier soils. Occurs on terraces and floodplains on Quaternary alluvium; alluvial soils, some earths and deep yellow podzolics.	Not Listed	Least Concern	Of Concern

8.2.1.1 Snappy Gum Open Woodland

The Snappy Gum Open Woodland (RE 1.11.2e) community is equivalent to the community found on the Project site. Refer to Section 6.2 for a detailed community description.

As detailed in Table 22, Snappy Gum Open Woodland (RE 1.11.2e), is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status and is not listed under the EPBC Act.

Based on proposed disturbance plans for the Project, the estimated disturbance footprint area within this community is 7.2 ha. It is unlikely the Project will affect the Snappy Gum Open Woodland at a regional scale.

8.2.1.2 Cloncurry Box Open Woodland

The Cloncurry Box Open Woodland (RE 1.11.3x1) community is identical to the community found within the Project site. Refer to Section 6.4for a detailed community description.

As detailed in Table 22, Cloncurry Box Open Woodland (RE 1.11.3x1), is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status and is not listed under the EPBC Act.

Based on proposed disturbance plans for the Project, the disturbance footprint within this vegetation community is estimated to be 3.2 ha. It is unlikely the Cloncurry Box Open Woodland will be affected at regional scale.

8.2.1.3 River Red Gum Riparian Woodland

The River Red Gum Riparian Woodland (Re 1.3.7a) occurs in three separate areas along the access route corridor. One riparian site is a larger watercourse (variation b), while two sites (Creek Crossing 1 and 3 – refer to Figure 12) are along relatively smaller creek lines (variation a). The creek line River Red Gum community (variation a) is synonymous to the community found within the Project site (refer to Section 6.6), whilst the larger watercourse (variation b) is similar to the community described in section 8.1.1.3. Two introduced species were noted within this community; the Calotrope (*Caltropsis procera*) and Buffel Grass (*Pennisetum ciliare*).

The River Red Gum Riparian Woodland (RE 1.3.7) is listed as „Least Concern" under the VMR and is not listed under the EPBC Act. However, the DERM Biodiversity Status lists this RE as being „Endangered".

Based on proposed disturbance plans for the Project, current access track disturbance, and a proposed access road clearance width of 8 m, no additional clearing will be necessary within the River Red Gum Riparian Woodland.

8.2.1.4 Gidgee Open Woodland

The Gidgee Open Woodland (RE 1.11.2x2) community occurs in two patches along the corridor (refer to Figure 12). This community is synonymous with the Gidgee Open Woodland community on the Project site. Refer to Section 6.7 for a detailed community description.

The Gidgee Open Woodland (RE 1.11.2x2) community is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status and is not listed under the EPBC Act.

Based on proposed disturbance plans for the Project, the estimated disturbance footprint area within the Gidgee Open Woodland from the access track will be 1.3 ha. It is unlikely disturbance within the access route corridor will significantly impact on the regional occurrence of this community.

8.2.1.5 Mixed Bloodwood Riparian Woodland

The Mixed Bloodwood Riparian Woodland (RE 1.3.6b) inhabiting the proposed site access road is identical with the community found on the Project site. Refer to Section 6.5 for a detailed description of this community.

The Mixed Bloodwood Riparian Woodland (RE 1.3.6b) community is listed as „Least Concern" under the VMR and is not listed under the EPBC Act. However, the DERM Biodiversity Status lists this RE as being „Of Concern".

Based on proposed disturbance plans for the Project and a site access road clearance width of 8 m, the estimated additional clearing of the Mixed Bloodwood Riparian Woodland will be 0.16 ha. It is unlikely this disturbance will significantly impact on the regional occurrence of this community.

8.2.2 Creek Crossings

Three major creek crossings exist along the access route corridor (refer to Figure 14). These larger crossings are the River Red Gum Riparian Woodland (RE 1.3.7). Four minor creek crossings are present along the alternate access road and temporary deviation.

Creek Crossing 1 is the Silvermine Creek (Photo Plate 33). It spans approximately 30 m wide and is a mature creek.



Photo Plate 33 Creek Crossing 1

Creek Crossing 2 is the Dugald River (Photo Plate 34 and Photo Plate 35). The Dugald River is a mature, major watercourse. This crossing is approximately 150 m wide, including floodplains.



Photo Plate 34 Creek Crossing 2 – Dugald River



Photo Plate 35 Creek Crossing 2 and Existing Track

Creek Crossing 3 is relatively small, approximately 8 – 10 m wide (Photo Plate 36). Surrounding vegetation density is moderate, and includes Turpentine.



Photo Plate 36 Creek Crossing 3

8.3 WATER PIPELINE

The survey of the water pipeline corridor included a 40 m wide assessment of the condition of the vegetation type with regard to quality and conservation value and the mapping of the REs. Since the water pipeline corridor travels close to the base of Mount Rose Bee, which is potential Purple-necked Rock-wallaby (*Petrogale purpureicollis*) habitat, scats were collected for analysis and outcrops were surveyed on foot to determine extent of habitat.

The following sections present a vegetation community map (Figure 15 and Figure 16), define the vegetation communities and describe the rocky outcrops along the corridor.

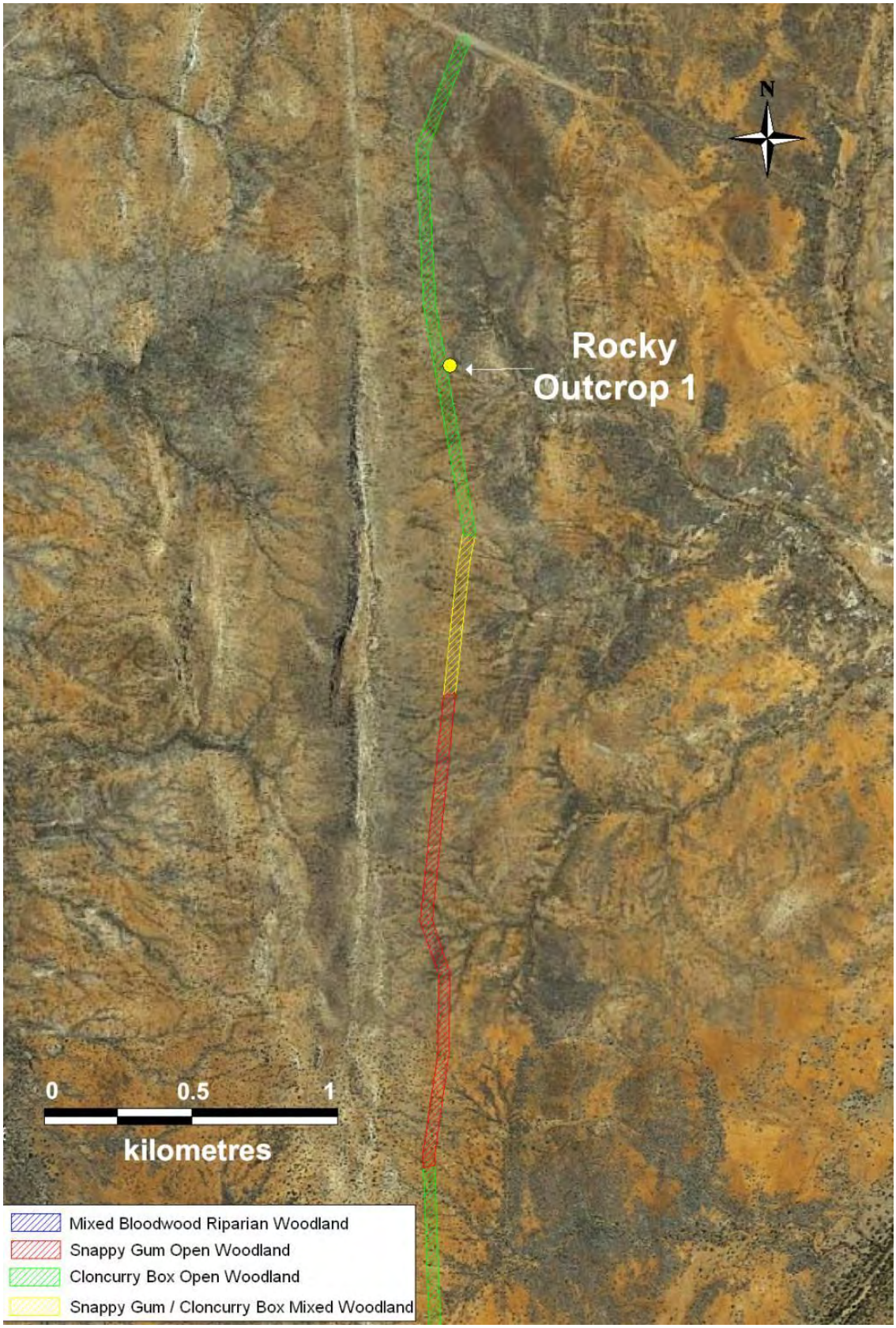


Figure 15 **Northern Section of Water Pipeline Corridor Vegetation Communities and Rocky Outcrops**

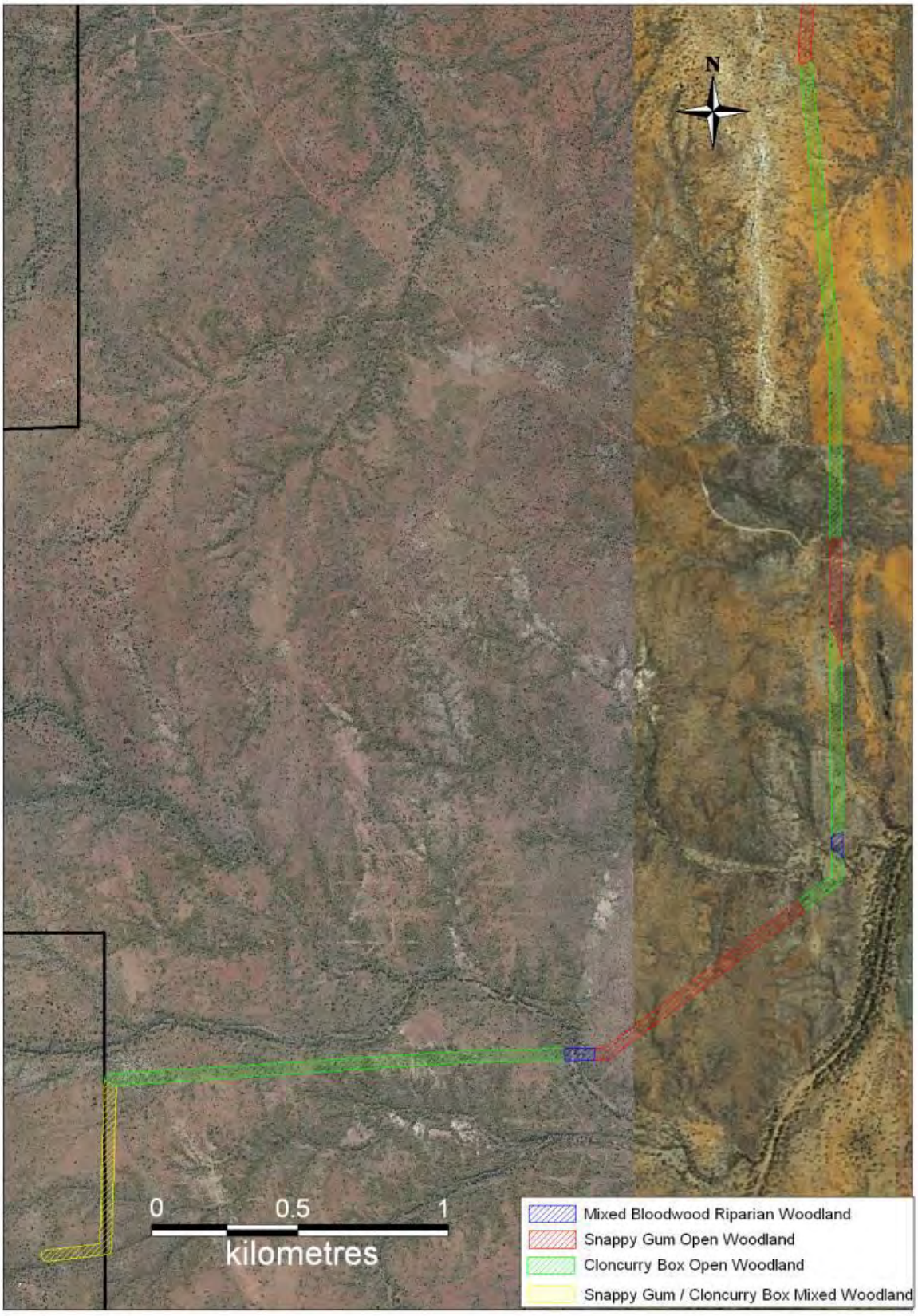


Figure 16 Southern Section of Water Pipeline Corridor Vegetation Communities

8.3.1 Vegetation Communities

Four vegetation communities are present along the water pipeline corridor; Cloncurry Box Open Woodland (RE 1.11.3x1), Snappy Gum Open Woodland (RE 1.11.2a), Mixed Bloodwood Riparian Woodland (RE 1.3.6b) and a co-dominant open woodland of Cloncurry Box and Snappy Gum (RE 1.11.2e) (refer to Figure 15 and Figure 16).

Each community is summarised with RE equivalents and corresponding conservation status (Table 23 below and in the following sections.

Table 23 Vegetation Communities on the Water Pipeline Corridor

Vegetation Community / RE	Community Description	EPBC Status	Queensland VMR	DERM Biodiversity Status
Snappy Gum Open Woodland / 1.11.2a	Low open-woodland of *Eucalyptus leucophloia* often with *Corymbia spp., Terminalia aridicola* and *Eucalyptus leucophylla* with shrub layer of *Acacia spp*. and ground layer of *Triodia spp.* Occurs on steep hills and strike ridges	Not Listed	Least Concern	No Concern at Present
Cloncurry Box Open Woodland / 1.11.3x1	Low open-woodland of *Eucalyptus leucophylla* often with *Corymbia terminalis* and *Eucalyptus leucophloia* with Acacia spp. dominated shrub layer and ground layer of *Triodia spp*. and/or tussock grasses. Includes areas of *Acacia spp*. shrubland and *Triodia spp*. grassland. Occurs on hills on strongly folded pre-Cambrian rocks; skeletal soils, some shallow loams	Not Listed	Least Concern	No Concern at Present
Snappy Gum / Cloncurry Box Open Woodland / RE 1.11.2e	Low open-woodland *of Eucalyptus leucophylla* and *Eucalyptus leucophloia* often with *Acacia cambagei* and *Corymbia terminalis* with a sparse ground layer of *Triodia pungens* and/or *Triodia longiceps*. Occurs on footslopes and lower slopes, broken by creeks and drainages	Not Listed	Least Concern	No Concern at Present
Mixed Bloodwood Riparian Woodland 1.3.6b	Woodland and low woodland of *Corymbia aparrerinja* and *Corymbia terminalis*. *Acacia victoriae* may dominate heavier soils. Occurs on terraces and	Not Listed	Least Concern	Of Concern

	floodplains on Quaternary alluvium; alluvial soils, some earths and deep yellow podzolics			

8.3.1.1 Snappy Gum Open Woodland

The Snappy Gum Open Woodland (RE 1.11.2a) community is equivalent to the community found on the Project site. Refer to Section 6.1 for a detailed community description.

The Snappy Gum Open Woodland (RE 1.11.2a), is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status and is not listed under the EPBC Act.

Based on proposed disturbance plans for the Project, additional clearing of the Snappy Gum Open Woodland will be required. It is unlikely disturbance within this community will significantly impact on the regional occurrence of this community.

8.3.1.2 Cloncurry Box Open Woodland

The Cloncurry Box Open Woodland community is equivalent to the community found within the Project site. Refer to Section 6.3 for a detailed community description.

Cloncurry Box Open Woodland (RE 1.11.3x1), is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status and is not listed under the EPBC Act.

Based on proposed disturbance plans for the Project, additional clearing of the Cloncurry Box Open Woodland will be required. It is unlikely disturbance within the pipeline corridor will significantly impact on the regional occurrence of this community.

8.3.1.3 Mixed Bloodwood Riparian Woodland

The Mixed Bloodwood Riparian Woodland is classified as RE 1.3.6b, and has similar structural composition as described in Section 6.5.

This community is listed as „Least Concern" under the VMR, „Of Concern" under the DERM Biodiversity Status and is not listed under the EPBC Act.

Proposed disturbance plans for the Project, show that clearing of this community will be required, with an estimated disturbance footprint of approximately 0.2 ha. Assuming appropriate sediment and erosion controls are in place, it is unlikely this community will be affected at a regional scale.

8.3.1.4 Snappy Gum / Cloncurry Box Open Woodland

The Snappy Gum Open / Cloncurry Box Woodland (RE 1.11.2e) community is equivalent to the community found on the Project site. Refer to Section 6.2 for a detailed community description.

The Snappy Gum Open Woodland (RE 1.11.2e), is listed as „Least Concern" under the VMR, „No Concern at Present" under the DERM Biodiversity Status and is not listed under the EPBC Act.

Based on proposed disturbance plans for the Project, additional clearing of the Snappy Gum / Cloncurry Box Open Woodland will be required. It is unlikely disturbance within this community will significantly impact on the regional occurrence of this community.

8.3.2 Rocky Outcrops

One rocky outcrop is located within the water pipeline corridor. Rocky Outcrop 1 is located along the northern section of the water pipeline corridor (refer to Figure 15). The outcrop is 80 m in length, with a maximum relief of approximately 4 m (Photo Plate 37 and Photo Plate 38). A few small crevices are present in this rock system. Marsupial scat samples have been collected and identified; however no Purple-necked Rock-wallaby (*Petrogale purpureicollis*) scats were present. The absence of Rock-wallaby scats suggests that this species is unlikely to reside at this small outcrop.



Photo Plate 37 Extent of Rocky Outcrop 1



Photo Plate 38 Rocky Outcrop 1

9.0 SUGGESTED MITIGATION AND REHABILITATION STRATEGIES

Suggested strategies to minimise the impacts on native flora and fauna, and recommendations regarding rehabilitation of the Project site are outlined below.

9.1 ENVIRONMENTAL VALUES

- The River Red Gum Riparian Woodland (RE 1.3.7a and RE 1.3.7b) and Mixed Bloodwood Riparian Woodland (RE 1.3.6b) provide refuge for fauna by providing water, shade and larger tree species with hollows;

- The River Red Gum Riparian Woodland is floristically the most diverse vegetation community within the local area of the project and it helps maintain the environmental integrity of watercourses by stabilising the banks with the root system and preventing erosion during flooding events;

- Rocky outcrops within the Cloncurry Box Open Woodland and Snappy Gum Open Woodland provide microhabitat for certain fauna;

- Silver Box / Cloncurry Box Open Woodland (RE 1.5.4x3), River Red Gum Riparian Woodland (RE 1.3.7) and Mixed Bloodwood Riparian Woodland (RE 1.3.6b) are listed are „Of Concern" or „Endangered" under DERM"s Biodiversity Status. These intact stands contribute to overall preservation of threatened ecosystems.

9.2 POTENTIAL IMPACTS FROM PROJECT

Potential impacts of the Project include habitat loss and fragmentation, increased traffic, noise, dust and artificial lighting over a greater area than currently exists, due to the proposed Project.

In order to preserve the native biodiversity of the immediate and greater regions, ecological processes, such as natural disturbance regimes, hydrological processes, nutrient cycles and biotic interactions, should be maintained. Additionally, landscapes and communities must be managed to be responsive to short-term and long-term environmental change.

Each habitat type, including open woodlands, tussock grasslands, riparian woodlands and stony hills, provides unique habitat which supports ecological processes within the landscape. Ecotones (boundaries between vegetation communities) may be especially important for resources, as these areas frequently have a higher diversity and abundance of species (Hunter, 1990).

The following potential impacts on nature conservation values may occur from the Project:

- Land clearing for the Project will reduce the current extent of vegetation communities and associated faunal habitats. The extent of disturbance within each RE is summarised in Table 24;

- Fauna injury or death may occur during the Project, with the greatest potential to occur during the construction phase;

- 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 Project site;

- Additional noise from mine site operations may disturb fauna or reduce available habitat for certain flora and fauna on the Project site. Noise effects can be highly species dependant and may vary widely. Impacts from noise will be concentrated around the process plant / decline area, which leaves the majority of the Project site and associated habitat types unaffected

- Increased lighting around the process plant and accommodation camp area may affect both nocturnal and diurnal fauna. The effects of artificial lighting will vary with different species. Additional lighting commonly attracts insects, which will result in a higher abundance of amphibians, microbats and reptiles ready to take advantage of concentrated prey;

- Loss of vegetation may cause fragmentation or loss of individual species" local population. Watercourses within the Project site are important linear habitat corridors, as they provide shelter and a water source for flora and fauna species. As the unnamed creek and associated valley within the TSF area will be disturbed, some loss of connectivity will occur. This may affect smaller, less mobile species;

- Loss of habitat may result in a loss of biological diversity (with associated removal of leaf litter, hollow bearing trees, fallen timber and resultant changes to soil biota);

- Altered fire regimes may occur as a result of the Project, as the risk of fire is greater with anthropogenic presence. Fire often increases nutrient availability to post-fire pioneer species. The proposed Project is not expected to significantly impact upon current natural fire systems;

- A change in population dynamics may occur, although it is not expected to be significant. Species most susceptible to a decline are low mobility species. Species such as amphibians and smaller reptiles may become genetically isolated, as a result of disrupting habitat connectivity near the TSF within the unnamed creek;

- Land clearing activities associated with the Project may increase soil erosion, inadvertently causing silting or sedimentation of riverine habitats and waterholes downstream. Soil erosion may also trigger a loss of nutrients to one area, causing a disruption of nutrient natural cycling;

- Processing and mining activities on the Project site may have the potential to contaminate riverine habitats and waterholes downstream;

- An increase of pest fauna species identified as utilising the Project site may occur, including the Cane Toad (*Rhinella marina*), Feral Pig (*Sus scrofa*) and Feral Cat (*Felis catus*); and

- The introduction of additional weed species and spread of weeds on the Project site via transport of seeds on vehicles and machinery.

Table 24 Regional Ecosystem Total Area and Disturbance Area

Vegetation Community	Regional Ecosystem Equivalents	Total Area on Project Site (ha)	Total Disturbance Area on Project Site (ha)
Snappy Gum Open Woodland on steep hills and strike ridges	1.11.2a	1,186	97.7
Snappy Gum Open Woodland on foothills	1.11.2e	555.5	30.4
Cloncurry Box Open Woodland on low broad hills	1.11.3a	365.5	0.0
Cloncurry Box Open Woodland on hills	1.11.3x1	331.6	24.5
Mixed Bloodwood Riparian Woodland	1.3.6b	11.2	0.0
River Red Gum Riparian Woodland	1.3.7b	98.4	16.7
Gidgee Open Woodland	1.3.4	97.12	0.0
Silver Box/ Cloncurry Box Open Woodland on red earths	1.5.4x3	155.1	23.6

9.2.1 Impacts on Threatened Species

The Purple-necked Rock-wallaby (*Petrogale purpureicollis*) was identified inhabiting sections of the Knapdale Range and along the powerline corridor. This species is listed as Vulnerable under NCWR. It is not listed under the EPBC Act.

The proposed development of the TSF may cause stress to the Rock-wallaby population present along the lower slopes of the Knapdale Range. The construction of the proposed project may have both detrimental as well as positive impacts on the local Rock-wallaby population. Positive impacts may include:

- Assuming that cattle grazing is not carried out during the proposed mine life, a slight increase in the availability of food through the reduction of grazing and hence reduced competition from cattle (Clancy and Close 1997); and

- Increased access to water resources, which may be beneficial during extended dry periods. Rock-wallabies do not require water, but will take advantage of nearby water resources when available (Sharman and Maynes 1998).

The proposed development of the TSF and powerline corridor will not necessitate clearing rocky outcrop structures.

Potential negative impacts may include:

- Effects of increased noise and vibration on Rock-wallabies are unknown and impossible to quantify prior to construction activities. Although blasting only lasts for a few seconds each day, this may induce an added stress to the rock wallabies;

- Pest species are known to increase around human habitation. The chances of higher predation may increase when the mine is in operation. Dingos (*Canis lupus dingo*) and feral cats (*Felis catus*) are of particular concern;

- Increased water availability and greater abundance of fodder may increase the number of competing macropods and other herbivorous species (i.e. European Rabbit, *Oryctolagus cuniculus*); and

- Additional roadways may result in an increase of Rock-wallaby injuries or death.

Mitigation strategies aimed at reducing or eliminating impacts from the Project on the Rock-wallaby population should include the creation of a vertebrate pest control program and roadway regulation.

9.2.2 Cumulative Impacts

The potential ecological impacts identified above are considered as a consequence of the construction and operation of the Project. The combined effect of multiple sources of impact (past, present and future) is referred to as „cumulative impacts" whereby the effects of multiple impacts may be additive within a region or accumulate over time. Consideration of cumulative impacts is necessary so impacts associated with the Project can be assessed with additional regional impacts from external sources.

Potential regional developments that may interact with the construction of the Project include:

- Other mines which may establish in the future within the region, as the Project site is adjacent to many exploration tenures;

- Low intensity stock graziers in the vicinity of the Project.

Residual impacts are those which will remain after a Project's mitigation and rehabilitation strategies have been carried out. Potential residual impacts include modification of vegetation and associated fauna habitat associated from Project infrastructure, including the waste rock dump and TSF. In the case of impacts of residual loss occurring subsequent to mine decommissioning, compensation in the form of further habitat rehabilitation in areas adjacent to the Project site or vegetation offsets can be employed.

All such developments are likely to contribute to a greater extent of ecological pressures on habitat and flora/fauna, such as vegetation clearing and a further fragmentation of habitat. Given mitigation measures are in place and that programs will be in place to monitor the success of rehabilitation, cumulative impacts of the Project are considered low.

9.3 MITIGATION STRATEGIES

Following the desktop assessment, literature review and on-site survey data, it has been determined that there is no significant hindrance, regarding terrestrial flora and fauna, to the development of the Dugald River Project. Suggested strategies to minimise the potential environmental impacts on native flora and fauna, and recommendations regarding rehabilitation of the Project site, are outlined below.

A general principle of environmental management, in order of preference, is to:

- Avoid environmental impacts;
- Minimise the impacts;
- Mitigate for impact; and
- Where impact cannot be avoided or minimised, compensation for residual impact by mitigative means such as offsets.

9.3.1 Avoidance of Environmental Impact

Avoiding environmental impacts has been planned for where possible throughout Project planning and design phases. There will also be ongoing opportunities to further avoid impacts at a local scale through the detailed design process. Infrastructure layout has been designed to avoid disconnection in the water flow regimes.

9.3.2 General Mitigation Strategies

- The River Red Gum riparian community should be managed using relevant strategies suggested under the QGEOP, with considerations for riverine wetland habitat;
- To maintain the integrity of vegetated land that is not cleared, appropriate erosion and sediment controls are recommended to prevent sediment deposition in remaining habitat. Maintenance of retained areas of native vegetation would also provide a source of seed for mine rehabilitation works;
- Native vegetation removal should 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 should be implemented to prevent the spread of weed species along riparian corridors. The most relevant examples being Noogoora Burr (*Xanthium strumianum*) and Caltrope (*Calotropis procera*) which was found along most riparian vegetation, but appeared to be more abundant downstream of the Project site; and
  - Appropriate erosion and sediment control structures are in place.
- Clear trees with hollows in the following manner:

- Use the biggest bulldozer available - it needs to take the weight of a tree - tap the trunk with the blade a few times to wake up anything inside the tree, wait a few minutes and watch for anything to come out;

- Push the tree slowly from the side with the hollow - the hollow needs to be upwards, not crushed on the ground - with the base of the blade about one metre up to get leverage; and

- As the tree starts to lean, lower the blade to the ground to catch the base/roots portion, and then lower the tree slowly by raising the blade.

- Salvage any good hollows for placement off site - wire them to other trees, pointing at the same compass aspect; and

- Relocate branches/roost trees that to a non-impacted area in the immediate neighbourhood. Where relocation of whole trees is not feasible, the extent of the tree hollow can be estimated and that section can be chain sawed out and fastened to nearby trees in a non-impacted area. Artificial nest boxes can also be installed within the non-impacted area.

- It is recommended that the methodologies for the rehabilitation/re-vegetation works for the Project use the most appropriate species for the landscape elements of the site. Such methodologies should include habitat matching of species to ensure rehabilitation success. Areas such as the waste rock dump should be assessed for species to ensure long-term stability and rehabilitation success rather than “quick fixes” that may not be successful in the long term;

- It is recommended that recreated landforms are contoured to resemble the original local topography. This includes replicating any stony hillocks, riverine areas and flat sandy plains which may be disturbed;

- Infrastructure planning should avoid the creation of permanent, shallow water areas, such as septic and other tank overflows that form a permanent seep. These areas attract Cane Toads (*Rhinella marina*) that are lethal to most snakes and other fauna species when ingested;

- Measures should 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 should be given the opportunity to move on naturally before clearing occurs;

- A segment of the Staff Induction Program should be allocated to informing staff of the conservation values on the Project site to increase staff awareness of the species present. This could include photographs, brief descriptions and management requirements of native species; and

- A rehabilitation strategy should be developed for the Project site. This strategy should embody the concepts and recommendations presented above and include provision for monitoring of rehabilitation progress over the life of the operation.

9.3.3 Threatened Species Management Strategies

The Purple-necked Rock-wallaby (*Petrogale purpureicollis*) was identified along sections of the Knapdale Range and in the vicinity of the proposed TSF area. This species is listed as Vulnerable under the NCWR. Strategies to manage and mitigate for impacts which may affect the Rock-wallaby include creating a vertebrate pest control program, regulate roadways and further monitoring. These strategies are described below.

Creation of a Vertebrate Pest Control Program

A Pest Control Program is recommended to commence before land clearing for mine infrastructure takes place on the Project site. This program is aimed at minimising populations and adverse impacts of pest fauna known to prey on Rock-wallabies, thereby reducing pressures on the Purple-necked Rock-wallaby (*Petrogale purpureicollis*) population. Recommendations for the Pest Control Program include:

- A pest inventory should put into practice, identifying types, abundance and location of pest animals. The data should be collected and managed in a standardised way so that trends can be determined;
- A process for reporting and identification of new pest species should be in place, along with a rapid response process for the management of new infestations;
- The Pest Control Program should directly relate to a Monitoring Program, with survey of both Purple-necked Rock-wallaby (*Petrogale purpureicollis*) numbers and pest species numbers;
- Targeting more than one pest species is important as the control of one pest species may benefit another (e.g. Control of Dingos (*Canis lupus familiaris*) may benefit the European rabbit (*Oryctolagus cuniculus*));
- A qualified pest control consultant or ecologist should be consulted prior to the commencement of the program as inappropriately designed baiting programs can be detrimental to other native fauna species;
- Pest management awareness should be included as a segment of the Staff Induction Program;
- Food scraps and waste should not be accessible or exposed to fauna, as this may attract pest wildlife and increase their food supply;
- Pest control strategies should be conducted in accordance with local government strategies;

Fencing along the TSF

It is recommended to enclose the TSF area with metal fencing, to prohibit access for the Purple-necked Rock-wallaby (*Petrogale purpureicollis*). Although the TSF location does not necessitate removal of outcrops, it is directly adjacent to outcrops and does include some foraging area. The fence would assist in preventing any unintentional harm to a Rock-wallaby, such as an individual becoming stuck in TSF slurry.

Roadway Regulation

As the proposed access roads to the TSF are in the vicinity of current habitat, foraging and roosting may be potentially impeded. An increase in Rock-wallabies crossing roadways may result in an increase in road injuries or death. To reduce the chances of road fatalities, mitigation strategies may include:

- Utilisation of wildlife reflectors along unfenced roads; and
- All personnel should be informed of the conservation value of the Rock-wallabies.

Further Research and Monitoring

A monitoring program would provide information on the impact (if any) on the affected animals. A monitoring program should consist of two sampling events each year, one in the wet season and the other in the dry season. This will ensure that seasonal behaviour patterns and population fluctuations are adequately accounted for. Data to be included in each sampling event should include, but is not limited to:

- An estimate of the number of Purple-necked Rock-wallabies (*Petrogale purpureicollis*) inhabiting the TSF area, or an indication of any changes in the population size;
- An estimate of the number and type of pest species occurring along the Knapdale Range within the Project site, or any changes in population size; and
- A continuation of data collection on suitable shelter sites and foraging areas as prescribed in this study.

The program should be flexible enough to allow changes in the methodology in response to previous results, which may include a reduction or addition of sample intensity. It is recommended qualified scientists or consultants who are familiar with the species, its faecal pellets and the Project should conduct the monitoring program. Monitoring results will be included in the Annual Audit report, which is submitted to DERM.

9.3.4 Powerline Construction Management Strategies

Strategies to minimise impacts on the River Red Gum Riparian Woodland (RE 1.3.7a) community whilst constructing the powerline corridor may include, but are not limited to:

- Employing horticulturists and tree cutting specialists to trim trees;
- Only trimming up to one third of the River Red Gum (*Eucalyptus camaldulensis*) height at any one time;
- Trimming should occur at the nearest growth point (tree stem or trunk offshoot) to protect trees from infections and disease. Trees should not be cut straight across to a standard clearance;
- Retention of large trees as close as feasible to powerline;
- Presence of a wildlife carer or specialist to determine hollows used by fauna and to aid in fauna relocation when clearing/trimming. Hollows used by fauna that have been removed should be replaced by appropriate nesting boxes; and

- Encourage natural regeneration of native shrubs by removing weeds, which will aid in keeping canopy at a lower height.

The powerline corridor should be aligned to avoid any ground disturbance near rocky outcrops by at least 150m, to protect the habitat of the Purple-necked Rock-wallaby (*Petrogale purpureicollis*).

9.3.5 Weed Management Strategies

No plant species declared under the LP Act were recorded in riparian areas during the survey.

However, a pest management plan may diminish the liability costs associated with weed infestation eradication and rather prevent seed spreading before infestations occur.

As it is an offence to move or transport a vehicle on a road if it is known, or should be known, that it is contaminated with a declared plant. Measures to control the spread of these weeds should be adopted across the Project.

It is recommended that a Pest Management Plan be developed to limit the spread of these species on the Project site. Staff should be informed of the species of weed likely to be encountered on the Project site, the location of known weed infestations, and how to report the presence of new infestations.

Cost effective and simple control measures should include:

- Remain on designated roads where practical;
- Stop water and fertilisers (when used) from running into bushland;
- Manage buffer or windbreak around disused revegetated areas (when applicable);
- Clean machinery; and
- Clean off-road vehicles (including visitors)

Biosecurity Queensland promotes a number of wash-down procedures, enabling industry to meet these requirements.

- Pest fact Sheets (made available from DEEDI) of the weed species which were identified within the River Red Gum Riparian Woodland and Bloodwood Riparian Woodland Regional Ecosystems detail the most effective methods of eradication. These Pest fact Sheets should be consulted, Appendix E, when requiring weed eradication/management strategies.

9.3.6 Management Strategies for Introduced Fauna Species

Under the LP Act, land managers must take reasonable steps to ensure that lands are kept free of Class 2 pests. Given this legal requirement in addition to the potential for these species to impact the environmental values of the Project site, management strategies for each of the Class 2 pests are addressed below:

1. **Dingo/Wild Dog (*Canis familiaris dingo*)** Different control methods including shooting, poisoning, trapping and fencing in combination with current land management practices are most effective to control Dingoes;

2. **Feral Cat (*Felis catus*)** Control methods for feral cats include shooting, poisoning, trapping and fencing in combination with current land management practices; and

3. **Feral Pigs (*Sus scrofa*)** Difficult to control, it is recommended that a combination of physical controls be employed, including shooting, poisoning, trapping and/or barrier construction.

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Appendix A: Database Search Results

Australian Government
Department of the Environment, Water, Heritage and the Arts

Protected Matters Search Tool

You are here: Environment Home > EPBC Act > Search

7 October 2008 14:01

EPBC Act Protected Matters Report

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

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

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

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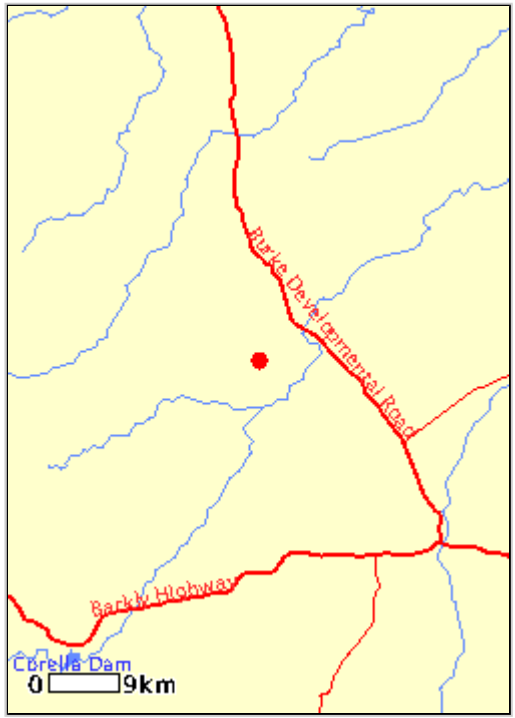


Report Contents:

Summary
Details
- Matters of NES
- Other matters protected by the EPBC Act

- Extra Information

Caveat
Acknowledgments



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Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance: (Ramsar Sites)	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	3
Migratory Species:	11

Other Matters Protected by the EPBC Act

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

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

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Places on the RNE:	1
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

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

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

Details

Matters of National Environmental Significance

Threatened Species [Dataset Information]	Status	Type of Presence

Birds		
Rostratula australis Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Mammals		
Sminthopsis douglasi Julia Creek Dunnart	Endangered	Species or species habitat may occur within area
Sharks		
Pristis microdon Freshwater Sawfish	Vulnerable	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Migratory Wetland Species		
Birds		
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel	Migratory	Species or species habitat may occur within area

Glareola maldivarum Oriental Pratincole	Migratory	Species or species habitat may occur within area
Numenius minutus Little Curlew, Little Whimbrel	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Charadrius veredus	Listed -	Species or species habitat may occur within area

Oriental Plover, Oriental Dotterel	overfly marine area	
Glareola maldivarum Oriental Pratincole	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Numenius minutus Little Curlew, Little Whimbrel	Listed - overfly marine area	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Reptiles		
Crocodylus johnstoni Freshwater Crocodile	Listed	Species or species habitat may occur within area

Places on the RNE [Dataset Information]
Note that not all Indigenous sites may be listed.

Indigenous

The Granites Area QLD

Caveat

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

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

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

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

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

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

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

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

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

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

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

Acknowledgments

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

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

- Northern Territory Herbarium
- Western Australian Herbarium
- Australian National Herbarium, Atherton and Canberra
- University of New England
- Other groups and individuals

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

Last updated: Monday, 21-Jul-2008 10:56:50 EST

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EPBC Act Protected Matters Report: Coordinates

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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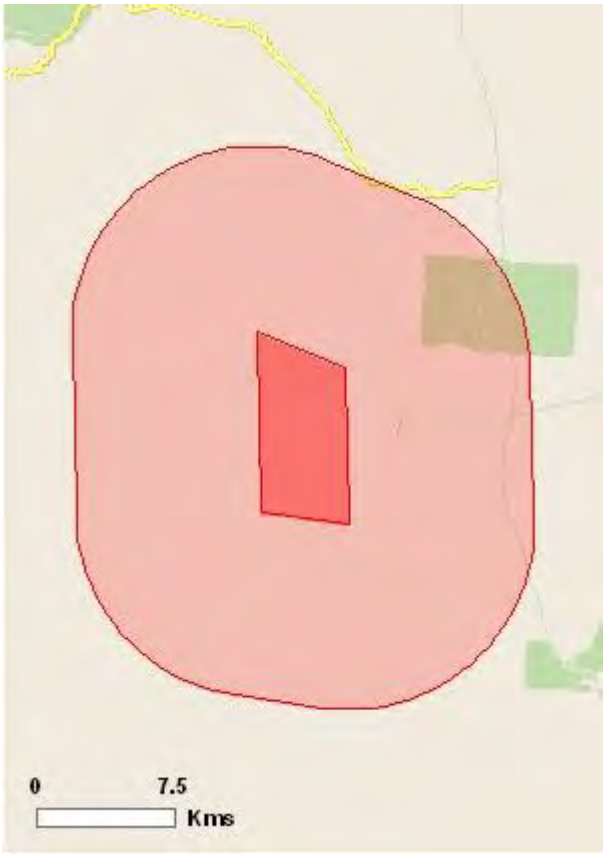
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Coordinates
Buffer: 10Km

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance (Ramsar Wetlands):	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communitites:	None
Threatened Species:	3
Migratory Species:	10

Other Matters Protected by the EPBC Act

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

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

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	9

Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

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

Place on the RNE:	None
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	12
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species		**[Resource Information]**
Name	Status	Type of Presence
BIRDS		
Rostratula australis		
Australian Painted Snipe [77037]	Vulnerable	Species or species habitat may occur within area
MAMMALS		
Sminthopsis douglasi		
Julia Creek Dunnart [305]	Endangered	Species or species habitat may occur within area
SHARKS		
Pristis microdon		
Freshwater Sawfish [66182]	Vulnerable	Species or species habitat likely to occur within area

Migratory Species		**[Resource Information]**
Name	Status	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		

Great Egret, White Egret [59541] Ardea ibis	Species or species habitat may occur within area
Cattle Egret [59542] Charadrius veredus	Species or species habitat may occur within area
Oriental Plover, Oriental Dotterel [882] Glareola maldivarum	Species or species habitat may occur within area
Oriental Pratincole [840] Rostratula benghalensis s. lat.	Species or species habitat may occur within area
Painted Snipe [889]	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species **[Resource Information]**

Name	Status	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe [889]		Species or species habitat may occur within area
Reptiles		
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area

Extra Information

Invasive Species **[Resource Information]**

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Frogs		
Bufo marinus Cane Toad [1772]		Species or species habitat likely to occur within area

Mammals	
Felis catus	
Cat, House Cat, Domestic Cat [19]	Species or species habitat may occur within area
Oryctolagus cuniculus	
Rabbit, European Rabbit [128]	Species or species habitat may occur within area
Sus scrofa	
Pig [6]	Species or species habitat likely to occur within area
Vulpes vulpes	
Red Fox, Fox [18]	Species or species habitat may occur within area
Plants	
Acacia nilotica subsp. indica	
Prickly Acacia [6196]	Species or species habitat may occur within area
Cenchrus ciliaris	
Buffel-grass, Black Buffel-grass [20213]	Species or species habitat likely to occur within area
Cryptostegia grandiflora	
Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]	Species or species habitat may occur within area
Hymenachne amplexicaulis	
Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]	Species or species habitat may occur within area
Parkinsonia aculeata	
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]	Species or species habitat may occur within area
Parthenium hysterophorus	
Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]	Species or species habitat may occur within area
Prosopis spp.	
Mesquite, Algaroba [68407]	Species or species habitat may occur within area

Caveat

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

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

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

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

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

Only selected species covered by the following provisions of the EPBC Act have been mapped:
- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:
- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:
- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

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

Coordinates

140.1579
-20.2122,140.1603
-20.2891,140.1167
-20.2828,140.1148
-20.1942,140.1579 -20.2122

Acknowledgements

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

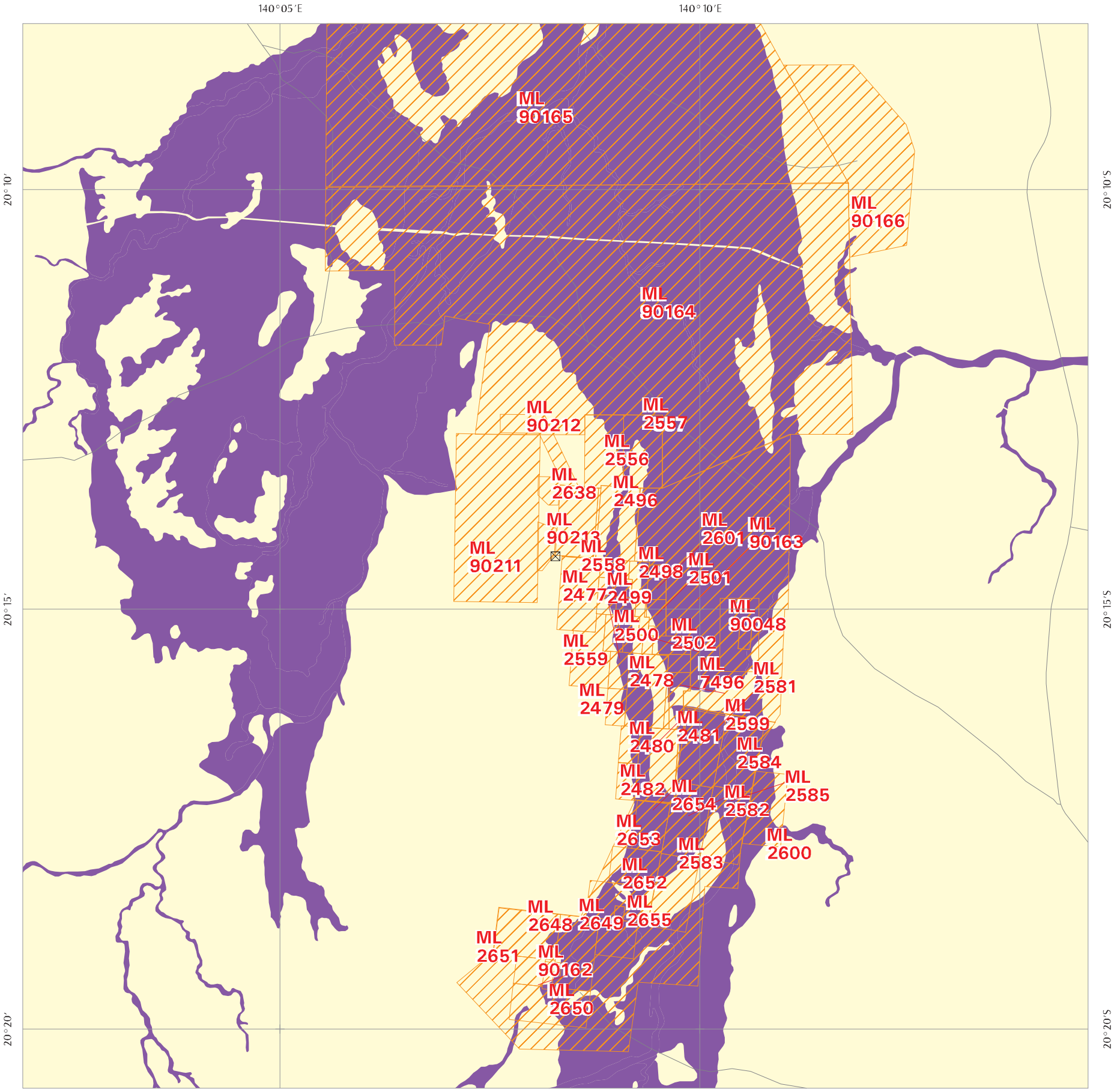
-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum

-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Legend

- Mining Leases

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

CATEGORY B
- World Heritage Areas
- Queensland Heritage Register Places
- Ramsar Sites
- Cultural Heritage Registered Areas and DLA's other than Stanbroke
- Special Forestry Areas
- Fish Habitat Areas
- Koala Plan
- Coordinated Conservation Areas
- Endangered Regional Ecosystems (Biodiversity Status)
- General Use Zones of Marine Parks
- Marine Plants

CATEGORY C
- Nature Refuges
- Resources Reserves
- Declared Catchment Areas
- Declared Irrigation Areas
- Drainage Areas
- River Improvement Areas
- Stanbroke DLA
- State Forests
- Timber Reserves
- Coastal Management Control Districts
- Dams and Weirs

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

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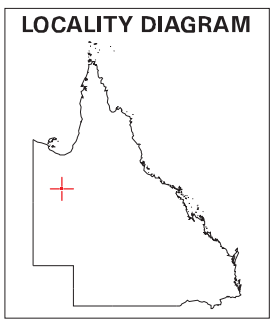
ENVIRONMENTALLY SENSITIVE AREAS - Mining Activities

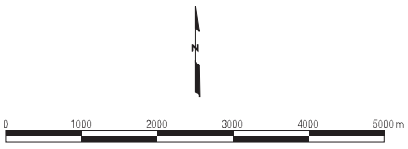
Requested By: JBYRD@AARC.NET.AU
Date: 19 Apr 11 Time: 11.15.28

Centered on point position:
Latitude: -20.2394 Longitude: 140.138
(decimal degrees)

Queensland Government

LOCALITY DIAGRAM





This scale bar is approximate only
Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)
This product is unprojected and is not suitable for measuring distances

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

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

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

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Aq_Nr	Batch_Nr	Cultivated	Group_Code	Group_Name	Family_Name	Status	Botanical_Name	Bc_Nr	Collect_Name	Collect_Code	Additional_Collectors	Collect_Date	Deter_Name	Deter_Date	Region_Name	District_Name	Locality	Floristic	Habitat	Additional	Altitude	Depth	Locn_Der	Geosource	Geodetic	Precision
326262	1		A	Angiosperm	Sterculiaceae	R	Brachychiton collinus Guymer	15244	Cole M.	105	Provan,D.;	15APR1962	Guymer G.		Queensland	Burke	DUGALD RIVER NEAR VOLGA	+---+000--+-	FT----				Hrb Convert	Lat/Long	AGD66	16000

Latitude	Longitude	Long_Decimal	Lat_Decimal	Amg_Zone	Amg_Easting	Amg_Northing	Grid	Label	Cultiv_Reference_Set	Public_Reference_Set	Reference_Set	Historical	Regional_Ecosystem1	Regional_Ecosystem2	Regional_Ecosystem3	Spirit	Carpological	Wood	Photo	Corveg	Date_Created	Last_Updated	GDA_lat_decimal	GDA_long_decimal
S20 15	E140 15	140.25	-20.25	54	421669	7760668	6957-216606	Dugald River near Volga. On rocky hill. Carpological material at BRI.													7/11/2000	16/08/2007	-20.2484874	140.251185

Aq_Nr	Batch_Nr	Group_Name	Family_Name	Status	Botanical_Name	Collect_Name	Collect_Code	Additional_Collectors	Collect_Date
724420	6592	Pteridophyte	Salviniaceae	*	Salvinia molesta D.S.Mitch.	Bean A.R.	24188		12JUN2005
747412	6833	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Kelman D.T.	141		10APR2002
650038	5645	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Barrs S.	SB24		18JUN1996
394031	1	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Schmid A.	684		20MAY1983
394030	1	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Schmid A.	648		20JUN1983
440883	1	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Harris P.L.	105		14NOV1986
178815	1	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Bishop H.G.			02AUG1969
440872	1	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Harris P.L.	93		16NOV1986
332686	1	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Benl G.	AU64	Maconochie,J.;	08MAR1978

394029	1	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Schmid A.	681		23MAY1983
699277	6568	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Johnston M.	05-101		06SEP2005
323904	1	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Blake S.T.	8783		28APR1935
114013	1	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Mason K.			1975
456557	1	Angiosperm	Amaranthaceae	N	Ptilotus maconochiei Benl	Harris P.L.	411		22JUL1989
850649	6930	Angiosperm	Convolvulaceae	N	Ipomoea antonschmidii R.W.Johnson	Booth R.	5541	Kelman,D.T.;	30JUN2010
749309	6868	Angiosperm	Convolvulaceae	N	Ipomoea antonschmidii R.W.Johnson	Booth R.	4484	Kelman,D.T.;	18MAY2006
451790	1	Angiosperm	Convolvulaceae	N	Ipomoea antonschmidii R.W.Johnson	Harris P.L.	201		04JUL1987
747455	6835	Angiosperm	Convolvulaceae	N	Ipomoea antonschmidii R.W.Johnson	Kelman D.T.		Turpin,G.P.;	10APR2002
407422	1	Angiosperm	Convolvulaceae	N	Ipomoea antonschmidii R.W.Johnson	Harris P.L.	155		22MAR1987

258552	1	Angiosperm	Convolvulaceae	N	Ipomoea antonschmidii R.W.Johnson	Schmid A.	AS430		20FEB1978
378135	1	Angiosperm	Convolvulaceae	N	Ipomoea antonschmidii R.W.Johnson	Schmid A.	756		19JAN1984
472703	1	Angiosperm	Convolvulaceae	N	Ipomoea antonschmidii R.W.Johnson	Harris P.L.	514		07APR1990
341042	1	Angiosperm	Cyperaceae	N	Fimbristylis distincta S.T.Blake	Blake S.T.	8715		22APR1935
406108	1	Angiosperm	Goodeniaceae	N	Goodenia angustifolia Carolin	Neldner V.J.	1615		OCT1984
406120	1	Angiosperm	Goodeniaceae	N	Goodenia angustifolia Carolin	Neldner V.J.	1627		OCT1984
405472	1	Angiosperm	Goodeniaceae	N	Goodenia angustifolia Carolin	Ollerenshaw P.	1253	Kratzing,D.;	06JUL1974
723395	6528	Angiosperm	Scrophulariaceae	N	Rhamphicarpa australiensis Steenis	McDonald K.R.	KRM4087		27MAR2005

769877	6735	Angiosperm	Scrophulariaceae	N	Rhamphicarpa australiensis Steenis	Fox I.D.	IDF3600	Wilson,G.W.;Kr	01MAR2005

Deter_Name	Deter_Date	Region_Name	District_Name	Locality	Floristic	Habitat
		Queensland	Burke	CORELLA DAM, C. 70KM E OF MT ISA.	----------	XDFA--
		Queensland	Burke	JUST OFF WAGER CREEK, 350M W OF LAKE JULIUS	+0+0000----	LT----
		Queensland	Burke	OSKARS VALLEY 15KM N MT ISA	+-+-000----	AT----
		Queensland	Burke	1.6KM N OF HILTON MINE	+++0000----	FTFA--
		Queensland	Burke	11KM N 2KM W OF MT ISA (REFSET)	+++0000----	L----G
		Queensland	Burke	11KM NE OF MT ISA OFF LM RD	+000000----	F-FA--
		Queensland	Burke	MT ISA CITY MAIN LOOKOUT	+000000----	FT----
		Queensland	Burke	MT ISA CITY LOOKOUT	+000000----	F-FA--
		Queensland	Burke	MT ISA CITY LOOKOUT	+000000----	F-----

		Queensland	Burke	MT ISA CITY MAIN LOOKOUT	+++-000----	-T----
		Queensland	Burke	MT ISA LOOKOUT	+0++000----	LT----
Benl G.		Queensland	Burke	MT ISA	+000000----	FTYC--
		Queensland	Burke	MT ISA	+000000----	------
		Queensland	Burke	FOUNTAIN RA 54KM SE OF MT ISA	+++-000----	K-FA-K
Johnson R.W.	NOV2010	Queensland	Burke	CA. 110KM NNE OF MT ISA.	++++000----	A-FA--
May A.R.		Queensland	Burke	CALTON HILLS STATION, NW OF GUNPOWDER	+++-000----	DD----
		Queensland	Burke	BULL CK 21KM E OF GUNPOWDER	+--+000----	D-----
Kelman D.T.		Queensland	Burke	WAGNER CREEK, EAST EDGE OF LAKE JULIUS, C. 70KM NNE OF MOUNT ISA	++++000----	-TFA--
		Queensland	Burke	LAKE JULIUS PIPELINE RD 66KM NNE OF MT ISA	+++0000----	------

	Queensland	Burke	CA 5KM SW LAKE JULIUS PUMP STN PIPELINE ROAD	+++0000----	------
	Queensland	Burke	5KM SW OF LAKE JULIUS PUMP STATION ON PIPELINE RD	++++000----	-K----
	Queensland	Burke	POLICE CK 42KM NNE OF MT ISA	+++-000----	X-OF--
	Queensland	Burke	UNDILLA	+000000----	C-----
	Queensland	Burke	6KM N OF MALBON	++++000----	ADYC--
	Queensland	Burke	NR RAILWAY CROSSING 5KM N OF MALBON VALE HS	++++000----	ADFA--
Taylor J.	Queensland	Gregory North	7M S OF DUCHESS ON RD TO TREKELANO MINE	+++0000----	------
	Queensland	Burke	14.1KM BY ROAD TOWARDS JULIA CREEK FROM JUNCTION WITH BURKE DEVELOPMENT RD.	++++000----	B-FA--

Queensland	Burke	IMMEDIATELY DOWNSTREAM OF THE ROAD CROSSING OF CROCODILE CREEK, SW OF BURKE AND WILLS ROADHOUSE.	++++000----	E-FF--

Additional	Altitude	Depth	Locn_Der	Geosource	Geodetic	Precision	Latitude	Longitude	Long_Decimal	Lat_Decimal	Amg_Zone
	297		GPS	Lat/Long	AGD84	100	S20 50 52.00	E140 03 02.00	140.0505556	-20.84777778	54
			GPS	AMG	WGS84	100	S20 08 28.21	E139 45 32.32	139.7589786	-20.14116946	54
G			Map	Lat/Long	AGD66	1600	S20 34 30.00	E139 28 30.00	139.475	-20.575	54
	350		Hrb Convert	Lat/Long	AGD66	1600	S20 34 30.00	E139 28 30.00	139.475	-20.575	54
	320		Hrb Convert	Lat/Long	AGD66	1600	S20 36 30.00	E139 28 30.00	139.475	-20.60833333	54
G	350		Hrb Convert	Lat/Long	AGD66	1600	S20 39 30.00	E139 33 30.00	139.5583333	-20.65833333	54
			GPS	Lat/Long	GDA94	100	S20 43 18.00	E139 30 02.00	139.5005556	-20.72166667	54
G	350		GPS	Lat/Long	GDA94	100	S20 43 18.00	E139 30 02.00	139.5005556	-20.72166667	54
T	570		GPS	Lat/Long	GDA94	100	S20 43 18.00	E139 30 02.00	139.5005556	-20.72166667	54

BF	380	GPS	Lat/Long	GDA94	100	S20 43 18.00	E139 30 02.00	139.5005556	-20.72166667	54
G		GPS	Lat/Long	AGD66	100	S20 43 23.46	E139 29 58.32	139.4995333	-20.72318333	54
		Hrb Convert	Lat/Long	AGD66	16000	S20 45	E139 25	139.4166667	-20.75	54
		Hrb Convert	Lat/Long	AGD66	16000	S20 45	E139 25	139.4166667	-20.75	54
G	520	Hrb Convert	Lat/Long	AGD66	1600	S20 59 30.00	E139 55 30.00	139.925	-20.99166667	54
J		GPS	AMG	WGS84	100	S19 25 18.77	E139 37 15.56	139.6209893	-19.42187953	54
J		GPS	Lat/Long	WGS84	100	S19 36 46.00	E139 21 15.00	139.3541667	-19.61277778	54
J	260	Hrb Convert	Lat/Long	AGD66	1600	S19 45 30.00	E139 35 30.00	139.5916667	-19.75833333	54
J		GPS	AMG	WGS84	100	S20 08 28.21	E139 45 32.32	139.7589786	-20.14116946	54
J	250	Hrb Convert	Lat/Long	AGD66	1600	S20 10 30.00	E139 43 30.00	139.725	-20.175	54

		Hrb Convert	Lat/Long	AGD66	1600	S20 15 30.00	E139 44 30.00	139.7416667	-20.25833333	54
TB		Hrb Convert	Lat/Long	AGD66	1600	S20 15 30.00	E139 44 30.00	139.7416667	-20.25833333	54
J	315	Hrb Convert	Lat/Long	AGD66	1600	S20 24 30.00	E139 41 30.00	139.6916667	-20.40833333	54
T		Hrb Convert	Lat/Long	AGD66	16000	S19 25	E138 45	138.75	-19.41666667	54
		Hrb Convert	Lat/Long	AGD66	1600	S21 01 30.00	E140 18 30.00	140.3083333	-21.025	54
		Hrb Convert	Lat/Long	AGD66	1600	S21 03 30.00	E139 35 30.00	139.5916667	-21.05833333	54
Q		Hrb Convert	Lat/Long	AGD66	1600	S21 27 30.00	E139 53 30.00	139.8916667	-21.45833333	54
G		GPS	Lat/Long	WGS84	100	S19 16 56.00	E140 27 43.00	140.4619444	-19.28222222	54

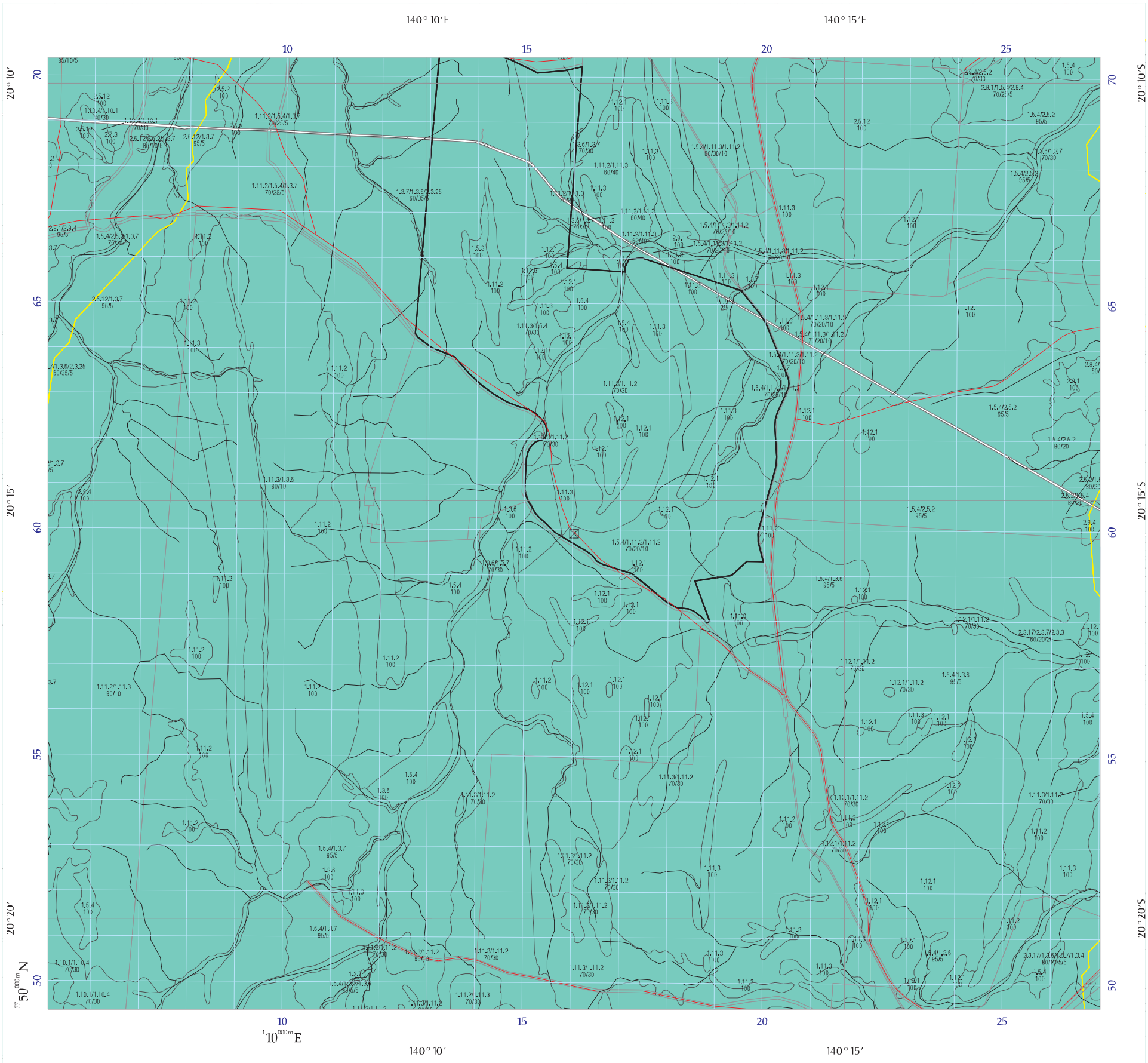
G	GPS	AMG	GDA94	100	S19 16 56.29	E140 27 39.26	140.4609048	-19.28230179	54

Amg_Easting	Amg_Northing	Grid	Label
			Corella Dam, c. 70km E of Mt Isa. Creek banks below dam wall. Woodland of Eucalyptus camaldulensis, Vitex benthamiana, Melaleuca trichostachya, Acacia hemsleyi.
401222	7694400	6956-012944	Plant floating on water surface. Abundant at site, choking entire creek.
			Just off Wager Creek, 350m W of Lake Julius.
370291	7772413	6857-702724	Rock face with Corymbia aspera, Terminalia aridicola, Eucalyptus leucophloia and Atalaya hemiglauca.
			Oskars Valley, 15km N Mt Isa.
341049	7724136	6756-410241	Herb growing abundantly on upper slope in rocky ground. Surrounding vegetation, Triodia longiceps hard spinifex, Eucalyptus leucophloia.
			1.6km N of Hilton mine.
341049	7724136	6756-410241	Slope, rocky soil, with Eucalyptus leucophloia and Triodia sp.
			11km N and 2km W of Mt Isa.
341084	7720446	6756-410204	Gorge E of Judean beds. Growing on rock outcrop (Magazine shale) with Acacia megalantha, A.orthocarpa, Dodonaea viscosa.
			11km NE of Mt Isa, off LM Road.
349818	7714990	6856-498149	Open woodland, slopes, Eucalyptus leucophloia, Triodia. Herb 0.4m. Growing with No.85 (Triodia sp.).
			Main lookout, Mt Isa city.
343864	7707933	6856-438079	Hillside, shale and rocky soil. Small shrub.
			Mt Isa city lookout.
343864	7707933	6856-438079	Eucalyptus leucophloia. Slope. Herb 0.4m.
			Mt Isa, city lookout.
343864	7707933	6856-438079	Shale hill slopes.

			Mt Isa city main lookout. Disturbed land. Breakaway shale, rock, skeletal soil. Growing with Cenchrus ciliaris.
343864	7707933	6856-438079	Shrub. Mt Isa lookout. Stony hillside, growing in rock crevices. Herb.
343759	7707756	6756-437077	Several plants seen. Mt Isa. Rocky quartzite hillsides with Triodia and mountain gums.
335157	7704705	6756-351047	Branched hairy shrub c 60cm, corolla deep pink within.
335157	7704705	6756-351047	Mt Isa. Fountain Range, 54km SE of Mt Isa. Open woodland, Eucalyptus aspera, E.exserta, E.capricornia and Triodia spp., on quartzite ridge top.
388265	7678391	6856-882783	Herb to 0.4m. Ca. 110km NNE of Mt Isa. Flat area at base of rise with Eucalyptus leucophloia.
355218	7851912	6859-552519	Velvety leaved prostrate plant with pink flowers. Scrambling over rocks. Calton Hills station, NW of Gunpowder. Sandy bank above rocky creek in small gorge; Hakea arborescens dominating bank.
327402	7830536	6758-274305	Ground-hugging vine, leaves grey-green, flowers pink. Bull Creek, 21km E of Gunpowder.
352445	7814640	6858-524146	Eucalyptus leucophloia, Acacia onticola. Wagner Creek, east edge of Lake Julius, c. 70km NNE of Mount Isa. Rocky area with Eucalyptus leucophloia, Corymbia capricornia and C. aparrerinja.
370291	7772413	6857-702724	Furry vine with large purple flowers. Lake Julius Pipeline Road, 66km NNE of Mt Isa. Eucalyptus leucophloia open woodland Acacia orthocarpa.
366767	7768634	6857-667686	Creeper with purple flowers.

368579	7759424	6857-685594	Ca 5km SW of Lake Julius Pump Station, Pipeline Road. Vine growing on road side.
368579	7759424	6857-685594	5K SW of Lake Julius pump station on Pipeline Rd. Growing in disturbed area in red clay with Acacia retivenia, Tephrosia sp, Hibiscus sturtii & Atalaya hemiglauca.
363488	7742780	6857-634427	Police Creek, 42km NNE of Mt Isa. Large creek, with Euc. camaldulensis and Melaleuca leucadendron. Creeper, blue flowers.
263735	7851518	6659-637515	Undilla. On a stream bank. Tufted, erect, c 3-5 in., subglaucous; spikelets black or nearly so.
428126	7674922	6955-281749	6km N of Malbon. On lower slope below quartzite hills; sandy loam on the surface. Triodia pungens dominates the ground layer with scattered Eucalyptus terminalis, E. argillacea and Atalaya hemiglauca.
353679	7670742	6855-536707	Near Railway Crossing, 5km N of Malbon Vale Homestead. In Eucalyptus terminalis low woodland on sandy loam soil.
385162	7626711	6855-851267	7 miles S of Duchess on road to Tredelano Mine. 25cm high. Yellow flowers. Common along roadside.
443465	7867857	6959-434678	14.1km by road towards Julia Creek from junction with Burke Development Rd. Riparian eucalypt open woodland on floodplain. White flowered soft herb near waterhole; clay soils. Scarce.

443356	7867848	6959-433678	Immediately downstream of the road crossing of Crocodile Creek, SW of Burke and Wills Roadhouse. Low open woodland of Eucalyptus camaldulensis, Cochlospermum gregorii and Terminalia platyphylla on a small creek channel in a landscape of ferruginous/calcrete rock. Herb at edge of the water. Common at site.



Vegetation Management Act Regional Ecosystem and Remnant Map-Version 6

Remnant vegetation containing endangered regional ecosystems
- Dominant
- Sub-dominant

Remnant vegetation containing of concern regional ecosystems
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- Sub-dominant

- Remnant vegetation that is a least concern regional ecosystem
- Remnant vegetation under Section 20AH of the VMA
- Non-remnant
- Plantation Forest
- Dam or Reservoir
- Remnant Vegetation
- PMAV Category X area
- Great Barrier Reef Wetlands
- Vegetation Management Act Essential Habitat
  For further information on VMA Essential Habitat, please see the attached VMA Essential Habitat map.
- Subject Lot
- Watercourse (Stream order shown as black number against stream where available)
- Bioregion boundary
- Roads © MapInfo Australia Pty Ltd 2009
- National Park, Conservation Area State Forest and other reserves
- Cadastral line
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- Towns
- Coordinate entered

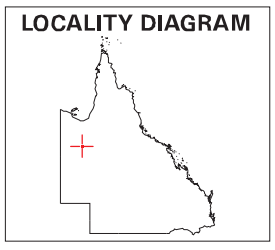
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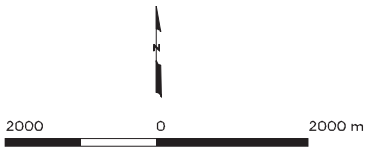
Requested By: JBYRD@AARC.NET.AU
Date: 06 May 10 Time: 12.58.42

Centered on point position:
Latitude: -20.2565 Longitude: 140.196 (decimal degrees)
Bioregion: North West Highlands

Queensland Government

LOCALITY DIAGRAM





Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

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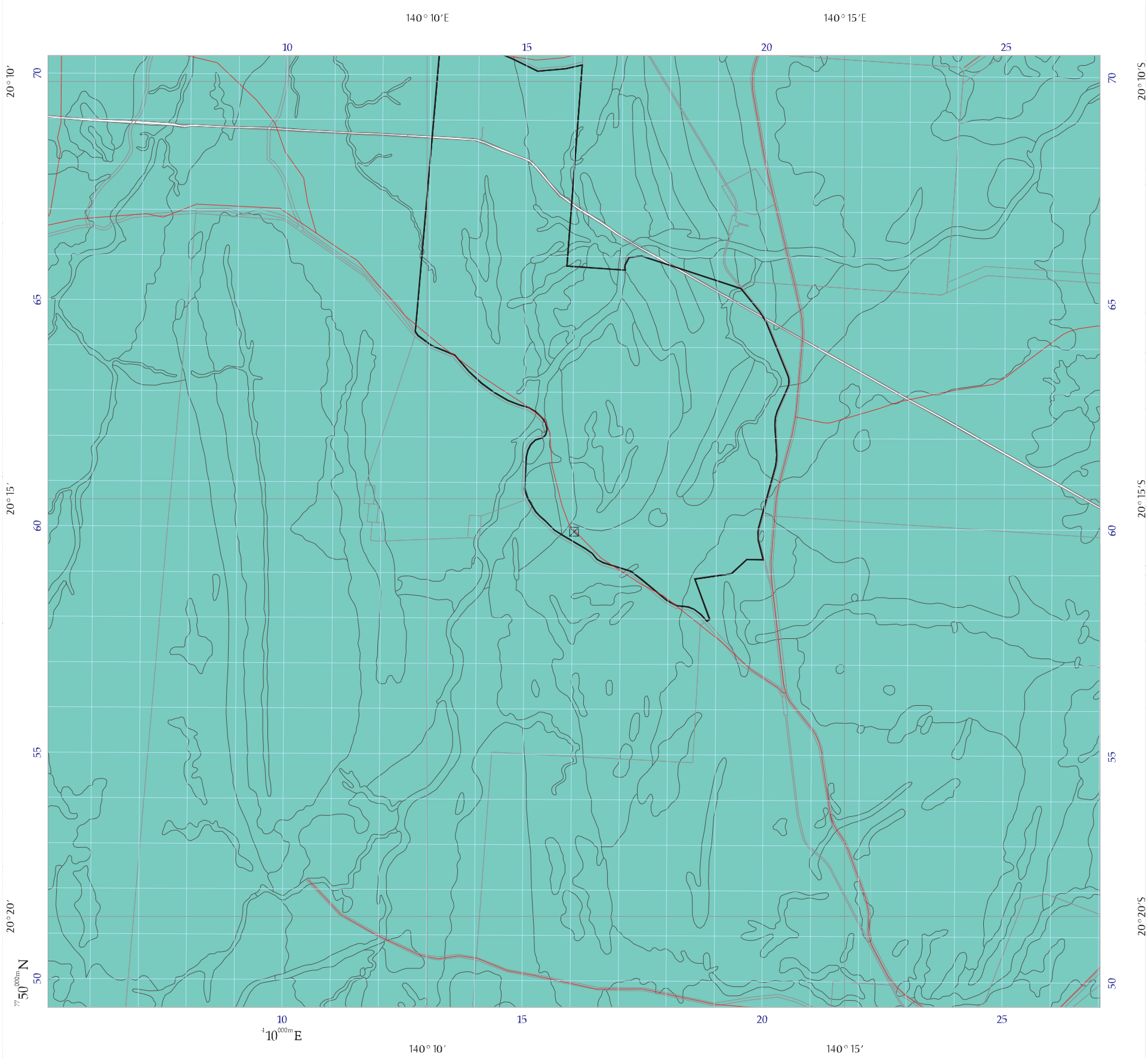
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Vegetation Management Act Essential Habitat Map Version 3.0

Remnant vegetation containing endangered regional ecosystems
- Dominant
- Sub-dominant

Remnant vegetation containing of concern regional ecosystems
- Dominant
- Sub-dominant

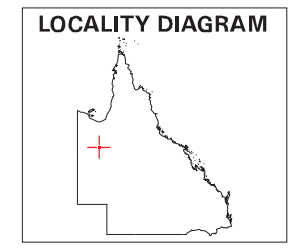
- Remnant vegetation that is a least concern regional ecosystem
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- Plantation Forest
- Dam or Reservoir
- Remnant Vegetation
- PMAV Category X area
- Vegetation Management Act Essential Habitat
- Vegetation Management Act Essential Habitat Species Records
- Subject Lot
- Roads © MapInfo Australia Pty Ltd 2009
- National Park, Conservation Area State Forest and other reserves
- Cadastral line
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- Towns
- Coordinate entered

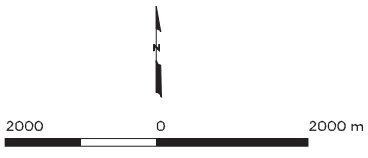
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Date: 06 May 10 Time: 12.58.45

Centered on point position:
Latitude: -20.2565 Longitude: 140.196 (decimal degrees)

Queensland Government

LOCALITY DIAGRAM





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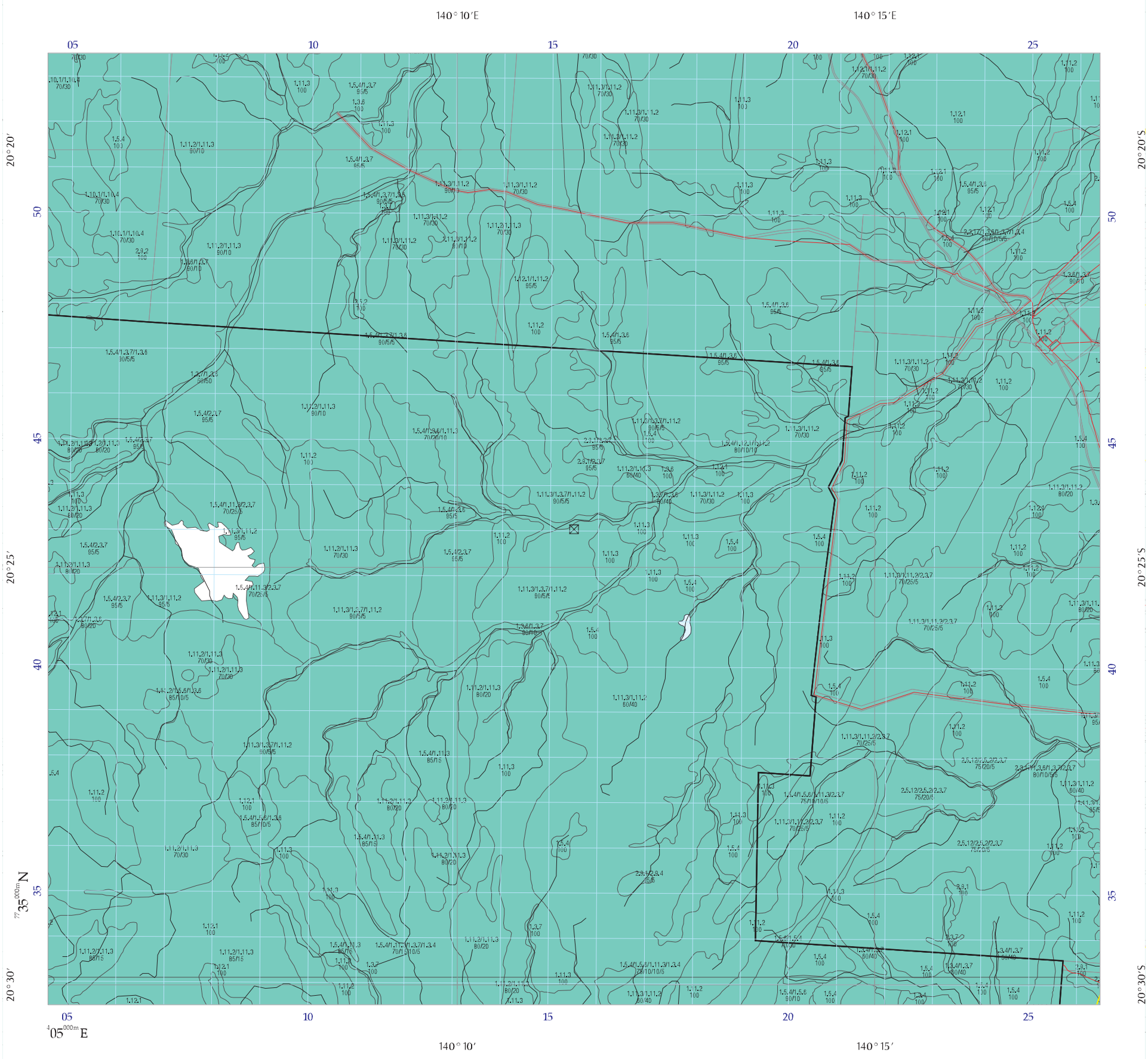
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Vegetation Management Act Regional Ecosystem and Remnant Map-Version 6

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- Sub-dominant

Remnant vegetation containing of concern regional ecosystems
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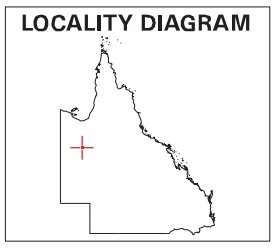
Based on 2006 Landsat TM imagery

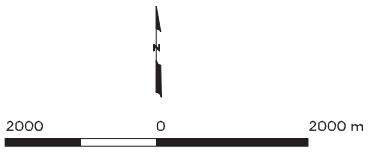
Requested By: JBYRD@AARC.NET.AU
Date: 06 May 10 Time: 13.01.59

Centered on point position:
Latitude: -20.409 Longitude: 140.19 (decimal degrees)
Bioregion: North West Highlands

Queensland Government

LOCALITY DIAGRAM





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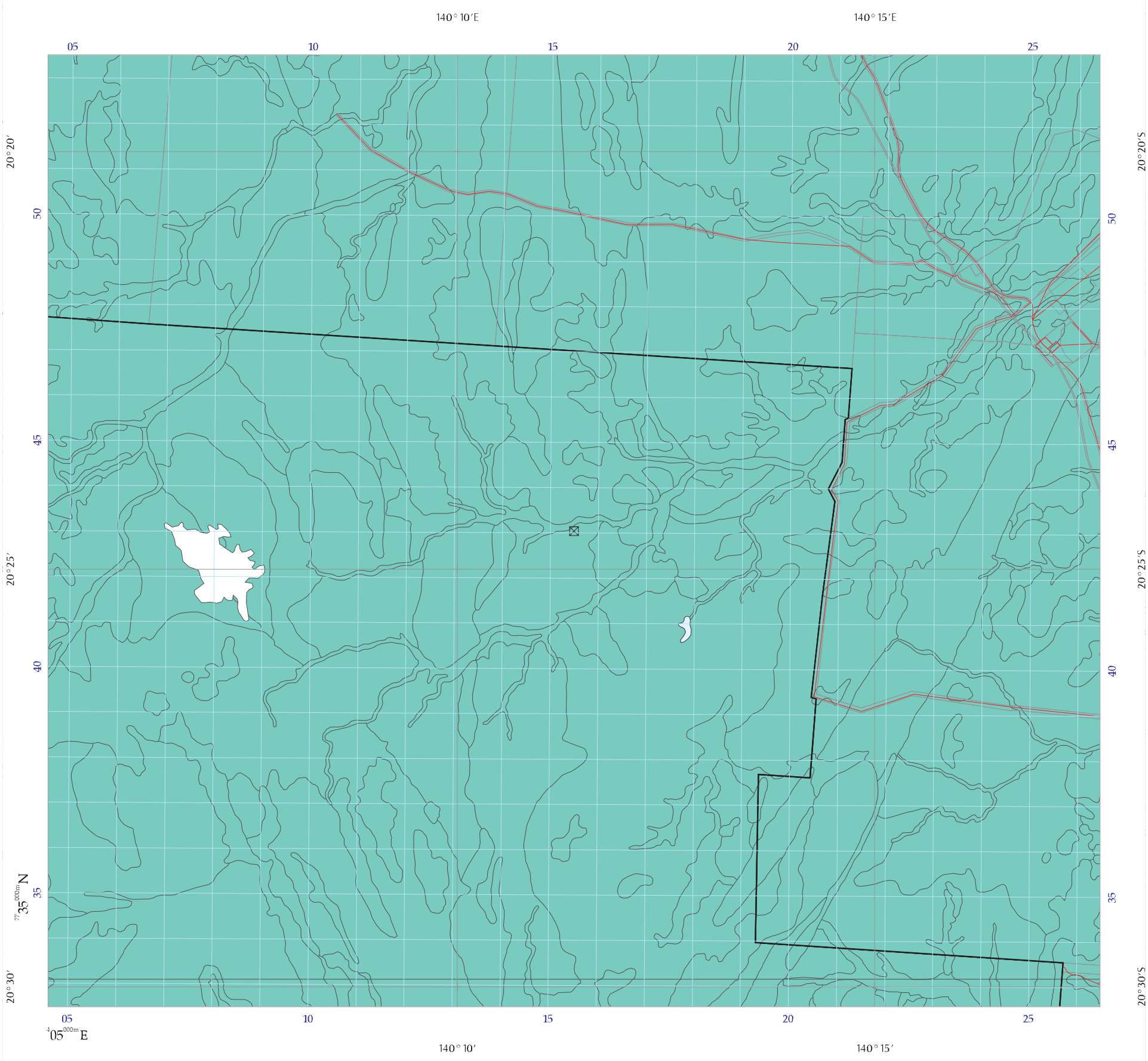
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Vegetation Management Act Essential Habitat Map Version 3.0

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Remnant vegetation containing of concern regional ecosystems
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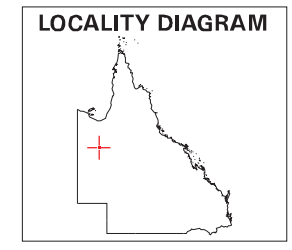
- Remnant vegetation that is a least concern regional ecosystem
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- Dam or Reservoir
- Remnant Vegetation
- PMAV Category X area
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- Vegetation Management Act Essential Habitat Species Records
- Subject Lot
- Roads © MapInfo Australia Pty Ltd 2009
- National Park, Conservation Area State Forest and other reserves
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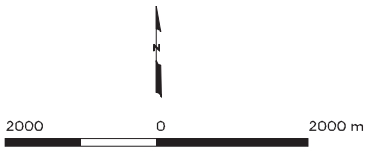
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Date: 06 May 10 Time: 13.02.03

Centered on point position:
Latitude: -20.409 Longitude: 140.19 (decimal degrees)

Queensland Government

LOCALITY DIAGRAM





Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

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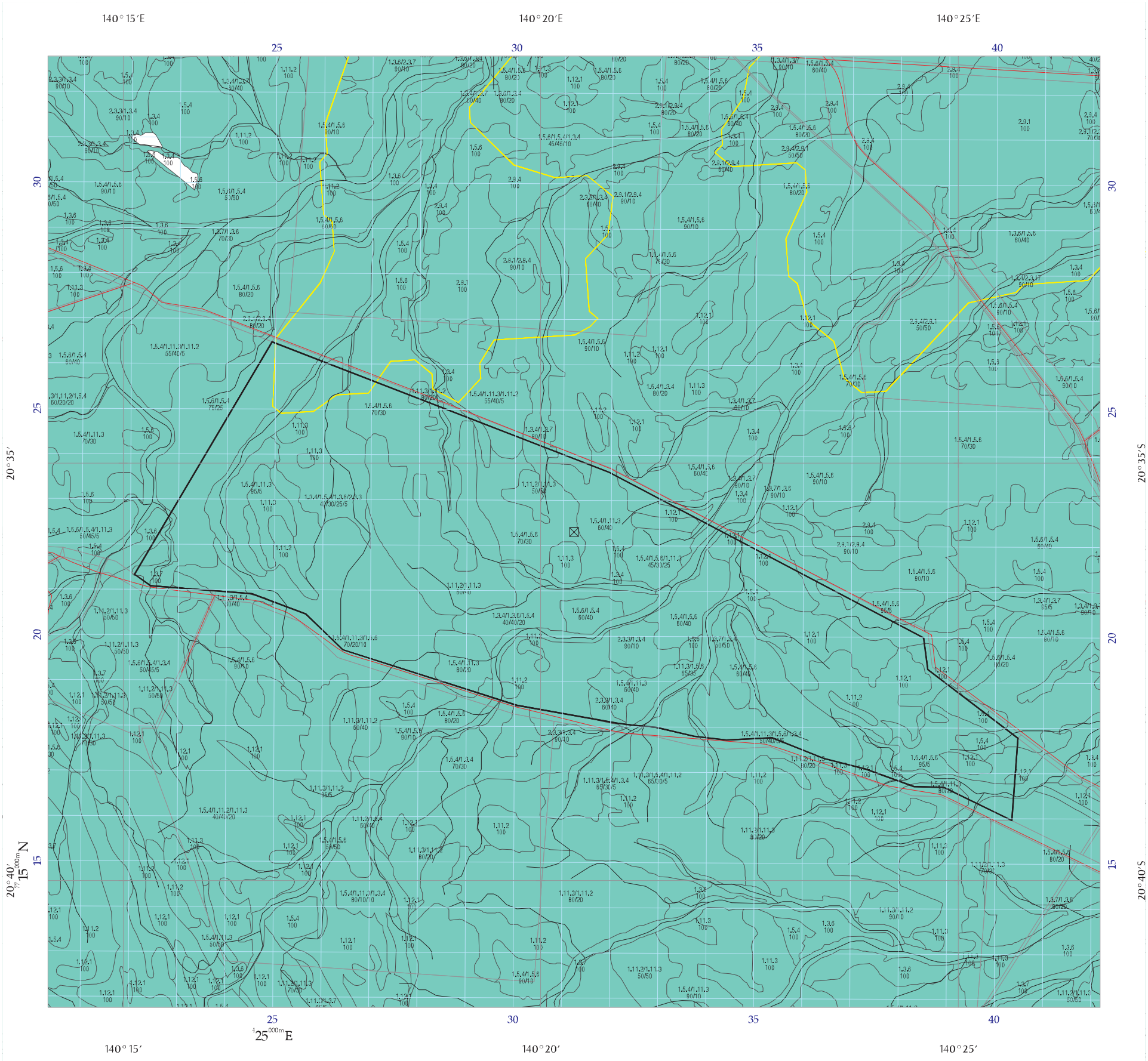
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Vegetation Management Act Regional Ecosystem and Remnant Map-Version 6

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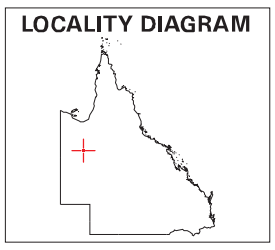
Based on 2006 Landsat TM imagery

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Date: 06 May 10 Time: 12.59.15

Centered on point position:
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Bioregion: North West Highlands

Queensland Government

LOCALITY DIAGRAM





Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

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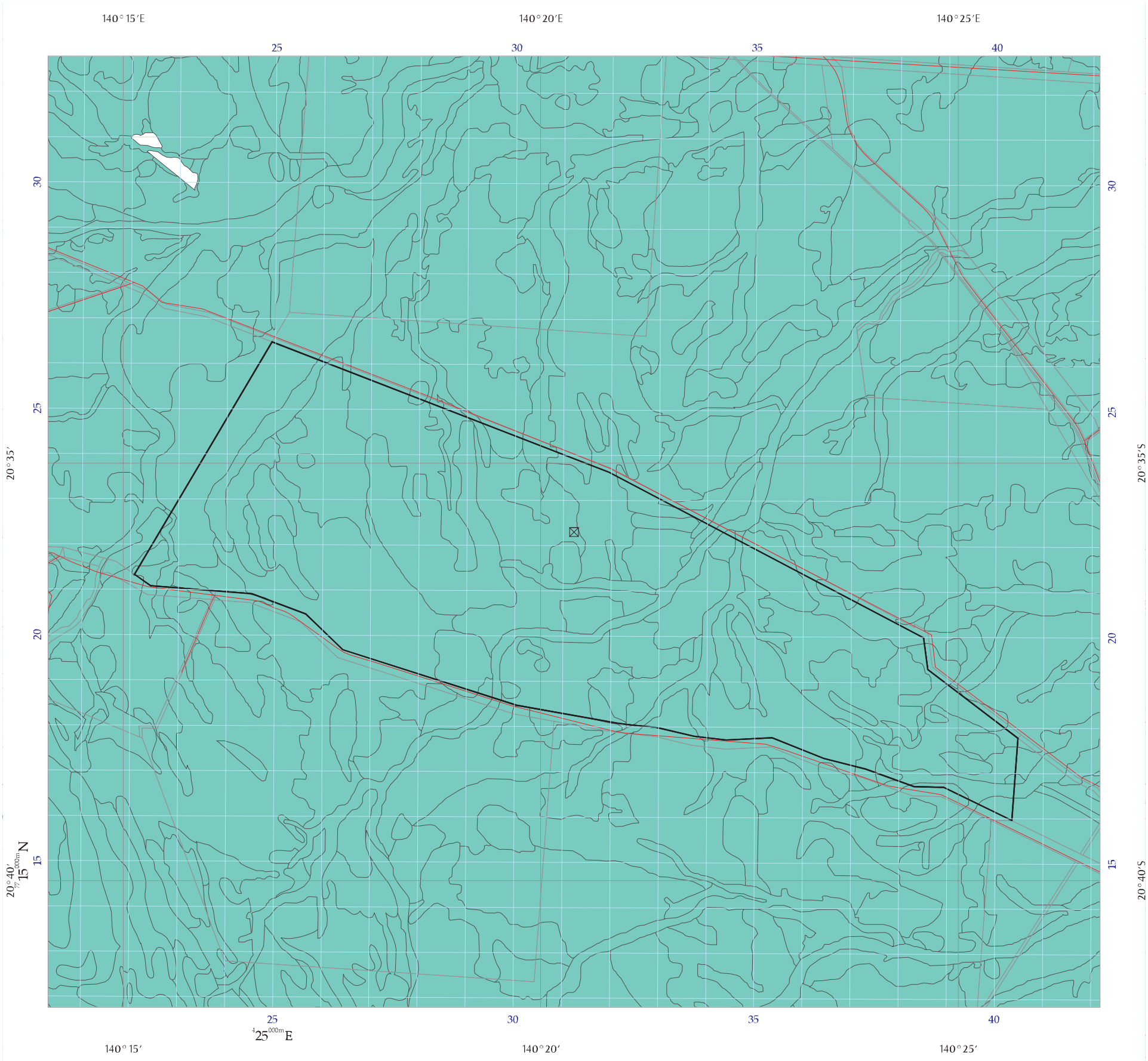
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Vegetation Management Act Essential Habitat Map Version 3.0

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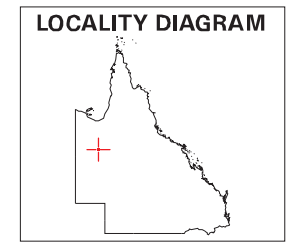
- Remnant vegetation that is a least concern regional ecosystem
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- PMAV Category X area
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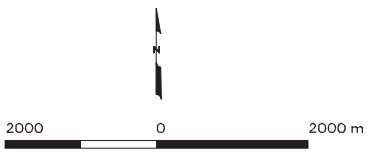
Requested By: JBYRD@AARC.NET.AU
Date: 06 May 10 Time: 12.59.19

Centered on point position:
Latitude: -20.597 Longitude: 140.34 (decimal degrees)

Queensland Government

LOCALITY DIAGRAM





Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

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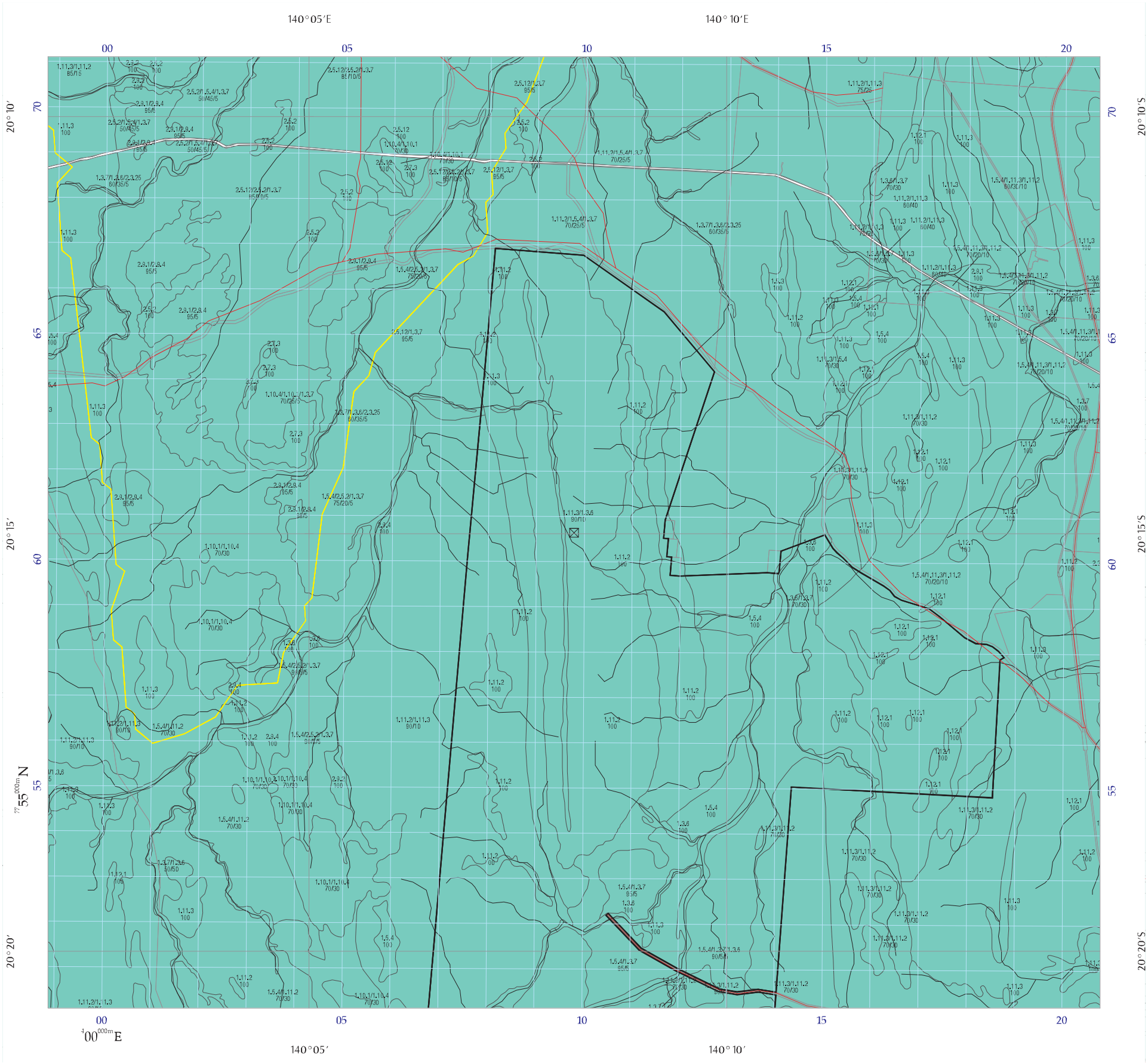
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Digital regional ecosystem data is available in shapefile format, for Lot on Plans from www.derm.qld.gov.au/REDATA or from DERM for larger areas.

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Vegetation Management Act Regional Ecosystem and Remnant Map-Version 6

Remnant vegetation containing endangered regional ecosystems
- Dominant
- Sub-dominant

Remnant vegetation containing of concern regional ecosystems
- Dominant
- Sub-dominant

- Remnant vegetation that is a least concern regional ecosystem
- Remnant vegetation under Section 20AH of the VMA
- Non-remnant
- Plantation Forest
- Dam or Reservoir
- Remnant Vegetation
- PMAV Category X area
- Great Barrier Reef Wetlands
- Vegetation Management Act Essential Habitat
  For further information on VMA Essential Habitat, please see the attached VMA Essential Habitat map.
- Subject Lot
- Watercourse (Stream order shown as black number against stream where available)
- Bioregion boundary
- Roads © MapInfo Australia Pty Ltd 2009
- National Park, Conservation Area State Forest and other reserves
- Cadastral line
  The maximum spatial error of parcels extracted for this map from the Digital Cadastral Data Base(DCDB) range from: 14m to 251m at a 95% confidence level. Property boundaries shown are provided as a locational aid only.
- Towns
- ☒ Coordinate entered

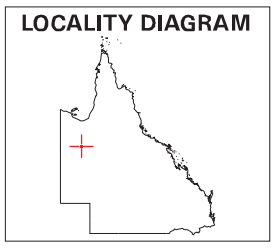
Based on 2006 Landsat TM imagery

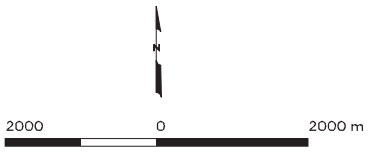
Requested By: JBYRD@AARC.NET.AU
Date: 06 May 10 Time: 12.58.13

Centered on point position:
Latitude: -20.2497 Longitude: 140.1362 (decimal degrees)
Bioregion: North West Highlands

Queensland Government

LOCALITY DIAGRAM





Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

A remnant map covers areas not covered by a regional ecosystem map.

Defined map areas are labelled with the regional ecosystem (RE) code along with the percentage breakdown if more than one RE occurs within the area. Detailed definitions of regional ecosystems are available from www.derm.qld.gov.au/REDD. Defined map areas smaller than 5ha may not be labelled.

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Some watercourse lines are derived from GeoScience Australia 1:250 000 mapping.

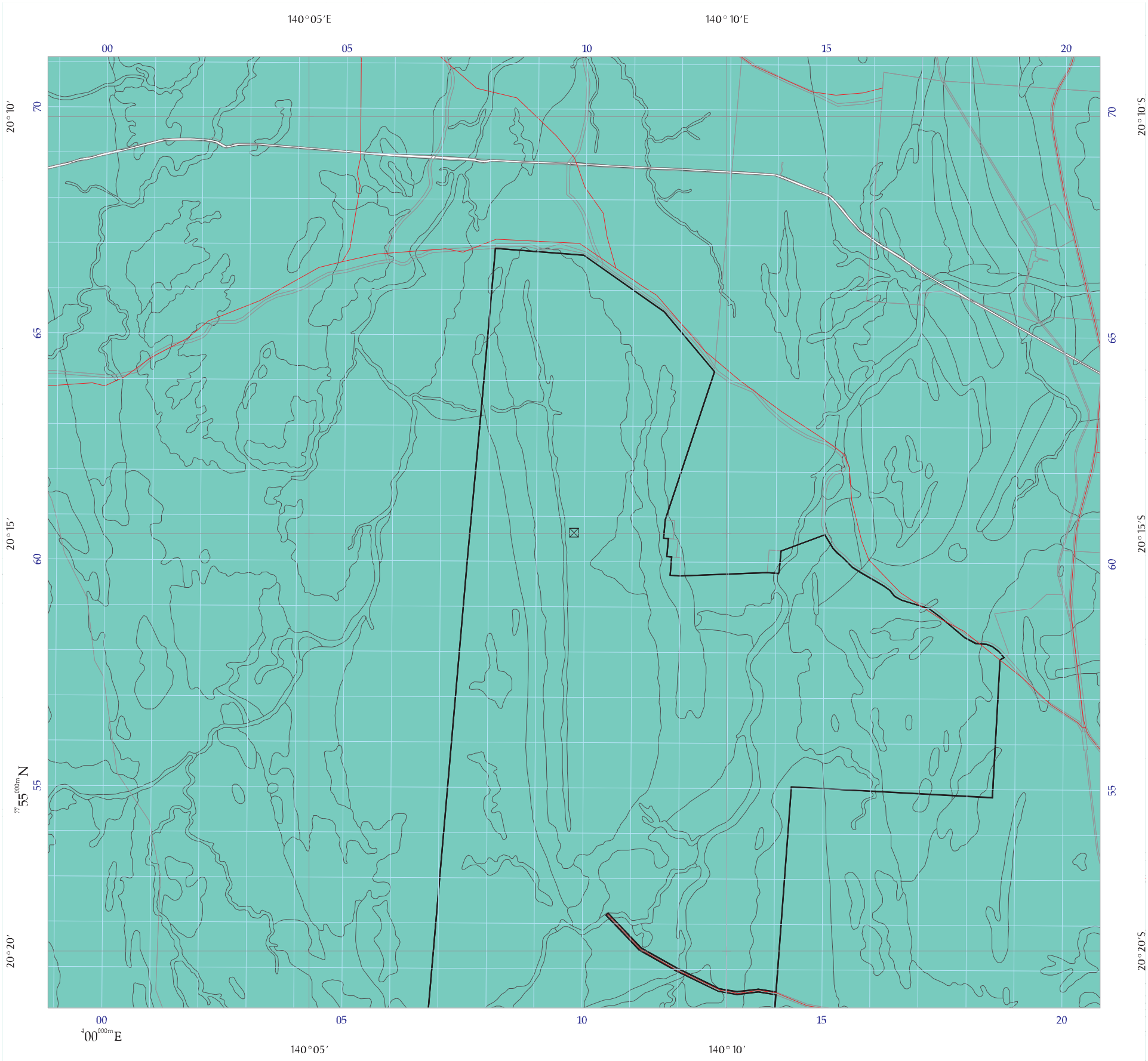
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Vegetation Management Act Essential Habitat Map Version 3.0

Remnant vegetation containing endangered regional ecosystems
- Dominant
- Sub-dominant

Remnant vegetation containing of concern regional ecosystems
- Dominant
- Sub-dominant

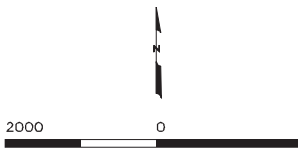
- Remnant vegetation that is a least concern regional ecosystem
- Remnant vegetation under Section 20AH of the VMA
- Non-remnant
- Plantation Forest
- Dam or Reservoir
- Remnant Vegetation
- PMAV Category X area
- Vegetation Management Act Essential Habitat
- Vegetation Management Act Essential Habitat Species Records
- Subject Lot
- Roads © MapInfo Australia Pty Ltd 2009
- National Park, Conservation Area State Forest and other reserves
- Cadastral line
  The maximum spatial error of parcels extracted for this map from the Digital Cadastral Data Base(DCDB) range from: 14m to 251m at a 95% confidence level. Property boundaries shown are provided as a locational aid only.
- Towns
- ⊠ Coordinate entered

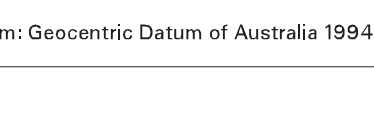
Requested By: JBYRD@AARC.NET.AU
Date: 06 May 10 Time: 12.58.16

Centered on point position:
Latitude: -20.2497 Longitude: 140.1362 (decimal degrees)

Queensland Government

LOCALITY DIAGRAM





Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

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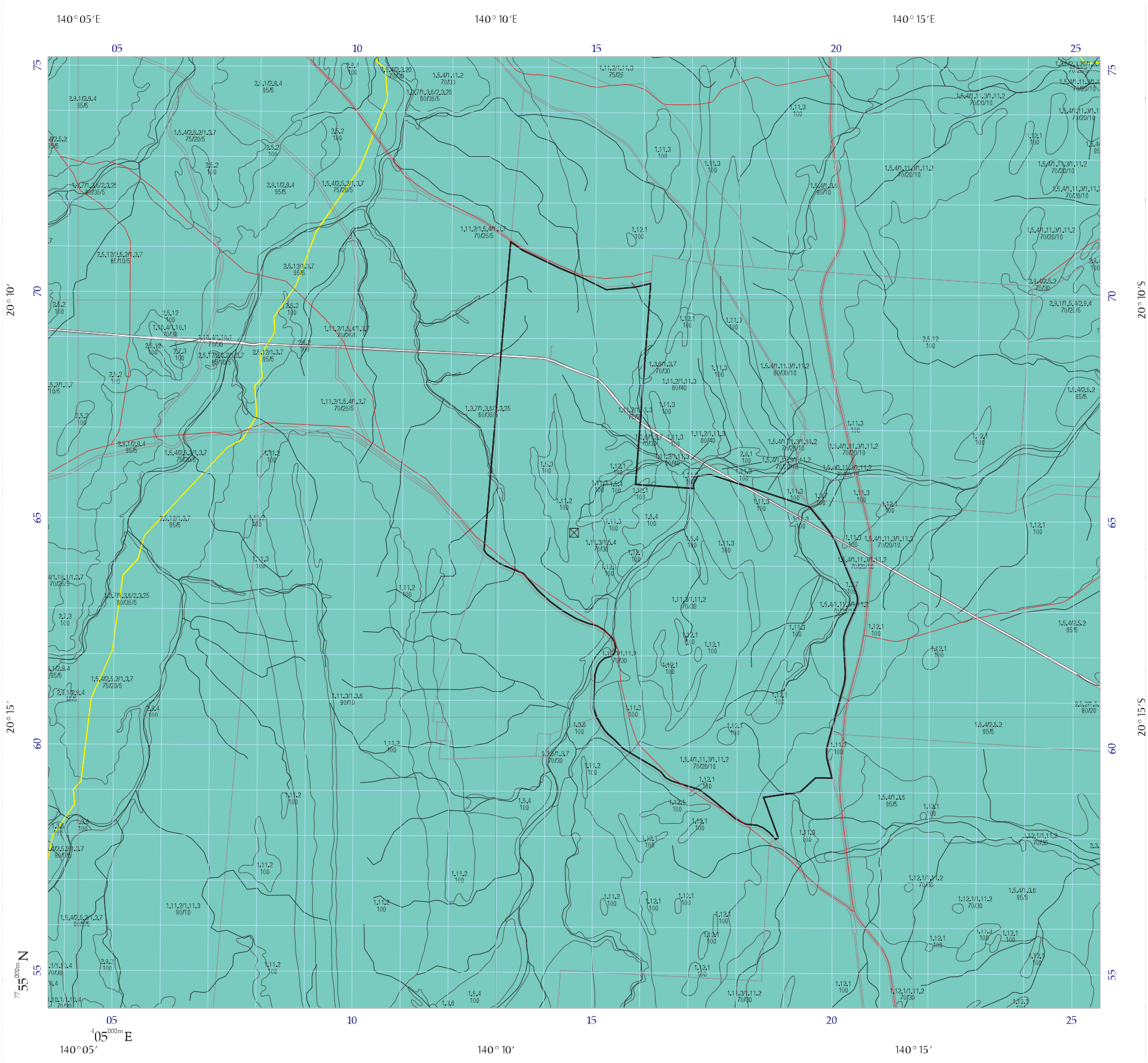
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Vegetation Management Act Regional Ecosystem and Remnant Map-Version 6

Remnant vegetation containing endangered regional ecosystems
- Dominant
- Sub-dominant

Remnant vegetation containing of concern regional ecosystems
- Dominant
- Sub-dominant

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- Non-remnant
- Plantation Forest
- Dam or Reservoir
- Remnant Vegetation
- PMAV Category X area
- Great Barrier Reef Wetlands
- Vegetation Management Act Essential Habitat
  For further information on VMA Essential Habitat, please see the attached VMA Essential Habitat map.
- Subject Lot
- Watercourse (Stream order shown as black number against stream where available)
- Bioregion boundary
- Roads © MapInfo Australia Pty Ltd 2009
- National Park, Conservation Area State Forest and other reserves
- Cadastral line
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- Towns
- ☒ Coordinate entered

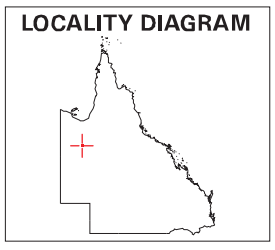
Based on 2006 Landsat TM imagery

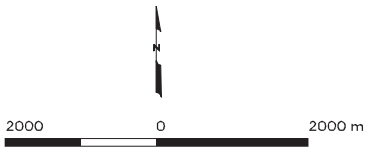
Requested By: JBYRD@AARC.NET.AU
Date: 06 May 10 Time: 12.58.32

Centered on point position:
Latitude: -20.2131 Longitude: 140.1823 (decimal degrees)
Bioregion: North West Highlands

Queensland Government

LOCALITY DIAGRAM





Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

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Vegetation Management Act Essential Habitat Map Version 3.0

Remnant vegetation containing endangered regional ecosystems
- Dominant
- Sub-dominant

Remnant vegetation containing of concern regional ecosystems
- Dominant
- Sub-dominant

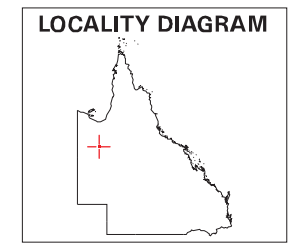
- Remnant vegetation that is a least concern regional ecosystem
- Remnant vegetation under Section 20AH of the VMA
- Non-remnant
- Plantation Forest
- Dam or Reservoir
- Remnant Vegetation
- PMAV Category X area
- Vegetation Management Act Essential Habitat
- Vegetation Management Act Essential Habitat Species Records
- Subject Lot
- Roads © MapInfo Australia Pty Ltd 2009
- National Park, Conservation Area State Forest and other reserves
- Cadastral line
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- Towns
- Coordinate entered

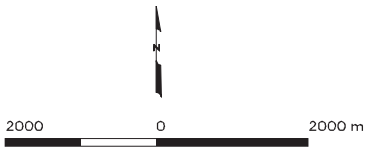
Requested By: JBYRD@AARC.NET.AU
Date: 06 May 10 Time: 12.58.35

Centered on point position:
Latitude: -20.2131 Longitude: 140.1823 (decimal degrees)

Queensland Government

LOCALITY DIAGRAM





Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

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Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Status: All
Records: All
Date: All
Latitude: 20.2509
Longitude: 140.1369
Distance: 25
Email: jbyrd@aarc.net.au
Date submitted: Monday 28 Feb 2011 18:20:13
Date extracted: Monday 28 Feb 2011 18:31:01

The number of records retrieved = 364

Disclaimer

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

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

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

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufonidae	*Rhinella marina*	cane toad	Y			2
animals	amphibians	Hylidae	*Litoria rothii*	northern laughing treefrog		C		2
animals	amphibians	Hylidae	*Litoria inermis*	bumpy rocketfrog		C		3
animals	amphibians	Hylidae	*Litoria pallida*	pallid rocketfrog		C		3
animals	amphibians	Hylidae	*Cyclorana australis*	northern snapping frog		C		7
animals	amphibians	Hylidae	*Litoria caerulea*	common green treefrog		C		6
animals	amphibians	Hylidae	*Litoria rubella*	ruddy treefrog		C		6
animals	amphibians	Limnodynastidae	*Platyplectrum ornatum*	ornate burrowing frog		C		3
animals	birds	Acanthizidae	*Gerygone fusca*	western gerygone		C		2
animals	birds	Acanthizidae	*Smicrornis brevirostris*	weebill		C		39
animals	birds	Acanthizidae	*Acanthiza chrysorrhoa*	yellow-rumped thornbill		C		3
animals	birds	Accipitridae	*Aquila audax*	wedge-tailed eagle		C		6
animals	birds	Accipitridae	*Accipiter fasciatus*	brown goshawk		C		9
animals	birds	Accipitridae	*Haliaeetus leucogaster*	white-bellied sea-eagle		C		1
animals	birds	Accipitridae	*Hamirostra melanosternon*	black-breasted buzzard		C		5
animals	birds	Accipitridae	*Accipiter cirrocephalus*	collared sparrowhawk		C		4
animals	birds	Accipitridae	*Haliastur sphenurus*	whistling kite		C		20
animals	birds	Accipitridae	*Circus assimilis*	spotted harrier		C		2
animals	birds	Accipitridae	*Milvus migrans*	black kite		C		26
animals	birds	Aegothelidae	*Aegotheles cristatus*	Australian owlet-nightjar		C		7
animals	birds	Alcedinidae	*Ceyx azureus*	azure kingfisher		C		2
animals	birds	Anatidae	*Anas gracilis*	grey teal		C		1
animals	birds	Anatidae	*Anas superciliosa*	Pacific black duck		C		1
animals	birds	Anatidae	*Dendrocygna eytoni*	plumed whistling-duck		C		4
animals	birds	Anatidae	*Nettapus coromandelianus*	cotton pygmy-goose		NT		1
animals	birds	Anatidae	*Aythya australis*	hardhead		C		1
animals	birds	Anhingidae	*Anhinga novaehollandiae*	Australasian darter		C		7
animals	birds	Ardeidae	*Ardea modesta*	eastern great egret		C		5
animals	birds	Ardeidae	*Ardea pacifica*	white-necked heron		C		12
animals	birds	Ardeidae	*Egretta garzetta*	little egret		C		2
animals	birds	Ardeidae	*Egretta novaehollandiae*	white-faced heron		C		12
animals	birds	Ardeidae	*Nycticorax caledonicus*	Nankeen night-heron		C		5
animals	birds	Ardeidae	*Ixobrychus flavicollis*	black bittern		C		5
animals	birds	Ardeidae	*Ardea intermedia*	intermediate egret		C		1
animals	birds	Artamidae	*Artamus minor*	little woodswallow		C		11
animals	birds	Artamidae	*Cracticus nigrogularis*	pied butcherbird		C		16
animals	birds	Artamidae	*Artamus superciliosus*	white-browed woodswallow		C		2
animals	birds	Artamidae	*Artamus leucorynchus*	white-breasted woodswallow		C		3
animals	birds	Artamidae	*Cracticus torquatus*	grey butcherbird		C		1
animals	birds	Artamidae	*Artamus personatus*	masked woodswallow		C		3
animals	birds	Artamidae	*Cracticus tibicen*	Australian magpie		C		10
animals	birds	Artamidae	*Artamus cinereus*	black-faced woodswallow		C		22
animals	birds	Burhinidae	*Burhinus grallarius*	bush stone-curlew		C		6
animals	birds	Cacatuidae	*Cacatua galerita*	sulphur-crested cockatoo		C		18
animals	birds	Cacatuidae	*Nymphicus hollandicus*	cockatiel		C		22
animals	birds	Cacatuidae	*Eolophus roseicapillus*	galah		C		20

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Cacatuidae	*Cacatua sanguinea*	little corella		C		6
animals	birds	Campephagidae	*Lalage sueurii*	white-winged triller		C		8
animals	birds	Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike		C		19
animals	birds	Campephagidae	*Coracina papuensis*	white-bellied cuckoo-shrike		C		2
animals	birds	Casuariidae	*Dromaius novaehollandiae*	emu		C		2
animals	birds	Charadriidae	*Vanellus miles*	masked lapwing		C		3
animals	birds	Charadriidae	*Vanellus miles miles*	masked lapwing (northern subspecies)		C		7
animals	birds	Charadriidae	*Elseyornis melanops*	black-fronted dotterel		C		13
animals	birds	Ciconiidae	*Ephippiorhynchus asiaticus*	black-necked stork		NT		5
animals	birds	Climacteridae	*Climacteris melanura*	black-tailed treecreeper		C		11
animals	birds	Columbidae	*Geopelia cuneata*	diamond dove		C		18
animals	birds	Columbidae	*Geopelia striata*	peaceful dove		C		32
animals	birds	Columbidae	*Phaps chalcoptera*	common bronzewing		C		11
animals	birds	Columbidae	*Geophaps plumifera*	spinifex pigeon		C		13
animals	birds	Columbidae	*Geopelia humeralis*	bar-shouldered dove		C		7
animals	birds	Columbidae	*Ocyphaps lophotes*	crested pigeon		C		13
animals	birds	Coraciidae	*Eurystomus orientalis*	dollarbird		C		5
animals	birds	Corcoracidae	*Struthidea cinerea*	apostlebird		C		17
animals	birds	Corvidae	*Corvus sp.*					9
animals	birds	Corvidae	*Corvus orru*	Torresian crow		C		9
animals	birds	Corvidae	*Corvus coronoides*	Australian raven		C		18
animals	birds	Cuculidae	*Chalcites basalis*	Horsfield's bronze-cuckoo		C		2
animals	birds	Cuculidae	*Chalcites osculans*	black-eared cuckoo		C		1
animals	birds	Cuculidae	*Eudynamys orientalis*	eastern koel		C		4
animals	birds	Cuculidae	*Scythrops novaehollandiae*	channel-billed cuckoo		C		3
animals	birds	Cuculidae	*Cacomantis variolosus*	brush cuckoo		C		3
animals	birds	Cuculidae	*Cacomantis pallidus*	pallid cuckoo		C		1
animals	birds	Estrildidae	*Emblema pictum*	painted finch		C		2
animals	birds	Estrildidae	*Heteromunia pectoralis*	pictorella mannikin		NT		2
animals	birds	Estrildidae	*Taeniopygia bichenovii*	double-barred finch		C		9
animals	birds	Estrildidae	*Taeniopygia guttata*	zebra finch		C		28
animals	birds	Estrildidae	*Poephila acuticauda*	long-tailed finch		C		9
animals	birds	Eurostopodidae	*Eurostopodus argus*	spotted nightjar		C		8/1
animals	birds	Falconidae	*Falco berigora*	brown falcon		C		7
animals	birds	Falconidae	*Falco longipennis*	Australian hobby		C		7
animals	birds	Falconidae	*Falco cenchroides*	nankeen kestrel		C		5
animals	birds	Gruidae	*Grus rubicunda*	brolga		C		9
animals	birds	Halcyonidae	*Dacelo leachii*	blue-winged kookaburra		C		23
animals	birds	Halcyonidae	*Todiramphus pyrrhopygius*	red-backed kingfisher		C		8
animals	birds	Halcyonidae	*Todiramphus sanctus*	sacred kingfisher		C		8
animals	birds	Hirundinidae	*Petrochelidon ariel*	fairy martin		C		9
animals	birds	Maluridae	*Amytornis ballarae*	Kalkadoon grasswren		C		4
animals	birds	Maluridae	*Malurus melanocephalus*	red-backed fairy-wren		C		5
animals	birds	Maluridae	*Malurus lamberti*	variegated fairy-wren		C		13
animals	birds	Megaluridae	*Eremiornis carteri*	spinifexbird		C		2
animals	birds	Megaluridae	*Cincloramphus mathewsi*	rufous songlark		C		5

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Meliphagidae	*Conopophila rufogularis*	rufous-throated honeyeater		C		16
animals	birds	Meliphagidae	*Philemon citreogularis*	little friarbird		C		23
animals	birds	Meliphagidae	*Lichenostomus unicolor*	white-gaped honeyeater		C		2
animals	birds	Meliphagidae	*Lichenostomus plumulus*	grey-fronted honeyeater		C		15
animals	birds	Meliphagidae	*Certhionyx variegatus*	pied honeyeater		C		1
animals	birds	Meliphagidae	*Philemon argenticeps*	silver-crowned friarbird		C		2
animals	birds	Meliphagidae	*Melithreptus gularis*	black-chinned honeyeater		NT		3
animals	birds	Meliphagidae	*Lichmera indistincta*	brown honeyeater		C		26
animals	birds	Meliphagidae	*Cissomela pectoralis*	banded honeyeater		C		2
animals	birds	Meliphagidae	*Epthianura tricolor*	crimson chat		C		4
animals	birds	Meliphagidae	*Phylidonyris niger*	white-cheeked honeyeater		C		1
animals	birds	Meliphagidae	*Manorina flavigula*	yellow-throated miner		C		20
animals	birds	Meliphagidae	*Sugomel niger*	black honeyeater		C		1
animals	birds	Meliphagidae	*Lichenostomus penicillatus*	white-plumed honeyeater		C		31/1
animals	birds	Meliphagidae	*Melithreptus brevirostris*	brown-headed honeyeater		C		1
animals	birds	Meliphagidae	*Lichenostomus keartlandi*	grey-headed honeyeater		C		10
animals	birds	Meliphagidae	*Lichenostomus flavescens*	yellow-tinted honeyeater		C		9
animals	birds	Meliphagidae	*Acanthagenys rufogularis*	spiny-cheeked honeyeater		C		3
animals	birds	Meliphagidae	*Lichenostomus virescens*	singing honeyeater		C		3
animals	birds	Meropidae	*Merops ornatus*	rainbow bee-eater		C		20
animals	birds	Monarchidae	*Myiagra inquieta*	restless flycatcher		C		10
animals	birds	Monarchidae	*Grallina cyanoleuca*	magpie-lark		C		29
animals	birds	Nectariniidae	*Dicaeum hirundinaceum*	mistletoebird		C		12
animals	birds	Neosittidae	*Daphoenositta chrysoptera*	varied sittella		C		1
animals	birds	Oriolidae	*Oriolus sagittatus*	olive-backed oriole		C		10
animals	birds	Otididae	*Ardeotis australis*	Australian bustard		C		4
animals	birds	Pachycephalidae	*Oreoica gutturalis*	crested bellbird		C		5
animals	birds	Pachycephalidae	*Pachycephala rufiventris*	rufous whistler		C		16
animals	birds	Pachycephalidae	*Colluricincla harmonica*	grey shrike-thrush		C		21/2
animals	birds	Pardalotidae	*Pardalotus striatus*	striated pardalote		C		18
animals	birds	Pardalotidae	*Pardalotus rubricatus*	red-browed pardalote		C		4
animals	birds	Passeridae	*Passer domesticus*	house sparrow	Y			1
animals	birds	Pelecanidae	*Pelecanus conspicillatus*	Australian pelican		C		1
animals	birds	Petroicidae	*Microeca fascinans*	jacky winter		C		2
animals	birds	Petroicidae	*Melanodryas cucullata*	hooded robin		C		3
animals	birds	Phalacrocoracidae	*Phalacrocorax carbo*	great cormorant		C		1
animals	birds	Phalacrocoracidae	*Microcarbo melanoleucos*	little pied cormorant		C		3
animals	birds	Phalacrocoracidae	*Phalacrocorax varius*	pied cormorant		C		2
animals	birds	Phalacrocoracidae	*Phalacrocorax sulcirostris*	little black cormorant		C		2
animals	birds	Phasianidae	*Coturnix ypsilophora*	brown quail		C		3
animals	birds	Podargidae	*Podargus strigoides*	tawny frogmouth		C		4
animals	birds	Podicipedidae	*Poliocephalus poliocephalus*	hoary-headed grebe		C		1
animals	birds	Pomatostomidae	*Pomatostomus temporalis*	grey-crowned babbler		C		26/1
animals	birds	Psittacidae	*Barnardius zonarius*	Australian ringneck		C		10
animals	birds	Psittacidae	*Aprosmictus erythropterus*	red-winged parrot		C		18
animals	birds	Psittacidae	*Trichoglossus haematodus moluccanus*	rainbow lorikeet		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Psittacidae	*Barnardius zonarius macgillivrayi*	Cloncurry parrot		C		8/1
animals	birds	Psittacidae	*Psitteuteles versicolor*	varied lorikeet		C		24
animals	birds	Psittacidae	*Melopsittacus undulatus*	budgerigar		C		24
animals	birds	Ptilonorhynchidae	*Ptilonorhynchus nuchalis*	great bowerbird		C		7
animals	birds	Ptilonorhynchidae	*Ptilonorhynchus maculatus*	spotted bowerbird		C		3
animals	birds	Rallidae	*Tribonyx ventralis*	black-tailed native-hen		C		1
animals	birds	Recurvirostridae	*Himantopus himantopus*	black-winged stilt		C		1
animals	birds	Rhipiduridae	*Rhipidura albiscapa*	grey fantail		C		2
animals	birds	Rhipiduridae	*Rhipidura leucophrys*	willie wagtail		C		31
animals	birds	Strigidae	*Ninox boobook*	southern boobook		C		7
animals	birds	Strigidae	*Ninox connivens*	barking owl		C		1
animals	birds	Threskiornithidae	*Platalea regia*	royal spoonbill		C		2
animals	birds	Threskiornithidae	*Threskiornis spinicollis*	straw-necked ibis		C		3
animals	birds	Threskiornithidae	*Threskiornis molucca*	Australian white ibis		C		1
animals	birds	Turnicidae	*Turnix velox*	little button-quail		C		1
animals	birds	Tytonidae	*Tyto javanica*	eastern barn owl		C		2
animals	bony fish	Ambassidae	*Ambassis species*	northwest glassfish				1
animals	bony fish	Clupeidae	*Nematalosa erebi*	bony bream				2
animals	bony fish	Melanotaeniidae	*Melanotaenia splendida splendida*	eastern rainbowfish				1
animals	bony fish	Terapontidae	*Amniataba percoides*	barred grunter				1
animals	bony fish	Terapontidae	*Leiopotherapon unicolor*	spangled perch				3
animals	insects	Nymphalidae	*Euploea core corinna*	common crow				2
animals	insects	Nymphalidae	*Danaus chrysippus petilia*	lesser wanderer				2
animals	insects	Nymphalidae	*Hypolimnas bolina nerina*	varied eggfly				5
animals	insects	Nymphalidae	*Junonia villida calybe*	meadow argus				1
animals	insects	Papilionidae	*Papilio demoleus sthenelus*	chequered swallowtail				3
animals	insects	Pieridae	*Eurema smilax*	small grass-yellow				1
animals	insects	Pieridae	*Catopsilia pomona pomona*	lemon migrant				1
animals	insects	Pieridae	*Catopsilia pyranthe crokera*	white migrant				1
animals	insects	Pieridae	*Belenois java teutonia*	caper white				1
animals	mammals	Emballonuridae	*Taphozous sp.*					1
animals	mammals	Macropodidae	*Macropus rufus*	red kangaroo		C		4
animals	mammals	Macropodidae	*Onychogalea unguifera*	northern nailtail wallaby		C		3
animals	mammals	Macropodidae	*Macropus agilis*	agile wallaby		C		2
animals	mammals	Macropodidae	*Macropus robustus*	common wallaroo		C		3
animals	mammals	Macropodidae	*Petrogale purpureicollis*	purple-necked rock-wallaby		V		4
animals	mammals	Molossidae	*Chaerephon jobensis*	northern freetail bat		C		1
animals	mammals	Molossidae	*Mormopterus beccarii*	Beccari's freetail bat		C		1
animals	mammals	Muridae	*Pseudomys desertor*	desert mouse		C		1
animals	mammals	Muridae	*Hydromys chrysogaster*	water rat		C		1
animals	mammals	Muridae	*Pseudomys johnsoni*			C		1
animals	mammals	Pteropodidae	*Pteropus scapulatus*	little red flying-fox		C		1
animals	mammals	Tachyglossidae	*Tachyglossus aculeatus*	short-beaked echidna		C		1
animals	mammals	Vespertilionidae	*Vespadelus sp.*					1/1
animals	mammals	Vespertilionidae	*Chalinolobus gouldii*	Gould's wattled bat		C		3
animals	mammals	Vespertilionidae	*Scotorepens balstoni*	inland broad-nosed bat		C		4/3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Vespertilionidae	*Vespadelus finlaysoni*	Finlayson's cave bat		C		1
animals	mammals	Vespertilionidae	*Chalinolobus nigrogriseus*	hoary wattled bat		C		1
animals	mammals	Vespertilionidae	*Scotorepens greyii*	little broad-nosed bat		C		14/2
animals	reptiles	Agamidae	*Pogona vitticeps*			C		4/1
animals	reptiles	Agamidae	*Amphibolurus temporalis*			C		2
animals	reptiles	Agamidae	*Ctenophorus caudicinctus*	ring-tailed dragon		C		1
animals	reptiles	Agamidae	*Diporiphora bilineata*	two-lined dragon		C		1
animals	reptiles	Agamidae	*Diporiphora magna*			C		3
animals	reptiles	Agamidae	*Amphibolurus gilberti*	Gilbert's dragon		C		7
animals	reptiles	Agamidae	*Chlamydosaurus kingii*	frilled lizard		C		1
animals	reptiles	Boidae	*Aspidites melanocephalus*	black-headed python		C		2
animals	reptiles	Crocodylidae	*Crocodylus johnstoni*	Australian freshwater crocodile		C		1
animals	reptiles	Elapidae	*Furina ornata*	orange-naped snake		C		1
animals	reptiles	Elapidae	*Vermicella annulata*	bandy-bandy		C		1
animals	reptiles	Elapidae	*Pseudonaja textilis*	eastern brown snake		C		1
animals	reptiles	Gekkonidae	*Gehyra sp.*					1
animals	reptiles	Gekkonidae	*Gehyra nana*			C		1
animals	reptiles	Gekkonidae	*Gehyra dubia*			C		2
animals	reptiles	Gekkonidae	*Gehyra variegata*	tree dtella		C		2
animals	reptiles	Gekkonidae	*Lucasium immaculatum*			C		2
animals	reptiles	Gekkonidae	*Rhynchoedura ornata*	beaked gecko		C		1/1
animals	reptiles	Gekkonidae	*Heteronotia binoei*	Bynoe's gecko		C		4/1
animals	reptiles	Gekkonidae	*Gehyra robusta*			C		2
animals	reptiles	Gekkonidae	*Lucasium stenodactylum*	crowned gecko		C		4
animals	reptiles	Gekkonidae	*Diplodactylus conspicillatus*	fat-tailed diplodactylus		C		3
animals	reptiles	Pygopodidae	*Delma nasuta*	sharp-snouted legless lizard		C		1
animals	reptiles	Pygopodidae	*Lialis burtonis*	Burton's legless lizard		C		2
animals	reptiles	Scincidae	*Tiliqua multifasciata*	Centralian blue-tongued lizard		C		2
animals	reptiles	Scincidae	*Cryptoblepharus zoticus*	agile snake-eyed skink		C		1
animals	reptiles	Scincidae	*Cryptoblepharus pannosus*	ragged snake-eyed skink		C		1
animals	reptiles	Scincidae	*Menetia maini*			C		1
animals	reptiles	Scincidae	*Ctenotus hebetior*			C		1
animals	reptiles	Scincidae	*Ctenotus striaticeps*			C		2
animals	reptiles	Scincidae	*Ctenotus pantherinus*			C		6
animals	reptiles	Scincidae	*Ctenotus pulchellus*			C		2/2
animals	reptiles	Scincidae	*Ctenotus decaneurus*			C		1
animals	reptiles	Scincidae	*Ctenotus lateralis*			C		8
animals	reptiles	Scincidae	*Egernia hosmeri*	Hosmer's skink		C		2
animals	reptiles	Scincidae	*Carlia amax*			C		2
animals	reptiles	Scincidae	*Cryptoblepharus plagiocephalus sensu lato*			C		1
animals	reptiles	Typhlopidae	*Ramphotyphlops diversus*			C		2
animals	reptiles	Varanidae	*Varanus mertensi*	Mertens' water monitor		C		5
animals	reptiles	Varanidae	*Varanus panoptes*	yellow-spotted monitor		C		2
animals	reptiles	Varanidae	*Varanus acanthurus*	ridge-tailed monitor		C		3/1
fungi	sac fungi	Lecideaceae	*Lecidea*			C		1/1
fungi	sac fungi	Teloschistaceae	*Caloplaca*			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Amaranthaceae	*Gomphrena lanata*			C		2/2
plants	higher dicots	Amaranthaceae	*Alternanthera denticulata*	lesser joyweed		C		1/1
plants	higher dicots	Amaranthaceae	*Gomphrena leptophylla*			C		1/1
plants	higher dicots	Amaranthaceae	*Achyranthes aspera*			C		1/1
plants	higher dicots	Apocynaceae	*Calotropis procera*		Y			3/3
plants	higher dicots	Apocynaceae	*Calotropis gigantea*		Y			1/1
plants	higher dicots	Apocynaceae	*Carissa lanceolata*			C		1/1
plants	higher dicots	Asteraceae	*Pluchea rubelliflora*			C		1/1
plants	higher dicots	Asteraceae	*Pterocaulon sphacelatum*	applebush		C		1/1
plants	higher dicots	Asteraceae	*Pterocaulon serrulatum var. serrulatum*			C		1/1
plants	higher dicots	Boraginaceae	*Heliotropium tanythrix*			C		1/1
plants	higher dicots	Boraginaceae	*Heliotropium cunninghamii*			C		1/1
plants	higher dicots	Boraginaceae	*Trichodesma zeylanicum var. zeylanicum*			C		1/1
plants	higher dicots	Boraginaceae	*Heliotropium tenuifolium*			C		1/1
plants	higher dicots	Byttneriaceae	*Waltheria indica*			C		1/1
plants	higher dicots	Caesalpiniaceae	*Senna notabilis*			C		1/1
plants	higher dicots	Caesalpiniaceae	*Senna artemisioides subsp. oligophylla*			C		1/1
plants	higher dicots	Caryophyllaceae	*Polycarpaea breviflora*			C		1/1
plants	higher dicots	Caryophyllaceae	*Polycarpaea spirostylis subsp. glabra*			C		1/1
plants	higher dicots	Caryophyllaceae	*Polycarpaea spirostylis subsp. spirostylis*			C		1/1
plants	higher dicots	Caryophyllaceae	*Polycarpaea corymbosa var. corymbosa*			C		1/1
plants	higher dicots	Chenopodiaceae	*Maireana georgei*			C		1/1
plants	higher dicots	Cleomaceae	*Cleome viscosa*	tick-weed		C		2/2
plants	higher dicots	Cleomaceae	*Cleome gynandra*		Y			1/1
plants	higher dicots	Combretaceae	*Terminalia aridicola subsp. aridicola*			C		2/2
plants	higher dicots	Convolvulaceae	*Bonamia pannosa*			C		2/2
plants	higher dicots	Convolvulaceae	*Ipomoea plebeia*	bellvine		C		1/1
plants	higher dicots	Cucurbitaceae	*Cucumis melo*			C		1/1
plants	higher dicots	Cucurbitaceae	*Momordica balsamina*	balsam apple	Y			1/1
plants	higher dicots	Cucurbitaceae	*Cucumis maderaspatanus*			C		1/1
plants	higher dicots	Euphorbiaceae	*Chamaesyce hirta*	asthma plant	Y			1/1
plants	higher dicots	Euphorbiaceae	*Chamaesyce australis*			C		1/1
plants	higher dicots	Fabaceae	*Vigna*			C		1/1
plants	higher dicots	Fabaceae	*Indigofera linnaei*	Birdsville indigo		C		1/1
plants	higher dicots	Fabaceae	*Tephrosia virens*			C		4/4
plants	higher dicots	Fabaceae	*Indigofera colutea*	sticky indigo		C		1/1
plants	higher dicots	Fabaceae	*Cajanus acutifolius*			C		1/1
plants	higher dicots	Fabaceae	*Sesbania benthamiana*			C		1/1
plants	higher dicots	Fabaceae	*Crotalaria novae-hollandiae subsp. novae-hollandiae*			C		1/1
plants	higher dicots	Fabaceae	*Tephrosia sp. (Magazine Hill P.Jones 365)*			C		1/1
plants	higher dicots	Fabaceae	*Tephrosia brachyodon var. longifolia*			C		1/1
plants	higher dicots	Fabaceae	*Crotalaria medicaginea var. neglecta*			C		1/1
plants	higher dicots	Fabaceae	*Vigna lanceolata var. lanceolata*			C		1/1
plants	higher dicots	Fabaceae	*Crotalaria novae-hollandiae*			C		1/1
plants	higher dicots	Fabaceae	*Macroptilium atropurpureum*	siratro	Y			1/1
plants	higher dicots	Fabaceae	*Indigastrum parviflorum*			C		1/1

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plants	higher dicots	Fabaceae	*Tephrosia lasiochlaena*			C		1/1
plants	higher dicots	Fabaceae	*Indigofera linifolia*			C		2/2
plants	higher dicots	Goodeniaceae	*Scaevola*			C		2/2
plants	higher dicots	Goodeniaceae	*Goodenia vilmoriniae*			C		1/1
plants	higher dicots	Lamiaceae	*Hyptis suaveolens*	hyptis	Y			1/1
plants	higher dicots	Lamiaceae	*Vitex benthamiana*			C		2/2
plants	higher dicots	Lamiaceae	*Ocimum tenuiflorum*			C		1/1
plants	higher dicots	Loranthaceae	*Diplatia grandibractea*			C		1/1
plants	higher dicots	Malvaceae	*Abutilon hannii*			C		1/1
plants	higher dicots	Malvaceae	*Sida rohlenae subsp. rohlenae*			C		1/1
plants	higher dicots	Malvaceae	*Hibiscus sturtii var. grandiflorus*			C		1/1
plants	higher dicots	Malvaceae	*Abutilon arenarium*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia chisholmii*			C		2/2
plants	higher dicots	Mimosaceae	*Acacia elachantha*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia farnesiana*	mimosa bush	Y			2/2
plants	higher dicots	Mimosaceae	*Acacia tenuissima*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia gonoclada*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia acradenia*			C		5/5
plants	higher dicots	Mimosaceae	*Acacia cambagei*	gidgee		C		1/1
plants	higher dicots	Mimosaceae	*Acacia retivenea subsp. retivenea*			C		3/3
plants	higher dicots	Myoporaceae	*Eremophila latrobei subsp. latrobei*			C		1/1
plants	higher dicots	Myrtaceae	*Melaleuca argentea*	silver tea-tree		C		3/3
plants	higher dicots	Myrtaceae	*Corymbia capricornia*			C		1/1
plants	higher dicots	Myrtaceae	*Melaleuca fluviatilis*			C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus leucophylla*			C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus leucophylla x E.pruinosa*			C		1/1
plants	higher dicots	Myrtaceae	*Melaleuca viridiflora var. viridiflora*			C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus pruinosa subsp. pruinosa*			C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus leucophloia subsp. euroa*			C		2/2
plants	higher dicots	Nyctaginaceae	*Boerhavia burbidgeana*			C		1/1
plants	higher dicots	Portulacaceae	*Portulaca*			C		1/1
plants	higher dicots	Portulacaceae	*Sedopsis armitii*			C		1/1
plants	higher dicots	Proteaceae	*Grevillea dryandri subsp. dryandri*			C		1/1
plants	higher dicots	Sapindaceae	*Dodonaea stenophylla*			C		1/1
plants	higher dicots	Solanaceae	*Datura inoxia*		Y			3/3
plants	higher dicots	Solanaceae	*Solanum esuriale*	quena		C		1/1
plants	higher dicots	Solanaceae	*Solanum succosum*			C		1/1
plants	higher dicots	Solanaceae	*Solanum echinatum*			C		1/1
plants	higher dicots	Solanaceae	*Solanum quadriloculatum*			C		2/2
plants	higher dicots	Sparrmanniaceae	*Corchorus pumilio*			C		1/1
plants	higher dicots	Sparrmanniaceae	*Corchorus tridens*			C		2/2
plants	higher dicots	Sparrmanniaceae	*Triumfetta rupestris*			C		1/1
plants	higher dicots	Sparrmanniaceae	*Corchorus sericeus subsp. densiflorus*			C		1/1
plants	higher dicots	Sparrmanniaceae	*Corchorus sidoides subsp. vermicularis*			C		1/1
plants	higher dicots	Violaceae	*Hybanthus enneaspermus*			C		1/1
plants	monocots	Arecaceae	*Livistona rigida*			C		1/1

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plants	monocots	Cyperaceae	*Cyperus iria*			C		3/3
plants	monocots	Cyperaceae	*Cyperus squarrosus*	bearded flatsedge		C		1/1
plants	monocots	Cyperaceae	*Cyperus carinatus*			C		1/1
plants	monocots	Cyperaceae	*Cyperus dactylotes*			C		1/1
plants	monocots	Cyperaceae	*Bulbostylis barbata*			C		3/3
plants	monocots	Cyperaceae	*Fimbristylis microcarya*			C		2/2
plants	monocots	Cyperaceae	*Fimbristylis sp. (Thargomindah D.E.Boyland 3094)*			C		1/1
plants	monocots	Cyperaceae	*Cyperus microcephalus subsp. microcephalus*			C		1/1
plants	monocots	Cyperaceae	*Cyperus cunninghamii subsp. cheradicus*			C		1/1
plants	monocots	Cyperaceae	*Fimbristylis corynocarya*			C		1/1
plants	monocots	Cyperaceae	*Lipocarpha microcephala*			C		1/1
plants	monocots	Cyperaceae	*Fimbristylis littoralis*			C		1/1
plants	monocots	Poaceae	*Tragus australianus*	small burr grass		C		1/1
plants	monocots	Poaceae	*Dichanthium fecundum*	curly bluegrass		C		1/1
plants	monocots	Poaceae	*Aristida hygrometrica*			C		1/1
plants	monocots	Poaceae	*Dichanthium annulatum*	sheda grass	Y			1/1
plants	monocots	Poaceae	*Heteropogon contortus*	black speargrass		C		1/1
plants	monocots	Poaceae	*Bothriochloa ewartiana*	desert bluegrass		C		1/1
plants	monocots	Poaceae	*Brachyachne convergens*	common native couch		C		2/2
plants	monocots	Poaceae	*Enneapogon cylindricus*	jointed nineawn		C		1/1
plants	monocots	Poaceae	*Enneapogon polyphyllus*	leafy nineawn		C		2/2
plants	monocots	Poaceae	*Sporobolus australasicus*			C		1/1
plants	monocots	Poaceae	*Pennisetum pennisetiforme*		Y			1/1
plants	monocots	Poaceae	*Aristida holathera var. holathera*			C		2/2
plants	monocots	Poaceae	*Eriachne pulchella subsp. dominii*			C		1/1
plants	monocots	Poaceae	*Bothriochloa bladhii subsp. bladhii*			C		1/1
plants	monocots	Poaceae	*Eriachne sp. (Dugald River B.K.Simon+ 3007)*			C		1/1
plants	monocots	Poaceae	*Oxychloris scariosa*	winged chloris		C		1/1
plants	monocots	Poaceae	*Echinochloa colona*	awnless barnyard grass	Y			1/1
plants	monocots	Poaceae	*Chrysopogon fallax*			C		1/1
plants	monocots	Poaceae	*Aristida latifolia*	feathertop wiregrass		C		1/1
plants	monocots	Poaceae	*Urochloa piligera*			C		2/2
plants	monocots	Poaceae	*Paspalidium rarum*			C		1/1
plants	monocots	Poaceae	*Mnesithea formosa*			C		1/1
plants	monocots	Poaceae	*Chloris pectinata*	comb chloris		C		1/1
plants	monocots	Poaceae	*Aristida pruinosa*			C		1/1
plants	monocots	Poaceae	*Aristida contorta*	bunched kerosene grass		C		1/1
plants	monocots	Poaceae	*Themeda triandra*	kangaroo grass		C		1/1
plants	monocots	Poaceae	*Themeda avenacea*			C		1/1
plants	monocots	Poaceae	*Sehima nervosum*			C		1/1
plants	monocots	Poaceae	*Eulalia aurea*	silky browntop		C		1/1
plants	monocots	Poaceae	*Eriachne mucronata forma (Alpha C.E.Hubbard 7882)*			C		1/1

CODES

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

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.* The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ( ).

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

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).
This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Appendix B: AARC Flora Species List

Species Name	Common Name	River Red Gum Riparian Woodland	Ghost Gum / Bloodwood Riparian Woodland	Gidgee Open Woodland	Cloncurry Box Open Woodland	Snappy Gum Open Woodland	Silver Box Open Woodland
Abutilon hannii	Andrews' Lantern Flower	x	x			x	
Acacia acradenia						x	
Acacia bidwillii	Corkwood Wattle	x	x		x	x	
Acacia cambagei	Gidgee			x			
Acacia chippendalei						x	x
Acacia chisholmii	Chisholm's Wattle, Turpentine				x	x	x
Acacia elachantha	Cowle's Wattle					x	
*Acacia farnesiana**	Mimosa	x	x	x	x		x
Acacia gonoclada						x	
Acacia hemignosta	Club-leaf Wattle	x		x			
Acacia holosericea	Soap Bush	x	x		x	x	x
Acacia lysiphloia	Turpentine	x	x		x	x	x
Acacia monticola	Turpentine	x	x			x	
Acacia retivenea	Net-Veined Wattle	x	x			x	
Acacia tenuissima	Narrow-Leaved Wattle				x	x	
Acacia torulosa		x	x				
Acacia victoriae					x		
Achyranthes aspera	Chaff Flower	x		x	x		
Aeschynomene indica	Budda Pea	x	x				
*Aerva javanica**	Kapok Bush		x	x	x	x	
Alternanthera denticulata	Lesser Joyweed	x	x				
*Alternanthera pungens**	Khaki Weed	x	x				
Alternanthera sp. (Mt Isa R.L.Specht+ 49)	Joyweed	x	x				
Anisomeles malabarica	Chodhava	x					
Aristida contorta	Bunched Kerosene Grass	x	x	x	x	x	x

Aristida inaequiglumis	Feathertop Three-Awn	x		x	x		
Aristida latifolia	Feathertop Grass	x				x	
Astrebla squarrosa	Bull Mitchell Grass		x		x		
Atalaya hemiglauca	Whitewood	x	x		x	x	x
*Boerhavia paludosa**	Tarvine					x	
Boerhavia schomburgkiana	Tar Vine	x		x	x	x	
Bonamia media	Conmmon Bonamia	x	x	x		x	
Bulbostylis barbata	Watergrass	x				x	
Cajanus acutifolius						x	
*Calotropis procera**	Calotrope, Cabbage Tree	x					
Capparis lasiantha	Wait-A-While	x	x	x		x	x
Carissa lanceolata	Conkerberry, Currant Bush	x	x	x	x		
Cassytha filiformis	Dodder Laurel, Spaghetti plant	x		x			
Chamaecrista symonii	Dwarf Cassia					x	
Chamaesyce coghlanii			x		x		
Chamaesyce drummondii	Caustic Weed	x		x			
Cheilanthes brownii						x	
Chloris virgata	Feathertop Rhodes Grass				x		
Chrysopogon fallax	Golden Beard Grass				x	x	
*Citrullus colocynthis**	Colocynth					x	
*Cleome viscosa**	Tick Weed	x				x	
Clerodendrum floribundum			x			x	x
Corchorus pascuorum	Native Jute	x	x				
Corchorus pumilio	Jute					x	
Corchorus tridens			x		x	x	x
Corymbia aparrerinja	North-west Ghost Gum		x		x		x
Corymbia aspera	Rough-leaved Ghost Gum					x	
Corymbia capricornia	Small-fruited Bloodwood		x		x	x	x
Corymbia terminalis	Western Bloodwood	x	x		x	x	
Crotalaria aridicola	Chillagoe Horse Poison	x			x	x	x
Crotalaria dissitiflora	Grey Rattlepod	x	x		x	x	

Crotalaria medicaginea	Treefoil rattlepod				x	x	
Crotalaria novae-hollandiae	New Holland Rattlepod	x		x	x	x	
Cucumis melo subsp. a*gretis*	Native Cucumber	x	x			x	
Cullen leucanthum	Native Cullen	x	x				
Cyanotis axillaris	Blue Ears	x					
Cymbopogon bombycinus	Silky Oil Grass	x	x			x	x
Cyperus conicus var. *conicus*		x	x			x	
Cyperus cunninghamii subsp. *cheradicus*		x	x			x	
Cyperus dactylotes		x	x				
Cyperus difformis	Dirty Dora	x	x		x	x	
Cyperus exaltatus	Giant Sedge	x					
Cyperus iria	Variable Sedge	x					
Cyperus javanicus	Java Sedge	x					
Cyperus microcephalus		x					
Cyperus pulchellus		x	x			x	
Cyperus vaginatus	Stiff Flat-sedge	x					
Dactyloctenium radulans	Button Grass			x			
*Datura inoxia**	Downy Thornapple			x			
Datura leichhardtii	Native Thornapple	x					
Dichantium fecundum	Curly Bluegrass	x					
Dichanthium sericeum	Queensland Bluegrass	x			x		x
Digitaria bicornis	Silky Arm Grass	x					
*Echinochloa colona**	Awnless Barnyard Grass	x					x
Echinochloa obtusa			x			x	
Enneapogon oblongus	Purple-Head Nineawn	x	x	x		x	
Enneapogon polyphyllus	Leafy Nineawn			x	x	x	
Eragrostis basedowii	Neat Lovegrass	x	x				
Eragrostis elongata	Clustered Lovegrass	x	x				
Eragrostis fallax		x	x		x		

Eragrostis lacunaria	Purple Lovegrass	x	x				
Eragrostis leptocarpa	Drooping Lovegrass				x	x	x
*Eragrostis minor**	Small Stinkgrass	x					
Eremophila latrobei	Crimson Turkey Bush		x	x	x		
Eremophila longifolia	Emu Bush	x			x		
Eriachne ciliata	Slender Wandarrie Grass	x	x		x	x	
Eriachne mucronata	Mountain Wandarrie Grass					x	
Eriachne obtusa	Northern Wandarrie Grass	x					
Eriochloa crebra	Cup Grass	x					
Eucalyptus camaldulensis	River Red Gum	x			x	x	x
Eucalyptus herbertiana						x	
Eucalyptus leucophloia	Snappy Gum	x	x		x	x	x
Eucalyptus leucophylla	Cloncurry Box	x				x	x
Eucalyptus pruinosa	Silver-leaved Box		x				
Eulalia aurea	Silky Browntop	x	x		x		
Euphorbia tannensis subsp. eremophila	Desert Spurge					x	
Evolvulus alsinoides	Tropical Speedwell	x	x	x	x	x	
Ficus aculeata	Sandpaper Fig	x	x				
Fimbristylis dichotoma	Common Fringerush	x	x		x	x	
Fimbristylis littoralis	Lesser Fringerush	x					
Fimbristylis microcarya	Fringerush	x	x		x	x	
Fimbristylis signata	Fringerush	x				x	
Fimbristylis tetragona	Single-head Fringerush					x	
Flueggea virosa subsp melanthesoides	White Currant	x	x				
Glycine tomentella	Wooly Glycine	x					
Gomphrena flaccida	Gomphrena	x		x	x	x	
Gossypium australe	Rose Cottonbush, Native Cotton				x	x	
Gossypium nelsoni			x		x	x	
Grevillea dryandri	Dryander's Grevillea					x	

Grevillea striata	Beefwood		x		x	x	x
Hakea aborescens	Tree Hakea	x				x	x
Hakea cordophylla	Bull Oak, Bootlace Oak	x	x		x		
Heliotropium cunninghamii	Heliotrope					x	
Heteropogon contortus	Black Speargrass	x					
Hibiscus meraukensis	Merauke Hibiscus	x					
Hibiscus pentaphyllus	Five-Leaflet Hibiscus		x				
Hybanthus aurantiacus	Orange Spadeflower		x				
Hybanthus enneaspermus	Blue Spadeflower	x	x		x	x	
Indigofera colutea	Sticky Indigo, Rusty Indigo	x	x		x		
Indigofera linifolia	Narrow-Leaved Indigo	x	x	x	x		
Indigofera linnaei		x		x	x	x	
Iphigenia indica	Indian Grass Lily	x					
Ipomoea diamantinensis	Desert Cow-vine	x	x				
Ipomoea lonchophylla	Cow Vine		x				
Ipomoea muelleri	Poison Morning Glory	x	x	x			
Iseilema vaginiflorum	Red Flinders Grass	x					
Iseilema sp.			x				
Jacquemontia browniana	Clustervine	x					
Leptochloa digitata	Cane Grass	x					
Lipocarpha microcephala	Button Rush	x	x				
Livistona rigida		x	x				
riparius	Northern Swamp Box	x	x				x
Ludwigia octovalvis	Willow Primrose	x					
Lysiphyllum cunninghamii	Bauhinia, Bean Tree	x					
Malvastrum americanum var. *americanum**	Spiked Malvastrum	x	x	x			x
Marsilea hirsuta	Hairy Nardoo		x				
Melaleuca argentea	Silvery Weeping River Teatree	x					
Melaleuca bracteata	River Teatree	x					
Melaleuca leucadendra	Weeping River Teatree	x					

Melinis repens	Red Natal Grass	x				x	
Mukia maderaspatensis	Desert Cucumber			x	x		x
Neptunia dimorphantha	Sensitive Plant				x	x	
Neptunia gracilis	Low Sensitive Plant	x	x	x	x		x
Ocimum tenuiflorum	Native Basil	x					
Operculina aequisepala	Paper Rose, Onion Vine		x				
Panicum decompositum	Native Panic	x		x			
Paratephrosia lantana	Velvet Bush	x	x	x		x	
Paspalidium rarum	Paspalidium	x	x	x	x	x	
*Pennisetum ciliare**	Buffel Grass	x	x	x	x	x	
*Pennisetum pennisetiforme**	Cloncurry Buffel	x	x	x	x	x	
Perotis rara	Comet Grass	x	x		x		
Phyllanthus maderaspatensis	Spurge	x	x	x		x	
Pluchea rubelliflora	Daisy	x					
Plumbago zeylanica	Plumbago		x				
Polycarpaea corymbosa	Copper Bush			x	x	x	
Polygala rhinanthoides		x					
Polygala wightiana		x	x				
Polymeria ambigua	Clumped Bindweed	x	x		x	x	
Polymeria longifolia	Polymeria				x		
Portulaca filifolia	Pigweed	x	x				
Pterocaulon serrulatum				x	x		
Pterocaulon serrulatum var. velutinum					x		
Pterocaulon sphacelatum	Fruit Salad Plant				x	x	
Ptilotus fusiformis	Pom-Pom Bottlebrush	x	x				
Rostellularia adscendens	Pinktongues	x				x	
Rhynchosia minima	Rhynchosia	x	x	x			
Rhynchospora pterochaeta	Rusty Heads				x	x	
Salsola kali	Soft Roly Poly			x	x	x	x
Santalum lanceolatum	Sandalwood	x		x			

Sarcostemma viminale subsp. *australe*	Pencil Caustic, Caustic Vine			x			
Sclerolaena bicornis	Goathead Burr		x	x			
Schizachyrium fragile	Firegrass				x		
Senna artemisioides subsp. o*ligophylla*	Limestone Cassia		x	x			
*Senna notabilis**	Cockroach Bush	x	x		x		
Sesbania campylocarpa	Sesbania Pea		x		x		
Sesbania javacina	Tall Sesbania Pea	x	x				
Setaria surgens	Annual Pigeon Grass	x	x				
*Sida cordifolia**	Flannel Weed	x	x		x		x
Sida fibulifera	Pin sida	x	x				x
*Sida spinosa**	Spiny Sida	x					
Sida subspicata	Spiked Sida	x		x	x	x	
Solanum echinatum	Wild Tomato				x	x	
Solanum ellipticum	Potato Bush		x	x	x		
Spermacoce auriculata	False Buttonwood	x	x			x	
Sporobolus actinocladus	Katoora, Ray Grass	x	x				
Sporobolus australasicus	Australian Dropseed				x		
Sporobolus caroli	Fairy Grass			x	x	x	
Stackhousia intermedia						x	
Stemodia lythrifolia		x					
Stemodia viscosa	Sticky Blue Rod	x			x		
Swainsona burkei	Desert Pea	x				x	
Tephrosia brachyodon var longifolia	Narrow-leaved Tephrosia	x				x	
Tephrosia flagellaris			x		x		
Tephrosia rosea var rosea	Flinders River Poison	x	x		x	x	x
Tephrosia varians		x				x	
Tephrosia virens	Green Tephrosia	x					
Terminalia aridicola subsp. *aridicola*	Arid Peach	x	x			x	

Terminalia canescens	Winged Nut Tree		x				
Terminalia oblongata subsp. *volcuris*	Rosewood, Yellow Wood		x				
Themeda triandra	Kangaroo Grass	x				x	
Tinospora smilacina	Snake Vine		x				
Trema tomentosa var aspera	Poison Peach	x	x	x	x	x	x
Trichodesma zeylanicum	Camelbush	x	x		x	x	
Trigonella suavissima	Coppers Clover	x	x		x		
Triodia pungens	Soft Spinifex, Gummy Spinifex	x	x	x	x	x	x
Triumfetta rupestris		x	x			x	
Vigna lanceolata	Maloga Bean	x			x	x	
Vigna radiata var sublobata	Mung Bean	x			x		
Vitex benthamiana	Vitex	x					
Vitex trifolia var. *trifolia*	Simple-leaf Chastetree	x					
Wahlenbergia gracilis	Australian Bluebell	x	x				
Waltheria indica	Walthera					x	
Xanthium strumarium	Noogoora Burr	x					
Xenostegia tridentata	Arrow-leaf Morning-glory					x	
Yakkira majuscula		x	x				
Zornia muriculata	Zornia	x	x		x	x	
Zornia prostrata	Prostrate Zornia	x			x		

Appendix C: AARC Fauna Species List

FAUNA SPECIES CATALOGUE				
REPTILES				
FAMILY				
Scientific Name	**Common Name**	**Status**	**Dry Season**	**Wet Season**
Agamidae				
Amphibolurus gilberti	Gilbert's Dragon	Least Concern		X
Diporiphora bilineata	Two-lined Dragon	Least Concern		X
Diporiphora magna	Yellow-sided Two-lined Dragon	Least Concern		X
Elapidae				
Furnia ornata	Orange-naped Snake	Least Concern		X
Gekkonidae				
Diplodactylus conspiculatus	Fat-tailed Gecko	Least Concern		X
Gehyra nana	Spotted Gecko	Least Concern		X
Gehyra variegata	Tree Dtella	Least Concern		X
Heteronotia binoei	Bynoes Gecko	Least Concern		X
Pythonidae				
Aspidites melanocephalus	Black-headed Python	Least Concern		X
Antaresia stimsoni	Stimpson's Python	Least Concern		X
Scincidae				
Cryptoblepharus plagiocephalus sensu lato		Least Concern		
Ctenotus herbetior	Stout Ctenotus	Least Concern		X
Ctenotus lateralis	Gravelly-soil Ctenotus	Least Concern		X
Ctenotus pantherinus	Leopard Ctenotus	Least Concern		X
Proablepharus tenuis	Northern Soil-crevice Skink	Least Concern		X
Tiliqua multifasciata	Centralian Blue-tongue	Least Concern		X
BIRDS				
FAMILY				
Scientific Name	**Common Name**	**Status**	**Dry Season**	**Wet Season**
Acanthizidae				
Smicrornis brevirostris race *flavescens*	Weebill	Least Concern	X	X
Accipitridae				
Aquila audax	Wedge-tail Eagle	Least Concern	X	X
Falco subniger	Black Falcon	Least Concern	X	
Haliastur sphenurus	Whistling Kite	Marine - EPBC ACT	X	X
Milvus migrans	Black Kite	Least Concern		X
Aegothelidae				
Aegotheles cristatus	Australian Owlet-nightjar	Least Concern		X
Alcedinidae				
Alcedo azurea	Azure Kingfisher	Least Concern		X
Ardeidae				
Egretta novaehollandiae	White-faced Heron	Least Concern		X
Artamidae				
Artamus cinereus	Black-faced Woodswallow	Least Concern	X	X
Cracticus nigrogularis	Pied Butcherbird	Least Concern		X
Gymnorhina tibicen	Australian Magpie	Least Concern	X	X
Burhinidae				
Burhinus grallarius	Bush-stone Curlew	Least Concern		X
Cacatuidae				

Cacatua galerita	Sulphur-crested Cockatoo	Least Concern		X
Cacatua roseicapilla	Galah	Least Concern		X
Nymphicus hollandicus	Cockatiel	Least Concern		X
Campephagidae				
Coracina novaehollindiae	Black-faced Cuckoo-shrike	Least Concern		X
Lalage sueurii	White-winged Triller	Least Concern		X
Casuariidae				
Dromaius novaehollandiae	Emu	Least Concern	X	
Charadriidae				
Elseyornis melanops	Black-fronted Dotterel	Least Concern		X
Vanellus miles miles	Masked Lapwing	Least Concern		X
Columbidae				
Geopelia cuneata	Diamond Dove	Least Concern	X	X
Geopelia striata	Peaceful Dove	Least Concern	X	X
Geophaps plumifera	Spinifex Pigeon	Least Concern	X	X
Ocyphaps lophotes	Crested Pigeon	Least Concern	X	X
Phaps chalcoptera	Common Bronzewing	Least Concern	X	X
Corvidae				
Corvus coronoides	Australian Raven	Least Concern	X	
Corvus orru	Torresian Crow	Least Concern		X
Cuculidae				
Centropus phasianinus	Pheasant Coucal	Least Concern	X	X
Chalcites basalis	Horsfield's Bronze-cuckoo	Least Concern		X
Chalcites oscularis	Black-eared Cuckoo	Least Concern		X
Dicruridae				
Grallina cyanoleuca	Magpie-lark	Least Concern	X	X
Rhipidura leucophrys	Willie Wagtail	Least Concern	X	X
Estrildidae				
Emblema pictum	Painted Finch	Least Concern		X
Taeniopygia guttata	Zebra Finch	Least Concern	X	X
Eurostopodidae				
Eurostopodus argus	Spotted Nightjar	Least Concern		X
Gruidae				
Grus rubicundus	Brolga	Least Concern		X
Halcyonidae				
Dacelo leachii	Blue-winged Kookaburra	Least Concern	X	X
Todiramphus sanctus	Sacred Kingfisher	Marine - EPBC ACT		X
Maluridae				
Malurus lamberti	Variegated Fairy-wren	Least Concern		X
Malurus melanocephalus	Red-backed Fairy-wren	Least Concern		X
Meliphagidae				
Entomyzon cyanotis	Blue-faced Honeyeater	Least Concern		X
Lichenostomus virescens	Singing Honeyeater	Least Concern		X
Lichmera indistincta	Brown Honeyeater	Least Concern		X
Marorina flavigula	Yellow-throated Miner	Least Concern		X
Philemon argenticeps	Silver-crowned Friarbird	Least Concern		X
Meropidae				
Merops ornatus	Rainbow Bee-eater	Marine, Migratory-EPBC		X
Otididae				
Ardeotis australis	Australian Bustard	Least Concern	X	X

Pachycephalidae				
Colluricincia harmonica	Grey Shrike-thrush	Least Concern		X
Pachycephala rufiventris	Rufous Whistler	Least Concern		X
Passeridae				
Emblema pictum	Painted Finch	Least Concern		X
Taeniopygia bichenovii	Double-barred Finch	Least Concern		X
Taeniopygia guttata	Zebra Finch	Least Concern		X
Pelecanidae				
Pelecanus conspicillatus	Australian Pelican	Marine - EPBC ACT		X
Petroicidae				
Melanodryas cucullata	Hooded Robin	Least Concern		X
Microeca fascinans	Jacky Winter	Least Concern	X	X
Phasianidae				
Coturnix pectoralis	Stubble Quail	Least Concern		X
Podargidae				
Podargus strigoides	Tawny Frogmouth	Least Concern		X
Pomatostomidae				
Pomatostomus temporalis	Grey-crowned Babbler	Least Concern		X
Psittacidae				
Aprosmictus erythropterus	Red-winged Parrot	Least Concern		X
Barnardius barnardi race *macgillivrayi*	Eastern Ringneck (Cloncurry Parrot)	Least Concern	X	X
Melopsittacus undulatus	Budgerigar	Least Concern		X
Platycercus adscitus	Pale-headed Rosella	Least Concern		X
Psitteuteles versicolor	Varied Lorikeet	Least Concern		X
Ptilonorhynchidae				
Ptilonorhynchus nuchalis	Great Bowerbird	Least Concern		X
Rhipiduridae				
Rhipidura leucophrys	Willy Wagtail	Least Concern	X	X
MAMMALS				
FAMILY				
Scientific Name	**Common Name**	**Status**	**Dry Season**	**Wet Season**
Canidae				
Canis familiaris dingo	Dingo	Class 2 - LP Act		X
Dasyuridae				
Sminthopsis crassicaudata	Fat-tailed Dunnart	Least Concern	X	
Emballonuridae				
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	Least Concern		X
Taphozous georianus	Common Sheathtail Bat	Least Concern		X
Taphozous troughtoni	Troughton's Sheathtail Bat	Least Concern		X
Felidae				
Felis catus	Feral Cat	Class 2 - LP Act		X
Macropodidae				
Macropus giganteus	Grey Kangaroo	Least Concern		X
Macropus robustus	Common Wallaroo	Least Concern		X
Macropus rufus	Red Kangaroo	Least Concern	X	X
Petrogale purpureicollis	Purple-necked Rock Wallaby	Vulnerable - NC Act		X
Muridae				
Mus musculus	House Mouse	Class 1 - LP Act	X	
Pseudomys desertor	Desert Mouse	Lease Concern		X

Pseudomys sp	unidentified Mouse			X
Zyzomys argurus	Common Rock Rat	Least Concern	X	
Molossidae				
Mormopterus beccarii	Beccari's Freetail Bat	Least Concern		X
Mormopterus loriae ridei	Eastern Little Freetail Bat	Least Concern		X
Mormopterus sp.	unknown Freetail Bat	Least Concern		X
Chalinolobus gouldii	Gould's Wattled Bat	Least Concern		X
Suidae				
Sus scrofa	Pig	Class 2 - LP Act		X
Vespertilionidae				
Charephon jobensis	Northern Free-tailed Bat	Least Concern		X
Chalinolobus nigrogriseus	Hoary Wattled Bat	Least Concern		X
Nyctophilus sp.	unknown Long-eared Bat	Least Concern		X
Scotorepens balstoni	Inland Broad-nosed Bat	Least Concern		X
Scotorepens greyii	Little Broad-nosed Bat	Least Concern		X
Vespadelus baverstocki	Inland Forest Bat	Least Concern		X
Vespadelus courinus	Northern Cave Bat	Least Concern		X
AMPHIBIANS				
FAMILY				
Scientific Name	**Common Name**	**Status**	**Dry Season**	**Wet Season**
Bufonidae				
Rhinella marina	Cane Toad	Least Concern	X	X
Hylidae				
Cyclorana australis	Giant Frog	Least Concern		X
Litoria caerulea	Green Tree Frog	Least Concern		X
Litoria pallida	Pale Tree Frog	Least Concern		X
Litoria rubella	Red Tree Frog	Least Concern		X
Limnidynstidae				
Platyplectrum ornatum	Ornate Burrowing Frog	Least Concern		X

Appendix D: ANABAT Results

Anabat echolocation data interpretation summary

Client: AARC (Julie Byrd; Townsville) **Balance Job no.:** AARC1104

Project name/location: Dugald River, NW of Cloncurry (March 2011)

Data summary tables

Numbers in columns indicate number of calls attributed to species/group for given night

	Anabat 2						Total Calls
Species	21-Mar	22-Mar	23-Mar	24-Mar	26-Mar	27-Mar	
Species positively identified (i.e. species definitely present)							
Chalinolobus gouldii	11	13	6	9		11	50
Chalinolobus nigrogriseus	1	13		1		1	16
Nyctophilus species	1	28	1				30
Scotorepens balstoni	22	20	9	19		21	91
Scotorepens greyii		7		4		11	22
Vespadelus baverstocki	24	40	2	14		15	95
Vespadelus caurinus / V. finlaysoni	2		8	20		28	58
Chaerephon jobensis	4	5	7	6		7	29
Mormopterus beccarii	1	2	3	2		12	20
Mormopterus species	3	9	1			6	19
Saccolaimus flaviventris	22	46	27	51	2	97	245
Taphozous georgianus							0
Taphozous troughtoni	1	1					2
Total calls positively identified	92	184	64	126	2	209	677
Calls NOT positively identified *							
Chalinolobus gouldii / Scotorepens balstoni	7	3	10	54		7	81
C. gouldii / S. balstoni / Mormopterus species	21	24	11	12		8	76
Scotorepens balstoni / S. greyii	2	4					6
Scotorepens greyii / Vespadelus baverstocki	10	48	9	48		17	132
Scotorepens greyii / Chalinolobus nigrogriseus	22	38	12	47	2	23	144
Vespadelus baverstocki / Nyctophilus sp		2					2
Chaerephon jobensis / Saccolaimus flaviventris	1	5	9	2		9	26
Mormopterus beccarii / Saccolaimus flaviventris			4	39		3	46
Mormopterus beccarii / Taphozous troughtoni	2	3	3			3	11
Saccolaimus flaviventris / Taphozous georgianus	2		1				3
UNIDENTIFIED BAT CALLS	14	28	10	5		2	59
Total calls not positively identified	81	155	69	207	2	72	586
Total calls for site/night	**173**	**339**	**133**	**333**	**4**	**281**	**1,263**

***** A species listed in the bottom section of the table that is not also listed in the top section should be considered as possibly present. Likelihood of occurrence and call identification issues for these species are discussed in the 'Reliability of species ID' section on the following pages.

Notes:

No bat calls recorded on night of 25th March and no Anabat data beyond morning of 28th March

Total number of sequence files recorded on this Anabat	10,464
Total number of sequence files that passed a generic bat-call filter	2,187
Total number of calls identified from filtered sequence files	1,263

Anabat echolocation data interpretation summary

Client: AARC (Julie Byrd; Townsville) **Balance Job no.:** AARC1104

Project name/location: Dugald River, NW of Cloncurry (March 2011)

Data summary tables

Numbers in columns indicate number of calls attributed to species/group for given night

	Un-named Anabat								Total Calls
Species	**21-Mar**	**22-Mar**	**24-Mar**	**25-Mar**	**26-Mar**	**27-Mar**	**29-Mar**	**30-Mar**	
Species positively identified (i.e. species definitely present)									
Chalinolobus gouldii	18	13	4	13		7	1	9	65
Chalinolobus nigrogriseus	3			2			4	1	10
Nyctophilus species		1				3		7	11
Scotorepens balstoni	10	8	2	17		13	13	83	146
Scotorepens greyii	1	2	3	6	1	3	1	6	23
Vespadelus baverstocki	5	19	6	4	2	6	11	52	105
Vespadelus caurinus / V. finlaysoni	2	6	7	4	2	3	4	7	35
Chaerephon jobensis	3	1	4	2		9	8	5	32
Mormopterus beccarii	1	6	2	5		5	12	13	44
Mormopterus species							1		1
Saccolaimus flaviventris	6	9	27	21	4	60	102	63	292
Taphozous georgianus							3		3
Taphozous troughtoni						1		1	2
Total calls positively identified	49	65	55	74	9	110	160	247	769
Calls NOT positively identified *									0
Chalinolobus gouldii / Scotorepens balstoni	13	23	1	5		85	31	42	200
C. gouldii / S. balstoni / Mormopterus species	14	8	10	4		14	35	5	90
Scotorepens balstoni / S. greyii	1						3	5	9
Scotorepens greyii / Vespadelus baverstocki	6	15	8	5	1	25	56	65	181
Scotorepens greyii / Chalinolobus nigrogriseus	6	5	2	2		4	55	23	97
Vespadelus baverstocki / Nyctophilus sp	3	15	1				4	4	27
Chaerephon jobensis / Saccolaimus flaviventris		1	7	4		22	28	7	69
Mormopterus beccarii / Saccolaimus flaviventris	1	4	1	3		8	67	85	169
Mormopterus beccarii / Taphozous troughtoni		2		1		7	3	1	14
Saccolaimus flaviventris / Taphozous georgianus			4			1		4	9
UNIDENTIFIED BAT CALLS		2	1			3	10	1	17
Total calls not positively identified	44	75	35	24	1	169	292	242	882
Total calls for site/night	**93**	**140**	**90**	**98**	**10**	**279**	**452**	**489**	**1,651**

***** A species listed in the bottom section of the table that is not also listed in the top section should be considered as possibly present. Likelihood of occurrence and call identification issues for these species are discussed in the 'Reliability of species ID' section on the following pages.

Notes:

No bat calls recorded on nights of 23rd, 28th and 31st March and no Anabat data beyond morning of 1st April.

Total number of sequence files recorded on this Anabat	3,455
Total number of sequence files that passed a generic bat-call filter	2,259
Total number of calls identified from filtered sequence files	1,651

Anabat echolocation data interpretation summary

Client: AARC (Julie Byrd; Townsville) **Balance Job no.:** AARC1104

Project name/location: Dugald River, NW of Cloncurry (March 2011)

Species nomenclature:

Species names used in this summary follow Churchill (2008), except for the free-tailed bats (Molossidae), which follow van Dyck & Strahan (2008) and Adams *et al.* (1988).

Call identification & reporting standard:

No bat call identification guide or key exists for the region from which these data were collected.

Call identification was based on published call descriptions (Milne 2001; Reinhold *et al* 2001; and Pennay *et al.* 2004); and on reference calls collected from various locations in Queensland, New South Wales & the Northern Territory.

Determination of species' identification was further refined by considering probability of occurrence based on distributional information presented in Churchill (2008) and van Dyck & Strahan (2008).

The format and content of this report complies with nationally accepted standards for the interpretation and reporting of Anabat data (Reardon 2003); latest version available from the Australasian Bat Society on-line at http://www.ausbats.org.au/.

Reliability of species ID

***Nyctophilus* species**

Nyctophilus bats generally produce distinctive calls, but the species cannot be reliably differentiated from call data. The species most likey to be present in the Dugald River area is *N. geoffroyi* . Three other species (*N. arnhemensis* , *N. daedelus* and *N. walkeri*) also occur in the far north-west of Queensland but are primarily restricted to moist habitats such as watercourses lined with pandanus and paperbark.

Vespadelus caurinus / V. finlaysoni

These species produce distinctive calls with hooked pulses at higher frequency (>50kHz) than any other species (with similar pulse shape) that would occur in the area. Most calls attributed to this species pair were in the range 54-56kHz, with a handful of sequences having slightly higher frequency (*ca.* 58kHz). The higher frequency is most likely to represent *V. caurinus* and the lower frequency *V. finlaysoni* ; however, the full range of both species is poorly known, so all calls were attributed to the pair rather than attempting an unreliable species split.

***Mormopterus* species**

Mormopterus calls generally sweep through a narrow frequency band, compared with vespertilionids in the same frequency range, and pulse shape is either flat or shallow-curved (rather than steep or sharply curved). A number of calls with typical *Mormopterus*- type pulses around 32-33kHz were recorded during this survey. These are likely to be from one of the un-named species in the *M. 'loriae'* complex, presumably *M.* 'species 5' (Adams *et al.* 1988).

***Chalinolobus gouldii / Scotorepens balstoni / Mormopterus* species**

C. gouldii (28-34kHz) has steep and curved pulses that usually alternate in frequency by 2-3kHz. *S. balstoni* (30-36kHz) pulses are also steep and curved but do not alternate in frequency. *Mormopterus* sp (30-34kHz) pulses are generally much flatter; however, pulses sometimes steepen when flying close to vegetation and brief calls may be confused with calls from the other two spp. Similarly, *C. gouldii* and *S. balstoni* pulses sometimes lack steep initial broad-band frequency sweeps when flying in open space and these calls can appear similar to those of *Mormopterus* .

A number of calls steep-pulsed calls at 30-34kHz were listed as either *C. gouldii* or *S. balstoni* because they were brief and/or weak and/or showed inconclusive evidence of frequency alternation and could not be reliably distinguished. Numerous calls with similarly low quality but obviously less steep pulses could have been from any of these three species.

Scotorepens balstoni / S. greyii

These species have very similar pulse shapes and overlap slightly with characteristic frequency (Fc) around 35kHz. Differentiation is based on the frequency at which the first abrupt change in slope ("knee") occurs in the pulse curve . If Fk<37kHz, then identity is attributable to *S. balstoni.* However, in a few calls with Fc around 35kHz, this feature was marginal, so identity was unclear.

Scotorepens greyii / Chalinolobus nigrogriseus

Signficant frequency overlap occurs in the range 36-39kHz, but pulse shape is sometimes diagnostic. Some *C. nigrogriseus* have flatter body of longer duration (2/3 of total pulse duration) compared with cup-shaped body of shorter duration in *S. greyii* . A high proportion of calls, however, exhibit pulses with intermediate features or a mixture of pulse types and cannot be reliably differentiated.

Anabat echolocation data interpretation summary

Client: AARC (Julie Byrd; Townsville) **Balance Job no.:** AARC1104

Project name/location: Dugald River, NW of Cloncurry (March 2011)

Reliability of species ID

Scotorepens greyii / Vespadelus baverstocki
S. greyii (35-40kHz) calls overlap in frequency with and have very similar pulse shapes to *V. baverstocki* (39-46kHz). A number of calls within the frequency overlap zone (39-40kHz) could have been from either of these species.

Vespadelus baverstocki / Nyctophilus sp
These species are generally easy to distinguish due to different search-phase pulse shapes (linear in *Nyctophilus cf.* curved in *V. baverstocki*). A few weak and brief calls in the relevant frequency range (44±3kHz), however, were not reliably identifed and could have been *V. baverstocki* attack-phase calls or *Nyctophilus* calls.

Cherephon jobensis / Saccolaimus flaviventris / Taphozous georgianus / T. troughtoni / Mormopterus beccarii
Frequency overlap occurs between these spp across a range of about 12kHz: *C. jobensis* (15-21kHz); *S. flaviventris* (17-22kHz); *T. georgianus* (21-23kHz); *T. roughtoni* (23-25kHz); *M. beccarii* (21-27kHz). Where good quality signals are recorded (i.e. long duration call sequence with numerous clearly defined pulses) species identity is usually discernible due to the shape and uniformity of pulses within the sequence. About 70% of the calls from this survey were of sufficient quality to be reliably attributed to one or other of these species. The remaining 30% of calls in this frequency range were too brief and/or weak and/or noisy to be reliably identified.

References:

Adams, M., Reardon, T., Baverstock, P.R. and Watts, C.H.S. (1988). Electrophoretic resolution of species boundaries in Australian Microchiroptera. IV. The Molossidae (Chiroptera). *Australian Journal of Biological Sciences* **41**, 315-326.

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Pennay, M., Law, B. and Reinhold, L. (2004). *Bat Calls of New South Wales.* Department of Environment and Conservation, Hurstville.

Reardon, T. (2003). Standards in bat detector based surveys. *Australasian Bat Society Newsletter* **20**, 41-43.

Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001). *Key to the bat calls of south-east Queensland and north-east New South Wales.* Department of Natural Resources and Mines, Brisbane.

van Dyck, S. and Strahan, R. (ed.) (2008). *The Mammals of Australia* (Third Edition); New Holland; Sydney.

Anabat Data Analysis Summary

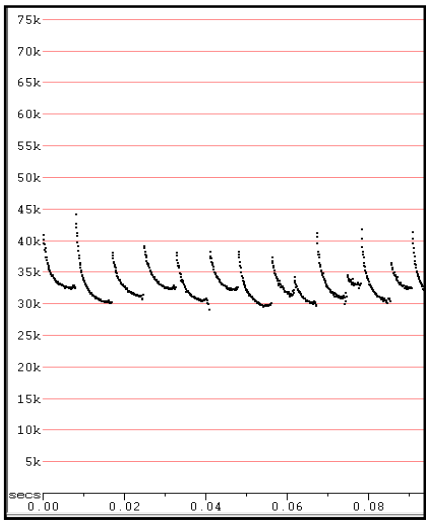
Client: AARC (Julie Byrd; Townsville) **Balance Job no.:** AARC1104

Project name/location: Dugald River, NW of Cloncurry (March 2011)

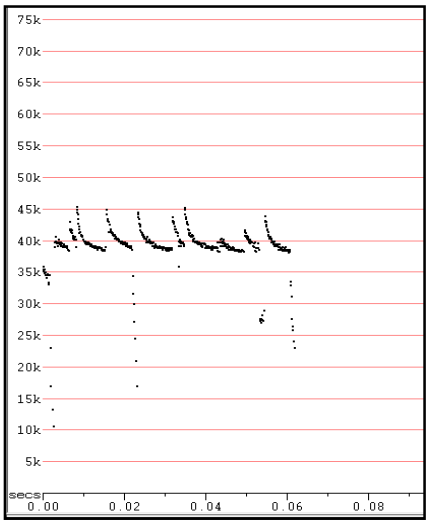
Sample calls extracted from the survey data.

Scale: 10 msec per tick; time between pulses removed (AnalookW F7 compressed mode)

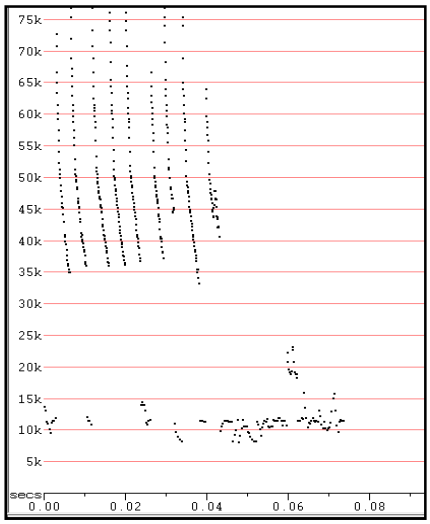
Species positively identified



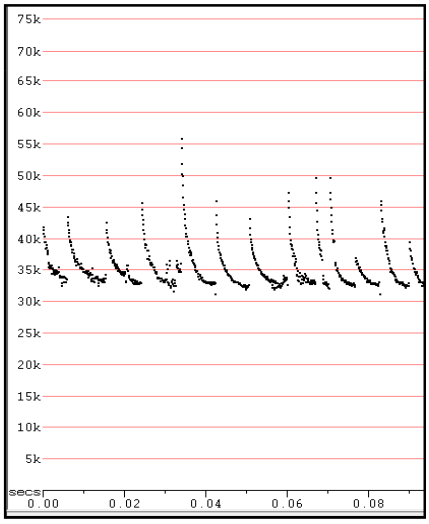
Chalinolobus gouldii



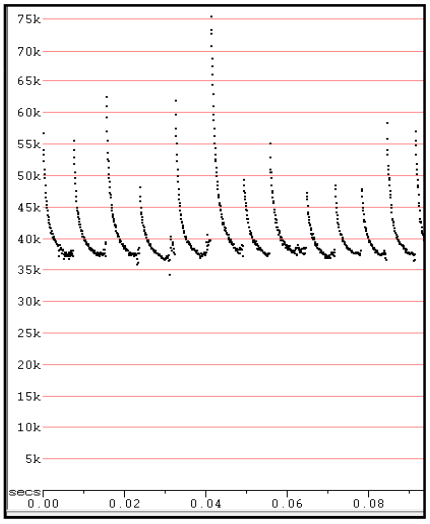
Chalinolobus nigrogriseus



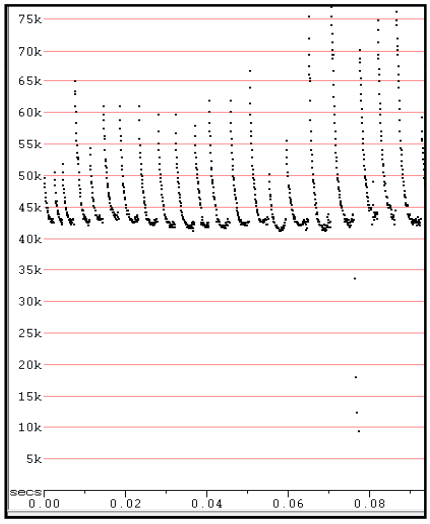
Nyctophilus species



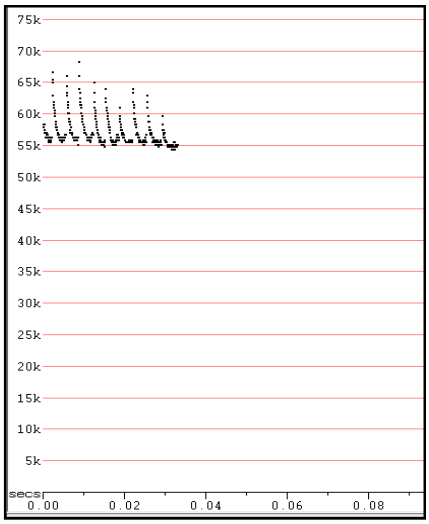
Scotorepens balstoni



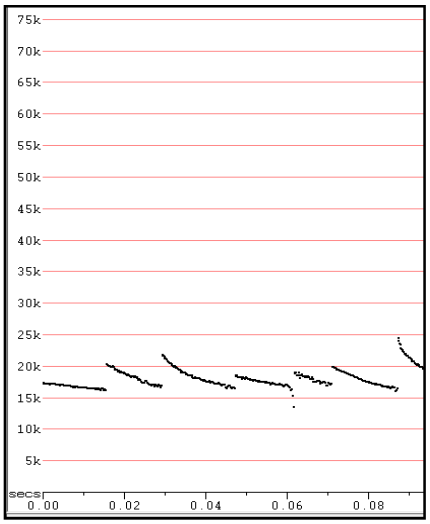
Scotorepens greyii



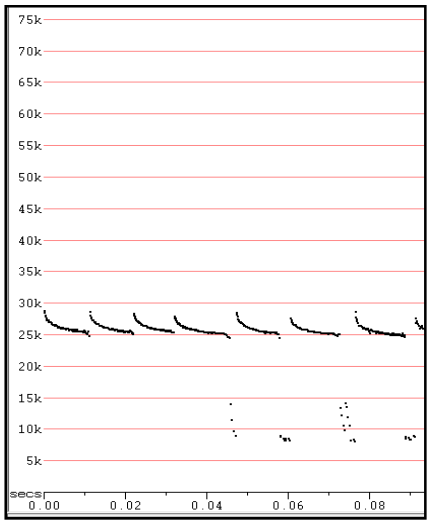
Vespadelus baverstocki



V. caurinus / V. finlaysoni



Chaerephon jobensis



Mormopterus beccarii

PO Box 1744, Toowoomba Qld 4350

Anabat Data Analysis Summary

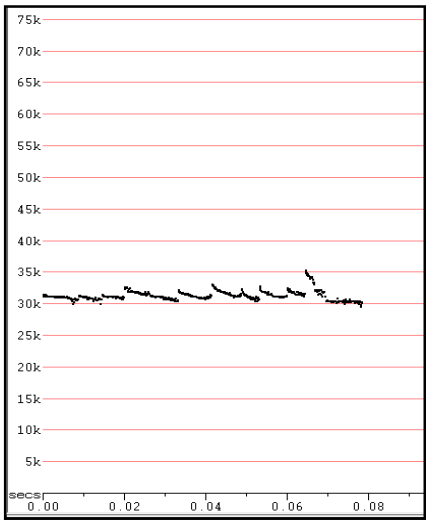
Client: AARC (Julie Byrd; Townsville) **Balance Job no.:** AARC1104

Project name/location: Dugald River, NW of Cloncurry (March 2011)

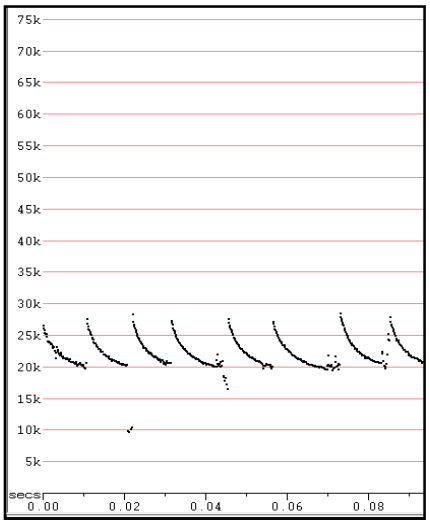
Sample calls extracted from the survey data.

Scale: 10 msec per tick; time between pulses removed (AnalookW F7 compressed mode)

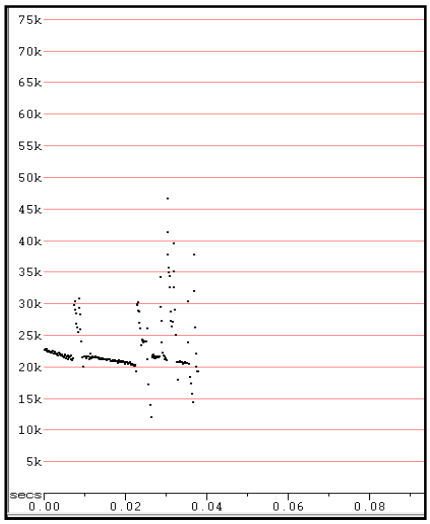
Species positively identified



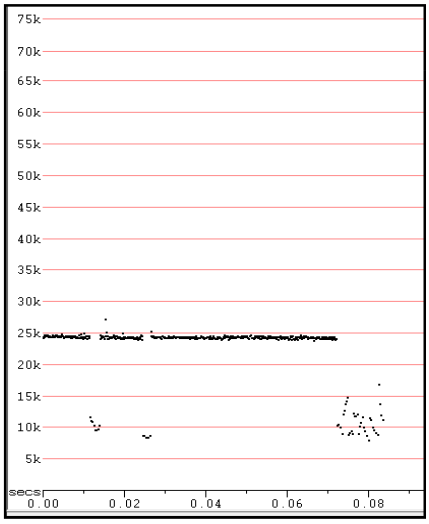
Mormopterus sp



Saccolaimus flaviventris



Taphozous georgianus



Taphozous troughtoni

Data received – quantity and quality

A single compressed data file was received via email (zinifex anabt.zip); said folder containing six folders of Anabat data recorded on the nights of 28th March to 2nd April 2008.

All folders contained a very low number of Anabat sequence files (maximum 16 files on 2nd April); and only two nights yielded bat echolocation calls (31/3 and 2/4).

Call identification standard

No keys or descriptions have been published for bat calls of north-west Queensland, and access to reliable locally recorded reference calls is limited. However, most of the species likely to be present are covered in keys and descriptions published for southern Queensland (Reinhold *et al.* 2001) and the Northern Territory (Milne 2002)

The extent of geographic variation in call characteristics is poorly known, but available evidence suggests that calls of most species do not vary significantly between regions. Therefore, it is deemed sufficient to refer to the above-named keys and reference calls collected from central- and south-western Queensland in determining the identity of calls recorded in the present survey.

Results

Bat calls were recorded only on 31st March (2 sequence files) and 2nd April (14 sequence files). All other files contained only environmental noise.

At least four species were recorded, with up to three other species also present but not reliably identified.

In the following species summary (Table 1), species presence is coded according to highest level of confidence achieved in call identification. Reliability of identification is coded as follows:

A	Definite	absolutely no doubt about identification of bat making call
B	Probable	most likely the species named but low probability of confusion with species with similar calls
C	Possible	call is comparable with the listed species, but moderate to high probability of confusion with species with similar calls

Table 1. Summary of species recorded for Zinifex survey,31st March and 2nd April 2008.

SPECIES	COMMON NAME	Recording date:	
		31/3	2/4
Saccolaimus flaviventris	Yellow-bellied Sheath-tailed Bat		B
Chaerephon jobensis	Northern Free-tailed Bat		A
Mormopterus loriae ridei	Eastern Little Free-tailed Bat		B
Chalinolobus gouldii	Gould's Wattled Bat	B	
Chalinolobus nigrogriseus	Hoary Wattled Bat	A	A
Nyctophilus species	unknown long-eared bat		C
Scotorepens greyii	Little Broad-nosed Bat		A

Species Notes

Saccolaimus flaviventris and *Chaerephon jobensis*

Calls overlap in frequency and often exhibit similar pulse shape; frequency overlaps also with *Taphozous georgianus* and *Mormopterus beccarii*. *S. flaviventris* differentiated from *C. jobensis* on consistent vs. erratic pulse frequency and shape; *T. georgianus* and *M. beccarii* are usually higher in frequency, and have subtle differences in pulse shape in frequency overlap zone.

C. jobensis was definitely present, with positive identification made for a number of calls; and several brief sequences with uniform frequency and pulse shape were very likely from *S. flaviventris*.

Mormopterus loriae ridei

A couple of calls on 2/4 were almost certainly from this species. These calls were definitely of *Mormopterus* type, and this species is likely to be the only one present in the survey area (Churchill 1998; van Dyck & Strahan 2008). No reference calls are available, although Milne's (2002) key shows the closely related *M. l. coburgiana* having similar calls to those observed in the Zinifex data.

Chalinolobus gouldii

Calls are readily recognised, typically exhibiting a steep curve with alternating frequency between successive pulses. Very likely responsible for one of the two calls recorded on 31/3, but very brief sequence and pulses not well-defined so cannot be certain of identity.

Chalinolobus nigrogriseus

This species calls overlap in frequency with those of *Scotorepens greyii* (see below), but pulse shape is diagnostic where long duration calls with good recording quality are available.

One of the calls from 31/3 was definitely attributable to *C. nigrogriseus*, along with a number of calls recorded on 2/4. Several poorer quality calls on 2/4 could not be reliably differentiated between *C. nigrogriseus* and *S. greyii*.

Nyctophilus species

Long-eared bats produce low intensity calls that are often poorly recorded. Pulse shape is distinctive and they are readily distinguished from other bats, but the species within *Nyctophilus* cannot be reliably differentiated from call data.

A single, very brief call on 2/4 may have emanated from a *Nyctophilus* species bat, although the brevity and poor quality of the call means it was not possible to discount the likelihood of *C. nigrogriseus* or *S. greyii* being responsible for the call.

Scotorepens greyii

This species' calls are often very similar to those of *C. nigrogriseus* (see above), although pulse shape is usually distinctive in better quality recordings.

A number of the calls recorded on 2/4 were definitely attributable to *S. greyii*.

References

Churchill, S. (1998). *Australian Bats*. New Holland, Sydney.

Milne, D.J. (2002). *Key to the Bat Calls of the Top End of the Northern Territory*. Technical Report No. 71, Parks and Wildlife Commission of the Northern Territory, Darwin.

Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001). *Key to the bat calls of south-east Queensland and north-east New South Wales*. Department of Natural Resources and Mines, Brisbane.

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Appendix E: DEEDI Pest Fact Sheets

Queensland Government

Department of **Primary Industries and Fisheries**

Dingo



Dingo (*Canis familiaris dingo*)



Dingoes can carry canid diseases and parasites

General information

The dingo (*Canis familiaris dingo*) is a primitive canid related to wolves and coyote. The dingo was not a part of the ancestral fauna of Australia. Though its origins are not clear, it is thought to have arrived in Australia 3500-4000 years ago.

It is the largest mammalian carnivore remaining in mainland Australia, and as such fills an important ecological niche. The dingo has been regarded as a serious domestic stock predator since early European settlement in Australia.

The dingo is a Class 2 declared animal under Queensland legislation. It is the responsibility of landholders to control dingoes on their land.

Scientific name	*Canis familiaris dingo*
Impacts	■ can carry diseases such as distemper and parvovirus as well as parasites ■ can harass and kill large numbers of sheep without feeding on the carcasses ■ could pose serious risk if rabies was introduced into Australia
Description	■ predominantly red, ginger and sandy-yellow, though dingoes can also be pure white, black and tan or solid black ■ adults reach up to 60 cm in height ■ heavily-boned skull and larger teeth than domestic dogs ■ females weigh about 12 kg and males 15 kg ■ naturally lean with large ears pricked and a white tip on their tails
Habitat and life cycle	■ found throughout Queensland ■ in far western area most dingoes are purebred

- close to settled areas there is a greater number of dingoes crossed with feral domestic dogs
- breed once a year (usually April to June)
- nine-week gestation
- usually 4-6 pups in a litter

Control

- different control methods including shooting, poisoning, trapping and fencing with land management practices is most effective
- can be controlled outside national parks and other protected areas
- see the wild dog control fact sheet for further information

Declaration details

- a declared Class 2 species under the *Land Protection (Pest and Stock Route Management) Act 2002*
- landholders are required to control declared pests on their land

Further information

- local government animal control/environmental staff
- Biosecurity Queensland, Ph: 13 25 23
- Dingoes in Queensland: distribution and ecology fact sheet (PDF, 158 kB)
- Queensland Pest Animal Strategy 2002-06 (PDF, 383 kB)
- Wild dogs
- Control methods
- Frequently asked questions
- Environmental Protection Agency

Page maintained by Sonia Jordan
Last reviewed 21 May 2008
URL: http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/cps/rde/dpi/hs.xsl/4790_8278_ENA_HTML.htm

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Queensland Government

Department of **Primary Industries and Fisheries**

House mouse



House mouse (*Mus domesticus)*



Dalby mouse plague, 1995

General information

Mice (*Mus domesticus)* are considered pests because of their diet, reproductive capacity and gnawing behaviour. When seasonal conditions are favourable, their numbers can increase to a level where they become a serious pest, causing damage to crops, stored products and equipment.

Although mice are not a declared animal under Queensland legislation, its control is recommended.

Scientific name

Mus domesticus

Impacts

- cause serious damage to crops during plagues
- can transmit Salmonella (which causes food poisoning) to human food stuffs

Description

- brown, grey or black short-haired pelt and may appear white, pale yellow or grey underneath
- notched upper incisors distinguish them from other species
- omnivorous and opportunistic feeders

Habitat and life cycle

- present in agricultural areas around long grass and crops
- may be found in and around sheds and homes
- field breeding occurs mostly in spring and early summer however, breeding may occur at any time
- females can produce a litter each month during the breeding season
- litters consist of up to six pups
- gestation lasts from 19-20 days
- first breeding commences from five weeks

Control

- a combined approach of different control methods including chemical, baiting, trapping, barrier fencing, habitat modification, ultrasonic devices, repellents, biological control integrated with land management practices is most effective

Declaration details

- not a declared animal under Queensland legislation but may be declared under local government law

Further information

- local government animal control/environmental staff
- Biosecurity Queensland, Ph: 13 25 23
- Mouse bait card (PDF, 97 kB)
- House mouse in Queensland pests status review (PDF, 155 kB)
- Zinc phosphide fact sheet (PDF, 54 kB)
- Mouse Strategy (PDF, 114 kB)
- Queensland Pest Animal Strategy 2002-06 (PDF, 383 kB)
- see the control methods page
- *Land Protection (Pest and Stock Route Management) Act 2002*

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Last reviewed 31 March 2008
URL: http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/cps/rde/dpi/hs.xsl/4790_8283_ENA_HTML.htm

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Queensland Government

Department of **Primary Industries and Fisheries**

Feral pig



Feral pig (*Sus scrofa*)



Feral pigs can damage sugar cane, wheat, banana and strawberry crops

General information

The feral pig (*Sus scrofa*) is one of the most widespread and damaging pest animals in Queensland. Feral pigs in Australia are descendants of various subspecies of the domestic pig. Accidental and deliberate releases of domestic and semi-feral pigs have resulted in a large feral pig population.

The feral pig is a declared Class 2 pest under Queensland legislation. It is the responsibility of landholders to control feral pigs on their land.

Scientific name

Sus scrofa

Impacts

- can damage almost all crops from sowing to harvest
- feeds on seed, grain, fruit and vegetable crops
- lamb predation
- damages pastures by grazing and rooting
- can also spread weeds
- can carry many diseases and parasites

Description

- smaller, leaner and more muscular than domestic pigs with well-developed shoulders and necks and smaller, shorter hindquarters
- sparse, coarse hair
- longer, larger snouts and tusks, straighter tails, smaller mostly pricked ears and much narrower backs than domestic pigs
- mostly black, buff-coloured or spotted black and white
- juveniles may be striped
- old boars (razorbacks) have massive heads and shoulders and a raised, prominent backbone

- generally shy and nocturnal

Habitat and life cycle

- inhabit about 40% of Australia from subalpine grasslands to monsoonal floodplains
- found in all areas of Queensland
- greatest concentrations on the larger drainage basins and swamp areas of the coast and inland
- females and juveniles usually live in small family groups
- adult males are typically solitary
- in ideal conditions sows can produce two litters of 4-10 piglets a year
- weaning occurs after 2-3 months
- in good conditions feral pig populations may increase fivefold in 12 months

Control

- difficult to control in some situations
- different control methods including shooting, poisoning, trapping and fencing with land management practices is most effective
- see the control of feral pigs fact sheet for further information

Declaration details

- a declared Class 2 species under the *Land Protection (Pest and Stock Route Management) Act 2002*
- landholders are required to control its numbers on their land

Further information

- local government animal control/environmental staff
- Biosecurity Queensland, Ph: 13 25 23
- Feral pigs in Queensland fact sheet (PDF, 212 kB)
- Control of feral pigs fact sheet (PDF, 246 kB)
- Feral pig control in the wet tropics fact sheet (PDF, 221 kB)
- Sodium fluroacetate (1080) fact sheet (PDF, 148 kB)
- Feral Pig Management Strategy (PDF, 250 kB)
- Queensland Pest Animal Strategy 2002-06 (PDF, 383 kB)
- Feral pig pest status review (PDF, 152 kB)
- Control methods
- Frequently asked questions
- Model code of practice for welfare of animals: feral animal control
- Codes of practice and standard operating procedures for humane vertebrate pest control
- *Land Protection (Pest and Stock Route Management) Act 2002*

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Invasive plants and animals

Feral cat ecology and control

DECLARED CLASS 2



A descendant of the African wild cat (*Felis silvestris lybica*), the common 'house' cat (*Felis catus*) has now been domesticated for about 4 000 years. Although the domestic cat has a long history of association with man, it retains a strong hunting instinct and can easily revert to a wild (feral) state when abandoned or having strayed from a domestic situation.

Semi-feral cats live around dump sites, alleys or abandoned buildings, relying on humans by scavenging rubbish scraps and sheltering in abandoned structures. The true feral cat does not rely on humans at all, obtaining its food and shelter from the natural environment.

Declaration details

The feral cat is declared as a Class 2 species under the *Land Protection (Pest and Stock Route Management) Act 2002*. Declared species represent a threat to primary industries and natural resources, and have a social impact on other human activities.

Legislation describes a feral cat as one that is not fed and kept by someone. The word ‘kept’ specifically means that the cat is housed in a domestic situation.

Produced by: Land Protection (Invasive Plants and Animals)

Queensland the Smart State

Queensland Government
Department of Primary Industries and Fisheries

Description

The feral cat differs little in appearance from its domestic counterpart; however, when in good condition, the feral cat displays increased overall muscle development, which is especially noticeable around the head, neck and shoulders, thus giving the animal a more robust appearance. The average body weight of male feral cats is from 3 kg to 6 kg, while that of females varies from 2 kg to 4 kg. Body weights vary with condition, with some extremely large specimens having been documented.

Australian feral cats are predominantly short-haired, with coat colours that range between ginger, tabby, tortoiseshell, grey and black. White markings may be present on the feet, belly, chest and throat; completely white feral cats are extremely rare. In established populations coat colours are the result of a natural, genetically selective process. Terrain, predators and the ability to capture prey limit coat colours to those that provide the most suitable camouflage and cause a predominance of these colours in subsequent offspring. Ginger cats are more likely to be found in the semi-arid and desert areas, while grey and black specimens generally predominate in scrub and more heavily timbered habitats.

The feral cat is most active at night, with peak hunting activity occurring soon after sunset and in the early hours before sunrise. At night the cat displays a distinctive green eyeshine under spotlight, making it easily distinguishable from other animals. During the day it will rest in any number of den sites, which may include hollow logs, dense clumps of grass, piles of debris, rabbit burrows, and even the hollow limbs of standing trees.

The most obvious and characteristic field signs of feral cats are their scats (droppings). Unlike the domestic cat, the feral cat does not bury its scats, but leaves them exposed at prominent sites to warn other cats of its territorial boundary.

History of introduction and dispersal

There is some evidence to suggest that the cat was present in Australia long before European settlement. This may have occurred as a result of Dutch shipwrecks and regular visits to northern Australia by early South-East Asian vessels as long as 500 years ago.

Post-settlement dispersal resulted from cats straying from areas of early colonisation. In the late 19th and early 20th centuries, large numbers of cats were purposely released in many rural areas to combat plague numbers of rabbits.
Unwanted cats continue to be released into urban and rural areas by irresponsible pet owners.

The feral cat is now present Australia-wide, thriving under all climatic extremes and in vastly different types of terrain.

Population dynamics

Male cats attain sexual maturity at about 12 months of age, whereas females are capable of reproduction at approximately 7 months. Annually, and under ideal conditions, an adult female can produce up to three litters—each of usually four kittens, but varying from two to seven.

As the breeding instinct is triggered by the increasing length of daylight, litters are less frequent in winter. Most reproduction occurs during the spring and summer months, and is generally limited to two litters per year. Birth follows a gestation period of 65 days, and kittens may be reared in a single den site or may be frequently shifted to other sites within the female's home range. Family and litter bonding begin to break down when the kittens are approximately seven-months old. The female's ability to bear litters does not decrease with age, so reproduction continues for the course of her life.

Social organisation and behaviour

Feral cats maintain stable home ranges, the sizes of which depend upon the relative abundance of food and the availability of suitable den sites. Dominant male cats may have territories of up to 8 square kilometres, while the territories of females are smaller and may even be halved when kittens are being reared. Scent glands are present on the chin, at the corners of the mouth, and in the anal region. Territorial boundaries are maintained by scent marking with the cheek glands, pole-clawing, urinating and exposed faecal deposits.

Although feral cats are often thought of as being solitary animals, studies have revealed that such behaviour is generally limited to hunting activities. At other times feral cats display a degree of social interaction that peaks during the breeding season. Group behaviour has been observed in semi-feral populations, and it has been suggested that such behaviour is exhibited also in feral populations. Groups usually comprise several related adult females, their young of both sexes, and an adult male—whose range may include other groups of females. Young females usually remain in a group, while young males either leave or are driven from the group as they reach sexual maturity.

Effects on wildlife

The energy expended by an adult male cat requires it to consume 5% to 8% of its body weight in prey per day, while females raising kittens require 20%. Based on these figures, one study concluded that 375 feral cats on Macquarie Island would consume 56 000 rabbits and 58 000 sea-birds per year. Where present on the mainland, rabbits may comprise up to 40% of the diet of feral cats. Cats are successful as a control mechanism only when rabbit densities are low. At other times cat predation does little to halt the build-up or spread of rabbit

populations; rabbits merely help to support a larger number of cats. When seasonal shortages of rabbits occur there is a corresponding rise in the number of native animals taken by cats.

The feral cat is an opportunistic predator, and dietary studies have shown that small mammals, birds, reptiles, amphibians, insects and even fish can be taken as prey. Cat predation is particularly harmful in island situations, and a number of species have become extinct due to the introduction of cats by early sealers and lighthouse keepers. On the mainland, native animals—which already suffer due to the destruction of their habitats by man and other introduced animals—may be endangered further by cat predation. Actual competition for prey can cause a decline in the numbers of native predatory species such as quolls, eagles, hawks and reptiles.

Not only do native animals bear the brunt of predation, but they also suffer the effects of a parasite which reproduces only in the intestine of the cat. This disease (toxoplasmosis) is particularly harmful to marsupials, which may develop blindness, respiratory disorders, paralysis, and suffer the loss of offspring through abortion and stillbirths.

Exotic disease—rabies

Due to their widespread distribution, feral cats may prove to be a major vector for this fatal viral disease should it ever enter Australia. Overseas studies have revealed that wounds inflicted by rabid cats are more dangerous than those caused by rabid dogs. While the bites of rabid dog bites are generally inflicted on the arms and legs, the cat attacks the head of its victim, biting and clawing viciously. These head and facial bites reduce the time taken for the virus to enter the central nervous system, lessening the chance of success from subsequent remedial treatment.

Methods of control

Exclusion

Fencing is the only feasible method of control when special areas need protection from cats. Feral cats have been successfully prevented from climbing over netted fences by the use of an electrified wire mounted 15 cm from the top and 10 cm outward from the fence. Non-electrified fencing should incorporate a netted ceiling, or a curved overhang, which prevents the cat from climbing straight up and over the fence.

Shooting

Night shooting is assisted by the cat's distinctive, green eyeshine. Cats have been successfully attracted by the use of a fox whistle.

Poisoning

Registration of the vertebrate pesticide sodium fluoroacetate (1080) is currently being sought for the control of feral cats where conditions for its use are suitable.

Audible recorded lures for feral cats and other predators are available through a number of sources. These recordings mimic the distress call of a small animal and can be use to draw a predator to a bait or trap site.

Trapping

Rubber-jawed, leg-hold traps (see below) can be laid in the same manner as they are laid for dingoes and foxes. Leg-hold traps can work well with true feral cats, which would normally avoid the live-capture box traps. Ideal sites are those where territorial markers, such as faecal deposits and pole-clawing, are noticed. Tuna fish oil has shown some success as an attractant; however, feral cats seem more readily attracted to a site by some visual stimulus such as a bunch of bird feathers hung from a bush or stick.

Cats are easily trapped in wire 'treadle-type' box traps (see diagram). This method is most practical for semi-feral urban cats. Attractants/lures may be of meat or fish and should be placed so that they cannot be reached through the wire and be retrieved by clawing.



Rubber-jawed leg-hold trap



Treadle box trap

A number of local governments lend cat traps for the purpose of removing stray and feral cats in urban situations.

Further information

Further information is available from animal control/environmental staff at your local government or, if your council does not have animal control staff, from your local Department of Primary Industries and Fisheries land protection officer. Contact details are available through 13 25 23.

Fact sheets are available from DPI&F service centres and the DPI&F Information Centre phone (13 25 23). Check our web site <www.dpi.qld.gov.au> to ensure you have the latest version of this fact sheet. The control methods referred to in this Pest Fact should be used in accordance with the restrictions (federal and state legislation and local government laws) directly or indirectly related to each control method. These restrictions may prevent the utilisation of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, the Department of Primary Industries and Fisheries does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.
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Appendix F: Fauna Study Sites

Descriptions of each terrestrial study site are detailed below, together with Photo Plate 39 - Photo Plate 55.

Study Site 1 was located in a drainage area within a valley surrounded by steep slopes.



Photo Plate 39 The Pitfall-line at Study Site 1 (Wet Season)



Photo Plate 40 The Pitfall-line at Study Site 1 (Dry Season)

Study Site 2 was located in open woodland on flat plains at the base of the Knapdale Range.



Photo Plate 41 The Pitfall-line at Study Site 2 (Wet Season)



Photo Plate 42 The Pitfall-line at Study Site 2 (Dry Season)

Study Site 3 was located along a drainage area with an open woodland context.



Photo Plate 43 Study Site 3 (Wet Season)



Photo Plate 44 The Pitfall-line at Study Site 3 (Dry Season)

Study Site 4 was located along a drainage area associated with low lying hills at the foot of the Knapdale Ranges.



Photo Plate 45 The Pitfall-line at Study Site 4 (Wet Season)



Photo Plate 46 The Pitfall-line at Study Site 4 (Dry Season)

Study Site 5 was located in low open woodland with rocky outcrops and exposed faces.



Photo Plate 47 The Pitfall-line at Study Site 5 (Wet Season)



Photo Plate 48 The Pitfall-line at Study Site 5 (Dry Season)

Study Site 6 was located in an open woodland floodplain tending towards a drainage line.



Photo Plate 49 The Pitfall-line at Study Site 6 (Wet Season)



Photo Plate 50 The Pitfall-line at Study Site 6 (Dry Season)

Secondary Study Site 1 was located in open woodland associated with a drainage area.



Photo Plate 51 Secondary Study Site 1 (Wet Season)

Secondary Study Site 2 was located on a rocky outcrop. Evidence of a recent grass-fire was evident.



Photo Plate 52 Secondary Study Site 2 (Wet Season)

Secondary Study Site 3 was located along the unnamed creek downstream of the Tailings Storage Facility (TSF);

Secondary Study Site 4 was located along the unnamed creek downstream of the TSF, in between two large sections of the Knapdale Range;



Photo Plate 53 Secondary Study Site 4 (Wet Season)

Secondary Study Site 5 was located along Silvermine Creek, with scattered sections of rocky outcrops present on creek banks;



Photo Plate 54 Secondary Study Site 5 (Wet Season)

Secondary Study Site 6 was located along the downstream reaches of Silvermine Creek, with open sandy plains and riverine terracing adjacent to the watercourse;

Secondary Study Site 7 was located along the banks of North Creek, will hilly sections adjacent to the creek;



Photo Plate 55 Secondary Study Site 7 (Wet Season)

Secondary Study Site 8 was located along the banks of North Creek, with an open sand plain adjacent to the watercourse.

Appendix G: Flora Secondary and Quaternary Transect Pro-formas

AARC FLORA SURVEY PROFORMA
Secondary Transect

Project	
Date	
Recorder	
Site No.	
GPS Coordinates	
Site Photo No.	

Locality	
Site Context	
RE	
General Notes	

Altitude	**Erosion Pattern**	**Slope (º)**	**Aspect**

Soil Description	
Geology	
Additional Soil Notes	

Disturbance Severity (1 = minor 2 = moderate 3 = severe)	
Storm Damage	
Road Works	
Fire	
Clearing	
Grazing	
Weeds	
Other	

Height	**Emergent**	**T1**	**T2**	**T3**	**S1**	**S2**	**Ground**

(m)							

Stem Cover (Bitterlich Method)	

Species Stem Cover (50x10m) – count all woody stems	
Emergent	
T1	
T2	
T3	
S1	
S2	
S3	

Additional Notes (sketch if required)

Crown Cover Calc.	0m	5m	10m	15m	20m	25m	30m	35m	40m	45m

D = Dominant, CD = Co-Dominant, A = Associated, O = Occasional

Dominance (D, CD, A, O or ✓)							Species	Sample #	Photo #	Q1	Q2	Q3	Q4	Q5
E	T1	T2	T3	S1	S2	G								
							Bare							
							Litter							
							Rock							

Dominance (D, CD, A, O or ✓)							Species	Sample #	Photo #	Q1	Q2	Q3	Q4	Q5
E	T1	T2	T3	S1	S2	G								

AARC FLORA SURVEY PROFORMA
Quaternary Transect

Project	
Date	
Recorder	
Site No.	
GPS Coordinates	
Site Photo No.	
RE	
Notes	

Dominance (D, CD, O, A)	Species	Sample No.	Photo No.

Appendix H: Queensland Herbarium Identifications

Queensland Herbarium
Brisbane Botanic Gardens Mt Coot-tha • Toowong 4066 Queensland • Australia
Telephone +61 7 3896 9326 • Facsimile +61 7 3896 9624
e-mail Queensland.Herbarium@derm.qld.gov.au • www.derm.qld.gov.au

Enquiries Tony Bean/ Jian Wang
Telephone 07 3896 9318
Your reference
Our reference ARB:JW:mh 3/11

11 January 2011

Julie Byrd
AARC
PO Box 675
TOWNSVILLE Qld 4810

Dear Julie

The botanical specimens received by the Queensland Herbarium on 4 January 2011, have been identified as:

DV3 *Triumfetta rupestris*
DV9 *Stemodia lythrifolia*
DV2 *Stemodia viscosa*
DR2 *Stemodia viscosa*
DV8 *Vigna radiata* var. *sublobata*
DV1 *#Tephrosia rosea* var. *rosea*
DR8 *Vigna radiata* var. *sublobata*
DR8 *Acrostichum speciosum*
DR3 *Cleome viscosa*
DR7 *Pluchea rubelliflora*
DV13 *Trema tomentosa* var. *aspera*
DR6 *Flueggea virosa* subsp. *melanthesoides*
DR1 *Vitex benthamiana*
DV12 *Cyperus microcephalus*
DR5 *Cyperus dactylotes*
DR4 *Cyperus javanicus*
DV14 *Acacia hemignosta*

This specimen has been retained for incorporation into the Herbarium collection, with thanks.

There is a charge of $407.60 (4 hrs @ $101.90 per hr incl GST) for these identifications and a tax invoice will be sent separately.

Yours sincerely

G.P.Guymer
Director

Queensland Herbarium
Brisbane Botanic Gardens Mt Coot-tha • Toowong 4066 Queensland • Australia
Telephone +61 7 3896 9326 • Facsimile +61 7 3896 9624
e-mail Queensland.Herbarium@derm.qld.gov.au • www.derm.qld.gov.au/herbarium

Enquiries Tony Bean
Telephone 07 3896 9318
Your reference
Our reference ARB:mh 355/11

3 May 2011

Julie Byrd
AARC
PO Box 675
TOWNSVILLE Qld 4810

Dear Julie

The botanical specimens received by the Queensland Herbarium on 18 April 2011 have been identified as:

D 1 *Anisomeles malabarica*
D 2 *#Polygala wightiana*
D 3 *#Polygala rhinanthoides*
D 4 *Fimbristylis dichotoma*
D 5 *Cymbopogon bombycinus*
D 7 *Xenostegia tridentata*
D 8 *Spermacoce auriculata*
D 9 *Corchorus pumilio*
D 10 *Cajanus acutifolius*
D 11 *Cyperus conicus* var. *conicus*
D 12 *Cyperus cunninghamii* subsp. *cheradicus*
D 13 *Cyperus pulchellus*
D 14 *Cyanotis axillaris*
D 15 *Lipocarpha microcephala*
D 16 *Hibiscus* sp., insufficient material for species identification
D 16 *#Fimbristylis signata*
D 17 *Vigna radiata* var. *sublobata*
D 18 *Iphigenia indica*
D 19 *Cheilanthes brownii*
D 20 *Eucalyptus herbertiana*
D 21 *Schizachyrium fragile*
D 22 *Eremophila latrobei*
D 24 *Stackhousia intermedia*
D 25 *Euphorbia tannensis* subsp. *eremophila*
D 27 *Sida* sp., fruits required for species identification

D 28 *Chamaecrista symonii*
D 30 *Fimbristylis microcarya*
D 31 *Aristida contorta*
D 32 *Jacquemontia browniana*
D 33 *Glycine tomentella*
D 34 **Eragrostis minor*
D 35 *Cyperus vaginatus*
D 36 *Eragrostis* sp., inflorescence too immature to allow species identification
D 37 **Sida spinosa*
D 38 *Fimbristylis littoralis*

These specimens have been retained for incorporation into the Herbarium collection, with thanks.

* Naturalised, usually non-native species

There is a charge of $815.20 (8 hrs @ $101.90 per hr incl GST) for these identifications and a tax invoice and receipt are enclosed.

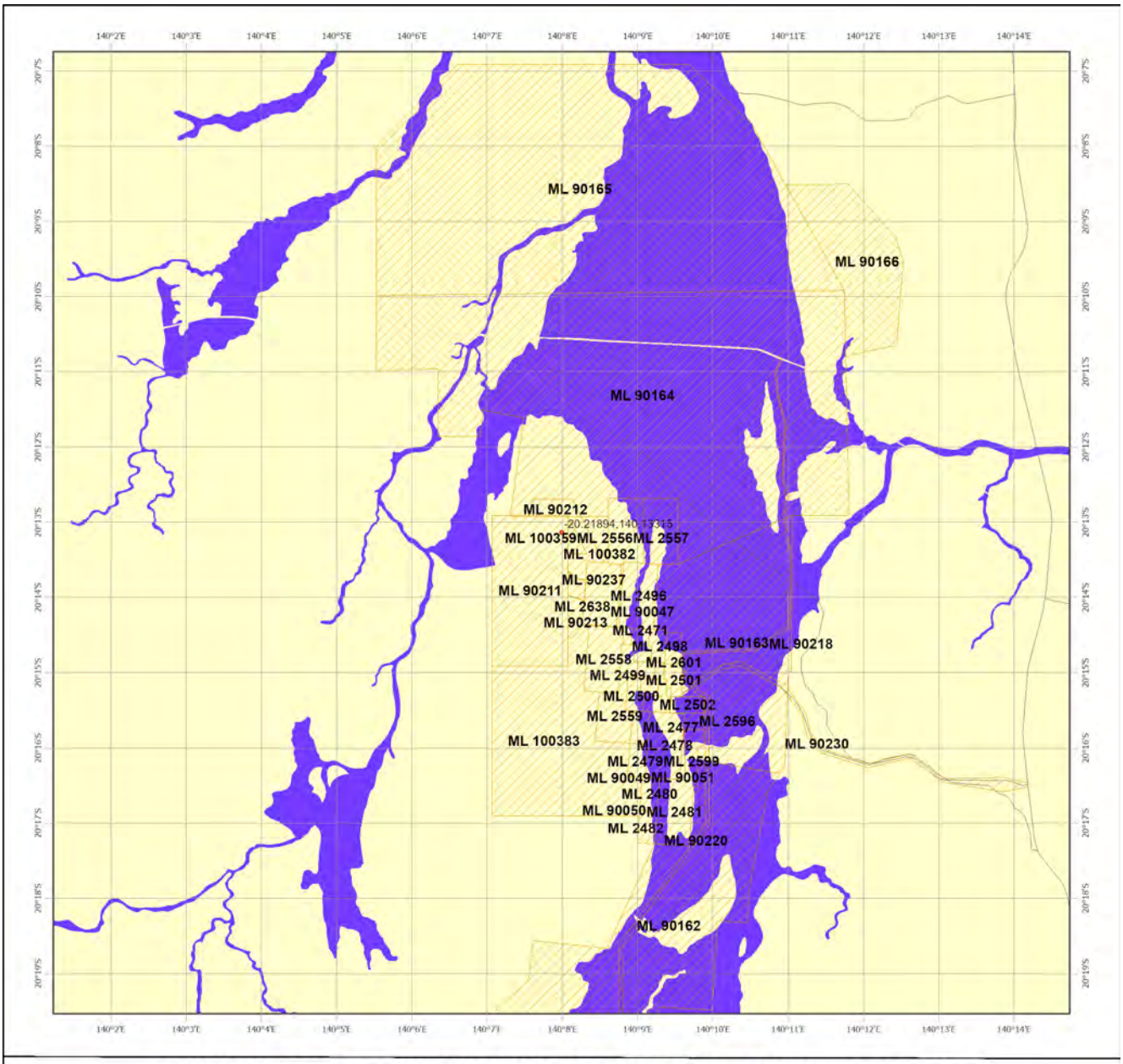
Yours sincerely

G.P.Guymer
Director

APPENDIX C: Environmentally Sensitive Areas

Tenure type: Mining Lease
Centred on point position: Longitude: 140.13315 Latitude: -20.21894

Map produced: 05/11/2024 15:47:00



ENVIRONMENTALLY SENSITIVE AREAS - Mining Activities

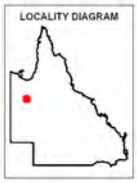
CATEGORY A
- National Parks
- Conservation Parks
- Forest Reserves
- Special Wildlife Reserve
- Wet Tropics World Heritage Area
- Great Barrier Reef Region
- Marine Parks other than General Use Zones

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

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

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

LOCALITY DIAGRAM



N

0 1,000 2,000 3,000 4,000 5,000 m

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

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

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

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APPENDIX D: Pre-survey Detailed Likelihood of Occurrence Tables

Non-migratory EVNT or Special Least Concern species under the NC Act

Common Name (Scientific Name)	Status		Source[3]	Likelihood of Occurrence	
	NC ACT[1]	EPBC[2]		50 km	10 km
Plants (n[4] = 3)					
Mt Isa Mallee (Eucalyptus nudicaulis)	E	E	PMST	**Unlikely** – No records exist within a 50 km buffer from a central point within the Project area. The 50 km buffer falls outside of the extent of occurrence identified within the conservation advice for the species.	**Unlikely** – No records exist within a 10 km buffer from a central point within the Project area on. The 10 km buffer falls outside of the extent of occurrence identified within the conservation advice for the species.
Ipomoea antonschmidii	NT	NL	WO	**Possible** – There are several records within a 50 km buffer from a central point within the Project area. The initial population is ~40 km to the east of the Project area. A newer population has been found ~100 km northwest of the Project area.	**Possible** – There are several records within a 50 km buffer from a central point within the Project area. The initial population is ~40 km to the east of the Project area. Species may occur within 10 km of Project area.
Ptilotus maconochiei	NT	NL	WO	**Unlikely** - One record exists approximately 40 km west of the Project area. The majority of records are centred around Mount Isa.	**Unlikely -** No records exist within a 10 km buffer from a central point within the Project area.
Birds (n = 8)					
Australian Painted Snipe (*Rostratula australis*)	E	E, Ma	PMST, ALA	**Possible** - one record exists approximately 40 km southwest of the Project area.	**Unlikely -** No records exist within a 10 km buffer from a central point within the Project area.
Carpentarian Grasswren (*Amytornis dorotheae*)	E	E	PMST, WO, ALA	**Possible -** One record is located approximately 40 km northwest of the Project area.	**Unlikely –** No records occur within a 10 km buffer of a central point within the Project area.
Gouldian Finch (*Erythrura gouldiae*)	E	E, M	PMST	**Unlikely** - no records exist within a 50 km buffer of a central point within the Project area.	**Unlikely** - no records exist within a 10 km buffer of a central point within the Project area.

Grey Falcon (*Falco hypoleucos*)	V	V	PMST, WO	**Unlikely –** There are two records within 50 km of a central point within the Project area. However, due to the low density of the species, it is considered unlikely to occur in the Project area.	**Unlikely –** There are no records within 10 km of a central point within the Project area. However, due to the low density of the species, it is considered unlikely to occur in the Project area.
Night Parrot (*Pezoporus occidentalis*)	E	E	PMST	**Unlikely -** no records exist within a 50 km buffer of a central point within the Project area. The nearest record is over 250 km south of the site.	**Unlikely -** no records exist within a 10 km buffer of a central point within the Project area. The nearest record is over 250 km south of the site.
Painted Honeyeater (*Grantiella picta*)	V	V	PMST	**Unlikely** – there are two records within a 50 km buffer of a central point within the Project area.	**Unlikely** – no records within a 10 km buffer of a central point within the Project area.
Purple-crowned Fairy-wren (*Malurus coronatus*)	V	NL	WO	**Possible** - One record exists within a 50 km buffer of a central point within the Project area.	**Unlikely** – no records within a 10 km buffer of a central point within the Project area.
Red Goshawk (*Erythrotriorchis radiatus*)	E	E	PMST	**Unlikely** - No records exist within a 50 km buffer of a central point within the Project area.	**Unlikely** - No records exist within a 10 km radius of the site.
Mammals (n = 5)					
Ghost Bat (*Macroderma gigas*)	E	V	PMST	**Unlikely -** No records exist within a 50 km buffer of a central point within the Project area. The habitat on site may be suitable if roosting structures are available.	**Unlikely -** No records exist within a 10 km buffer of a central point within the Project area. The habitat on site may be suitable if roosting structures are available.
Greater Bilby (Macrotis lagotis)	E	V	PMST	**Unlikely** - No records exist within a 50 km buffer of a central point within the Project area. The nearest record in the ALA database is approximately 250 km southwest of the site.	**Unlikely** - No records exist within a 10 km buffer of a central point within the Project area. The nearest record in the ALA database is approximately 250 km southwest of the site.

Julia Creek Dunnart (Sminthopsis douglasi)	E	V	PMST	**Unlikely -** No records exist within a 50 km buffer of a central point within the Project area. Most records for this species are centred around Julia Creek, with occasional outliers.	**Unlikely -** No records exist within a 10 km buffer of a central point within the Project area. Most records for this species are centred around Julia Creek, with occasional outliers.
Purple-necked rock-wallaby (*Petrogale purpureicollis*)	V	NL	WO, ALA	**Likely** – 23 records exist within a 50 km buffer of a central point within the Project area.	**Likely** – 11 records exist within a 10 km buffer of a central point within the Project area.
Short-beaked echidna (*Tachyglossus aculeatus*)	SL	NL	WO, ALA	**Likely** - Four records exist within a 50 km buffer of a central point within the Project area. This species is widely distributed and utilizes a variety of habitats across its range.	**Likely** - Two records exist within a 10 km buffer of a central point within the Project area. This species is widely distributed and utilizes a variety of habitats across its range.
Reptiles (n = 3)					
Gulf Snapping Turtle (Elseya lavarackorum)	V	E	PMST	**Unlikely -** No records exist within a 50 km buffer of a central point within the Project area. The nearest population is over 225 km northwest of the site.	**Unlikely -** No records exist within a 10 km buffer of a central point within the Project area. The nearest population is over 225 km northwest of the site.
Mertens' water monitor (*Varanus mertensi*)	E	NL	WO	**Possible** – Six records exist within 50 km buffer of a central point within the Project area. Several records are located along the Dugald River.	**Possible** – Two records exist within 10 km buffer of a central point within the Project area. Several records are located along the Dugald River.
Plains Death Adder (*Acanthophis hawkei*)	V	V	PMST	**Unlikely** - No records exist within a 50 km buffer of a central point within the Project area. The site is likely unsuitable habitat as this species favours habitat that is flat, while the site is geographically complex.	**Unlikely** - No records exist within a 10 km buffer of a central point within the Project area. The site is likely unsuitable habitat as this species favours habitat that is flat, while the site is geographically complex.

[1]NC ACTNC ACT Status – Nature Conservation Act (1992) Status. LC – Least Concern, SL – Special Least Concern, NT – Near Threatened, V – Vulnerable, E – Endangered, CR – Critically Endangered.

[2]EPBC Status – Environment Protection and Biodiversity Conservation Act (1999) Status. V – Vulnerable, E – Endangered, CE – Critically Endangered, NL – Not Listed, M – Migratory, Ma - Marine.

[3]50 km search radius around central coordinate for records in: PMST – EPBC Act Protected Matters Report; WO – Wildlife Online Database, ALA – Atlas of Living Australia, EAA Flyway – East Australasian Flyway, 2023. 2 km search radius around central coordinate for: MPH – Modelled Potential Habitat layer in Qspatial.

[4]Number of species for each group

Migratory Species

Common Name (*Scientific Name*)	Status		Source[3]	Likelihood of Occurrence	
	NC Act[1]	EPBC[2]		50 km	10 km
Asian Dowitcher (*Limnodromus semipalmatus*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area. The species is a regular visitor to the north-west between Port Hedland and Broome. Elsewhere they are sporadic and rare.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area. The species is a regular visitor to the north-west between Port Hedland and Broome. Elsewhere they are sporadic and rare.
Bar-tailed Godwit (*Limosa lapponica*)	E	E, M, Ma	EAA Flyway	**Possible** – The species is rarely found inland; however, some inland records suggest there is some passage overland and there are records at Lake Moondarra, approximately 70 km southwest of the Project area.	**Possible** – The species is rarely found inland; however, some inland records suggest there is some passage overland and there are records at Lake Moondarra, approximately 70 km southwest of the Project area.
Black-tailed Godwit (*Limosa limosa*)	E	E, M, Ma	EAA Flyway	**Possible** - Birds travelling south from northern Australia often pass through the Mt Isa region and there are several records of birds congregating at Lake Moondarra, approximately 70 km southwest of the Project area, as well as records at Rifle Creek Dam.	**Possible** - Birds travelling south from northern Australia often pass through the Mt Isa region and there are several records of birds congregating at Lake Moondarra, approximately 70 km southwest of the Project area, as well as records at Rifle Creek Dam.
Broad-billed Sandpiper (*Limicola falcinellus*)	SL	M, Ma	EAA Flyway	**Unlikely -** There are no records in the vicinity of the Project area. The species is rarely recorded inland.	**Unlikely -** There are no records in the vicinity of the Project area. The species is rarely recorded inland.
Caspian tern (*Hydroprogne caspia*)	SL	M, Ma	ALA, EAA Flyway	**Possible -** Within a 50 km buffer from a central point within the Project area, the Caspian tern has 15 records. This species is primarily coastal, though travels	**Unlikely –** no records occur within 10 km buffer from a central point within the Project area. This species is primarily coastal, though travels inland to visit large bodies of water, of

				inland to visit large bodies of water.	which none are present in the area.
Common Greenshank (*Tringa nebularia*)	E	E, M, Ma	PMST, ALA, EAA Flyway	**Possible** - four records exist within a 50 km buffer from a central point within the Project area.	**Unlikely** – No records within 10 km buffer from a central point within the Project area.
Common Redshank (*Tringa totanus*)	SL	M, Ma	EAA Flyway	**Unlikely -** No records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** No records exist within a 10 km buffer from a central point within the Project area.
Common Sandpiper (*Actitis hypoleucos*)	SL	M, Ma	PMST, EAA Flyway	**Unlikely** – No records within 50 km buffer from a central point within the Project area.	**Unlikely** – No records within 10 km buffer from a central point within the Project area.
Common Tern (*Sterna hirundo*)	SL	M, Ma	EAA Flyway	**Unlikely** – No records within 50 km buffer from a central point within the Project area.	**Unlikely** – No records within 10 km buffer from a central point within the Project area.
Curlew Sandpiper (*Calidris ferruginea*)	CR	CE, M, Ma	PMST, ALA, EAA Flyway	**Possible** - Two records exist within a 50 km buffer from a central point within the Project area.	**Unlikely** – No records within 10 km buffer from a central point within the Project area.
Double-banded Plover (*Charadrius bicinctus*)	SL	M, Ma	EAA Flyway	**Unlikely** - no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely** - no records exist within a 10 km buffer from a central point within the Project area.
Eastern Curlew (*Numenius madagascariensis*)	E	CE, M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area. Eastern curlews are rarely recorded inland. They have a continuous distribution from Barrow Island and Dampier Archipelago, Western Australia, through the Kimberley and along the Northern Territory, Queensland, and NSW coasts and the islands of Torres Strait.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area. Eastern curlews are rarely recorded inland. They have a continuous distribution from Barrow Island and Dampier Archipelago, Western Australia, through the Kimberley and along the Northern Territory, Queensland, and NSW coasts and the islands of Torres Strait.
Fork-tailed swift (*Apus pacificus*)	SL	M, Ma	PMST	**Unlikely -** no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records or modelled flight paths exist within a 10 km buffer from a central point within the Project area.
Glossy ibis (*Plegadis falcinellus*)	SL	M, Ma	ALA, WO	**Possible** - 14 records exist within a 50 km buffer from a central point within the Project area.	**Unlikely** - There are no records within a 10 km buffer from a central point within the Project area.
Great Knot (*Calidris tenuirostris*)	CE	CE, M, Ma	EAA Flyway	**Possible –** No records located near the Project area**.** Recorded primarily	**Possible –** No records located near the Project area**.** Recorded primarily

				around coastal wetlands with sparse scattered inland records, usually on inland lakes. May fly through the Project area to access suitable habitat.	around coastal wetlands with sparse scattered inland records, usually on inland lakes. May fly through the Project area to access suitable habitat.
Greater Sand Plover (*Charadrius leschenaultii*)	V	V, M, Ma	EAA Flyway	**Possible -** There is a record in the vicinity of the Project area at Lake Moondarra, approximately 70 km southwest of the Project area. May fly through the Project area to access suitable habitat.	**Possible -** There is a record in the vicinity of the Project area at Lake Moondarra, approximately 70 km southwest of the Project area. May fly through the Project area to access suitable habitat.
Grey Plover (*Pluvialis squatarola*)	V	V, M, Ma	EAA Flyway	**Possible -** There is a record in the vicinity of the Project area at Lake Moondarra, approximately 70 km southwest of the Project area. May fly through the Project area to access suitable habitat.	**Possible -** There is a record in the vicinity of the Project area at Lake Moondarra, approximately 70 km southwest of the Project area. May fly through the Project area to access suitable habitat.
Grey-tailed Tattler (*Tringa brevipes*)	SL	M, Ma	EAA Flyway	**Possible - T**he species is found in most coastal regions, primarily along the northern coast. There are rare inland records, including Burdekin Weir, Charters Towers and Mount Isa. May fly through the Project area to access suitable habitat.	**Possible - T**he species is found in most coastal regions, primarily along the northern coast. There are rare inland records, including Burdekin Weir, Charters Towers and Mount Isa. May fly through the Project area to access suitable habitat.
Grey Wagtail (*Motacilla cinerea*)	SL	M, Ma	PMST	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area. The nearest record is over 600 km away, on the coast.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area. The nearest record is over 600 km away, on the coast.
Gull-billed Tern (*Gelochelidon nilotica*)	SL	M, Ma	EAA Flyway	**Unlikely** - no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely** - no records exist within a 10 km buffer from a central point within the Project area a.
Latham's snipe (*Gallinago hardwickii*)	V	V, M, Ma	PMST	**Possible** - Two records are located approximately 40 km southwest of Project area. May fly through the Project area to access suitable habitat.	**Possible -** no records exist within a 10 km radius of the site. May fly through the Project area to access suitable habitat.
Lesser Sand Plover (*Charadrius mongolus*)	E	E, M, Ma	ALA, EAA Flyway	**Possible -** records around Mt Isa City, indicate there is a possibility for this species	**Possible -** records around Mt Isa City, indicate there is a possibility for this

				to occur within the Project area. May fly through the Project area to access suitable habitat.	species to occur within the Project area. May fly through the Project area to access suitable habitat.
Little curlew (*Numenius minutus*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Little Ringed Plover (*Charadrius dubius*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Little Tern (*Sterna albifrons*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Long-toed Stint (*Calidris subminuta*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Marsh sandpiper (*Tringa stagnatilis*)	SL	M, Ma	ALA, EAA Flyway	**Possible** - records at Lake Moondarra, Corella Dam, Chinaman Dam, and around Mt Isa City, indicate there is a possibility for this species to occur within the Project area. May fly through the Project area to access suitable habitat.	**Possible** - records at Lake Moondarra, Corella Dam, Chinaman Dam, and around Mt Isa City, indicate there is a possibility for this species to occur within the Project area. May fly through the Project area to access suitable habitat.
Oriental Plover (*Charadrius veredus*)	SL	M, Ma	PMST	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Oriental Pratincole (*Glareola maldivarum*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Pacific Golden Plover (*Pluvialis fulva*)	SL	M, Ma	EAA Flyway	**Possible -** records at Late Moondarra and around Mt Isa City, indicate there is a possibility for this species to occur within the Project area. May fly through the Project area to access suitable habitat	**Possible -** records at Late Moondarra and around Mt Isa City, indicate there is a possibility for this species to occur within the Project area. May fly through the Project area to access suitable habitat
Pectoral Sandpiper	SL	Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central

					point within the Project area.
Red Knot (*Calidris canutus*)	E	E, M, Ma	EAA Flyway	**Possible -** There is evidence of some overland movement, however there are no records in the vicinity of the Project area. May fly through the Project area to access suitable habitat	**Possible -** There is evidence of some overland movement, however there are no records in the vicinity of the Project area. May fly through the Project area to access suitable habitat
Red-necked Phalarope (*Phalaropus lobatus*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Red-necked Stint (*Calidris ruficollis*)	SL	M, Ma	ALA, EAA Flyway	**Possible -** records at Late Moondarra, Chinaman Dam, and around Mt Isa City and Cloncurry, indicate there is a possibility for this species to occur within the Project area. May fly through the Project area to access suitable habitat	**Possible -** records at Late Moondarra, Chinaman Dam, and around Mt Isa City and Cloncurry, indicate there is a possibility for this species to occur within the Project area. May fly through the Project area to access suitable habitat
Ruddy Turnstone (*Arenaria interpres*)	V	V, M, Ma	EAA Flyway	**Possible -** records at Lake Moondarra, indicate there is a possibility for this species to occur within the Project area. May fly through the Project area to access suitable habitat	**Possible -** records at Lake Moondarra, indicate there is a possibility for this species to occur within the Project area. May fly through the Project area to access suitable habitat
Ruff (*Philomachus pugnax*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Sanderling (*Calidris alba*)	SL	M, Ma	EAA Flyway	**Possible –** Records exist of birds utilizing inland lakes or river pools as a temporary refuge. May fly through the Project area to access suitable habitat	**Possible –** Records exist of birds utilizing inland lakes or river pools as a temporary refuge. May fly through the Project area to access suitable habitat
Sharp-tailed sandpiper (*Calidris acuminata*)	V	V, M, Ma	ALA, WO, EAA Flyway	**Possible –** There are three records within a 50 km buffer from a central point within the Project area	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Short-tailed Shearwater (*Ardenna tenuirostris*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.

Swinhoe's Snipe (*Gallinago megala*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Terek Sandpiper (*Xenus cinereus*)	V	V, M, Ma	EAA Flyway	**Possible -** records at Lake Moondarra, indicate there is a possibility for this species to occur within the Project area. May fly through the Project area to access suitable habitat	**Possible -** records at Lake Moondarra, indicate there is a possibility for this species to occur within the Project area. May fly through the Project area to access suitable habitat
Wandering Albatross (*Diomedea exulans*)	V	V, M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Whimbrel (*Numenius phaeopus*)	SL	M, Ma	EAA Flyway	**Possible –** Inland records suggest there is some overland movement. May fly through the Project area to access suitable habitat	**Possible –** Inland records suggest there is some overland movement. May fly through the Project area to access suitable habitat
White-winged Black Tern (*Chlidonias leucopterus*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.
Wood Sandpiper (*Tringa glareola*)	SL	M, Ma	EAA Flyway	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area.	**Unlikely -** no records exist within a 10 km buffer from a central point within the Project area.

[1]NC ACT Status – Nature Conservation Act (1992) Status. LC – Least Concern, SL – Special Least Concern, NT – Near Threatened, V – Vulnerable, E – Endangered, CR – Critically Endangered.

[2]EPBC Status – Environment Protection and Biodiversity Conservation Act (1999) Status. V – Vulnerable, E – Endangered, CE – Critically Endangered, NL – Not Listed, M – Migratory, Ma - Marine.

[3]50 km search radius around central coordinate for records in: PMST – EPBC Act Protected Matters Report; ALA – Atlas of Living Australia; EAA Flyway – East Australasian Flyway.

APPENDIX E: Post-survey Detailed Likelihood of Occurrence Tables

Non-migratory EVNT or Special Least Concern species under the NC Act

Common Name (Scientific Name)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
Plants (n[4] = 3)					
Mt Isa Mallee (Eucalyptus nudicaulis)	E	E	PMST	*Eucalyptus nudicaulis* is known from a restricted distribution to the west of Cloncurry. It grows in skeletal granite soils amongst open woodland of *E. leucophloia* and *Corymbia capricornia* on exposed quartzite, rocky gullies, and steep hillsides between 400-520 m above sea level (Bean 1991). It is typically associated with a dense understorey of Triodia spp. (Bean, Two new species of red gum (Eucalyptus L'Herit., Myrtaceae) from Queensland, 1991) and occurs in Queensland Region Ecosystem 1.11.2 – *Eucalyptus leicophloia* low open woodland (Bean, Conservation status assessment for Eucalyptus nudicaulis (Myrtaceae), 2009) (Queensland Herbarium, 2023). Associated species include *Acacia* sp., *Corymbia aspersa*, *E. normantonensis* and *Plectrachne pugens*.	**Unlikely** – No records exist within a 50 km buffer from a central point within the Project area. The 50 km buffer falls outside of the extent of occurrence identified within the conservation advice for the species.
Ipomoea antonschmidii	NT	NL	WO	This species is currently known from a restricted area southwest of Lake Julius Dam, north-northeast of Mt. Isa. It grows on shallow, red, stoney soils in *Eucalyptus leucophloia* woodland (Johnson, 1986). Records within the past 20 years have been centered around	**Unlikely*** – The initial population is ~40 km to the east of the Project area. A newer population has been found ~100 km northwest of the Project area. All records have been found in relatively low elevations, proximal to waterbodies or ephemeral

				gunpowder creek, north of Mt. Isa (Atlas of Living Australia, 2023).	streams, the Project area does not provide suitable conditions for this species.
Ptilotus maconochiei	NT	NL	WO	The native range of this species is western & central Queensland. It is a subshrub or shrub and grows primarily in the desert or dry shrubland biome (Kew Royal Botanic Gardens, 2023). The original collections of the species were found between 550 and 570 m in elevation around Mount Isa (Benl, 1979).	**Unlikely** - One record exists approximately 40 km west of the Project area. The majority of records are centred around Mount Isa.
Birds (n = 8)					
Australian Painted Snipe (*Rostratula australis*)	E	E, Ma	PMST	Heavily vegetated margins of wetlands, dams, marshy areas, swamps etc.; wet pasture, irrigated areas, lignum, tea-tree shrubs. (Pizzey and Knight, 2012).	**Possible** – one record has been recorded approximately 40 km southwest of the Project area. Any waterholes within the Project area are ephemeral and are fed by streams flowing from the ridgeline. All of the waterholes are small and surrounded by rocks, unsuitable habitat for the species.
Carpentarian Grasswren (*Amytornis dorotheae*)	E	E	PMST, WO	Generally confined to long-unburnt mature Triodia spp. hummock grassland or very open low woodland with Triodia understorey, avoiding recently (3 to 4 years previously) burnt areas, forages for seeds and insects around sandstone outcropping, on the ground, in rock crevices, leaf litter under Triodia hummocks and shrubs. Breeding season is November to March (Threatened Species Scientific Committee, 2016).	**Unlikely*** – While one record is located approximately 40 km northwest of the Project area, habitat assessments confirm a lack of hummocking spinifex grasses with which the species is typically associated.12 years of fauna survey effort have not produced records of the species in the Knapdale Range.
Gouldian Finch (*Erythrura gouldiae*)	E	E	PMST	A rarely encountered species in the region due to ongoing population declines. Favours Eucalyptus woodlands with a significant layer of tall native	**Unlikely** – no records exist within a 50 km buffer from a central point within the Project area. The site does not contain suitable

				grasses. As with other finch species, the Gouldian finch has a high association with water sources, particularly in the dry season (Pizzey and Knight, 2012).	habitat as there are no permanent water sources on site.
Grey Falcon (*Falco hypoleucos*)	V	V	PMST, WO	The grey falcon exists in a variety of habitats, from inland plains and deserts to well-timbered watercourses. It is considered rare and probably exists in low densities throughout most of its range (Pizzey and Knight, 2012).	**Unlikely** – due to the lack of sparsely treed areas preferred by the grey falcon, and the low density of the species, it is considered unlikely to occur in the Project area.
Night Parrot (*Pezoporus occidentalis*)	E	E	PMST	Not well known, most associated with spinifex grasslands and chenopod shrublands (Pizzey & Knight, 2012).	**Unlikely** - no records exist within a 50 km buffer from a central point within the Project area. The nearest record is over 250 km south of the site.
Painted Honeyeater (*Grantiella picta*)	V	V	PMST, WO	Elusive species with high association with mistletoe, particularly in woodlands with larger numbers of mature eucalypt trees (Pizzey and Knight, 2012). Migration movements are influenced by rainfall and fruiting of mistletoes.	**Unlikely** – Despite the species being recorded three times within a 50 km buffer from a central point within the Project area, there are no mistletoe species present on site which this species is highly associated with.
Purple-crowned Fairy-wren (*Malurus coronatus*)	V	NL	WO	The species occurs from the Kimberly region to the gulf of Carpentaria drainage of western Queensland and north-eastern Northern Territory (Threatened Species Scientific Committee, 2015). The species is restricted to a narrow band around well-vegetated river channels. They prefer thick riparian vegetation, typically of cane grass and/or pandanus, but also dense patchy shrubs up to 3 m (Ward & Woinarski, 2012). It is probable the record near the Project area was the eastern subspecies (*Malurus coronatus macgillivrayi*), which occurs along most rivers draining into south-western and southern Gulf of Carpentaria from Roper	**Possible** – One record exists within a 50 km buffer from a central point within the Project area. Vegetation along the Dugald River and smaller order streams that run through the site may provide potential habitat for the species.

				River in Northern Territory to Leichhardt and Flinders Rivers in Queensland. A natural biogeographic barrier of approximately 300 km of unsuitable habitat separates this subspecies from the western subspecies (*Malurus coronatus coronatus*).	
Red Goshawk (*Erythrotriorchis radiatus*)	E	E	PMST	Rarely encountered species. Habitat is open forests, woodlands, and rainforest fringes, particularly near rivers and wetlands. Range from Kimberly, WA to Sydney, NSW in coastal and subcoastal regions (Pizzey and Knight, 2012).	**Unlikely** – No records exist within a 50 km radius of the site using the ALA database. Habitat on site may be suitable, but it is unlikely that the species utilizes it.
Mammals (n = 5)					
Ghost Bat (*Macroderma gigas*)	E	V	PMST	Patchy and uncommon in most areas with populations limited by the availability of caves, disused mine shafts or similar structures for roosting habitat (Menkhorst and Knight, 2011).	**Unlikely** – No records exist within a 50 km buffer from a central point within the Project area. The habitat on site may be suitable if roosting structures are available.
Greater Bilby (*Macrotis lagotis*)	E	V	PMST	Open tussock grasslands, Mulga shrublands, hummock grassland. Once widespread through arid and semi-arid areas of the country, now reduced to isolated populations. In QLD, this species is restricted almost exclusively to Astrebla Downs National Park, east of Bedourie (Menkhorst & Knight, 2011).	**Unlikely** - No records exist within a 50 km buffer from a central point within the Project area. The nearest record in the ALA database is approximately 250 km southwest of the site.
Julia Creek Dunnart (*Sminthopsis douglasi*)	E	V	PMST	Known from open grasslands on deeply cracked soils of the Mitchell Grass Downs bioregion. Infrequently encountered and poorly known species, likely utilising deep soil cracks for shelter (Menkhorst & Knight, 2011).	**Unlikely** - No records exist within a 50 km buffer from a central point within the Project area. Most records for this species are centred around Julia Creek, with occasional outliers.
Purple-necked rock-wallaby (*Petrogale purpureicollis*)	V	NL	WO	As the name suggests, this species is a rock specialist and generally inhabits rocky outcrops and boulder piles in	**Known*** – Over 12 years of targeted surveys, this species

				spinifex grasslands and mulga (Menkhorst & Knight, 2011).	has been recorded on 611 instances on site.
Short-beaked echidna (*Tachyglossus aculeatus*)	SL	NL	WO	This species is Australia's most widely distributed mammal, inhabiting almost every terrestrial habitat on the continent (Menkhorst and Knight, 2011). Exists in lower densities in north.	**Known*** – Four records exist within a 50 km buffer from a central point within the Project area. This species is widely distributed and utilizes a variety of habitat including that present within the Project area.
Reptiles (n = 3)					
Gulf Snapping Turtle (*Elseya lavarackorum*)	V	E	PMST	This species is restricted to rivers draining into the Gulf of Carpentaria. It occurs within the Northern Territory and the Southern Gulf (Queensland) Natural Resource Management Regions (Department of the Environment, Water, Heritage and the Arts, 2008).	**Unlikely** - No records exist within a 50 km buffer from a central point within the Project area. The nearest population is over 225 km northwest of the site.
Mertens' water monitor (*Varanus mertensi*)	E	NL	WO	It has a broad distribution that encompasses coastal and inland waters across far north Australia from the Kimberley to Cape York. This species is rarely seen far from water. It is often seen basking on branches overhanging water or on rocks in the middle of streams.	**Unlikely** – This species has been recorded ~2 km east of the Project area twice in 12 years of fauna surveys. However, habitat analysis has determined this species to be unlikely to occur within this area.
Plains Death Adder (*Acanthophis hawkei*)	V	V	PMST	Not well described. Primarily known from flat, treeless plains of Barkly Tableland where it is associated with Mitchell grasses and deep cracking soils. Taxonomic uncertainty and extreme morphological similarity make correct species identification difficult. (Wilson & Swan, 2021)	**Unlikely** – No records exist within a 50 km buffer from a central point within the Project area. The site is likely unsuitable habitat as this species favours habitat that is flat, while the site is geographically complex.

[1]NC ACT Status – Nature Conservation Act (1992) Status. LC – Least Concern, SL – Special Least Concern, NT – Near Threatened, V – Vulnerable, E – Endangered, CR – Critically Endangered.

[2]EPBC Status – Environment Protection and Biodiversity Conservation Act (1999) Status. V – Vulnerable, E – Endangered, CE – Critically Endangered, NL – Not Listed, M – Migratory, Ma - Marine.

[3]50 km search radius around central coordinate for records in: PMST – EPBC Act Protected Matters Report; WO – Wildlife Online Database, ALA – Atlas of Living Australia, Flightpath Modelling – WTS, 2023. 2 km search radius around central coordinate for: MPH – Modelled Potential Habitat layer in Qspatial.

[4]Number of species for each group

Migratory Species

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
Asian Dowitcher (*Limnodromus semipalmatus*)	SL	M, Ma	EAA Flyway, Flightpath modelling	A large migratory wader that breeds in isolated colonies in central and eastern Siberia, Mongolia, and north-east China. The species is a regular visitor to the north-west between Port Hedland and Broome. Elsewhere they are sporadic and rare. They occur in sheltered coastal environments, such as embayments, coastal lagoons, estuaries, and tidal creeks (Higgins & Davies, 1996).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area. The species is a regular visitor to the north-west of Australia between Port Hedland and Broome. Elsewhere they are sporadic and rare.
Bar-tailed Godwit (*Limosa lapponica*)	E	E, M, Ma	EAA Flyway, Flightpath modelling	A large, primarily coastal migratory wader rarely found inland. However, some inland records suggest there is some passage overland and there are records at Lake Moondarra, approximately 70 km southwest of the Project area (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area, and records at Lake Moondarra, indicate there is a possibility for this species to occur, likely transiently if at all, within the Project area.
Black-tailed Godwit (*Limosa limosa*)	E	E, M, Ma	EAA Flyway, Flightpath modelling	A large, migratory wader that inhabits both coastal and inland wetlands. Birds travelling south from northern Australia often pass through the Mt Isa region and there are several records of birds congregating at Lake Moondarra, approximately 70 km southwest of the Project area, as well as records at Rifle Creek Dam (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area, and records at Lake Moondarra and Rifle Creek Dam, indicate there is a possibility for this species to occur, likely transiently if at all, within the Project area.

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
Broad-billed Sandpiper (*Limicola falcinellus*)	SL	M, Ma	EAA Flyway, Flightpath modelling	A small, primarily coastal migratory wader rarely recorded inland. There are no records in the vicinity of the Project area (ALA, 2023).	**Possible*** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.
Caspian tern (*Hydroprogne caspia*)	SL	M, Ma	EAA Flyway, ALA, Flightpath modelling	A large part-migratory to migratory species of tern with a cosmopolitan distribution. In Australia, this species is primarily coastal, though travels inland to visit large bodies of water (Pizzey and Knight, 2012).	**Possible** – within a 50 km buffer from a central point within the Project area, the Caspian tern has 15 records. The Project area has no large bodies of water that are suitable for the species, however, the species may use the Project area temporarily while in transit between waterholes.
Common greenshank/ greenshank (*Tringa nebularia*)	E	E, M, Ma	PMST, ALA, EAA Flyway	Inhabits mudflats, estuaries, saltmarshes, lake and pond margins, wetlands. Generally found in coastal environments, but present inland where habitat is suitable. Widespread summer migrant, with some overwintering. (Pizzey and Knight, 2012).	**Possible** – four records exist within a 50 km buffer from a central point within the Project area. The habitat on Project area is largely unsuitable due to the lack of permanent water sources, however the species may be a temporary resident.
Common Redshank (*Tringa totanus*)	SL	M, Ma	EAA Flyway	A stout migratory wader that breeds in Iceland, the British Isles, and Scandinavia and spends the non-breeding season in Asia, primarily China, Australasia, Australia, and some Pacific islands (Higgins & Davies, 1996). In Australia, the Common Redshank has been recorded at scattered locations.	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
				In Queensland, the species is known to occur in the Cairns district.	
Common Sandpiper (*Actitis hypoleucos*)	SL	M, Ma	EAA Flyway	A small sandpiper that is found along all coastlines of Australia and in many areas inland, it is widespread in small numbers. When in Australia, populations are concentrated in northern and west Australia (Higgins and Davies, 1996). They typically occur in sandy, pebbly, or muddy edges of streams or rivers, either coastal or inland (Pizzey & Knight, The Field Guide to the Birds of Australia, 2012).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Common Tern (*Sterna hirundo*)	SL	M, Ma	EAA Flyway	A medium-sized slender sea-tern that breeds in North America and Eurasia. They are a non-breeding migrant to Australia, where they are widespread and common on the eastern coast south to eastern Victoria, and common on parts of the northern coast, mainly east of Darwin. In Australia, they are recorded in all marine zones, but are commonly observed in near-coastal waters, both on ocean beaches, platforms, and headlands and in sheltered waters (Higgins & Davies, 1996).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Curlew sandpiper (*Calidris ferruginea*)	CR	CE, M, Ma	ALA, PMST, Flightpath modelling	Usually inhabits intertidal mudflats, such as lagoons, bays, estuaries, inlets etc. Recorded less often inland around permanent and ephemeral water sources such as dams, ponds, lakes, waterholes. Inland records are sparse. (Pizzey and Knight, 2012) (DAWE, 2022d).	**Possible** – Two records exist within a 50 km radius of the Project area; they are located approximately 40 km southwest of the Project area. A very small percentage of the Project area would be considered suitable habitat, furthermore due to the seasonal and ephemeral nature of the waterholes, it is unlikely that it would be used as habitat for the species. The species may use the Project area

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
					temporarily while in transit between waterholes.
Double-banded Plover (*Charadrius bicinctus*)	SL	M, Ma	EAA Flyway	A medium-sized dotterel that is generally found in pairs during the breeding season but are gregarious in the non-breeding season. The Double-banded Plover breeds only in New Zealand, where it is widespread. During the non-breeding season, it is common in eastern and southern Australia, mainly between the Tropic of Capricorn and western Eyre Peninsula, with occasional records in northern Queensland and Western Australia (Marchant & Higgins, 1993). They are found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands, and pasture.	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Eastern Curlew (*Numenius madagascariensis*)	E	CE, M, Ma	EAA Flyway	Within Australia, the eastern curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Eastern curlews are rarely recorded inland. They have a continuous distribution from Barrow Island and Dampier Archipelago, Western Australia, through the Kimberley and along the Northern Territory, Queensland, and NSW coasts and the islands of Torres Strait. They are patchily distributed elsewhere (Department of the Environment, 2015).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area. Eastern curlews are rarely recorded inland.
Fork-tailed swift (*Apus pacificus*)	SL	M, Ma	PMST	Widespread across Australia. Scattered records from throughout the Gulf of Carpentaria and Cape York. Almost exclusively aerial, have been recorded in most habitats across Australia (Pizzey and Knight, 2012).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Glossy ibis (*Plegadis falcinellus*)	SL	M, Ma	ALA	Prefers well-vegetated wetlands, floodplains, irrigated pastures, sewage ponds, mangroves, mudflats, and the like. Occasionally occurs in dry grasslands. The migratory and nomadic species	**Known*** – 14 records exist within a 50 km radius of the Project area. Most of the occurrences are proximal to

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
				breeds in southern Australia between October to December and in north Australia between February to April. Range may extend far inland after good rains. (Pizzey and Knight, 2012).	water sources, due to the lack of permanent water sources on Project area, the species may be less likely to frequent the Project area.
Great Knot (*Calidris tenuirostris*)	CE	CE, M, Ma	EAA Flyway, Flightpath modelling	The largest of its genus. A migratory bird that breeds in Siberia and spends the non-breeding season in Australia. Recorded primarily around coastal wetlands with sparse scattered inland records, usually on inland lakes (Garnett, Szabo, & Dutson, The Action Plan for Australian Birds 2010, 2011).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.
Greater Sand Plover (*Charadrius leschenaultii*)	V	V, M, Ma	EAA Flyway, Flightpath modelling	A medium-sized migratory plover that breeds in Asia and migrates to Australia and some western-pacific islands for the non-breeding season. They are primarily coastal, arriving in northern Australia and dispersing around the country. The scarcity of inland records suggests that movements to southern and eastern areas in Australia occur around the coastline rather than across the continent (Bamford, 1988) (Blakers, Davies, & Reilly, 1984) (Lane, 1987) (Sibson, 1948) (Stewart, Rogers, & Rogers, 2007). However, there is a single record in the vicinity of the Project area at Lake Moondarra, approximately 70 km southwest of the Project area (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.
Grey Plover (*Pluvialis squatarola*)	V	V, M, Ma	EAA Flyway, Flightpath modelling	A medium-sized migratory plover that breeds in the far northern hemisphere and spends the non-breeding season on the coasts of America, southern Europe, Africa, southern Asia, and Australia (Cramp & Simmons, 1983) (de Schauensee, 1970) (de Schauensee, The Birds of China, 1984) (Grimmett, Inskipp, & Inskipp, 1999b) (Orn. Soc. Japan, 2000) (Urban, Fry, & Keith, 1986) (Wiersma, 1996). In	**Possible** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
				Australia, Grey Plovers occur almost entirely in coastal areas, however there are records of overland movement. There is a single record in the vicinity of the Project area at Lake Moondarra, approximately 70 km southwest of the Project area (ALA, 2023).	
Grey-tailed Tattler (*Tringa brevipes*)	SL	M, Ma	EAA Flyway, Flightpath modelling	A medium-sized migratory wader that breeds in the northern hemisphere, specifically north Siberia, and migrates south to Australia for the boreal winter. In Australia, the species is found in most coastal regions, primarily along the northern coast. There are rare inland records, including Burdekin Weir, Charters Towers and Mount Isa. There are no records in the vicinity of the Project area (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.
Grey Wagtail (*Motacilla cinerea*)	SL	M, Ma	PMST	Distribution suggests this species favours coastal regions with higher rainfall. Typically found near running water in sandy or rocky streams in escarpments and rainforests, sometimes in disused quarries. Also found near sewage ponds, agricultural/cropping areas, and airfields (Pizzey and Knight, 2012).	**Unlikely -** no records exist within a 50 km buffer from a central point within the Project area. The nearest record is over 600 km away, on the coast.
Gull-billed Tern (*Gelochelidon nilotica*)	SL	M, Ma	EAA Flyway	A medium-sized, stocky tern. Preferred habitat includes beaches, mudflats, fresh and brackish wetlands including far inland grasslands, crops, ploughed fields and airfields (Pizzey & Knight, The Field Guide to the Birds of Australia, 2012). Breeding occurs in September–May usually in small colonies on islands.	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Latham's snipe (*Gallinago hardwickii*)	V	V, M, Ma	PMST	Typically inhabits soft wet ground, including shallow waters with vegetation and wet parts of paddocks, seepage, irrigation, and similar habitats. Mostly found in coastal regions of eastern Australia but exhibits strong inland movements in certain areas (Pizzey and Knight, 2012).	**Possible** – Two records are located within a 50 km buffer from a central point within the Project area, they are located approximately 40 km southwest of Project area.

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
					The Project area may contain potential habitat.
Lesser Sand Plover (*Charadrius mongolus*)	E	E, M, Ma	ALA, EAA Flyway, Flightpath modelling	Two Lesser Sand Plover subspecies migrate to Australia for the boreal winter. In Australia, this species is present in coastal regions in all states but are most common in northern and eastern Australia. They are rarely recorded inland; however, they have been recorded at margins of lakes and soaks and swamps associated with artesian bores (Marchant & Higgins, 1993). Within the vicinity of the Project area, there are three records around Mt Isa City (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area, and records around Mt Isa City, indicate there is a possibility for this species to occur transiently within the Project area.
Little curlew (*Numenius minutus*)	SL	M, Ma	EAA Flyway	A small migratory curlew that breeds in Siberia, and generally spends the non-breeding season in northern Australia from Port Hedland, WA to the Queensland coast. They are widespread in coastal regions with some inland records. In the vicinity of the Project area, they are known to congregate at Lake Moondarra, approximately 70 km southwest of the Project area, and there are records scattered in and around Mt Isa City (ALA, 2023).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Little Ringed Plover (*Charadrius dubius*)	SL	M, Ma	EAA Flyway	A small delicately built plover that breeds on stony substrates around lakes, gravel pits, and along rivers. Migrants occur in wide variety of fresh and brackish wetland habitats, but rarely out on open tidal areas (Sullivan, et al., 2009).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Little Tern (*Sterna albifrons*)	SL	M, Ma	Flightpath modelling	A small, slender tern that breeds overseas and in Australia. In Australia there are three distinct populations of Little Tern: two breeding populations in northern and eastern Australia and one non-breeding population that migrates from breeding grounds in Asia to avoid the winter. They are associated with sheltered coastal environments.	**Possible*** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
				There are no records of this species in the vicinity of the Project area (ALA, 2023).	
Long-toed Stint (*Calidris subminuta*)	SL	M, Ma	EAA Flyway	A very small migratory sandpiper that is believed to breed in Siberia and is a regular summer visitor to Australia, but uncommon in the east. In Australia, the Long-toed Stint occurs in a variety of terrestrial wetlands. They prefer shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds. They have been recorded at Mount Isa (Higgins & Davies, 1996).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Marsh sandpiper (*Tringa stagnatilis*)	SL	M, Ma	ALA, Flightpath modelling	A medium-sized migratory sandpiper often found singly or in small to large flocks. They are a non-breeding visitor to Australia, where they are found on coastal and inland wetlands around the country. In the vicinity of the Project area, they are known to congregate at Lake Moondarra, approximately 70 km southwest of the Project area, and there are abundant records in and around Mt Isa City, as well as at Corella Dam and Chinaman Dam (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area, and records at Late Moondarra, Corella Dam, Chinaman Dam, and around Mt Isa City, indicate there is a possibility for this species to occur within the Project area.
Oriental Plover (*Charadrius veredus*)	SL	M, Ma	PMST	Inland swamps or wetlands, may venture far from water into open plains or bare country (Pizzey & Knight, 2012).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Oriental Pratincole (*Glareola maldivarum*)	SL	M, Ma	PMST, EAA Flyway	A tern-like shorebird with long, pointed wings and a forked tail (Department of Climate Change, Energy, the Environment and Water., 2023). This species generally migrates to Australia from Nov-Feb, and inhabits plains, shallow edges of wetlands, mudflats, beaches. Nomadic, follows rainfall, appearing in large companies before moving on.	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
Pacific Golden Plover (*Pluvialis fulva*)	SL	M, Ma	EAA Flyway, Flightpath modelling	A medium-sized migratory plover often found in flocks of 20-50 birds (Marchant & Higgins, 1993). They breed in northern Siberia and Alaska, and spend the non-breeding season in Asia, Australia, and Polynesia (Grimmett, Inskipp, & Inskipp, 1999b) (de Schauensee, 1984). They are common in coastal regions in all states, though there are also inland records in all states often along major river systems. In the vicinity of the Project area, there are several records at Lake Moondarra, approximately 70 km southwest of the Project area, and in and around Mt Isa City (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area, and records at Late Moondarra and around Mt Isa City, indicate there is a possibility for this species to occur within the Project area.
Pectoral Sandpiper	SL	Ma	EAA Flyway	A small to medium sized sandpiper characterised by a flat back and a plump body that tapers to a drawn-out rear end (Higgins & Davies, 1996). Typically, they inhabit shallow fresh water, often with grasses or other herbage. Associated with swamp margins, flooded agricultural land, tidal areas, saltmarshes. Regular but uncommon summer migrant. (Pizzey & Knight, The Field Guide to the Birds of Australia, 2012). In Queensland, most records occur around Cairns with scattered records elsewhere including a few inland records around Mt Isa.	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Red Knot (*Calidris canutus*)	E	E, M, Ma	EAA Flyway, Flightpath modelling	A robust small to medium-sized migratory wader that breeds in the Arctic and migrates to non-breeding areas that extend to south America, Africa, and Australasia (del Hoyo, Elliott, & Sargatal, 1996). They are primarily coastal and mainly inhabit intertidal mudflats, sandflats, and sandy beaches of sheltered coasts. There is evidence of some overland movement, however there are no records in the vicinity of the Project area (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.
Red-necked Phalarope (*Phalaropus lobatus*)	SL	M, Ma	EAA Flyway	A distinctive marine wader that is the smallest of its family. One of the only waders occurring regularly at sea. They mainly winter at sea around the tropics but	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
				are occasionally seen on coastal and inland wetlands (Higgins & Davies, 1996). In Queensland the species has been found at Lake Moondarra, Mount Isa, Hood's Lagoon and Helidon.	central point within the Project area..
Red-necked Stint (*Calidris ruficollis*)	SL	M, Ma	ALA, EAA Flyway, Flightpath modelling	The smallest shorebird in Australia. They breed in Siberia and Alaska and migrate to Australasia, primarily Australia, for the Boreal winter (Higgins & Davies, 1996). In Australia, they are found mainly on the coast in sheltered inlets, bays, lagoons, and estuaries with intertidal mudflats, and can also occur on near coastal or inland ephemeral or permanent shallow wetlands. They often move overland and there are several records within the vicinity of the Project area at Lake Moondarra, approximately 70 km southwest of the Project area, in and around Mt Isa City, at Chinaman Dam, and in Cloncurry (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area, and records at Lake Moondarra, Chinaman Dam, and around Mt Isa City and Cloncurry, indicate there is a possibility for this species to occur within the Project area.
Ruddy Turnstone (*Arenaria interpres*)	V	V, M, Ma	EAA Flyway, Flightpath modelling	A stocky medium-sized wader that breeds in coastal Europe, Asia, and North America. Their non-breeding distribution is almost cosmopolitan, they are common throughout Australasia and are widespread in Australia (Higgins & Davies, 1996). In Australia, they are found in most coastal regions with exposed rock coastlines or coral reefs, with occasional records of inland populations in habitats such as riverbeds, and on inland lakes and adjacent farmland (Higgins & Davies, 1996). In the vicinity of the Project area, there are several records at Lake Moondarra, approximately 70 km southwest of the Project area (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area, and records at Lake Moondarra, indicate there is a possibility for this species to occur within the Project area.

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
Ruff (*Philomachus pugnax*)	SL	M, Ma	EAA Flyway	A medium-sized wader that breeds in Europe from north Russia to north-west Kazakhstan. They are a rare but regular visitor to Australia, being recorded in all States and Territories. In Australia the Ruff is found on generally fresh, brackish of saline wetlands with exposed mudflats at the edges. It is found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and flood lands.	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Sanderling (*Calidris alba*)	SL	M, Ma	EAA Flyway, Flightpath modelling	A migratory sandpiper typically found in small to large flocks, sometimes in the hundreds. They breed in the northern hemisphere, specifically in northern North America, northern Russia, and islands in the Arctic Ocean. They migrate south to spend the non-breeding season on sandy coastal shores of all continents except Antarctica. They are mainly coastal, however there are rare records of birds stopping inland on sandy shores of ephemeral brackish lakes or river-pools (Higgins & Davies, 1996). There are no records of the species in the vicinity of the Project area (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.
Sharp-tailed sandpiper (*Calidris acuminata*)	V	V, M, Ma	ALA, EAA Flyway	Species typically inhabits tidal mudflats, saltmarshes, mangroves, wetlands, floodwater, irrigated agricultural land, ponds. Strong association with water. Widespread summer migrant to coastal and inland Australia (Pizzey and Knight, 2012).	**Possible** – Within a 50 km buffer from a central point within the Project area, three records exist within the ALA database. The Project area has several small, ephemeral waterholes that the species could potentially utilize.
Short-tailed Shearwater (*Ardenna tenuirostris*)	SL	M, Ma	EAA Flyway	A medium-sized shearwater that is common in the Pacific Ocean, especially around Australia, New Zealand and up to the Bering Sea. Can be abundant in ocean waters off Alaska, gathering in enormous flocks; less common further south (Sullivan, et al., 2009).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
Swinhoe's Snipe (*Gallinago megala*)	SL	M, Ma	EAA Flyway	Very similar in morphology to Latham's snipe (*Gallinago hardwickii*). Swinhoe's Snipe breeds in central and southern Siberia. Few definite records exist for Swinhoe's Snipe in Australia. The species has been recorded in the north between the Kimberley Divide and Cape York Peninsula. During the non-breeding season Swinhoe's Snipe occurs at the edges of wetlands, such as wet paddy fields, swamps, and freshwater streams. The species is also known to occur in grasslands, drier cultivated areas (including crops of rapeseed and wheat) and market gardens (Higgins & Davies 1996).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Terek Sandpiper (*Xenus cinereus*)	V	V, M, Ma	EAA Flyway, Flightpath modelling	A small migratory wader that breeds in the northern hemisphere, specifically Russia, Ukraine, Finland, and northern Estonia. They migrate south for the boreal winter, occurring in coastal Africa, throughout southern Asia from the Persian Gulf east to Japan, Indomalaya and Indochina, New Guinea, Australia, and New Zealand (Marchant & Higgins, 1993). Approximately 1/8th of the global population spends the non-breeding season in Australia (Geering A, 2007). They are associated with coastal areas and prefer mangroves for roosting and soft wet intertidal mudflats or sheltered estuaries, embayments, harbors or lagoons for foraging (Marchant & Higgins, 1993). Inland records suggest there is some overland migration (Blakers, Davies, & Reilly, 1984). There is a single record in the vicinity of the Project area at Lake Moondarra, approximately 70 km southwest of the Project area (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area, and records at Lake Moondarra, indicate there is a possibility for this species to occur within the Project area.
Wandering Albatross (*Diomedea exulans*)	V	V, M, Ma	EAA Flyway	A large migratory bird with the longest wing-span of any ocean bird (2.5-3.5m). They are solitary or gregarious at sea. It breeds in colonies (Marchant & Higgins, Handbook of Australian, New Zealand and Antarctic Birds. Volume One - Ratites to Ducks,	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
				1990). The Wandering Albatross has a circumpolar distribution. It breeds on six subantarctic island groups (Marchant & Higgins, 1990). In the Australasian region, it occurs inshore, offshore and in pelagic waters (Barton, 1979).	central point within the Project area.
Whimbrel (*Numenius phaeopus*)	SL	M, Ma	EAA Flyway, Flightpath modelling	A medium-sized migratory curlew that breeds in the northern hemisphere, mainly in Alaska but has also been observed breeding across northern Europe into Russia. They migrate south for the boreal winter and can occur through Central and South America, coastal Africa, the Persian Gulf, south-east Asia, New Guinea, Micronesia, Melanesia, Polynesia, and Australia. Only one subspecies, *Numenius phaeopus variegates*, occurs in the East Asian-Australasian Flyway. In Australia, Whimbrels are often found on the intertidal mudflats of sheltered coasts or harbors. Inland records suggest there is some overland movement, however there are no records of the Whimbrel in the vicinity of the Project area (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.

Common Name (*Scientific Name*)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
White-winged Black Tern (*Chlidonias leucopterus*)	SL	M, Ma	EAA Flyway	A slender, compact migratory marsh tern that breeds in a wide range in the northern hemisphere, from Italy through Russia to Eastern China. The species migrates south for the boreal winter, occurring in sub-Saharan Africa, southern Asia, Indonesia, New Guinea, Australia, and New Zealand. Within Australia, White-winged Black Terns are common along most coastal areas except the south-east. They are commonly found on tidal wetlands and rarely on inland wetlands such as lakes, billabongs, rivers, floodplains, or reservoirs (Higgins & Davies, 1996) (Gochfeld & Burger, 1996). In the vicinity of the Project area, there are several records on Lake Moondarra and scattered records near Mt Isa City, approximately 70 km southwest of the Project area, at Corella Dam, and at Chinaman Dam near Cloncurry (ALA, 2023).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.
Wood Sandpiper (*Tringa glareola*)	SL	M, Ma	EAA Flyway	A small, thin wader that is seen singly, in pairs or in small flocks. Occasionally they will flock in the hundreds. They associate freely with other waders (Higgins & Davies, 1996). This species is a regular summer (September – April) migrant to northern Australia, however Queensland records are scattered (Pizzey & Knight, 2012). Typical habitat includes well vegetated, shallow, freshwater wetlands such as swamps, billabongs, lakes, pools, and waterholes. They are typically associated with emergent, aquatic plants and areas dominated by taller fringing vegetation. This species will also use artificial wetlands including open sewage ponds, large farm dams and bore drains (Higgins & Davies, 1996).	**Unlikely** - no records or modelled flight paths exist within a 50 km buffer from a central point within the Project area.

[1]NC ACT Status – Nature Conservation Act (1992) Status. LC – Least Concern, SL – Special Least Concern, NT – Near Threatened, V – Vulnerable, E – Endangered, CR – Critically Endangered.

[2]EPBC Status – Environment Protection and Biodiversity Conservation Act (1999) Status. V – Vulnerable, E – Endangered, CE – Critically Endangered, NL – Not Listed, M – Migratory, Ma - Marine.

[3]50 km search radius around central coordinate for records in: PMST – EPBC Act Protected Matters Report; ALA – Atlas of Living Australia; Flightpath Modelling – WTS, 2023; EAA Flyway – East Australasian Flyway.

Migratory Species also listed under the NC Act:

Common Name (Scientific Name)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
Curlew sandpiper (*Calidris ferruginea*)	CR	CE, M, Ma	ALA, PMST, Flightpath modelling	Usually inhabits intertidal mudflats, such as lagoons, bays, estuaries, inlets etc. Recorded less often inland around permanent and ephemeral water sources such as dams, ponds, lakes, waterholes. Inland records are sparse. (Pizzey and Knight, 2012) (DAWE, 2022d).	**Possible** – Two records exist within a 50 km radius of the Project area; they are located approximately 40 km southwest of the Project area. A very small percentage of the Project area would be considered suitable habitat, furthermore due to the seasonal and ephemeral nature of the waterholes, it is unlikely that it would be used as habitat for the species.
Eastern Curlew (*Numenius madagascariensis*)	E	CE, M, Ma	PMST, Flightpath modelling	Within Australia, the eastern curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Eastern curlews are rarely recorded inland. They have a continuous distribution from Barrow Island and Dampier Archipelago, Western Australia, through the Kimberley and along the Northern Territory, Queensland, and NSW coasts and the islands of Torres Strait. They are patchily distributed elsewhere (Department of the Environment, 2015).	**Possible** – Within the ALA database, no records exist within 50 km of the Project area. The species does not often travel inland, and most inland records are proximal to large water sources, which the Project area does not possess. However, due to the presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.
Great Knot (*Calidris tenuirostris*)	CE	CE, M, Ma	Flightpath modelling	The largest of its genus. A migratory bird that breeds in Siberia and spends the non-breeding season in Australia. Recorded primarily around coastal wetlands with sparse scattered inland records, usually on inland lakes (Garnett, Szabo, & Dutson, The Action Plan for Australian Birds 2010, 2011).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.

Common Name (Scientific Name)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
Lesser Sand Plover (*Charadrius mongolus*)	E	E, M, Ma	ALA, Flightpath modelling	Two Lesser Sand Plover subspecies migrate to Australia for the boreal winter. In Australia, this species is present in coastal regions in all states but are most common in northern and eastern Australia. They are rarely recorded inland; however, they have been recorded at margins of lakes and soaks and swamps associated with artesian bores (Marchant & Higgins, 1993). Within the vicinity of the Project area, there are three records around Mt Isa City (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area, and records around Mt Isa City, indicate there is a possibility for this species to occur within the Project area.
Red Knot (*Calidris canutus*)	E	E, M, Ma	Flightpath modelling	A robust small to medium-sized migratory wader that breeds in the Arctic and migrates to non-breeding areas that extend to south America, Africa, and Australasia (del Hoyo, Elliott, & Sargatal, 1996). They are primarily coastal and mainly inhabit intertidal mudflats, sandflats, and sandy beaches of sheltered coasts. There is evidence of some overland movement, however there are no records in the vicinity of the Project area (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur transiently within the Project area, despite the lack of nearby records.
Wandering Albatross (*Diomedea exulans*)	V	V, M, Ma	Flightpath modelling	A large migratory bird with the longest wing-span of any ocean bird (2.5-3.5m). They are solitary or gregarious at sea. It breeds in colonies (Marchant & Higgins, Handbook of Australian, New Zealand and Antarctic Birds. Volume One - Ratites to Ducks, 1990). The Wandering Albatross has a circumpolar distribution. It breeds on six subantarctic island groups (Marchant & Higgins, 1990). In the Australasian region, it occurs inshore, offshore and in pelagic waters (Barton, 1979).	**Unlikely** - no records or modelled flight paths exist within a 50 km radius of the Project area.

Common Name (Scientific Name)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
Sharp-tailed sandpiper (*Calidris acuminata*)	V	V, M, Ma	ALA, EAA Flyway	Species typically inhabits tidal mudflats, saltmarshes, mangroves, wetlands, floodwater, irrigated agricultural land, ponds. Strong association with water. Widespread summer migrant to coastal and inland Australia (Pizzey and Knight, 2012).	**Possible** – Within a 50 km buffer from a central point within the Project area, three records exist within the ALA database. The Project area has several small, ephemeral waterholes that the species could potentially utilize.
Latham's snipe (*Gallinago hardwickii*)	V	V, M, Ma	PMST	Typically inhabits soft wet ground, including shallow waters with vegetation and wet parts of paddocks, seepage, irrigation, and similar habitats. Mostly found in coastal regions of eastern Australia but exhibits strong inland movements in certain areas (Pizzey and Knight, 2012).	**Possible** – Two records are located within a 50 km buffer from a central point within the Project area, they are located approximately 40 km southwest of Project area. The Project area may contain potential habitat.
Bar-tailed Godwit (*Limosa lapponica*)	E	E, M, Ma	EAA Flyway, Flightpath modelling	A large, primarily coastal migratory wader rarely found inland. However, some inland records suggest there is some passage overland and there are records at Lake Moondarra, approximately 70 km southwest of the Project area (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area, and records at Lake Moondarra, indicate there is a possibility for this species to occur, likely transiently if at all, within the Project area.
Black-tailed Godwit (*Limosa limosa*)	E	E, M, Ma	EAA Flyway, Flightpath modelling	A large, migratory wader that inhabits both coastal and inland wetlands. Birds travelling south from northern Australia often pass through the Mt Isa region and there are several records of birds congregating at Lake Moondarra, approximately 70 km southwest of the Project area, as well as records at Rifle Creek Dam (ALA, 2023).	**Possible** – The presence of modelled flight paths in the vicinity of the Project area, and records at Lake Moondarra and Rifle Creek Dam, indicate there is a possibility for this species to occur, likely transiently if at all, within the Project area.
Grey Plover (*Pluvialis squatarola*)	V	V, M, Ma	EAA Flyway, Flightpath modelling	A medium-sized migratory plover that breeds in the far northern hemisphere and spends the non-breeding season on the coasts of America, southern Europe, Africa, southern Asia, and Australia (Cramp & Simmons,	**Possible** – The presence of modelled flight paths in the vicinity of the Project area indicates there is a possibility for this species to occur

Common Name (Scientific Name)	Status		Source[3]	Description and Ecology	Likelihood of Occurrence
	NC ACT[1]	EPBC[2]			
				1983) (de Schauensee, 1970) (de Schauensee, The Birds of China, 1984) (Grimmett, Inskipp, & Inskipp, 1999b) (Orn. Soc. Japan, 2000) (Urban, Fry, & Keith, 1986) (Wiersma, 1996). In Australia, Grey Plovers occur almost entirely in coastal areas, however there are records of overland movement. There is a single record in the vicinity of the Project area at Lake Moondarra, approximately 70 km southwest of the Project area (ALA, 2023).	transiently within the Project area, despite the lack of nearby records.
Common greenshank/ greenshank (*Tringa nebularia*)	E	E, M, Ma	PMST, ALA, EAA Flyway	Inhabits mudflats, estuaries, saltmarshes, lake and pond margins, wetlands. Generally found in coastal environments, but present inland where habitat is suitable. Widespread summer migrant, with some overwintering. (Pizzey and Knight, 2012).	**Possible** – four records exist within a 50 km buffer from a central point within the Project area. The habitat on Project area is largely unsuitable due to the lack of permanent water sources, however the species may be a temporary resident.

[1]NC ACT Status – Nature Conservation Act (1992) Status. LC – Least Concern, SL – Special Least Concern, NT – Near Threatened, V – Vulnerable, E – Endangered, CR – Critically Endangered.

[2]EPBC Status – Environment Protection and Biodiversity Conservation Act (1999) Status. V – Vulnerable, E – Endangered, CE – Critically Endangered, NL – Not Listed, M – Migratory, Ma - Marine.

[3]50 km search radius around central coordinate for records in: PMST – EPBC Act Protected Matters Report; WO – Wildlife Online Database, ALA – Atlas of Living Australia, Flightpath Modelling – WTS, 2023 (APPENDIX F). 2 km search buffer around central coordinate for: MPH – Modelled Potential Habitat layer in Qspatial.

APPENDIX F: Spatial Analysis of Migratory Bird Flight Paths

Figure 1: Asian Dowitcher - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Asian Dowitcher



Client: Minerals and Metals Group
Project number: 2023.03001
CRS: WGS 84 EPSG:4326
Date: 6 December 2023

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Figure 2: Bar-tailed Godwit - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Bar-tailed godwit records
- Bar-tailed Godwit

Dugald River Mine Leases

200 0 200 400 km

1:10,000,000

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Project number: 2023.03001
CRS: WGS 84 EPSG:4326
Date: 6 December 2023

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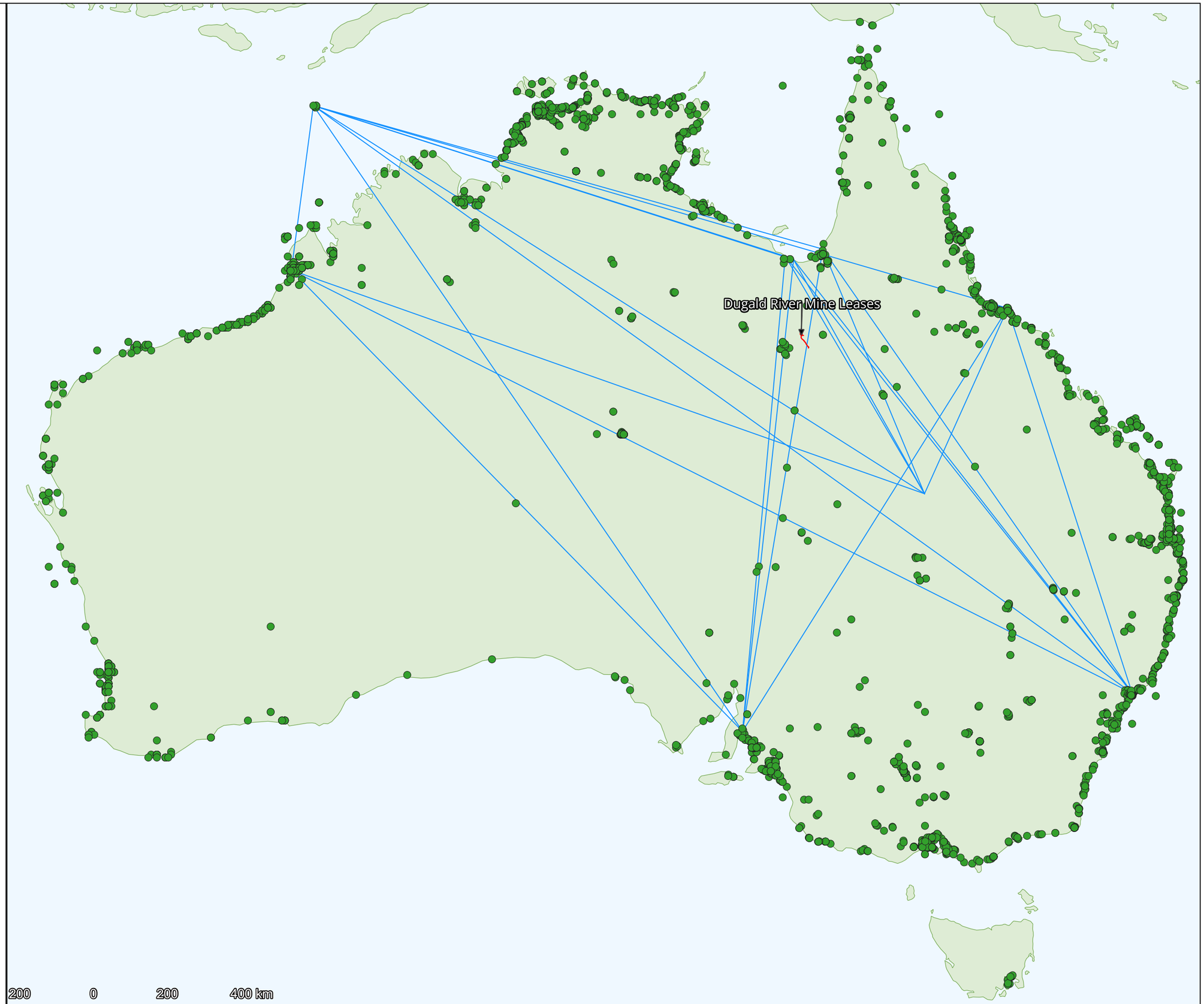
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Figure 3: Black-tailed Godwit - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Black-tailed Godwit Records
- Black-tailed Godwit



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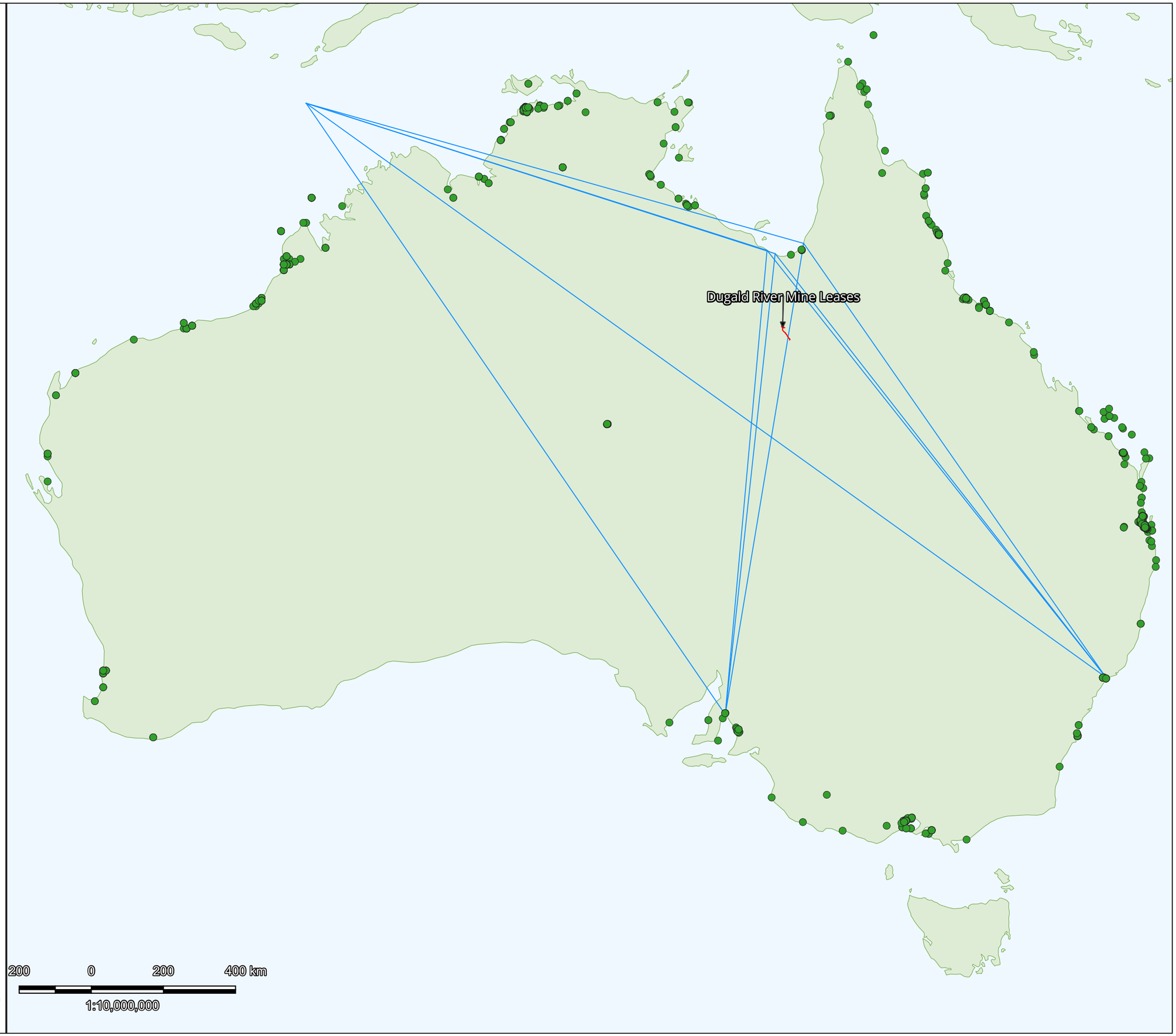
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Figure 4: Broad-billed Sandpiper - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Broad-billed Sandpiper Records
- Broad-billed Sandpiper



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Figure 5: Caspian Tern - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Caspian Tern



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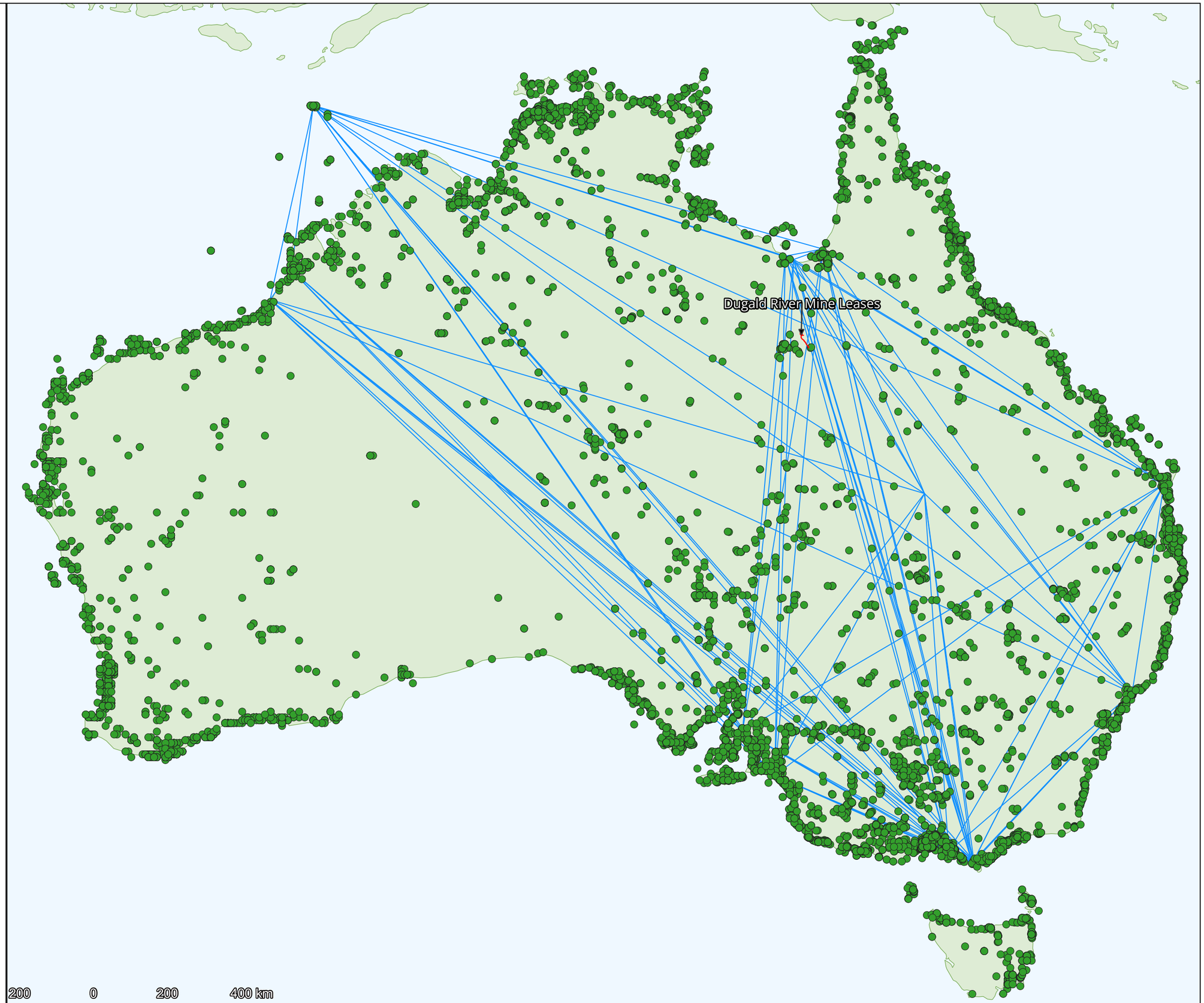
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Figure 6. Common Greenshank - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Common Greenshank Records
- Common Greenshank



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Figure 7. Common Redshank - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Common Redshank



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Figure 8. Common Sandpiper - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Common Sandpiper



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Figure 9. Curlew Sandpiper - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Curlew Sandpiper Records
- Curlew Sandpiper

Dugald River Mine Leases

200 0 200 400 km

1:10,000,000

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Figure 10. Double Banded Plover - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Double Banded Plover



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Figure 11. Eastern Curlew - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Eastern Curlew Records
- Eastern Curlew

Dugald River Mine Leases

200 0 200 400 km

1:10,000,000

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Project number: 2023.03001
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Figure 12. Great Knot - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Great Knot Records
- Great Knot

Dugald River Mine Leases

200 0 200 400 km

1:10,000,000

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Project number: 2023.03001
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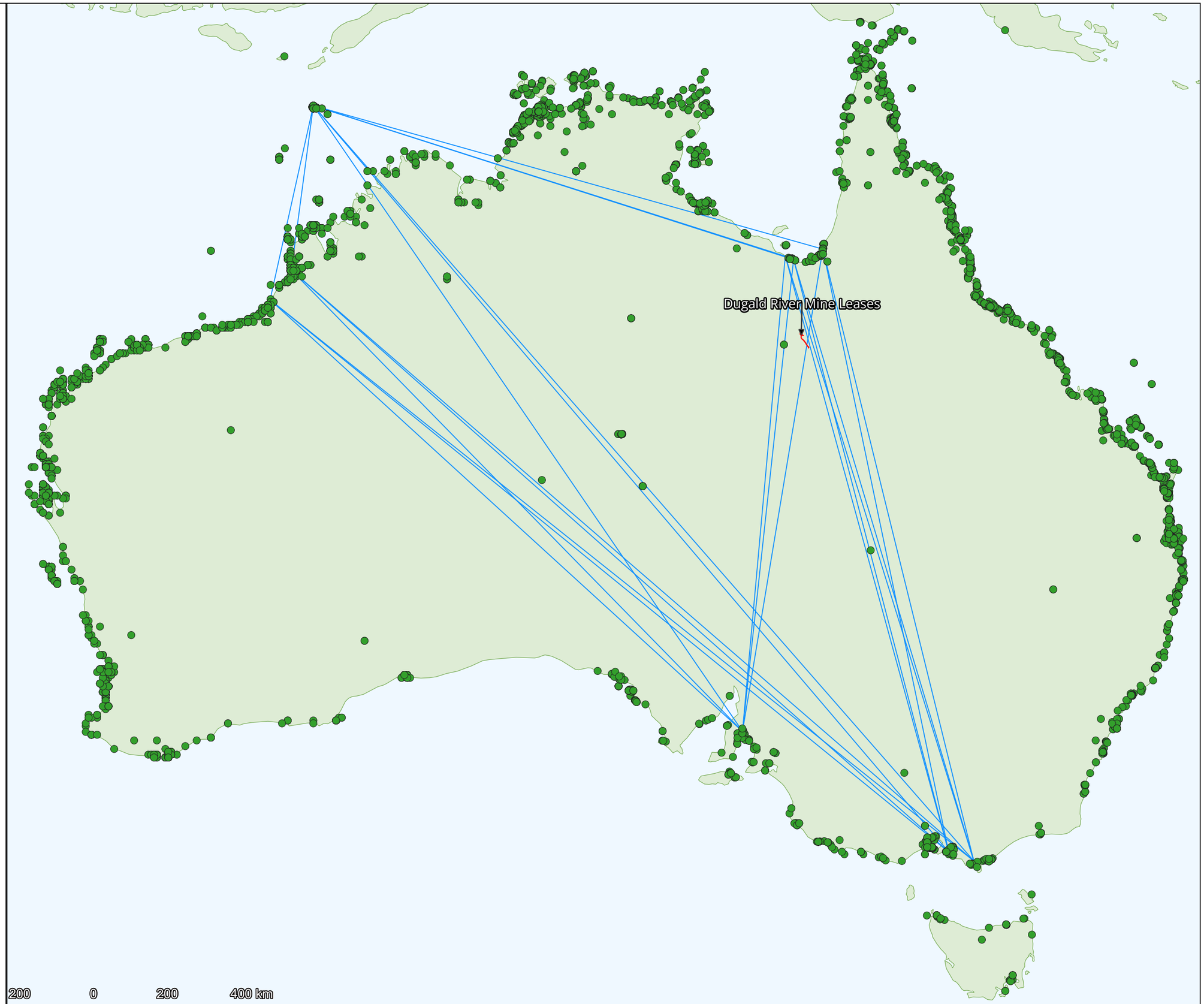
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Figure 13. Greater Sand Plover - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Greater Sand Plover Records
- Greater Sand Plover



Client: Minerals and Metals Group
Project number: 2023.03001
CRS: WGS 84 EPSG:4326
Date: 6 December 2023

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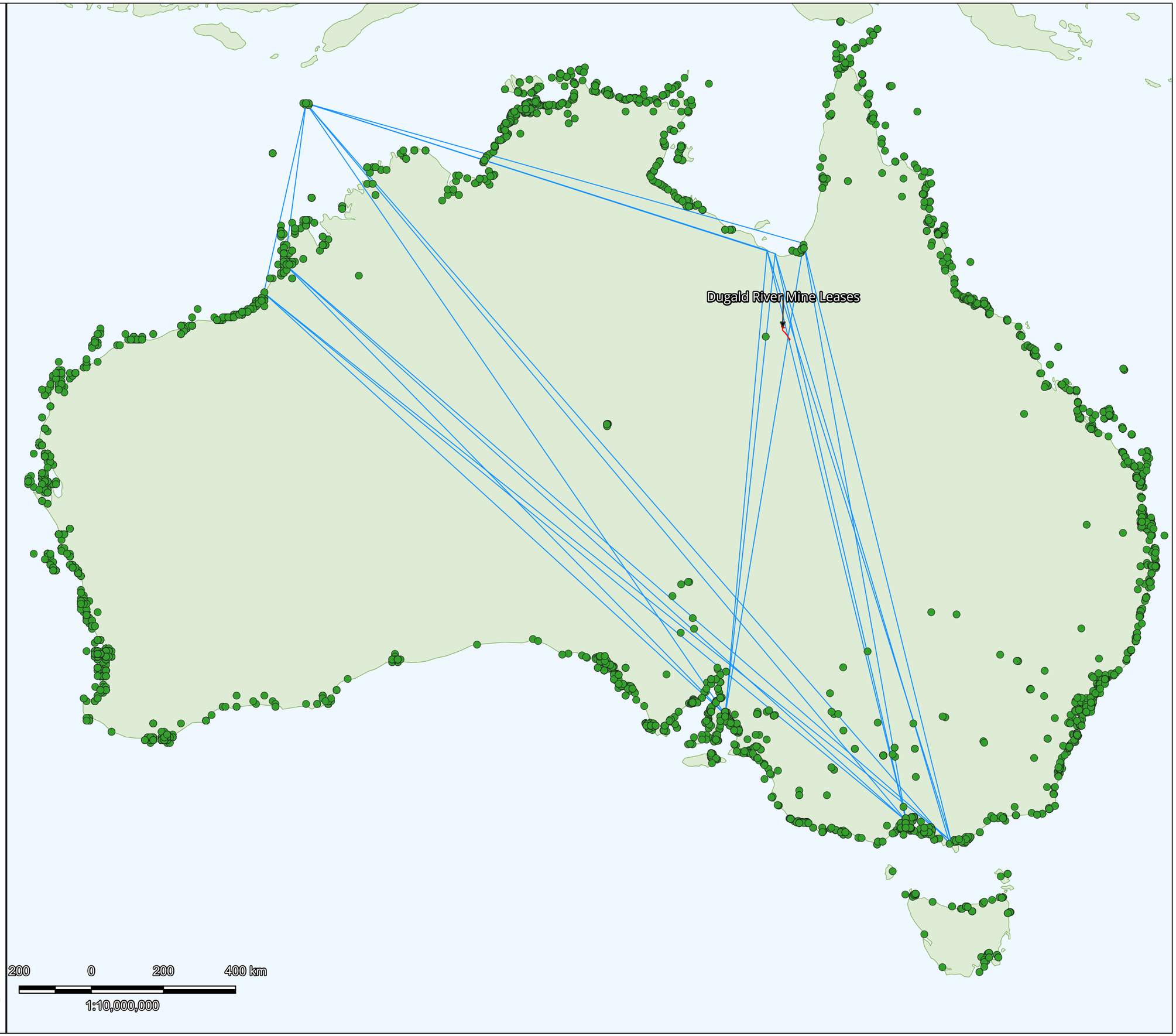
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Figure 14. Grey Plover - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Grey Plover Records
- Grey Plover



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Figure 15. Grey-billed Tattler - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Grey-billed Tattler Records
- Grey-billed Tattler

Dugald River Mine Leases

200 0 200 400 km

1:10,000,000

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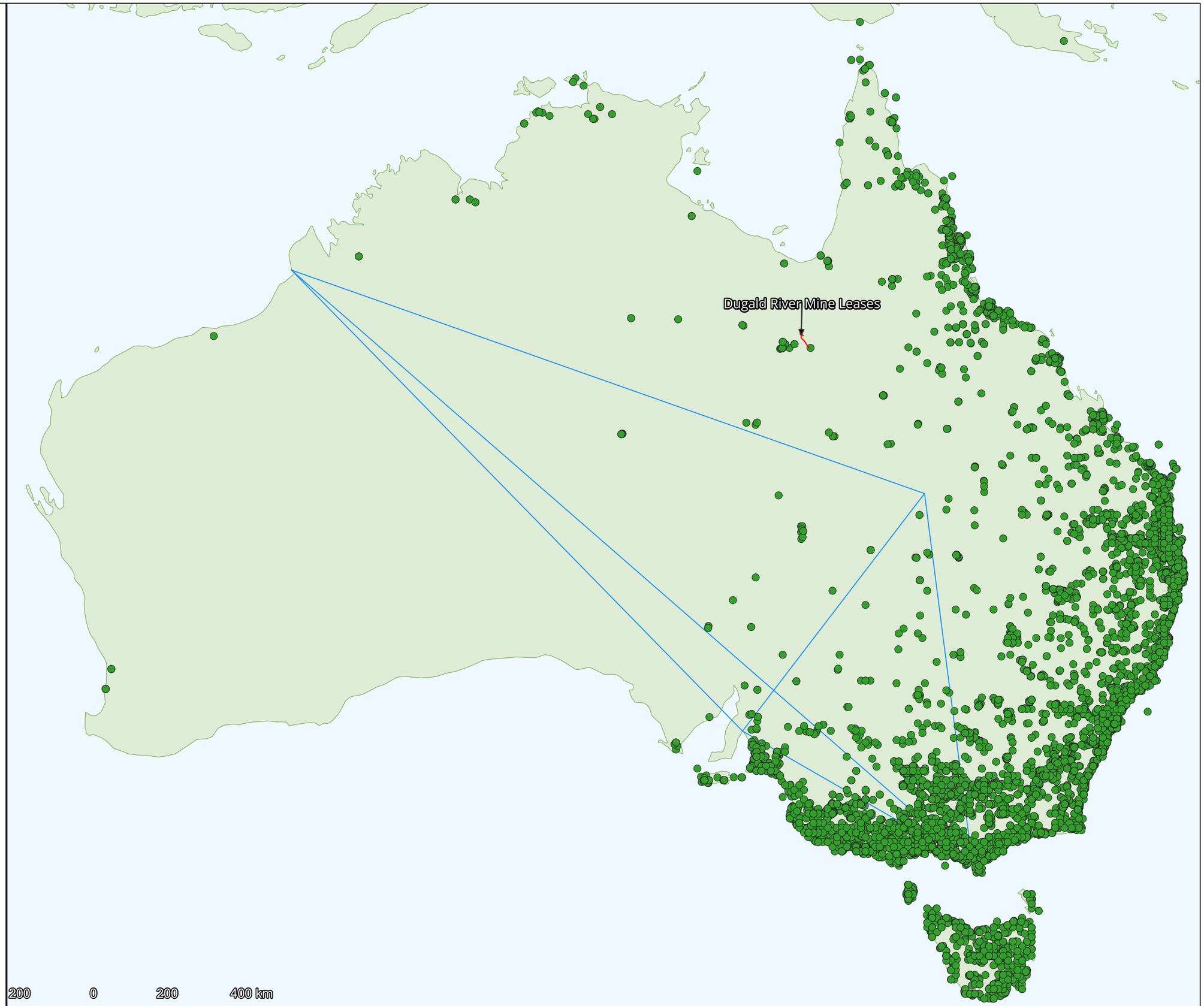
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Figure 16. Latham's Snipe - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Latham's Snipe Records
- Latham's Snipe



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Figure 17. Lesser Sand Plover - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Lesser Sand Plover Records
- Lesser Sand Plover

Dugald River Mine Leases

200 0 200 400 km

1:10,000,000

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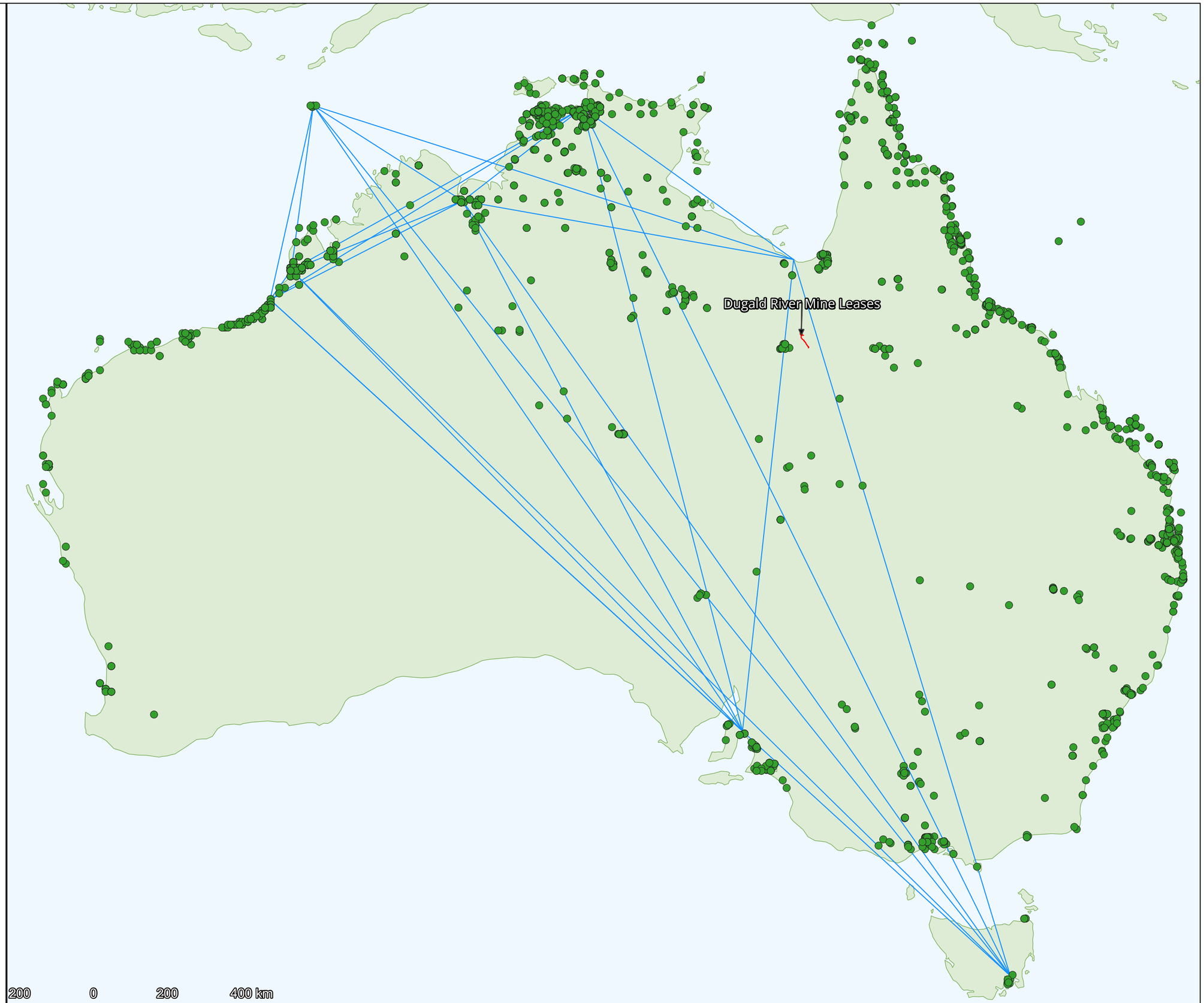
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Figure 18. Little Curlew - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Little Curlew Records
- Little Curlew



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Figure 19. Little Ringed Plover - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Little Ringed Plover



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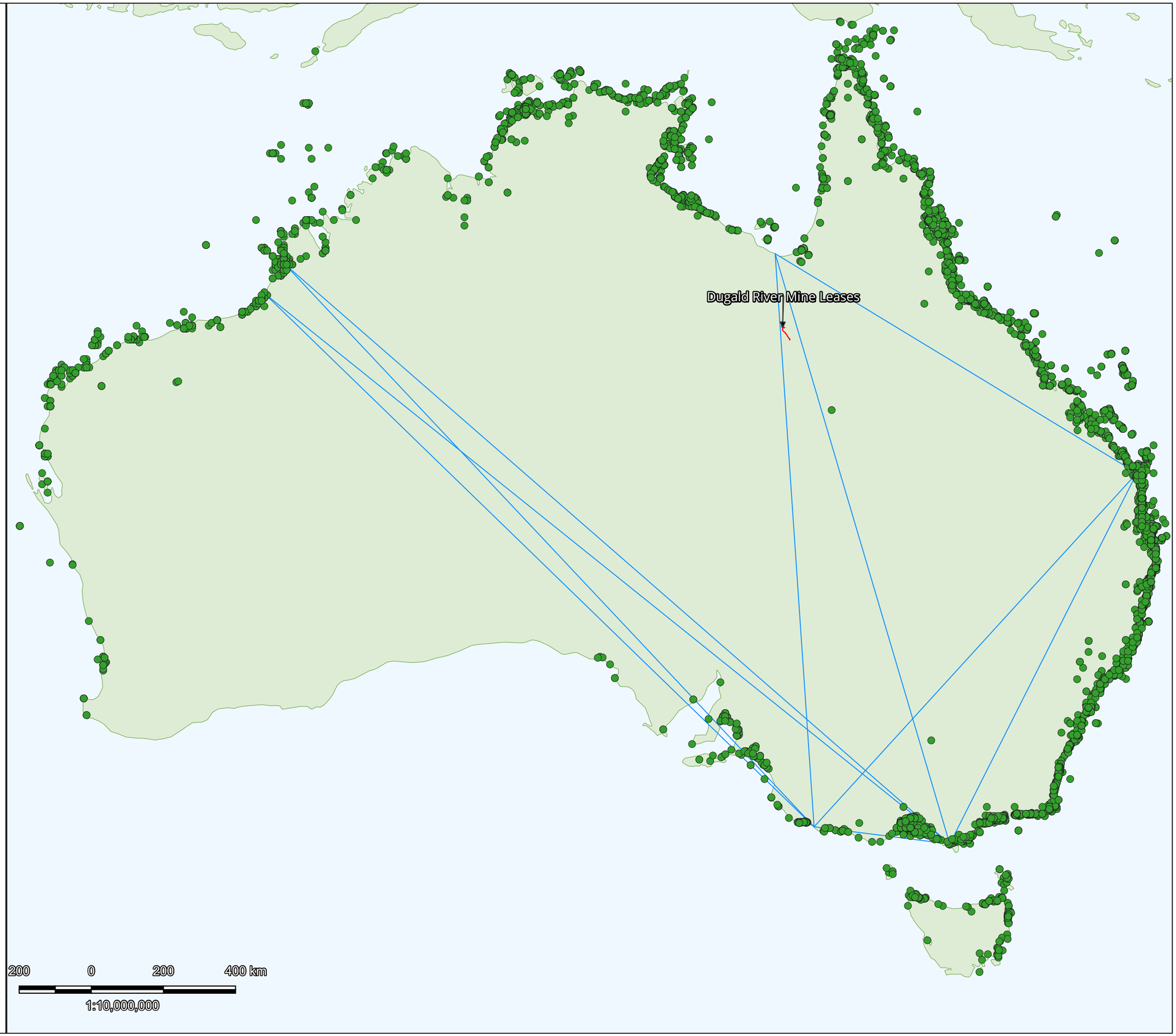
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Figure 20. Little Tern - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Little Tern Records
- Little Tern



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Figure 21. Long-toed Stint - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Long-toed Stint



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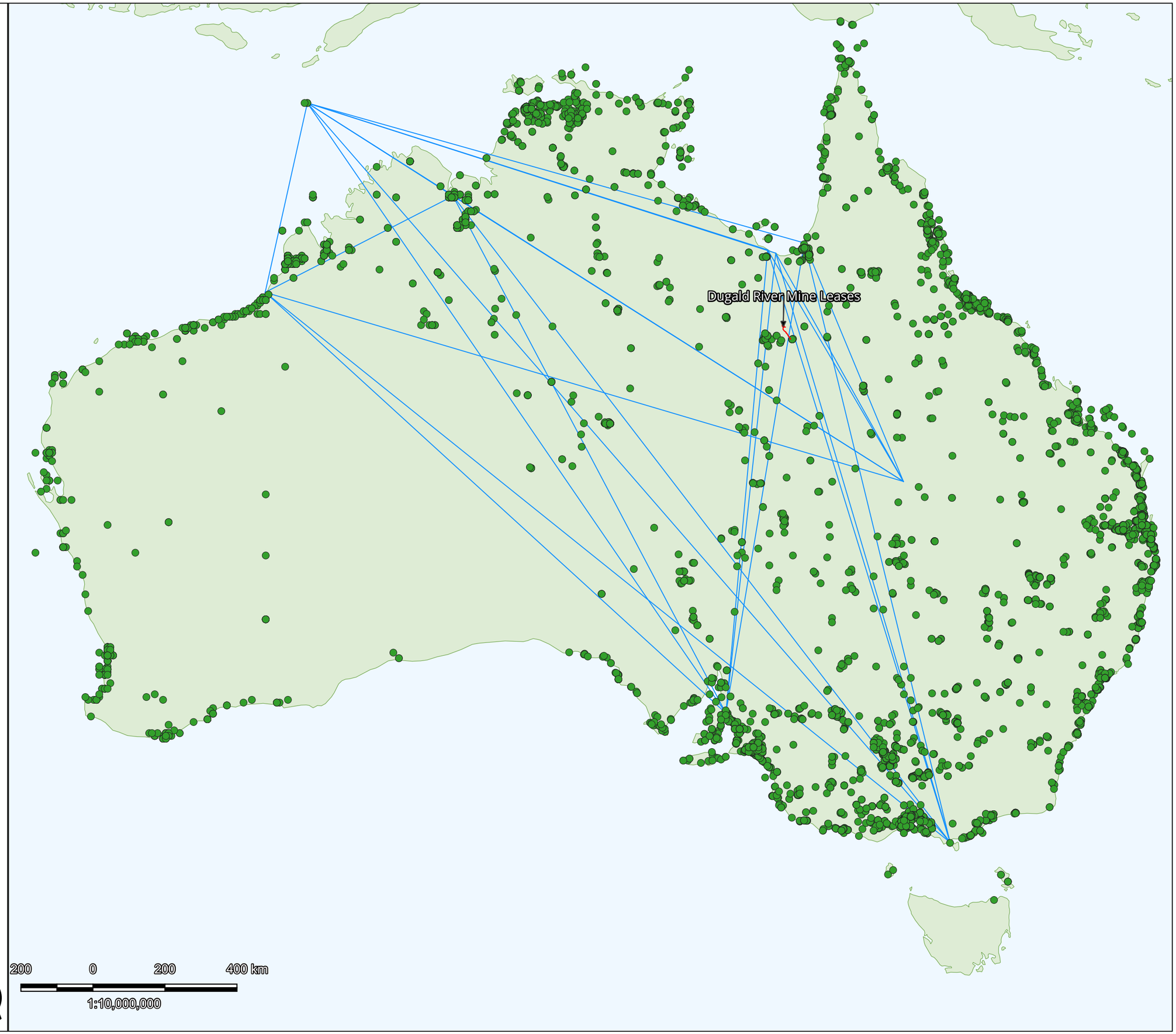
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Figure 22. Marsh Sandpiper - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Marsh Sandpiper Records
- Marsh Sandpiper



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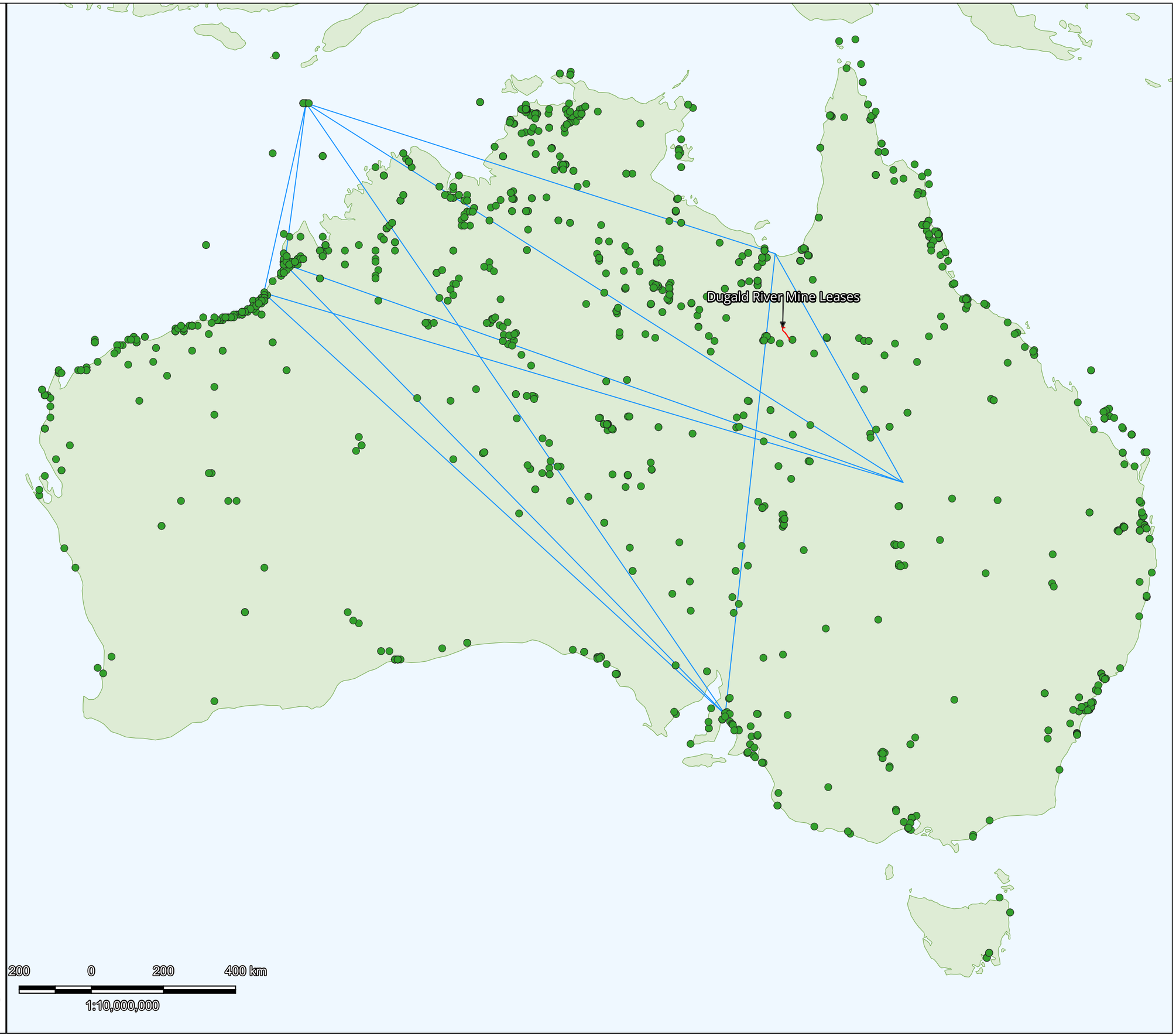
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Figure 23. Oriental Plover - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Oriental Plover Records
- Oriental Plover



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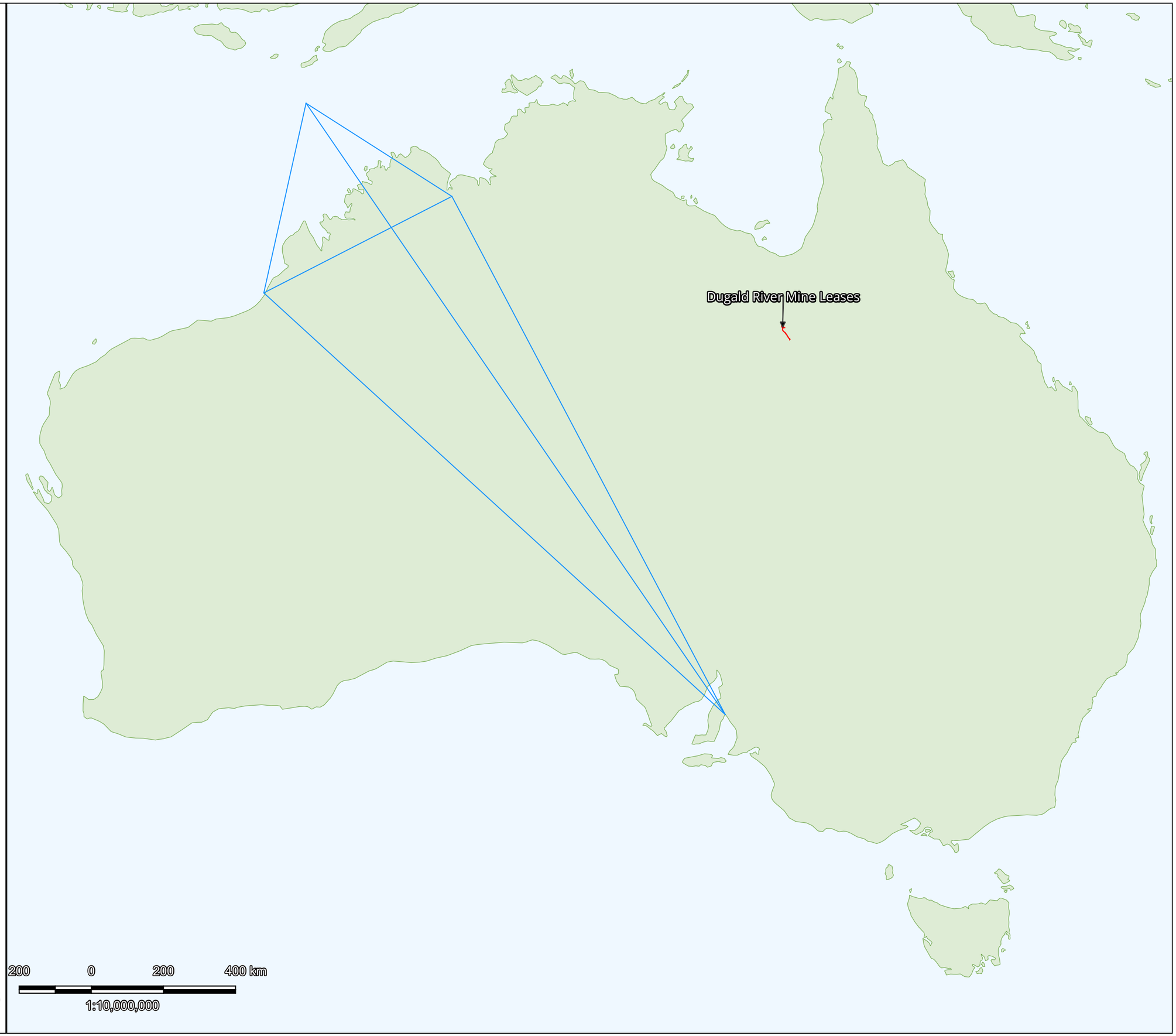
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Figure 24. Oriental Pratincole - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Oriental Pratincole



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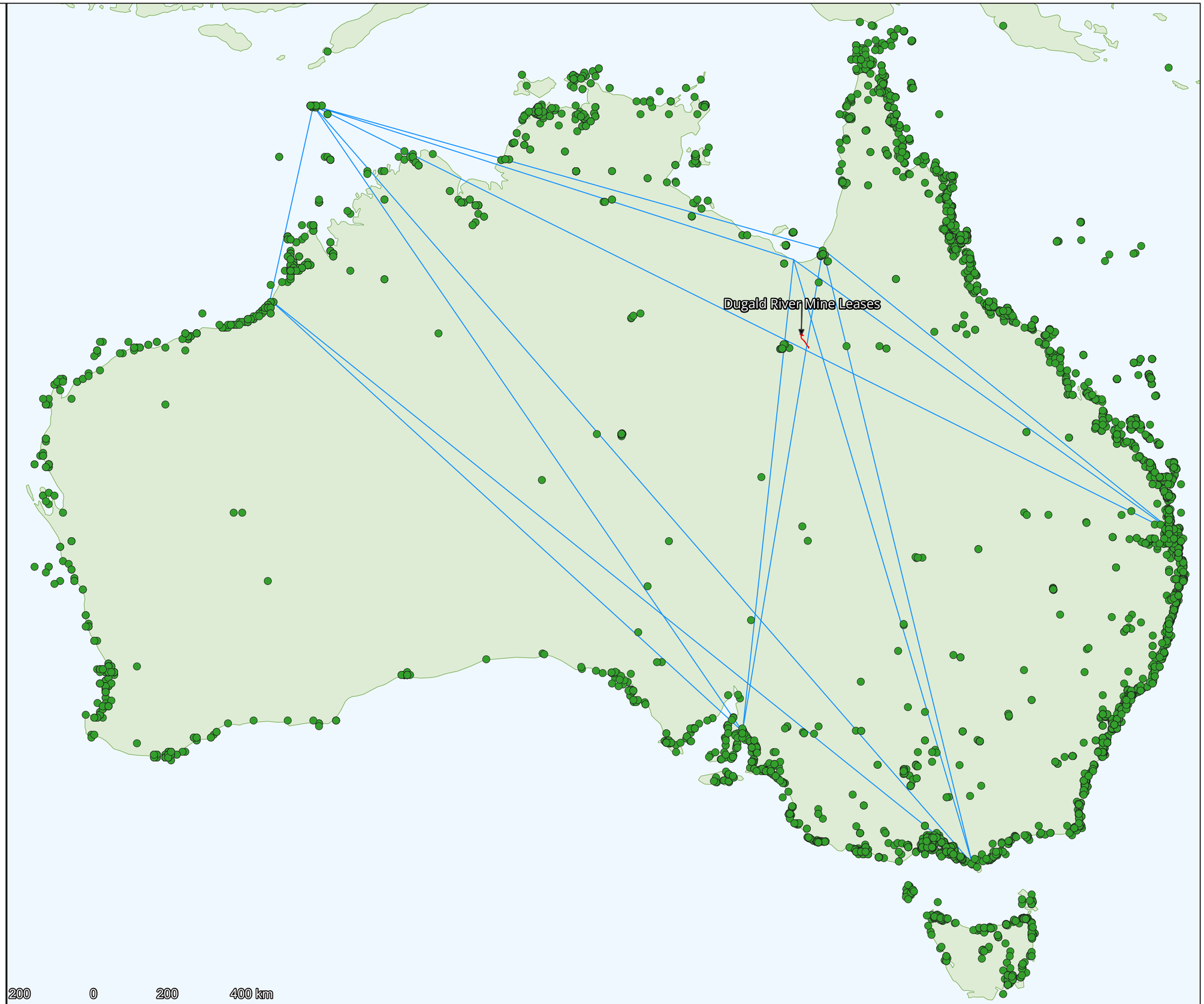
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Figure 25. Pacific Golden Plover - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Pacific Golden Plover Records
- Pacific Golden Plover



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Figure 26. Pectoral Sandpiper - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Pectoral Sandpiper



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Figure 27. Red Knot - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Red Knot Records
- Red Knot

Dugald River Mine Leases

200 0 200 400 km

1:10,000,000

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Figure 28. Red-necked Phalarope - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Red-necked Phalarope



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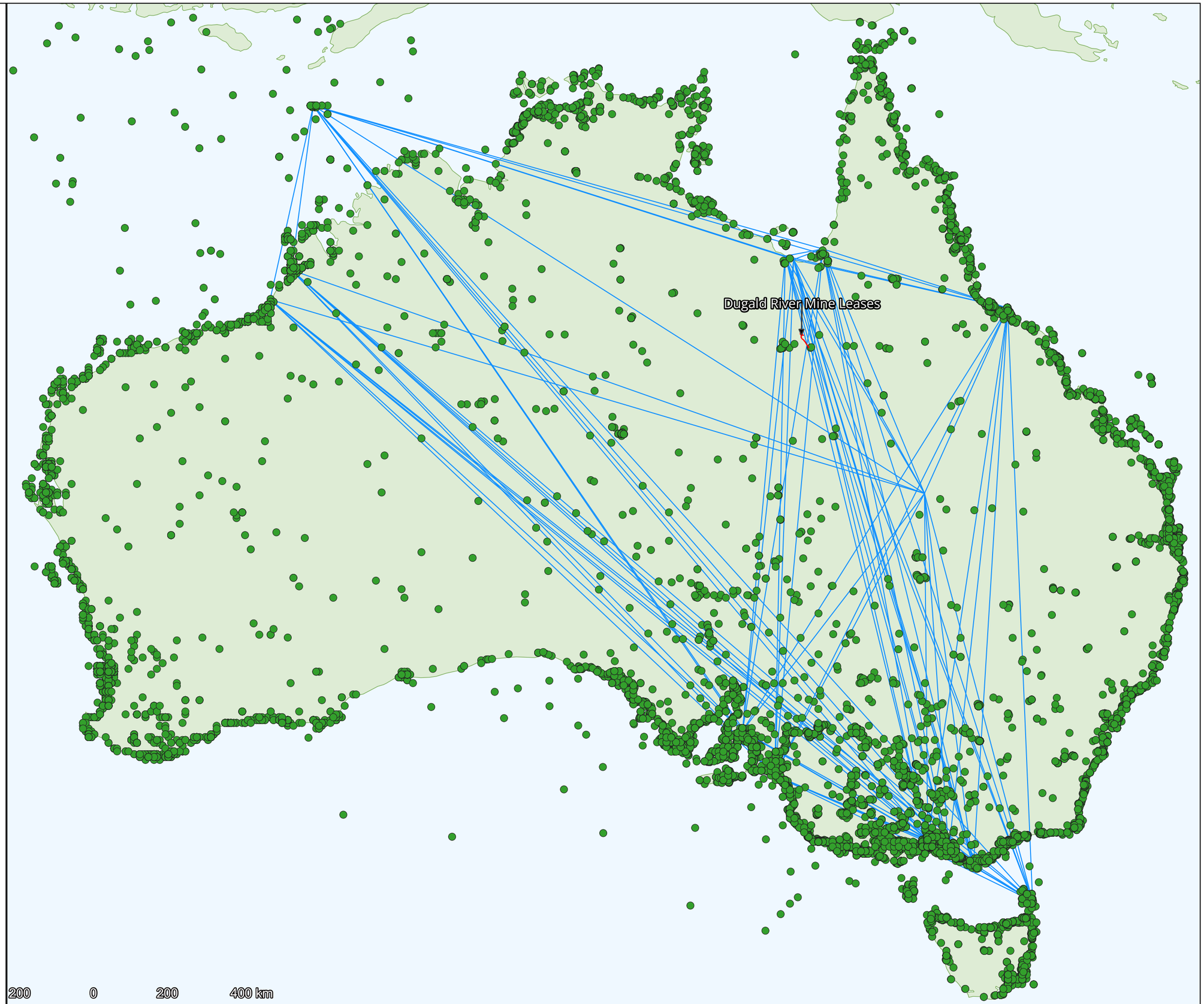
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Figure 29. Red-necked Stint - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Red-necked Stint Records
- Red-necked Stint



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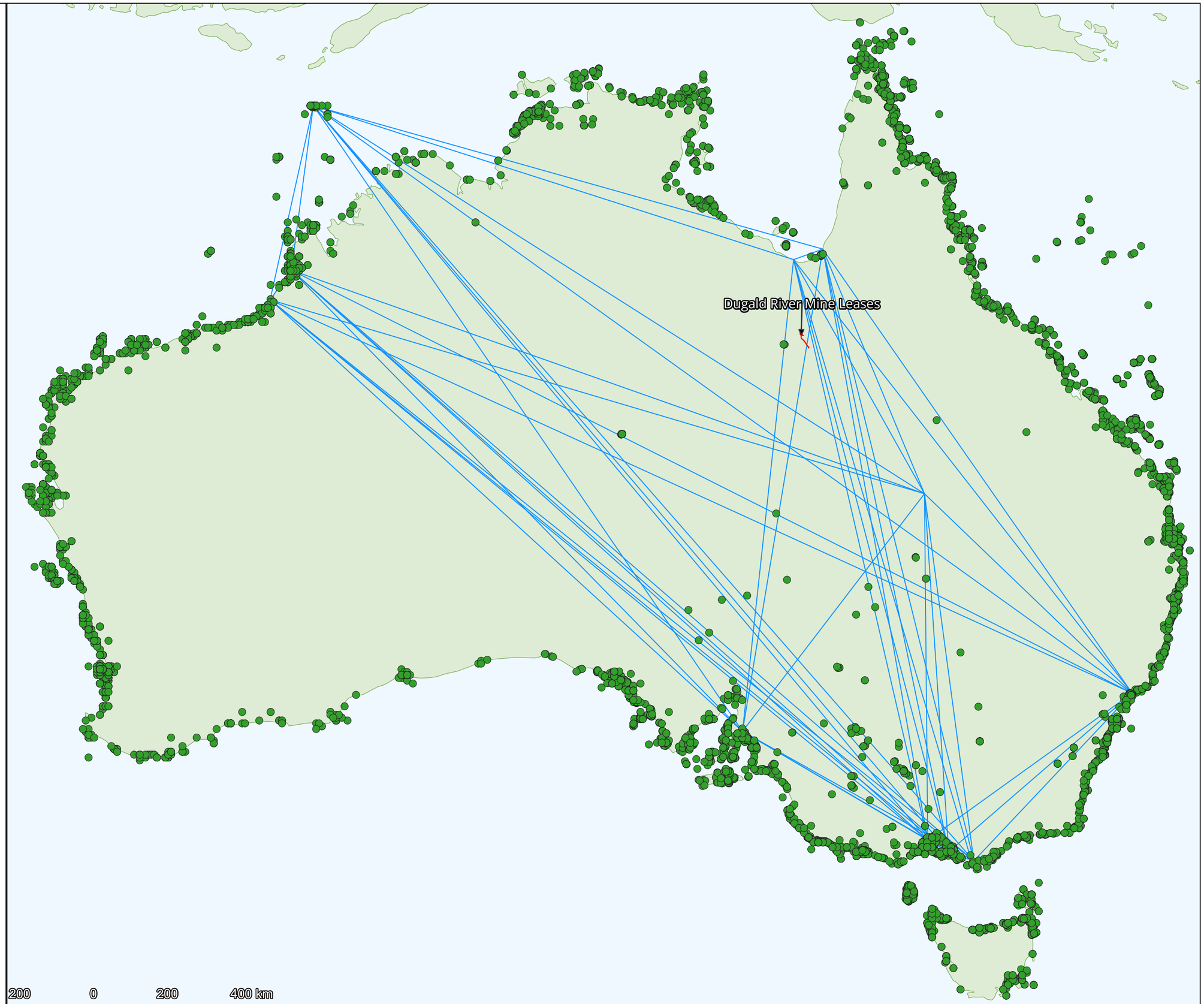
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Figure 30. Ruddy Turnstone - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Ruddy Turnstone Records
- Ruddy Turnstone



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Figure 31. Ruff - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Ruff

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Figure 32. Sanderling - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Sanderling Records
- Sanderling

Dugald River Mine Leases

200 0 200 400 km

1:10,000,000

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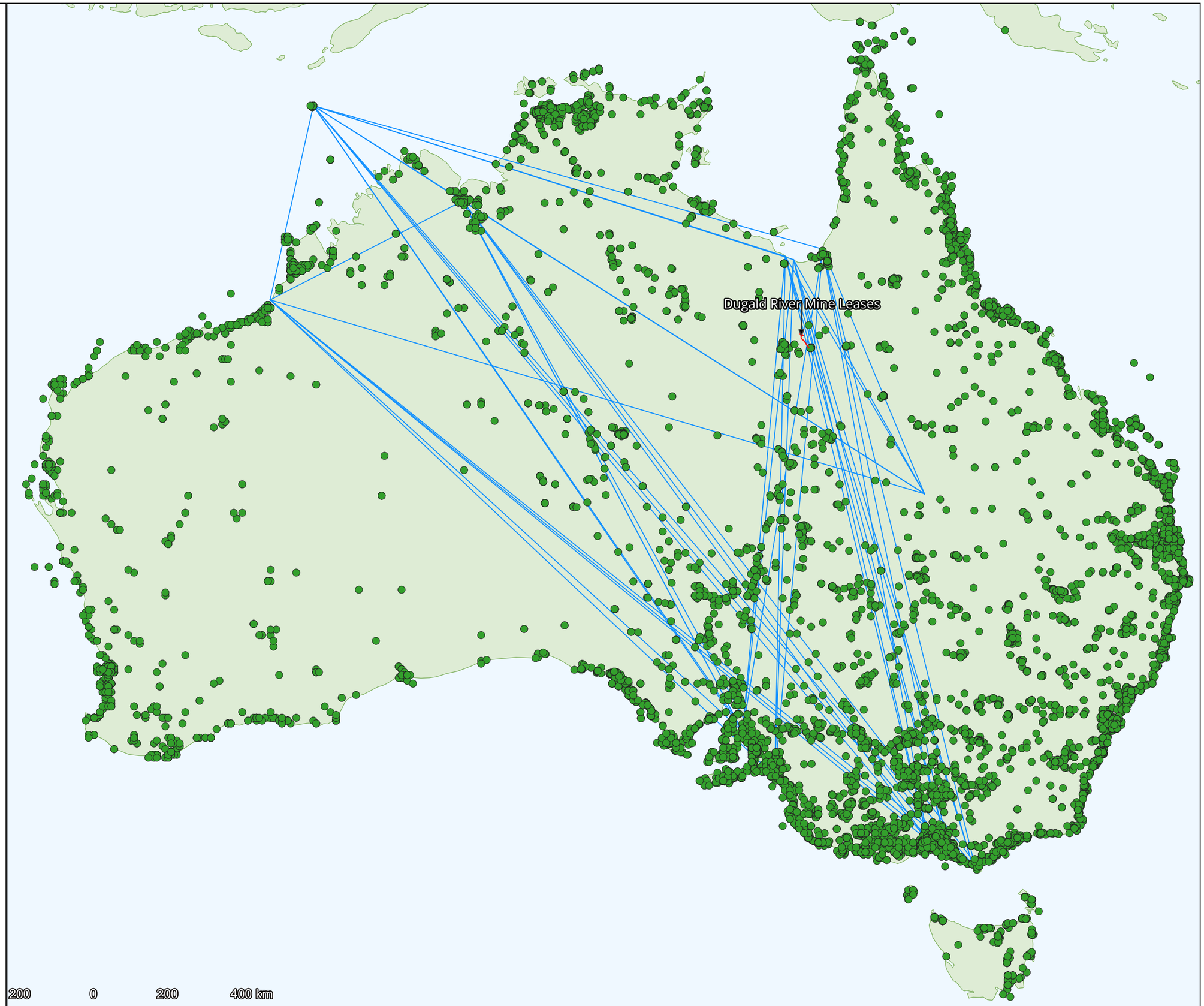
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Figure 33. Sharp-tailed Sandpiper - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Sharp-tailed Sandpiper Records
- Sharp-tailed Sandpiper



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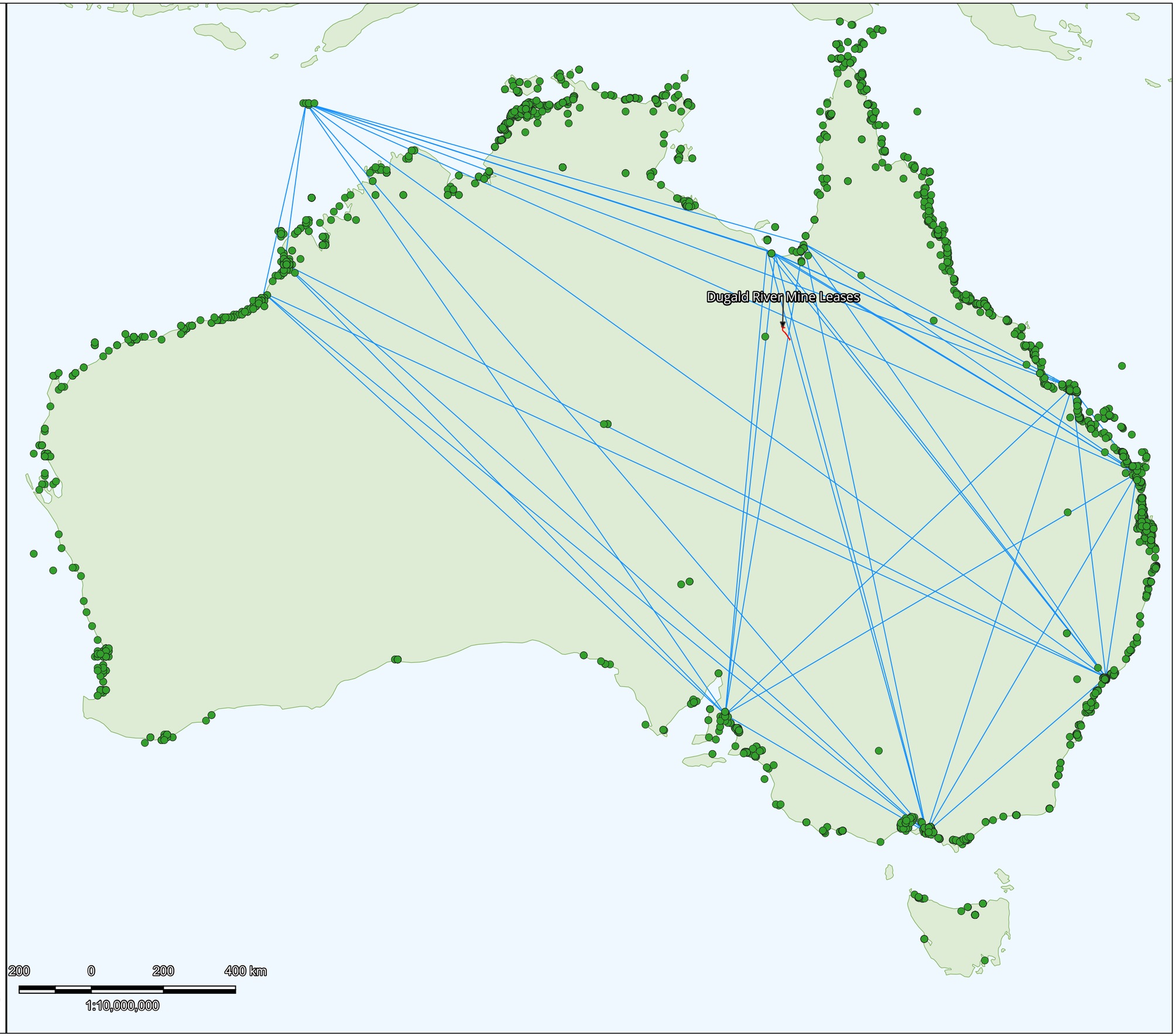
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Figure 34. Terek Sandpiper - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Terek Sandpiper Records
- Terek Sandpiper



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Figure 35. Whimbrel - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Whimbrel Records
- Whimbrel

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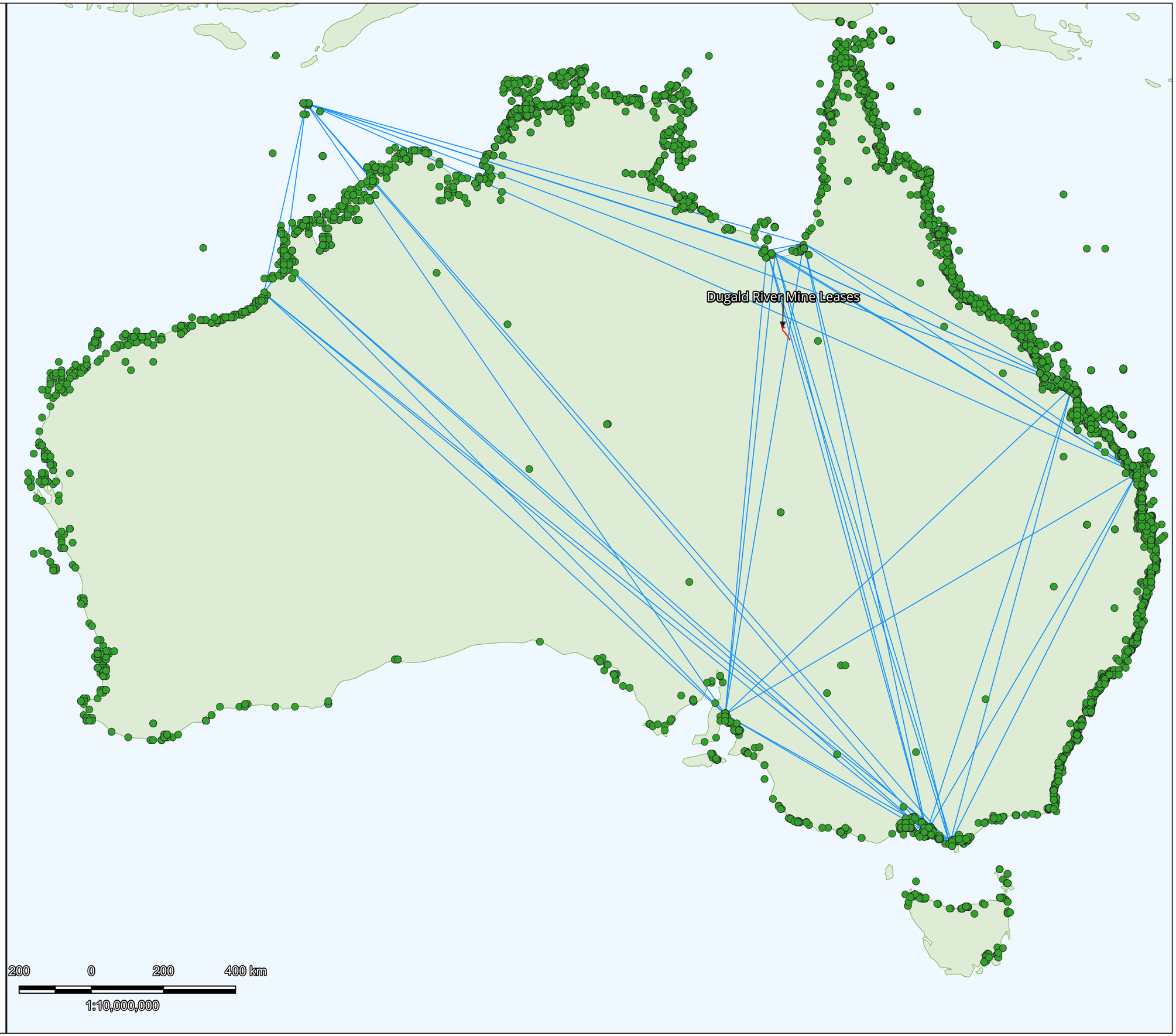


Figure 36. White-winged Black Tern- Potential Migratory Routes

Legend

- Dugald River Mine Leases
- White-winged Black Tern



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Figure 37. Wood Sandpiper - Potential Migratory Routes

Legend

- Dugald River Mine Leases
- Wood Sandpiper



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