APPENDIX K

INLAND RAIL

Matters of National Environmental Significance Technical Report

PART 2 OF 4

Appendices A to F

CALVERT TO KAGARU ENVIRONMENTAL IMPACT STATEMENT

IR_1381

ARTC

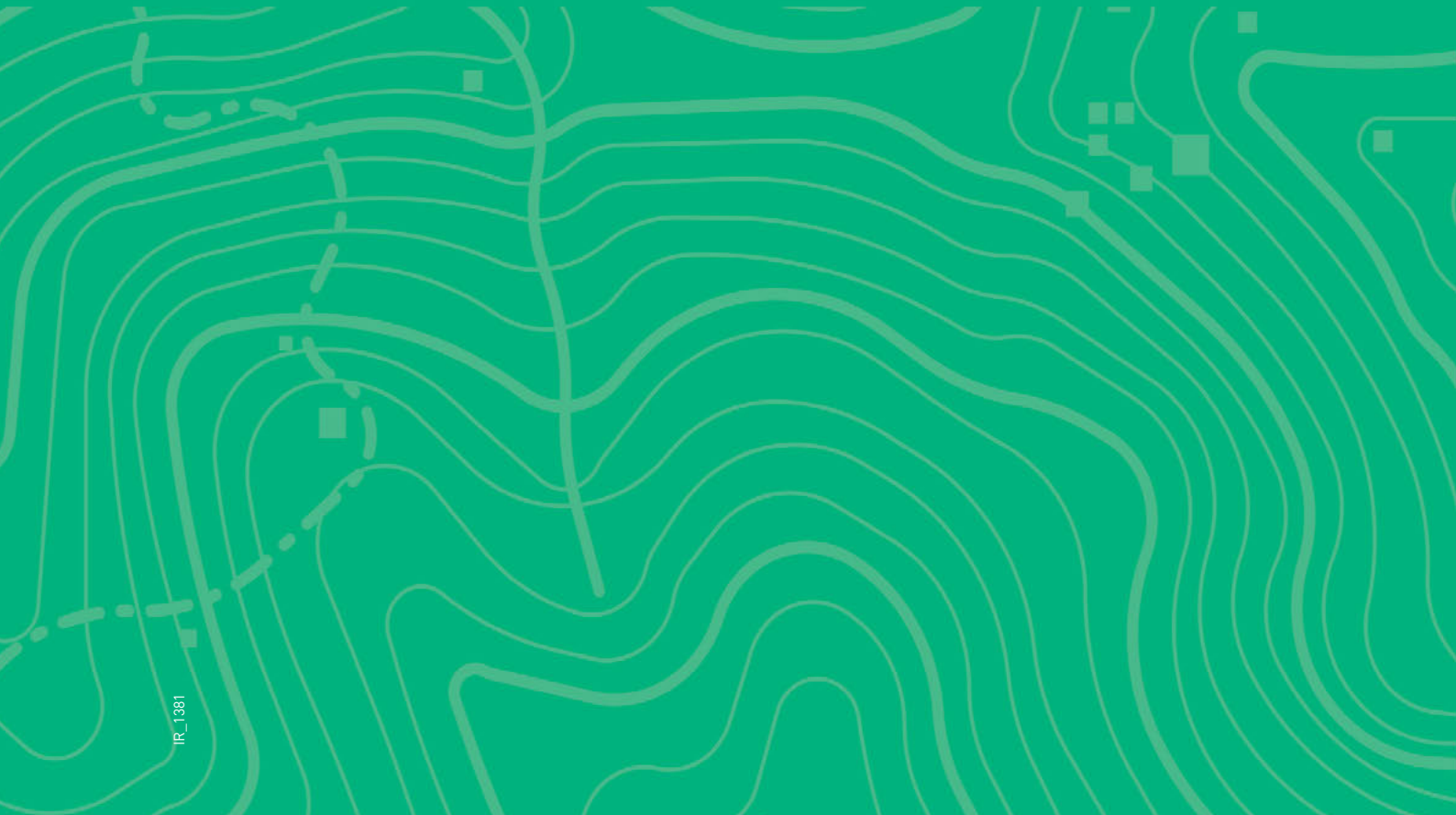
The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

APPENDIX K

Matters of National Environmental Significance Technical Report

Appendix A Predicted habitat modelling methodology

CALVERT TO KAGARU ENVIRONMENTAL IMPACT STATEMENT



IR_1381

Inland Rail Calvert to Kagaru EIS

Appendix A – Predictive habitat modelling methodology

Australian Rail Track Corporation

Reference: 3400

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Appendices

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1 Introduction

1.1 Background

For the purposes of the Inland Rail Project (Calvert to Kagaru) (the Project) predictive habitat models for flora and fauna have been prepared. These models have been designed to map the potential areas that are likely to be analogous to habitat associated with *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth (Cth)) (EPBC Act) threatened species. This mapping has the following objective:

- To provide predictive habitat modelling for EPBC Act listed flora and/or fauna species to:
  - Identify areas of potential habitat for EPBC Act listed species
  - Facilitate the calculation of potential disturbance areas associated with the Project and to subsequently inform the assessment of significant residual impacts for matters of national environmental significance (MNES).

This document outlines the methodology used for the development of the predictive habitat models and provides the species/community specific assumptions and mapping requirements required to reproduce the predictive habitat models for each individual species. The models have been used to prepare maps indicating the potential extent of each threatened species associated with the Project as identified in the Project Environmental Impact Statement (EIS) Terms of Reference (ToR), in addition to those species identified from the desktop review phase of the Project EIS. The methodologies presented here represent a conservative approach to mapping and apply the precautionary principle to the identification of habitat for each specific matter.

The approach adopted is designed to be dynamic and will evolve in response to changes to the design and footprint, along with additional ecological information gained from Project activities (e.g. pre-clearing surveys or protected plant surveys in accordance with the relevant flora survey guidelines (i.e. DES 2019) and changes to species status. This flexibility also has benefits such that during the construction stage, it allows management and monitoring of compliance with disturbance limits and environmental offset requirements. That is, the predictive mapping models along with other Project inputs (e.g. fauna 'breeding places' identified during pre-clearing surveys) can be used to identify temporary and permanent no-go zones and track clearing extents against relevant disturbance limits and where applicable inform additional specific mitigation measures.

1.2 Context

For context with respect to the methodology's compliance with EPBC Act Survey Guidelines for threatened species, the more conservative approach of this methodology surpasses the guidelines expectations. The *"How to use these guidelines"* statement includes:

"*… Alternatives to a dedicated survey may also be appropriate. For example, a desktop analysis of historic data may indicate that a significant impact is not likely. Similarly, a regional habitat analysis may be used to determine the importance of a site to the listed birds. Proponents should also consider the proposals impact in the context of the species' national, regional, district and site importance to establish the most effective survey technique(s)…*"

This methodology includes analysis of historic and current data gained from a range of sources (as listed in Table 1.1), with direct and current survey efforts including dedicated ground truthing surveys of the database mapping and follow-up ecological assessments within the MNES study area as part of the projects geotechnical drilling survey program.

1.3 Review of existing databases and literature

Each predictive habitat model has been developed to deliver a process that is robust, transparent and repeatable. The first stage in developing each of the models involved determining the extent of species occurrence and the availability of information pertaining to available species habitat.

Eleven data sources were accessed to identify MNES species that have potential to occur within the MNES study area. These data sources are listed in Table 1.1.

In addition, a total of eight ecological assessment were identified which describe the MNES values, including species protected under the EPBC Act within the MNES study area (refer Table 1.2).

Table 1.1 Database and document review summary

Database/data source name	Database search date	Database search areas	Data type
Atlas of Living Australia (2018)	29/03/2020	Disturbance footprint with 50 km buffer applied	Ongoing inspection of records of flora and fauna, including threatened species listed under the EPBC Act. The Atlas database includes confirmed records from all Australian museums including the Queensland Museum.
Flying Fox Monitoring Program (DES 2020a)	24/03/2020	Disturbance footprint with 15 km buffer applied	Show the general location of flying-fox roosts in Queensland recorded by the DES and includes camp survey data for continuously and periodically (seasonally or irregularly) used roosts. The exact location of roosts may vary within a small localised area.
Flying-fox roost monitoring and locations (DES 2020b)	06/02/2020	Disturbance footprint with 15 km buffer applied	show the general location of flying-fox roosts in Queensland recorded by the department and include continuously and periodically (seasonally or irregularly) used roosts. The exact location of roosts may vary within a small localised area.
Birds Australia (BA NRS 2002)	29/03/2019	MNES study area	Records of avian fauna, including threatened species listed under the EPBC Act.
EPBC Act Protected Matters Search Tool (DAWE, 2020)	06/02/2020	MNES study area	Provides a “predictive” account of MNES identified within a specific area. Includes MNES such as world heritage properties, national heritage places or wetlands of international importance and threatened species.
Regulated Vegetation Management Map Version 11.1 (DNRME 2020)	06/02/2020	MNES study area	Mapping of REs and High Value Regrowth that provide habitat for TECs and threatened species under the EPBC Act.
Wetland Info database (DES 2019)	06/02/2020	Impact assessment area	Provides interactive maps, species records, case studies and legislation associated with Queensland wetlands.
Wildlife Habitat Map, Version 11.1 (DNRME 2020)	06/02/2020	MNES study area	Modelled habitat for threatened species listed under the EPBC Act.
Wildlife Online database (Queensland Government) incorporating Wildlife Online and Herbrecs datasets	06/02/2020	MNES study area	Records of flora and vertebrate fauna including threatened species listed under the EPBC Act.
Queensland Springs Database (Queensland Government 2018)	06/02/2020	Regional extent	The dataset provides a comprehensive catalogue of permanently saturated springs that have fixed locations and any associated surface expression Groundwater Dependant Ecosystems.

Database/data source name	Database search date	Database search areas	Data type
Matters of national environmental significance (Department of Agriculture, Water and the Environment 2020)	06/02/2020	MNES study area	Location of MNES, including: ■ Threatened species as listed under the EPBC Act ■ Migratory species listed under the EPBC Act ■ TECs listed under the EPBC Act ■ Critical habitats ■ World Heritage Properties ■ National Heritage Places ■ Wetlands of International Importance (i.e. Ramsar) ■ Great Barrier Reef Marine Park ■ Commonwealth Marine Area ■ Nuclear Areas.

Table 1.2 Assessments and reports providing ecological information for areas associated with the Project

Document title	Reference	Summary of significant findings related to MNES
Southern Freight Rail Corridor Study (March 2010)	AECOM (2010)	■ Confirmation of the presence of the Swamp Tea-tree (*Melaleuca irbyana*) Forest of South-east Queensland threatened ecological community (TEC) ■ Observations of Koala (*Phascolarctos cinereus*) – anecdotally known to occur throughout the study area from community consultation feedback. Also identified at Paynes Road in September 2009 ■ Observation of Brush-tailed Rock Wallaby (*Petrogale penicillata*) - Observed opportunistically on Mount Flinders ■ Identification of patch of Brigalow (*Acacia harpophylla*) TEC within current MNES study area
Calvert to Kagaru Flora and Fauna Technical Report	Jacobs-GHD (2016)	■ Confirmation of the presence of the Swamp Tea-tree (*Melaleuca irbyana*) Forest of South-east Queensland TEC which extends into the periphery of the proposed rail corridor ■ Observations of Koala (*Phascolarctos cinereus*) – direct observations and Koala scats in both intact and fragmented landscapes
Woolooman Tunnel Geotechnical Access – Ecological Assessment Report	GHD (2017)	■ Evidence of Koala (*Phascolarctos cinereus*) presence (scats) recorded
Australian Rail Track Corporation/ Transport - Land/southwest of Ipswich/Queensland/Inland Rail Calvert to Kagaru Project (EPBC Referral number 2017/7944)	ARTC (2017)	■ Provides initial details on how the project is likely to impact upon MNES. This includes, identification of potential impacts to nine threatened species, one TEC and three migratory species.
Initial Advice Statement: Inland Rail – Calvert to Kagaru – 10 May 2017.	ARTC (2017)	■ Confirmation of the presence of the Swamp Tea-tree (*Melaleuca irbyana*) Forest of South-east Queensland TEC particularly around the Purga nature reserve ■ Observations of Koala (*Phascolarctos cinereus*) – nine distinct locations along the alignment
Inland Rail – Gowrie to Kagaru Geotechnical investigations. MNES assessment report – 23 July 2018	EMM (2018a)	■ Confirmation of the presence of the Swamp Tea-tree (*Melaleuca irbyana*) Forest of South-east Queensland TEC particularly around Ebeneezer ■ Evidence of Koala (*Phascolarctos cinereus*) presence (scats and scratches) throughout locations along alignment ■ Observation of Swift parrot (*Lathamus discolor*) along alignment south of Rosewood

Document title	Reference	Summary of significant findings related to MNES
Inland Rail – Gowrie to Kagaru Geotechnical investigations. Protected plant survey reports (2018 and 2019) Preclearance survey reports (2018 and 2019)	EMM (2018b-e; 2019a-c)	▪ No MNES observed
Inland Rail – Calvert to Kagaru Geotechnical investigations. Protected plants flora survey reports (8 May 2019, 20 June 2019) Preclearance survey report (11 June 2019)	Eco logical Australia (2019a-c)	▪ Confirmation of the presence of the Swamp Tea-tree (*Melaleuca irbyana*) Forest of South-east Queensland TEC east of Paynes Road (June 2019) ▪ Evidence of Koala (*Phascolarctos cinereus*) presence (scats and scratches) throughout locations along alignment

In addition to the data sources identified above, findings associated with EIS field investigations/analysis assisted in the validation and iteration of the predictive habitat mapping. However, it must be noted that field investigations were subject to voluntary land access agreements which place heavy restrictions upon area that were accessible.

In addition to previous surveys and site-based investigations, recovery plans were assessed in order to identify areas of high conservation significance or of recognised conservation value for each of the MNES subject to predictive habitat modelling. In addition, the *Draft Guide to nationally protected species significantly impacted by paddock tree removal* (DoEE 2020) was also assessed to determine species that may be impact by the removal of paddock trees.

Of the species identified as potentially occurring in the MNES study area and impacted by the project activities, 10 have a Commonwealth approved recovery plan. These species consist of the following:

- Macadamia nut (*Macadamia integrifolia*)
- *Rough-shelled bush nut* (*Macadamia tetraphylla*)
- Brush-tailed Rock-wallaby (*Petrogale penicillate*)
- Spotted-tailed quoll (*Dasyurus maculatus maculatus*)
- Large-eared pied bat (*Chalinolobus dwyeri*)
- Black-breasted button-quail (*Turnix melanogaster*)
- Red goshawk (Erythrotriorchis radiatus)
- Regent honeyeater (*Anthochaera phrygia*)
- Swift parrot (*Lathamus discolor*)
- Mary river cod (*Maccullochella mariensis*).

Four species relevant to this assessment are subject to a draft recovery plan. These species consist of the following:

- Australian lungfish (*Neoceratodus forsteri*)
- Australian painted snipe (*Rostratula australis*)
- Australasian bittern (*Botaurus poiciloptilus*)
- Grey-headed flying-fox (*Pteropus poliocephalus*).

In addition to the recovery plans identified above, draft referral guidelines are applicable to the following species:

- Collared delma (*Delma torquata*)
- Dunmall's snake (*Furina dunmalli*)
- Five-clawed worm-skink (*Anomalopus mackayi*)

- Koala (*Phascolarctos cinereus*)
- White-throated needletail (*Hirundapus caudacutus*).

Information derived from the recovery plans and referral guidelines were used to derive specific habitat characterisation criteria to inform the predictive habitat modelling process.

2 Species included within the predictive habitat mapping model

A total of 20 threatened flora species and 32 threatened fauna species listed under the provisions of the EPBC Act and/or NC Act were identified as occurring or potentially occurring within the MNES study area (refer Table 2.1 and Table 2.2). Of these, 16 floral and 20 faunal species are considered to have potential or are likely to occur within the MNES study area.

All threatened species identified as potentially occurring within the MNES study area were subject to habitat modelling as outlined within this document.

Table 2.1 Threatened flora species identified from database searches

Family	Species name	Common name	EPBC Act	Data source			Likelihood of occurrence
				Wildlife online	PMST	Atlas	
Poaceae	*Arthraxon hispidus*	Hairy-joint grass	V		✓		Possible
Euphorbiaceae	*Bertya ernestiana*	A shrub	V		✓		Possible
Rutaceae	*Bosistoa transversa*	Three-leaved bosistoa	V		✓		Possible
Orchidaceae	*Bulbophyllum globuliforme**	Miniature moss-orchid	V				Possible
Cycadaceae	*Cycas ophiolitica*	-	E		✓		Unlikely, the MNES study area is outside of the species natural range (i.e. Rockhampton region of Queensland)
Sapindaceae	*Cupaniopsis tomentella*	Boonah tuckeroo	V	✓	✓		Possible
Poaceae	*Dichanthium setosum*	Bluegrass	V		✓		Possible
Brassicaceae	*Lepidium peregrinum*	Wandering pepper-cress	E		✓		Possible
Characeae	*Lychnothamnus barbatus^*	A green algae	E				Possible
Proteceae	*Macadamia integrifolia*	Macadamia nut	V		✓		Possible
Proteceae	*Macadamia tetraphylla*	Rough-shelled bush nut	V		✓		Unlikely, there are no occurrences of this species within 40 km of the MNES study area. Outside of the known range.
Oleaceae	*Notelaea ipsviciensis*	Cooneana olive	CE		✓		Unlikely, this species is very localised occurring in the Ipswich area. MNES study area is outside of the known range.
Oleaceae	*Notelaea lloydii*	Lloyd's olive	V	✓	✓		Likely
Orchidaceae	*Phaius australis*	Lesser swamp-orchid	E		✓		Possible
Rutaceae	*Phebalium distans*	Mt Berryman phebalium	CE		✓		Possible
Sapotaceae	*Planchonella eerwah*	Shiny-leaved condoo	E	✓	✓	✓	Likely
Asteraceae	*Rhaponticum australe**	Austral cornflower	V				Unlikely, the MNES study area is outside of the species natural range
Simaroubaceae	*Samadera bidwillii*	Quassia	V		✓		Possible
Fabaceae	*Sophora fraseri*	Brush sophora	V		✓		Possible
Santalaceae	*Thesium australe*	Austral toadflax	V		✓		Possible

Table notes:

EX = Extinct E = Endangered V = Vulnerable NT = Near threatened C = Least concern PMST = Protected Matters Search Tool

\- Species not listed or no common name ✓ Species present within database record within the Project MNES study area

* Species not returned in database searches but has been included as it has been previously identified from Warrill Creek that is in proximity to the Project MNES study area

Table 2.2 Threatened fauna species identified from database searches

Family	Species name	Common name	EPBC Act	Data source			Likelihood of occurrence
				Wildlife Online	PMST	Atlas	
Birds							
Accipitridae	*Erythrotriorchis radiatus*	Red goshawk	V		✓		Possible
Ardeidae	*Botaurus poiciloptilus*	Australasian bittern	E		✓		Possible
Columbidae	*Geophaps scripta scripta*	Squatter pigeon	V		✓		Unlikely. The species is typically associated with the western slopes of the Great Dividing Range. While there are some records of this species within the broader project context, there are no recent records within 20 km of the MNES study area (AoLA 2020)
Dasyornithidae	*Dasyornis brachypterus*	Eastern bristlebird	E		✓		Unlikely, species occurs in montane areas in eucalypt forests with a dense tussock grass layer (DAWE 2020). Habitat does not occur and the species has never occurred in or near the MNES study area.
Estrildidae	*Poephila cincta cincta*	Southern Black-throated Finch	E		✓		Unlikely. Expert advice indicated that this species is locally extinct within SEQ (DAWE 2020)
Meliphagidae	*Anthochaera phrygia*	Regent honeyeater	CE		✓		Possible
Meliphagidae	*Grantiella picta*	Painted honeyeater	V		✓		Possible
Psittacidae	*Cyclopsitta diophthalma coxeni*	Coxen's fig-parrot	E		✓		Unlikely. No records close to MNES study area and no reliable records of the species from the year 2000 onwards. Preferred habitats featuring fig trees (lowland rainforest, warm and cold subtropical as well as cool temperate rainforests) (Birdlife International 2018) do not occur within the MNES study area.
Psittacidae	*Lathamus discolor*	Swift parrot	CE		✓		Known. Recorded within MNES study area during protected plant surveys (EMM 2018)
Rostratulidae	*Rostratula australis*	Australian painted snipe	E		✓		Possible
Scolopacidae	*Calidris ferruginea*	Curlew sandpiper	CE, M		✓		Possible
Scolopacidae	*Numenius madagascariensis*	Eastern curlew	CE, M		✓		Unlikely. Species is essentially a coastal specialist
Turnicidae	*Turnix melanogaster*	Black-breasted button-quail	V		✓		Possible

Family	Species name	Common name	EPBC Act	Data source			Likelihood of occurrence
				Wildlife Online	PMST	Atlas	
Apodidae	*Hirundapus caudacutus*	White-throated needletail	V, M		✓		Likely
Mammals							
Dasyuridae	*Dasyurus hallucatus*	Northern quoll	E		✓		Unlikely, the species has never been recorded in the greater Brisbane region. Nearest records in the Toowoomba Range are older (<1986) (AoLA 2020) and the species is no longer likely to occur in the area.
Dasyuridae	*Dasyurus maculatus maculatus*	Spotted-tailed quoll	E		✓		Possible
Macropodidae	*Petrogale penicillata*	Brush-tailed rock-wallaby	V		✓		Possible
Muridae	*Pseudomys novaehollandiae*	New Holland mouse	V		✓		Possible
Petauridae	*Petauroides volans volans*	Southern greater glider	V	✓	✓	✓	Likely
Phascolarctidae	*Phascolarctos cinereus*	Koala	V	✓	✓		Known. Recorded during surveys by Jacobs-GHD (2016)
Potoroidae	*Potorous tridactylus tridactylus*	Long-nosed potoroo	V		✓		Possible
Pteropodidae	*Pteropus poliocephalus*	Grey-headed flying-fox	V		✓		Likely
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared pied bat	V		✓		Possible
Reptiles							
Elapidae	*Furina dunmalli*	Dunmall's snake	V		✓		Unlikely. No database records of this species ever occurring to the east of the Great Dividing Range (AoLA 2020).
Pygopodidae	*Delma torquata*	Collared delma	V				Possible
Scincidae	*Anomalopus mackay*	Five-clawed worm-skink	V				Possible
Scincidae	*Coeranoscincus reticulatus*	Three-toed snake-tooth skink	V				Unlikely. Largely occurs in wet rainforest and wet sclerophyll forest habitats (DAWE 2020) which does not occur within or near the footprint. Nearest record is from Mount Tamborine (AoLA 2020).
Invertebrates							
Noctuidae	*Phyllodes imperialis smithersi*	Pink underwing moth	E		✓		Unlikely, no suitable habitat (wet old growth rainforest) (OEH 2017) likely present and no evidence the species may occur. The nearest moth record is 58 km away from the MNES study area and nearest record of the laval food plant (native rainforest vine, *Carronia multisepalea*) is 31 km away from the MNES study area

Family	Species name	Common name	EPBC Act	Data source			Likelihood of occurrence
				Wildlife Online	PMST	Atlas	
Nymphalidae	*Argynnis hyperbius inconstans*	Australian fritillary	CE		✓		Unlikely, no suitable habitat likely present and no evidence the species may occur. Additionally, there are no known records of the larval host plant *Viola* betonicifolia within the MNES study area, with the nearest record from 1987 located 16 km from the disturbance footprint
Fish							
Pericichthyidae	*Maccullochella mariensis*	Mary River cod	E		✓		Unlikely. Whilst it is acknowledged the Mary River cod may have potential to occur within the broader region, these individuals are likely to have resulted from fish stocking activities and are considered to be outside of areas within their natural distribution. There are no database records of the species in the Brisbane/Logan River catchments. Habitat critical to the survival of this species is restricted to the Mary River drainage system and therefore this species has been excluded from the impact assessment
Pericichthyidae	*Maccullochella peelii*	Murray cod	V		✓		Unlikely, the MNES study area is beyond the known range of this species. (i.e. Murray-Darling Basin)
Protopteridae	*Neoceratodus forsteri*	Australian lungfish	V		✓		Possible

Table notes:

EX = Extinct E = Endangered V = Vulnerable NT = Near threatened C = Least concern PMST = Protected Matters Search Tool

- Species not listed or no common name

✓ Species present within database record within the Project MNES study area

3 Predictive habitat modelling input datasets

Predictive habitat modelling was undertaken to identify and map areas that are considered to have the potential to provide habitat for the threatened species listed in Table 2.1 and Table 2.2 which have potential to occur within the MNES study area. This modelling provides an additional tool to assess the likely occurrence of species of interest and facilitates impact assessment by allowing for the quantification of areas of habitat using GIS analysis.

In addition to specimen and community specific vegetation associations that are identified within Table 5.1 and Table 5.2, additional GIS layers and field derived information have been utilised to identify areas of habitat within the MNES study area where applicable to a species. These layers include:

- Regional ecosystem datasets (Version 11) (remnant and high value regrowth) and pre-clearing regional ecosystem layers (refer Appendix A for the description of Regional Ecosystems that occur within the MNES study area)
- High resolution aerial photography with site derived datasets (i.e. utilisation of condition data, species records and general observational data pertaining to species habitat where applicable)
- Where available[1], threatened species records from Atlas of Living Australia, the Queensland Department of Environment and Science species profile and previous ecological investigations
- Field derived datasets related to species sightings/records, habitat suitability and the presence of micro-habitat features
- Topographic and geological information
- Government derived cadastral datasets
- Where applicable distribution and habitat modelling from the State and Commonwealth
- Essential habitat and wildlife habitat mapping
- Watercourses and wetlands datasets
  - Defined watercourses
  - Queensland waterways for waterway barrier works
  - State government based wetland mapping, including springs and groundwater dependent ecosystems (GDEs).

[1] Some species records are confidential

4 Predictive habitat modelling categories

4.1 Flora and fauna species

4.1.1 General context

Each predictive habitat model allowed partitioning of habitat for flora and fauna species using current scientific knowledge (including relevant Commonwealth threatened species listing advice and recovery plans) and pre-existing data derived from historic surveys and State based mapping identified above. The specific habitat assumptions for each species that were subject to predictive mapping are provided in Table 5.1 and Table 5.2.

The species-specific assumptions allowed the following areas to be identified for each threatened species:

- Unlikely habitat
- Potential habitat
- Important habitat (where applicable)
- Habitat critical to the survival of the species (where applicable).

The use of these habitat categories aligns with the Commonwealth Department of Agriculture, Water and Environment's (DAWE's) habitat definitions for species protected under the EPBC Act and terminology used in the DAWE's significant impact assessment guidelines.

An overview of each of these categories is provided in the sections below.

4.1.2 Unlikely habitat

Unlikely habitat consists of areas that do not contain specimen backed records of the particular species (i.e. no point data derived from the positive identification/confirmation of a species in the field) and contain no evidence of habitat values to support the presence or existence of resident individuals or populations of the species. However, it is acknowledged that these areas may provide temporary habitat for species during exceptional circumstances. It is considered that occurrences of the subject species within these areas is an anomaly as these areas are not likely to support the species in the long term.

4.1.3 Potential habitat

Potential habitat consists of areas or locations used by transient individuals or where species may have been recorded but where there is insufficient information to assess the area as Important habitat or Habitat critical to the survival of the species (i.e. records of the species are considered anomalies as general microhabitat features are not considered to be present from a desktop perspective). Potential habitat also includes habitat that is considered to potentially support a species according to expert knowledge of habitat relationships, despite the absence of specimen backed records, where these areas are not considered to fulfil the criteria of "*Habitat Critical to the survival of the species*". Potential habitat may include areas of suboptimal habitat for species. Species specific assumptions that define the Potential habitat category are identified in Table 5.1 and Table 5.2. Impacts to *Potential habitat* are not considered to contribute to significant impact to an MNES as the loss of these areas is not deemed to be significant in accordance with the Commonwealth significant impact criteria. However, impact to Potential habitat have been considered in relation to movement of species and the potential to contribute towards fragmentation and barrier effects, rather than the loss of habitat *per se*.

4.1.4 Important habitat

In line with DAWE's guidelines, areas of Important habitat are regarded as a surrogate for important populations of Brigalow belt reptiles. Relevant to the current investigations, the following species are classified as Brigalow Belt reptiles and important habitat for these species has been mapped where relevant:

- Dunmall's snake (*Furina dunmalli*)
- Collared delma (*Delma torquata*)
- Five-clawed worm-skink (*Anomalopus mackayi*).

Important habitat for Brigalow Belt reptiles is defined in Section 5 of the Draft Referral guidelines for the nationally listed Brigalow Belt reptiles (Commonwealth of Australia 2011):

"Suitable habitat for any one of the listed Brigalow Belt reptiles is considered important if it is:

- *habitat where the species has been identified during a survey*
- *near the limit of the species' known range*
- *large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the purposes of breeding, dispersal or maintaining the genetic diversity of the species over successive generations), or*
- *a habitat type where the species is identified during a survey, but which was previously thought not to support the species.*

In addition to the species identified above, the Important habitat has been used to capture "Priority habitat areas" for the Swift parrot (*Lathamus discolor*) as identified in the *National Recovery Plan for the Swift Parrot (Lathamus discolor)* (Saunders and Tzaros 2011).

Species specific assumptions that define the Important habitat category for the above-mentioned species is provided in Table 5.2. Impacts to *Important habitat* are considered to contribute to significant impact to an MNES.

4.1.5 Habitat critical to the survival of the species

Habitat critical to the survival of the species represents habitat with the greatest value for the particular MNES. This habitat category identifies areas that align with "*habitat critical to the survival*" of a listed threatened species is identified in an approved Recovery Plan for the relevant MNES. However, in instances where there are no Recovery Plans for a specific species, the presence of a specimen backed record (i.e. derived from either desktop assessments or field investigations) is considered to align with this category where breeding and foraging habitat is potentially present. For these species, elevation of habitat to this level adequately accounts for the significance of such areas regardless of the absence of a Recovery Plan and applies the precautionary principle to mapping areas of potentially high value habitat. Species specific assumptions associated with the mapping of Habitat critical to the survival of the species are detailed in Table 5.1 and Table 5.2. Impacts to *Habitat critical to the survival of the species* are considered to contribute to significant impact to an MNES.

5 Predictive habitat models and general assumptions associated with their development

5.1 Flora and fauna habitat models

The predictive habitat models for each of the relevant flora and fauna species, was designed to provide a dynamic, robust and predictive GIS layer that could incorporate data from scientific literature and DAWE conservation listing advice/recovery plans, verified government datasets, specimen backed datasets (i.e. data derived from a known/confirmed location of an observed specimen) and field identified records into a single layer that could be used to identify areas that are known, or considered to have the potential to support specific threatened EPBC Act listed flora and fauna species. Development of these layers had the ultimate objective to:

- Predict areas that have the potential to support EPBC Act listed flora and fauna species
- Facilitate the quantification of impacts to inform later stages of the EIS process (e.g. offset liabilities)
- Inform the design with respect to identifying areas of high ecological value which should be avoided or measures implemented to minimise the impacts
- Facilitate the assessment of assessment of significant residual impacts in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DotE 2013).

The habitat modelling was created using ESRI ArcGIS, specifically the ESRI ArcGIS Model Builder which facilitated the development of scripts that allowed for the species-specific development of queries that utilised a range of GIS input datasets (e.g. vegetation communities containing site derived and filed verified information).

The models also incorporated the use of selecting relevant components and performing functions such as buffers and intersects that reflected the preferred habitat of a particular species. As a result of this process output habitat layers were generated for each species according to their individual requirements. The species-specific requirements that were used to generate the species-specific queries used to map potential habitat are identified in Table 5.1 and Table 5.2. Once produced model outputs were reviewed internally by suitably qualified and experience ecologists to assess that they accurately reflected/identified habitat suitable for supporting the relevant species. If anomalies were identified, GIS iterations were undertaken to produce outputs of greater accuracy. However, it is noted that whilst species that were identified to have potential to occur within the broader region underwent habitat modelling, the results of the modelling did not necessarily identify habitat within the MNES study area for all of the species modelled. Where this occurred, these species (i.e. without identified habitat within the MNES study area) did not undergo impact assessment as part of the Project EIS.

As the predictive flora and fauna habitat model mapping has been designed to identify areas of potential habitat for EPBC Act listed species as stipulated by relevant guidelines, policy statements, conservation listing advice and recovery plans, several assumptions to the model have been made. These assumptions are outlined below.

- Heterogeneous vegetation community polygons – Mapping has been designed to identify maximum areas of disturbance based on a conservative approach. In the case of heterogeneous polygons, if the vegetation community code is contained within the heterogeneous polygon, and if the relevant community/communities constitute 50 per cent or more of the heterogeneous polygon, then the entire polygon was selected and included as part of the habitat mapping. This represents a highly conservative approach to habitat modelling as it has potential to significantly over-estimate habitat in the absence of ground-truthing. This is of importance to species such as those that rely on limited areas of habitat such as Brigalow reptiles[2], which would otherwise be overlooked by the model. Areas of predicted habitat may be removed from mapping if field survey indicates that habitat is not available.
- Buffers – Buffers have been used when integrating a specimen backed record into the predicted mapping. Generally, a 1 km buffer from the species data point is used (in line with the methodology adopted by the Queensland *Vegetation Management 1999* when identifying *essential habitat* derived from a specimen backed record under state based legislation) which results in some areas being identified as potential habitat despite being developed for other purposes (i.e. irrelevant on the level of development or clearing) and thus unlikely to support the species. This is particularly apt for the Koala, where the buffer results in areas of grazing land being defined as koala habitat despite the absence of koala trees etc. In these areas it is noted that the loss of habitat is not the risk but the potential for barrier impacts for koalas and potentially the Spotted-tail quoll. Deviations from this methodology (where they occur), are identified in Table 5.1 and Table 5.2.
- Habitat critical to the survival of the species – The predictive flora and fauna habitat mapping outlined in this document primarily proposes potential habitat as the preferred habitat requirements for many of the species mapped. This is as a result of their habitat not being fully understood or cannot be easily extrapolated from available datasets or species information (such as applicable species recovery plans or approved conservation advice). In those cases, site derived species records were used to extrapolate preferred habitat by correlating with the underlying GIS layer. For these species, where a species point record and associated 1 km buffer intersect with areas of predicted potential habitat, the area of overlap has been elevated to the Habitat critical to the survival of the species category. The relationship between potential habitat, important habitat, species records and habitat critical to the survival of the species outlined in Table 5.1 (flora) and Table 5.2 (fauna).
- Use of existing specimen backed records to identify habitat associations – In instances where there was insufficient literature to confidently identify areas of potential habitat, specimen backed records were used to identify the associated vegetation association (e.g. preferred vegetation communities and geological components). These point-selected datasets were then assessed to determine that they were consistent with the species habitat requirements. When identified as valid, the point selected data points were incorporated into the predictive mapping "recipe" for the particular species (refer Table 5.1 and Table 5.2). Point selected datasets that were not identified as being able to support the species were rejected from use in further analysis.
- Minimum areas of habitat – Mapping has been designed to identify maximum areas of disturbance and therefore no minimum area of habitat has been identified. The methodology was developed to predict areas of potential habitat. However, the resolution of the mapping is constrained by the data inputs (e.g. vegetation community mapping) and therefore areas that may potentially be identified as habitat will always be contiguous to areas of similar habitat that reflect the minimum resolution for the input dataset (e.g. minimum vegetation community polygon size, etc.).

[2] The Draft Referral guidelines for the nationally listed Brigalow Belt reptiles noted that the RE's suitability for reptile habitation is only broadly indicative as RE polygons are mapped at a 2-5 ha scale depending on how, where and when the mapping was carried out. This means that RE polygons mapped as unsuitable habitat may actually contain 2-5 ha of suitable habitat and vice versa for polygons mapped as suitable.

- Levels of habitat mapping – Potential habitat has primarily been indicated on the predictive mapping. However, where areas identified in relevant recovery plans or referral guidelines have been identified and these areas overlap with areas of predicted Potential habitat category, these areas have been elevated to Habitat critical to the survival of the species or Important habitat (e.g. for Brigalow belt reptiles) in line with the information contained within the relevant species advice/guideline or policy.

Table 5.1 Listed threatened flora species habitat assumptions used to map areas of occurrence within Project matters of national environmental significance study area

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Brassicaceae	*Lepidium peregrinum*	Wandering pepper-cress	E	*Lepidium peregrinum* has not been identified as occurring within or near the MNES study area. Desktop assessments also indicate that there is an absence of specimen backed records within the region. *Lepidium peregrinum* grows in riparian open forest dominated by *Eucalyptus camaldulensis* and *Casuarina cunninghamiana* with a variably dense shrubby understorey of *Hymenanthera dentata, Bursaria spinosa, Acacia fimbriata, Acacia floribunda, Callistemon viminalis* and *Leptospermum brachyandrum*. This species is often most abundant in tussock grassland fringing riparian open forest (*Poa* sp. - *Lomandra longifolia* - *Paspalum dilatatum*), with some plants scrambling to a height of 2 m in thickets of *Hymenanthera*. It also occurred in shade under shrubs close to the creek bank, where most plants were small, about 30 cm in height.	The following REs (remnant and regrowth) are considered to constitute potential habitat as they are identified as open forest communities that contain one or more of the following species species: *Eucalyptus camaldulensis, Casuarina cunninghamiana, Hymenanthera dentata, Bursaria spinosa, Acacia fimbriata, Acacia floribunda, Callistemon viminalis* and/or *Leptospermum brachyandrum:* 11.3.2b, 11.3.25, 113.25c, 11.3.25e and 11.3.27. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.* *Note: this species has been derived from the predictive PMST and has been included for completeness.*	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Characeae	*Lychnothamnus barbatus*	A green alga	E	*Lychnothamnus barbatus* has not been identified within or near the MNES study area. Database records are located 20 km south-west and 26 km south (upstream) of the Project disturbance footprint including Warrill Creek. *Lychnothamnus barbatus* occurs in clear flowing water (Queensland Herbarium 2009).	The following is considered to be potential habitat: All areas identified as stream order 3 and above with a 10 m buffer applied. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside areas specified above are considered to constitute potential habitat.*	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).
Euphorbiaceae	*Bertya ernestiana*	A shrub	V	*Bertya ernestiana* has not been identified as occurring within or near the MNES study area. Desktop assessments also indicate that there is an absence of specimen backed records within the region. *Bertya ernestiana* grows in heath or open eucalypt forest with heath understorey on skeletal sandy loam soils derived from rhyolite on steep rocky slopes, rock pavements and in mountain gorges. The species has been recorded growing in association with *Leptospermum* spp., *Gynura* spp., *Keraudrenia* spp., and *Plectranthus suaveolens.*	The following REs (remnant) are considered to constitute potential habitat as they are *heath* or *eucalyptus open forest with a heathy understory*: 12.8.19, 12.11.28, 12.12.10. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.* Non-remnant and regrowth areas have been excluded from the predictive mapping for this species as these areas deviate from habitat requirements as identified within the conservation listing advice for this species.	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Fabaceae	*Sophora fraseri*	Brush sophora	V	*Sophora fraseri* has not been identified as occurring within or near the MNES study area. Desktop assessments also indicate that there is an absence of specimen backed records within the region. *Sophora fraseri* grows in moist habitats, often in hilly terrain at altitudes from 60 to 660 m ASL on shallow soils along rainforest margins in eucalypt forests or in large canopy gaps in closed forest communities.	The following REs (remnant vegetation), which are identified as either *rainforest*, or *vine thickets* are considered to constitute potential habitat (i.e. to capture large canopy gaps in closed forest communities) when they are located within an altitude of 60 to 660 m ASL: 12.8.14, 12.8.14a, 12.8.14 x 1, 12.9-10.5d, 12.9-10.19, 12.11.3, 12.11.3a, 12.11.3b, 12.11.5, 12.11.15a. 12.11.5e, 12.11.5h, 12.11.5j, 12.11.5k, 12.11.25, 12.11.26, 12.11.27. In addition to the above REs, where the following remnant REs (identified as vine forest) occur within an altitude of 60 to 660 m ASL, a 200 m buffer is to be placed around their perimeter where it intersects with any other RE type in order to include vine forest margins and transitional zones into the Potential habitat category: 12.3.1, 12.3.17, 12.11.1. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.* Non-remnant and regrowth areas have been excluded from the predictive mapping for this species as these areas deviate from habitat requirements as identified within the conservation listing advice for this species.	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Oleaceae	*Notelaea lloydii*	Lloyd's olive	V	Eight individuals were recorded within 200 m of the disturbance footprint during Project-associated protected plant surveys in 2018. Multiple database records for this species exist for areas within the MNES study area. It is estimated that the Project is likely to impact habitat in which this species is predicted to occur. Database records indicate that this species occurs within the MNES study area. A review of the available literature has not revealed any important populations (DEWHA 2008a). However, given that the database records are in such close proximity to and have potential to be impacted by the Project there is potential to impact a population for the species. This species has a restricted distribution, has undergone historical loss and will encounter future loss resulting from rural and urban development. As such the population that is relevant to the project can be considered an important population and therefore key to the long-term survival of this species.	Given that this species has been identified within the project footprint, any identified habitat has been categorised as habitat critical to the survival of the species. Potential habitat has not been mapped for this species	Not applicable	Given that this species has been identified within the project footprint, the following REs are considered to constitute habitat critical to the survival of the species when it is located at an elevation between 80 to 480 m as it has been identified by the Qld Government as providing habitat for *Notelaea lloydii*: 12.9-10.2. In addition, the following REs (identified as remnant "*open eucalypt forest*"): 12.8.1, 12.8.2, 12.8.8, 12.8.9, 12.8.10, 12.8.1112.8.12, 12.8.24, 12.8.25, 12.9-10.1, 12.9.10.3, 12.9-10.14, 12.9-10.17, 12.9-10.17a, 12.9-10.17b, 12.9-10.17c, 12.9-10.17d, 12.9-10.17e, 12.9-10.23, 12.9-10.27, 12.9-10.29, 12.12.2, 12.12.3, 12.12.15 and 12.12.20 are considered to constitute habitat critical to the survival of the species, when they occur at an elevation between 80 to 480 m and are **located directly adjacent** to the following REs (remnant vegetation), which are identified as either *rainforest*, or *vine thickets*: 12.2.1, 12.2.2, 12.2.3, 12.3.1, 12.3.1a, 12.3.2, 12.3.16, 12.3.21, 12.5.13, 12.5.13a, 12.5.13b, 12.5.13c, 12.8.3, 12.8.4, 12.8.5, 12.8.8, 12.8.9, 12.8.13, 12.8.18, 12.8.21, 12.8.22, 129-10.15, 12.9-10.16,

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
				Notelaea lloydii occurs in open eucalypt forest, often near the margins of vine thickets, vine forests and softwood scrub at altitudes between 80 and 480 m ASL. It is usually found on stony, shallow and rocky soils derived from sandstone or acid volcanic rocks, often on steep slopes, or near drainage lines. Lloyd's olive is known from eight sites at five locations within south-east Queensland.			12.11.1, 12.11.2, 12.11.3, 12.11.4, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.12.1, 12.12.13, 12.12.15, 12.12.15a, 12.12.16, 12.12.17 and 12.12.18. A buffer of 200 m is to be used from the above remnant REs to create a new polygon from the larger "parent" REs. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are also considered to constitute habitat critical to the survival of the species.* *It is also noted that (in the absence of a specimen backed record) non-remnant and regrowth vegetation communities have not been included as part of the habitat mapping as these areas do not conform to habitat as identified within the conservation listing advice for this species.*

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Orchidaceae	*Bulbophyllum globuliforme*	Miniature moss-orchid	V	The species was not identified within any Project-associated field surveys. There are no historic records of this species within or close to the disturbance footprint. Database records indicate that this species is known to occur within 50 km of the Project. However, the nearest record is from Lamington National Park located around 45 km south of the Project with the record taken in 2002. *Bulbophyllum globuliforme* grows as an epiphyte only on *Araucaria cunninghamii*, colonising the upper branches of mature trees in upland rainforest.	In order for *Araucaria cunninghamii* to provide habitat for *Bulbophyllum globuliforme*, trees must be mature (i.e. 100 plus years). Therefore, only mature (remnant) vegetation communities were selected. The following REs (remnant patches only) are considered to constitute potential habitat for this species as they may contain *Araucaria cunninghamii*: 12.2.3, 12.3.1, 12.3.11a, 12.3.16, 12.3.21, 12.5.13, 12.5.13a, 12.5.13c, 12.8.4, 12.8.13, 12.8.21, 12.9-10.15, 12.9-10.16, 12.11.3, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.12.1, 12.12.13, 12.12.15, 12.12.15a, 12.12.16, 12.12.17, 12.12.18. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).
Orchidaceae	*Phaius australis*	Lesser swamp orchid	E	There are no records of the Lesser swamp orchid within 50km of the Project area. The Lesser swamp orchid is associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest and often where *Melaleuca leucadendra, Melaleuca quinquenervia* or *Eucalyptus robusta* are found.	The following REs (remnant) are considered to constitute potential habitat as they are wet heath/sedgeland wetlands, swampy grassland or swamp that may contain *Melaleuca quinquenervia* or *Eucalyptus robusta*: 12.2.5, 12.2.5a, 12.2.7, 12.2.7a, 12.2.7c, 12.3.4, 12.3.4a, 12.3.5, 12.3.5a, 12.3.6, 12.3.12, 12.3.14. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Poaceae	*Arthraxon hispidus*	Hairy-joint grass	V	The species is mapped as may occur only in isolated portions of the disturbance footprint. The species was not identified within any Project-associated field surveys. There are no database records of this species within or adjacent to the MNES study area. Database records indicate the species has been recorded in the wider region surrounding the Project. The nearest database record is dated from 1941 and is located approximately 14 km south of the disturbance footprint (to the south of Wyaralong Dam) in cleared habitat. Hairy-joint grass is found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps, as well as woodland. In southeast Queensland, Hairy-joint grass has also been recorded growing around freshwater springs on coastal foreshore dunes, in shaded small gullies, on creek banks, and on sandy alluvium in creek beds in open forests, and also with bog mosses in mound springs.	The following REs (remnant and regrowth and springs) are considered to constitute potential habitat as they are ether wet eucalypt forest, swamps, woodland freshwater springs on coastal foreshore dunes, shaded small gullies or sandy alluvium or open forests: 12.2.1, 12.2.2, 12.2.3, 12.2.4, 12.3.1, 12.3.1a, 12.3.2, 12.3.16, 12.3.21, 12.5.13, 12.5.13a, 12.5.13b, 12.5.13c, 12.8.3, 12.8.4, 12.8.5, 12.8.8, 12.8.9, 12.8.13, 12.8.18, 12.8.21, 12.8.22, 129-10.15, 12.9-10.16, 12.11.1, 12.11.2, 12.11.3, 12.11.4, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.12.1, 12.12.13, 12.12.15, 12.12.15a, 12.12.16, 12.12.17, 12.12.18. In addition, to capture areas of habitat located in proximity to watercourses as identified within the conservation listing advice, the following REs (remnant and regrowth) are considered to constitute potential habitat when they are located **within 100 m** (i.e. create a buffer, which will be used to "cleave" larger REs to create new polygons) of a watercourse (stream order 3 and above): 12.2.6, 12.2.11, 12.3.3, 12.3.7, 12.3.10, 12.3.12. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Poaceae	*Dichanthium setosum*	A bluegrass	V	*Dichanthium setosum* has not been identified as occurring within or near the MNES study area. Desktop assessments also indicate that there is an absence of specimen backed records within the region. *Dichanthium setosum* is associated with heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil and is found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture. The extent to which this species tolerates disturbance is unknown.	The following REs (remnant and regrowth) are considered to constitute potential habitat as they represent grassy woodlands on basalt derived soils. 12.8.14, 12.8.19, 12.8.27. In order to capture information related to cleared woodland, regrowth mapping has been used as these areas have historically been subject to clearing activities. In addition, road reserves that are mapped as RE (pre-clear) 12.8.14, 12.8.19, 12.8.27 area also potential habitat for this species in recognition of the species ability to persist in disturbed environments. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).
Proteaceae	*Macadamia integrifolia*	Queensland nut tree	V	Naturally occurring *Macadamia integrifolia* (i.e. specimens growing within natural habitat) has not been identified as occurring within or near the MNES study area. The Queensland nut tree grows in remnant rainforest, preferring partially open areas such as rainforest edges.	Given that this species occurs in remnant rainforest communities, the following REs (remnant communities) are considered to constitute potential habitat when they are within an altitude of 5 - 400 m ASL: 12.3.1, 12.3.1a, 12.3.16, 12.3.21, 12.8.3, 12.8.4, 12.8.5, 12.8.13, 12.8.18, 12.8.21, 12.8.22, 12.11.1, 12.11.4, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.12.1, 12.12.13, 12.12.16, 12.12.17, 12.12.18.	Not applicable	All areas occupied by the species - Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	**Important habitat**	**Habitat critical to the survival of the species**
					*Note: Any specimen backed records of **naturally occurring** individuals (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.* Note that non-remnant and regrowth communities have not been identified as habitat for this species as they lack the required structural complexity required to support the species.		
Rutaceae	*Bosistoa transversa*	Three-leaved bosistoa	V	This species has not been identified as occurring within or near the MNES study area. The Three-leaved bosistoa grows in lowland subtropical rainforest up to 300 m ASL.	Given that this species requires a well-developed (complex) vegetation community (i.e. Lowland tropical rainforest), the following REs (remnant vegetation) are considered to constitute potential habitat when they occur at an elevation below 300 m ASL: 12.3.1, 12.5.13, 12.8.3, 12.8.4, 12.11.1, 12.11.10, 12.12.1 and 12.12.16. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.* Note that non-remnant and regrowth communities have not been identified as habitat for this species as they lack the required structural complexity required to support the species.	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Rutaceae	*Phebalium distans*	Mt Berryman phebalium	CE	Restricted species known from ten populations in SEQ. The Mt Berryman phebalium is found in semi-evergreen vine thicket on red volcanic soils, or in communities adjacent to this vegetation type. Vegetation associations in which Mt Berryman phebalium occur include microphyll to notophyll vine forest with or without *Araucaria cunninghamii* and low microphyll vine forest and semi-evergreen vine thicket with or without *Araucaria cunninghamii.*	Given that this species requires a well-developed (complex) vegetation community (ie semi-evergreen vine thickets), the following REs (remnant) are considered to constitute potential habitat: 12.12.13, 12.12.16, 12.12.17, 12.12.18. In addition, any RE that is contained within 200 m (create a buffer, which will be used to "cleave" larger REs to create new polygons) of the following REs are considered to constitute potential habitat: 12.12.13, 12.12.16, 12.12.17, 12.12.18. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.* Note that non-remnant and regrowth communities have not been identified as habitat for this species as they lack the required structural complexity required to support the species.	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).
Santalaceae	*Thesium australe*	Austral toadflax	V	There are no recent records of Austral toadflax within or in proximity to the Project area. Austral toadflax is semi-parasitic on roots of a range of grass species, notably *Themeda triandra* and *Dichanthium* sp.	The following REs (remnant and regrowth) are considered to constitute potential habitat as they comprise *open forest/woodland with a grassy understory,* or *grasslands* on basalt derived sediments : 12.3.3, 12.8.16, 12.8.17, 12.8.27.	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	**Important habitat**	**Habitat critical to the survival of the species**
				It occurs in shrubland, grassland or woodland, often on damp sites. Vegetation types include open grassy heath dominated by *Leptospermum myrtifolium*, *Hakea microcarpa*, *Callistemon sieberi, Grevillea lanigera*, *Epacris microphylla* and Poa spp.; *Themeda triandra* grassland surrounded by *Eucalyptus* woodland; and grassland dominated by *Cymbopogon refractus.* The species is also known to occur within highly disturbed road reserves within the Toowoomba region which are maintained to control woody weed species.	In addition, the following pre-clearance REs (cleared, non-remnant areas) are considered to constitute habitat when they are contained within a road reserve **on basalt derived soils** as these areas coincide with areas that may historically have contained the species: 12.3.3, 12.8.16. 12.8.17, 12.8.27. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*		
Sapindaceae	*Cupaniopsis tomentella*	Boonah tuckeroo	V	The species is mapped as likely to occur to the south of the Project and a small area to the north around Flinders Peak. The species was not identified within any Project-associated field surveys. There are no historic records of this species within or directly adjacent to the disturbance footprint. Database records indicate this species is known to occur within 10 km south of the Project, within an area of Teviot Range (Ivory's Knob) from several 1980s records.	The following mature REs (Remnant) are considered to constitute potential habitat as they represent vine thickets on fertile clay soils within SEQ: 12.5.13, 12.5.13a, 12.5.13b, 12.5.13c, 12.8.3, 12.8.4, 12.8.5, 12.8.13, 12.8.18, 12.8.21, 12.8.22, 12.9-10.15 and 12.9-10.16. Non-mature vegetation communities (i.e. regrowth and non-remnant vegetation) were not included as it does not conform to habitat as identified within the conservation listing advice for this species.	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	**Important habitat**	**Habitat critical to the survival of the species**
				The Boonah tuckeroo is known only from an area between Boonah and Ipswich in south-eastern Queensland. It grows in vine thickets predominantly on fertile clay soils. Restricted to vine thickets on fertile clay soils within SEQ confined to seven known occurrences within scree slopes and roadsides.	*Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*		
Sapotaceae	*Planchonella eerwah*	Shiny-leaved condoo	E	The desktop searches identified records within the MNES study area and disturbance footprint along Woollaman Creek (within the Teviot Range to the east of Jimboomba). Three historical specimen records (all from 1985) are found approximately 240 m north of Chainage 46 of the Project alignment, however nothing within the last 30 years. There are a number of database records (i.e. AoLA, Wildlife Online) surrounding the MNES study area associated with the Teviot Range and immediate surrounds. The majority of these are records that are over 30 years old. More recent specimen backed records occurring within 10 km of the Project include two records between Jimboomba and Beaudesert (2015 and 2007) and a single record (2016) to the north near Flinders Peak.	The following REs (remnant vegetation communities) are considered to constitute potential habitat as they are consistent with vegetation communities described as either subtropical rainforest, dry rainforest or *Araucaria cunninghamii* vine scrub as identified within the conservation listing advice for this species: 12.2.1, 12.2.2, 12.2.3, 12.3.1, 12.3.1a, 12.3.16, 12.3.21, 12.5.13, 12.5.13a, 12.5.13b, 12.5.13c, 12.8.3, 12.8.4, 12.8.5, 12.8.13, 12.8.18, 12.8.21, 12.8.22, 12.9-10.15, 12.9-10.16, 12.11.1, 12.11.4, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.12.1, 12.12.13, 12.12.16, 12.12.17 and 12.12.18. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	**Important habitat**	**Habitat critical to the survival of the species**
				The Shiny-leaved condoo grows in subtropical rainforest, dry rainforest and *Araucaria cunninghamii* vine scrub. All known areas in which the Shiny-leaved condoo occurs are warm and subtropical with an annual rainfall of between 650 to 1,000 mm. Sixty per cent of the annual rain falls in the summer months.	Note that areas identified as non-remnant or regrowth communities have not been included as mapped habitat as these areas do not meet the habitat requirements as identified within the conservation listing advice for *Planchonella eerwah*.		
Simaroubaceae	*Samadera bidwillii*	Quassia	V	There are no recent records for *Samadera bidwillii* within the Project area or within the broader context of the site. Quassia commonly occurs in lowland rainforest or on rainforest margins, but it can also be found in other forest types, such as open forest and woodland. Quassia is commonly found in areas adjacent to both temporary and permanent watercourses in locations up to 510 m altitude. The species occurs on lithosols, skeletal soils, loam soils, sands, silts and sands with clay subsoils.	The following REs (remnant only) are considered to constitute potential habitat at elevations below 510 m as they are identified as rainforest or vine forest vegetation communities: 12.3.1, 12.5.13, 12.8.3, 12.8.4, 12.11.1, 12.11.10, 12.12.1 and 12.12.16. In addition to the above REs, the portions of the following REs (i.e. sections that are located 200 m from the REs identified above) are considered potential habitat as they represent transitional zones between oven forest and rainforest/vine forest vegetation communities: 12.3.3, 12.3.11, 12.3.18, 12.5.1, 12.5.7, 12.8.24, 12.9-10.2, 12.9-10.3, 12.9-10.5, 12.9-10.12, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.23, 12.9-10.27, 12.9-10.28, 12.12.3, 12.12.5, 12.12.23, 12.12.24 and 12.12.25. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	All areas occupied by the species. Any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Family	Scientific name	Common name	EPBC Act status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	Habitat modelling assumptions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
				Commonly associated tree species include *Corymbia citriodora, Eucalyptus propinqua, Eucalyptus acmenoides, Eucalyptus tereticornis, Eucalyptus intermedia, Eucalyptus siderophloia, Eucalyptus moluccana, Eucalyptus cloeziana* and *Eucalyptus fibrosa*.	Note that areas identified as non-remnant or regrowth communities have not been included as mapped habitat as these areas do not meet the habitat requirements as identified within the conservation listing advice for *Samadera bidwillii*.		

Table notes:

CE = Critically endangered E = Endangered V = Vulnerable C = Least concern

Table 5.2 Listed threatened fauna species habitat assumptions used to map areas of occurrence within the Project matters of national environmental significance study area

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Birds	*Anthochaera phrygia*	Regent honeyeater	CE	The Regent honeyeater primarily inhabits inland slopes of the Great Dividing Range, in areas of low to moderate relief with moist, fertile soils. It is most commonly associated with box-ironbark eucalypt woodland and dry sclerophyll forest, but also inhabits riparian vegetation such as she oak (*Casuarina* spp.) where it feeds on needle-leaved mistletoe and occasionally breeds. It may occasionally utilise lowland coastal forest, which may act as a refuge when its usual habitat is affected by drought. Tree species with which the Regent honeyeater is most often associated include *Eucalyptus melliodora, Eucalyptus albens, Eucalyptus sideroxylon* away from the coast, and *Eucalyptus robusta* and *Corymbia maculata* close to the coast. The species prefers mature large trees that produce more flowers, particularly those on fertile soils and in riparian areas (DotE 2016). Not identified as occurring during the Project surveys. In SEQ, the Regent honeyeater irregularly and sparsely occurs as individuals or in pairs from the Cooloola Plains in the north to inland areas such as Dalby. It is known to breed in small numbers regularly to the west of Warwick in Durikai State Forest (Garnett et al. 2011).	The following mapped vegetation communities (REs – remnant and regrowth) comprise vegetation communities containing the preferred tree species: *Eucalyptus melliodora, Eucalyptus albens, Eucalyptus sideroxylon, Eucalyptus robusta* and *Corymbia maculata,* and are considered as potential habitat: 12.2.7c, 12.3.3c, 12.3.3.d, 12.3.11, 12.3.4, 12.5.1, 12.5.7, 12.5.7a, 12.5.7c, 12.8.14, 12.8.16, 12.8.17, 12.8.24, 12.9-10.2, 12.9-10.5, 12.9-10.17, 12.9-10.27, 12.11.5, 12.11.6, 12.11.9, 12.11.25, 12.12.3, 12.12.5. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	Under the *National recovery plan for the Regent honeyeater (Anthochaera Phrygia)* habitat critical to the survival of this species includes: ■ Any breeding or foraging areas where the species is considered 'known or likely to occur' as indicated in Figure 1 of the plan. The Project is located within the 'may occur' area only. Therefore, for this assessment any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Birds	*Botaurus poiciloptilus*	Australasian bittern	E	The Australasian bittern occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. It favours wetlands with tall, dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. The species favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus*) or cutting grass (Gahnia) growing over muddy or peaty substrate. This species occurs from Bundaberg in south-east Queensland south to Victoria and west into South Australia. There are few and sparse records from SEQ where the population is estimated to be 3 to 16 individuals (Garnett et al. 2011). In SEQ there are records from the Lockyer Valley associated with large permanent water bodies.	The following mapped vegetation community /wetland areas are considered to constitute potential habitat: Lacustrine REs, lacustrine water bodies, palustrine REs, palustrine water bodies, riverine REs, riverine water bodies, estuarine REs, estuarine water bodies, marine REs and marine water bodies and wetland areas (outside of mapped REs). It is noted that due to the dry conditions during the survey period, some wetland areas may exist that were not detected during the surveys. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	Under the draft *National recovery plan for the Australasian bittern (Botaurus poiciloptilus)* (DoEE 2019) habitat critical to the survival of this species includes: ■ Any wetland habitat where the species is 'known or likely to occur' (breeding or foraging habitat) within the indicative distribution map within the Draft recovery plan; and ■ Any location with suitable habitat outside the above area that may be periodically occupied by Australasian Bittern. The MNES study area is currently outside of areas mapped within the recovery plan for this species. However, any wetland containing a specimen backed record is considered to constitute Critical habitat for this species.

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Birds	*Calidris ferruginea*	Curlew sandpiper	CE	The Curlew sandpiper primarily occurs on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters. Species occurs around entire Australian coastline. There are scattered records from large permanent waterbodies in the Lockyer Valley but the majority of records from the region are coastal or from inshore islands in Moreton Bay.	The following mapped vegetation community /wetland areas are considered to constitute potential habitat: Lacustrine REs, lacustrine water bodies, palustrine REs, palustrine water bodies, riverine REs, riverine water bodies, estuarine REs, estuarine water bodies, marine REs and marine water bodies and wetland areas (outside of mapped REs). It is noted that due to the dry conditions during the survey period, some wetland areas may exist that were not detected during the surveys. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	Species does not breed in the southern hemisphere. There is no definition of critical habitat available for the species. Therefore, for the purposes of this assessment, wetlands containing a specimen backed record are considered to constitute Critical habitat for this species.
Birds	*Hirundapus caudacutus*	White - throated needletail	M, V	This is an aerial species that uses all airspace for general hunting. The species breeds within the northern hemisphere summer. The species is thought to rarely land when in Australia (during the southern hemisphere summer). Night-time roosting sites are rarely recorded although the species has been observed roosting on trees in sclerophyll forest on a low ridgeline (Tarburton 1993). The species occurs across eastern Australia during the summer months.	All areas located outside of mapped remnant vegetation communities are potential habitat.	Under the *Referral guideline for 14 birds listed as migratory species under the EPBC Act (*DoE 2015) important habitat is described as non-breeding habitat – more often over wooded areas. As such all areas mapped as remnant vegetation are considered as 'important habitat.	Not applicable

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Birds	*Erythrotriorchis radiatus*	Red goshawk	V	The Red goshawk prefers forest and woodland with a mosaic of vegetation types, large prey populations (birds), and permanent water. Habitat must be open enough for fast attack and manoeuvring in flight but provide cover for ambushing of prey. They avoid very dense and very open habitats. The species occupies large home ranges estimated to be up to 120 km^2 (females) and 200 km^2 (males). The vegetation types utilised by this species include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins. Nests are in tall trees within one km of and often beside permanent water (e.g. river, swamp, pool), usually in fairly open, biologically rich forest or woodland. These habitats provide appropriate foraging conditions for the large Red goshawk, and a diversity and abundance of the medium to large birds taken as food. SEQ is likely the southern extent of the species distribution. There are scattered records from the Lockyer Valley and Toowoomba areas although recent intensive surveys targeting the species did not observe any individuals (Seaton 2014).	The following mapped vegetation communities (REs) are considered to be potential habitat in the Teviot Range and Little Liverpool Range areas (i.e. smaller isolated fragments are unlikely to represent suitable habitat for the species)**:** 12.2.4, 12.3.1, 12.3.1a, 12.3.2, 12.3.3, 12.3.3a, 12.3.3c, 12.3.4, 12.3.5, 12.3.7, 12.3.16, 12.3.17, 12.3.19, 12.3.21, 12.5.1, 12.5.2x1, 12.5.5, 12.7.2, 12.8.1, 12.8.2, 12.8.8, 12.8.10, 12.8.11, 12.8.12, 12.8.23, 12.9-10.1, 12.9-10.1x1, 12.9-10.2, 12.9-10.4a, 12.9-10.5, 12.9-10.14, 12.9-10.14a, 12.9-10.14b, 12.9-10.18, 12.9-10.18b, 12.9-10.29, 12.11.2, 12.11.3b, 12.11.6, 12.11.16, 12.11.16x1, 12.12.2, 12.12.2a, 12.12.15, 12.12.15a, 12.12.15b, 12.12.20. For the purposes of mapping habitat, grasslands/cleared areas were excluded as they are non-conducive to an ambush predator and not compatible with the foraging habitat of this species. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	The *National recovery plan for the Red goshawk (Erythrotriorchis radiatus)* (DERM 2012) describes habitat critical to the survival of this species comprises all required habitat elements including 'sites for nesting, food resources, water, shelter, essential travel routes, dispersal, buffer areas, and sites needed for the future recovery'. As such, for this assessment any potential habitat when it is contained within 1 km of a stream order 3 watercourse (or above) or a lacustrine or palustrine RE or Water body.

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Birds	*Grantiella picta*	Painted honeyeater	V	The Painted honeyeater inhabits mistletoes in eucalypt forests/woodlands, **riparian** woodlands of black box and River red gum, box-ironbark-Yellow gum woodlands, Acacia-dominated woodlands, paperbarks, casuarinas, Callitris, and trees on farmland or gardens. The species is often associated with following tree species: *Acacia harpophylla, Acacia homalophylla, Acacia pendula, Allocasuarina luehmannii, Eucalyptus largiflorens* and *Eucalyptus camaldulensis.* The Painted honeyeater prefers woodlands which contain a **higher number of mature trees**, as these host more mistletoes. It is more common in wider blocks of remnant woodland than in narrower strips, although it has been observed to breed in relatively narrow roadside strips when ample mistletoe fruit is available. The species population is sparsely dispersed across south-east Australia to north-west Queensland and eastern Northern Territory. There are a few scattered coastal records to the north and south of the Project, but the vast majority of records lie on the western slopes of the Great Dividing Range. Coastal records may be considered as vagrant individuals. Rowland (2012) notes non-breeding individuals are recorded occasionally from coastal areas along the eastern seaboard.	The following mapped vegetation communities (remnant and regrowth REs) are considered potential habitat where they comprise the trees identified under the species habitat requirements: 12.3.3, 12.3.3a, 12.3.3b, 12.3.3d, 12.3.6, 12.3.7, 12.3.7a, 12.3.10, 12.3.11, 12.3.19, 12.5.1, 12.5.2, 12.5.6. It is noted that Project is located well to the east of the species normal distribution are there are no identified important populations of the species *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	There is no definition of habitat critical to the survival of this species available. For the purposes of this assessment this habitat includes: ■ Any breeding or foraging areas where the species is likely to occur. Therefore, any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (excluding areas that fall outside of identified vegetation communities).

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Birds	*Lathamus discolor*	Swift parrot	CE	The Swift parrot inhabits dry sclerophyll eucalypt forests and woodlands. It occasionally occurs in wet sclerophyll forests. The Swift parrot predominantly forages within habitats that have been so significantly cleared that they are classified as **endangered** ecological communities. Nevertheless, they are recorded in a wide range of habitats including parklands in urban areas. These sites may be used opportunistically when resources elsewhere are scarce. This species primarily feeds on nectar and lerp in the canopy. The species is observed to prefer foraging in large mature trees (Saunders and Tzaros 2011). In south-east Queensland/northern NSW (coastal) the Swift parrot is known to preferentially forage on the following tree species: Queensland blue gum (*Eucalyptus tereticornis*), Yellow box (*E. melliodora*), Grey box (*E. microcarpa*) and Swamp mahogany (*E. robusta*) (Saunders and Tzaros 2011). Species also known to forage in Gum-topped box (*E. moluccana*) and Blackbutt (*E. pilularis*) in northern NSW (coastal) (Saunders and Heinsohn 2008) in which the species has been recorded during project surveys. Species has been identified foraging in *E. moluccana* during surveys for the Project. Swift parrot breeds only in Tasmania. The species is an uncommon but regular visitor to south-east Queensland in the winter months.	The following REs (remnant and regrowth areas) are considered to be potential habitat as they may provide cover for the species but do not provide tree species that are identified as providing feeding resources: 12.3.5, 12.3.14, 12.5.1, 12.5.7, 12.5.7a, 12.5.7c, 12.8.24, 12.9-10.1x1, 12.9-10.2, 12.9-10.5, 12.9-10.5a, 12.9-10.7, 12.9-10.17, 12.9-10.17b, 12.9-10.27, 12.11.5, 12.11.25, 12.12.3, 12.12.5, 12.12.7. It is acknowledged that mature food trees are preferred foraging habitat, however to capture non-mature foraging habitat, the following regrowth REs containing the food trees (i.e. *Eucalyptus tereticornis, Eucalyptus melliodora, Eucalyptus microcarpa, Eucalyptus robusta and Eucalyptus moluccana*) are considered to provide potential habitat: 12.2.7, 12.3.3, 12.3.4, 12.3.7, 12.3.11, 12.3.11a, 12.3.18, 12.3.19, 12.5.2, 12.5.2a, 12.5.2b, 12.5.2x1, 12.5.7b, 12.8.14, 12.8.16, 12.9-10.1, 12.9-10.3, 12.9-10.8, 12.9-10.11, 12.9-10.14, 12.9-10.18a, 12.11.6, 12.11.9, 12.11.14, 12.11.15, 12.11.18a, 12.12.2, 12.12.12, 12.12.23.	The *National Recovery Plan for the Swift Parrot (Lathamus discolor)* (Saunders and Tzaros 2011) defines important habitat areas (sites used repeatedly between seasons or for prolonged periods) as "priority habitat" for this species. This includes the following: ■ Brisbane - Bowman Park, Bardon; Rafting Creek Reserve Kenmore/Fig Tree Pocket. ■ Toowoomba - Glen Lomond Park.	The recovery plan does not define 'critical habitat' for this species. Therefore, for this assessment the following REs which contain food trees (i.e. *Eucalyptus tereticornis, Eucalyptus melliodora, Eucalyptus microcarpa, Eucalyptus robusta and Eucalyptus moluccana*) have been considered as 'foraging habitat critical to the survival of the species' where they occur in remnant (mature) patches: 12.2.7, 12.3.3, 12.3.4, 12.3.7, 12.3.11, 12.3.11a, 12.3.18, 12.3.19, 12.5.2, 12.5.2a, 12.5.2b, 12.5.2x1, 12.5.7b, 12.8.14, 12.8.16, 12.9-10.1, 12.9-10.3, 12.9-10.8, 12.9-10.11, 12.9-10.14, 12.9-10.18a, 12.11.6, 12.11.9, 12.11.14, 12.11.15, 12.11.18a, 12.12.2, 12.12.12, 12.12.23.

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	**Important habitat**	**Habitat critical to the survival of the species**
					Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.		
Birds	*Rostratula australis*	Australian painted snipe	E	The Australian painted snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and clay pans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* spp. or cane grass or sometimes *Melaleuca* spp. The Australian painted snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber. Not identified during Project surveys. Scattered but regular records in SEQ including in the Lockyer Valley.	The following mapped vegetation community /wetland areas are considered to constitute potential habitat: Lacustrine REs, lacustrine water bodies, palustrine REs, palustrine water bodies, riverine REs, riverine water bodies, estuarine REs, estuarine water bodies, marine REs and marine water bodies and wetland areas (outside of mapped REs). It is noted that due to the dry conditions during the survey period, some wetland areas and more transient habitats such as drainage channels, waterlogged communities may exist that were not detected during the survey. These areas have not been included within the predictive mapping layer where they fall outside of government datasets. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	Under the draft *National recovery plan for the Australian painted snipe (Rostratula australis)* (DotEE 2019) habitat critical to the survival of the species includes: ■ Any habitat where the species is known or likely to occur (from map within the Plan). ■ Any location outside the above area that may be periodically occupied by Australian Painted Snipe when conditions are favourable. The MNES study area occurs within areas mapped as known or likely to support the species as indicated by the Draft Recovery Plan. Therefore, all wetland areas identified as Potential habitat within the MNES study area constitute critical habitat for this species.

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Birds	*Turnix melanogaster*	Black-breasted button-quail	V	The Black-breasted button-quail primarily occurs in drier low closed forests, particularly semi-evergreen vine thicket (SEVT), low microphyll vine forest, Araucarian notophyll vine forest and *Brachychiton* scrubs that may incorporate bottle trees (*Brachychiton* sp.), brigalow (*Acacia harpophylla)* and belah (*Casuarina cristata*). They may also be found in low thickets or woodlands with a dense understorey but little ground cover, typically dominated by *Acacia* spp. The *National Recovery Plan for the Black-breasted button quail Turnix melanogaster* (Mathieson and Smith 2010) identifies important populations in the following areas: Yarraman-Nanango, the Jimna-Conondale Range, the Great Sandy region, populations in Barakula State Forest and Palmgrove National Park, and all populations in New South Wales. The species was not recorded during Project surveys. The species is known from the surrounding area and is very habitat specific.	The following is considered to be potential habitat: Any specimen backed records (buffered to a 1 km radius) that fall outside of areas identified as Critical habitat (regardless of the level of clearing or development within the area).	Not applicable	The recovery plan identifies habitat considered critical to the survival of the species as those communities described under the species habitat requirements (SEVT, dry rainforest communities and Brigalow scrubs). As such the following vegetation communities (remnant and regrowth REs) are Critical habitat: 11.2.3, 11.3.11, 11.3.11x1, 11.4.1, 11.5.15, 11.7.1x1, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.4a, 11.9.4c, 11.9.8, 11.9.11, 11.10.2a, 11.10.8, 11.11.5, 11.11.14, 11.11.18, 11.11.21, 11.12.4, 11.12.21, 12.2.1, 12.2.2, 12.2.3, 12.2.4, 12.3.1, 12.3.2, 12.3.15, 12.5.6a, 12.5.13, 12.5.13a, 12.5.13b, 12.5.13c, 12.8.1, 12.8.3, 12.8.4, 12.8.5, 12.8.6, 12.8.7, 12.8.8, 12.8.9, 12.8.13, 12.8.18, 12.8.21, 12.8.22, 12.8.23, 12.9-10.15, 12.11.1, 12.11.2, 12.11.4, 12.11.6, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.11.16, 12.12.1, 12.12.2, 12.12.6, 12.12.13, 12.12.16, 12.12.17, 12.12.18, 12.12.26.

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Lobe-finned fishes	*Neoceratodus forsteri*	Australian lungfish	V	The Australian lungfish is endemic to Australia and restricted to south-eastern Queensland (Wager 1993). The species' natural distribution is the Mary, Burnett and Brisbane River systems and (possibly) the Pine River system (Kemp 2014). The species has been translocated to many other locations and translocated populations persist in the Coomera, Condamine, Albert and Logan Rivers (Kemp 2014). The Australian lungfish requires still or slow-flowing, shallow, vegetated pools with clear or turbid water in which to spawn and feed. The species is restricted to areas of permanent water and **cannot live in saline waters or migrate through sea water**. Emergent or submerged vegetation are essential for successful deposition of eggs and for providing refuges for juveniles. There are records of the species from the Bremer River. The nearest of these is located 5 km downstream of the Project. There are no records located upstream of the Project.	The following is considered to constitute Potential habitat: Areas identified within the QLD waterway barrier works mapping as a risk impact of 3 or greater to select wet/inundated vegetation community (RE) areas (with a tolerance of within 20m of the waterway centreline). It is noted that the majority of the watercourses are ephemeral and do not contain permanent pools (at least in the vicinity of the Project). Waterways with a risk impact of less than 3 are unlikely to retain water for extended periods and are therefore unsuitable. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	Under the draft *National recovery plan for the Australian lungfish (Neoceratodus forsteri)* (DotEE 2019) habitat critical to the survival of the species includes: ■ Any breeding/foraging habitat where the species occurs (from the known distribution in Figure 4 within the Plan). ■ Any newly discovered breeding or foraging locations. As such, the Bremer River and Lockyer Creek have been identified as habitat critical for the survival of this species.
Mammals	*Chalinolobus dwyeri*	Large-eared pied bat	V	This species has been recorded from a large range of vegetation types including: dry and **wet sclerophyll** forest; *Callitris glauca* dominated forest; **tall open eucalypt** forest. Roosting has also been observed in disused mine shafts, caves, overhangs and disused Fairy martin nests.	The following vegetation communities (REs) are considered potential habitat as they comprise either rocky habitats (volcanic origin) or fertile valley habitat: 12.2.4, 12.3.2, 12.3.3, 12.8.1, 12.8.2, 12.8.8, 12.8.10, 12.8.11, 12.8.12, 12.8.14, 12.8.16, 12.8.17, 12.8.23, 12.12.26, 12.8.23, 12.11.2, 12.12.2, 12.12.15a, 12.12.20.	Not applicable	The *National recovery plan for the Large-eared pied bat Chalinolobus dwyeri* (DERM 2011) defines habitat critical to the survival of the species as: ■ Sandstone cliffs and fertile wooded valley habitat within close proximity of each other

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	**Important habitat**	**Habitat critical to the survival of the species**
				The species occurs from the Rockhampton region, inland to the Carnarvon Range, and potentially as far south as the Wollongong area. It is strongly associated with sandstone escarpment country. The largest known populations occur in areas dominated by sandstone escarpments in Carnarvon National Park, Blackdown Tableland National Park, Expedition National Park and Isla Gorge National Park. In SEQ this also includes rainforest and wet eucalypt habitats on volcanic substrates such as in Main Range and Lamington National Parks (DERM 2012). The nearest records to the Project are located 30 km away in the Main Range area.	*Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*		As such, the following vegetation communities (REs) constitute habitat critical to the survival of the species as they comprise sandstone derived habitats with potential rocky areas/cliffs present: 12.9-10.1, 12.9-10.6, 12.9-10.14, 12.9-10.29, 12.11.2. Whist it is noted that records from south-east Queensland suggest that rainforest and moist eucalypt forest habitats on other geological substrates (viz. rhyolite, trachyte and basalt) at high elevation may be of similar importance for this species, these areas have not been included within the Habitat critical to the survival of the species category.
Mammals	*Dasyurus maculatus maculatus*	Spotted-tailed quoll (southern subspecies)	E	In southeast Queensland, the Spotted-tailed quoll occurs coastally from Bundaberg to the border and inland to Monto and Stanthorpe. The Spotted-tailed quoll prefers mature wet forest habitat, especially in areas with rainfall in excess of 600 mm/year. Unlogged forest or forest that has been less disturbed by timber harvesting is also preferable. This subspecies has been recorded from a wide range of habitats, including large tracts of vine forest, wet and dry sclerophyll forest and woodland, and is often associated with	Species has broad habitat requirements. The following vegetation communities (REs) are considered to constitute potential habitat (wet and dry sclerophyl forest and woodland) where they occur in areas that **receive at least 600 mm of rainfall annually**: 12.2.1, 12.2.2, 12.2.3, 12.2.4, 12.3.1, 12.3.1a, 12.3.2, 12.3.3, 12.3.11, 12.3.16, 12.3.19, 12.3.21, 12.5.1, 12.5.2, 12.5.13, 12.5.13a, 12.5.13b, 12.5.13c, 12.8.3, 12.8.4,	Not applicable	The *National recovery plan for the Spotted-tail quoll (Dasyurus maculatus)* (DEWLP 2016) identifies habitat critical to the survival of the species as including: ▪ large patches of forest with adequate denning resources and relatively high densities of medium-sized mammalian prey.

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	**Important habitat**	**Habitat critical to the survival of the species**
				Eucalyptus camaldulensis within the west of its range. Habitat requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves (DAWE 2020). The species requires large home ranges of several hundred hectares (DELWP 2016). No records within or close to Project. It was previously known from the wider area. Recent records (post 2000) exist north-west of the Project from the Greenbank-Jimboomba area. Species may occur in the Flinders Peak area.	12.8.5, 12.8.8, 12.8.9, 12.8.13, 12.8.14, 12.8.18, 12.8.16, 12.8.19, 12.8.20, 12.8.21, 12.8.22, 12.8.26, 12.9-10.5, 12.9-10.7, 12.9-10.15, 12.9-10.16, 12.9-10.17, 12.9-10.25, 12.9-10.26, 12.11.1, 12.11.2, 12.11.4, 12.11.5, 12.11.9, 12.11.9x1, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.11.15, 12.11.26, 12.12.1, 12.12.4, 12.12.9, 12.12.11, 12.12.12, 12.12.13, 12.12.14, 12.12.16, 12.12.17, 12.12.18, 12.12.22, 12.12.23. As part of the modelling process, open areas through which the species may move (transient) have not been captured as habitat as these areas do not contain the microhabitat features required for the survival of this species. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*		As such, for the purposes of this assessment potential habitat that intersects with remnant vegetation patches that are equal to or greater than 200 ha in size are considered critical habitat for this species (taking into account the species extensive home range requirements).

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
Mammals	*Petauroides volans*	Southern greater glider	V	The Southern greater glider is an arboreal nocturnal marsupial, largely restricted to **eucalypt forests and woodlands**. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers. It is typically found in highest abundance in **taller, montane, moist eucalypt forests with relatively old trees and abundant hollows**. Greater gliders are typically found in mature eucalypt forests and woodlands with a variety of eucalypt species and a high density of large tree hollows (van der Ree et al. 2004). The distribution may be patchy even in suitable habitat. The Southern greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. During the day Southern greater gliders shelter in tree hollows, with a selection for large hollows in large, old trees. Home ranges may be relatively small (1 to 4 ha). Within southeast Queensland, the Southern greater glider has been reported to feed upon the following species: *Eucalyptus latisinensis, Corymbia intermedia, Eucalyptus drepanophylla, Corymbia trachyphloia* with lesser amounts of *Melaleuca quinquenervia*.	The species main habitat requirement is tall eucalypt woodland/open forests with large tree hollows for shelter. The following remnant vegetation communities (REs) which contain *Eucalyptus latisinensis, Corymbia intermedia, Eucalyptus drepanophylla, Corymbia trachyphloia* and *Melaleuca quinquenervia* (i.e. potential food trees) are considered to constitute potential habitat in remnant habitat only (i.e. where large hollows are much more likely to occur): 12.2.7, 12.2.5, 12.2.6, 12.2.9, 12.3.3, 12.3.3d, 12.3.5, 12.3.6, 12.3.7, 12.3.11, 12.3.12, 12.3.14, 12.3.15, 12.5.1, 12.5.2, 12.5.3, 12.5.3a, 12.5.4, 12.5.5, 12.7.2, 12.8.1, 12.8.8a, 12.8.26, 12.9-10.1, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.5, 12.9-10.7, 12.9-10.12, 12.9-10.17, 12.9-10.20, 12.9-10.21, 12.11.14, 12.11.17, 12.11.20, 12.11.23, 12.11.24, 12.12.3, 12.12.6, 12.12.11, 12.12.12, 12.12.15, 12.12.21, 12.12.27. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	There is no recognised definition of habitat critical to the survival of the species. For the purpose of this assessment critical habitat is considered to include: ■ Any breeding or foraging habitat in areas where the species occurs. Therefore, any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified remnant vegetation communities*).

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
				The Greater glider occurs in eucalypt forests along the ranges and coastal plains of eastern Australia from central Victoria near Daylesford to the Windsor Tablelands in far northern Queensland. Not recorded during any Project-associated surveys. Older records from the surrounding area but mostly concentrated to the north-east (Ipswich and greater Brisbane).			
Mammals	*Petrogale penicillata*	Brush-tailed rock-wallaby	V	The Brush-tailed rock-wallaby prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks. Rocky outcrops are a crucial feature to habitat selection by rock-wallabies, however, vegetation structure and composition is also considered to be an important factor. In many parts of their range, rock-wallabies are closely associated with dense arboreal cover, especially fig trees. The vegetation on and below rocky shelter sites appear to be important to this species as a source of food and shelter and in some cases, may provide some protection from predation. A range of vegetation types are associated with Brush-tailed rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest. Species is known to occur in the Teviot Range immediately north of Project. Not identified during Project surveys and no suitable rocky shelter habitat identified as present within/adjacent to footprint.	The following remnant vegetation communities (REs), which represent dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest are considered potential habitat where they contain **very steep terrain** (i.e. terrain with **a 50 per cent grade**) likely to provide suitable rocky refuge habitat: 12.7.2, 12.8.1, 12.8.3, 12.8.4, 12.8.5, 12.8.6, 12.8.7, 12.8.8, 12.8.9, 12.8.10, 12.8.13, 12.8.18, 12.8.19, 12.8.21, 12.8.22, 12.8.23, 12.9-10.3, 12.9-10.5, 12.9-10.6, 12.9-10.16, 12.9-10.19, 12.11.1, 12.11.2, 12.11.4, 12.11.6, 12.11.10, 12.11.11, 12.11.12, 12.11.13, 12.11.16, 12.12.1, 12.12.3, 12.12.4, 12.12.5, 12.12.6, 12.12.7, 12.12.8, 12.12.9, 12.12.11, 12.12.12, 12.12.13, 12.12.14, 12.12.15, 12.12.16, 12.12.17, 12.12.18, 12.12.20, 12.12.21, 12.12.22, 12.12.23, 12.12.24, 12.12.25, 12.12.26, 12.12.27, 12.12.28.	Not applicable	The *National Recovery Plan for the Brush-tailed Rock-wallaby (Petrogale penicillata)* (Menkhorst and Hynes 2010) describes habitat critical to survival of the species as: ■ rocky refuge habitat, foraging habitat and commuting routes between the two. Therefore, all areas mapped as potential habitat that intersect with remnant vegetation are considered to constitute critical habitat for the species.

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	**Important habitat**	**Habitat critical to the survival of the species**
					Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.		
Mammals	*Phascolarctos cinereus*	Koala	V	Koalas naturally inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by eucalypt species which can be broadly defined as any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees. Along the Great Dividing Range and the coastal belt throughout the species' range, Koalas inhabit moist forests and woodlands mostly dominated by *Eucalyptus* species. Its diet is restricted mainly to foliage of *Eucalyptus* spp.; however, it may also consume foliage of related genera, including *Corymbia* spp., *Angophora* spp. and *Lophostemon* spp. The Koala is distributed along the east coast of Australia extending from Queensland to Victoria. Home range size is dependent on the quality of habitat. In northern New South Wales home ranges of 37 ha are recorded (Goldingay and Dobner 2014). Koalas are generally sedentary with longer movements largely restricted to dispersing males which may extend several kilometres through lands cleared of vegetation (DAWE 2020).	The following is considered to be potential habitat: Any specimen backed records (buffered to a 1 km radius) that fall outside of areas identified as Critical habitat (regardless of the level of clearing or development within the area).	Not applicable	Under the *EPBC Act referral guidelines for the vulnerable Koala* (DotE 2014) critical habitat for Koala can be characterised by areas containing mature and regrowth eucalypt communities. The species has broad habitat preferences that may encompass remnant and non-remnant habitat where suitable eucalypts occur. The following mapped vegetation communities (REs - both remnant and HVR) and unmapped riparian conduits (often featuring large eucalypts), and non-remnant paddock trees (where they facilitate koala movement across the landscape) are considered to constitute critical habitat: 12.3.2, 12.3.3, 12.3.3a, 12.3.3b, 12.3.3c, 12.3.3d, 12.3.4, 12.3.4a, 12.3.6, 12.3.7, 12.3.10, 12.3.11, 12.3.11a, 12.5.1, 12.5.2, 12.5.2x1, 12.5.3, 12.5.3a, 12.5.6, 12.8.14, 12.8.14a, 12.8.14x1, 12.8.16, 12.8.17, 12.9-10.2, 12.9-

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
				Project surveys have recorded Koala close to the Project in the Peak Crossing and Ebenezer areas. There have also been records of scats through much of the alignment including within the disturbance footprint.			10.4, 12.9-10.7, 12.9-10.7a, 12.9-10.17, 12.9-10.17a, 12.9-10.17b, 12.9-10.17c, 12.9-10.17d, 12.11.5, 12.11.5a, 12.11.5e, 12.11.5h, 12.11.5j, 12.11.5k, 12.11.18, 12.11.18a, 12.12.12.
Mammals	*Potorous tridactylus tridactylus*	Long-nosed potoroo	V	The Long-nosed potoroo (SE Mainland) is sparsely distributed along the coast and Great Dividing Range of southeast Queensland through NSW. There is limited information about the species habitat in Queensland and NSW. There is no consistent pattern to the habitat of the Long-nosed potoroo (SE Mainland); It can be found in wet eucalypt forests to warm temperate rainforest and coastal heaths and scrubs (Woinarski et al 2014). The species requires dense low vegetation and ground cover used for shelter and avoiding predators, although it may forage in more open areas. The species is known to utilise Lantana (Lantana camara) thickets for shelter (Lindemayer and Viggers 1994). The main factors would appear to be **access to some form of dense vegetation** for shelter and the presence of an abundant supply of fungi for food. In NSW and Queensland, the Long-nosed potoroo (SE Mainland) has scattered populations east of the Great Dividing Range extending from south-eastern Queensland through to NSW. Its range is largely coastal extending up to 800 m ASL and preferring areas with rainfall exceeding 760 mm.	The following vegetation communities (remnant REs) are considered to constitute potential habitat as they may comprise a suitable shrubby understorey: 12.2.4, 12.5.1, 12.5.6, 12.5.7, 12.8.1, 12.8.9, 12.8.14, 12.8.16, 12.8.17, 12.9-10.2, 12.9-10.14, 12.9-10.18, 12.9-10.18b, 12.11.6, 12.11.9, 12.12.2, 12.12.20, 11.8.5, 11.8.15, 11.10.3, 11.10.6, 11.11.15 and 11.12.20 *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute general habitat*	Not applicable	There is no recognised definition of habitat critical to the survival of the species. For the purpose of this assessment critical habitat is considered to include: ■ Any breeding or foraging habitat in areas where the species occurs Therefore, any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified remnant vegetation communities*)

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	Important habitat	Habitat critical to the survival of the species
				Not recorded during Project surveys and nearest records are over 25 km from the Project (Mt Tamborine area).			
Mammals	*Pseudomys novaehollandiae*	New Holland mouse	V	The New Holland mouse has been found from coastal areas at sea level to 100 km inland on sandstone country, 900 m ASL. Soil type may be an important indicator of suitability of habitat for the New Holland mouse, with deeper topsoils and softer substrates being preferred for digging burrows. The habitat preference in southeast Queensland appears to be limited to tall dry open forest communities with an understorey of heath dominated by ***Xanthorrhoea*** species. In the Gatton and Laidley Shire area, the New Holland mouse has been recorded in the Blackfellow Creek and Helidon Hills areas and its habitat is associated with REs 12.5.1, 12.5.6, 12.8.14, 12.8.17, 12.8.19, 12.9-10.5 and 12.9-10.19 Upon its discovery in Queensland in 1997 at Crow's Nest (near Toowoomba), the species associated habitat appeared to differ substantially from that previously known to support the species. Habitat was characterised by **dry open Eucalypt forest** at relatively high elevation (560 m). In addition, there was a **total lack of dense shrubs**, previously thought to be an essential habitat requirement of the species. The nearest records to the Project are from Main Range and the Helidon Hills and are all over 35 km away.	The following vegetation communities (REs) are considered to constitute potential habitat as they may comprise habitats in or near where the species has been recorded previously in SEQ: 12.5.1, 12.5.4, 12.5.6, 12.8.1, 12.8.14, 12.8.14a, 12.8.17, 12.8.19, 12.9-10.2, 12.9-10.3, 12.9-10.5, 12.9-10.19 and 12.11.5. It is noted that given the conservative mapping approach, an overestimation of habitat for this species is likely. For example, this species does not require a dense understory, however vegetation communities such as RE 12.5.1 have been included as part of the habitat for this species. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	Not applicable	There is no recognised definition of habitat critical to the survival of the species. For the purpose of this assessment critical habitat is considered to include: ■ Any breeding or foraging habitat in areas where the species occurs. Therefore, any specimen backed records (buffered to a 1 km radius) that fall within areas mapped as potential habitat (refer previous column) constitute Habitat critical to the survival of the species (*excluding areas that fall outside of identified vegetation communities*).

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	**Important habitat**	**Habitat critical to the survival of the species**
Mammals	*Pteropus poliocephalus*	Grey-headed flying-fox	V	The Grey-headed flying-fox requires foraging resources and roosting sites. It is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. It also feeds on commercial fruit crops and on introduced tree species in urban areas. The primary food source is blossom from *Eucalyptus* and related genera but in some areas it also utilises a wide range of rainforest fruits. None of the vegetation communities used by the Grey-headed flying-fox produce continuous foraging resources throughout the year. As a result, the species has adopted complex migration traits in response to ephemeral and patchy food resources. The Grey-headed flying-fox roosts in aggregations of various sizes on exposed branches. Roost sites are typically located near water, such as lakes, rivers or the coast. Roost vegetation includes rainforest patches, stands of *Melaleuca*, mangroves and riparian vegetation. Grey-headed flying-foxes commute daily to foraging areas, usually within 15 km of the day roost site. Grey-headed flying-foxes are capable of nightly flights of up to 50 km from their roost to different feeding areas as food resources change. At most times of the year there is a complete exodus from the colony site at dusk.	The following is considered to constitute potential habitat: Any vegetation community (remnant and regrowth REs) located within a **50 km radius of a flying fox camp known to regularly support Grey headed flying-foxes**. Five camps (based on QLD monitoring data) that fit this criteria are known to occur at the following locations: ▪ Bundamba, Paice St (-27.612423; 152.81273) ▪ Woodend (-27.6031; 152.7485) ▪ Yamanto (-27.651449; 152.755601) ▪ Cedar Grove, Brushwood Cres. (-27.8558; 152.98) ▪ Laidley, Laidley Plainlands Road (-27.620558; 152.394769).	Not applicable	The *draft National recovery plan for the Grey-headed flying-fox (Pteropus poliocephalus)* (DoEE 2017) does not define habitat critical to the survival of the species but recommends management of habitat associated with a number of tree species that occur in the area including *Eucalyptus tereticornis, E. crebra, E. siderophloia, Corymbia citriodora citriodora,* and *Grevillea robusta*. For the purpose of this assessment critical habitat is considered to include: 100 m buffer surrounding the camps listed below and all mature vegetation (remnant and regrowth communities) within 15 km from a flying fox camp known to regularly support the species: ▪ Bundamba, Paice St (-27.612423; 152.81273) ▪ Woodend (-27.6031; 152.7485) ▪ Yamanto (-27.651449; 152.755601) ▪ Cedar Grove, Brushwood Cres. (-27.8558; 152.98)

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	**Important habitat**	**Habitat critical to the survival of the species**
							▪ Laidley, Laidley Plainlands Road (-27.620558; 152.394769).
Reptiles	*Anomalopus mackayi*	Five-clawed worm-skink	V	The species shelters at the soil surface where moisture is sufficiently retained under decaying leaf litter, coarse woody debris or artificial debris. The species also lives in cavities in rotting tree bases, logs and in tussock bases. It is known to dig permanent tunnel-like burrows in loose, friable, humic soils in woodlands on slight basalt rises. On the Darling Downs, the species occurs in Bluegrass (*Dichanthium sericeum)* and/or Mitchell Grass dominated grasslands or mixed grasslands dominated by other grass species. In south-east Queensland, the species may occur in *Eucalyptus tereticornis/ Eucalyptus camaldulensis/ Eucalyptus populnea* grassy woodland/ open forests. In addition, the species has been recorded in areas characterised by Callitris sp. woodland. The species is not likely to be found in soils in which deep cracks do not form, such as hard-setting brown clays or sandy soils types). The species occurs in the Brigalow Belt and is not known to occur east of Toowoomba.	The following vegetation communities (REs) from SEQ are considered as potential habitat based on the presence of cracking clay soils: with grassland or grassy woodland featuring *Eucalyptus tereticornis or Eucalyptus populnea*: 12.3.10, 11.3.2, 11.3.4, 11.3.15, 11.3.21, 11.3.25, 11.4.4, 11.4.7, 11.4.11, 11.5.17, 11.9.12. Note: Any specimen backed records (buffered to a 1km radius) that fall outside of the REs identified above are considered to constitute Potential habitat.	The *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (DSEWPaC 2011) describe 'important habitat' under Section 5 of the guidelines. All habitat within floodplains and riparian zones, uncultivated grassy headlands and strips between cropped areas, road reserves, travelling stock routes and remnant vegetation on vacant lands Habitat within the Known/Likely-to occur distribution of the species The MNES study area does not occur in any area where the species 'may' or is 'known/ likely' to occur' (Map 2 of the Guidelines). Therefore, no important habitat occurs in the Project area.	Not applicable

Class	Scientific name	Common name	EPBC Act Status	Habitat requirements that are the basis for the GIS assumptions (derived from references provided within the bibliography)	GIS habitat modelling instructions		
					Potential habitat	**Important habitat**	**Habitat critical to the survival of the species**
Reptiles	*Delma torquata*	Collared delma	V	The **presence of rocks, logs, bark and other coarse woody debris**, and mats of leaf litter (typically 30 to 100 mm thick) appears to be an essential characteristic of the Collared delma microhabitat and is always present where the species occurs. It typically inhabits eucalypt-dominated woodlands and open-forests in Queensland on RE land zones 3, 9 and 10 (Brigalow Belt Reptiles Workshop 2010). In the Toowoomba Range the species was associated with open *Eucalyptus crebra* woodland located on northwest facing slopes on land zone 9 Whilst Collared delmas are often found associated with small rocks, the presence of small rocks is not an essential habitat characteristic. On the Toowoomba range, the species is most often found in association with **Eucalyptus crebra open forest or woodland** with a grassy understorey containing *Lantana montividensis*. An essential habitat component is the **penetration of sunlight to the ground**. Dense thickets of *Lantana camara* (i.e. reduces light penetration to the ground) has been identified as a threatening process to this species. The species is not recorded from the Project. Species is known from records to the north of Ipswich with the nearest records approx. 25 km north of the Project.	The following vegetation communities (REs) from SEQ are considered as potential habitat based on the presence of potentially rocky habitat on hillslopes: 12.3.3a, 12.5.1, 12.5.1e, 12.8.16, 12.8.17, 12.8.24, 12.9-10.2, 12.9-10.5, 12.9-10.7, 12.9-10.8, 12.9-10.18, 12.11.8, 12.11.14. It is noted that the inclusion of landzones within the potential habitat category outside landzones 3, 9 and 10 is based on observations of the occurrence of the species within the Toowoomba range as part of the Toowoomba Second Range Project. *Note: Any specimen backed records (buffered to a 1 km radius) that fall outside of the REs identified above are considered to constitute potential habitat.*	The *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (DSEWPaC 2011) describe 'important habitat' under Section 5 of the guidelines. The entire MNES study area has been identified as habitat in which Collared delma 'may occur' (Map 7 of the Guidelines). The Project is located adjacent to (south of) habitat in which the species is considered as 'known/likely' to occur. Given suitable habitat may occur 'important habitat' has been deemed as occurring in the Project area.	Not applicable

Table notes:

CE = Critically endangered E = Endangered V = Vulnerable

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7.2.1 Fish

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Appendix A
Regional Ecosystem descriptions used in the predictive habitat mapping

CALVERT TO KAGARU ENVIRONMENTAL IMPACT STATEMENT

Table A1 Descriptions of Regional ecosystems (Remnant and Regrowth) within the MNES study area

Regional ecosystems (REs)	Description (Regional Ecosystem Description Database Version 11)
12.3.3	*Eucalyptus tereticornis* woodland. *Eucalyptus crebra* and *E. moluccana* are sometimes present and may be relatively abundant in places, especially on edges of plains and higher level alluvium. Other species that may be present as scattered individuals or clumps include *Angophora subvelutina* or *A. floribunda, Corymbia clarksoniana, C. intermedia, C. tessellaris, Lophostemon suaveolens* and *E. melanophloia*. Occurs on Quaternary alluvial plains, terraces and fans where rainfall is usually less than 1,000 mm/y.
12.3.3d	*Eucalyptus moluccana* woodland. Other frequently occurring species include *Eucalyptus tereticornis, E. crebra, E. siderophloia, Corymbia citriodora* subsp. *variegata, Angophora leiocarpa* and *C. intermedia*. Occurs on margins of Quaternary alluvial plains often adjacent sedimentary geologies. May also occur on stranded Pleistocene river terraces. Floodplain (other than floodplain wetlands).
12.3.7	Narrow fringing woodland of *Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca viminalis*. Other species associated with this RE include *Melaleuca bracteata, M. trichostachya, M. linariifolia*. North of Brisbane Waterhousea floribunda commonly occurs and may at times dominate this RE. *Melaleuca fluviatilis* occurs in this RE in the north of the bioregion. *Lomandra hystrix* often present in stream beds. Occurs on fringing levees and banks of rivers and drainage lines of alluvial plains throughout the region.
12.3.7c	*Melaleuca bracteata* open forest +/- emergent *Eucalypts tereticor*nis. Occurs in drainage depressions on Quaternary alluvial plains. Riverine wetland or fringing riverine wetland.
12.3.8	Swamps with characteristic species including *Cyperus* spp., *Schoenoplectus* spp., *Philydrum lanuginosum, Eleocharis* spp., *Leersia hexandra, Cycnogeton procerus, Nymphaea* spp., *Nymphoides indica, Persicaria* spp., *Phragmites australis, Typha* spp. and a wide range of sedges grasses or forbs. Emergent *Melaleuca* spp. may sometimes occur. Occurs in freshwater swamps associated with floodplains.
12.3.18	*Melaleuca irbyana* low open forest or thicket. Emergent *Eucalyptus moluccana, E. crebra, E. tereticornis* or *Corymbia citriodora* subsp. *variegata* may be present. Occurs on Quaternary alluvial plains where drainage of soils is impeded. This is analogous to the EPBC Act listed Swamp Tea-tree (*Melaleuca irbyana*) Forest of SEQ Threatened ecological community
12.3.19	*Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra* open forest to woodland, with a sparse to mid-dense understorey of *Melaleuca irbyana*. Occurs on margins of Quaternary alluvial plains.
12.8.24	*Corymbia citriodora* subsp. *variegata*, *Eucalyptus crebra* +/- *E. moluccana* open forest. Occurs on Cainozoic igneous rocks especially lower slopes of rhyolite and trachyte hills (e.g. Moogerah Peaks)
12.9-10.2	*Corymbia citriodora* subsp. *variegata* open forest or woodland usually with *Eucalyptus crebra*. Other species such as *Eucalyptus tereticornis, E. moluccana, E. acmenoides* and *E. siderophloia* may be present in scattered patches or in low densities. Understorey can be grassy or shrubby. Shrubby understorey of *Lophostemon confertus* (whipstick form) often present in northern parts of bioregion. Occurs on Cainozoic and Mesozoic sediments.
12.9-10.3	*Eucalyptus moluccana* open forest. Other canopy species include *Eucalyptus siderophloia* or *E. crebra, E. tereticornis* and *Corymbia citriodora* subsp. *variegata*. Understorey generally sparse but can become shrubby in absence of fire. Occurs on Cainozoic and Mesozoic sediments, especially shales. Prefers lower slopes.
12.9-10.7	*Eucalyptus crebra* +/- *E. tereticornis, Corymbia tessellaris, Angophora leiocarpa, E. melanophloia* woodland. Occurs on Cainozoic and Mesozoic sediments.
12.9-10.11	*Melaleuca irbyana* low open forest or thicket. Emergent *Eucalyptus moluccana, E. crebra, E. tereticornis* or *Corymbia citriodora* subsp. *variegata* may be present. Occurs on Mesozoic sediments where drainage of soils is impeded.
12.9-10.16	Microphyll to notophyll vine forest +/- *Araucaria cunninghamii*. Characteristic species include *Argyrodendron* sp. (Kin Kin W.D.Francis AQ81198), *Araucaria cunninghamii, Agathis robusta, Backhousia myrtifolia, Cupaniopsis parvifolia, Dendrocnide photinophylla, Rhodosphaera rhodanthema, Flindersia australis, F. xanthoxyla, Drypetes deplanchei, Olea paniculata, Diospyros geminata, Gossia bidwillii, Excoecaria dallachyana* and *Vitex lignum-vitae. Archontophoenix cunninghamiana* often present in gully floors. Occurs on Cainozoic and Mesozoic sediments.
12.9-10.17	Open forest to woodland complex generally with a variety of stringybarks, grey gums, ironbarks and in some areas spotted gum. Canopy trees include *Eucalyptus siderophloia, E. propinqua or E. major, E. acmenoides or E. portuensis, E. carnea* and/or *E. microcorys* and/or *Corymbia citriodora* subsp. *variegata*. Other species that may be present locally include *Corymbia intermedia, C. trachyphloia, Eucalyptus tereticornis, E. biturbinata, E. moluccana, E. longirostrata, E. fibrosa* subsp. *fibrosa* and *Angophora leiocarpa. Lophostemon confertus* or Whipstick *Lophostemon confertus* often present in gullies and as a sub-canopy or understorey tree. Mixed understorey of grasses, shrubs and ferns. Hills and ranges of Cainozoic and Mesozoic sediments.

Regional ecosystems (REs)	Description (Regional Ecosystem Description Database Version 11)
12.9-10.17a	*Lophostemon confertus* or *L. suaveolens* dominated open forest usually with emergent *Eucalyptus* and/or *Corymbia* species. Occurs in gullies and southern slopes on Cainozoic and Mesozoic sediments.
12.9-10.27	*Corymbia citriodora* subsp. *variegata, Eucalyptus crebra* and/or *E. moluccana, E. tereticornis* open forest with a sparse to mid-dense understorey of *Melaleuca irbyana*. Occurs on lower slopes and elevated flats with impeded drainage on Mesozoic sediments.

Table notes:

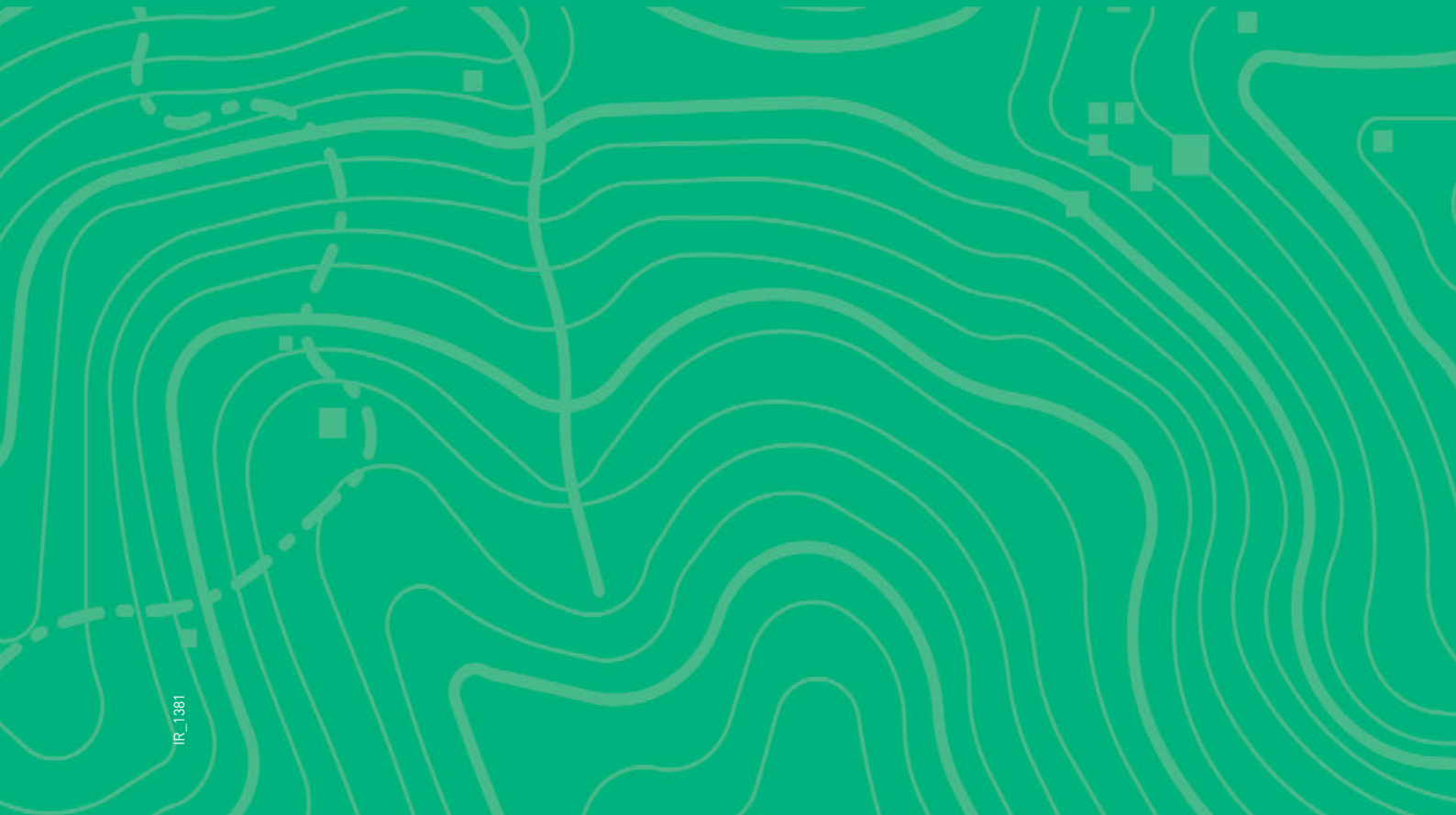
LC = Least concern NC = No concern at present OC = Of concern E = Endangered BD = Biodiversity

APPENDIX K

Matters of National Environmental Significance Technical Report

Appendix B Species and Community Profiles

CALVERT TO KAGARU ENVIRONMENTAL IMPACT STATEMENT



IR_1381

Inland Rail: Calvert to Kagaru

Appendix B - Species and Community Profiles

Australian Rail Track Corporation

Reference: 3400

Contents

Figures

1 Flora – Threatened species

1.1 Austral cornflower (*Rhaponticum australe*)

1.1.1 Status

EPBC Act – Vulnerable

1.1.2 Biology and ecology

1.1.2.1 Characteristic

Austral cornflower (*Rhaponticum australe)* is an erect perennial herb that grows to 60 cm in height (refer Photograph 1.1). The branches are slightly woolly. Leaves are oblanceolate and toothed to deeply pinnatifid. The lower leaves are up to 18 cm long and 6 cm wide, reducing in size up the stem. The upper leaves are few, small and nearly sessile (DotEE 2018).

Photograph 1.1 Austral cornflower (*Rhaponticum australe*)

Source: Queensland Herbarium (2007)

1.1.2.2 Known distribution

Austral cornflower is currently confined to Queensland. The species was known to previously occur in NSW and Victoria but is now presumed extinct in those states. The current distribution of *R. australe* extends from Allora (north of Warwick) to Callide (northwest of Biloela), Queensland (TSSC 2008) (refer Figure 1.1).

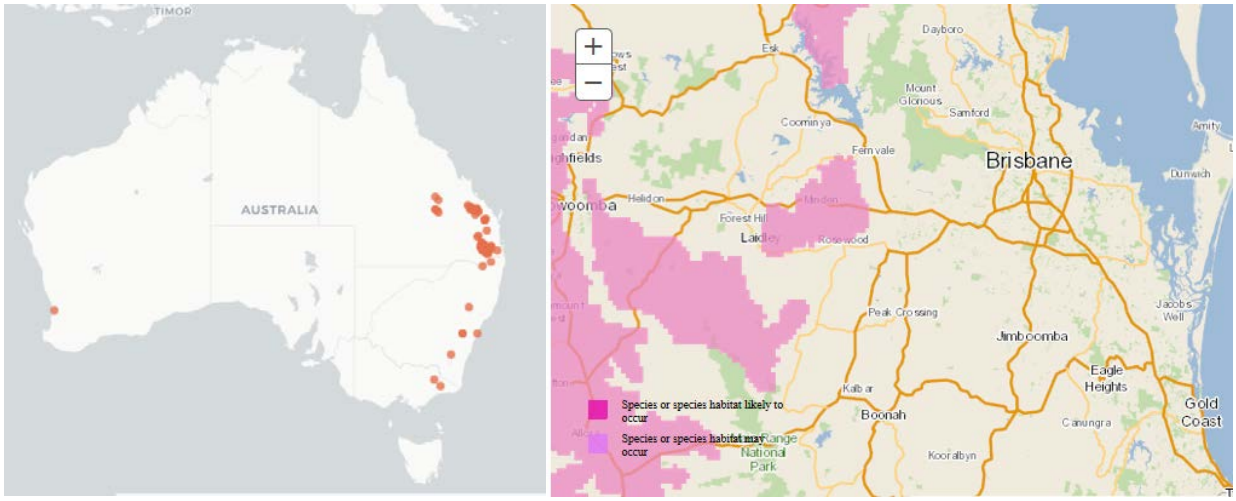


Figure 1.1 **Distribution range of the Austral cornflower**

Source: ALA (2018); DotEE 2018

1.1.2.3 Distribution in relation to the Project

Rhaponticum australe has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) did not indicate any specimen back records from within the MNES study area however, did indicate multiple records from approximately 25 km from the disturbance footprint largely to the west in Laidley. There is a single 2011 record with a high spatial uncertainty (16 km) located approximately 5 km south of the eastern extent of the Project in the Beaudesert area.

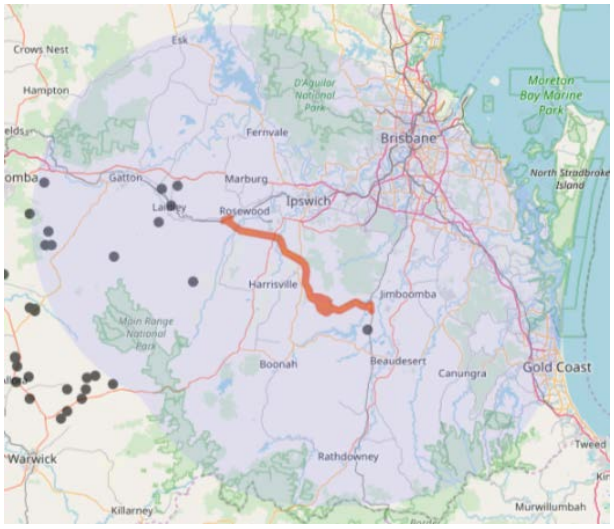


Figure 1.2 **Distribution range of the Austral cornflower in relation to the Project**

Source: ALA (2020)

1.1.2.4 Biology and reproduction

The flowering and fruiting period for Austral cornflower typically occurs in Spring, through to Autumn. The dead flowering stems can remain on the plant for several months after the seeds have dispersed (DotEE 2018).

1.1.3 Habitat

Austral cornflower typically grows in Eucalypt open forests, with grassy understory. This species often occurs on roadsides and on road reserves alongside Rhodes grass *(Chloris gayana*), Spear thistle *(Cirsium vulgare*), Queensland blue gum *(Eucalyptus tereticornis*) and Rough-barked apple *(Angophora floribunda*) on black clay soil derived from basalt. This species is considered to be a poor competitor and prefers habitat where grass competition has been reduced by fire, or other forms of disturbance. However, Austral cornflower is unlikely to benefit from disturbance that allows the development of a dense cover of exotic grasses (DotEE 2018).

1.1.4 Threatening processes

The following have been identified as potentially threatening processes to the Austral cornflower:

- Woodland clearing for agriculture and urban development and livestock grazing has caused the local extinction of the Austral Cornflower in Victoria and NSW
- The invasion of exotic grass species into Austral Cornflower habitat may also threaten extant populations. As most populations occur on highly disturbed roadsides, they must compete with introduced species (DotEE 2018).

1.1.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

1.1.6 References

Atlas of Living Australia (2018). *Rhaponticum australe*. Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2908264 [Accessed 27 August 2018].

Department of the Environment and Energy (2018). *Rhaponticum australe* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=23949 [Accessed 27 August 2018].

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Threatened Species Scientific Committee (2008). *Approved Conservation Advice for Rhaponticum australe (Austral cornflower)*.

1.2 Austral toadflax (*Thesium australe*)

1.2.1 Status

EPBC Act – Vulnerable

1.2.2 Biology and ecology

1.2.2.1 Characteristic

Austral toadflax is a small, straggling herb growing to 40 cm tall. Leaves are pale green to yellow-green, somewhat succulent, 1 to 4 cm long and 0.5 to 1.5 mm wide (refer Photograph 1.2). Flowers are minute and white, emerging where the leaves meet the stems and appearing in spring. The fruit is small and nut-like, developing in summer. This species is often hidden amongst grasses and herbs (OEH 2017).

Photograph 1.2 Austral toadflax (*Thesium australe*)

Source: Hunter (2018)

1.2.2.2 Known distribution

Austral toadflax occurs in NSW, the Australian Capital Territory (ACT), Queensland and Victoria (refer Figure 1.3). It is also known from eastern Asia. Its current distribution is sporadic but widespread, occurring between the Bunya Mountains in southeast Queensland to northeast Victoria and as far inland as the southern, central and northern tablelands in NSW and the Toowoomba region (ALA 2018; OEH 2017; DotEE 2018).

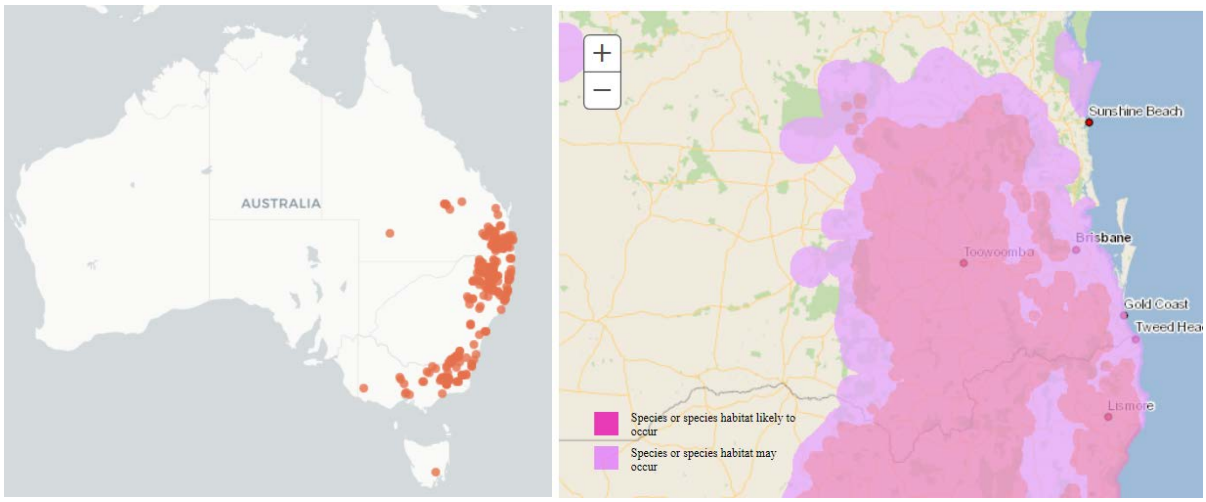


Figure 1.3 Distribution range of the Austral toadflax

Source: ALA (2018); DotEE (2018)

1.2.2.3 Distribution in relation to the Project

Thesium australe has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicated that this species occurs within 50 km of the Project. The nearest database record is from 1993 taken from within approximately 10 km west of the Project near Harrisville. There are a number of more recent records within a 50 km radius located to the west, south-west, east, north and north-west.

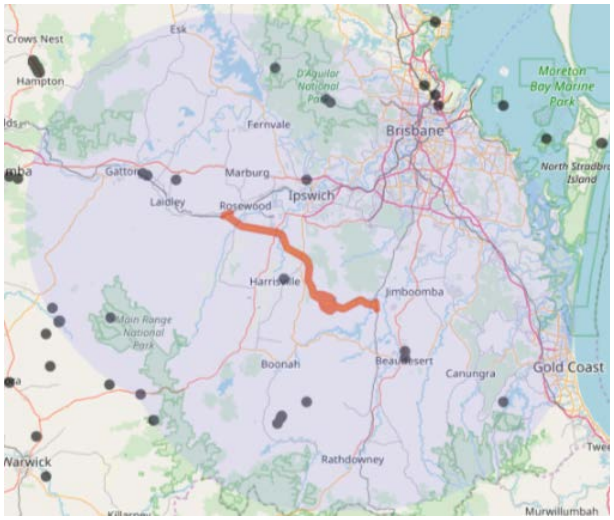


Figure 1.4 **Distribution range of the Austral toadflax in relation to the Project**

Source: ALA (2020)

1.2.2.4 Biology and reproduction

Austral toadflax flowers and fruits throughout the year on the coast, and during summer at higher altitudes. In subalpine and tableland climates, the species dies back to rootstock during winter and resprouts in spring. In coastal areas, the species persists all year round and may live for longer than two years. The existence of buds near the soil surface allows the species to resprout after disturbance. It is observed to germinate well after fire; however fire is not essential for germination (DotEE 2018).

1.2.3 Habitat

It is semi-parasitic on the roots of certain grass species; occurring in shrubland, grassland or woodland, often on damp sites. It occurs in subtropical, temperate and subalpine climates over a wide range of altitudes. It occurs on soils derived from sedimentary, igneous and metamorphic geology on a range of soils, including black clay loams to yellow podzolics and peaty loams (Leigh et al.1984; Hunter et al. 1999; Cohn 2004).

Vegetation types include open grassy heath dominated by Swamp myrtle (*Leptospermum myrtifolium*), Small-fruit hakea (*Hakea microcarpa*), Alpine bottlebrush (*Callistemon sieberi*), Woolly grevillea (*Grevillea lanigera*), Coral heath (*Epacris microphylla*) and *Poa* spp.; Kangaroo grass grassland surrounded by Eucalypt woodland; and grassland dominated by Barbed-wire grass (*Cymbopogon refractus*) (DotEE 2018).

1.2.4 Threatening processes

The following have been identified as potentially threatening processes to the Austral toadflax:

- Lack of fire/disturbance
- Existing and intensified grazing by livestock, native herbivores and feral herbivores
- Residential, infrastructure and agricultural development
- Weed invasion
- Infrastructure (road and rail) maintenance (DotEE 2018; NSW OEH 2018).

1.2.5 Threat abatement/recovery plans

The following threat abatement/recovery plan has been identified as being relevant for this species:

- Department of the Environment and Energy (2016). *Threat abatement plan for competition and land degradation by rabbits*. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-rabbits-2016. In effect under the EPBC Act from 07-Jan-2017.

1.2.6 Summary of threat abatement/recovery plan

Threats identified in the threat abatement plan for competition and land degradation by rabbit relevant to Austral toadflax include:

- Preventing plant regeneration
- Overgrazing and general damage to plant species
- Reversing the normal processes of plant succession
- Altering ecological communities and changing soil structure and nutrient cycling, leading to significant erosion.

Relevant management strategies relevant to Austral toadflax include population control. Following the plan, control efforts should be:

- Targeted to protect sites where rabbits pose the greatest threat to biodiversity
- Undertaken in a strategic manner to take advantage of the environmental conditions and other complementary activities
- Monitored to ensure that objectives are met and allow management options to be adapted to changing circumstances.

1.2.7 References

Atlas of Living Australia (2018). *Thesium australe*. Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2898274#tab_recordsView [Accessed 30 August 2018].

Department of the Environment and Energy (2018). *Thesium australe* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=23949 [Accessed 27 August 2018].

Office of Environment and Heritage, NSW (2018). Austral toadflax. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10802 [Accessed 30 August 2018].

1.3 Bertya ernestiana

1.3.1 Status

EPBC Act – Vulnerable

1.3.2 Biology and ecology

1.3.2.1 Characteristic

Bertya ernestiana is a branched shrub (refer Photograph 1.3) growing to 1.5 m in height with a terminal inflorescences and a solitary flower (DotEE 2019).

Photograph 1.3 ***Bertya ernestiana***

Source: Halford (2002)

1.3.2.2 Known distribution

This species occurs in southeast Queensland around Boonah in Mt Barney National Park and near Mt May and Mt Ernest (TSSC 2011) (refer Figure 1.5).

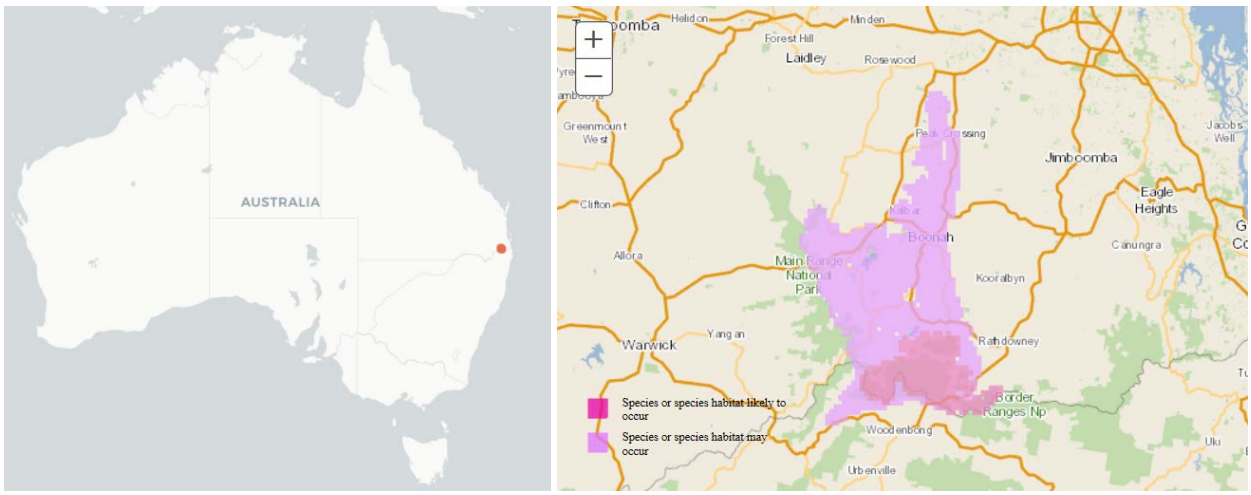


Figure 1.5 **Distribution range of the *B. ernestiana***

Source: ALA (2018); DotEE (2018)

1.3.2.3 Distribution in relation to the Project

Bertya ernestiana has been predicted to occur within the region and associated habitat within the MNES study area. The closest database records (i.e. AoLA, WildNet) indicate that this species occurs within 50 km of the Project with a restricted distribution. The nearest database record is from 2002 and occurs at Mount Barney National Park located approximately 40 km south of the disturbance footprint. The MNES study area is not located near the limit of the range of this species.

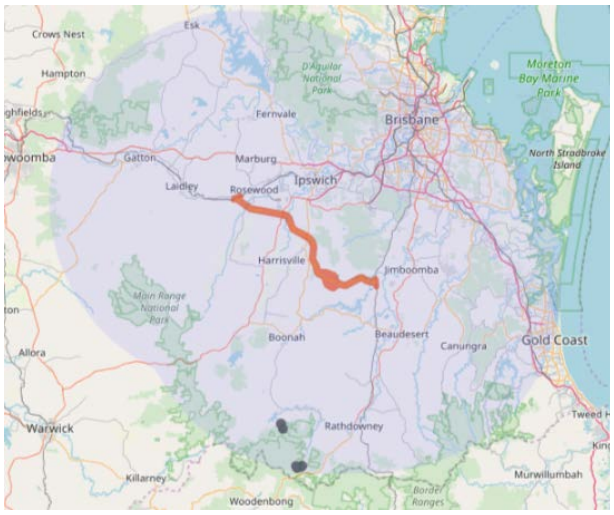


Figure 1.6 Distribution range of the *B. ernestiana* in relation to the Project

Source: ALA (2020)

1.3.2.4 Biology and reproduction

Plants are monoecious, and fruits and flowers have been recorded in April, July and September (DotEE 2019; TSSC 2011).

1.3.3 Habitat

Bertya ernestiana grows in heath or open eucalypt forest with a heath understorey. This species has been recorded growing with tea tree (*Leptospermum* spp.), *Gynura* spp., *Keraudrenia* spp. and *Plectranthus suaveolens*. It occurs on skeletal sandy loam soils derived from rhyolite on steep rocky slopes, rock pavements and in mountain gorges (DotEE 2018; TSSC 2011).

1.3.4 Threatening processes

The following has been identified as potentially threatening processes to *B. ernestiana*:

- Inappropriate fire regimes such as repeated annual burns (Halford and Henderson 2002).

1.3.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018)

1.3.6 References

Atlas of Living Australia (2018). *Bertya ernestiana*. Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2897952# [Accessed 30 August 2018].

Department of the Environment and Energy (2018). *Bertya ernestiana* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=78349 [Accessed 30 August 2018].

Halford D. (2002). *Bertya ernestiana* (Image) [Online] Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2897952# [Accessed 30 August 2018].

Threatened Species Scientific Committee (2011). *Bertya ernestiana,* advice to the Minister for Sustainability, Environment, Water, Population and Communities on amendment to the list of Threatened Species under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. Available from: www.environment.gov.au/biodiversity/threatened/species/pubs/78349-listing-advice.pdf [Accessed 30 August 2018].

1.4 Bluegrass (*Dichanthium setosum*)

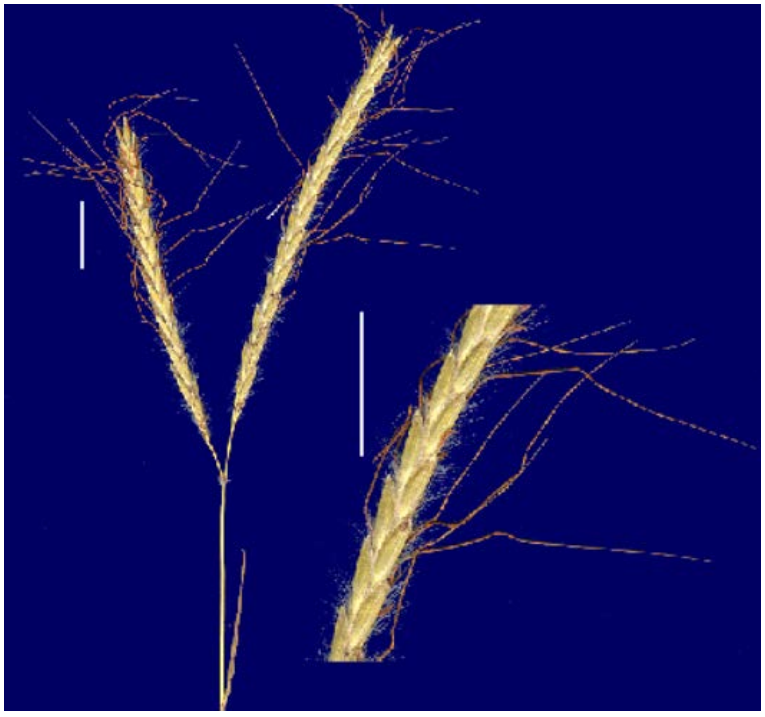
1.4.1 Status

EPBC Act – Vulnerable

1.4.2 Biology and ecology

1.4.2.1 Characteristic

Bluegrass (*Dichanthium setosum*) is an upright perennial grass less than 1 m tall. It has mostly hairless leaves about 2 to 3 mm wide. The flowers are densely hairy and clustered together along a stalk in a cylinder shape (refer Photograph 1.4) and appear mostly during summer. The species can form pure swards or occur as scattered clumps (DotEE 2018).



Photograph 1.4 Bluegrass (*Dichanthium setosum*)

Source: AusGrass2 (2018)

1.4.2.2 Known distribution

Bluegrass occurs on the northern tablelands in the Saumarez area, west of Armidale, and 18 to 30 km east of Guyra. It has been found sparsely on the northwestern slopes, central western slopes and northwestern plains of NSW, extending west to Narrabri. In Queensland, it has been documented to occur from the Leichhardt, Morton, North Kennedy and Port Curtis regions (refer Figure 1.7). This species occurs in the Mistake Range, in Main Range National Park, and possibly in Glen Rock Regional Park, adjacent to the Main Range National Park (DotEE 2018).

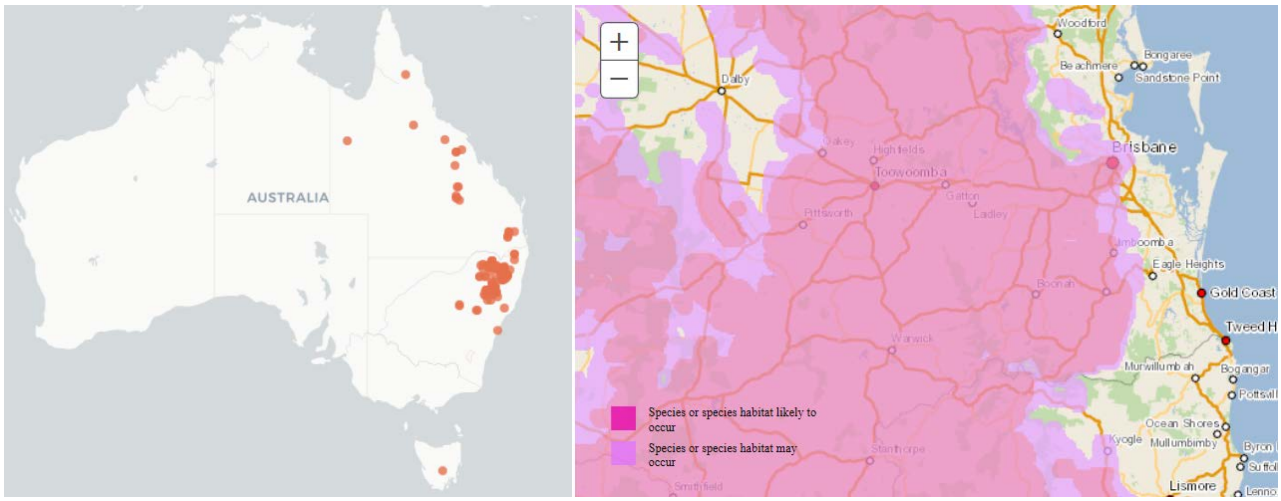


Figure 1.7 **Distribution range of bluegrass**

Source: ALA (2018), DotEE (2018)

1.4.2.3 Distribution in relation to the Project

Dichanthium setosum has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA) indicate that this species is known to occur within 50 km of the Project. The only record is from Bald Hills Creek taken from the year 2000. This record is approximately 45 km north of the Project.

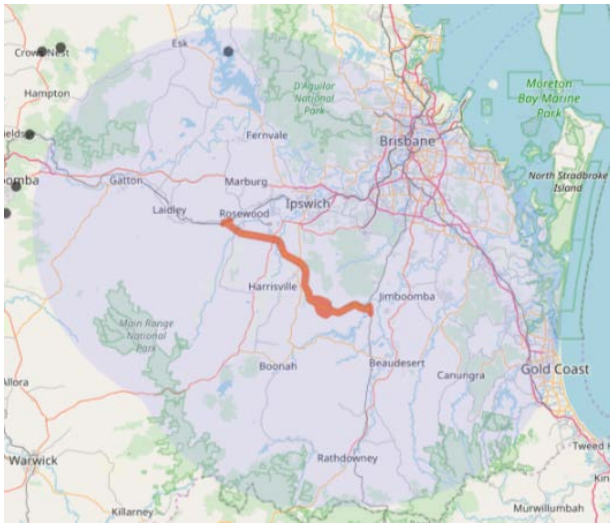


Figure 1.8 **Distribution range of bluegrass in relation to the Project**

Source: ALA (2020)

1.4.2.4 Biology and reproduction

Bluegrass is a warm season perennial grass, that commences growing in springs, flowers in summer and becomes dormant in late autumn. A fire frequency of greater than five years has been recommended for the species (DotEE 2019).

1.4.3 Habitat

Bluegrass is associated with heavy basaltic black soils and stony red-brown hardsetting loam with clay subsoil and is found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture. The extent to which this species tolerates disturbance is unknown. The species occurs within the Border Rivers−Gwydir, Central West, Namoi, Northern Rivers (NSW), South East and Fitzroy (Queensland) Natural Resources Management regions (DotEE 2018; DEC 2005).

1.4.4 Threatening processes

The following have been identified as potentially threatening processes to Bluegrass:

- Heavy grazing by agricultural animals
- Clearing of habitat for pasture and cropping
- Frequent irregular fires for agricultural purposes
- Road widening
- Invasion by introduced grasses (DotEE 2018).

1.4.5 Threat abatement/recovery plans

The following recovery plans have been identified as being relevant for this species:

- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from **https://www.environment.nsw.gov.au/savingourspeciesapp/ViewFile.aspx?ReportProjectID=1192&ReportProfileID=10221**. In effect under the BC Act 2016.
- Department of Environment, Climate Change and Water NSW (2010). *National Recovery Plan for White Box - Yellow* Box - *Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. Department of Environment, Climate Change and Water NSW, Sydney. Available from: . **http://www.environment.gov.au/biodiversity/threatened/recovery-plans/white-box-yellow-box-blakelys-red-gum-grassy-woodland-and-derived-native-grassland-national**. In effect under the EPBC Act from 22-Mar-2013.

The following threat abatement plan has been identified as being relevant for this species:

- Department of the Environment and Energy (2016). *Threat abatement plan for competition and land* degradation *by rabbits*. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-rabbits-2016**. In effect under the EPBC Act from 07-Jan-2017.

1.4.6 Summary of threat abatement/recovery plan

The *Saving our Species* conservation strategy for *Dichanthium setosum* identifies five priority management sites in NSW:

- East of Guyra in Armidale Regional LGA
- Apex Lookout in Armidale Regional LGA
- Armidale Arboretum in Armidale Regional LGA
- Saumarez North TSR in Armidale Regional, Uralla LGA
- Wallabadah Cemetery in Liverpool Plains LGA.

Threats identified at the management sites include:

- Heavy grazing by domestic stock
- Invasion by introduced grasses such as Coolatai, African Lovegrass, Phalaris and ox-eye dasiy.

- Inappropriate slashing regimes
- Distribution and recruitment/germination issues due to low species numbers.

Management activities to protect *Dichanthium setosum* at the Saving our Species sites are:

- Appropriate grazing management, including excluding stock from the sites September-December or following rainfall events and fencing off areas of high density plants from stock
- Targeted, physical removal of invasive grasses
- Track species abundance/condition over time, including assessment of reproduction/seed set, weed encroachment and grazing/mowing or slashing impacts.
- Liaise with local government to ensure awareness of the species' locations and importance
- Collect and sow seeds during the species' flowering/seeding period to enhance recruitment and population density.

Threats identified in the National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland include:

- Land use and management change
- Agricultural and horticultural development
- Public Infrastructure upgrades in travelling stock routes (TSRs)
- Firewood collection and 'tidying up'
- Changed fire regimes
- Increase in soil nutrients and use of chemicals
- Mowing and slashing regimes
- Revegetation management
- Weed invasion
- Climate change
- Salinity
- Acid soils
- Declining tree health and regeneration
- Increased grazing pressure from invasive herbivores
- Disease – *Phytophthora cinnamomic*
- Collection and removal of native flora.

Recovery actions identified in the National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland include:

- Collect baseline data on the locations, quality and management regimes of remnant sites
- Extent and condition mapping
- Component species surveys
- Protection of existing habitat in priority areas including on private land
- Engagement with the community, particularly where remnants occur on private land to provide information on appropriate management and with Aboriginal communities.

Summary of baseline information actions undertaken to date:

- The establishment of databases comprising of information on CMN members (land managers with Box-Gum Grassy Woodland remnants), remnant locations, composition of flora and fauna species and remnant condition from surveys of CMN members' sites and other sites

- Minimum condition criteria and assessment method developed to assist land managers in identification of listed ecological communities
- Development of regional models using remote sensing
- Mapping of Box-Gum Grassy Woodland extent
- Surveys conducted during research programs through various organisations.

Threats identified in the threat abatement plan for competition and land degradation by rabbit relevant to *Dichanthium setosum* include:

- Preventing plant regeneration
- Overgrazing and general damage to plant species
- Reversing the normal processes of plant succession
- Altering ecological communities and changing soil structure and nutrient cycling, leading to significant erosion.

Management strategies relevant to *Dichanthium setosum* in the threat abatement plan for rabbits include population control. Following the plan, control efforts should be:

- Targeted to protect sites where rabbits pose the greatest threat to biodiversity
- Undertaken in a strategic manner to take advantage of the environmental conditions and other complementary activities
- Monitored to ensure that objectives are met and allow management options to be adapted to changing circumstances.

1.4.7 References

Atlas of Living Australia (2018). Distribution of *Dichanthium setosum,* viewed 24 August 2018, available: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2905357.

AusGrass2 (2018). *Dichanthium setosum,* viewed 24 August 2018, available: http://ausgrass2.myspecies.info/content/dichanthium-setosum.

Department of the Environment and Energy (2018). *Dichanthium setosum* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=78349 [Accessed 30 August 2018].

Department of Environment and Conservation New South Wales (2005), *Dichanthium setosum* – Profile, viewed 11 December 2007, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10221.

1.5 Boonah tuckeroo (*Cupaniopsis tomentella*)

1.5.1 Status

EPBC Act – Vulnerable

1.5.2 Biology and ecology

1.5.2.1 Characteristic

Boonah tuckeroo (*Cupaniopsis tomentella*) is a tree that grows up to 10 m tall. It has compound leaves with 3 to 4 pairs of elliptic, often serrated leaflets which are densely rusty and hairy, especially when young (refer Photograph 1.5). Flowers are white, small, 7 to 8 mm, in terminal panicles. The fruit are hairy, orange-yellow, 3-celled capsules that are up to 2.5 cm long (TSSC 2008).

Photograph 1.5 Boonah tuckeroo (*Cupaniopsis tomentella*)

Source: Elsol (1978)

1.5.2.2 Known distribution

Boonah tuckeroo is known only from an area between Boonah and Ipswich in southeast Queensland (ALA 2018) (refer Figure 1.9).

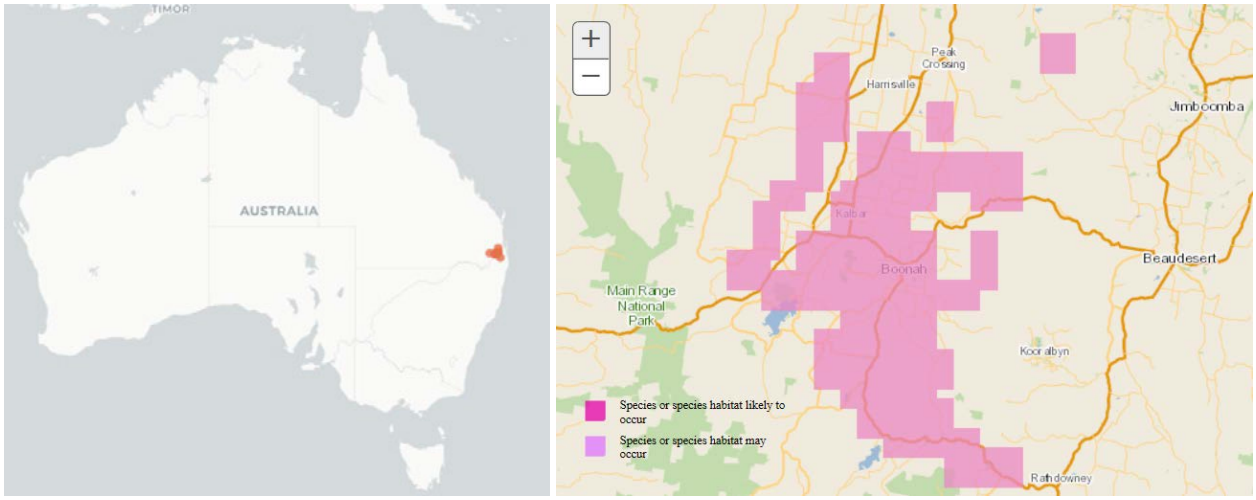


Figure 1.9 Distribution range of the Boonah tuckeroo

Source: ALA (2018); DotEE (2018)

1.5.2.3 Distribution in relation to the Project

Cupaniopsis tomentella was not identified within any Project-associated field surveys. There are no historic records of this species within or directly adjacent to the MNES study area. Database records indicate this species is known to occur within 10 km south of the Project, within an area of Teviot Range (Ivory's Knob) from several 1980s records. The species is only known from an area between Ipswich and Boonah, with the population estimated at between 120 to 140 individuals. Database records indicate that the Project is north of the edge of the eastern distribution for this species (AoLA 2020) (refer Figure 1.10). There is 6.29 ha of dry rainforest habitat suitable for this species within the MNES study area, however no habitat is located within the disturbance footprint (refer Figure 1.9 and habitat figure in Figure 1.10). This habitat is located approximately 180 m north of the disturbance footprint and will not be impacted directly or indirectly. Nevertheless, the species has never been identified north of the disturbance footprint.

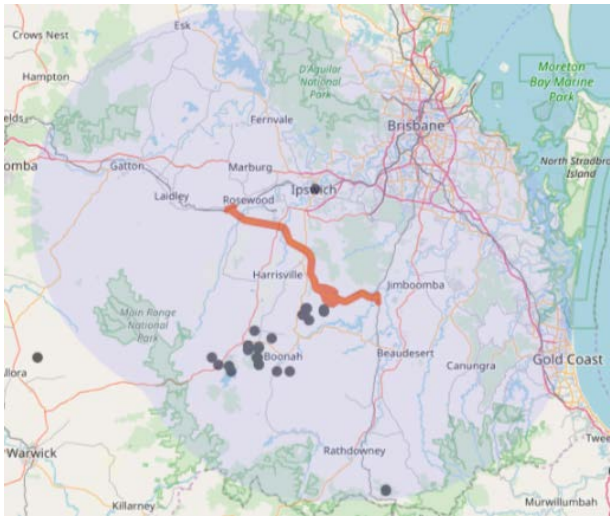


Figure 1.10 **Distribution range of the Boonah tuckeroo in relation to the Project**

Source: ALA (2020)

1.5.2.4 Biology and reproduction

Based on other species of *Cupaniopsis*, Boonah tuckeroo most likely flowers from May to September and fruits from July to December (TSSC 2008).

1.5.3 Habitat

Boonah tuckeroo grows in vine thickets predominantly on fertile clay soils. These areas have been extensively cleared for agriculture and close settlement over the last 150 years, and the only seven known occurrences are confined to small isolated remnants on scree slopes and roadsides. All known records are from outside of conservation reserves (TSSC 2008).

1.5.4 Threatening processes

The following have been identified as potentially threatening processes to the Boonah tuckeroo:

- Isolated and fragmented distribution
- Smothering exotic vines and understorey species
- Fire incursion
- Road widening and maintenance activities (TSSC 2008).

1.5.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

1.5.6 References

Atlas of Living Australia (2018). *Cupaniopsis tomentella*. Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2888688#overview [Accessed 31 August 2018].

Department of the Environment and Energy (2018). *Cupaniopsis tomentella* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=3322 [Accessed 31 August 2018].

Threatened Species Scientific Committee (2018). Conservation Advice on *Cupaniopsis tomentella* (Boonah Tuckeroo). http://www.environment.gov.au/biodiversity/threatened/species/pubs/3322-conservation-advice.pdf [Accessed 31 August 2018].

1.6 Brush sophora (*Sophora fraseri*)

1.6.1 Status

EPBC Act – Vulnerable

1.6.2 Biology and ecology

1.6.2.1 Characteristic

Sophora fraseri (Brush sophora), is a softly pubescent, sparsely branched leguminous shrub that grows to 1 to 2 m high. Leaves are pinnate and are 6 to 15 cm long with a 10 to 20 mm stalk. Leaves have 21 to 35 oblong to ovate leaflets 5 to 25 mm long, 3 to 10 mm wide, with smooth margins and stalks 1 to 2 mm long. Flowers occur in racemes about 10 cm long during spring (refer Photograph 1.6). Petals are pale yellow, about 10 mm long, and the sepals are about 5 mm long. The fruit, 3 to 10 cm long and up to 8 mm in diameter, is irregularly restricted between the seeds and does not open at maturity. There are 2 to 7 seeds, about 6 mm long (WetlandInfo 2018; TSSC 2008).

Photograph 1.6 Brush sophora *(Sophora fraseri)*

Source: Scott (2016)

1.6.2.2 Known distribution

Brush sophora is found north of Casino in northern NSW, where it is very rare, and into southeast Queensland (refer Figure 1.11), where it is widespread but not common. Brush sophora is conserved in Lamington National Park and Mount Mistake National Park (TSSC 2008).

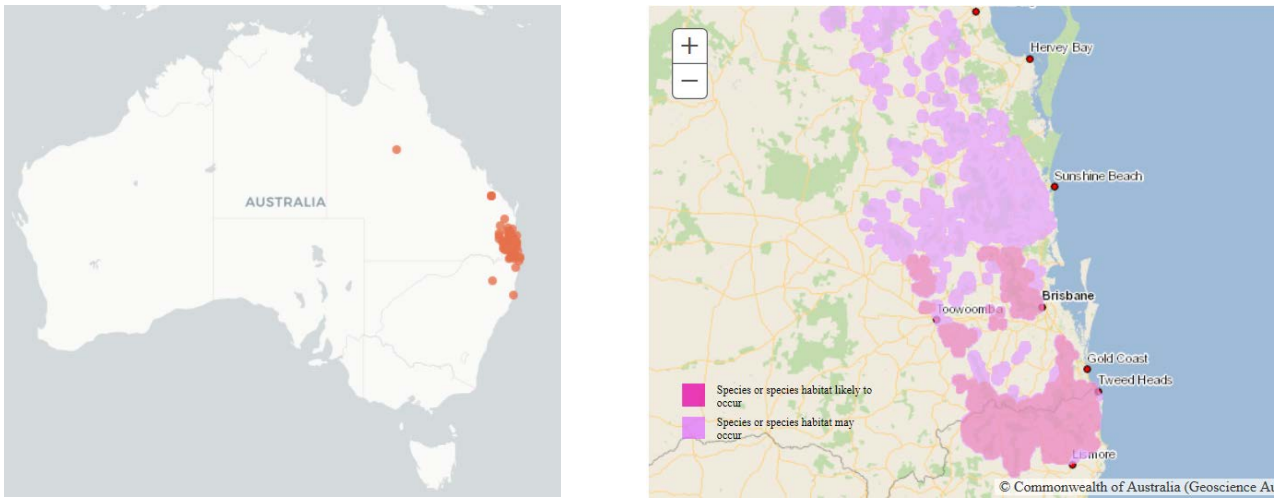


Figure 1.11 **Distribution range of the Brush sophora**

Source: ALA (2018), DotEE (2019)

1.6.2.3 Distribution in relation to the Project

Sophora fraseri has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicate that this species occurs within 50 km of the Project. The nearest database record is from 1992 taken from The Bluff approximately 8 km West of Rosewood, around 5 km north of the western extent of the Project. There are a number of more recent records within a 50 km radius located to the south, south-west, east, north and north-west.

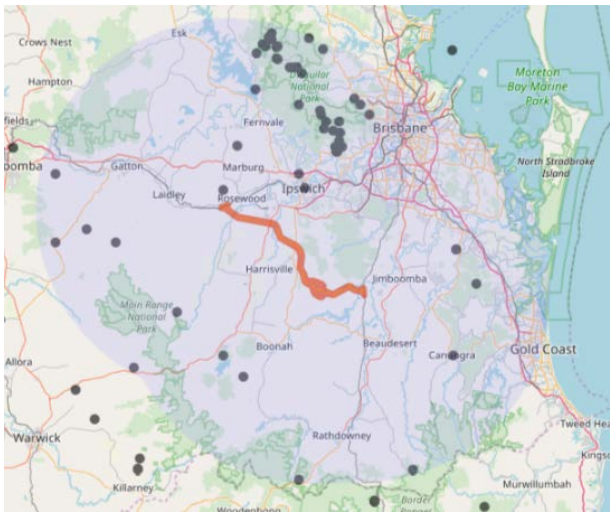


Figure 1.12 **Distribution range of the Brush sophora in relation to the Project**

Source: ALA (2020)

1.6.2.4 Biology and reproduction

Flowering of Brush sophora has been recorded in April and from late August to mid November. Fruiting has been recorded in January, April, July, August and November (Barker and Borsboom 1997; WetlandInfo 2018).

1.6.3 Habitat

Brush sophora normally grows in wet sclerophyll forest and a range of rainforest types. It has been reported growing in hilly terrain on hillslopes at altitudes at altitudes from 60 to 660m, in mostly shallow stony to shaly soils, of loam to clay texture derived from sandstone or basalt rocks. The shrub appears to prefer growing along rainforest margins, in eucalypt forests in the vicinity of rainforests or in large canopy gaps in closed forest communities (Barker and Borsboom 1997; WetlandInfo 2018).

1.6.4 Threatening processes

The following have been identified as potentially threatening processes to the Brush sophora:

- Loss of habitat through clearing for agriculture and development
- Timber harvesting
- Weed infestation
- Inappropriate fire regimes
- Loss of individuals from road/track works or maintenance
- Grazing by domestic stock
- Risk of local extinction because populations are small (OEH 2018).

1.6.5 Threat abatement/recovery plans

The following recovery plans have been identified as being relevant for this species:

- Department of Environment and Energy (2010). National recovery plan for the Semi-evergreen vine thickets of the Bigalow Belt (North and South) and Nadewar Bioregions ecological community. Canberra, ACT: Australian Government. Available from: **http://www.environment.gov.au/resource/national-recovery-plan-semi-evergreen-vine-thickets-brigalow-belt-north-and-south-and**.
- Office of Environment and Heritage (2016), *Saving our Species Program.* Available from: **https://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10764**. In effect under the BC Act 2016.

No threat abatement plan has been identified as relevant for this species.

1.6.6 Summary of threat abatement/recovery plan

Brush sepohra is listed as species that frequently occurs or primarily occurs within the semi-evergreen vine thikets of the Bigalow Belt and Nadeware Bioregions ecological community. The threats outlined in the National recovery plan for the "Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions" ecological community include:

- Broad-scale land clearing of remnant vegetation
- Fire where SEVT is not protected by topography or substrate and where fuel characteristics have been altered by the introduction of introduced pasture grasses
- Incursion by exotic flora including Buffel grass *Pennisetum ciliare*, Green panic *Megathyrsus maximus var. pubiglumis*, Parthenium weed *Parthenium hysterophorus*, Velvet tree pear *Opuntia tomentosa*, Lantana *Lantana camara*, Rubber vine *Cryptostegia grandiflora* and Brazilian nightshade *Solanum seaforthianum*. Of these *L. camara* and *C. grandiflora* pose the most serious threat to this TEC.
- Trampling from cattle grazing opening up the understorey of SEVT habitat facilitating the incursion of invasive flora

- Invertebrate pest species including feral pigs, foxes, rabbits and cane toads impacting the vegetation structure and associated native fauna
- Coastal development where remnant vine thicket occurs on coastal beach ridges.

Threat abatement actions outlined in the National recovery plan for the "Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions" ecological community include:

- Identify and evaluate the extent, biodiversity value and condition of remnant and regrowth areas of this TEC in the Brigalow Belt (North and South) and Nandewar Bioregions
- Complete mapping of this TEC in New South Wales and refine mapping of remnants in Queensland
- Establish a condition assessment methodology establishing benchmark sites for each component regional ecosystem
- Determine the extent and condition of SEVT areas that have been impacted by invasive flora, particularly weeds of national significance
- Survey data deficient species within SEVT communities
- Identify key ecosystem components and processes determining their response to management actions
- Monitor selected populations of EPBC-Act listed species that occur within SEVT communities including *Cadellia pentastylis, Cossinia australiana, Denhamia parvifolia, Macropus dorsalis, Paradelma orientalis, Turnix melanogaster* and *Zieria verrucose*
- Establish a comprehensive, adequate and representative system of SEVT ecological community across the Brigalow Belt (North and South) and Nandewar Bioregions, protected by either reservations or conservation agreements (including MOUs)
- Ensure best practice management to sites containing SEVT
- Involve landholders and community members in the conservation and management of SEVT ecological communities
- Enhance the ability of government and non-government organisations at the national, regional and local level (including consent authorities) to recognise and incorporate SEVT ecological community conservation issues into all planning processes.

The *Saving our Species* conservation strategy for *Sophora fraseri* identifies five priority management sites:

- Cougal in Kyogle LGA
- Toonumbar in Kyogle LGA
- Ettrick in Kyogle LGA
- Bungabee in Lismore LGA
- Richmond Range in Kyogle LGA.

Threats identified at the management sites include:

- Loss of habitat through clearing or agriculture
- Weed infestation, especially by Lantana
- Inappropriate fire regimes
- Loss of individuals from road/track works or maintenance.

Management activities to protect *Sophora fraseri* at the *Saving our Species* sites are:

- Encourage landholders to enter into voluntary management agreement to maintain or enhance the species and its habitat
- Physical and chemical control of weeds, including splatter gun and foliar spray to control Lantana
- Track species abundance/condition over time by counting individuals and juveniles, monitoring weed densities and other potential threats (species surveys to be conducted when flowering in Spring/Summer)

- Liaise with relevant agency to incorporate species requirements into the Flora Fire Response Database and Reserve Fire Management Strategy
- Monitor species recruitment and adult condition post fire event
- Install green posts to indicate locations of sensitive threatened species to reduce impacts of slashing and track maintenance and monitor for evidence of disturbance.

1.6.7 References

Atlas of Living Australia (2018). *Sophora fraseri*. Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2909150#overview [Accessed 30 August 2018].

Barker, M. and Borsboom, A. (1997). *Sophora fraseri* Species Management Profile. Department of Environment and Resource Management.

Office of Environment and Heritage, NSW (2018). Brush sophora. Available from: https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10764 [Accessed 21 August 2018].

Scott E. (2016). *Sophora fraseri* (Image) [Online] Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2909150# [Accessed 30 August 2018].

WetlandInfo, Department of Environment and Science, Queensland (2018). *Sophora fraseri.* [Online] Available from: https://wetlandinfo.ehp.qld.gov.au/wetlands/ecology/components/species/?sophora-fraseri [Accessed 30 August 2018].

Threatened Species Scientific Committee (2008). Conservation Advice on *Sophora fraseri* (Brush sophora). http://www.environment.gov.au/biodiversity/threatened/species/pubs/8836-conservation-advice.pdf [Accessed 31 August 2018].

1.7 Cooneana olive (*Notelaea ipsviciensis*)

1.7.1 Status

EPBC Act – Critically endangered

1.7.2 Biology and ecology

1.7.2.1 Characteristic

Cooneana olive (*Notelaea ipsviciensis*) is a small multi-stemmed evergreen shrub growing up to 1 to 2 m in height (refer Photograph 1.7). It is slow-growing, forming large underground lignotubers. It produces very small cream-yellow flowers and its fruit is small (up to 10 mm wide), purple and fleshy, surrounding one seed (TSSC 2009).

Photograph 1.7 Cooneana olive (*Notelaea ipsviciensis*)

Source: Chapman (2008)

1.7.2.2 Known distribution

The Cooneana olive is known from three closely clustered sub-populations in the Ipswich area (Dinmore) of southern Queensland. The three locations are Murphy's Gully, a site adjacent to Cunningham Highway and Bergin's Hill. The current extent of occurrence is less than 2 km² (DotEE 2018; TSSC 2009). Potential habitat mapping indicates the 'species or species habitat may occur' only in the eastern portion of the alignment (refer Figure 1.13).

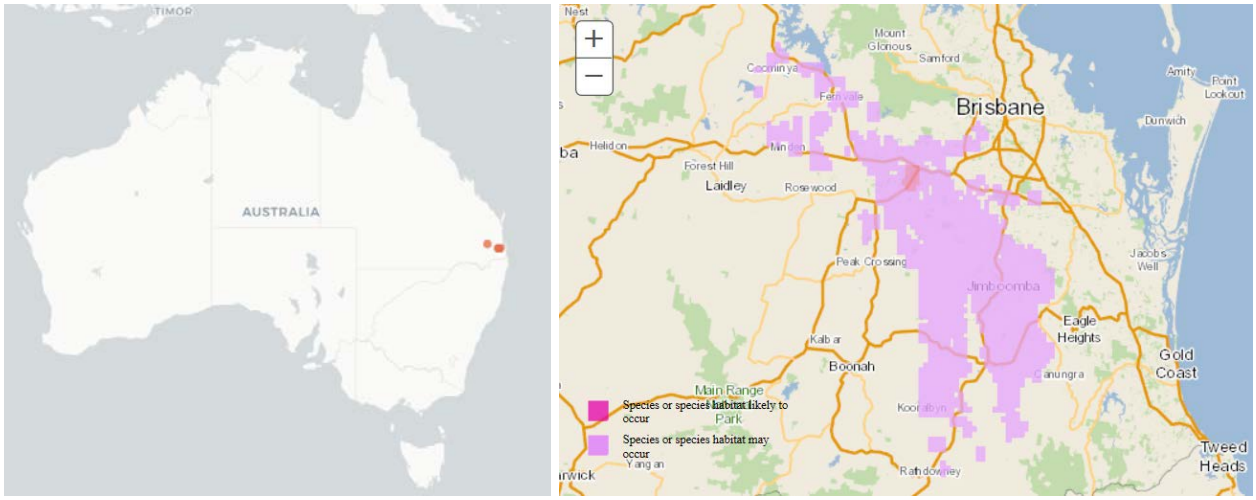


Figure 1.13 Distribution range of the Cooneana olive

Source: ALA (2018); DotEE (2018)

1.7.2.3 Distribution in relation to the Project

Notelaea ipsviciensis has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA) indicated that Cooneana olive is known from three closely clustered sub-populations in the Ipswich area (Dinmore) of southern Queensland. The three locations are Murphy's Gully, a site adjacent to Cunningham Highway and Bergin's Hill. The current extent of occurrence is less than 2 km². Database records are located approximately 16 km north-east of the Project disturbance area.

The species is very localised in occurrence and is located well north of the MNES study area. There is no evidence the species has ever occurred in the wider area surrounding the Project. As such, the species is considered unlikely to occur and is not treated further for assessment within the main body of the MNES report.

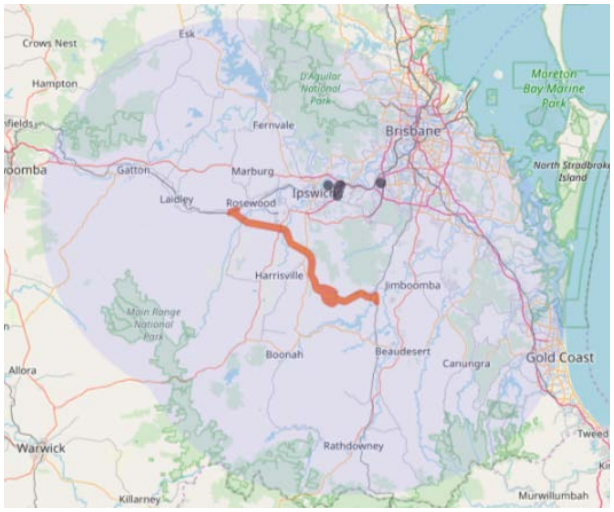


Figure 1.14 **Distribution range of the Cooneana olive in relation to the Project**

Source: ALA (2020)

1.7.2.4 Biology and reproduction

Cooneana olive is a very slow growing, lignotuberous plant, presumably long-lived, with resilience to occasional burning and canopy loss. Seed recruitment appears to be low, although it is not known if this is due to sporadic flowering which may limit pollinators or seed dispersers. Native bees are suspected to be the pollinator species, but no fauna has been observed eating/dispersing fruits. A germination rate of 60 to 80% has been recorded with propagation trials (DotEE 2018).

Records suggest that the Cooneana olive flowers in July and fruits in October, however, recent studies suggest that flowering can occur at other times of the year in response to fire and weather conditions. Similarly, fruiting may be sporadic which may be the result of environmental stress or the result of poor environmental conditions in which the species grows (DotEE 2018).

1.7.3 Habitat

The Cooneana olive survives as an understorey plant in degraded, eucalypt dominated dry sclerophyll vegetation communities. Soils in the area are of low fertility, depauperate and sandstone-based. This species prefers open woodland communities with open canopies (DotEE 2018).

1.7.4 Threatening processes

The following have been identified as potentially threatening processes to the Cooneana olive (Beyleveld 2006, Lock et al. 2004, TSSC 2009):

- Land disturbance – land clearing, substrate disturbance, mining activities, urban development and soil dumping
- Weed invasion – weeds compete for moisture and light, inhibit seedling regeneration and increase localised fuel load
- Inappropriate fire regimes – high intensity fire can kill individuals and inhibit seed recruitment (Beyleveld 2006; Lock et al. 2004; TSSC 2009).

1.7.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

1.7.6 References

Atlas of Living Australia (2018). *Notelaea ipsviciensis*. Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2903014#overview [Accessed 30 August 2018].

Chapman A. (2008). *Notelaea ipsviciensis* (Image) [Online] Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2903014#gallery [Accessed 30 August 2018].

Department of the Environment and Energy (2018). *Notelaea ipsviciensis* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=81858 [Accessed 30 August 2018].

Threatened Species Scientific Committee (2009). *Commonwealth Listing Advice on* Notelaea ipsviciensis. Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/81858-listing-advice.pdf. In effect under the EPBC Act from 16 January 2009.

1.8 Hairy-joint grass (*Arthraxon hispidus*)

1.8.1 Status

EPBC Act – Vulnerable

1.8.2 Biology and ecology

1.8.2.1 Characteristic

Hairy-joint grass (*Arthraxon hispidus*) is a slender tufted creeping grass that roots at the nodes, with erect to semi-erect stems. The leaves are reddish to purplish, with long white hairs around the edge, broad at the base and tapering abruptly to a sharp point (refer Photograph 1.8). Flowers appear in March to July and summer to autumn. The fruit is a caryopsis (simple, dry single seeded fruit, with seed fused to the wall of the fruit and remaining closed at maturity). The seed-heads are held above the plant on a long fine stalk. Once thought to be an annual species, more recent information suggests it is a perennial that tends to die down in winter (TSSC 2008).

Photograph 1.8 **Hairy-joint grass (*Arthraxon hispidus*)**

Source: OEH (2015)

1.8.2.2 Known distribution

Hairy-joint grass has been recorded from scattered locations throughout Queensland and on the northern tablelands and north coast of NSW. In Queensland, the species occurs north to Port Douglas, and west to disjunct occurrences around mound springs in Carnavon National Park. However, the most common occurrences are from Noosa southwards. This species has been recorded within the Border River–Gwydir, Northern Rivers (NSW), Fitzroy, Border Rivers–Maranoa Balonne, Condamine, South East, Burnett Mary and Wet Tropics (Queensland) Natural Resource Management regions (refer Figure 1.15). It is also known to be reserved in Carnarvon Cooloola NP, Noosa NP, Carnarvon NP, and Daintree NP (DotEE 2018).

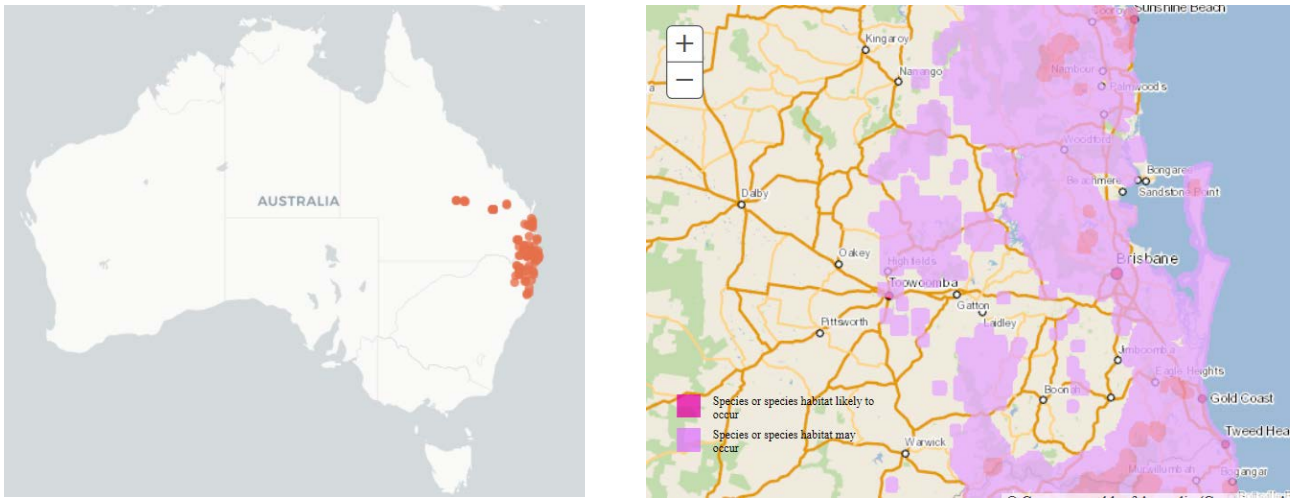


Figure 1.15 **Distribution range of Hairy-joint grass**

Source: ALA (2018), DotEE (2018)

1.8.2.3 Distribution in relation to the Project

Arthraxon hispidus was not identified within any Project-associated field surveys. There are no database records of this species within of adjacent to the MNES study area. Database records indicate the species has been recorded in the wider region surrounding the Project. The nearest database record is dated from 1941 and is located approximately 14 km south of the disturbance footprint. There are a number of other records within a 50 km radius located to the south, east and north-east. The nearest recent record is from Main Range National Park over 30 km south of the MNES study area (refer Figure 1.16. The species occurs from Paluma (north Queensland) south to Kempsey in NSW.

Figure 1.16 **Distribution range of Hairy-joint grass in relation to the Project**

Source: ALA (2020)

1.8.2.4 Biology and reproduction

Fertile material of Hairy-joint grass has been collected from March to May, and July. The species has been reported as flowering during summer-autumn. Hairy-joint grass was once considered an annual, but is now thought to be a perennial that tends to die down in winter (TSSC 2008).

1.8.3 Habitat

Hairy-joint grass is found in or on the edges of rainforest and in wet Eucalypt forest, often near creeks or swamps, as well as woodland. The species has been recorded growing around freshwater springs on coastal foreshore dunes, in shaded small gullies, on creek banks, and on sandy alluvium in creek beds in open forests. It has also been recorded with bog mosses in mound springs (TSSC 2008). May also occur in disturbed habitats such as pastures where tussock grasses protect the species from grazing pressure.

1.8.4 Threatening processes

The following have been by identified by DotEE as potentially threatening processes to the Hairy-joint grass:

- Trampling and over grazing by stock
- Clearing for agriculture and development
- Inappropriate fire regimes
- Competition from introduced grasses.

1.8.5 Threat abatement/recovery plans

The following recovery plan has been identified as being relevant for this species:

- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from **https://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10066**. In effect under the BC Act 2016.

No threat abatement plan has been identified as being relevant for this species.

1.8.6 Summary of threat abatement/recovery plan

Arthraxon hispidus is assigned as a keep-watch species under the NSW *Saving our Species Program* as it is widespread with many small populations across NSW. State wide conservation actions identified for this species include:

- Educate the public on *Arthraxon hispidus*, particularly landowners adjacent to areas of known occurrence
- Reserve Fire management Strategy to include operational guidelines to protect this species from fire
- Develop and implement site management plans for some of the known populations.
- Establish monitoring sites to determine trends in habitat condition and population size.
- Maintain populations ex situ at suitable botanic gardens, regional gardens or nurseries.
- Map extent of known populations and survey areas of potential habitat near known occurrences for additional populations.
- Assess weed threats to populations, manage as necessary. Implement Bitou bush control as described in the approved TAP.
- Control Feral animals in known habitat for this species.

1.8.7 References

Atlas of Living Australia, (2018), Distribution of Hairy-joint grass, accessed 24 August 2018, available https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2902385.

Department of the Environment and Energy (2018). *Arthraxon hispidus* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=9338 [Accessed 30 August 2018].

Office of the Environment and Heritage, (2015a), Threatened Species Website, image of: *Arthraxon hispidus* - Hairy-joint grass, accessed 23 August 2018, available https://images.ala.org.au/image/viewer?imageId=3c1642c2-522e-495d-95cc-f8f60a4f2f9a.

Office of the Environment and Heritage, (2015b), Threatened Species Website, image of: *Arthraxon hispidus* - Hairy-joint grass, accessed 23 August 2018, available https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2902385#gallery.

Threatened Species Scientific Committee (2008). *Commonwealth Listing Advice on* Arthraxon hispidus. Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/9338-conservation-advice.pdf.

1.9 Hawkweed (*Picris evae*)

1.9.1 Status

EPBC Act – Vulnerable

1.9.2 Biology and ecology

1.9.2.1 Characteristic

Hawkweed (*Picris evae*) is a soft-stemmed annual plant, up to 130 cm tall with most of the leaves growing around the base of the plant. The leaves are sometimes toothed, have a pointed tip, and are sparsely hairy with split-end hairs (the hairs divided into two for half their length). Leaves are 2.5 to 15 cm long and 4 to 30 mm wide. The small, yellow flowers grow in dense heads 8 to 10 mm wide at the ends of the stems (OEH 2018) (refer Photograph 1.9).

Photograph 1.9 Hawkweed (*Picris evae*)

Source: Sharp (n.d)

1.9.2.2 Known distribution

Hawkweed is known to occur in the areas of northern NSW (eg. Inverell, Elsmore, Tamworth) and the Darling Downs and Moreton pastoral districts in southeast Queensland (Bostock and Holland 2007) (refer Figure 1.17).

Figure 1.17 Distribution range of the Hawkweed

Source: ALA (2020)

1.9.2.3 Distribution in relation to the Project

Picris evae has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicate that the nearest specimen backed record from 1962 occurs from within 40 km of the disturbance footprint. More recent records for the species occur from within 50 km of the temporary and permanent disturbance footprint to the south, south-west, west and north-west.

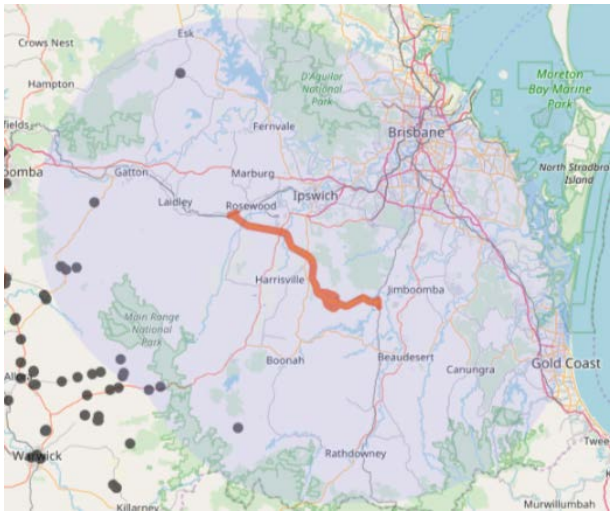


Figure 1.18 **Distribution range of the Hawkweed in relation to the Project**

Source: ALA (2020)

1.9.2.4 Biology and reproduction

The flowering and fruiting period occurs during October to January and sometimes until May (OEH 2017).

1.9.3 Habitat

Hawkweed typically occurs in Eucalypt open woodlands, with grassy understories characteristically represented by *Dichanthium* spp. Upper stratum species include *Eucalyptus melliodora*, *E. crebra*, *E. populnea*, *E. albens*, *Angophora subvelutina*, *Allocasuarina torulosa*, and *Casuarina cunninghamiana*. This species has been collected along roadsides, and in cultivated areas (i.e. paddocks), on black, dark grey or red-brown soils, reddish clay-loam or medium clay soils (Holzapfel 1994; TSSC 2008).

1.9.4 Threatening processes

The following have been identified as potentially threatening processes to Hawkweed:

- Weed invasion
- Inappropriate fire regimes
- Habitat fragmentation
- Clearing of vegetation for cropping and grazing (DECC 2005).

1.9.5 Threat abatement/recovery plans

The following recovery plans have been identified as being relevant for this species:

- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from https://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10627. In effect under the BC Act 2016.
- Department of Environment, Climate Change and Water NSW (2010). *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. Department of Environment, Climate Change and Water NSW, Sydney. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/white-box-yellow-box-blakelys-red-gum-grassy-woodland-and-derived-native-grassland-national In effect under the EPBC Act from 22-Mar-2013.

1.9.6 Summary of threat abatement/recovery plan

The *Save our Species* conservation strategy for *Picris evae* identifies two priority management sites:

- Myall Creek in Inverell LGA
- Barayamal in Inverell LGA

Threats identified at the management sites include:

- Clearing of habitat for cropping and grazing
- Accidentally and illegally lit fires
- Accidental damage during road maintenance activities
- Invasion of habitat by introduced weeds.

Management activities to protect this species at the *Save our Species* sites include:

- Minimise impacts and incidences of clearing by providing advice to local council in order to inform planning decisions and environmental assessment
- Reduce the risk of adverse fire at the site by liasing with private landholders and local Bushfire Committee to educate on appropriate time to burn and encourage the building of fire breaks and slashing on road-edge to reduce likelihood of accidental igition of the site
- Reduce and maintain weed densities at low levels by slashing and poisoning, spot spraying.

Threats identified in the National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland include:

- Land use and management change
- Agricultural and horticultural development
- Public Infrastructure upgrades in travelling stock routes (TSRs)
- Firewood collection and ‘tidying up’
- Changed fire regimes
- Increase in soil nutrients and use of chemicals
- Mowing and slashing regimes
- Revegetation management
- Weed invasion
- Climate change
- Salinity
- Acid soils
- Declining tree health and regeneration
- Increased grazing pressure from invasive herbivores
- Disease – *Phytophthora cinnamomi*
- Collection and removal of native flora.

Recovery actions identified in the National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland include:

- Collect baseline data on the locations, quality and management regimes of remnant sites
- Extent and condition mapping
- Component species surveys
- Protection of existing habitat in priority areas including on private land

- Engagement with the community, particularly where remnants occur on private land to provide information on appropriate management and with Aboriginal communities.

Summary of baseline information actions undertaken to date:

- The establishment of databases comprising of information on CMN members (land managers with Box-Gum Grassy Woodland remnants), remnant locations, composition of flora and fauna species and remnant condition from surveys of CMN members' sites and other sites
- Minimum condition criteria and assessment method developed to assist land managers in identification of listed ecological communities
- Development of regional models using remote sensing
- Mapping of Box-Gum Grassy Woodland extent
- Surveys conducted during research programs through various organisations.

1.9.7 References

Atlas of Living Australia (2018). *Picris evae*. Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2887141 [Accessed 27 August 2018].

Bostock, PD and Holland, AE (2007). *Census of Queensland flora*, CD-ROM, Queensland Herbarium, Brisbane.

Department of Environment and Climate Change NSW (2005). *Hawkweed – Profile*. Available from: http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10627 [Accessed 27 August 2018].

Holzapfel, S (1994). A revision of the genus *Picris* (Asteraceae, Lactuceae) s.l. in *Australia, Willdenowia*, vol. 24, pp. 97-218.

Office of Environment and Heritage (2018). Hawkweed. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10627 [Accessed 27 August 2018].

Sharp, D. (nd). Queensland Herbarium, Department of Science, Information Technology and Innovation (DSITI), Queensland Government.

Threatened Species Scientific Committee (2008). *Approved Conservation Advice for Picris evae (Hawkweed)* Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/10839-conservation-advice.pdf [Accessed 27 August 2018].

1.10 Lesser swamp-orchid *(Phaius australis)*

1.10.1 Status

EPBC Act – Endangered

1.10.2 Biology and ecology

1.10.2.1 Characteristic

The Lesser swamp-orchid *(Phaius australia)* is endemic to Australia and occurs in southern Queensland and northern NSW. The species produces the largest flowers of any Australian orchid, with each orchid having 4 to 8 large, pleated leaves and 1 to 2 spikes (flower stalks). The leaves of this species are long (approximately 70 cm), relatively narrow (3 to 10 cm wide) and are very similar to other swamp-orchids. The flowers grow on the top of the stalk of the Lesser swamp-orchid is approximately 70 to 110 cm long and unlike other orchids, has a red-brown with yellow veins inside the flower (refer Photograph 1.10). The flowers are perfumed and are 10 to 15 cm across (Benwell 1994; DotEE 2018; NH NSW 2006; Searle and Maden 2006).

Photograph 1.10 Lesser-swamp orchid (*Phaius australis*)

Source: Harden (1993)

1.10.2.2 Known distribution

The Lesser-swamp orchid is endemic to Australia and occurs in eastern Queensland and northern NSW. Records indicate the species extending as far as Lake Cathie near Port Macquarie and as far south at South West Rocks (DotEE 2018).

This species occurs within the southeast Queensland, NSW North Coast, Brigalow Belt south and Central Mackay coast Bioregions and the Burnett Mary, southeast Queensland catchments, Northern Rivers and Fitzroy Natural Resource Management regions (refer Figure 1.19).

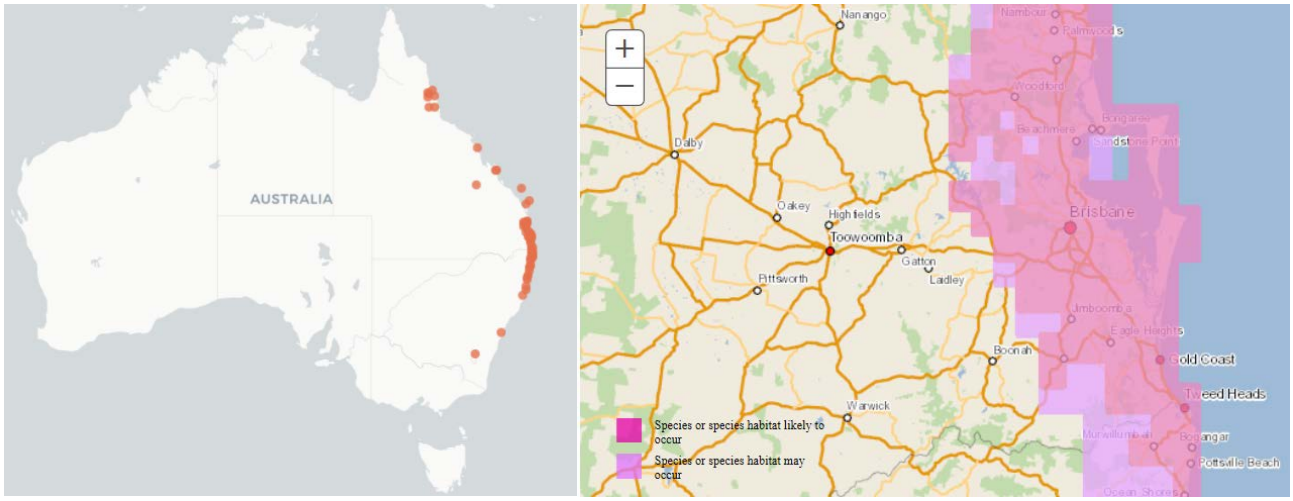


Figure 1.19 **Distribution range of the Lesser-swamp orchid**

Source: ALA (2018), DotEE (2018)

1.10.2.3 Distribution in relation to the Project

Phaius australis has been predicted to occur within the region and associated habitat within the MNES study area. The nearest specimen records (i.e. AoLA, WildNet) are from Hollywell, and Redlands Bay (45 km east and northeast of the project respectively). It is noted AoLA records of the species have been generalised to protect the species and so may not reflect the actual occurrence location.

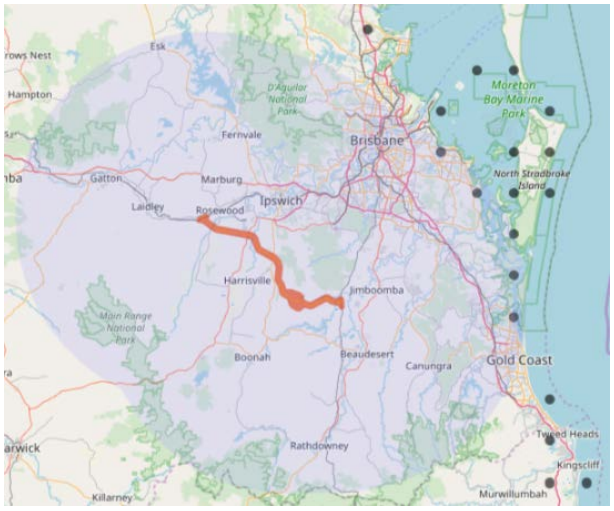


Figure 1.20 **Distribution range of the Lesser-swamp orchid in relation to the Project**

Source: ALA (2020)

1.10.2.4 Biology and reproduction

The Lesser swamp-orchid flowers in spring (September to November) and can reproduce sexually (by pollination) and asexually (by dormant buds along the flower spikes). Although vegetative reproduction is thought to occur only infrequently in the wild, it is common in cultivation. Most flowers of the Lesser swamp-orchid set fruit and like most orchids, thousands of tiny seeds may be produced within each fruit. Information on the pollination biology of this species is limited, but it is thought that members of this genus are pollinated by bees. Other members of the genus *Phaius* have a 'rostellum', a structure that acts like a cap and prevents the male and female parts of an individual flower coming into contact, but is removed by the pollinator to enable cross-pollination. The Lesser swamp-orchid lacks this cap and it is possible that the abundant fruit set of this species is indicative of self-pollination (DotEE 2018).

1.10.3 Habitat

This species is associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest and often where Broad-leaved paperbark (*Melaleuca leucadendra*) or Swamp mahogany (*Eucalyptus robusta*) are found. Less commonly, the species has been found in drier forest near the coast. The species are known to be restricted to the swamp-forest margins, where it occurs in swamp sclerophyll forest, swampy rainforest, or fringing open forest. It is often associated with rainforest elements such as Bangalow palm (*Archontophoenix cunninghamiana*) or Cabbage tree palm (*Livistona australis*) (DotEE 2018, National Herbarium 2006).

The Lesser-swamp orchid is relatively adaptable in its requirements for light and soil type. Soils range from acidic waterlogged peat, with a pH of 4.2 to peaty-sand, with a pH of 7.0. Soil parent materials include marine aeolian sand, the most common substrate, alluvium, granite, meta sediments, hailstone gravel and sandstone. Soil types on sand range from shallow peat to humus/groundwater podzol (DotEE 2018).

1.10.4 Threatening processes

The following have been identified as potentially threatening processes to the Lesser-swamp orchid:

- Illegal collection
- Habitat loss
- Fire
- Weed invasion (DotEE 2018).

1.10.5 Threat abatement/recovery plans

The following recovery plan has been identified as being relevant for this species:

- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from **https://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10610**. In effect under the BC Act 2016.

The following threat abatement plans has been identified as being relevant for this species:

- Department of the Environment and Energy (2017). Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa) (2017). Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/feral-pig-2017**. In effect under the EPBC Act from 18-Mar-2017.

1.10.6 Summary of threat abatement/Recovery plans

The *Saving our Species* conservation strategy for *Phaius australia* identifies six priority management sites:

- Tugun in Tweed LGA
- Cudgen in Tweed LGA
- Iluka in Clarence Valley LGA
- Yamba in Clarence Valley LGA
- Translocation site
- Yuraygir.

Threats identified at the management sites include:

- Invasion of habitat by introduced weeds
- Trail bike riders disturbing substrate and destroying plants
- Illegal rubbish dumping and other disturbances caused by people and/or vehicles

- Drainage of swamps, or pollution from nutrient run-off
- Illegal collection for horticulture or cut flowers.

Management activities to protect this species at the *Save our Species* sites are:

- Reduce and maintain weed densities at low levels through hand-pulling, removal of all weeds in close proximity to known populations, monitor target weed density
- Minimise disturbance from recreational activities by maintaining fence and ensuring gates are locked
- Reduce incidence of illegal dumping by liaising with local council to ensure illegal dumping laws are enforced and signage to warn general public is installed
- Minimise habitat and species exposure to pollution by liaising with the Roads and Maritime Disturbances to control disturbances to hydrology
- Track species abundance and condition annually by counting all individuals (clumps) and assessing weed densities.

The threats outlined in the threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) include:

- Impacts on plant species composition and succession
- Alterations to nutrient, water cycling and water quality
- Predation of native fauna and flora including small mammals, birds, reptiles, frogs, crayfish, eggs, invertebrates, fungi and all part of plants including fruit, seeds, roots, tubers, bulbs and foliage
- Digging and disturbance to substrate resulting in the destruction of plants threatening their survival and recruitment of new plants altering the floral composition and soil structure
- Disturbance caused by pigs can increase the incursion and recruitment of weeds and provide reservoirs for endemic animal diseases.

Threat abatement actions for ferals (*Sus scrofa*) include:

- Implementation of control measures including trapping, aerial and ground shooting, poisoning and fencing
- Using tracking dogs to detect and flush out feral pigs by commercial harvesters
- Manipulating habitat by reducing watering point and crop waste
- Manage feral pigs within a policy, legislative and planning framework.

1.10.7 References

Atlas of Living Australia (2018), *Phaius australis* – Lesser-swamp orchid, viewed 24 August 2018, available: < https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2910902>.

Department of the Environment and Energy (2018). *Phaius australis* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed Thu, 23 August 2018

National Herbarium of NSW (2006). PlantNET - New South Wales flora online - *Phaius australis*. Viewed 23 August 2018. Royal Botanic Gardens and Domain Trust, Sydney Australia. Available from: <http://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswflandlvl=spandname=Phaius~australis.>

1.11 Lloyd's native olive *(Notelaea lloydii)*

1.11.1 Status

EPBC Act – Vulnerable

1.11.2 Biology and ecology

1.11.2.1 Characteristic

Lloyd's native olive (*Notelaea lloydii*) is a shrub that grows to an approximate height of 1 to 4 m, with many smooth, pale grey barked stems arising from the base. Stems are approximately 2 to 4 cm in diameter and leaves are hairless and leathery with a linear or slight sickle-shape. Leaves are approximately 7 to 14 cm long and 2 to 5.5 mm wide with the main veins clearly visible, and slightly raised on the upper leaf surface (refer Photograph 1.11). Up to 20 flowers grow in groups in leaf axils (upper angle between leaf stalk and stem) (DotEE 2018).

Photograph 1.11 Lloyd's native olive (*Notelaea lloydii*)

Source: Fagg (2018)

1.11.2.2 Known distribution

Lloyd's native olive is endemic to southeast Queensland between Mt Brisbane, near Somerset Dam, to just south of Beaudesert and as far west as Mt Berryman near Laidley, a range of approximately 120 km, occupying an area of approximately 37,000 km ^{2}. The species is known to occur on well-drained slopes in Boonah and Ipswich areas (Halford 1998; Leiper et al. 2008) (refer Figure 1.21).

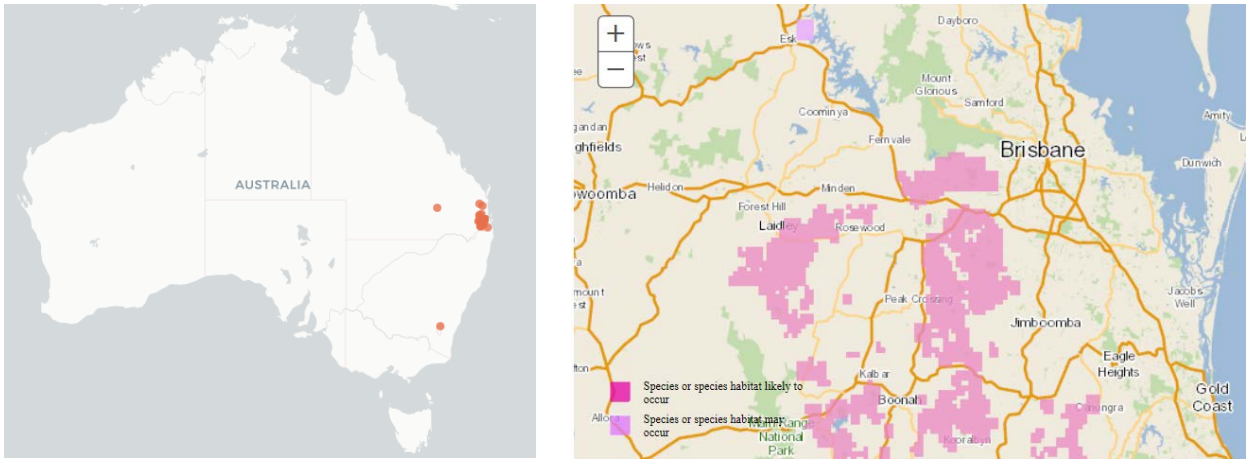


Figure 1.21 Distribution range of Lloyd's native olive

Source: ALA (2018), DotEE (2018)

1.11.2.3 Distribution in relation to the Project

Eight individuals of this species were recorded within 200 m of the disturbance footprint during Project-associated protected plant surveys in 2018. Multiple database records for this species exist for areas within the MNES study area. It is estimated that the Project is likely to impact habitat in which this species is predicted to occur. Database records indicate that this species occurs within the MNES study area with eight individuals encountered from a 2018 ALA record (refer Figure 1.22). Numerous records occur between 2.5 and 5 km east of the disturbance footprint at the Flinders Goolman Conservation Estate. Some of these records are old (1984) and others more recent (2003).

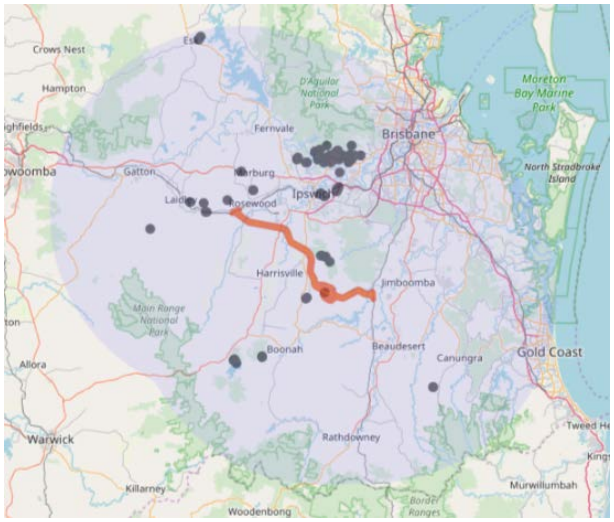


Figure 1.22 **Distribution range of Lloyd's native olive in relation to the Project**

Source: ALA (2018)

1.11.2.4 Biology and reproduction

Lloyd's native olive flowers from autumn to winter with flower size roughly 3 mm. Flowers are generally a pale yellow or cream colour, on stalks 3 to 5 mm long. The fruits are spherical to oval shape approximately 5 to 8 mm in diameter and consist of a hard woody nut with a thin, dark blue skin that is also known to be reddish to black in colour when ripe (DEWHA 2008; Leiper et al. 2008).

1.11.3 Habitat

The species is known to occur in open eucalypt forest, often near the margins of vine thickets, vine forests and softwood scrub. It is usually found on stony, shallow and rocky soils derived from sandstone or acid volcanic rocks, often on steep slopes, or near drainage lines. It is recorded from three national parks in the area, but most populations occur on road verges or freehold land. Most known populations occur in areas of remnant vegetation as defined under the *Vegetation Management Act 1999* (Qld), and are therefore currently protected from broad-scale clearing. This species occurs within the southeast Queensland Natural Resource Management region (Halford 1998).

1.11.4 Threatening processes

The following have been identified as potentially threatening processes to the Lloyd's native olive:

- Habitat fragmentation for urban development and associated infrastructure (Halford 1998)
- Inappropriate fire regimes. Mature Lloyd's native olive are known to withstand fire, but frequent fire kills juvenile plants and seedlings, supressing species recruitment (Halford 1998)
- Road maintenance
- Weed invasion, notably Lantana (*Lantana camara).* Latana is known to invade forest margins, smothering plants, reducing light and increasing fuel loads

- Some remnant populations occur on roadsides and therefore are potentially affected by road widening and maintenance (DEWHA 2008).

1.11.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

1.11.6 References

Atlas of Living Australia (2018), Occurrence records map, accessed 23 August 2018, available https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2902777.

Department of the Environment and Energy (2018). *Notelaea lloydii* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed Thu, 23 August 2018

Department of the Environment, Water, Heritage and the Arts (2008). Approved Conservation Advice for Notelaea lloydii. Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/15002-conservation-advice.pdf. In effect under the EPBC Act from 16 December 2008.

Fagg, M. (2018) *Notelaea lloydii,* accessed 23 August 2018, available https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2902777#gallery.

Guymer, G.P. (1987). Two new species of Notelaea Vent. (Oleaceae) from southeastern Queensland. Austrobaileya. 2(4):339-343

Halford, DA (1998), 'Survey of threatened plant species in southeast Queensland Biogeographical Region', Queensland CRA/RFA Steering committee, Queensland Government.

Leiper, G., Glazebrook, J., Cox, D., Rathie, K., (2008), *Mangroves to Mountains, A field guide to the Native Plants of Southeast Queensland,* 125 and 227.

1.12 Lychnothamnus barbatus

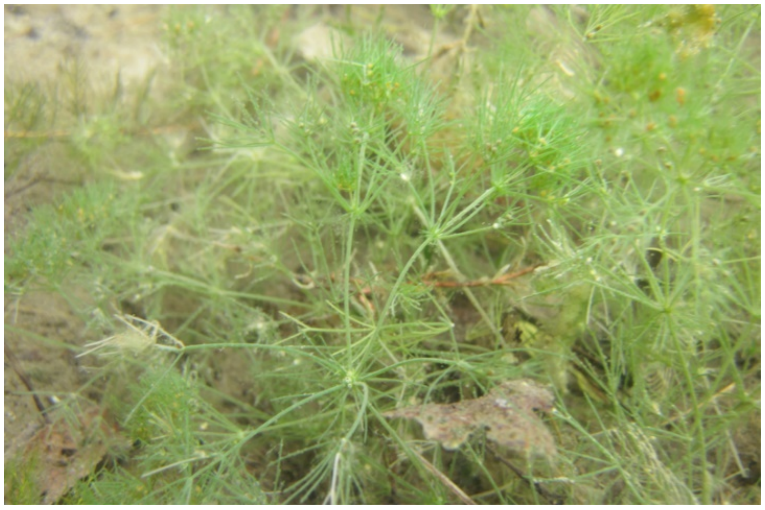
1.12.1 Status

EPBC Act – Endangered

1.12.2 Biology and ecology

1.12.2.1 Characteristic

Lychnothamnus barbatus is a submerged aquatic freshwater macrophyte (algae). Plants usually grow 12 to 25 cm high, are greyish-green, somewhat branched and moderately encrusted. There are 7 to 10 branchlets in a whorl that are up to 5 cm long, with 3 to 5 segments and an elongated primary segment (refer Photograph 1.12). Spores are orange-brown to dark brown, usually 1 to 1.15 mm long and 0.6 to 0.72 mm wide, with 8 to 10 prominent ridges (DotEE 2018).



Photograph 1.12 ***Lychnothamnus barbatus***

Source: Skawinski (2017)

1.12.2.2 Known distribution

Lychnothamnus barbatus has been collected from sites in Europe, India, China, Australia and Papua New Guinea. In Australia, it is only found in Queensland in Warrill Creek, west of Boonah and Wallace Creek, south of Boonah (Balevicius 2001; McCourt et al. 1999; Osborne 1989; Queensland Herbarium 2009) (refer Figure 1.23).

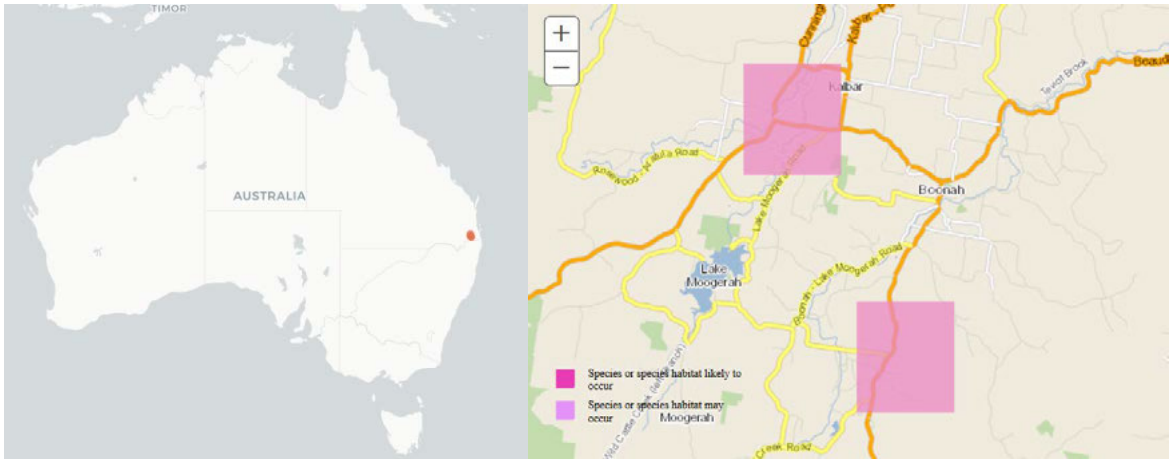


Figure 1.23 **Distribution range of the *L. barbatus***

Source: DotEE (2018)

1.12.2.3 Distribution in relation to the Project

Lychnothamnus barbatus has not been identified within or near the MNES study area. Database records are located 20 km south-west and 26 km south (upstream) of the Project disturbance area including Warrill Creek (refer Figure 1.24). The Project is located downstream of the known occurrences of the species and crosses Warrill Creek. Aquatic habitat assessment and water quality sampling was carried out at the location of the Project crossing on Warrill Creek for the EIS studies. The habitat assessment noted a large pooled area with clear water and a range of aquatic macrophytes as occurring. *Lychnothamnus* barbatus was not observed. Water quality sampling was carried out at this site in September 2017 but was not carried out during a subsequent sampling event in February 2018 due to dry conditions (indicating this section of Warrill Creek is ephemeral) (refer to Appendix J Terrestrial and Aquatic Ecology Technical Report for further information regarding aquatic habitat and surface water assessment).

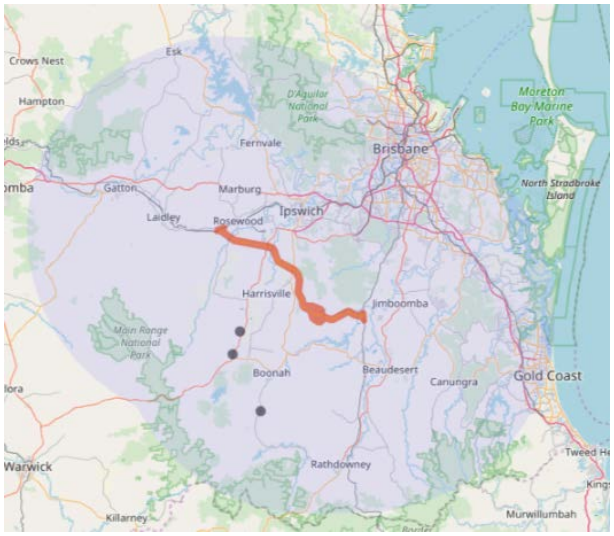


Figure 1.24 **Distribution range of the *L. barbatus* in relation to the Project**

Source: ALA (2020)

1.12.2.4 Biology and reproduction

Lychnothamnus barbatus is an alga, and hence does not flower or fruit but instead releases spores into the water it inhabits. Not much else is known about its reproduction (DoE 2018).

1.12.3 Habitat

Lychnothamnus barbatus occurs in clear flowing water (DotEE 2018).

1.12.4 Threatening processes

The following have been identified as potentially threatening processes to *L. barbatus*:

- Increased turbidity from land clearance upstream of its habitat
- Sand or gravel extraction
- Reduced stream flows from increased water extraction
- Changes in flow conditions from impoundments
- Eutrophication (DotEE 2018).

1.12.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

1.12.6 References

Department of the Environment and Energy (2018). *Lychnothamnus barbatus* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64479 [Accessed 31 August 2018].

Skawinski P. (2017). *Lychnothamnus barbatus* (Image) [Online] Available from: https://phys.org/news/2017-07-dinosaur-era-alive-north-america.html [Accessed 31 August 2018].

1.13 Marlborough blue (*Cycas ophiolitica*)

1.13.1 Status

EPBC Act – Endangered

1.13.2 Biology and ecology

1.13.2.1 Characteristic

Marlborough blue (*Cycas ophiolitica*) is a small to medium sized cycad, with an erect trunk and a spreading to rounded crown. The trunk is 14 to 20 cm in diameter and grows up to 2 m tall. The mature leaves are 95 to 140 cm long, glossy blue-green to dark green and keeled in cross-section (refer Photograph 1.13). The petiole is 18 to 35 cm long and hairy. Each leaf consists of 170 to 220 leathery leaflets arranged in two rows along a rhachis. The leaflets are 15 to 24 cm long and 0.6 to 0.75 mm wide, with slightly recurved margins. The lowest leaflets are reduced to spine-like structures. Male plants produce brown, hairy cylindrical cones 14 to 17 cm long and 6 to 8 cm in diameter. The female plants produce loose, open cone-like structures at the top of the plant (Halford 1995; DotEE 2018).

Photograph 1.13 Marlborough blue (*Cycas ophiolitica*)

Source: Hogan (2002)

1.13.2.2 Known distribution

Marlborough blue is endemic to Queensland, occurring from Marlborough to Rockhampton in central-eastern Queensland (Hill 1998) (refer Figure 1.25).

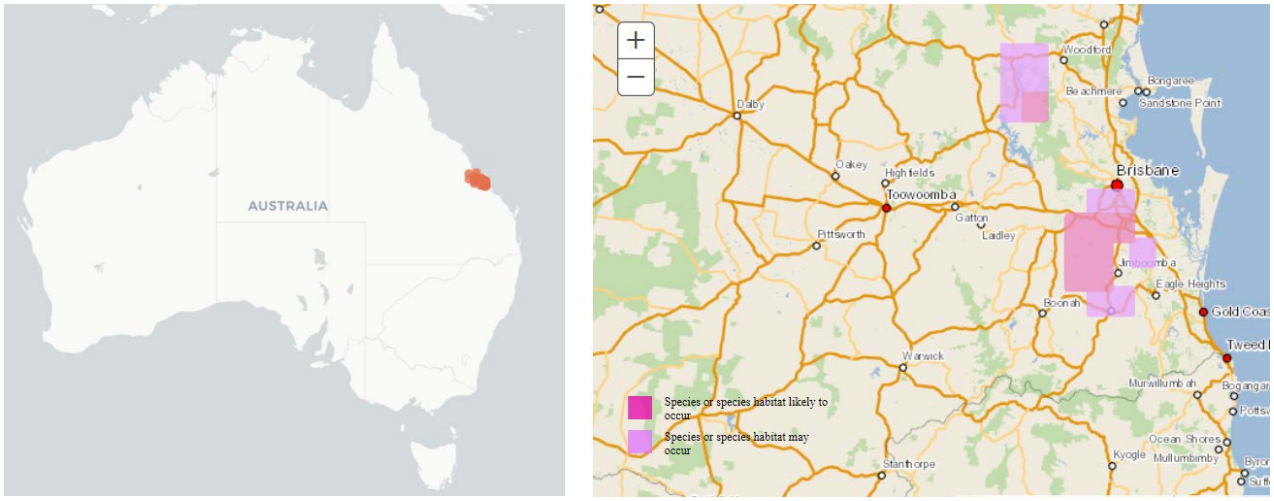


Figure 1.25 **Distribution range of the Marlborough blue**

Source: ALA (2018), DotEE (2018)

1.13.2.3 Distribution in relation to the Project

Cycas ophiolitica has been predicted to occur within the region and associated habitat within the MNES study area. However there are no current records for this species within 50 km of the temporary and permanent disturbance footprint. The nearest database records (i.e. AoLA, WildNet) occur to the north of the Project around Rockhampton, more than 500 km from the disturbance footprint.

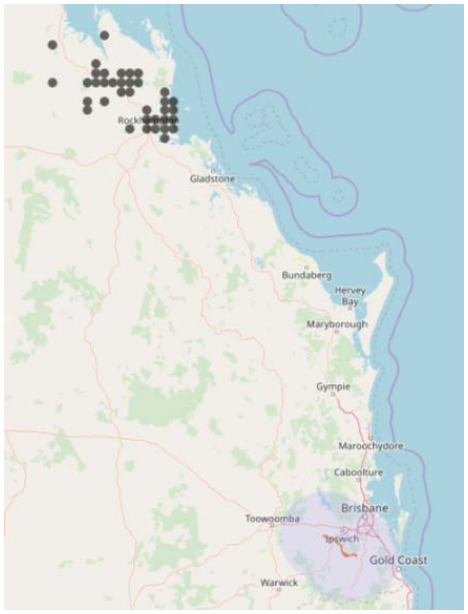


Figure 1.26 **Distribution range of the Marlborough blue in relation to the Project**

Source: ALA (2020)

1.13.2.4 Biology and reproduction

The male and female reproductive structures develop on separate plants. Generally cycads can be long-lived, with some Macrozamia species life span ranging from 60 to 1,500 years. It is likely that this species is pollinated by beetles. Seed dispersal can be limited for this species, due to seed toxicity and the lack of vertebrate dispersers within Australia. Seeds may be dispersed by mammals such as possums, rodents or fruit bats. Lack of dispersal means that many populations can be locally dense in terms of individuals, with sharply defined boundaries and no apparent change in habitat. Seeds become ripe from March onwards when they drop from the megasporophylls. The seeds are not ready to germinate for at least nine months due to the delayed fertilisation unique to cycads (Queensland Herbarium 2007).

1.13.3 Habitat

Marlborough blue inhabits eucalypt open forest and woodland communities with a grassy understorey. They occur on hill tops or steep slopes, at altitudes of 80 to 620 m above sea level. It grows on shallow, stony, red clay loams or sandy soils (Halford 1995).

1.13.4 Threatening processes

The following have been identified as potentially threatening processes to the Marlborough blue:

- Particular conditions required for dispersal and recruitment, slow seedling growth and specialist pollination requirements
- Land clearing (e.g. road corridors, housing development, mining activities)
- Inappropriate fire regimes
- Commercial pressure (Forster 1996; Queensland Herbarium 1997; 2007).

1.13.5 Threat abatement/recovery plans

The following recovery plan has been adopted for this species:

- Queensland Herbarium (2007). National Multi-species Recovery Plan for the cycads, Cycas megacarpa, Cycas ophiolitica, Macrozamia cranei, Macrozamia lomandroides, Macrozamia pauli-guilielmi and Macrozamia platyrhachis. Report to Department of the Environment and Water Resources, Canberra. Queensland Parks and Wildlife Service, Brisbane. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/recovery/national-multi-species-recovery-plan-cycads.** In effect under the EPBC Act from 08-Jan-2008.

No threat abatement plan has been identified as being relevant for this species.

1.13.6 Summary of threat abatement/recovery plans

Threats outlined in the National Multi-Species Recovery Plan for the cycads that are specific to *Cycas ophiolitica* are:

- Land clearing activity associated with proposed road corridors in the vicinity of Rockhampton, Glen Geddes and Marlborough, and throughout Livingstone Shire; housing development in the vicinity of Rockhampton City; existing mining and quarrying activities
- Legal and illegal harvesting and commercial salvage
- Loss of genetic variation and insect pollinators
- Poor land management practices surrounding fire and timber harvesting.

Current actions being undertaken to reduce threats include:

- Populations located, surveyed and documented. Populations in remnant vegetation have been mapped in buffered points where clearing is prohibited
- Permitted commercial harvesting of whole plants ceased in 2005, unless permitted under a permit from the EPA for non-commercial purposes such as bio-prospecting
- Education of the public and horticultural societies through talks, displays and publications
- Research conducted on similar overseas species on diversity within populations and on local populations cone, seed and seedling behaviour due to fire.

Future proposed actions to reduce threats include:

- Negotiate conservation agreements to ensure protections of significant known populations of cycads on freehold and leasehold property
- Continue monitoring for further populations and establish long-term monitoring plots

- Conduct detailed surveys of known populations considered to be threatened and update mapping
- Contact major landholders and custodians to educate on current regulations and to assist in fencing of small isolated populations
- Strengthen relevant legislation and permit processes to protect habitat from clearing
- Cease harvesting of plant parts and seeds unless it is for the purpose of the recovery plan
- Conduct further research to determine genetic variation, robustness of population mosaics and dispersal vectors.

1.13.7 References

Atlas of Living Australia (2018). *Cycas ophiolitica*. Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2914888#overview [Accessed 30 August 2018].

Department of the Environment and Energy (2018). *Cycas ophiolitica* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=55797 [Accessed 30 August 2018].

Forster, P.I. (1996). A preliminary assessment of Cycad conservation and diversity in Queensland, Australia. *Encephalartos*. 46:8-18.

Halford, D. (1995). *Cycas ophiolitica*, in Species Management Manual. Department of Natural Resources, Brisbane.

Hogan L. (2002). Marlborough blue – *Cycas ophiolitica* (Image) [Online] Available from: https://wetlandinfo.ehp.qld.gov.au/wetlands/ecology/components/species/?cycas-ophiolitica#prettyPhoto [Accessed 30 August 2018].

Queensland Herbarium (1997). *Biodiversity - rare and endangered plants, Papua - Gladstone Gas Pipeline*. Qld Herbarium, Dept of Environment, Indooroopilly.

Queensland Herbarium (2007). *National Multi-species Recovery Plan for the cycads,* Cycas megacarpa, Cycas ophiolitica, Macrozamia cranei, Macrozamia lomandroides, Macrozamia pauli-guilielmi and Macrozamia platyrhachis. Report to Department of the Environment and Water Resources, Canberra. Queensland Parks and Wildlife Service, Brisbane. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/national-multi-species-recovery-plan-cycads. In effect under the EPBC Act from 08 January 2008.

1.14 Miniature moss-orchid (*Bulbophyllum globuliforme*)

1.14.1 Status

EPBC Act – Vulnerable

1.14.2 Biology and ecology

1.14.2.1 Characteristic

Miniature moss-orchid or Hoop pine orchid (*Bulbophyllum globuliforme*) is a tiny rhizomatous orchid that grows only on the bark of Hoop pine trees, (*Araucaria cunninghamii*), forming a dense mat. It produces green, globular, bulb-like stems 1 to 2 mm in diameter. Leaves are narrow-triangular, 1 to 2 mm long, 0.2 to 0.3 mm wide, papery and concave. The inflorescence is 1 to 1.5 cm long, bearing one flower (refer Photograph 1.14). The sepals and petals are white to pale yellow. Miniature moss-orchid flowers from September to November (DotEE 2018).

Photograph 1.14 Miniature moss-orchid (*Bulbophyllujm globuliforme*)

Source: ALA (2018)

1.14.2.2 Known distribution

Endemic to eastern Australia, the species is recorded from near Paluma, northeast Queensland, south to the McPherson Range on the Queensland/NSW border (refer Figure 1.27). This species is known to occur in four locations including Puzzle Creek near Paluma (northeast Queensland), Kroombit Tops near Calliope (central Queensland), Cainbable Creek in Lamington National Park (southeast Queensland) and Levers Plateau (northeast NSW) (DotEE 2018).

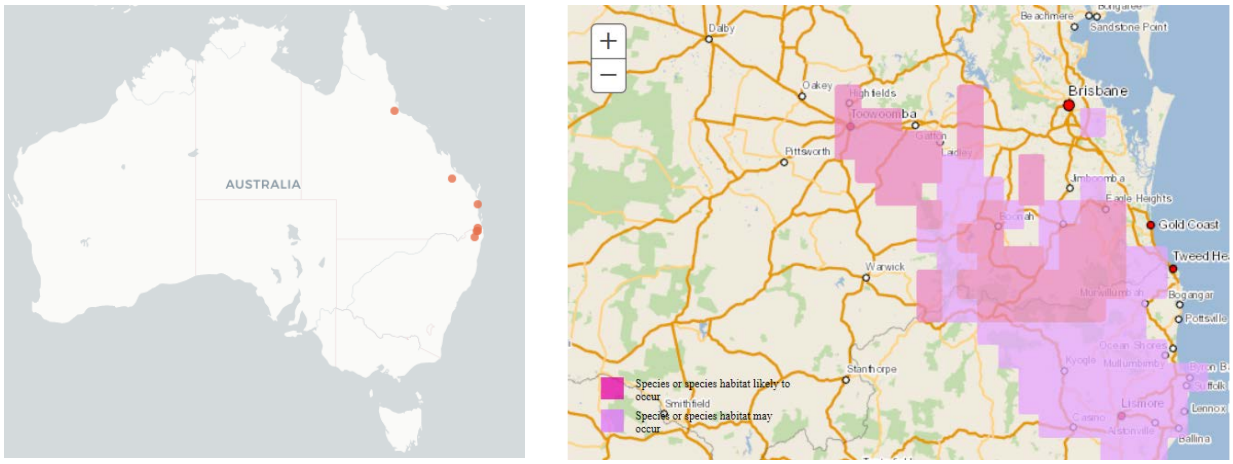


Figure 1.27 Distribution range of Miniature moss-orchid

Source: ALA (2018), DotEE (2018)

1.14.2.3 Distribution in relation to the Project

The species was not identified within any Project-associated field surveys. There are no historic records of this species within or close to the MNES study area. Database records indicate that this species is known to occur within 50 km of the Project. However, the nearest record is from Lamington National Park located around 45 km south of the disturbance footprint with the record taken in 2002. Database records indicate the species is restricted in its local distribution to the Lamington and Border Ranges National Parks (refer Figure 1.28) (AoLA 2020). There is 6.9 ha of dry rainforest habitat suitable for this species within the MNES study area, however no habitat is located within the disturbance footprint (refer Figure 1.27 and habitat figure in Figure 1.28). The habitat is located approximately 180 m from the disturbance footprint and will not be impacted directly or indirectly.

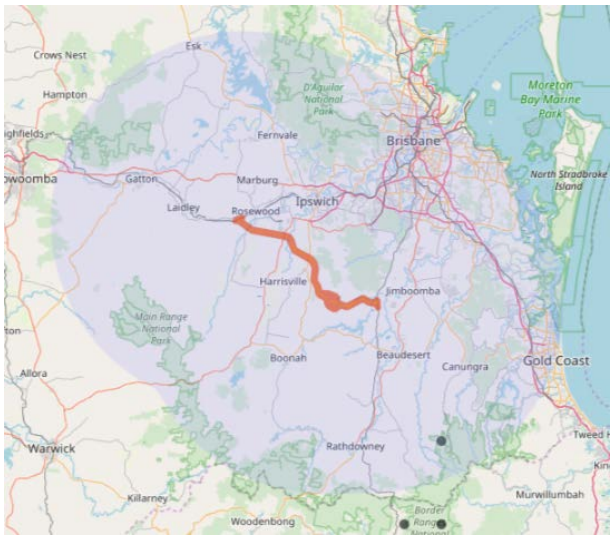


Figure 1.28 **Distribution range of Miniature moss-orchid in relation to the Project**

Source: ALA (2020)

1.14.2.4 Biology and reproduction

Miniature moss-orchid flowers in May to November. The growth form of this species is unusual, as it forms mats of tiny bulbs (leaves) on the wrinkled bark of hoop pine, making it very difficult to identify in the field. Generation length is unknown however, as the plant forms colonies by rhizome growth, each clump may be very long-lived (DotEE 2018).

1.14.3 Habitat

This species has been previously recorded in the Bunya Mountains. The species grows only on Hoop pines, colonising the upper branches of mature trees in upland rainforest. Miniature moss-orchid are conserved in Noosa National Park, Lamington National Park and Bunya Mountains National Park, Queensland, and the Border Ranges National Park, NSW (; DotEE 2018; Harrison 2002).

1.14.4 Threatening processes

The following have been identified as potentially threatening processes to the Miniature moss-orchid:

- Destruction of habitat by clearing of Hoop pine host-trees
- Disturbance of habitat by timber harvesting and road works
- Inappropriate fire regimes
- Disturbance of habitat by weeds
- Damage and collection by orchid enthusiasts (Barker 1999).

1.14.5 Threat abatement/recovery plans

There is no Commonwealth adopted recovery plan for the species. The following NSW 'species action statement' has been identified as being relevant for this species:

- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from https://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10112. In effect under the BC Act 2016.

No threat abatement plan has been identified as being relevant for this species.

1.14.6 Summary of threat abatement/recovery plan

Bulbophyllum globuliforme is assigned as a keep-watch species under the NSW *Saving our Species Program* as relatively large populations are known to occur within reserves where current management is sufficient to ensure their long-term security. State wide conservation actions identified for this species include:

- Assess all known sites for population condition, habitat quality and threats
- Ensure that managers are aware of populations, habitat and threats and that fire plans, pest management plans take account of requirements for the recovery of the orchid
- Ensure confidentiality is applied to information about locations of the orchid to protect against illegal collection
- Avoid damage to and lopping of Hoop Pines within the habitat and range of the orchid
- Investigate and apply appropriate method for estimating populations.

1.14.7 References

Atlas of Living Australia (2018), *Bulbophyllum globuliforme*, accessed 23 August 2018. Available from: https://images.ala.org.au/image/viewer?imageId=050ae1de-9eb1-4f7d-926f-073d9e7ab02c.

Department of the Environment and Energy (2018). *Bulbophyllum globuliforme* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed Thu, 23 August 2018.

Harrison, m (2002), 'Bulbophyllum species of Australia', Australian Orchid Review Dec 2001/Jan 2002, pp. 4–19.

1.15 Mt. Berryman phebalium (*Phebalium distans*)

1.15.1 Status

EPBC Act – Critically Endangered

1.15.2 Biology and ecology

1.15.2.1 Characteristic

The Mt. Berryman phebalium (*Phebalium distans*) is a small tree growing to 8 m and up to 15 cm in diameter. The bark is grey mottled and distinctly rough and flaky with a strong aromatic scent (DotEE 2018). The flowers of the species are cream, and the leaves are 1.5 to 5 cm long, 2 to 10 mm wide, and more or less smooth on the upper surface (refer Photograph 1.15). The leaves have a variable shape and are usually linear to oblong or lance-shaped, but may also be elliptic to broad-elliptic or egg-shaped (DotEE 2018; Forster 2003).

Photograph 1.15 Mt. Berryman phebalium (*Phebalium distans*)

Source: ALA (2018)

1.15.2.2 Known distribution

Mt. Berryman phebalium is endemic to southeastern Queensland, where it is currently known from ten populations at three locations. Five of the known populations are in close proximity at Mt. Berryman (Lockyer Valley Regional Council), four are near Kingaroy (South Burnett Regional Council) and the tenth at Mt Walla, near Coalstoun Lakes (North Burnett Regional Council) (DotEE 2018) (refer Figure 1.29).

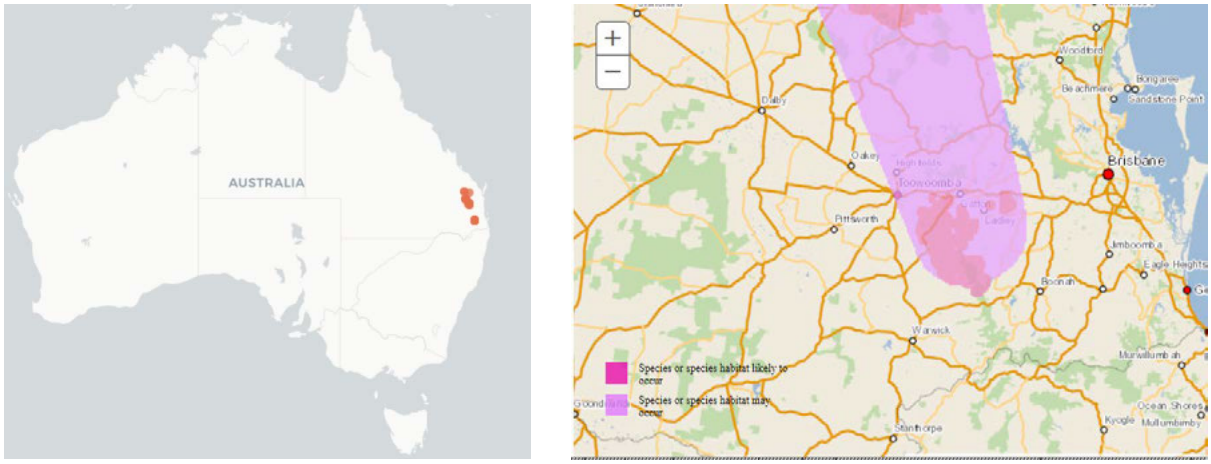


Figure 1.29 Distribution range of Mt. Berryman phebalium

Source: ALA (2018), DotEE (2018)

1.15.2.3 Distribution in relation to the Project

Phebalium distans has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicated that the species is known from within 50 km of the temporary and permanent disturbance footprint. The only specimen records are from Mt Berryman near Laidley (30 km west).

Figure 1.30 **Distribution range of Mt. Berryman phebalium in relation to the Project**

Source: ALA (2020)

1.15.2.4 Biology and reproduction

Mt. Berryman phebalium generally flowers during spring, however, opportunistic flowering can occur at other times after moderate falls of rain. Fruiting generally occurs during late summer and early autumn. The capsular fruit produce small seeds that have a limited dispersal ability. Plants become sexually mature after they reach 1 to 2 m in height. The plant has not been recorded as reproducing vegetatively, and monitoring indicates that this species does not readily reproduce under disturbance regimes (DEWHA 2008).

1.15.3 Habitat

Mt. Berryman phebalium is found in semi-evergreen vine thicket on red volcanic soils, or in communities adjacent to this vegetation type in small groups or as solitary specimens. Soils were the species occurs range from red-brown earths to brown clays (derived from siltstone and mudstones), and lithosols to shallow, gravelly krasnozems (very dark brown loam), derived from the Main Range Volcanics of the Tertiary period (DotEE 2018; DEWHA 2008).

1.15.4 Threatening processes

The following have been identified as potentially threatening processes to the Mt. Berryman phebalium:

- Habitat fragmentation and clearing
- Road works and roadside maintenance
- Irregular fire events
- Weed invasion
- Drift of agricultural chemicals
- Erosion and soil compaction due to human traffic
- Dumping of rubbish (DotEE 2018).

1.15.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

1.15.6 References

Atlas of Living Australia (2018), *Phebalium distans.* Australia's species Databas, accessed 26 August 2018, available: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2908293.

Department of the Environment, Water, Heritage and the Arts (2008). Approved Conservation Advice for *Phebalium distans* (Mt. Berryman Phebalium). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/81869-conservation-advice.pdf. In effect under the EPBC Act from 24 December 2008.

Department of the Environment and Energy (2018). *Phebalium distans* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed Sun, 26 August 2018.

1.16 Quassia (*Samadera bidwillii*)

1.16.1 Status

EPBC Act – Vulnerable

1.16.2 Biology and ecology

1.16.2.1 Characteristic

Quassia (*Samadera bidwillii*) is a small shrub or tree that grows to about 6 m in height, with red flowers and red fruit. Branchlets are ribbed, with fine, pale-brown hairs. The leaves are 4.5 to 9 cm long, 6 to 12 mm wide, glossy and hairless above, silky to pubescent on the lower surface and have secondary veins that are numerous and regularly arranged. The leaves are also stiff and leathery, narrow-elliptic or lanceolate, blunt or bluntly pointed with the margins bent under. Quassia flowers occur in clusters of 1 to 4, and each flower has 8 to 10 stamens, with filaments densely villous on the outer surface (refer Photograph 1.16). The sepals are 0.75 to 1 mm long and the red petals are approximately 2.5 mm in length. The fruit are ovid-ellipsoid, 1 cm long, hairy and sometimes appear winged (DotEE 2018).

Photograph 1.16 Quassia (*Samadera bidwillii*)

Source: Reef Catchments (2018)

1.16.2.2 Known distribution

Quassia is currently known to occur in coastal localities between Scawfell Island, near Mackay, and Goomboorian, north of Gympie. Quassia is predicted to be found further south around Brisbane and Jimboomba (DotEE 2018) (refer Figure 1.31).

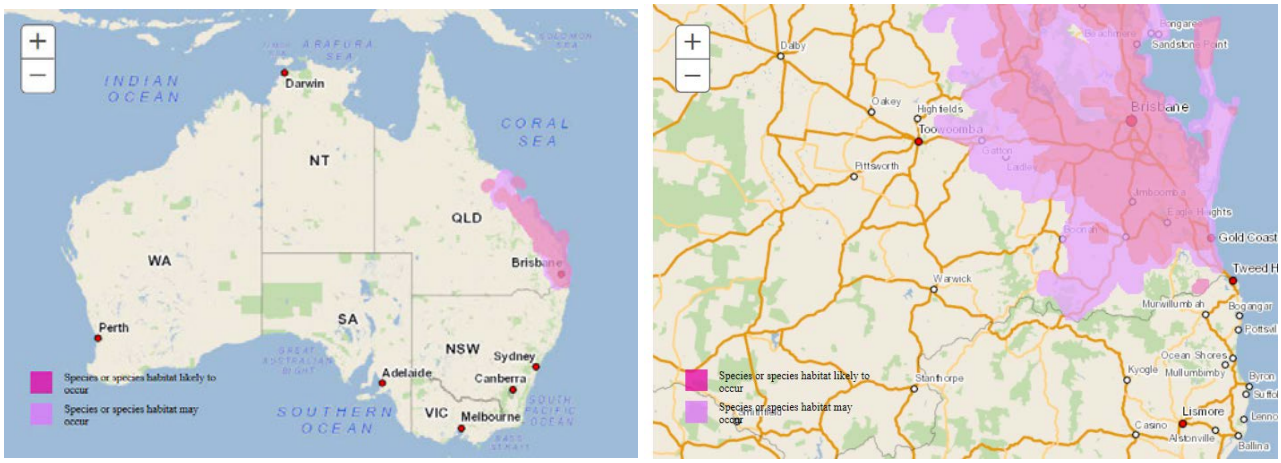


Figure 1.31 **Distribution range of the Quassia**

Source: DotEE (2018)

1.16.2.3 Distribution in relation to the Project

Samadera bidwillii has been predicted to occur within the region and associated habitat within the MNES study area. Database records (i.e. AoLA, WildNet) indicate this species does not occur within 50 km of the Project. The nearest database record is from 1999 taken from Currumbin Valley more than 50 km south-east of the Project. The approved conservation advice notes the species occurs from Gympie north to the Mackay area.

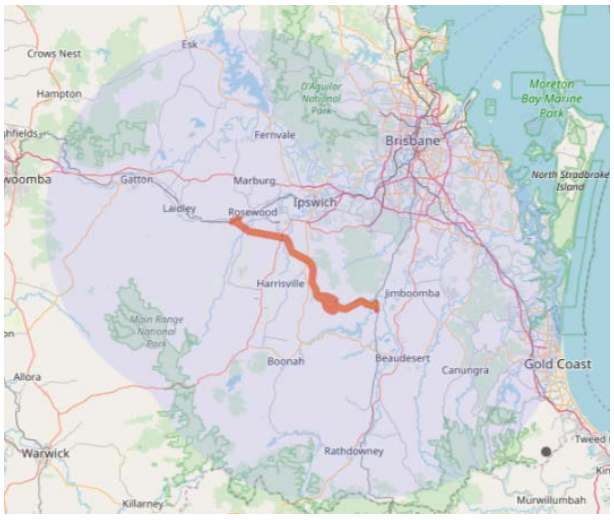


Figure 1.32 **Distribution range of the Quassia in relation to the Project**

Source: ALA (2020)

1.16.2.4 Biology and reproduction

Quassia flowers have been recorded in November, December, January and March. Fruit has been recorded from February to April (TSSC 2008).

1.16.3 Habitat

Quassia commonly occurs in lowland rainforest or on rainforest margins, but it can also be found in other forest types, such as open forest and woodland. Quassia is commonly found in areas adjacent to both temporary and permanent watercourses in locations up to 510 m altitude. The species occurs on lithosols, skeletal soils, loam soils, sands, silts and sands with clay subsoils (DotEE 2008, TSSC 2018)).

1.16.4 Threatening processes

The following have been identified as potentially threatening processes to the Quassia:

- Soil erosion and habitat clearing (e.g. agriculture, forestry, urban development and recreational activities)
- Inappropriate fire regimes and weed encroachment (TSSC 2008).

1.16.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

1.16.6 References

Department of the Environment and Energy (2018). *Samadera Bidwillii* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=29708 [Accessed 31 August 2018].

Reef Catchments (2018). *Samadera Bidwillii* (Image) [Online] Available from: http://reefcatchments.com.au/species_ecosystems/samadera-bidwillii/ [Accessed 31 August 2018].

Threatened Species Scientific Committee (2008). Approved Conservation Advice for *Quassia bidwillii* (Quassia). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/10094-conservation-advice.pdf. In effect under the EPBC Act from 03 July 2008.

1.17 Queensland nut tree (*Macadamia integrifolia*)

1.17.1 Status

EPBC Act – Vulnerable

1.17.2 Biology and ecology

1.17.2.1 Characteristic

Queensland nut tree (*Macadamia integrifolia*) is a medium sized tree that grows to 20 m in height with a 20 m wide crown. This species produces cream or creamy-white flowers that have been recorded in January, March and June to November. Flowers occur on the end of 30 cm long racemes (refer Photograph 1.17). Fruit is a hard brown spherical nut encased in a green leathery outer shell with a diameter of 2 to 3 cm (DotEE 2018).

Photograph 1.17 Queensland nut tree (*Macadamia integrifolia*)

Source: ALA (2018)

1.17.2.2 Known distribution

Queensland nut tree occurs from Mt Bauple, near Gympie, to Currumbin Valley in the Gold Coast hinterland, southeast Queensland (refer Figure 1.33). The species occurs as a scattered rare to occasional tree, and population sizes have been noted as difficult to estimate (Barry and Thomas 1994).

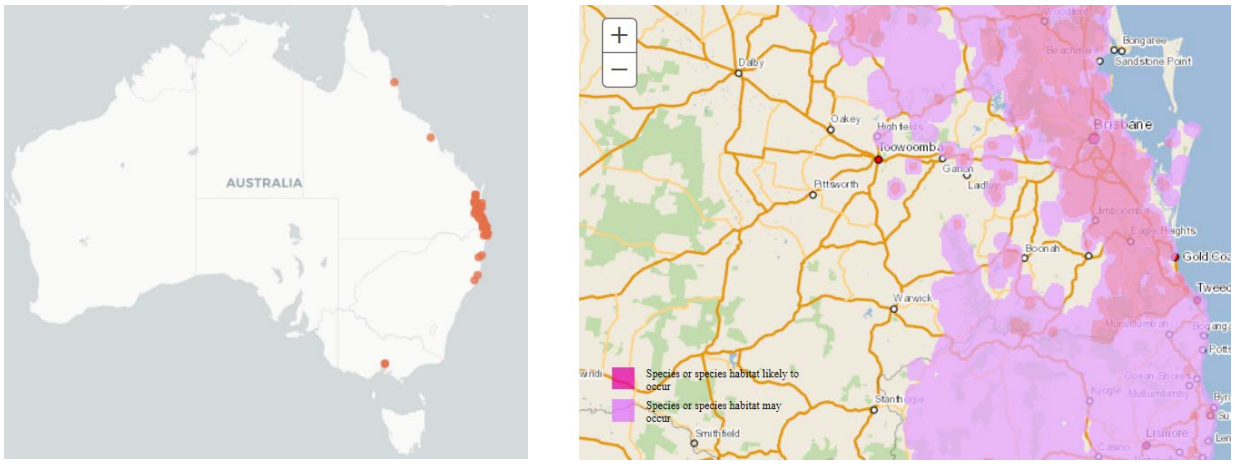


Figure 1.33 Distribution range of Queensland nut tree

Source: ALA (2018), DotEE (2018)

1.17.2.3 Distribution in relation to the Project

Macadamia integrifolia has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicate that this species is known to occur within 50 km of the Project. The nearest record is from Mount Tamborine taken from the year 2000. This record is approximately 45 km from the Project. Other records for this species occur to the east and south-east of the Project at Tamborine and Lamington National Park.

Figure 1.34 **Distribution range of Queensland nut tree in relation to the Project**

Source: ALA (2020)

1.17.2.4 Biology and reproduction

Queensland nut tree flowers in January, March and June to November. Fruits have been recorded from November to January and March to April. Macadamia nuts begin to produce viable nut loads at around 10 years of age. Reproduction is by seed, with a seed viability of 3 to 6 months. The species has a juvenile period of over six years. The seeds are eaten by mammals and are dispersed by stream. The plant re-sprouts when damaged (DotEE 2018, DEWHA 2008).

1.17.3 Habitat

Queensland nut tree grows in remnant rainforest, including complex mixed notophyll forest, and prefers partially open areas such as rainforest edges (DEWHA 2008). This species occurs within the Northern Rivers (NSW) and southeast Queensland Natural Resource Management regions.

Queensland nut tree is known to prefer to grow in mild frost-free areas with a reasonably high rainfall. There have been records of planted specimens bearing fruit as far south as Sydney (DotEE 2018).

Vegetation communities in which the Queensland nut tree is found range from complex notophyll mixed forest, extremely tall closed forest, simple notophyll mixed very tall closed forest to simple microphyll-notophyll mixed mid-high closed forest with *Araucaria* and *Argyrodendron* emergents (DotEE 2018).

1.17.4 Threatening processes

The following have been identified as potentially threatening processes to the Queensland nut tree:

- Land clearing for urban and agricultural development (DotEE 2018).
- Inappropriate fire regimes (DotEE 2018)
- Land clearing making them more susceptible to wind damage, as well as reducing the availability of natural pollinators (DotEE 2018)
- Invasive weed species
- Compaction of the soil layer (DotEE 2018).

1.17.5 Threat abatement/recovery plans

The following recovery plan is relevant to this species:

- Costello, G., M. Gregory & P. Donatiu (2009). Southern Macadamia Species Recovery Plan. Report to Department of the Environment, Water, Heritage and the Arts, Canberra by Horticulture Australia Limited, Sydney. Available from: **http://www.environment.gov.au/biodiversity/threatened/recovery-plans/southern-macadamia-species-recovery-plan**. In effect under the EPBC Act from 13-Nov-2009 as *Macadamia integrifolia*.

No threat abatement plan has been identified as being relevant for this species.

1.17.6 Summary of threat abatement/recovery plans

The threats outlined in the Southern Macadamia Species Recovery Plan include:

- Land clearing, fragmentation and loss of connectivity
- Inappropriate fire regimes
- Habitat modification by weeds
- Lack of appropriate gazing regimes
- Reduce gene flow
- Climate change.

Current recovery actions include:

- Restoration of rainforest habitat for private landholders under SEQ Rainforest Recovery Project
- Designation of ecologically appropriate fire regimes under the Hotspots Fire Project
- Rebates for fencing under Australian Government funding programs to assist in managing grazing
- Studies on the genetic characterisation of macadamia species and impacts of habitat fragmentation.

Future actions proposed by the Southern Macadamia Species Recovery Plan include:

- Assist landholders in accessing resources to protect macadamia habitat on their property through grazing control, weed management and rehabilitation strategies
- Provide fire and biodiversity workshops to land managers
- Continue research on population genetics
- Model the projected impact of climate change on the ecology, distribution and habitat of southern macadamia species.

1.17.7 References

Atlas of Living Australia (2018), *Macadamia integrifolia,* accessed 24 August 2018, available: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2890419.

Department of the Environment and Energy (2018). *Macadamia integrifolia* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed Fri, 24 August 2018

Department of the Environment, Water, Heritage and the Arts (2008). Approved Conservation Advice for *Macadamia integrifolia* (Macadamia Nut). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/7326-conservation-advice.pdf. In effect under the EPBC Act from 16 December 2008.

Queensland CRA/RFA Steering Committee (1997). Forest taxa at risk, threats, conservation needs and recovery planning in southeast Queensland. Queensland Government and Commonwealth of Australia.

1.18 Rough-leaved Queensland nut (*Macadamia tetraphylla*)

1.18.1 Status

EPBC Act – Vulnerable

1.18.2 Biology and ecology

1.18.2.1 Characteristic

Rough-leaved Queensland nut (*Macadamia tetraphylla*) is a small to medium tree growing to 20 m tall, generally densely bush, and often branched near the base. Leaves are in whorls of mostly 4, and are oblong, 7 to 30 cm long and 1.4 to 6 cm (refer Photograph 1.18). Flowers are cream of pinkish, with 4 'petals' 5.5 to 15 mm long. In the northern part of this species' range, hybrids with *Macadamia intergrifolia* occur (DotEE 2018).

Photograph 1.18 Rough-leaved Queensland nut (*Macadamia tetraphylla*)

Source: Fagg (2018)

1.18.2.2 Known distribution

Rough-leaved Queensland nut occurs from northeast NSW (chiefly in the Richmond and Tweed River areas) to southeast Queensland (Mt Glorious, near Brisbane) (DotEE 2018). Potential habitat mapping indicates the 'species or species habitat may occur' only in the eastern portion of the alignment (refer Figure 1.35).

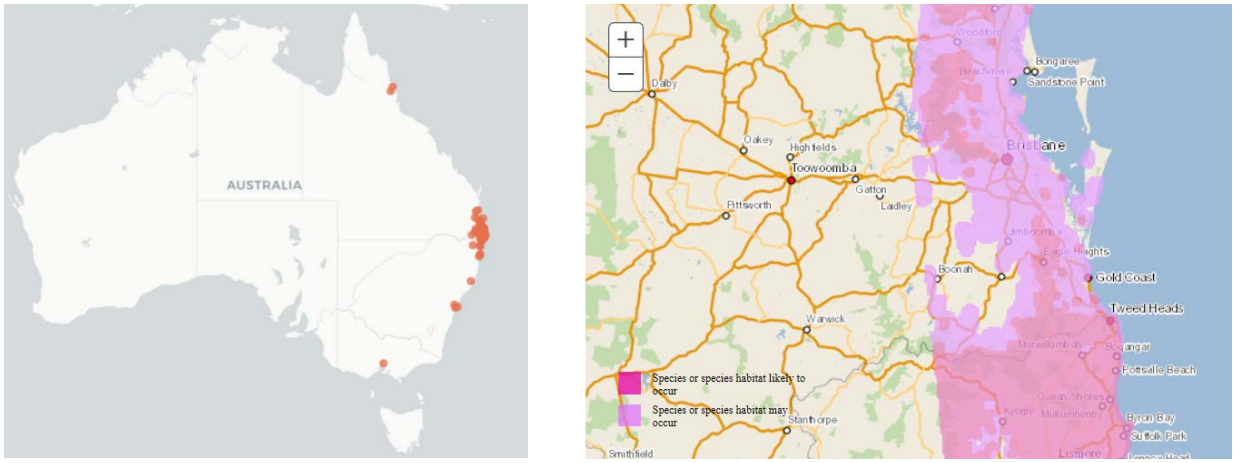


Figure 1.35 **Distribution range of Rough-leaved Queensland nut**

Source: ALA (2018), DotEE (2018)

1.18.2.3 Distribution in relation to the Project

Macadamia tetraphylla has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicate that this species is known to occur within 50 km of the Project. The nearest record is from Mount Tamborine taken from the year 2002. This record is approximately 45 km from the Project. Other records for this species occur to the north-east, east and south-east of the Project from Maroochydore to Coffs Harbour.

There is no evidence the species has ever occurred in the wider area surrounding the Project and there is little suitable habitat likely to be present. As such, the species is considered unlikely to occur and is not treated further for assessment within the main body of the MNES report.

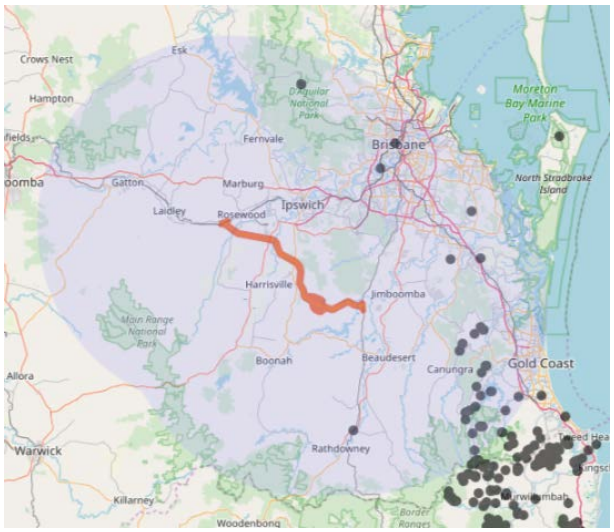


Figure 1.36 **Distribution range of Rough-leaved Queensland nut in relation to the Project**

Source: ALA (2020)

1.18.2.4 Biology and reproduction

The rough-leaved Queensland nut has a juvenile period greater than six years and the species is known to have a lifespan of over 100 years (DotEE 2018).

The species flowers from August to October and is recorded fruiting between January and April. Reproduction takes place from seed and seed dispersal is via streams. Clean nuts germinate within a period of two weeks and the seed remains viable for a period of a few weeks to six months. Seeds of this species are subject to Black rat (*Rattus rattus*) predation. Vegetative re-sprouting and new seedlings have been recorded following habitat damage (DotEE 2019).

1.18.3 Habitat

Rough-leaved Queensland nut inhabits areas in subtropical rainforest and notophyll vine forest in near coastal areas. The species has been noted to occur on steep slopes especially at ecotones. This species is conserved within Lamington National Park, Mt Warning National Park and the Andrew Johnston Big Scrub Nature Reserve. This species occurs within the southeast Queensland and Northern Rivers (NSW) Natural Resource Management regions. The distribution of this species is not known to overlap with any EPBC Act-listed threatened ecological community (DotEE 2018).

1.18.4 Threatening processes

The following have been identified as potentially threatening processes to the Rough-leaved Queensland nut:

- Clearing and fragmentation of habitat for coastal development, agriculture and roadworks
- Localised extinction associated with low numbers
- Degradation associated with edge effects
- Grazing and trampling by domestic stock
- Inappropriate fire regimes
- Invasion of habitat by weeds
- Loss of genetic diversity through hybridisation with commercial varieties (DotEE 2018).

1.18.5 Threat abatement/recovery plans

The following recovery plan is relevant to this species:

- Costello, G., M. Gregory & P. Donatiu (2009). Southern Macadamia Species Recovery Plan. Report to Department of the Environment, Water, Heritage and the Arts, Canberra by Horticulture Australia Limited, Sydney. Available from: **http://www.environment.gov.au/biodiversity/threatened/recovery-plans/southern-macadamia-species-recovery-plan.** In effect under the EPBC Act from 13-Nov-2009 as *Macadamia integrifolia*.

No threat abatement plan has been identified as being relevant for this species.

1.18.6 Summary of threat abatement/recovery plans

The threats outlined in the Southern Macadamia Species Recovery Plan include:

- Land clearing, fragmentation and loss of connectivity
- Inappropriate fire regimes
- Habitat modification by weeds
- Lack of appropriate gazing regimes
- Reduce gene flow
- Climate change.

Current recovery actions include:

- Restoration of rainforest habitat for private landholders under SEQ Rainforest Recovery Project
- Designation of ecologically appropriate fire regimes under the Hotspots Fire Project
- Rebates for fencing under Australian Government funding programs to assist in managing grazing
- Studies on the genetic characterisation of macadamia species and impacts of habitat fragmentation.

Future actions proposed by the Southern Macadamia Species Recovery Plan include:

- Assist landholders in accessing resources to protect macadamia habitat on their property through grazing control, weed management and rehabilitation strategies
- Provide fire and biodiversity workshops to land managers
- Continue research on population genetics
- Model the projected impact of climate change on the ecology, distribution and habitat of southern macadamia species.

1.18.7 References

Atlas of Living Australia (2018), Rough-leaved Queensland nut, viewed 24 August 2018, available: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2890983.

Department of the Environment and Energy (2018). *Macadamia tetraphylla* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=6581. Accessed Fri, 24 August 2018

Fagg, M. (2018), *Macadamia tetraphylla* - Rough-leaved Queensland nut, viewed 24 August 2018, available: https://images.ala.org.au/image/proxyImageThumbnailLarge?imageId=745b0ec9-2b32-408c-bd5c-4249603c90aa.

1.19 Shiny-leaved condoo (*Planchonella eerwah*)

1.19.1 Status

EPBC Act – Endangered

1.19.2 Biology and ecology

1.19.2.1 Characteristic

The Shiny-leaved condoo is a tree growing up to 40 m high. Its foliage is dense and glossy, with young branchlets greyish, hairy and exuding a milky latex when cut. Leaves are egg or spatula-shaped, 4 to 14 cm long, leathery and hairless with raised venation on both surfaces (refer Photograph 1.19). The fruits are firm-fleshed, spherical, 3 to 6 cm long, red-purple to black, and contain three to five seeds (Barry and Thomas 1994; Harden et al. 2006; Hauser and Blok 1998; Stanley and Ross 1986).

Photograph 1.19 Shiny-leaved condoo (*Planchonella eerwah*)

Source: Boden (n.d.)

1.19.2.2 Known distribution

The Shiny-leaved condoo is restricted to the Nambour-Maleny district, Beenleigh-Ormeau-Pimpama district and Ipswich-Beaudesert district in southeast Queensland (DotEE 2018) (refer Figure 1.37).

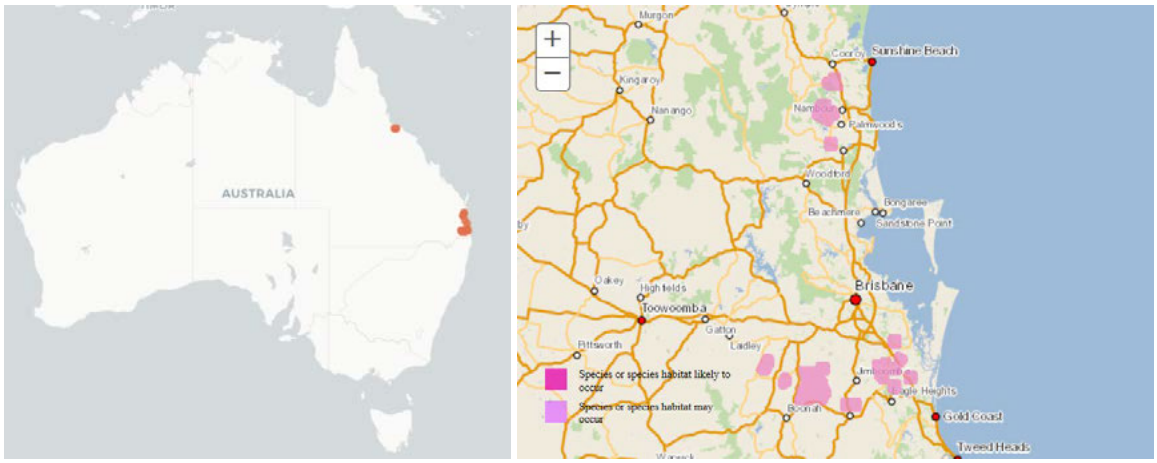


Figure 1.37 **Distribution range of the Shiny-leaved condoo**

Source: ALA (2018); DotEE (2018)

1.19.2.3 Distribution in relation to the Project

Shiny-leaved condoo was not identified during any Project-associated field surveys. The desktop searches identified records within the MNES study area and disturbance footprint along Woollaman Creek (within the Teviot Range to the east of Jimboomba). Three historical specimen records are found near chainage 46 of the Project alignment, however nothing within the last 30 years. There are a number of database records (i.e. AoLA, WildNet) surrounding the MNES study area associated with the Teviot Range and immediate surrounds. The majority of these are older records. More recent specimen backed records occurring within 10 km of the Project include two records between Jimboomba and Beaudesert (2015 and 2007) and a single record (2016) to the north near Flinders Peak (refer Figure 1.38).

Figure 1.38 **Distribution range of the Shiny-leaved condoo in relation to the Project**

Source: ALA (2020)

1.19.2.4 Biology and reproduction

Flowering is recorded from January to April, in June, and August to September. Fruits are reported from January to September and November to December. The fruit is apparently readily eaten by native animals and seed viability is very high when seed is sown fresh (Forster et al. 1991; DotEE 2018).

1.19.3 Habitat

The species grows in subtropical rainforest, notophyll vine forest, dry rainforest and Hoop pine vine scrub. All known areas in which the Shiny-leaved condoo occurs are warm and subtropical with an annual rainfall of between 650 to 1,000 mm. It grows on a variety of soils including basaltic well-drained, dark reddish brown sandy loams and nutrient poor soils derived from metasediments. It typically occurs in gullies or on slops in both the canopy and lower strata of forests (DotEE 2018; Forster et al. 1991; Leigh et al. 1984).

1.19.4 Threatening processes

The following have been identified as potentially threatening processes to the Shiny-leaved condoo:

- Land clearing, logging and quarrying operations reduces habitat availability
- Weed invasion
- Destruction of seedlings by fire (DotEE 2018).

1.19.5 Threat abatement/recovery plans

No recovery plan has been identified as being relevant for this species. The following threat abatement plan is relevant to this species:

- Department of the Environment and Energy (2017). Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa) (2017). Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/feral-pig-2017. In effect under the EPBC Act from 18-Mar-2017.

1.19.6 Summary of threat abatement/recovery plan

The threats outlined in the threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) include:

- Impacts on plant species composition and succession
- Alterations to nutrient, water cycling and water quality
- Predation of native fauna and flora including small mammals, birds, reptiles, frogs, crayfish, eggs, invertebrates, fungi and all part of plants including fruit, seeds, roots, tubers, bulbs and foliage
- Digging and disturbance to substrate resulting in the destruction of plants threatening their survival and recruitment of new plants altering the floral composition and soil structure
- Disturbance caused by pigs can increase the incursion and recruitment of weeds and provide reservoirs for endemic animal diseases.

Threat abatement actions for feral pics (*Sus scrofa*) include:

- Implementation of control measures including trapping, aerial and ground shooting, poisoning and fencing
- Using tracking dogs to detect and flush out feral pigs by commercial harvesters
- Manipulating habitat by reducing watering point and crop waste
- Manage feral pigs within a policy, legislative and planning framework.

1.19.7 References

Atlas of Living Australia (2018). *Planchonella eerwah*. Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2903411#overview [Accessed 31 August 2018].

Boden R. (n.d.). *Pouteria eerwah* (Image) [Online] Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2903411#gallery [Accessed 31 August 2018].

Department of the Environment and Energy (2018). *Planchonella eerwah* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=17340 [Accessed 31 August 2018].

Forster, P.I., Bostock P.D., Bird L.H. and Bean A.R. (1991). *Vineforest Plant Atlas for Southeast Queensland with Assessment of Conservation Status*. Indooroopilly: Queensland Herbarium.

Hauser, J. and Blok J. (1998). *Fragments of Green*. Aust. Rainforest Conservation Society, Bardon, Qld.

Leigh, J., Boden R. and Briggs J. (1984). *Extinct and Endangered Plants of Australia*. Melbourne, Victoria: Macmillan.

1.20 Three-leaved bosistoa (*Bosistoa transversa*)

1.20.1 Status

EPBC Act – Vulnerable

1.20.2 Biology and ecology

1.20.2.1 Characteristic

Three-leaved bosistoa (*Bosistoa transversa*) is a small to medium tree growing to 22 m high. Leaves are 5 to 16 cm long, 2.5 to 9 cm wide; leaflets 1 to 3, tips pointed to rounded, bases round to wedge-shaped or heart-shaped. Flowers are small and white, and arranged in loose clusters at or near the tips to the branches (refer Photograph 1.20). Fruit (cocci) are 1 cm wide, hard, transversely ribbed, egg-shaped and have one kidney-shaped seed (Hartley 1977; Richards 2002).

Photograph 1.20 Three-leaved bosistoa (Bosistoa transversa s. lat.)

Source: Fagg (2018)

1.20.2.2 Known distribution

Three-leaved bosistoa is known to occur from the Richmond River, NSW, to Mt Larcom near Gladstone, Queensland. This species occurs within the Natural Resource Management regions of the Northern Rivers (NSW), Fitzroy, Burnett Mary and southeast Queensland (refer Figure 1.39). The Three-leaved bosistoa is conserved within Brisbane Forest Park, Kondalilla Falls National Park, and Conondale Range National Park in southeast Queensland. (Floyd 1989; Hartley 2004; pers. comm. Queensland Herbarium 2012 as in QG 2014).

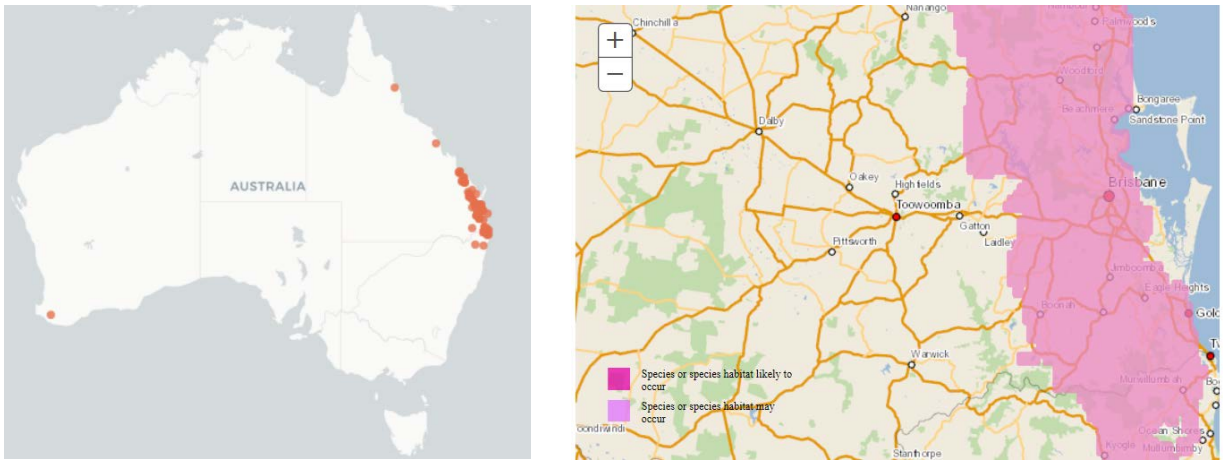


Figure 1.39 **Distribution range of Three-leaved bosistoa**

Source: ALA (2018), DotEE (2018)

1.20.2.3 Distribution in relation to the Project

Bosistoa transversa has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicate that the species is known from within approximately 30 km to the east of the disturbance footprint (2016) from the Guanaba Indigenous Protected Area. Other records for this species exist to the south-east of the Project throughout the Border Ranges and Springbrook National Parks.

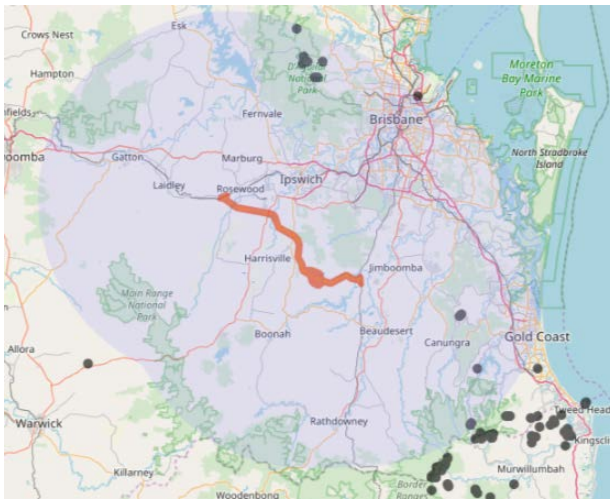


Figure 1.40 **Distribution range of Three-leaved bosistoa in relation to the Project**

Source: ALA (2020)

1.20.2.4 Biology and reproduction

The Three-leaved bosistoa flowers from January to May. Ripe fruits become present from May to November and the species germination is noted as erratic, as fruiting has been noted to occur most of the year (DotEE 2018).

1.20.3 Habitat

The Three-leaved bosistoa inhabits wet sclerophyll forest, dry sclerophyll forest and rainforest up to 300 m in altitude (Flyod 1989). Associated vegetation includes *Argyrodendron trifoliolatum, Syzygium hodgkinsoniae, Endiandra pubens, Dendrocnide photinophylla, Acmena ingens, Diploglottis australis* and *Diospyros mabacea* (DotEE 2018, DEWHA 2008).

In Queensland, the Three-leaved bosistoa has been found to grow on:

- Reddish loam over basalt rock on a very steep slope in complex notophyll vine forest with emergent Brush box (*Lophostemon confertus*) (DotEE 2018)
- On browny loamy soils on a hillside within a complex notophyll vine forest with Brush poison tree (*Excoecaria dallachyana*) and Hauer (*Dissiliaria baloghioides*) (DotEE 2018)
- Remnant vine forest pockets within highly disturbed and weed infested habitats on a site with varying slope, from relatively flat to a steep slope. The species appears to occur only in areas that have experienced minimal disturbance (DotEE 2018).

1.20.4 Threatening processes

The following have been identified as potentially threatening processes to the Three-leaved bosistoa:

- Loss of habitat due to clearing and fragmentation
- Habitat degradation from invasive species
- Inappropriate fire regimes
- Grazing by stock
- Timber harvesting (DotEE 2018).

1.20.5 Threat abatement/recovery plans

The following recovery plan has been identified as being relevant for this species:

- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from **https://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10103**. In effect under the BC Act 2016.

No threat abatement plan has been identified as being relevant for this species.

1.20.6 Summary of threat abatement/recovery plan

Bosistoa transversa is assigned to the *Partnership (range-restricted)* management under the *Saving our Species* program. The conservation strategy for this species identifies five priority management sites:

- Terranora Plateau in Tweed LGA
- Numinbah Nature Reserve in Tweed LGA
- Limpinwood Nature Reserve in Tweed LGA
- Wollumbin National Park in Tweed LGA
- Inner Pocket Nature Reserve in Byron, Tweed LGA.

Threats identified at the management sites include:

- Habitat degradation through weed invasion and disturbance
- Vegetation clearing for development and agricultural purposes.

Management activities to protect this species at the sites are:

- Reduce and maintain weed densities at low levels at priority sites

- Ensure land management is suitable for long term requirements by liaising with council, Local Land Services and landholders for surveys, protection and management of the species
- Restore and supplement habitat through supporting regeneration with Landcare
- Establish baseline monitoring spots for the species population at the priority sites, conducting annual surveys during flowering and seeding to record abundance, extent, recruitment and condition at the site.

1.20.7 References

Atlas of Living Australia (2018), *Bosistoa transversa s. lat.* - Three-leaved Bosistoa, accessed 25 August 2018, available: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2905714.

Department of the Environment and Energy (2018). *Bosistoa transversa* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed Fri, 24 August 2018

Department of the Environment, Water, Heritage and the Arts (2008). Approved Conservation Advice for *Bosistoa transversa* s. lat. (Three-leaved Bosistoa). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/78841-conservation-advice.pdf. In effect under the EPBC Act from 01 October 2008.

Queensland Government (2014), Species profile—*Bosistoa transversa* (Rutaceae), accessed 25 August 2018, available: https://environment.ehp.qld.gov.au/species-search/details/?id=11988.

1.21 Wandering pepper-cress (*Lepidium peregrinum*)

1.21.1 Status

EPBC Act – Endangered

1.21.2 Biology and ecology

1.21.2.1 Characteristic

Wandering pepper-cress (*Lepidium peregrinum*) is a perennial plant that grows to 10 to 80 cm tall, sometimes ascending to 2 m in surrounding vegetation. The lower cauline leaves are deeply divided with a large broad-lanceolate terminal lobe and measure 6 to 10 cm long by 15 to 25 mm wide (refer Figure 1.41). Leaf edges are fringed with eyelash-like hairs. The mid-cauline leaves are lanceolate in outline with serrate to serrulate margins and measure 4 to 9 cm long by 4 to 9 mm wide. The small flowers are less than 1 mm long and arranged in hairy, terminal racemes (ALA 2018; DotEE 2018; OEH 2018).

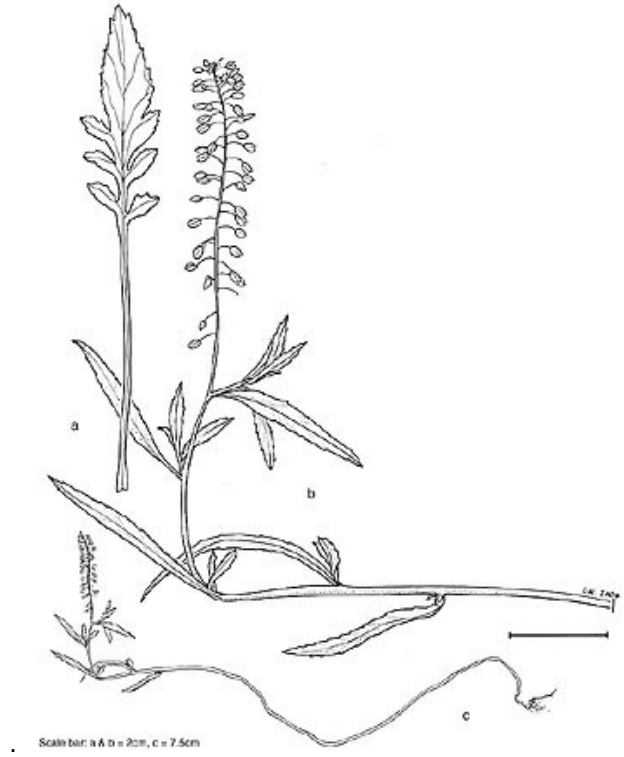


Figure 1.41 **Wandering pepper-cress (*Lepidium peregrinum*)**

Source: OEH (n.d.)

1.21.2.2 Known distribution

Wandering pepper-cress occurs from the Bunya Mountains, southeast Queensland, to near Tenterfield, in northern NSW. This species occurs within the New England Tableland and southeast Queensland Bioregions and the southeast Queensland, Condamine and Border-Rivers Maranoa-Balonne Natural Resource Management regions (OEH 2018; DotEE 2018) (refer Figure 1.42).

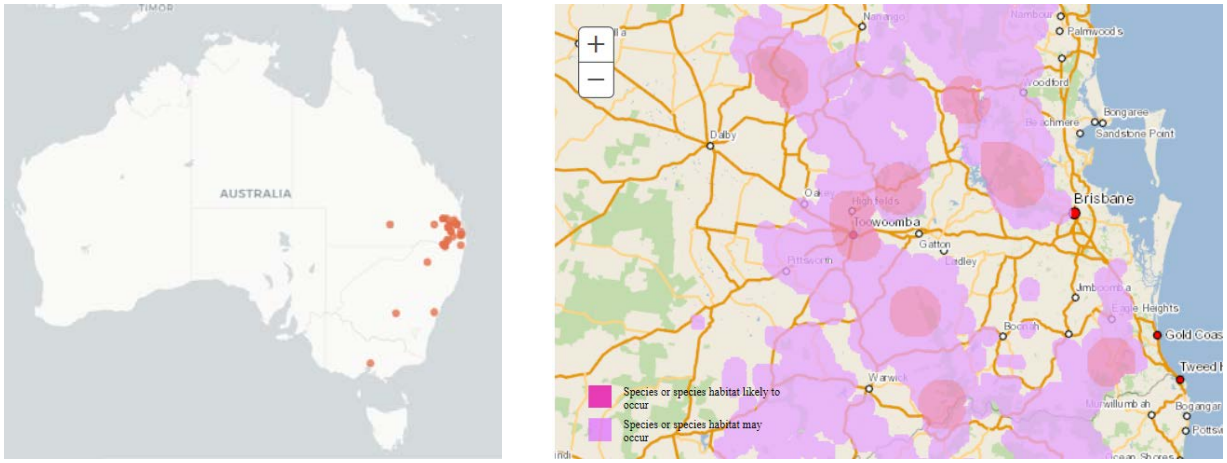


Figure 1.42 **Distribution range of the Wandering pepper-cress**

Source: ALA (2018), DotEE (2018)

1.21.2.3 Distribution in relation to the Project

Lepidium peregrinum has not been identified within or near the ecology MNES area. The nearest database record is from Tamborine Mountain (1993) approximately 24 km east of the eastern extent of the disturbance footprint. The next closest records are from Main Range National Park and D'Aguilar National Park (40 km south-west and north of the Project respectively).

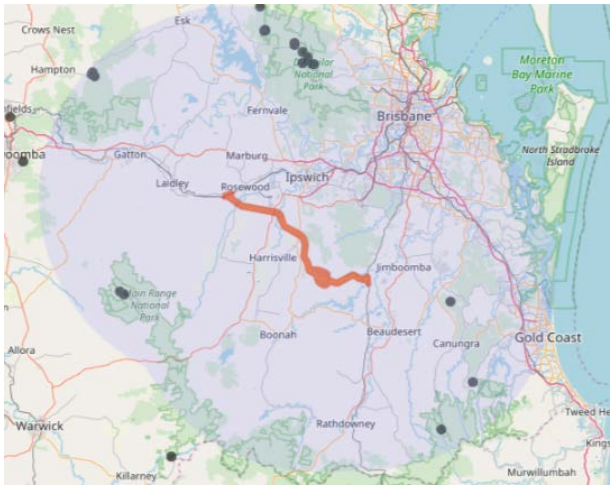


Figure 1.43 **Distribution range of the Wandering pepper-cress in relation to the Project**

Source: ALA (2020)

1.21.2.4 Biology and reproduction

Wandering pepper-cress flowers from January to April. Initial studies of Wandering pepper-cress subpopulations found some have little or no recruitment, while others have juvenile plants in the absence of mature plants. This could be indicative that the species requires specific triggers to break seed dormancy, and naturally experiences 'boom and bust' cycles in the number of mature plants. It is possible the species persists in some locations as dormant seed with no vegetative specimens being evident (OEH 2018).

1.21.3 Habitat

The species has been recorded growing in riparian open forest dominated by *Eucalyptus camaldulensis* and *Casuarina cunninghamiana* with variably dense shrubby understorey. The species was most abundant in the tussock grassland fridge of the riparian open forest, with some plants reaching a height of 2 m in thickets of *Hymenanthera*. It has also been recorded in shade under shrubs close to the creek bank, in which cases most plants have been small, approximately 30 cm in height. Herbarium records and observations in the wild suggest this species responds to disturbance events, due to observations along walking tracks, native pine plantations and car parks, and therefore population densities may fluctuate as a response to such events (Scarlett 1999; OEH 2018; DotEE 2018).

1.21.4 Threatening processes

The following have been identified as potentially threatening processes to the Wandering pepper-cress:

- Populations are fragmented and generally very small, with recruitment spasmodic or limited
- Clearing of habitat for agriculture and grazing
- Grazing
- Introduced weeds
- Destruction of plants following misidentification
- Extended drought periods and other forms of land degradation (OEH 2018).

1.21.5 Threat abatement/recovery plans

The following threat abatement/recovery plan has been identified as being relevant for this species:

- Department of the Environment and Energy (2016). Threat abatement plan for competition and land degradation by rabbits. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-rabbits-2016**. In effect under the EPBC Act from 07-Jan-2017.

1.21.6 Summary of threat abatement/recovery plan

Threats identified in the threat abatement plan for competition and land degradation by rabbits includes:

- Competition with native wildlife for food and shelter
- Prevention of plant regeneration
- Increased grazing pressure and damage to native vegetation
- Altering the regular process of plant succession
- Altering ecological communities and impacting soil structure and nutrient cycling contributing to serious erosion
- Increasing predation and reducing reproduction for native arboreal mammals and birds through the removal of critical habitat.

Threat abatement actions for rabbits include:

- Supress rabbit populations at the landscape scale below thresholds in identified priority areas
- Gain a better understanding of the impacts rabbits have and their interactions with other species and ecological processes
- Increase the effectiveness of rabbit control programs
- Increase engagement within the local community to provide awareness of the environmental impact of rabbits and the need for integrated control.

1.21.7 References

Atlas of Living Australia (2018). Wandering pepper-cress. Available from: https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2896651# [Accessed 30 August 2018].

Department of the Environment and Energy (2018). *Lepidium peregrinum* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=14035t. Accessed Fri, 24 August 2018

Office of Environment and Heritage, NSW (2018). Wandering pepper-cress. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10464 [Accessed 30 August 2018].

2 Fauna – Threatened species – Invertebrates

2.1 Australian fritillary (*Argynnis hyperbius inconstans*)

2.1.1 Status

EPBC Act – Critically endangered

2.1.2 Biology and ecology

2.1.2.1 Characteristics

The Australian fritillary (*Argynnis hyperbius inconstans*) is a butterfly species with a light orange-brown upper-side with numerous rounded black markings and a double black subterminal line near the edges of the wings. The underside of the forewings are duplicates of the upper-side however pinkish-orange in colour (refer Photograph 2.1). The apex of the wings on the anterior corners are light orange. A male fritillary has a wingspan of 60 mm whilst the females have a larger wingspan of 66 mm. Aside from the larger wingspan, female fritillary sometimes have a tinged green apex on their wings (DotEE 2018).

First instar of the Australian fritillary has a brown body with lateral white stripe and pairs of white dorsal spots. The second instar has a brownish black body with a short thick external spine. The third and fourth instar have black heads with blunt horns on either side and a black body featuring an orange dorsal stripe. Pupa are approximately 26 mm long and are orange-brown with brown markings which fade with age (DotEE 2018).

Photograph 2.1 Australian fritillary (*Argynnis hyperbius inconstans*)

Source: OEH (2017); Butterfly House (2016)

2.1.2.2 Known distribution

The known distribution of the Australian fritillary occurs as fragmented patches across southeastern Queensland and northeastern NSW, extending from Gympie to Port Macquarie. Mapping from the SPRAT website indicates the species or species habitat ‘may occur’ within the MNES study area (refer Figure 2.1). The species is also known to inhabit areas of lower altitudes preferring sites below 600 m above sea level and containing their larval food plant Arrowhead violet (*Viola betonicifolia*) (DES 2018; DotEE 2018).

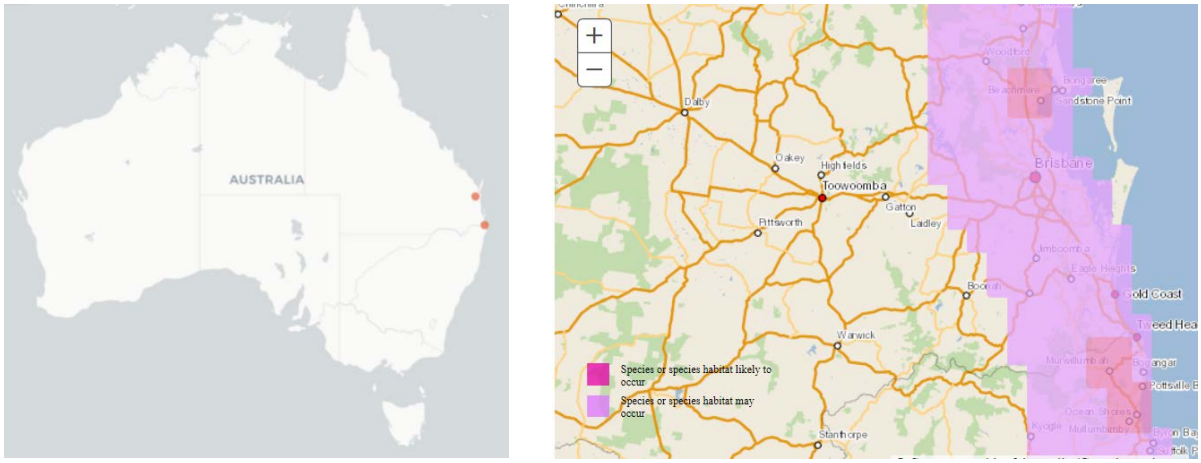


Figure 2.1 **Distribution range of the Australian fritillary**

Source: ALA (2018), DotEE (2018)

Distribution in relation to the Project

The main range of the species is from Gympie in south-east Queensland south to Port Macquarie in New South Wales. The species is rarely sighted with only anecdotal reports in recent years including in Port Macquarie and the town of 1770 (TSSC 2017). There are only two available database records from Gympie (1977) and the Murwillumbah area (1965) (AoLA 2020). The nearest of these is located 75 km south of the disturbance footprint.

Areas with sufficient densities of *V. betonicifolia* are considered critical habitat for the species. There are no known records of *V. betonicifolia* with the MNES study area, with the nearest record from 1987 located 16 km from the disturbance footprint. No individuals of the host plant were observed during field investigations associated with the Project.

The MNES study area is not considered coastal and suitable habitat (coastal swamps and riverine estuaries) likely does not occur. There is no evidence the species has ever occurred in the wider area surrounding the Project. As such, the species is considered unlikely to occur and is not treated further for assessment within the main body of the MNES report.

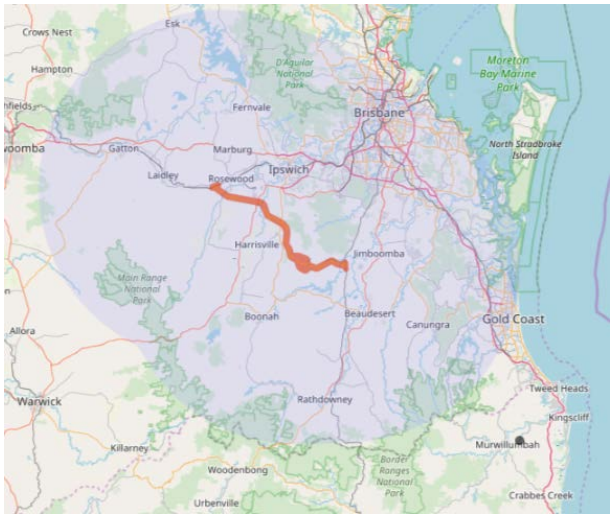


Figure 2.2 **Distribution range of the Australian fritillary in relation to the Project**

Source: ALA (2020)

2.1.2.3 Biology and reproduction

In butterfly form the Australian fritillary feeds on the nectar of flowers of various plants near its breeding habitat. However, larval stages (i.e. caterpillars) feed only on *V. betonicifolia* (refer Photograph 2.2), which the butterflies deposit their eggs directly upon. Eggs are laid singly on the leaf of *V. betonicifolia* which is often intertwined and when the female is unable to find the preferred plant, eggs are instead laid on a plant overlapping *V. betonicifolia*. Egg stage of the species lasts 5 days before entering the larval stage which lasts approximately 23 days prior to a pupal stage lasting between 4 to 9 days (DotEE 2018; OEH 2017).

Life cycle of the Australasian fritillary is often characterised by a 'boom and bust' cycle due to their sudden high abundance locally at intervals of several years and typical low densities. *Viola betonicifolia* is widespread, although moderate densities of the species is required to sustain breeding populations of the Australian fritillary (Sands & New 2002; Qld DEHP 2010). The species is heavily reliant on the availability of *V. betonicifolia* which is thought to have a significant influence on species numbers (DES 2018; DotEE 2018).

Photograph 2.2 ***Viola betonicifolia*** **which is the larval food plant of the Australian fritillary**

Source: Plantnet (n.d.)

2.1.3 Habitat

The species is often found in open swampy coastal habitats or around river estuaries where *V. betonicifolia* grow often amongst vegetation in the ground layer beneath grasses and mat-rushes. The butterfly is also at times found in disturbed areas such as drainage ditches or sugar cane farms in association with water course plant communities when its primary food plant is present (OEH 2017; DES 2018).

2.1.4 Threatening processes

The following have been identified as potentially threatening processes to the Australian fritillary:

- Habitat destruction due to coastal development, drainage of wetlands and farming
- Poisoning due to herbicide usage
- Predation by introduced ants such as fire ants and coastal brown ants (DES 2018).

2.1.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

2.1.6 References

Atlas of Living Australia (2018). *Argynnis hyperbius inconstans*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:86d8a81c-9760-40ef-9d6a-e02c0494d798 [Accessed 2 September 2018].

Butterfly House (2016). *Argynnis hyperbius* – Laced Fritillary. Available from: http://lepidoptera.butterflyhouse.com.au/nymp/hyperbius.html [Accessed 22 August 2018].

Department of the Environment and Energy (2018). *Argynnis hyperbius inconstans* (Australian Fritillary) in Species Profile and Threats Database. Australian Government. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=88056 [Accessed 22 August 2018].

Department of Environment and Science (2018). Australian fritillary butterfly. Queensland Government. Available from: https://www.ehp.qld.gov.au/wildlife/animals-az/australian_fritillary_butterfly.html [Accessed 22 August 2018].

Office of Environment and Heritage (2017). Laced Fritillary - Profile. New South Wales Government. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10064 [Accessed 2 September 2018].

Plantnet. (n.d.). *Viola betonicifolia*. Available from: http://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswflandlvl=spandname=Viola~betonicifolia [Accessed 2 September 2018].

2.2 Pink underwing moth (*Phyllodes imperialis smithersi*)

2.2.1 Status

EPBC Act – Endangered

2.2.2 Biology and ecology

2.2.2.1 Characteristics

The Southern pink underwing moth (*Phyllodes imperialis smithersi*) is a moth species known for its bright pink patches and eight white spots on the trailing edge of its dark hindwing. The moth has grey-brown forewings approximately 14 cm in total length when outspread with white on the underside (DotEE 2018) (refer Figure 2.3). Young caterpillars of the species are a dull brown with the pupal stage a bronze coloured 5 cm case consisting of silk and leaves in metallic brown bands (refer Photograph 2.3). The moth is well known for its extravagant pupal case which resembles a head with two large eye spots and a double row of white teeth displayed when alarmed. Females of the species are usually similar in colour to males but darker in colour with longer, broader and strong convex wings (OEH 2017; Sands 2012).

Figure 2.3 **Southern pink underwing moth**

Source: Sands (2012); OEH (2017)

Photograph 2.3 Defensive position of alarmed Southern pink underwing moth larvae

Source: Sands (2012); OEH (2017)

2.2.2.2 Known distribution

The distribution of the moth extends from Nambour in southeastern Queensland through to the NSW-QLD Border Ranges and down to Bellingen in northern NSW. Under DAWE mapping the species or species habitat 'may occur' in a small portion of the MNES study area associated with the Teviot Range (refer Figure 2.4). The species is known to occur in altitudes of 600 m undisturbed in its preferred habitat (DotEE 2018, Sands 2012, OEH 2017).

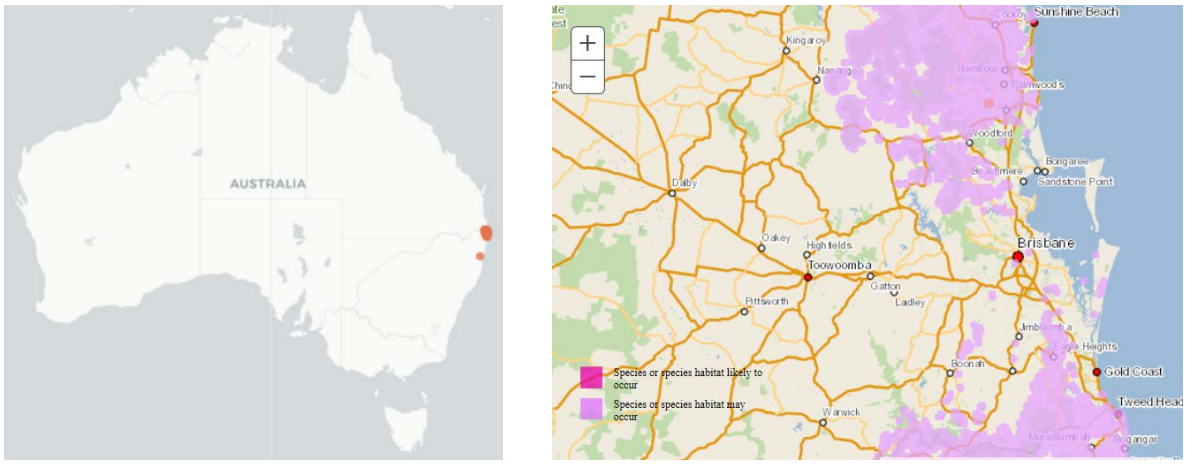


Figure 2.4 Distribution range of the Southern pink underwing moth

Source: ALA (2018), DotEE (2018)

2.2.2.3 Distribution in relation to the Project

Phyllodes imperialis smithersi has been predicted to occur within the region and associated habitat within the MNES study area. The nearest database record (AoLA) of Pink underwing moth is located 58 km from the disturbance footprint in the Lamington National Park area. The nearest database record (AoLA) of the larval food plant (*Carronia multisepalea*) is located 31 km from the disturbance footprint. The larval food plant has not been identified during any Project-associated surveys of the alignment. Sands (2012) notes the species as being known from the ranges north of Brisbane (Mount Mee north through the Conondale Range) and south (Lamington and Springbrook plateaus and into northern NewSouth Wales).

There is little to no suitable wetter rainforest habitat in the wider area and none within the disturbance footprint. There is no evidence the species has ever occurred in the wider area surrounding the Project. As such, the species is considered unlikely to occur and is not treated further for assessment within the main body of the MNES report.

Figure 2.5 **Distribution range of the Southern pink underwing moth in relation to the Project**

Source: ALA (2020)

2.2.2.4 Biology and reproduction

Adults of the moth species have been recorded to feed on damaged fruit of the *Ficus* spp. And a *Syzygium* spp. Larvae of the moth have been found feeding on the vine of *Carronia multisepalea* in its shrub-like form (refer Photograph 2.4). Breeding is known to only occur on the vine of *C. multisepalea* as it requires the darkness supplied by the vine and rainforest vegetation with an egg being deposited beneath the leaf (Sands 2012; DotEE 2018).

Photograph 2.4 **Southern pink underwing moth larvae feeding on its plant food *Carronia multisepalea***

Source: Plantnerd (2013)

2.2.3 Habitat

The habitat of the Southern pink underwing moth is restricted to areas of undisturbed old growth rainforests, usually subtropical, below 600 m elevation that contain a specific type of vine known to occur in southeastern Queensland and northeastern NSW (OEH 2017; Sands 2012).

2.2.4 Threatening processes

The following have been identified as potentially threatening processes to the Pink underwing moth.

- Loss of rainforest habitat through fragmentation and clearing
- Disturbance through increased foot traffic in its known breeding sites (DotEE 2018).

2.2.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

2.2.6 References

Atlas of Living Australia (2018). Phyllodes imperialis southern subspecies. Available from: https://bie.ala.org.au/species/ALA_Phyllodes_imperialis_southern_subspecies [Accessed 22 August 2018].

Department of the Environment and Energy (2018). Phyllodes imperialis smithersi (Pink Underwing Moth) in Species Profile and Threats Database. Australian Government. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=86084 [Accessed 22 August 2018].

Office of Environment and Heritage (2017). Southern Pink Underwing Moth - Profile. New South Wales Government. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10625 [Accessed 22 August 2018].

Plantnerd. (2013). Southern Pink Underwing Moth (Phyllodes imperialis). Available from: https://www.flickr.com/photos/plantnerd/8526432622/in/album-72157629646709975/ [Accessed 2 September 2018].

Sands, D.P.A. (2012). Review of Australian Phyllodes Imperialis Druce (Lepidoptera: Erebidae) with Description of a new Subspecies from Subtropical Australia. CSIRO. Available from: https://publications.csiro.au/rpr/download?pid=csiro:EP121773anddsid=DS5 [Accessed 22 August 2018].

3 Fauna – Threatened species – Fish

3.1 Australian lungfish (*Neoceratodus forsteri*)

3.1.1 Status

EPBC Act – Vulnerable

3.1.2 Biology and ecology

3.1.2.1 Characteristics

The Australian lungfish (*Neoceratodus forsteri*) is a heavy-bodied and elongated freshwater fish with five pairs of gills and fins that resemble flippers (refer Photograph 3.1). An adult lungfish can weigh up to 48 kg with a total body length of 2 m. The large, overlapping scales of the fish is dark brown or olive brown on the back however pinkish white on the underbelly and underside of the head. Juvenile lungfish are dark olive, brown or yellow in colour with mottled patterns above the scales with a dull pink belly. Both juvenile and adult lungfish are equipped with sharp cone shaped teeth on the palate and lower jaw (DotEE 2018).

Photograph 3.1 ***Neoceratodus forsteri*** **(Australian lungfish)**

Source: Queensland Museum (2018)

3.1.2.2 Known distribution

The lungfish is an endemic species to Australia and limited in distribution to southeast Queensland (refer Figure 3.1). River systems such as the Mary, Burnett and Brisbane Rivers are inhabited. The species and also been translocated successfully to the Condamine, Albert and Logan Rivers (DotEE 2018). The species is native to the Mary and Burnett Rivers and was potentially the Brisbane River catchment. A number of individuals were translocated from the Mary River in the 1890s. Creeks crossed by the Project alignment are within the upper catchment of the Brisbane River.

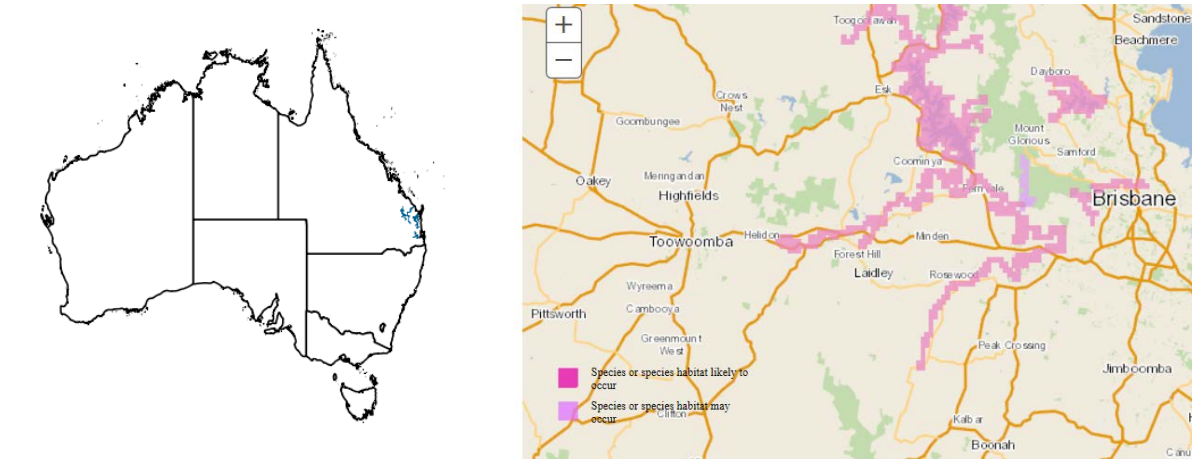


Figure 3.1 **Distribution range of the Australian lungfish**

Source: ALA (2018), DotEE (2018)

3.1.2.3 Distribution in relation to the Project

Neoceratodus forsteri has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicate this species has not been recorded within the MNES study area. The nearest database record is from 1989 taken from approximately 5 km east (and downstream) of the eastern extent of the Project from the Logan River (south-west of Jimboomba). There is a 1971 record from the Bremer River located 5 km downstream of the Project. The nearest recent record (2017) is from the Bremer River located 12 km north of the Project in the Ipswich city area. There are further records to the north of the Project from elsewhere in the Brisbane River catchment including Lockyer Creek.

Waterways crossed by the western section of the Project alignment are within the upper catchment of the Brisbane River and include the Bremer River. The eastern section of the Project lies within the Albert River which includes the alignment crossing at Teviot Brook.

Figure 3.2 **Distribution range of the Australian lungfish in relation to the Project**

Source: ALA (2020)

3.1.2.4 Biology and reproduction

The primary source of food for the Australian lungfish is molluscs and other small animals. The species is known to be a low level benthic carnivore with hatchlings and juveniles feeding on small invertebrates as active predators during the developmental stage (Kemp 1996).

The breeding cycle of the lungfish occurs at around 15 years of age for the male and 20 years for the female with spawning at night between August and December in preferably clear waters. Spawning cycles are triggered by increased daylength with lungfish pairing spawn amongst aquatic macrophytes, producing a clutch size of 50 to 100 eggs. The species is known to abandon any spawning sites upon disturbance (DotEE 2018).

3.1.3 Habitat

The preferred habitat of the species is still or slow-flowing, shallow waters with clear, vegetated pools to allow feeding, shelter and spawning. Vegetation such as Red bottle-brush (*Callistemon saligna*), She-oak (*Casuarina* spp.) and aquatic macrophytes are the dominant species used by the lungfish. Despite the capability of the species to breath aerially using its single lung, it requires permanent water and cannot live in saline environments (Brooks and Kind 2002).

3.1.4 Threatening processes

The following have been identified as potentially threatening processes to the Australian lungfish:

- Impoundment through development of dams, weirs and bridges
- Erratic recruitment
- Accidental targets by recreational anglers
- Predation of eggs by species such as the Tilapia (*Cichlidae)*
- Clearing of riverbanks (DotEE 2018).

3.1.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

3.1.6 References

Atlas of Living Australia. (2018). Neoceratodus forsteri. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:38a5a409-3f58-4522-acec-61444d999bd2#overview [Accessed 22 August 2018].

Brooks, S.G. and P.K. Kind. (2002). Ecology and demography of the Queensland lungfish (*Neoceratodus forsteri*) in the Burnett River, Queensland with reference to the impacts of Walla Weir and future water infrastructure development. Queensland Department of Primary Industries. Queensland, Queensland Agency for Food and Fibre Services.

Department of the Environment and Energy. (2018). Neoceratodus forsteri (Australian Lungfish) Species Profile and Threats Database. Australian Government. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=67620 [Accessed 22 August 2018].

Kemp, A. (1996). The role of epidermal cilia in development of the Australian lungfish, Neoceratodus forsteri (Osteichthyes: Dipnoi). Journal of Morphology. 228:203-221.

Queensland Museum. (2018). The unique Australian Lungfish. Available from: http://www.qm.qld.gov.au/Find+out+about/Animals+of+Queensland/Fishes/The+unique+Australian+Lungfish#.W5Bu8aiWZ9M [Accessed 22 August 2018].

3.2 Mary River cod (*Maccullochella mariensis*)

3.2.1 Status

EPBC Act – Endangered

3.2.2 Biology and ecology

3.2.2.1 Characteristics

The Mary River cod (*Maccullochella mariensis*) is a pale green to golden-yellow fish with dark brown mottled scales featuring heavily on the fish's body. This fish species has a protruding lower jaw, concaved head profile and soft dorsal fins as well as thin white edged anal and caudal fins (refer Photograph 3.2). The average weight of this species is approximately 5 kg with a total body length of 70 cm (DotEE 2018; DAF 2018).

Photograph 3.2 Mary River cod (*Maccullochella mariensis*)

Source: DAF (2018)

3.2.2.2 Known distribution

The Mary River cod is endemic to the Mary River catchment in southeast Queensland (refer Figure 3.3). Creek systems which feed off the Mary River such as Six Mile, Tinana-Coondoo and Obi Obi Creek are all well known areas of distribution for the Mary River cod (Simpson and Jackson 1996). The species historically may have included the Brisbane, Logan and Coomera catchments (this remains uncertain). Impoundments outside of the Mary River catchment within the potential historical range of the species are currently stocked with Mary River cod (Simpson and Jackson 1996). It is not known if this has led to any self-sustaining populations within these catchments (TSSC 2016).

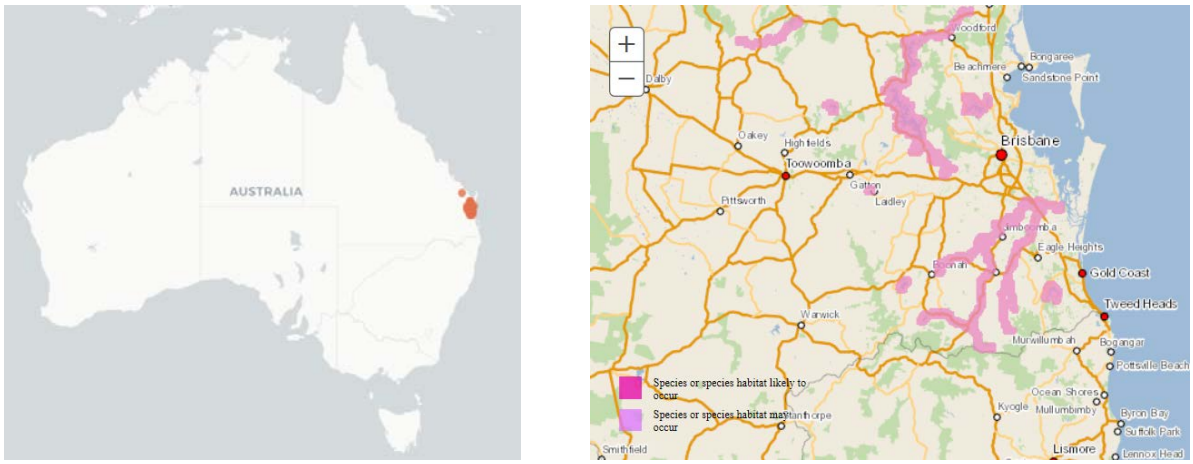


Figure 3.3 Distribution range of the Mary River cod

Source: ALA (2018), DotEE (2018)

3.2.2.3 Distribution in relation to the Project

Maccullochella mariensis has been predicted to occur within the region and associated habitat within the MNES study area. However, there are no current records for this species within 50 km of the temporary and permanent disturbance footprint. The nearest database record (AoLA) recorded in 1975 is located 103 km from the disturbance footprint and within the Mary River catchment. The species' current distribution is limited to the Mary River catchment, but may have historically included the Brisbane, Logan and Coomera catchments (Simpson and Jackson 1996). The species is known to be stocked in several impoundments within the Brisbane River and Logan-Albert River catchments. There is no evidence that breeding populations have become established in these catchments (Huey et al. 2013).

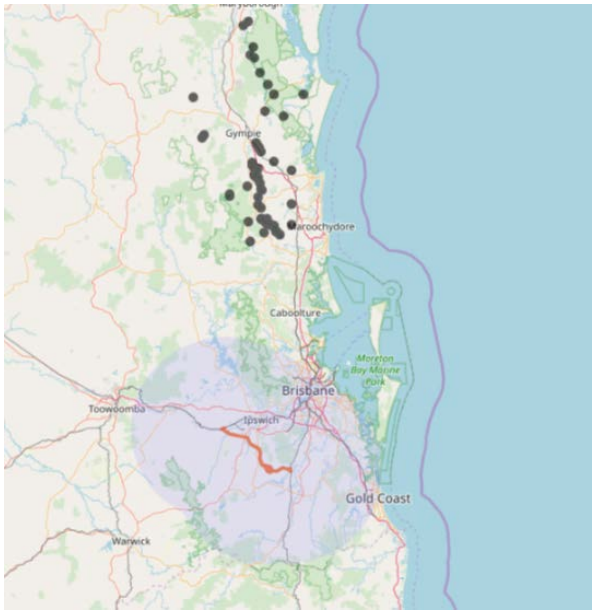


Figure 3.4 **Distribution range of the Mary River cod in relation to the Project**

Source: ALA (2020)

3.2.2.4 Biology and reproduction

Adult Mary River cod feed on a variety of prey such as fish, freshwater crayfish, shrimp, mussel, frogs and even small reptiles. Juvenile Mary River cod feed on crustaceans including crayfish and shrimp, insect larvae. Newly hatched cod consume zooplankton and aquatic insects such as chironomid larvae (Gomon and Bray 2018).

The Mary River cod form pairs and spawn annually around spring, as water temperature reaches 20°C with the male selecting and guarding the nest site which is thought to be a hollow logs in the wild. Eggs, which may be as many as 2,000 eggs per kilogram of the female fish's bodyweight, are deposited as a layer inside the log which are opaque in colour with hatching occurring towards the end of the fourth day and complete by the seventh day (TSSC 2016).

3.2.3 Habitat

The preferred habitat for the species is a high gradient, rocky, upland stream or slow-flowing pools in lowland areas. Deep, shaded areas of water with snags and log-piles are often inhabited as they provide good conditions of the species to spawn. The Mary River cod is known to migrate over 30 km into smaller tributaries in late winter either up or down stream and have a long home range returning after long absences (Simpson and Jackson 1996; TSSC 2016).

3.2.4 Threatening processes

The following have been identified as potentially threatening processes to the Mary River cod:

- Impoundment of streams

- Loss of riparian vegetation
- Competition by invasive species (DotEE 2018).

3.2.5 Threat abatement/recovery plans

No threat abatement plan has been identified as being relevant for this species. The following recovery plan is applicable to this species:

- Simpson, R. & P. Jackson (1996). *The Mary River Cod Research and Recovery Plan*. Queensland Department of Primary Industries - Fisheries Group. Available from: http://www.environment.gov.au/resource/mary-river-cod-research-and-recovery-plan. In effect under the EPBC Act from 09-Mar-2001 as *Maccullochella mariensis*.

3.2.6 Summary of threat abatement/recovery plans

Important populations outlined in the National Recovery Plan for the Murray Cod *Maccullochella peelii peelii* that could be relevant to the Project include:

- Tinana-Coondoo Creek
- Six Mile Creek
- Obi Obi Creek.

Threats identified in the National Recovery Plan include:

- Habitat change
- Overfishing
- Introduced fish species.

Recovery actions outlined in the National Recovery Plan include:

- Establishing a program of community involvement/education in order to foster public support or the conservation of the species
- Develop and implement regulations and administration actions to protect the species and their habitat
- Manage captive breeding and restocking efforts into suitable habitat
- Research biological requirements to improve captive-breeding techniques
- Implement programs to rehabilitate riparian and instream habitats in the Mary river system along with targeted restocking sites
- Develop and implement a long-term monitoring program for assessment of the species.

3.2.7 References

Atlas of Living Australia. (2018). *Maccullochella mariensis*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:9d455adb-4fa8-4853-a3a6-f7d28d838fc6 [Accessed 22 August 2018].

Department of Agriculture and Fisheries. (2018). Mary River Cod. Queensland Government. Available from: https://www.daf.qld.gov.au/business-priorities/fisheries/species-identification/freshwater-fish/mary-river-cod [Accessed 22 August 2018].

Department of the Environment and Energy. (2018). *Maccullochella mariensis* (Mary River Cod) Species Profile and Threats Database. Australian Government. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=83806 [Accessed 22 August 2018].

Gomon M.F. and Bray D.J. (2018). *Maccullochella mariensis* in Fishes of Australia, accessed 30 August 2018, http://fishesofaustralia.net.au/home/species/3000 [Accessed 22 August 2018].

Huey, J.A., Espinoza, T. and Hughes, J. (2013). Natural and Anthropogenic Drivers of Genetic Structure and Low Genetic Variation in the Endangered Freshwater Cod, Maccullochella Mariensis. *Conservation Genetics*. Vol. 14, pp. 997-1008.

Simpson, R. and P. Jackson. (1996). The Mary River Cod Research and Recovery Plan. Queensland Department of Primary Industries - Fisheries Group. Available from: http://www.environment.gov.au/resource/mary-river-cod-research-and-recovery-plan [Accessed 22 August 2018].

Threatened Species Scientific Committee (2016). *Maccullochella mariensis* in Species Profile and Threats Database. Department of the Environment and Energy. Canberra. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/83806-conservation-advice-16122016.pdf [Accessed 22 August 2018].

3.3 Murray cod (*Maccullochella peelii*)

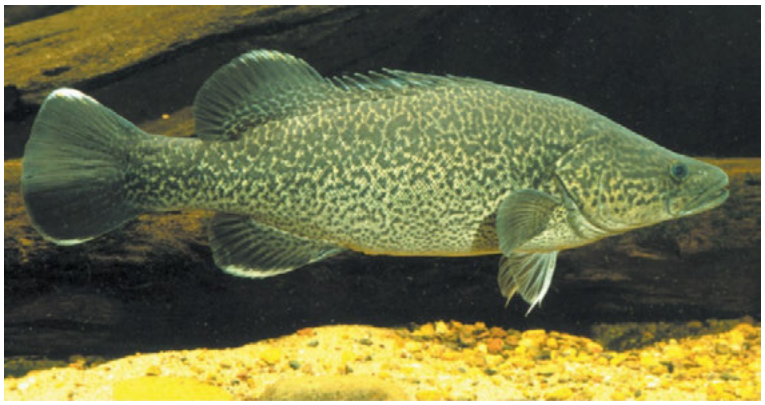
3.3.1 Status

EPBC Act – Vulnerable

3.3.2 Biology and ecology

3.3.2.1 Characteristics

The Murray cod (*Maccullochella peelii*) is the largest freshwater species of fish in Australia, measuring up to 1.8 m in length and weighing about 10 kg although some records indicate the species may reach over 100 kg in weight. The Murray cod has a broad head, rounded snout, equal length jaws and has a concaved facial profile. The light olive to dark green scales of the fish has mottled pattern, with a white ventral colouration. The pectoral fins of the fish are rounded and large with soft dorsal, anal and caudal fins with distinctive red or white edging (DotEE 2018) (refer Photograph 3.3).



Photograph 3.3 Murray cod (*Maccullochella peelii*)

Source: MDBC (2007)

3.3.2.2 Known distribution

The Murray cod was once a widespread species and abundant in the lower and mid reaches of the Murray-Darling Basin between Queensland and South Australia (refer Figure 3.5). However, the distribution of the species has now reduced to several bioregions between Queensland and Victoria, including the Brigalow Belt South Bioregion (National Murray Cod Recovery Team 2010).

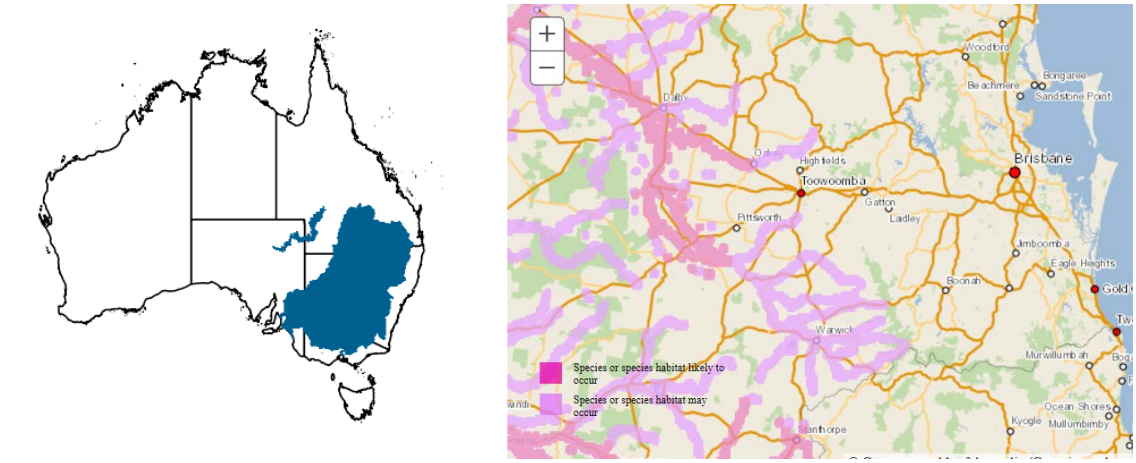


Figure 3.5 **Distribution range of Murray cod**

Source: ALA (2018), DotEE (2018)

3.3.2.3 Distribution in relation to the Project

Maccullochella peelii has been predicted to occur within the region and associated habitat within the MNES study area. However, there are no current records for this species within 50 km of the temporary and permanent disturbance footprint. The nearest database record (i.e. AoLA, WildNet) is from approximately 60 km to the west of the disturbance footprint recorded in 2014 from the Toowoomba region. Other records occur to the north, north-west, west and south-west of the Project.

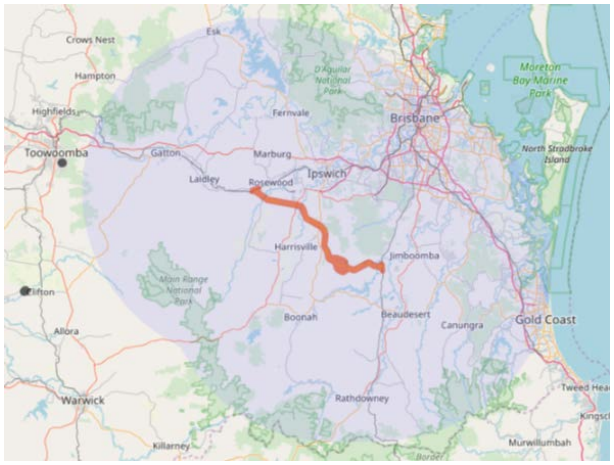


Figure 3.6 **Distribution range of Murray cod in relation to the Project**

Source: ALA (2020)

3.3.2.4 Biology and reproduction

Due to the size of the Murray cod, it is considered the apex predator of the Murray-Darling river system and known to ambush its prey. The demersal species is known to hunt from sunset to sunrise, feeding on spiny crayfish and shrimp as well as reptiles and other fish species including cod (DotEE 2018).

The Murray cod has relatively low fertility compared to many other freshwater fish with the species generally reaching sexual maturity, which is heavily dependent on size, at 5 years of age. Male Murray cod, who are known to guard and fan the eggs during incubation, mature at a larger size than females with the species breeding as a pair. A female cod weighing 3 kg can produce up to 10,000 eggs often laid in logs or snags after developing them through winter until spawning, which is triggered by an increase in temperature and day length (DotEE 2018).

Upon hatching larvae tend to remain clustered in their nest for up to 11 days with the male continually providing protection before the larvae leave the nest to drift downstream and feed on zooplankton as well as aquatic insects (DotEE 2018).

3.3.3 Habitat

The habitat of the species is diverse, ranging from clear rocky streams to slow-flowing, turbid lowland rivers or billabongs where the fish is found frequently in the main channel. Due to the species preferred breeding environment, it is often found in streams containing large rock, snags, overhanging vegetation, stumps or other woody structures (DotEE 2018).

The species is known to take long distance journeys prior to spawning travelling up to several hundred kilometres upstream despite their naturally sedentary nature (Koehn et al. 2009).

3.3.4 Threatening processes

The following have been identified as potentially threatening processes to the Murray cod:

- Impoundment of streams and altered water flow
- Loss of riparian vegetation
- Habitat removal, modification and degradation (DotEE 2018).

3.3.5 Threat abatement/recovery plans

No threat abatement plan has been identified as being relevant for this species. The following recovery plan is applicable to this species:

- National Murray Cod Recovery Team (2010). *National Recovery Plan for the Murray Cod* Maccullochella peelii peelii. Department of Sustainability and Environment, Melbourne. Available from: **http://www.environment.gov.au/resource/national-recovery-plan-murray-cod-maccullochella-peelii-peelii.** In effect under the EPBC Act from 16-Dec-2010 as *Maccullochella peelii*.

3.3.6 Summary of threat abatement/recovery plans

Important populations outlined in the National Recovery Plan for the Murray Cod *Maccullochella peelii peelii* that could be relevant to the Project include:

- New South Wales: Darling River main channel and tributaries
- New South Wales: Murray River main channel and tributaries
- New South Wales: Murrumbidgee River from Wagga to Hay
- New South Wales: Edwards River and tributaries
- New South Wales: Naomi River, Peel River junction to Wee Waa
- New South Wales: Gwydir River and major tributaries from Copeton Dam to Gwydir River
- New South Wales: Birder rivers (Barwon and Macintyre) including major tributaries in NSW
- Queensland: Border Rivers
- Queensland: Condamine River
- Queensland: Warrego River between Charleville and Cunnamulla
- Queensland: McIntyre River downstream of Texas.

Threats identified in the National Recovery Plan include:

- Flow regulation
- Habitat degradation
- Lowered water quality
- Barriers
- Exotic/alien species

- Commercial fishing
- Recreational fishing
- Illegal fishing
- Stocking and translocations
- Genetic issues
- Disease
- Climate change.

Objectives outlined in the National Recovery Plan include:

- Determine the distribution, structure and population dynamics across the MDB
- Manage river flows in a way that enhances recruitment
- Risk assess the threats and evaluate benefits of recovery actions
- Determine habitat requirements for various life stages
- Manage recreational fishing in a sustainable manner taking into account the social, economic and recreational value of the fishery
- Encourage community ownership of conservation for the species
- Manage recovery plan implementation.

3.3.7 References

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4 Fauna – Threatened species – Reptiles

4.1 Collared delma (*Delma torquata*)

4.1.1 Status

EPBC Act – Vulnerable

4.1.2 Biology and ecology

4.1.2.1 Characteristics

The Collared delma (*Delma torquata*) is a flap-footed lizard that has no forelimbs but retains vestigial hind limbs in the form of small scaly flaps. The body of the Collared delma is brown to reddish-brown in colour becoming grey to bluish-grey on the tail. It has large black bands across the head and nape interspaced by four cream-yellow stripes (refer Photograph 4.1). This species moves with a snake-like gait through the matrix but travel with a series of wriggling leaps over open ground. The Collared delma is a small cryptic species reaching a maximum size of 7 cm (snout-vent) and a maximum total length of approximately 190 mm (DotEE 2018; Santos 2012).

Photograph 4.1 Collared delma (*Delma torquata*)

Source: Wilson (2018)

4.1.2.2 Known distribution

The Collared delma is endemic to southeast Queensland. The known distribution of the species occurs at Lockyer Forest Reserves, Western Creek near Millmerran, the Toowoomba Range eastward to Moggill on the western outskirts of Brisbane (refer Figure 4.1). The largest known occurrence of this species occurs on the Toowoomba range where large numbers of this species were subject to translocation activities associated with the Toowoomba second range crossing project (DotEE 2018; Schell and Stark pers. obs. 2017).

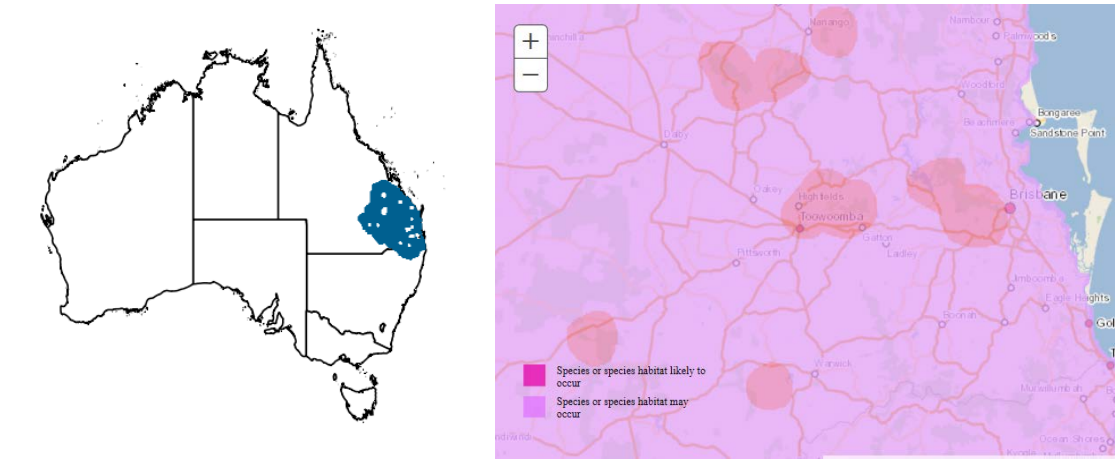

Figure 4.1 **Distribution range of the Collared delma**

Source: ALA (2018), DotEE (2018)

4.1.2.3 Distribution in relation to the Project

Delma torquata has been identified as potentially occurring within the MNES study area. There are no known records of this species within or close to the MNES study area. Database records (AoLA) indicate that this species occurs within 50 km of the Project. The nearest database record is from 1993 taken from within approximately 25 km north of the Project in Karana Downs, north of Ipswich. There is also a single 2019 record of uncertain provenance / accuracy located in the Richlands area approximately 26 km north-east of the Project. There are a number of more recent records in the area north of Karana Downs, the Lockyer Forest Reserves (35 km north-west of the Project) the Toowoomba Range (over 50 km west of theProject), Bunya Mountains National park and Yarraman State Forest and surrounds (ALA 2020). The MNES study area is located near the southern limit of the species range.

Figure 4.2 **Distribution range of the Collared delma in relation to the Project**

Source: ALA (2020)

4.1.2.4 Biology and reproduction

The Collared delma feeds on insects and spiders, with small cockroaches the most common prey item. Some individuals have been captured in subterranean termite colonies (Davidson 1993; Porter 1998; Schell and Stark pers. obs. 2017).

As with all members of the Pygopodidae family, the Collared delma produces two small white, elongated eggs in December. These hatch in February to March (Peck and Hobson 2007; Schell and Stark pers. obs. 2017).

4.1.3 Habitat

The Collared delma typically inhabits Eucalypt-dominated woodlands and open-forests in Queensland RE Land Zones 3, 9 and 10 (Brigalow Belt Reptiles Workshop 2010). However, recent studies associated with the species indicate that the species is most frequently associated with open *Eucalyptus crebra* woodland (canopy cover between 10 to 30%) located on northwest facing slopes (Schell and Stark pers. obs. 2017).

The Collared delma has been recorded from rocky areas associated with dry open forests. This species occurs in open Eucalypt and acacia woodland with an understorey of native grasses and loose rocks. The Collared delma has also been recorded from Eucalypt woodland adjacent to semi-evergreen vine thicket. This species shelters under rocks, fallen timber, leaf litter and in soil cracks (Richardson 2006).

The presence of rocks, logs, bark and other coarse woody debris, and mats of leaf litter (typically 30 to 100 mm thick) appears to be an essential characteristic of the Collared delma microhabitat and is always present where the species occurs (Brigalow Belt Reptiles Workshop 2010; Davidson 1993; Schell and Stark pers. obs. 2017).

4.1.4 Threatening processes

The following have been identified as potentially threatening processes to the Collared delma:

- Loss and modification of habitat due to urban and agricultural development
- Landscaping activities removing surface rocks
- Invasive weed species such as Dwarf lantana (*Lantana montevidensis*) (DotEE 2018).

4.1.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species. The Priority Threat Management for Imperilled Species of the Queensland Brigalow Belt has been identified as being relevant for this species. Available from: **https://publications.csiro.au/rpr/download?pid=csiro:EP154521&dsid=DS5** (Ponce Reyes, R., J. Firn, S. Nicol, I. Chadès, D.S. Stratford, T.G. Martin, S. Whitten & J. Carwardine, 2016).

4.1.6 Summary of threat abatement/recovery plans

Given the difficulty in detecting the Collared delma (*Delma torquata*) the Commonwealth environmental department considers that the presence of suitable and important habitat for this species is a surrogate for an important population of the species. Important habitat as described in the Draft referral guidelines for the nationally listed Brigalow Belt reptiles (available from: **http://www.environment.gov.au/system/files/resources/570964ac-15bf-4e07-80da-848fead7b0cd/files/draft-referral-guidelines-comment-brigalow-reptiles.pdf**) includes:

- Open forest eucalypt woodland dominated by ironbarks
- Woodland adjacent to exposed rocky areas
- RE Land Zones 3, 9 and 10.

Threats to the Brigalow belt environmental community outlined in the Threat Management for Imperilled Species of the Queensland Brigalow Belt includes:

- Grazing
- Cultivation of arable crops
- Coal mining
- Coal Seam Gas industry development and associated infrastructure
- Changes in hydrology and pollution
- Invasive animals

- Invasive flora
- Fire
- Climate change.

Conservation management outcomes identified in the Threat Management for Imperilled Species of the Queensland Brigalow Belt document includes:

- Management of 29 national parks through the Department of National Parks, Sport and Racing
- Management of four Conservation Parks and one Resource Reserve that protects the brigalow ecosystems through the Department of Natural Resources and Mines supporting conservation and rehabilitation of the natural environment
- Encouraging sustainable agriculture to improve biodiversity and farm practices
- 'Back on Track' initiative prioritising the conservation, management and recovery of Queensland's native species
- Indigenous land management practices implemented for weed and fire management by Traditional Owners
- Biodiversity offsets through voluntary or mandatory investments in conservation management.

4.1.7 References

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Steve Wilson. (2018). Arkive - Collared delma (*Delma torquata*). Available from: https://www.arkive.org/collared-delma/delma-torquata/image-G82236.html [Accessed 22 August 2018].

4.2 Dunmall's snake (*Furina dunmalli*)

4.2.1 Status

EPBC Act – Vulnerable

4.2.2 Biology and ecology

4.2.2.1 Characteristics

Dunmall's snake (*Furina dunmalli*) is a small to medium-sized, venomous (family Elapidae), snake that typically grows to a length of up to 75 cm. It has a uniform dark grey-brown colour on the top of the body, which fades to white at its lower flanks and has 21 rows on the mid-section (refer Photograph 4.2). Most of the scales near the upper lip exhibit pale blotches. The head is large and distinct from the neck (DES 2017).

Photograph 4.2 Dunmall's snake (*Furina dunmalli*)

Source: Wilson (n.d.)

4.2.2.2 Known distribution

Dunmall's snake is endemic to Australia and inhabits areas near the Queensland border within the Brigalow Belt South bioregion to the Nandewar bioregion in NSW (refer Figure 4.3). In Queensland, the snake is often found in areas 200 to 500 m above sea level with recorded sightings in Oakey and Inglewood. In NSW, the species is predominantly found in the northeast inland region (DotEE 2018).

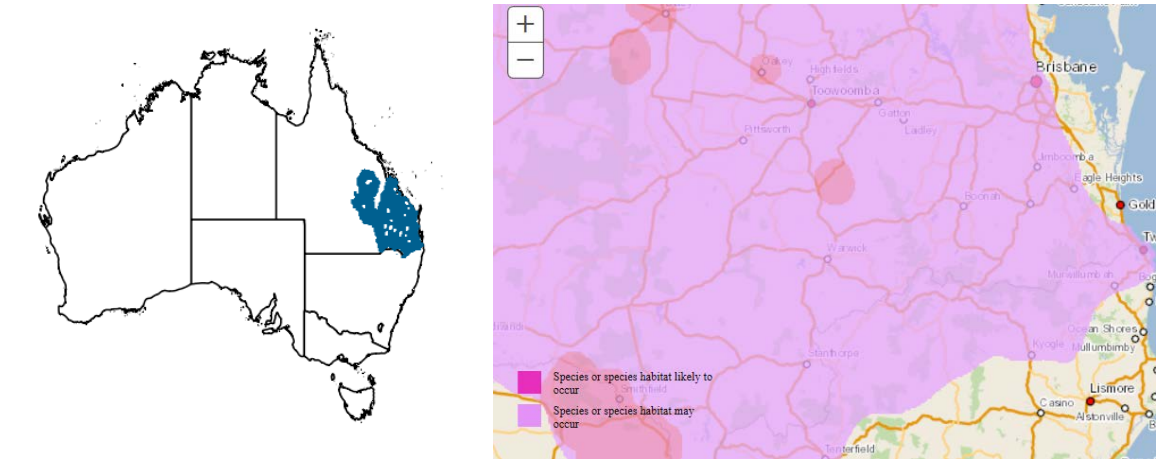

Figure 4.3 **Distribution range of the Dunmall's snake**

Source: ALA (2018), DotEE (2018)

4.2.2.3 Distribution in relation to the Project

Furina dunmalli has been predicted to occur within the region and associated habitat within the MNES study area. However, there are no current records for this species within 50 km of the temporary and permanent disturbance footprint. The nearest database record is from Oakey (84 km west of the MNES study area), however there is no specified date or confirmation of the accuracy of the location for this record. There are a number of confirmed records to the north-east, west and south-west of the Project. The MNES study area is located near the eastern limit of the species range (ALA 2020).

Figure 4.4 **Distribution range of the Dunmall's snake in relation to the Project**

Source: ALA (2020)

4.2.2.4 Biology and reproduction

Dunmall's snake are known to eat small lizards such as skinks and geckos. Analysis of the gut contents of this species yielded the remains of Tree skink (*Egernia striolata*). Limited knowledge is available on the snake's life cycle or reproductive behaviour, however, it is known that the species lays eggs rather than live young (DotEE 2018).

4.2.3 Habitat

Given the rarity, and difficulty of detecting Dunmall's snake, all suitable habitats (remnant or non-remnant vegetation) that are coincident with the known locations of the species are considered important habitats. Dunmall's snake has been found in a broad range of habitats, including:

- Forests and woodlands on black alluvial cracking clay and clay loams dominated by Brigalow (*Acacia harpophylla*), other Wattles (*A. burowii, A. deanii, A. leioclyx*), native Cypress (*Callitris* spp.) or Bull-oak (*Allocasuarina luehmannii*)

- Various Spotted gum (*Corymbia citriodora*), Ironbark (*Eucalyptus crebra* and *E. melanophloia*), White cypress pine (*Callitris glaucophylla*) and Bull-oak open forest and woodland associations on sandstone derived soils
- The edge of dry vine scrub near Tarong Power Station, Queensland, and hard ironstone country (Queensland RE Land Zone 7) at Lake Broadwater near Dalby, Queensland.

There is a paucity of information related to ecological requirements of this species, however it has been observed sheltering under fallen timber and ground debris, and is known to utilise cracks in alluvial clay soils (DES 2017; DotEE 2018).

4.2.4 Threatening processes

The following have been identified as potentially threatening processes to Dunmall's snake:

- Habitat loss and fragmentation due to land clearing in core areas of the Darling Downs
- Predation by feral animals such as foxes, cats and pigs
- Inappropriate road side management (DES 2017).

4.2.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

4.2.6 References

Atlas of Living Australia (2018). Furina dunmalli. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:9ba2edaa-574b-4c18-8503-d0b658b16cc4 [Accessed 2 September 2018].

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4.3 Long-legged worm-skink (*Anomalopus mackayi*)

4.3.1 Status

EPBC Act – Vulnerable

4.3.2 Biology and ecology

4.3.2.1 Characteristic

The Long-legged worm-skink, also called the Five-clawed worm skink (*Anomalopus mackayi*), is a burrowing skink, which is characterised by three fingers and two toes. This species typically grows to 27 cm long. It has smooth scales with an overall greyish-brown upper body, with dark spots in longitudinal rows. Its ventral surface is yellow-green with dark flecking (refer Photograph 4.3). In the southern region of its range, this species is unpatterned, while in the north, it has longitudinal rows of dark spots on the dorsal and lateral surfaces (DotEE 2018).

Photograph 4.3 Long-legged worm-skink (*Anomalopus mackayi*)

Source: Dolley (n.d.)

4.3.2.2 Known distribution

The known distribution of the Long-legged worm-skink is patchy in northeastern NSW and southeastern Queensland (refer Figure 4.5). In southeastern Queensland, the species' known distribution is on the upper Condamine River floodplain, from Warwick in the south, to the Jimbour region in the north, and bordered by the western edge of the granite belt (Brigalow Belt Reptiles Workshop 2010; DotEE 2018).

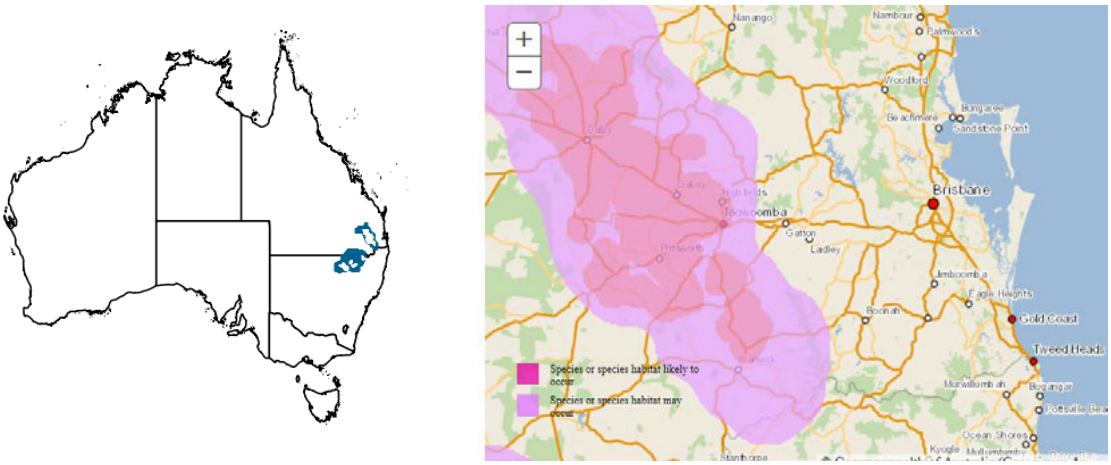

Figure 4.5 Distribution range of the Long-legged worm-skink

Source: ALA (2018), DotEE (2018)

4.3.2.3 Distribution in relation to the Project

Anomalopus mackayi has been predicted to occur within the region and associated habitat within the MNES study area. However, there are no current records for this species within 50 km of the temporary and permanent disturbance footprint. The nearest database record is from 1983 and located approximately 60 km west of the MNES study area in Toowoomba. There are several more recent records to the west, south-west and south of Toowoomba (ALA 2020). The MNES study area is located east of the species known / likely distribution which is well to the west of the MNES study area (DSEWPaC 2011).

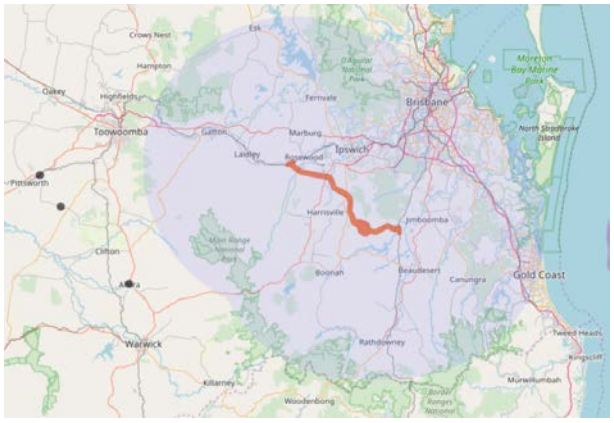

Figure 4.6 Distribution range of the Long-legged worm-skink in relation to the Project

Source: ALA (2020)

4.3.2.4 Biology and reproduction

Very little is known about the Long-legged worm-skink's reproduction and diet. However, it is believed to feed on arthropods, such as white ants and captive specimens have been recorded eating mealworms (DotEE 2018). Long-legged worm-skinks lay up to three eggs per clutch during Spring (DotEE 2018).

4.3.3 Habitat

The Long-legged worm-skink is known to occur in both remnant and non-remnant woodlands and grasslands, and in areas modified by agriculture and other human activities. It is typically found under timber, leaf litter and other debris. It is also known to inhabit rotting tree base cavities, logs and tussock bases. This species has been found sheltering under artificial materials lying flat on the ground, such as discarded railway sleepers, sheet metal and hay bales. On the Darling Downs, the species occurs in Bluegrass (*Dichanthium sericeum*) and/or Mitchell Grass (*Astrebla* spp.) dominated grasslands, or mixed grasslands dominated by other grass species (Brigalow Belt Reptiles Workshop 2010; DotEE 2018).

4.3.4 Threatening processes

The following have been identified as potentially threatening processes to the Long-legged worm-skink:

- Land clearing for agriculture has been particularly severe within the Long-legged worm-skink's range
- Overgrazing compacts soil making it difficult for the species to find suitable shelter
- Removal of logs and timber also reduces soil humidity and the amount of shelter available for the species. Agricultural chemicals may poison and pollute the soil which may adversely affect the species
- Predation by feral species, such as cats and foxes, is another threat facing much of Australia's native wildlife including the Long-legged worm-skink (Brigalow Belt Reptiles Workshop 2010; NSW NPWS 1999).

4.3.5 Threat abatement/recovery plans

The following recovery plan is relevant to this species:

- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from https://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10055. In effect under the BC Act 2016.

- Department of Environment, Climate Change and Water NSW (2010). *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. Department of Environment, Climate Change and Water NSW, Sydney. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/white-box-yellow-box-blakelys-red-gum-grassy-woodland-and-derived-native-grassland-national. In effect under the EPBC Act from 22-Mar-2013.

The following threat abatement plan is relevant to this species:

- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats. In effect under the EPBC Act from 23-Jul-2015.

4.3.6 Summary of threat abatement/recovery plans

Anomalopus mackayi is assigned as a data-deficient species under the NSW *Saving our Species Program* as there is little known about the ecology and habitat requirements of this species. State wide conservation actions identified for this species include:

- Encourage community education, awareness and involvement
- Encourage landholders to enter voluntary conservation and site management agreements
- Create corridors to reduce isolation of known population sites
- Protect or fence areas to create high quality habitat that sustains a significant population or foraging area
- Develop and test artificial refuge habitat as an interim protection measure
- Monitor the species for movement patterns, habitat range, success of management actions and for new threats at the site, movement pa
- Develop a successful technique to survey
- Identify two targeted populations annually to focus recovery actions on
- Conduct fox baiting.

Threats identified in the National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland include:

- Land use and management change
- Agricultural and horticultural development
- Public Infrastructure upgrades in travelling stock routes (TSRs)
- Firewood collection and ‘tidying up’
- Changed fire regimes
- Increase in soil nutrients and use of chemicals
- Mowing and slashing regimes
- Revegetation management
- Weed invasion
- Climate change
- Salinity
- Acid soils
- Declining tree health and regeneration
- Increased grazing pressure from invasive herbivores

- Disease – *Phytophthora cinnamomic*
- Collection and removal of native flora.

Recovery actions identified in the National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland include:

- Collect baseline data on the locations, quality and management regimes of remnant sites
- Extent and condition mapping
- Component species surveys
- Protection of existing habitat in priority areas including on private land
- Engagement with the community, particularly where remnants occur on private land to provide information on appropriate management and with Aboriginal communities.

Summary of baseline information actions undertaken to date:

- The establishment of databases comprising of information on CMN members (land managers with Box-Gum Grassy Woodland remnants), remnant locations, composition of flora and fauna species and remnant condition from surveys of CMN members' sites and other sites
- Minimum condition criteria and assessment method developed to assist land managers in identification of listed ecological communities
- Development of regional models using remote sensing
- Mapping of Box-Gum Grassy Woodland extent
- Surveys conducted during research programs through various organisations.

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

4.3.7 References

Atlas of Living Australia (2018). *Anomalopus mackayi*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:bcbb3f69-0f90-4b6d-a062-218439a61a51 [Accessed 23 August 2018].

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Department of the Environment and Energy (2018). *Anomalopus mackayi* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=25934 [Accessed 23 August 2018].

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4.4 Three-toed snake-tooth skink (*Coeranoscincus reticulatus*)

4.4.1 Status

EPBC Act – Vulnerable

4.4.2 Biology and ecology

4.4.2.1 Characteristic

The Three-toed snake-tooth skink (*Coeranoscincus reticulatus*) has reduced limbs, each with three digits and a total length of approximately 483 to 565 mm. Adults are usualy dark around the eyes and ears with a distinct wedge-shaped, pointed pale snout. Dorsal colour in adults is generally brown to yellowish brown or grey with a dark brown collar (refer Photograph 4.4). Individual flecked scales have dark brown streaks and there are small, dark brown scattered spots on the back and streaks on the throat. Ventral scales are normally greyish and dark-edged to form a fine reticulum-like pattern (DotEE 2018).

Juveniles are cream to brown dorsally with prominent, irregular transverse dark bands that are more conspicuous on the anterior and often absent on the posterior. In juveniles the scales on the sides of the body are dark-edged, forming irregular longitudinal streaks (DotEE 2018).

Photograph 4.4 Three-toed snake-tooth skink (*Coeranoscincus reticulatus*)

Source: Lewis Ecological (2016)

4.4.2.2 Known distribution

The Three-toed snake-tooth skink occurs from Crescent Head in northeast NSW to Fraser Island in southeast Queensland. Most records are from the Border Ranges in the vicinity of the NSW/Queensland border (refer Figure 4.7). In Queensland, the Three-toed Snake-tooth skink has a disjunct north-south distribution, with the species absent from apparently suitable habitat in the D'Aguilar Ranges, between the lowland areas of Fraser Island and Cooloola and upland records from Blackall Range and Conondale Range (DotEE 2018).

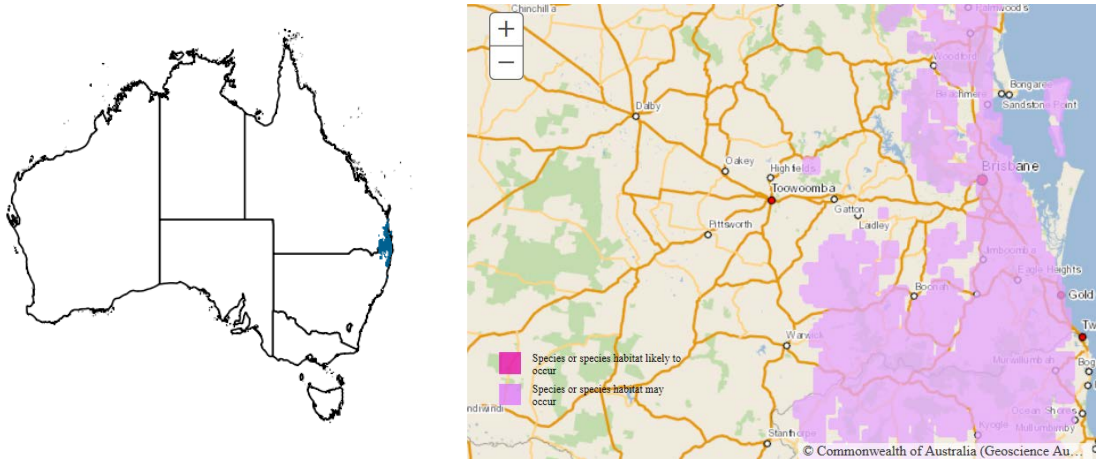


Figure 4.7 **Distribution range of the Three-toed snake-tooth skink**

Source: ALA (2018), DotEE (2018)

4.4.2.3 Distribution in relation to the Project

Coeranoscincus reticulatus has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA) indicated that the species is known from within 50 km of the temporary and permanent disturbance footprint. The nearest database record is from 1995 taken from within approximately 40 km east of the Project in Tamborine National Park. There are several more recent records to the south-west, south and south-east of the Project all associated with the wet forests extending in the ranges from Main Range National Park east to Lamington National Park (ALA 2020). There are older records to the north of Brisbane from the Maleny plateau.

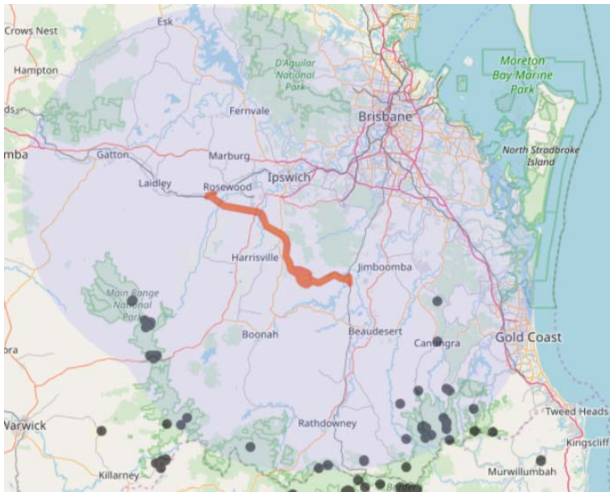


Figure 4.8 **Distribution range of the Three-toed snake-tooth skink in relation to the Project**

Source: ALA (2020)

4.4.2.4 Biology and reproduction

Examination of the Three-toed snake-tooth skink's stomach contents indicates that they eat earthworms, beetle larvae and insects. It is believed that they encounter earthworms on the forest floor at night and in the loose soil that the skink burrows (DotEE 2018).

Females of the Three-toed snake-tooth skink have been recorded with 2 to 6 oviducal eggs. Records show that eggs (23.7 to 28.9 mm) are large for a skink of this size (DotEE 2018).

4.4.3 Habitat

The Three-toed snake-tooth skink has been found in loose, well mulched friable soil, in and under rotting logs, forest litter, bark and under decomposing cane mulch. In Queensland, the Three-toed snake-tooth skink has been recorded in rainforest, closed forest, wet sclerophyll forest, tall open Blackbutt forest, tall layered open eucalypt forest and closed Brush Box forest and regrowth in heavily logged areas. In NSW, the Three-toed snake-tooth skink has been recorded in dry rainforest, northern warm temperate rainforest, subtropical rainforest, grassy wet sclerophyll forest and shrubby sclerophyll forest (DotEE 2018; OEH 2018).

4.4.4 Threatening processes

The following have been identified as potentially threatening processes to the Three-toed snake-tooth skink:

- Clearing of habitat for agriculture and grazing,
- Removal of fallen logs and leaf litter through frequent fire
- Soil compaction from livestock grazing
- The domestic cat and the red fox are also known to prey on skinks (DotEE 2018; OEH 2018).

4.4.5 Threat abatement/recovery plans

The following threat abatement/recovery plan has been identified as relevant for this species:

- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from **https://www.environment.nsw.gov.au/savingourspeciesapp/ViewFile.aspx?ReportProjectID=316&ReportProfileID=10131**. In effect under the BC Act 2016.

4.4.6 Summary of threat abatement/recovery plans

Coeranoscincus reticulatus is assigned to the landscape species management under the NSW *Saving our Species Program* as it is distributed over a large area and is subject to threatening processes that effect at the landscape scale.

Threats identified in the Saving our Species program include:

- Alterations to fire regime resulting in a loss of habitat within rainforest (considered to be an emerging threat due to climate change)
- Grazing stock causing loss of leaf litter and compaction of soil
- Firewood collection resulting in reduced habitat in fallen logs and leaf litter
- Habitat degradation, loss of shelter and forage habitat through feral pig activity.

Management activities to protect this species at the sites are:

- Raise awareness with relevant landholders and reduce deliberate burning that is likely to affect this species
- Promote strategic grazing that maintains the structure and function of the ground layer
- Educate private and commercial firewood collectors on the importance of retaining woody debris in areas of known habitat
- Identify important areas of habitat within state forests so disturbance to the ground layer can be minimised
- Monitor pig activity in the species habitat and control via cage trapping and/or poison ground-baiting.

4.4.7 References

Atlas of Living Australia (2018). *Saiphos reticulatus*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:25b1747b-a67b-4603-9d13-e98da9a0122e#overview [Accessed 23 August 2018].

Department of the Environment and Energy (2018). *Coeranoscincus reticulatus* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59628 [Accessed 23 August 2018].

Lewis Ecological (2016). *Additional Crossing of Clarence River at Grafton: Biodiversity Gap Field Survey (Stage 2) March 2016*. Available from: http://www.rms.nsw.gov.au/documents/projects/northern-nsw/grafton-clarence-river-crossing/biodiversity-gap-field-survey-2016-03.pdf [Accessed 23 August 2018].

Office of Environment and Heritage, NSW (2018). *Three-toed Snake-tooth Skink - profile*. Available from: https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10172 [Accessed 23 August 2018].

5 Fauna– Threatened species – Mammals

5.1 Brush-tailed rock-wallaby (*Petrogale penicillata*)

5.1.1 Status

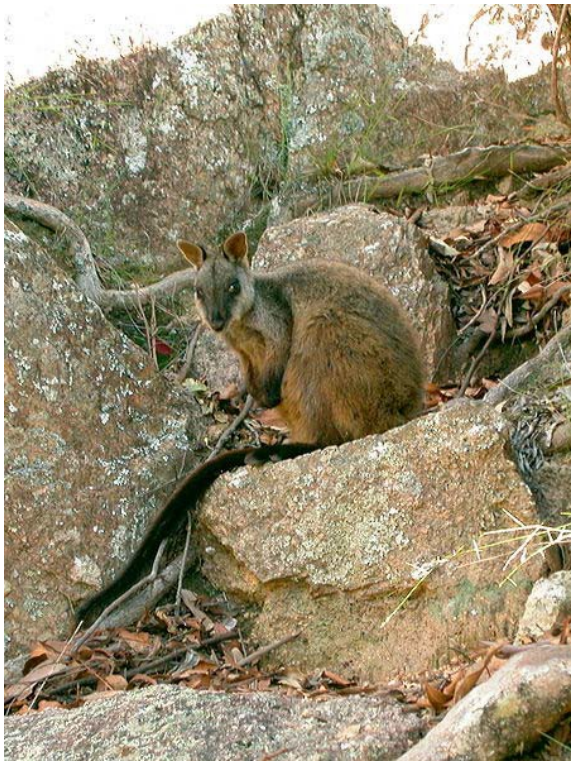
EPBC Act – Vulnerable

NC Act – Vulnerable

5.1.2 Biology and ecology

5.1.2.1 Characteristic

The male Brush-tailed rock-wallaby (*Petrogale penicillata*) is typically larger than the female and generally weigh 5.5 to 10.9 kg with females weighing 4.9 to 8.2 kg. Males grow to 529 to 586 mm and females to 510 to 570 mm in head-body length. Individuals are brown above, tending to be rufous on the rump and grey on the shoulders. Typically, the chest and belly is paler, with some individuals possessing a white blaze on the chest. The Brush-tailed rock-wallaby has a white to buff cheek stripe and a black dorsal stripe from the forehead to the back of the head. The exterior of the ears is black, and inside the ears is buff (refer Photograph 5.1). Individuals from the north of the species range tend to be lighter and have a less prominent tail brush (DotEE 2018).



Photograph 5.1 Brush-tailed rock-wallaby

Source: Fergus (2004)

5.1.2.2 Known distribution

Populations of the Brush-tailed rock-wallaby occur throughout the Great Dividing Range from the border with NSW to Nanango, 100 km northwest of Brisbane (refer Figure 5.1). Although there are no recent surveys published from Queensland, this species is considered to be declining and vulnerable, with the population in Lamington National Park now considered to be extinct (Clancy and Close 1997; Eldridge and Close 1992; Maxwell et al. 1996).

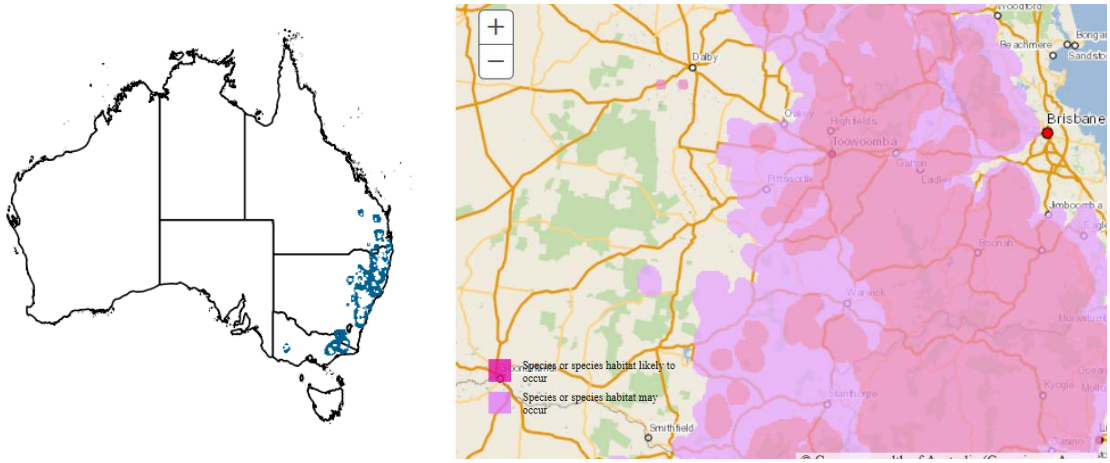


Figure 5.1 **Distribution range of the Brush-tailed rock-wallaby**

Source: ALA (2018), DotEE (2018)

5.1.2.3 Distribution in relation to the Project

Database records indicate *Petrogale penicillata* has been recently recorded (2018) within the MNES study area where it intersects with the Teviot Range, although there is substantial spatial uncertainty (29 km) as to the exact location. There are numerous records from the Flinders Peak/Teviot Range area within 10 km north of the MNES study area which may indicate this could be an important source population (refer Figure 5.1 in Appendix C). This is effectively an isolated colony and is at the eastern limit of its local distribution. Other database records occur to the north-west and south-west of the Project, many within the 50 km buffer (ALA 2020).

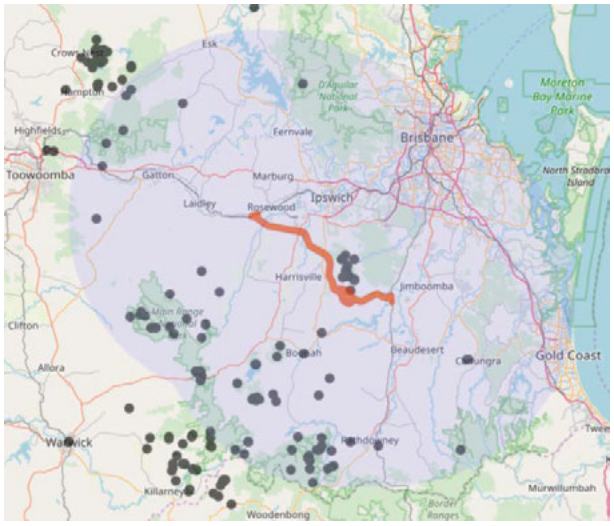


Figure 5.2 **Distribution range of the Brush-tailed rock-wallaby in relation to the Project**

Source: ALA (2020)

5.1.2.4 Biology and reproduction

The diet of the Brush-tailed rock-wallaby consists primarily of grasses (35 to 50%), forbs (25 to 40%) and "browse" (shrubs, trees and climbers) (12 to 30%) with ferns and sedges constituting a very minor component. Brush-tailed rock-wallabies typically forage at night (DotEE 2018).

Sexual maturation of females occurs at 18 months and males at 20 to 24 months. Brush-tailed rock-wallabies are a polygamous species and a dominant male will be found with up to four females. They appear to live in family groups of two to five adults and usually one or two juveniles and sub-adult individuals, but are also known to occur in male-female pairs (DotEE 2018; DES 2018).

Females give birth to one pouch young at a time, after a gestation period of approximately 30 days. The young remain in the pouch for six months. Weaning is believed to occur 86 days after leaving the pouch, when the joey is nine months old (DotEE 2018).

5.1.3 Habitat

The Brush-tailed rock-wallaby prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks. However, it is also known to use tree limbs (DotEE 2018)

Rocky outcrops appear crucial to current habitat selection by rock-wallabies, however, vegetation structure and composition is also considered to be an important factor determining habitat suitability. In many parts of their range, including at the Warrumbungles, Brush-tailed rock-wallabies are closely associated with dense arboreal cover, especially fig trees. The vegetation on and below the cliff appear to be important to this species as a source of food and shelter and in some cases may provide some protection from predation. A range of vegetation types are associated with Brush-tailed rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest (DotEE 2018).

Brush-tailed rock-wallabies are known to shelter during the day in rock crevices, caves and overhangs, but have been observed to bask in exposed sunny spots. Within their home range, rock-wallabies habitually use the same refuges, sunning spots, feeding areas and pathways and these are often defended vigorously (DotEE 2018).

Brush-tailed rock-wallabies select foraging locations that tend to be more open and with a greater abundance of short green grasses and forbs than other locations nearby. Foraging Brush-tailed rock-wallabies do not favour areas that are concealed by tussocks or near to the cliffs (DotEE 2018).

5.1.4 Threatening processes

The following have been identified as potentially threatening processes to the Brush-tailed rock-wallaby:

- Habitat modification continues due to rural, residential and tourist developments have led to changes in vegetation structure, extent, species assemblages and species proportions (DEC 2005)
- Other impacts also include changed fire regimes, competition from exotic herbivores, land degradation, altered nutrient status, and even altered behaviour and numbers of other native animals (DEC 2005)
- The invasion of grassy feeding areas by weed species such as Lantana is thought to reduce habitat quality for the species (DotEE 2018)
- Predation from domestic cats, red foxes and wild dogs are known threats to *P. penicillata* (DotEE 2018)
- Brush-tailed rock-wallabies are found in small, fragmented populations which exhibit low migration rates and are highly vulnerable to local catastrophes, predations, inbreeding and the associated loss of genetic variation (DEC 2005)
- Bioclimatic changes resulting in lower rainfall and a decline in rainforest vegetation, may have contributed to the recently contracting distribution of *P. penicillata* throughout its range (DEC 2005).

5.1.5 Threat abatement/recovery plans

The following threat abatement plans have been identified as being relevant for this species:

- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats**. In effect under the EPBC Act from 23-Jul-2015.

- Department of the Environment and Energy (2016). Threat abatement plan for competition and land degradation by rabbits. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-rabbits-2016. In effect under the EPBC Act from 07-Jan-2017.
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Threat abatement plan for predation by the European red fox. DEWHA, Canberra. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox. In effect under the EPBC Act from 01-Oct-2008.
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Threat abatement plan for competition and land degradation by unmanaged goats. DEWHA, Canberra. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-unmanaged-goats. In effect under the EPBC Act from 01-Oct-2008.

The following Recovery plan has been identified as being relevant to this species:

- Menkhorst, P. & E. Hynes (2010). National Recovery Plan for the Brush-tailed Rock-wallaby Petrogale penicillata. Department of Sustainability and Environment, East Melbourne. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/brush-tailed-rock-wallaby-petrogale-penicillata. In effect under the EPBC Act from 10-Feb-2012.

5.1.6 Summary of threat abatement/recovery plan

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

Threats identified in the threat abatement plan for competition and land degradation by rabbits includes:

- Competition with native wildlife for food and shelter
- Prevention of plant regeneration
- Increased grazing pressure and damage to native vegetation
- Altering the regular process of plant succession
- Altering ecological communities and impacting soil structure and nutrient cycling contributing to serious erosion
- Increasing predation and reducing reproduction for native arboreal mammals and birds through the removal of critical habitat.

Threat abatement actions for rabbits include:

- Supress rabbit populations at the landscape scale below thresholds in identified priority areas
- Gain a better understanding of the impacts rabbits have and their interactions with other species and ecological processes
- Increase the effectiveness of rabbit control programs
- Increase engagement within the local community to provide awareness of the environmental impact of rabbits and the need for integrated control.

Threats identified in the threat abatement plan for competition and land degradation by unmanaged goats relevant this species include:

- Overgrazing by goats and resulting soil erosion
- Introduction of weeds through seeds carried in their dung.

The primary focus of the abatement plan is the control of unmanaged goat populations. The main objectives of controlling unmanaged goats are:

- Prevent unmanaged goats from occupying new areas in Australia and eradicate them from high-conservation value areas
- Promote the maintenance and recovery of native species and ecological communities that are affected by competition and land degradation by unmanaged goats
- Improve knowledge and understanding of unmanaged goat impacts and interactions with other species and other ecological processes
- Improve the effectiveness, target specificity, integration and humaneness of control options for unmanaged goats
- Increase awareness of all stakeholders of the objectives and actions of threat abatement plan, and of the need to control unmanaged goats.

The conservation strategy for National Recovery Plan for the Brush-tailed Rock-wallaby Petrogale penicillata identifies the following priority management sites:

- Victoria: Grampians Range - Moora Moora Creek (Grampians National Park)
- Victoria: East Gippsland – Little River Gorge (Snowy River National Park)
- New South Wales: Warrumbungle Range
- New South Wales: Mt Kaputar
- New South Wales: Wollemi National Park and Jenolan Caves
- New South Wales: Nattai National Park
- New South Wales: Shoalhaven
- New South Wales: Macleay Gorges region.

Threats outlined in the conservation strategy for National Recovery Plan for the Brush-tailed Rock-wallaby *Petrogale penicillate* include:

- Historical hunting and persecution for fur and meat
- Habitat degradation and loss
- Predation from native and feral species
- Competition with native and introduced herbivores
- Decline in genetic diversity.

Objectives and actions outlined in the conservation strategy for National Recovery Plan for the Brush-tailed Rock-wallaby *Petrogale penicillate* include:

- Determine threats faced by the species
- Determine current distribution, abundance and population trends
- Establish and maintain a captive population
- Perform translocations to improve the genetic robustness of existing populations.

Investigate key ecological and biological aspects of the species for conservation management.

5.1.7 References

Atlas of Living Australia (2018), *Petrogale penicillata.* Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:7a7a2817-26e7-44bd-bb34-1dc9c1ed4d38 [Accessed 21 August 2018].

Department of Environment and Conservation (2005). Draft Recovery Plan for the Brush-tailed rock-wallaby, *Petrogale penicillata*. Sydney, NSW: Department of Environment and Conservation.

Department of the Environment and Energy (2018). *Petrogale penicillata* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=225 [Accessed 21 August 2018].

Fergus, G (1994). *Brush-tailed rock-wallaby* (Image) [Online] Available from: http://thewebsiteofeverything.com/animals/mammals/Diprotodontia/Macropodidae/Petrogale/Petrogale-penicillata.html [Accessed 21 August 2018].

Jarman, P.J. and Phillips C.M. (1989). Diets in a community of macropod species. In: Grigg, G., P. Jarman and I. Hume, eds. Kangaroos, Wallabies and Rat-kangaroos. 1:143-149. Chipping Norton, NSW: Surrey Beatty and Sons.

5.2 Greater glider (*Petauroides volans*)

5.2.1 Status

EPBC Act – Vulnerable

5.2.2 Biology and ecology

5.2.2.1 Characteristic

The Greater glider (*Petauroides volans*) is the largest species of gliding possum with a head-body length of 350 to 460 mm and a long furry tail measuring 450 to 600 mm. It has large ears fringed with thick fur and a gliding membrane which attaches to the elbows and ankles. Its thick fur is white or cream below but the upperparts can vary from dark grey to dusky brown through to light mottled grey and cream (refer Photograph 5.2). It also has strongly reflective eyeshine in the beam of a spotlight (DotEE 2018; OEH 2018).

Photograph 5.2 Greater glider (*Petauroides volans*)

Source: Thomson (2002)

5.2.2.2 Known distribution

The Greater glider occurs in Eucalypt forests along the ranges and coastal plains of eastern Australia from Central Victoria near Daylesford to the Windsor Tablelands in far northern Queensland (refer Figure 5.3). It has an elevational range from sea level to 1,200 m above sea level (DotEE 2018, OEH 2018; TSSC 2016).

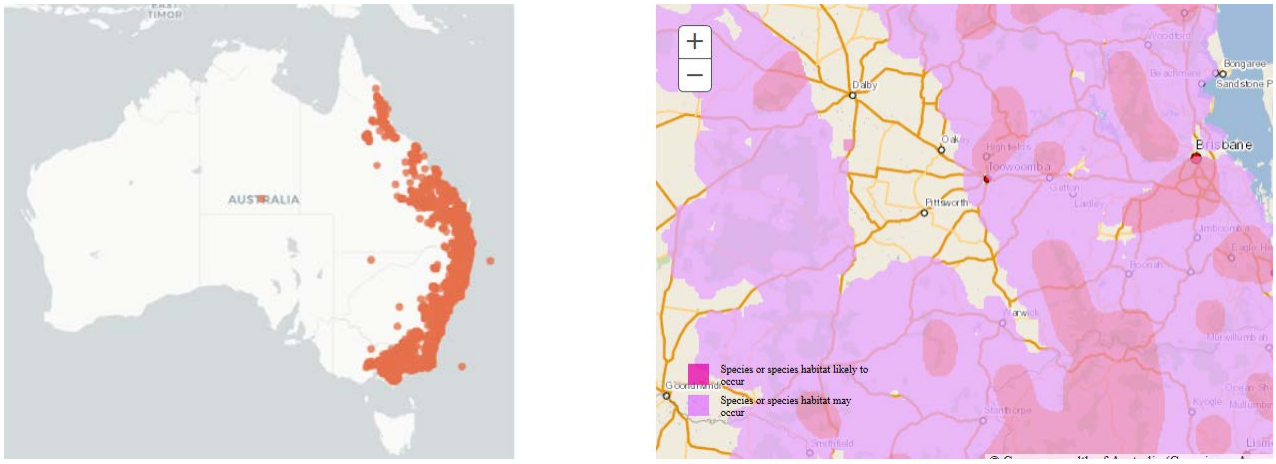


Figure 5.3 Distribution range of the Greater glider

Source: ALA (2018), DotEE (2018)

5.2.2.3 Distribution in relation to the Project

The species has not been recorded during Project-associated surveys. Database records indicate this species has occurred within the MNES study area. The nearest database record (1999) is approximately 500 m north of the disturbance footprint in the Peak Crossing area (refer Figure 5.4). A second record (1989) lies approximately 5 km north of the Project between Rosewood and Marburg. Other database records occur in all directions around the Project, many within the 50 km buffer (AoLA 2020) (refer Figure 5.4). The species occurs from south-east Australia to central and north-east Queensland. The northern subspecies (*Petauroides volans minor*) occurs on the Atherton Tablelands. Other database records occur in all directions around the Project, many within the 50 km buffer (ALA 2020).

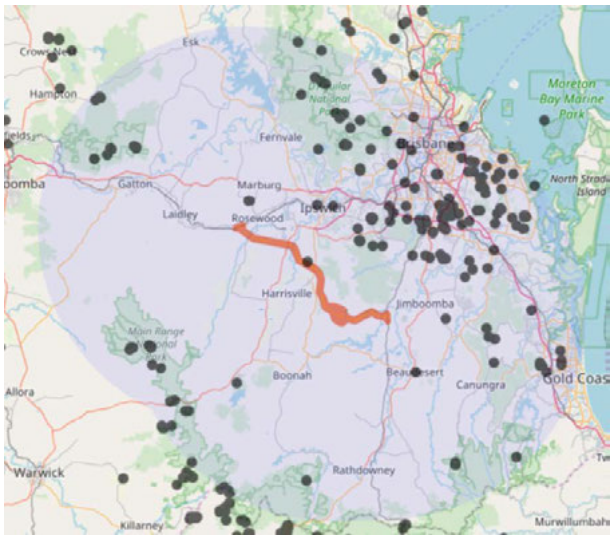


Figure 5.4 **Distribution range of the Greater glider in relation to the Project**

Source: ALA (2020)

5.2.2.4 Biology and reproduction

The Greater glider is nocturnal and feeds solely on young leaves and flower buds of specific eucalypts. Similarly to koalas, what eucalypt species Greater gliders feed on depends on what species are available to the specific populations in the immediate area. For example, in the Redlands, Queensland, their species of preference are *Eucalyptus tereticornis, Eucalypyus pilularis, Eucalyptus racemosa, Eucalyptus sideroploia, Eucalyptus resinifera, Eucalyptus carnea, Eucalyptus crebra, Eucalyptus major, Eucalyptus propinqua, Eucalyptus microcorys* and *Corymbia maculate* (Menkhorst and Knight 2011; RCC 2008)

They are usually solitary, though mated pairs and offspring will share a den during the breeding season and until the young are independent. Mating occurs from March to June and the female gives birth to a single young in late autumn or early winter. The young remains in the pouch for approximately 4 months and then rides on the mothers back until the age of 9 months when it is considered independent. Sexual maturity is reached in the second year. Longevity is estimated at 15 years and they have a relatively low reproductive rate (DotEE 2018; OEH 2018; TSSC 2016).

5.2.3 Habitat

The Greater glider is largely restricted to eucalypt forests and woodlands. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows but the distribution may be patchy even in suitable habitat. The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. They tend to prefer more open woodlands with larger spaces between trees so they have room to glide (DotEE 2018).

During the day they shelter in large hollows in large, old trees. In southern Queensland, greater gliders require at least 2 to 4 live den trees for every 2 ha of suitable forest habitat. Home ranges are relatively small (1 to 4 ha), with male home ranges being largely non-overlapping. They are known to be very loyal to their territory (DotEE 2018).

5.2.4 Threatening processes

The following have been identified as potentially threatening processes to the Greater glider:

- Habitat loss and fragmentation from development and clear fell operations are major issues for the Greater glider
- Fires that are too frequent or intense and unsustainable timber production can lead to direct impacts and or loss of habitat
- Changes in vegetation due to climate change, barbed wire fencing and increased predation from native and introduced predators are also threats facing the Greater glider populations (TSSC 2016).

5.2.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

5.2.6 References

Atlas of Living Australia (2018). *Petauroides volans*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:7e891f26-c72e-4b29-98db-1cd10c4eaa6d#overview [Accessed 24 August 2018].

Department of the Environment and Energy (2018). *Petauroides volans* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=254 [Accessed 21 August 2018].

Thomson B. (2002). *Petauroides volans* (greater glider). (Image) [Online] Available from: https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?petauroides-volans#prettyPhoto [Accessed 24 August 2018].

Office of Environment and Heritage, NSW (2017). Greater Glider *Petauroides volans* in the Seven Mile Beach National Park area - profile. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20324 [Accessed 24 August 2018].

Redlands City Council (2008). Biodiversity Research Projects: Greater Gliders. Available from: http://www2.redland.qld.gov.au/EnvironmentWaste/EnvironmentPlans/Documents/Greater%20Gliders.pdf [Accessed 24 August 2018].

Threatened Species Scientific Committee (2016). Conservation Advice on greater glider (*Petauroides volans*). Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/254-conservation-advice-05052016.pdf [Accessed 24 August 2018].

5.3 Grey-headed flying-fox (*Pteropus poliocephalus*)

5.3.1 Status

EPBC Act – Vulnerable

5.3.2 Biology and ecology

5.3.2.1 Characteristic

The Grey-headed flying-fox (*Pteropus poliocephalus*) weighs approximately 600 g to 1 kg, and typically measures 23 cm to 28 cm from head to body. The Grey-headed flying fox exhibits a collar of orange/brown around its neck, whilst its head is covered in light grey. The fur on the body is grey, often with flecks of white and ginger (refer Photograph 5.3). The fur on the back exhibits two morphs, which are possibly related to age, moult, or sub-population. Winter fur is typically darker than summer fur, and pronounced moulting is known to occur in June (DotEE 2018).

Photograph 5.3 Grey-headed flying-fox (*Pteropus poliocephalus*)

Source: Leo (2010)

5.3.2.2 Known distribution

The Grey-headed flying-fox occurs in the coastal belt of Eastern Australia, typically ranging from Rockhampton in central Queensland to Melbourne in Victoria (refer Figure 5.5). It is noted that only a small portion of this range is used at any one time, as the species selectively forages where resources are available (DotEE 2018).

The availability of food resources have a direct influence on the occurrence and relative abundance within the Grey-headed flying foxes distribution in various seasons and years (DotEE 2019).

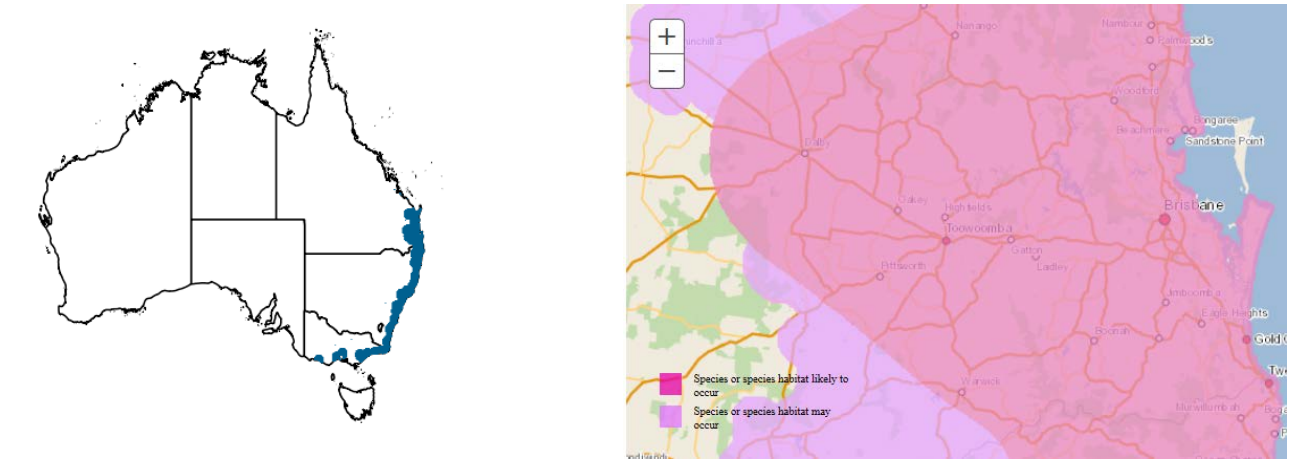


Figure 5.5 **Distribution range of the Grey-headed flying-fox**

Source: ALA (2018), DotEE (2018)

5.3.2.3 Distribution in relation to the Project

Database records indicate this species has not been recorded within the MNES when however has commonly occurred within 50 km of the Project. There are three recent database records (post 2007) located within 5 km north of the Project in the Teviot Range area. Database searches indicate a large number of records in all directions around the Project, although these are largely concentrated to the north (ALA 2020). The species distribution extends from Rockhampton south to Victoria and South Australia. The MNES study area is not at the limit of the species range. Based on quarterly flying-fox data collected by DES in the south-east Queensland region there are five Flying-fox camps located within 20 km of the Project which regularly comprise Grey-headed flying-fox: three in the Ipswich area, one at Laidley, and one from Cedar Grove (east of Kagaru).

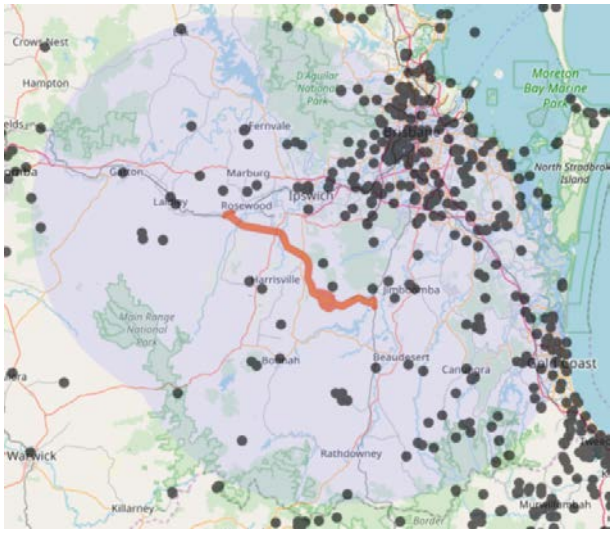


Figure 5.6 **Distribution range of the Grey-headed flying-fox in relation to the Project**

Source: ALA (2020)

5.3.2.4 Biology and reproduction

Nectar and pollen from *Eucalyptus*, *Corymbia, Angophora, Melaleuca*, and *Banksia* species are considered the primary food source for Grey-headed flying foxes. This species is known to supplement its diet with a wide range of rainforest fruits and introduced species (Duncan et al. 1999; DotEE 2019).

Mating is known to occur in the early autumn months, after which time the larger camps begin to separate, reforming in late spring/early summer when food resources become more abundant. Males and females typically separate in October, when the young are born. Each year, following six months of gestation, females bear a single young. For one month after giving birth, the mother carries her offspring on her ventral surface to feeding sites. When completely furred, the young are left in maternal camps, and are nursed until they are independent, at approximately 12 weeks of age. Sexual maturity typically occurs at about three years of age (DotEE 2018).

5.3.3 Habitat

The Grey-headed flying-fox is a canopy-feeding species that eats fruit and nectar. This species utilises a range of vegetated habitats, including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. In an urban setting, this species is known to feed on commercial fruit crops, and on introduced tree species (DotEE 2018).

Roost sites are generally located near water bodies. This species is known to roost in vegetation ranging from rainforest, *Melaleuca* stands, mangroves and riparian vegetation. The species has a high level of roost site fidelity, although new sites have been known to be colonised (DotEE 2018).

5.3.4 Threatening processes

The following have been identified as potentially threatening processes to the Grey-headed flying-fox:

- Clearing of native vegetation for agriculture and forestry operations has accelerated the destruction and disturbance of roosting and foraging habitats of the species in eastern Australia (DotEE 2018; Duncan et al. 1999; SEAC 1996; Teagle 2002)
- Lack of foraging resources can also force Grey-headed flying-foxes into commercial fruit crops, increasing conflict with growers and subsequent culling of individuals (DotEE 2018)
- Urban-dwelling Grey-headed flying-foxes can accumulate lethal levels of lead from the environment and are prone to electrocution on powerlines (DotEE 2018)
- Displacement leading to competition and hybridisation with the Black Flying-fox (*P. alecto*) is also a known threat (DotEE 2018).

5.3.5 Threat abatement/recovery plans

The following threat abatement/recovery plan has been identified as being relevant for this species:

- Office of Environment and Heritage (2017). Saving our Species: Help save the Grey-headed Flying-fox. New South Wales Government. Available from: **https://www.environment.nsw.gov.au/savingourspeciesapp/ViewFile.aspx?ReportProjectID=785&ReportProfileID=10697**.

5.3.6 Summary of threat abatement/recovery plan

Threats identified in the Saving our Species plan includes:

- Loss of roosting and foraging sites
- Human animal conflict
- Heat stress.

Management actions outline in the Saving our Species plan includes:

- Increase extent and viability of foraging and roosting habitat through habitat creation and restoration
- Liaise with landholders to strike agreements to protect and retain high quality foraging and roosting habitat

- Rehabilitate degraded nesting and foraging habitat managing invasive flora and understorey vegetation to provide suitable microclimate conditions establishing a buffer between bat camps to avoid conflict with people
- Provide education and awareness around the species to foster acceptance and reduce anti-sentiment
- Develop site-based heat stress management strategies recording and sharing data for future heat stress events.

5.3.7 References

Atlas of Living Australia (2018). *Pteropus poliocephalus*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:a2553aed-383a-4c9b-9534-c6058bcee81b# [Accessed 24 August 2018].

Department of the Environment and Energy (2018). *Pteropus poliocephalus* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=186 [Accessed 24 August 2018].

Duncan, A., Baker, G.B and Montgomery, N. (1999), *The Action Plan for Australian Bats.* [Online]. Canberra: Environment Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/action/bats/index.html. [Accessed 24 August 2018].

Leo (2010). *Pteropus poliocephalus*. (Image) [Online] Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:a2553aed-383a-4c9b-9534-c6058bcee81b [Accessed 24 August 2018].

5.4 Koala (*Phascolarctos cinereus*)

5.4.1 Status

EPBC Act – Vulnerable

5.4.2 Biology and ecology

5.4.2.1 Characteristics

The Koala (*Phascolarctos cinereus*) is an arboreal marsupial, with a stocky body, large rounded ears, sharp claws and has grey-coloured fur (refer Photograph 5.4). This species displays sexual dimorphism (males generally are larger than females), with male Koalas weighing approximately 6.5 kg (DotEE 2018).

Photograph 5.4 Koala (*Phascolarctos cinereus*)

Source: DES (2018)

5.4.2.2 Known distribution

The Koala is distributed along the east coast of Australia extending from Queensland to NSW (refer Figure 5.7). In Queensland, the Koala's distribution extends across several bioregions, encompassing a great diversity of habitats with the greatest concentration on southeast Queensland. In NSW, the species occurs mostly in central and north coasts with populations known to inhabit the area west of the Great Dividing Range (DES 2018; OEH 2018).

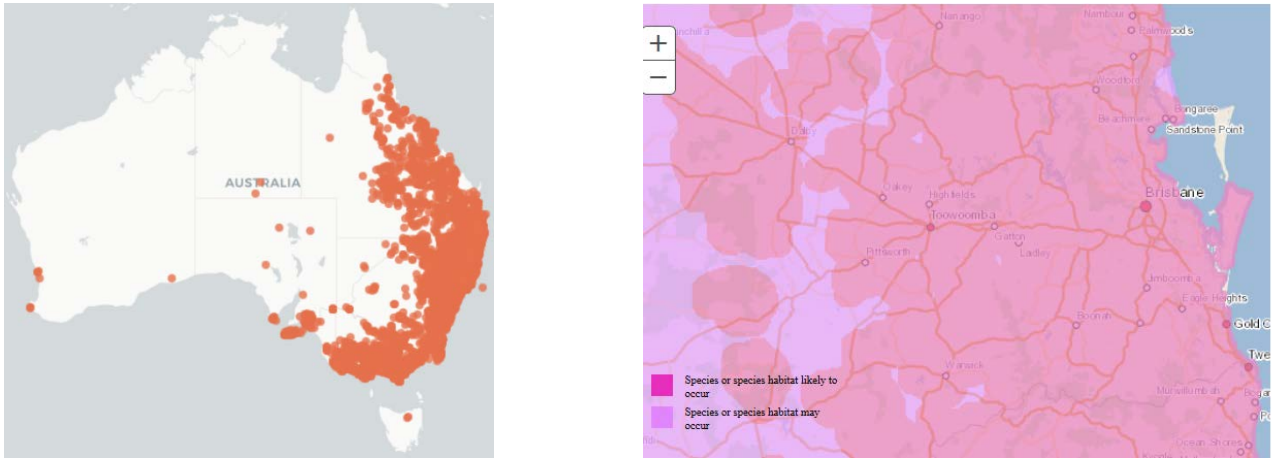


Figure 5.7 Distribution range of Koala

Source: ALA (2018), DotEE (2018)

5.4.2.3 Distribution in relation to the Project

Database records (i.e. AoLA & WildNet) indicated Koala has been identified as potentially occurring within the temporary and permanent disturbance footprint. A number of records occur within the MNES study area to the east of Purga Nature Reserve all from July 2015. More recent records (2019) occur to the west of Gum Tips Nature Reserve (Mount Forbes area) within the MNES study area (refer Figure 5.8). There are numerous records to the north of the eastern section of the MNES study area associated with the Flinders Peak reserves (AoLA 2020) (refer Figure 5.8 in Appendix B). Project associated surveys have recorded Koala very close to the disturbance footprint in the Peak Crossing area (GHD 2016) and within the MNES study area in the Ebenezer area. There have also been records of scats through much of the alignment.

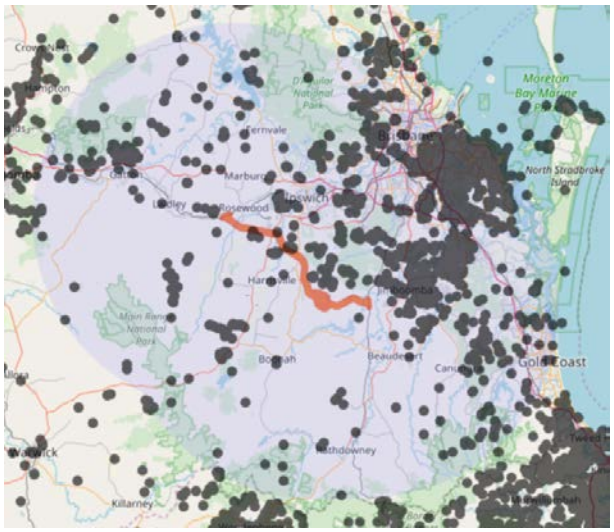


Figure 5.8 **Distribution range of Koala in relation to the Project**

Source: ALA (2020)

5.4.2.4 Biology and reproduction

The Koala is a leaf-eating specialist feeding primarily during dawn, dusk or during the night. Its diet is restricted mainly to foliage of Eucalyptus spp.; however, it may also consume foliage of related genera, including *Corymbia* spp.*, Angophora* spp. and *Lophostemon* spp. The Koala may, at times, supplement its diet with other species, including Leptospermum spp. and Melaleuca spp. (DotEE 2018).

Female Koalas can potentially produce one offspring each year with births occurring between October and May. The newly-born Koala lives in its mother's pouch for six to eight months and, after leaving the pouch, remain dependent on the mother, riding on her back. Young Koalas are independent from about 12 months of age (DotEE 2018).

5.4.3 Habitat

Koala habitat can be broadly defined as any environment containing Koala food tree species (*Eucalyptus* spp., *Corymbia* spp., *Angophora* spp. and *Lophostemon* spp.) or shelter trees. Preferred food and shelter trees are naturally abundant on fertile clayey soils (DotEE 2018).

Along the Great Dividing Range and the coastal belt throughout the species' range, Koalas inhabit moist forests and woodlands mostly dominated by Eucalyptus species. Koalas are also known to occur in highly modified (e.g. urbanised) or regenerating native vegetation communities (DotEE 2018).

5.4.4 Threatening processes

The following have been identified as potentially threatening processes to the Koala:

- Habitat loss, modification or fragmentation as a result of urbanisation
- Secondary threats such as predation by domestic dogs, vehicle strikes and stress
- *Chlamydia* which reduces the life expectancy of the species (OEH 2018; DES 2018).

5.4.5 Threat abatement/recovery plans

The following management strategy has been identified as being relevant for this species:

- National Koala Conservation and Management Strategy 2009-2014 (Natural Resource Management Ministerial Council (NRMMC), 2009) [Information Sheet].. Available from: http://www.environment.gov.au/system/files/resources/165139fc-3ab5-4c96-8b15-d11a1ad882ab/files/koala-strategy.pdf.

No threat abatement/recovery plan has been identified for this species.

5.4.6 Summary of threat abatement/recovery plan

Threats identified in the conservation and management strategy includes:

- Habitat loss, fragmentation and degradation
- Over-browsing
- Natural disasters
- Disease
- Vehicle collisions
- Predation by dogs
- Climate change.

Management actions outline in the conservation and management strategy includes:

- Identify key habitat with a high priority for protection
- Prioritise populations under immediate pressure
- Revegetate corridors between fragments to facilitate natural dispersal
- Establish a national database mapping habitat, distribution and density
- Establish and support existing surveying and monitoring programs
- Incorporate causes of habitat loss outside of land clearing into planning for habitat conservation
- Identify areas susceptible to severe tree defoliation early and regulate koala density
- Develop a national guideline for road design
- Implement strategies that minimise the impacts of dogs on koala populations
- Assess and develop appropriate methods to reduce vulnerability of populations to disease
- Encourage retention and restoration of koala habitat on private land
- Develop and distribute educational material
- Develop national guidelines that outline appropriate care, handling and management of koalas captive, sick, injured or orphaned koalas
- Identify the direction of research required to address the impacts of climate change on the species.

5.4.7 References

Atlas of Living Australia. (2018). *Phascolarctos cinereus*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:e9d6fbbd-1505-4073-990a-dc66c930dad6 [Accessed 22 August 2018].

Department of the Environment and Energy (2018). Phascolarctos cinereus (Koala) Species Profile and Threats Database. Australian Government. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85104 [Accessed 22 August 2018].

Department of Environment and Science (2017). Koala facts. Queensland Government. Available from: https://www.ehp.qld.gov.au/wildlife/koalas/koala-ecology.html [Accessed 22 August 2018].

Office of Environment and Heritage (2018). Koala - Profile. New South Wales Government. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10616 [Accessed 22 August 2018].

5.5 Large-eared pied bat (*Chalinolobus dwyeri*)

5.5.1 Status

EPBC Act – Vulnerable

5.5.2 Biology and ecology

5.5.2.1 Characteristic

The Large-eared pied bat (*Chalinolobus dwyeri*) is a medium-sized insectivorous bat measuring approximately 100 mm in length, and weighing 7 to 12 g. This species exhibits a shiny black coat, with a white stripe on the flank (underside) of each wing. The ears are large and the facial lobes are located on the lower lip, between the corner of the mouth and the bottom of the ear (refer Photograph 5.5). Its short, broad wings suggest that this species flies slowly, and with considerable manoeuvrability (DERM 2011; DotEE 2018).

Photograph 5.5 Large-eared pied bat (*Chalinolobus dwyeri*)

Source: DERM (2011)

5.5.2.2 Known distribution

The former and current distribution of the Large-eared pied bat is poorly known. Records for current distribution exist from Shoalwater Bay and inland to Carnavon in Queensland, through to Ulladulla, in NSW (refer Figure 5.9). It is thought that this species is uncommon and has a patchy distribution (DotEE 2018). The *National recovery plan for the Large-eared pied bat Chalinolobus dwyeri* (DERM 2011) identifies important populations as the largest known populations occurring in areas dominated by sandstone escarpments in Carnarvon National Park, Blackdown Tableland National Park, Expedition National Park and Isla Gorge National Park. The Shoalwater Bay population occurs at the northern limit for the species and has been identified as an important population when referring to DAWE's SPRAT database (2020).

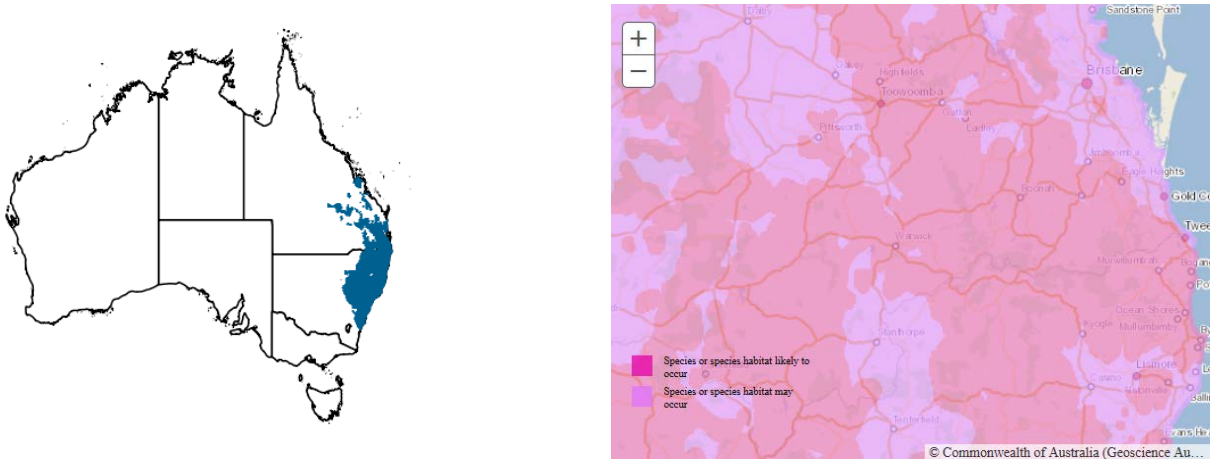


Figure 5.9 **Distribution range of the Large-eared pied bat**

Source: ALA (2018), DotEE (2018)

5.5.2.3 Distribution in relation to the Project

There are no known records of this species within or adjacent to the MNES study area. The nearest database record is from 1994 and located approximately 30 km south of the western extent of the Project at Shingle Hut Creek Nature Refuge, adjacent to Main Range National Park area are located 30 km south-east. Other more recent records (from the 2000s) are from the Lamington National Park area between 32 km and 45 km south-east of the eastern extent of the Project. There are no other records to the north, east or west within 100 km of the Project (ALA 2020).

Figure 5.10 **Distribution range of the Large-eared pied bat in relation to the Project**

Source: ALA (2020)

5.5.2.4 Biology and reproduction

The Large-eared pied bat feeds on insects flying at 6 to 10 m off the ground and along creek lines. It is unknown if it targets particular groups of insects (DotEE 2018; DERM 2011).

Females can give birth at one year of age, and males also appear capable of breeding at this age. Mating appears to occur in early winter. A nursery colony is typically established in September by both adult females and males, with the majority of adult males leaving by the time the young are born in early summer. Females are known to give birth to one or two young per year. By the end of March, the juveniles have left the roost. The adult females leave the roost after the juveniles, and the site is abandoned during the winter months. Life expectancy and natural mortality have not been determined (DotEE 2018).

5.5.3 Habitat

Available roosts are unevenly distributed throughout the landscape. Large-eared pied bats require a combination of sandstone cliffs/escarpments to provide roosting habitat that is adjacent to higher fertility sites (particularly box gum woodlands or river/rainforest corridors which are used for foraging) (DotEE 2018).

Large-eared pied bats have been observed in disused mine shafts, caves, overhangs and disused Fairy martin (*Hirundo ariel*) nests for shelter and to raise young. This species possibly also roosts in tree hollows, within dry and wet sclerophyll forest, Cyprus-pine dominated forest, tall open eucalypt forest with a rainforest sub-canopy, sub-alpine woodland, Brigalow and sandstone outcrop country. In southeast Queensland, the species has primarily been recorded from higher altitude, among moist tall open forest adjacent to rainforest (DotEE 2018).

'Sandstone cliffs and fertile wooded valley habitat within close proximity' is identified as habitat critical to the survival of the species. In SEQ this also includes rainforest and wet eucalypt habitats on volcanic substrates (DERM 2012).

5.5.4 Threatening processes

The following have been identified as potentially threatening processes to the Large-eared pied bat:

- Disturbance and damage to primary nursery sites by animals (particularly goats) and humans (DotEE 2018; TSSC 2012)
- Populations can be easily displaced as they roost in disused mines which often become active if commodity prices make them economical or they can be filled for safety reasons (DotEE 2018; TSSC 2012).

5.5.5 Threat abatement/recovery plans

The following threat abatement/recovery plan has been identified as relevant for this species:

- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from **https://www.environment.nsw.gov.au/savingourspeciesapp/Project.aspx?results=c&ProfileID=10157**. In effect under the BC Act 2016.

The following Recovery program is relevant for this species:

- Department of Environment and Resource Management (2011). National recovery plan for the large-eared pied bat Chalinolobus dwyeri. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from: **http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-large-eared-pied-bat-chalinolobus-dwyeri**. In effect under the EPBC Act from 10-Feb-2012.

5.5.6 Summary of threat abatement/recovery plan

Chalinolobus dwyeri is assigned as a data-deficient species under the NSW *Saving our Species Program* as there is insufficient information on ecology and distribution for effective management. Vegetation clearing for agricultural purposes is identified as the key threat. The key priority action is to address key knowledge gaps for this species through survey and investigating threat dynamics.

Major threatening processes for this species have not been clearly established, however threats to the *Chalinolobus dwyeri* in the National recovery plan for the large-eared pied bat are:

- Destruction of and interference to subterranean roosts and maternity sites
- Mining of roosts and mine induced subsidence of cliff lines
- Disturbance from human recreational activities such as bushwalking, caving and abseiling
- Habitat disturbance by other animals, including livestock and feral animals such as goats
- Predation by introduced predators such as cats, foxes and possibly rats
- Vegetation clearance in proximity of roosts causing habitat loss and fragmentation and reducing foraging resources
- Fire in proximity to roosts, potentially causing direct mortality from heat stroke and smoke.

Recovery objectives of the plan are:

- Identify priority roosts and maternity sites for protection and map known colonies in NSW and QLD
- Implement conservation and management strategies for priority sites, including foraging habitats
- Install bat gates to protect populations and stabilise site entrances (e.g. old mines)
- Implement fire prescriptions for areas around each identified priority roost or maternity site
- Control introduced species such as goats
- Undertake monitoring to assess the success of management strategies
- Conduct research to improve knowledge on species habitat requirements, roost and maternity sites, diet and foraging strategy and threatening process.

5.5.7 References

Atlas of Living Australia (2018). *Chalinolobus dwyeri*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:cddd224d-40ed-49d9-bb88-dcbfe064a35e#gallery [Accessed 24 August 2018].

Department of the Environment and Energy (2018). *Chalinolobus dwyeri* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=183 [Accessed 24 August 2018].

Threatened Species Scientific Committee (2012). *Commonwealth Listing Advice on* Chalinolobus dwyeri *(Large-eared Pied Bat)*. Department of Sustainability, Environment, Water, Population and Communities. Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/183-listing-advice.pdf. In effect under the EPBC Act from 29 June 2012.

5.6 Long-nosed potoroo (SE mainland) (*Potorous tridactylus tridactylus*)

5.6.1 Status

EPBC Act – Vulnerable

5.6.2 Biology and ecology

5.6.2.1 Characteristic

The Long-nosed potoroo (*Potorous tridactylus tridactylus*) (SE Mainland) is a medium sized marsupial. Males and females have a body length (excluding the tail) between 287 to 410 mm and 259 to 378 mm respectively. Males have longer tails and are typically heavier than females (740 to 1,640 g for males and 660 to 1,350 g for females). They can be identified by a brown-grey upper body and paler underbody. They have small round ears and a long nose that tapers with a small patch of skin extending from the snout to the nose (refer Photograph 5.6). Their tail is sparsely furred, tapered and marked with a white tip. They have only two pads on their hindfeet (DotEE 2018).

Photograph 5.6 Long-nosed potoroo (*Potorous tridactylus tridactylus*)

Source: Mulvaney (2017)

5.6.2.2 Known distribution

In NSW and Queensland, the Long-nosed potoroo (SE Mainland) has scattered populations east of the Great Dividing Range extending from south-eastern Queensland through to NSW (refer Figure 5.11). In Queensland the species has been recorded patchily from southeast of Gladstone to Lamington National Park and the Border Ranges. The species is also found in southern Victoria (DotEE 2018).

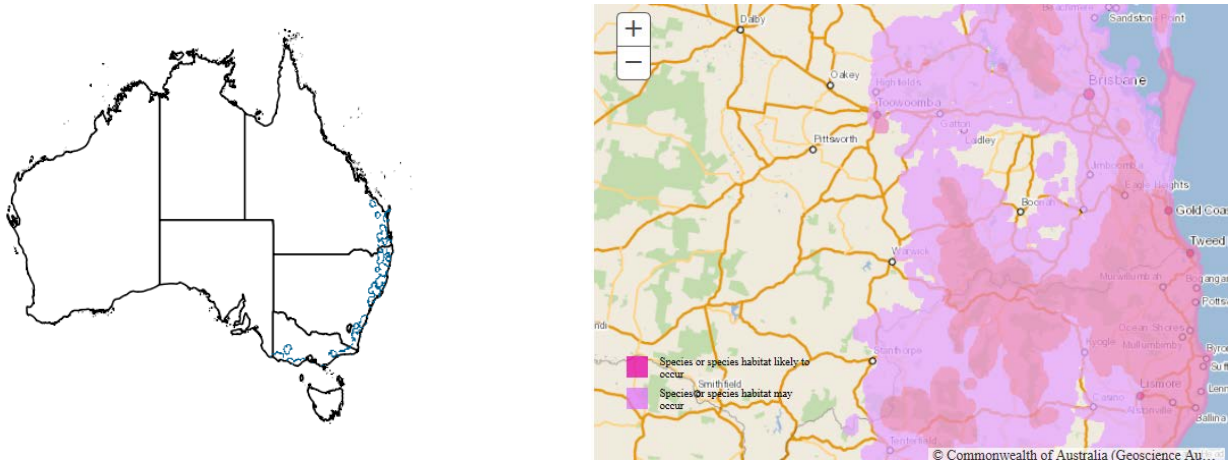


Figure 5.11 Distribution range of the Long-nosed potoroo (SE Mainland)

Source: ALA (2018), DotEE (2018)

5.6.2.3 Distribution in relation to the Project

Potorous tridactylus tridactylus has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA) indicate this species does not occur within the MNES study area however has occurred within 50 km of the Project. Species mapping on the SPRAT database shows the species or species habitat as 'may occur' only where the MNES study area intersects the Teviot Range (DAWE 2020). The nearest database records are from Mt Tamborine (1982) and Canungra (1976) and located 27 km south-east and 35 km south of the Project respectively. Other database records occurring within the 50 km buffer including the D'Aguilar Range (30 km to the north) and Main Range and Lamington National Parks (over 40 km to the south-west and south) (ALA 2020).

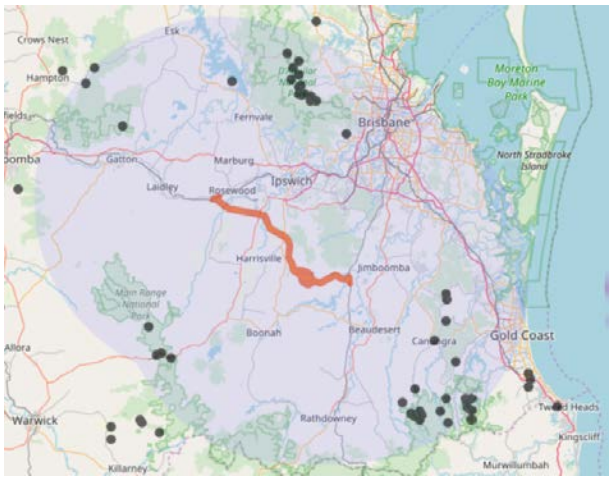


Figure 5.12 Distribution range of the Long-nosed potoroo (SE Mainland) in relation to the Project

Source: ALA (2020)

5.6.2.4 Biology and reproduction

The Long-nosed potoroo (SE Mainland) is known to consume flowers, fruits, seeds, leaves, stems, roots and bulbs. They also feed on both hypogeous and epigeous components of fungal fruit bodies as well as invertebrates (DotEE 2018).

The Long-nosed potoroo (SE mainland) breeds all year round a single joey is born after a gestation of 37 days and they remain in their mothers pouch for 100 to 125 days reaching sexual maturity at about 12 months. They have a lifespan of about 10 years (DES 2017, DotEE 2018).

5.6.3 Habitat

In NSW and Queensland, there is no consistent pattern to the habitat of the Long-nosed potoroo (SE Mainland); it can be found in wet eucalypt forests to warm temperate rainforest and coastal heaths and scrubs. The main habitat requirements appear to be some form of dense vegetation for shelter and the presence of light soils and an abundance of fungi (DotEE 2018; DES 2017).

5.6.4 Threatening processes

The following have been identified as potentially threatening processes to the Long-nosed potoroo:

- The main threat to the Long-nosed potoroo (SE Mainland) is predation by European Red Foxes and Feral Cats (DotEE 2018)
- Residential and industrial development has also caused habitat loss, degradation and fragmentation (DotEE 2018).

5.6.5 Threat abatement/recovery plans

No recovery plan has been identified as being relevant for this species. The following Threat abatement Plans are relevant for this species:

- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats. In effect under the EPBC Act from 23-Jul-2015.
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Threat abatement plan for predation by the European red fox. DEWHA, Canberra. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox. In effect under the EPBC Act from 01-Oct-2008.

5.6.6 Summary of threat abatement/recovery plans

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

Threats identified in the threat abatement plan for predation by the European red fox include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for the European red fox include:

- Baiting
- Biological control
- Barriers
- Habitat management
- Shooting and bounties.

5.6.7 References

Atlas of Living Australia (2018). *Potorous tridactylus*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:76cb4b83-1a55-4ff8-98ff-4e7eb6fc0c9b [Accessed 23 August 2018].

Department of the Environment and Energy (2018). *Potorous tridactylus* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66645 [Accessed 23 August 2018].

Department of the Environment and Science (2017). Long-nosed potoroo. Available from: https://www.ehp.qld.gov.au/wildlife/threatened-species/vulnerable/longnosed_potoroo.html [Accessed 23 August 2018].

Mulvaney, M. (1994). *Potorous tridactylus* (Image) [Online] Available from: https://canberra.naturemapr.org/Community/Sighting/3377980 [Accessed 21 August 2018].

5.7 New Holland mouse (Pseudomys novaehollandiae)

5.7.1 Status

EPBC Act – Vulnerable

5.7.2 Biology and ecology

5.7.2.1 Characteristics

The New Holland mouse (*Pseudomys novaehollandiae*) is a native small, burrowing rodent. The grey-brown mouse has a dusk-brown tail which is darker on the dorsal side with a head to body length of approximately 65 to 90 mm and a tail reaching 105 mm (DotEE 2018; OEH 2017) (refer Photograph 5.7).

Photograph 5.7 New Holland mouse (*Pseudomys novaehollandiae*)

Source: ALA (2018)

5.7.2.2 Known distribution

The known distribution of the New Holland mouse is fragmented along the east coast of Australian from Queensland through to Tasmania (refer Figure 5.13). The exact whereabouts of the New Holland mouse in Queensland, NSW, Victoria and Tasmania is still unknown however with further research currently being undertaken (DotEE 2018).

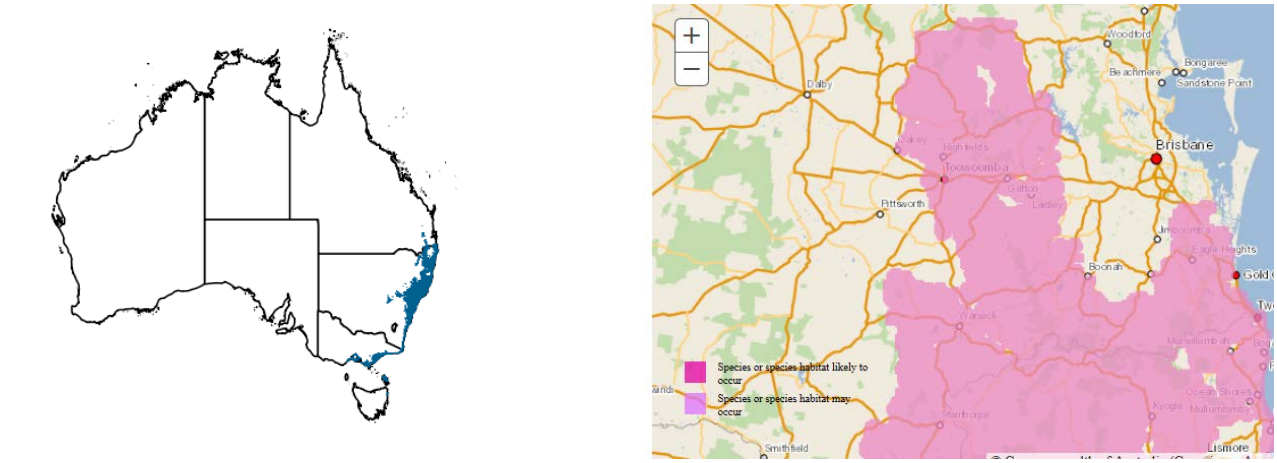


Figure 5.13 **Distribution range of New Holland mouse**

Source: ALA (2018), DotEE (2018)

5.7.2.3 Distribution in relation to the Project

Pseudomys novaehollandiae has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicate this species does not occur within the MNES study area but has occurred within 50 km of the Project. Species mapping on the SPRAT database shows the species or species habitat as 'may occur' only in the very western portion of the MNES study area near Laidley (this does not extend to the Teviot Range) (DAWE 2020). The nearest database record is from 1982 taken from approximately 27 km north-west of the Project near Gatton. The location data associated with this record appears dubious (recorded at a fast food takeaway in Gatton). More recent database records occur further north-west of this record in the Crow's Nest and Helidon areas (35 km north-west of the Project). There are also records (from 1997) approximately 40 to the south-west of the Project from Main Range National Park. The MNES study area is located outside of the potential distribution for the species (ALA 2020).

Figure 5.14 **Distribution range of New Holland mouse in relation to the Project**

Source: ALA (2020)

5.7.2.4 Biology and reproduction

The New Holland mouse is a nocturnal and omnivorous species feeding on seeds, insects, leaves, flowers as well as fungi. This social species lives in shared burrows, spending considerable time foraging above ground for food (DotEE 2018).

The known breeding period for the species occurs between August and January but can extend to autumn with slight variation between years producing litters ranging from 2 to 6. Female New Holland mouse are capable of producing two litters in a breeding season, with first year females produce one litter per season, and reach sexual maturity after 13 weeks than males, who take 20 weeks, with a generation length assumed to be 1.5 years. Reproduction however is strongly dependent on rainfall, resource availability, adult survival and recruitment (Woinarski and Burbidge 2016; DotEE 2018).

5.7.3 Habitat

The New Holland mouse is known to inhabit open heathlands, woodlands and forests with heathland understorey as well as vegetated sand dunes with peak abundance though to be early to mid-stages of vegetation succession typically induced by fire. However, in areas such as Tasmania and Victoria the species has been found living amongst landscapes not burnt for 16 to 30 years post fire in dunes vegetated by *Banksia allocasuarina* woodland with understorey dominated by sedges and low shrubs. The mouse also has a large home range between 0.44 to 1.4 ha (DotEE 2018; OEH 2017; Woinarski and Burbidge 2016).

5.7.4 Threatening processes

The following have been identified as potentially threatening processes to the New Holland mouse:

- Inappropriate fire regimes, as the species heavily depends on early to mid-stages of vegetation recovery post fire
- Predation by feral and domestic cats
- Fragmentation caused by clearing and reduced rainfall activity (Woinarski and Burbidge 2016).

5.7.5 Threat abatement/recovery plans

No recovery plan has been identified as being relevant for this species. The following threat abatement plans are relevant for this species:

- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats.** In effect under the EPBC Act from 23-Jul-2015.
- Department of the Environment and Energy (2018). Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi. Canberra: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/threat-abatement-plan-disease-natural-ecosystems-caused-phytophthora-cinnamomi-2018**. In effect under the EPBC Act from 22-Feb-2019.

5.7.6 Summary of threat abatement/recovery plans

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

The consequences of potential infection outlined in the threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomic* include:

- Inability of infected plants to develop new shoots, flowers, fruit and seed
- Complete loss of some flora populations
- Dramatic alteration to the structure and composition of native plant communities
- A severe reduction in primary productivity and functionality
- Irreversible habitat loss and degradation of dependent flora and fauna
- Loss of shelter and nesting sites and food sources resulting in major declines of fauna.

Objectives and actions outlined in the threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomic include:

- Identifying and prioritising the protection of biodiversity assets that are, or may be, impacted by Phytophthora including listed threatened species, ecological communities and areas where non-listed species or ecological communities that may become eligible for listing under the EPBC Act occur
- Reduce the spread and mitigate the impacts of Phytophthora to protect priority biodiversity assets and areas where non-listed species or ecological communities that may become eligible for listing under the EPBC Act
- Inform the community through education on the impacts that Phytophthora has on biodiversity and actions to mitigate these impacts
- Encourage research on Phytophthora species and option to manage infestations and protect biodiversity assets.

5.7.7 References

Atlas of Living Australia (2018). Pseudomys novaehollandiae. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:47a50ee8-7678-4d8e-8f8a-e11d12a46ec5 [Accessed 22 August 2018].

Department of the Environment and Energy (2018). Pseudomys novaehollandiae (New Holland Mouse, Pookilain) Species Profile and Threats Database. Australian Government. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=96 [Accessed 22 August 2018].

Office of Environment and Heritage (2017). New Holland Mouse - Profile. New South Wales Government. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20253 [Accessed 22 August 2018].

Woinarski, J. and Burbidge, A.A. (2016). Pseudomys novaehollandiae. The IUCN Red List of Threatened Species 2016. Available from: http://www.iucnredlist.org/details/18552/0. [Accessed 26 August 2018].

5.8 Northern quoll (*Dasyurus hallucatus*)

5.8.1 Status

EPBC Act – Endangered

5.8.2 Biology and ecology

5.8.2.1 Characteristic

Male Northern quolls (*Dasyurus hallucatus*) have a head-body length of 270 to 370 mm, weighing between 340 to 1,120 g. Females are smaller with a head-body length of 250 to 310 mm, and weighing between 240 to 690 g. Northern quolls have reddish brown fur with white spots on their back and a cream underside. It has a long, sparsely-furred, unspotted tail (refer Photograph 5.8). Their tail length ranges between 202 and 345 mm and their hindfeet have striated pads and five toes (Oakwood 2008).

Photograph 5.8 Northern quoll (*Dasyurus hallucatus*)

Source: Australian Wildlife Conservancy (2018)

5.8.2.2 Known distribution

Historically common across northern Australia, occurring almost continuously from the Pilbara, Western Australia, to near Brisbane, Queensland, the Northern quoll now occurs in five regional populations across Queensland, the Northern Territory and Western Australia (refer Figure 5.15). Known Queensland populations occur as far south as Gracemere and Mt Morgan, to Weipa in the north and west into central Queensland near Carnarvon Range National Park. The species is highly fragmented with severe reductions from the species' former distribution. There are occasionally records as far south as Maleny on the sunshine coast hinterland and the species and or species habitat is likely to extend as far south as Millmerran (DotEE 2018; DES 2018; McGoldrick 2013; Woinarski et al. 2008).

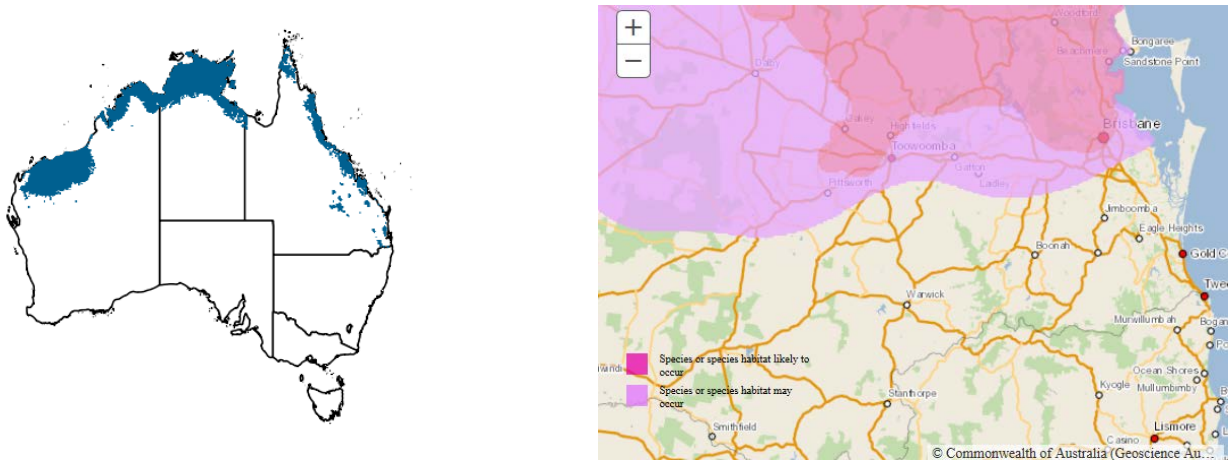


Figure 5.15 Distribution range of the Northern quoll

Source: ALA (2018), DotEE (2018)

5.8.2.3 Distribution in relation to the Project

Dasyurus hallucatus has been predicted to occur within the region and associated habitat within the MNES study area. Database records (i.e. AoLA, WildNet) indicate that a previous record of this species (1966) occurs approximately 50 km from the Project alignment between Crows Nest National Park and Ravensbourne National Park to the north-west of the Project. More recent records exist to the west, north-west and north of the Project but none occur within 50 km of the MNES study area.

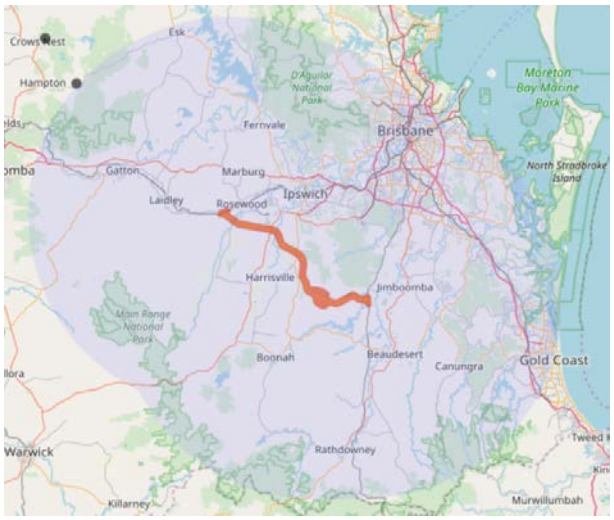


Figure 5.16 Distribution range of the Northern quoll in relation to the Project

Source: ALA (2020)

5.8.2.4 Biology and reproduction

Northern quolls are nocturnal predators of invertebrates such as beetles, grasshoppers, spiders, scorpions and centipedes, but they also eat small mammals, reptiles, amphibians, birds, carrion, nectar and fruit (DotEE 2018).

Northern quolls become sexually mature at one year of age. Around June to August, during the mating season, persistent fighting means males do not survive to breed a second year whilst females may live for two or three years. As a result, the Northern quoll population is comprised almost entirely of mature females and their young by the end of the breeding season. Females can raise a litter of up to eight young in tree hollows, hollow logs and rock crevices (DotEE 2018).

5.8.3 Habitat

The Northern quoll can be found in various habitats across its range including rocky areas, eucalypt forest and woodlands, sandy lowlands and beaches, rainforests, shrubland, grasslands and desert. They tend to require a habitat with some form of rocky area for denning purposes and surrounding vegetation used for foraging and dispersal. They are also known to inhabit areas around human dwellings and campgrounds (TSSC 2005).

5.8.4 Threatening processes

The following have been identified as potentially threatening processes to the Northern quoll:

- Lethal toxic ingestion caused by Cane toads (DotEE 2018)
- The removal, degradation and fragmentation of Northern quoll habitat - transport infrastructure, mining, offshore petroleum or gas processing facilities or agricultural activities such as land clearing, pasture improvement or grazing (DotEE 2018)
- The decline in shelter availability and habitat heterogeneity by fire (DotEE 2018)

- The invasion of northern Australia by Gamba grass (*Andropogon gayanus*) and other introduced grasses and increased fuel loads (DotEE; TSSC 2009)
- Predation by Feral cats (*Felis catus*) and European red foxes (*Vulpes vulpes*) and competition for food (DEWHA 2008; DotEE 2018).

5.8.5 Threat abatement/recovery plans

The following recovery plan has been identified as being relevant for this species:

- Hill, B.M. & S.J. Ward (2010). National Recovery Plan For the Northern Quoll *Dasyurus hallucatus*. Department of Natural Resources, Environment, The Arts and Sport, Darwin. Available from: **http://www.environment.gov.au/resource/national-recovery-plan-northern-quoll-dasyurus-hallucatus**. In effect under the EPBC Act from 16-Dec-2010.

The following threat abatement plans are relevant for this species:

- Department of Sustainability, Environment, Water, Population and Communities (2011). Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/resource/threat-abatement-plan-biological-effects-including-lethal-toxic-ingestion-caused-cane-toads**. In effect under the EPBC Act from 06-Jul-2011.
- Department of Sustainability, Environment, Water, Population and Communities (2012). Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses. Department of Sustainability, Environment, Water, Population and Communities. Available from: **http://www.environment.gov.au/resource/threat-abatement-plan-reduce-impacts-northern-australias-biodiversity-five-listed-grasses**. In effect under the EPBC Act from 11-Dec-2012.
- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats**. In effect under the EPBC Act from 23-Jul-2015.

5.8.6 Summary of threat abatement/recovery plan

Cane toads are identified as the main threat to the Northern quoll in the National Recovery Plan. Other threats identified include:

- Feral predators through direct predation and competition for food
- Inappropriate fire regimes
- Habitat degradation and destruction
- Weeds, particularly exotic pasture grasses
- Increased risk of disease due to isolation of populations
- Illegal hunting by humans
- Population isolation.

Recovery actions outlined in the National Recovery Plan include:

- Protect populations on offshore islands from invasion and establishment of invasive pests including cane toads and cats
- Support the recovery of sub-populations that have survived cane toad establishment
- Maintain secure populations and source animals for potential reintroductions/introductions, including maintaining captive breeding populations
- Reduce risk of disease by improving knowledge of and monitoring for disease
- Improve public awareness of the species and the need for biosecurity control.

The threats outlined in the threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads include:

- Predation by cane toads
- Larval competition with frog tadpoles or mosquitoes
- Parasite transfer
- Competition for terrestrial food
- Competition for shelter sites.

Threat abatement actions for cane toads (*Rhinella marina*) include:

- $11 million in funding from the Australian Government provided for the development of a broad-scale control method
- $9 million in funding from the Australian Government for research and management actitivies
- Identification of native species, ecological communities and off-shore islands that are known to have a high to moderate risk
- Identify the impacts that toads have on listed native species and ecological communities
- Where the impact is expected to be high on native species and ecological communities establish support research techniques in aiding the recovery of priority native species and ecological communities
- Develop a prioritisation tool to aid in the direction of resources for the protection of native species and ecological communities.

Threats identified in threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses includes:

- These highly invasive grasses can increase fuel loads
- Alter nitrogen cycling and water availability
- Degrade ecosystems through loss of habitat and biodiversity declines.

Management actions outlined in the threat abatement plan include:

- Determine the extent and spread pathways of infestation by the five listed grasses outlined in the plan
- Support and facilitate coordination management strategies through the design of tools, systems and guidelines
- Identify and prioritise key asset and areas for the implementation of management strategies
- Implement on the ground management strategies that are cost effective in high priority areas
- Monitor, evaluate and report back on the effectiveness of management programs.

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

5.8.7 References

Atlas of Living Australia (2018). *Dasyurus hallucatus*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:c4be3b87-b482-4b23-8086-a6634882fce1#overview [Accessed 21 August 2018].

Australian Wildlife Conservancy (2018). *Dasyurus hallucatus*. (Image) [Online] Available from: http://www.australianwildlife.org/wildlife/northern-quoll.aspx [Accessed 21 August 2018].

Department of Environment and Science (2018). *Queensland's quolls*. Available from: https://www.ehp.qld.gov.au/wildlife/threatened-species/endangered/endangered-animals/queenslands_quolls.html [Accessed 21 August 2018].

Threatened Species Scientific Committee (2005). *NON-APPROVED Conservation Advice on Northern Quoll (Dasyurus hallucatus)*. Available from: http://www.environment.gov.au/biodiversity/threatened/species/dasyurus-hallucatus.html#conservation. [Accessed 21 August 2018]

Threatened Species Scientific Committee (2009). *Commonwealth listing advice on invasion of northern Australian by gamba grass and other introduced grasses*. Available from: www.environment.gov.au/biodiversity/threatened/ktp/pubs/northern-australia-introduced-grasses.pdf [Accessed 21 August 2018].

5.9 Spotted-tail quoll (southeastern mainland population) (*Dasyurus maculatus maculatus*)

5.9.1 Status

EPBC Act – Endangered

5.9.2 Biology and ecology

5.9.2.1 Characteristic

Male Spotted-tail quolls (southeastern mainland population) (*Dasyurus maculatus maculatus*) have a head-body length of 380 to 759 mm, and females are 350 to 450 mm. Male tail lengths are between 370 to 550 mm and 340 to 420 mm for females. The average male Spotted-tail quoll weighs between 2.8 to 4.6 kg, whilst females average a weight of 1.5 to 2 kg. The fur on its back ranges in colour from rich red-brown to dark brown with white spots (refer Photograph 5.9). The Spotted-tail quoll is distinguished from other quolls by the spots running along the length of its tail. The fur on the underside is cream or white. They also have short, round ears which extend just above the outline of the head. Female Spotted-tail quolls have a poorly developed pouch (Belcher 2003; DotEE 2018; Green and Scarborough 1990; Jones 1997; Körtner et al. 2004; Queensland Museum 2015).

Photograph 5.9 **Spotted-tail quoll (*Dasyurus maculatus maculatus*)**

Source: PPF (2016)

5.9.2.2 Known distribution

The Spotted-tail quoll (southern subspecies) was previously widely distributed from southeast Queensland, eastern NSW, Victoria, southeast South Australia and Tasmania (refer Figure 5.17), however, it is estimated that the range has reduced by 50 to 90%. Detailed distribution records and abundance estimates are lacking, due to the scale and intensity of survey effort that is required to detect the species across its entire range (DotEE 2018).

In Queensland, the Spotted-tail quoll occurs in the southeast, coastally from Bundaberg to the NSW border, and inland to Monto and Stanthorpe. Spotted-tail quolls are known from five broad geographic: four from coastal ranges and the Great Dividing Range from the NSW border to Gladstone. The fifth is centered on the eastern Darling Downs-Inglewood Sandstone provinces of the Brigalow Belt South Bioregion. Unconfirmed reports suggest the subspecies may occur in the Clarke and Conway Range areas, eastern Queensland (DotEE 2018).

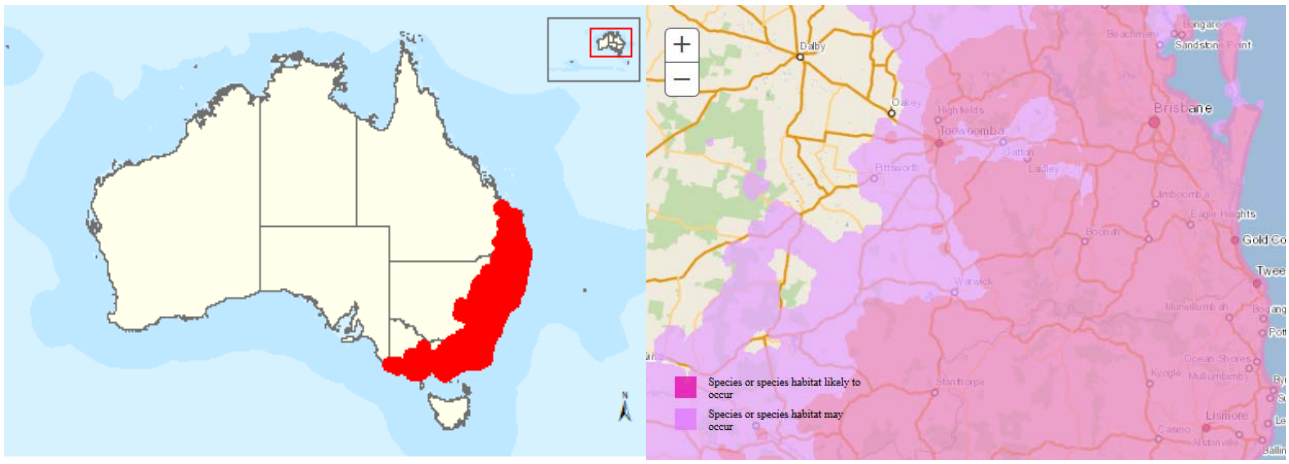


Figure 5.17 **Distribution range of the Spotted-tail quoll (southern subspecies)**

Source: DotEE (2018)

5.9.2.3 Distribution in relation to the Project

Dasyurus maculatus has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicated that the species is known from within 10 km of the temporary and permanent disturbance footprint. There are a number of database records in the region surrounding the MNES study area. The nearest records are two older records (1930 and 1970) located in the Wyaralong area 6 km south of the disturbance footprint, and 1975 record near Rosewood (4.5k north). There are a number of recent (post 2000) records located between 10 km east and 25 km north-east of the Project in the Greenbank-Jimboomba area (ALA 2020). Recent surveys using scent detection dogs carried out by the Wildlife Preservation Society of Queensland indicate the species may still occur in the Flinders Peak area.

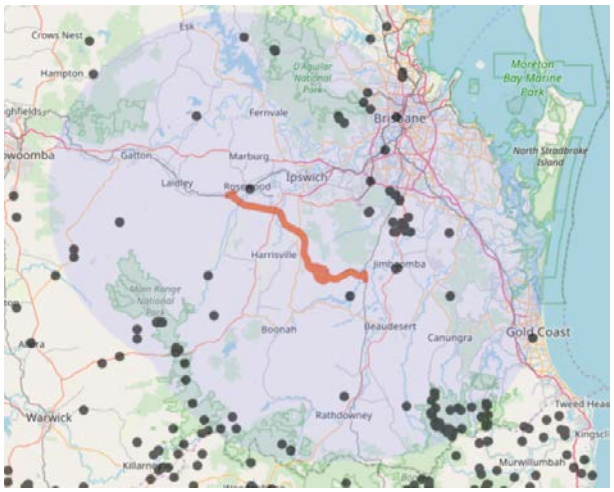


Figure 5.18 **Distribution range of the Spotted-tail quoll (southern subspecies) in relation to the Project**

Source: ALA (2020)

5.9.2.4 Biology and reproduction

Spotted-tail quolls are predominantly nocturnal and typically prey on medium-sized mammals. Typically, prey includes Ringtail possum (*Pseudocheirus pererinus*), Common brushtail possum (*Trichosurus vulpecula*), Mountain brushtail possum (*Trichosurus caninus*), Greater gilder (*Petauroides volans*) and Rabbit. Additionally, this species consumes insects, lizards, crayfish, poultry, birds, small mammals, frogs, fish, plant material and refuse that has been discarded by humans (DotEE 2018).

Mating and births for the Spotted-tail quoll occur over the winter months (June to August). It is possible for roaming males to mate with more than one female per year (DotEE 2018).

After a gestation period of 21 days, litters of between four and six are born, in late-July to mid-August. Young are attached to the teat for about eight weeks from birth. Subsequently, young may be left in the maternal den while the mother is hunting for food to provide to her young. At 18 to 21 weeks the young are fully independent and 33% of the body size of the mother (Belcher 2003; DotEE 2018; Edgar and Belcher 2008; Fleay 1940; Green and Scarborough 1990; Jones et al. 2001).

5.9.3 Habitat

Spotted-tail quolls have been recorded from a wide range of habitats, including temperate and subtropical rainforests in mountain areas, wet schlerophyll forest, lowland forests, open and closed eucalypt woodlands, inland riparian and River red gum (*Eucalyptus camaldulensis*) forests, dry 'rainshadow' woodland, sub-alpine woodlands, coastal heathlands and occasionally in open country/other treeless areas. Habitat requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves. From a study in Kosciuszko National Park, home range estimates were 620 to 2560 ha for males, and 90 to 650 ha for females (DotEE 2018).

The Spotted-tail quoll is known to prefer mature wet forest habitat especially areas with rainfall 600 mm/year. Unlogged forest or forest that has had limited disturbance by timber harvesting is also preferable (TSSC 2004, DotEE 2018).

5.9.4 Threatening processes

The following have been identified as potentially threatening processes to the Spotted-tail quoll:

- The loss, fragmentation, disturbance and degradation of habitat through clearing of native vegetation, timber harvesting and other forest management practices (DotEE 2018)
- Predation from Red foxes, Dingos (Canis lupus dingo) and Domestic dogs. Dietary and habitat overlap with these species may also be leading to competitive effects (DotEE 2018)
- Spot-tailed quolls have been killed by landholders in response to poultry coop raids. The large home ranges of the Spotted-tail quoll, particularly males, also makes them susceptible to road mortality in forested areas fragmented by roads, and a tendency to scavenge carrion may increase this threat (DotEE 2018).
- Following various baiting programs using 1080 baits for invasive predators, the dosage for foxes and dogs is potentially fatal to the Spotted-tail quoll, particularly for smaller individuals, such as females and juveniles (DotEE 2018).

5.9.5 Threat abatement/recovery plans

The following threat abatement plans have been identified as being relevant to this species:

- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats**. In effect under the EPBC Act from 23-Jul-2015.
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Threat abatement plan for predation by the European red fox. DEWHA, Canberra. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox**. In effect under the EPBC Act from 01-Oct-2008.

The following recovery plan has been identified as being relevant for this species

- Department of Environment, Land, Water and Planning (2016). National Recovery Plan for the Spotted-tailed Quoll Dasyurus maculatus. Australian Government, Canberra. Available from: **http://www.environment.gov.au/biodiversity/threatened/recovery-plans/spotted-tailed-quoll**. In effect under the EPBC Act from 06-May-2016.

5.9.6 Summary of threat abatement/recovery plans

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

Threats identified in the threat abatement plan for predation by the European red fox include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for the European red fox include:

- Baiting
- Biological control
- Barriers
- Habitat management
- Shooting and bounties.

Important populations outlined in the National Recovery Plan for the Spotted-tailed Quoll *Dasyurus maculatus* that could be relevant to the Project include:

- New South Wales: Marylands National Park and adjacent freehold property 'Mowamba'
- New South Wales: Northern Tablelands: Tenterfield, Glen Innes, Armidale/Walcha, Dorrigo Plateau and Barrington
- New South Wales: Yuragir and Mariah
- New South Wales: Greater blue mountains
- New South Wales: Barren Grounds/Budderoo, Escarpment forest from Morton National Park to Victorian border, Tallaganda/Badja
- New South Wales: Kosciuszko National Park/Snowy Mountains Byadbo
- Queensland: Stanthorpe to Wallangarra, Granite Belt/New England Tablelands
- Queensland: Cherrabah Homestead (between Warwick and Killarney)
- Queensland: Main Range-McPherson Range west
- Queensland: Lamington Plateau-McPherson Range east
- Queensland: Burnett Range
- Queensland: Dalby region.

Threats identified in the National Recovery Plan include:

- Habitat loss and modification
- Fragmentation of habitat and populations
- Timber harvesting
- Poison baiting
- Competition and predation from introduced predators
- Deliberate killing
- Road mortality
- Bushfire and prescription burning
- Poisoning by Cane toads
- Climate change.

Recovery actions outlined in the National Recovery Plan include:

- Determine the distribution and status of populations throughout the species' range
- Investigate key aspects of the biology and ecology to acquire targeted information to aid recovery
- Reduce habitat loss and fragmentation on private land
- Evaluate and manage risk posed by silviculture
- Determine and manage impacts from introduced predators
- Reduce deliberate killing of Quolls

- Assess the threat Can toads pose to the species and develop threat abatement actions
- Determine the likely impact of climate change on populations
- Increase community awareness and involvement in the recovery program.

5.9.7 References

Department of the Environment and Energy (2018). *Dasyurus maculatus maculatus (SE mainland population)* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=75184. [Accessed 21 August 2018]

Paddy Pallin Foundation (2016). Spotted-tail quoll. (Image) [Online] Available from: http://paddypallinfoundation.org.au/spotted-tailed-quoll-project/ [Accessed 21 August 2018]

Threatened Species Scientific Committee (2004). Commonwealth Listing Advice on *Dasyurus maculatus maculatus* (Spotted-tail quoll, Spotted-tail quoll, Tiger Quoll). [Online]. Available from: http://www.environment.gov.au/biodiversity/threatened/species/tiger-quoll.html [Accessed 21 August 2018].

6 Fauna – Threatened species – Birds

6.1 Australasian bittern (*Botaurus poiciloptilus*)

6.1.1 Status

EPBC Act – Endangered

6.1.2 Biology and ecology

6.1.2.1 Characteristics

The Australasian bittern (*Botaurus poiciloptilus*) is a large stocky, partially nocturnal heron which can reach up to a total body length of 75 cm with a wingspan just over 1 m. The species has a long narrow neck, a straight brownish-yellow bill which transitions into a dark brown feathering on the side of its neck and becomes pale at the throat. The mottled brown upper surface of the bittern is supported by a buff dark brown striped under surface and pale green legs (refer Photograph 6.1). Bittern juveniles differ from adults due to their paler feathering and heavier buff flecking on the back. Sexes can be differentiated through size as female bittern weigh about 900 g compared to male bittern, who are significantly heavier weighing up to 1,400 g. The physical appearance of the bittern makes it very well camouflaged within its natural habitat and often go unspotted (Birdlife 2018; SWIFFT 2018; TSSC 2011).

Photograph 6.1 Australasian bittern (*Botaurus poiciloptilus*)

Source: Birdlife (2018)

6.1.2.2 Known distribution

The Australasian bittern is known to occur in southeastern Australia, extending from Bundaberg through to northern Tasmania (refer Figure 6.1). In NSW, Australasian bittern is predominantly found in the Murray-Darling basin which once formed a stronghold for the species (Birdlife 2018; Birdlife International 2016).

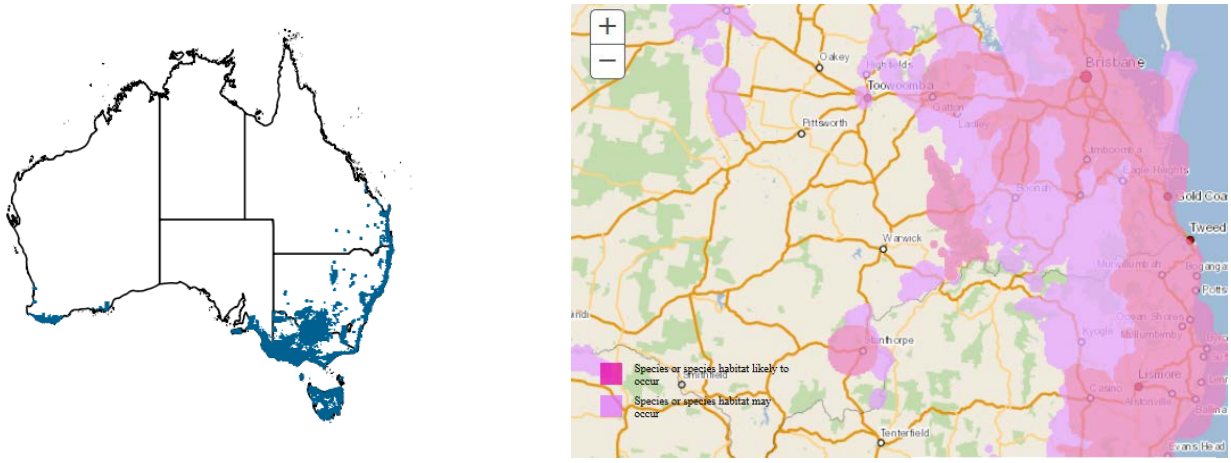


Figure 6.1 **Distribution range of the Australasian bittern**

Source: ALA (2018), DotEE (2018)

6.1.2.3 Distribution in relation to the Project

Database records indicate that the species is known from within approximately 10 km of the disturbance footprint with the closest record located 5 km west of the Project in the Harrisville area. It is noted this record is undated and has been generalised to protect the species and so may not reflect the actual occurrence location. There are several similar records in the region to the north of the Project. The nearest dated records include from Lake Clarendon (near Gatton) (2009) approximately 25 km north-west of the disturbance footprint and from Mount Tamborine (2001) located 24 km to the east (AoLA 2020). Lake Clarendon is identified as a 'key area' for sightings of the species. The expert opinion layer for the species (AoLA) suggests Australasian bittern is likely to occur within the disturbance footprint for Project. It is uncertain the MNES study area is located within the known or likely to occur habitat mapped within the distribution map.

Figure 6.2 **Distribution range of the Australasian bittern in relation to the Project**

Source: ALA (2020)

6.1.2.4 Biology and reproduction

The Australasian bittern is crepuscular and known to hide during day time and come out after sun down. It feeds mainly on frogs, fish, crayfish, spiders, insects and snails. The species constructs a feeding platform over deeper water using reeds trampled by the bird and uses multiple hunting techniques to capture prey (Birdlife 2018; OEH 2017).

The species breed around summer, between October and January, as solitary pairs and begin building nests in secluded, densely vegetated wetlands on platforms of reeds approximately 30 cm above water level. The female Australasian bittern will lay six eggs of olive to brown colour to a clutch and known to have a short incubation period (Birdlife 2018; O'Donnell 2011; TSSC 2011).

6.1.3 Habitat

Preferred habitat for the Australasian bittern consists of permanent freshwater wetlands with tall dense vegetation including bulrushes (*Tyhpa* spp.), spikerushes (*Eleocharis* spp.) and tall emergent sedges. Rice paddies within the Murray-Darling basin are a known habitat for the species who disperse widely during periods of droughts to coastal wetlands and to ephemeral wetlands (Birdlife International 2016; OEH 2017).

6.1.4 Threatening processes

The following have been identified as potentially threatening processes to the Australasian bittern:

- Wetland drainage for agriculture
- Changes brought on by high levels of grazing, drought and salinisation of swamps
- Long term habitat destruction exposing species to predation
- Abandoning nests due to slight disturbances as a result of their sensitive nature (Birdlife International 2016).

6.1.5 Threat abatement/recovery plans

The following recovery plan has been identified as being relevant for this species:

- There is currently a draft *National recovery plan for the Australasian bittern (Botaurus poiciloptilus*) (DotEE 2019a) awaiting adoption by DAWE.
- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from **https://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10105**. In effect under the BC Act 2016.

The following threat abatement plans have been identified as being relevant to this species:

- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats**. In effect under the EPBC Act from 23-Jul-2015.
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Threat abatement plan for predation by the European red fox. DEWHA, Canberra. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox**. In effect under the EPBC Act from 01-Oct-2008.

6.1.6 Summary of threat abatement/recovery plan

The draft Plan identifies the following threatening processes as applicable to the species:

- Reduced wetland availability due to changed hydrology
- Habitat loss and degradation such as reduced water quality
- Low genetic diversity
- Invasive species including herbivores impacting habitat (horses, pigs, goats and deer) and predators (red fox, cats, rats and pigs)
- Climate variability and change

The draft *National recovery plan for the Australasian bittern (Botaurus poiciloptilus*) (DotEE 2019a) identifies all populations of Australasian bittern should be considered as important. Habitat 'critical to the survival of the species' is described as:

- Any wetland habitat where the species is known or likely to occur (breeding or foraging habitat) within the indicative distribution map
- Any location with suitable habitat outside the above area that may be periodically occupied by Australasian Bittern

Threats identified by the *Saving our Species* program include:

- Drainage of wetlands and ponds and alteration of natural flow regimes
- Loss and degradation of wetland habitat, including artificial wetland habitat in rice growing areas, due to changes in water management and cropping practises
- Climate change driven seasonality changes such as amount of rainfall and associated changes in environmental water allocations
- Predation by foxes, pigs and cats.

Management activities in the Saving our Species program to protect this species are:

- Apply environmental water quality requirements (timing, depth, duration, frequency) in long-term environmental water plans (including Murrumbidgee, Murray, Lachlan, Macquarie, Gwydir) to maintain and restore habitat
- Develop and/or upgrade infrastructure to support environmental water delivery to priority bittern habitat areas
- Educate and encourage landholders to improve wetland management and awareness of bitterns, and report sightings (target landholders in Hunter, north and south coast, northern basin and Riverina/Murray areas)
- Undertake targeted control of predators at selected priority sites during breeding (summer) using techniques such as trapping and/or baiting
- Educate irrigation corporations in rice-growing areas and encourage sensitive management of canals
- Work with rice growers to develop a "bittern friendly" rice label that promotes best practice rice growing for maintaining bittern habitat
- Conduct targeted research into habitat use during non-breeding season and during drought.

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

Threats identified in the threat abatement plan for predation by the European red fox include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for the European red fox include:

- Baiting
- Biological control
- Barriers
- Habitat management
- Shooting and bounties.

6.1.7 References

Atlas of Living Australia (2018). *Botaurus poiciloptilus*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:47dca80b-ac7c-4130-bef3-4afb4fad35ab [Accessed 22 August 2018].

Birdlife Australia (2018). Australasian Bittern. Available from: http://www.birdlife.org.au/bird-profile/australasian-bittern [Accessed 22 August 2018].

BirdLife International (2016). *Botaurus poiciloptilus*. The IUCN Red List of Threatened. Available from: http://www.iucnredlist.org/details/22697353/0 [Accessed 22 August 2018].

O'Donnell, Colin. (2011). Breeding of the Australasian Bittern (*Botaurus poiciloptilus*) in New Zealand. ResearchGate. Available from: https://www.researchgate.net/publication/263002340 [Accessed 22 August 2018].

Office of Environment and Heritage (2017). Australasian Bittern – Profile. New South Wales Government. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10105 [Accessed 22 August 2018].

State Wide Integrated Flora and Fauna Teams (2018). Australasian Bittern. Available from: http://www.swifft.net.au/cb_pages/australasian_bittern.php [Accessed 22 August 2018].

Threatened Species Scientific Committee (2011). *Botaurus poiciloptilus* in Species Profile and Threats Database. Department of the Environment and Energy. Canberra. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/1001-listing-advice.pdf [Accessed 22 August 2018].

6.2 Australian painted snipe (*Rostratula australis*)

6.2.1 Status

EPBC Act – Endangered Marine (CAMBA)

6.2.2 Biology and ecology

6.2.2.1 Characteristic

The Australian painted snipe (*Rostratula australis*) is a stocky wading bird approximately 220 to 250 mm in length. It has a long pinkish bill and chestnut-coloured head, with a white ring around the eye and a crown stripe. The back and wings are metallic green and barred with black and chestnut. There is a pale stripe extending from the shoulder into a V down the individuals upper back (refer Photograph 6.2). The adult female is slightly larger and more brightly coloured than the male (DotEE 2018).

Photograph 6.2 Australian painted snipe male (*Rostratula australis*)

Source: Aviceda (2002)

6.2.2.2 Known distribution

The Australian painted snipe has been recorded at wetlands in all states and territories of Australia but is most common in eastern Australia, where it has been recorded at scattered locations throughout much of Queensland, NSW, Victoria and southeastern South Australia (refer Figure 6.3). Known distribution has likely declined by approximately 50% in Australia since European settlement (DotEE 2018; Garnett & Crowley 2000).

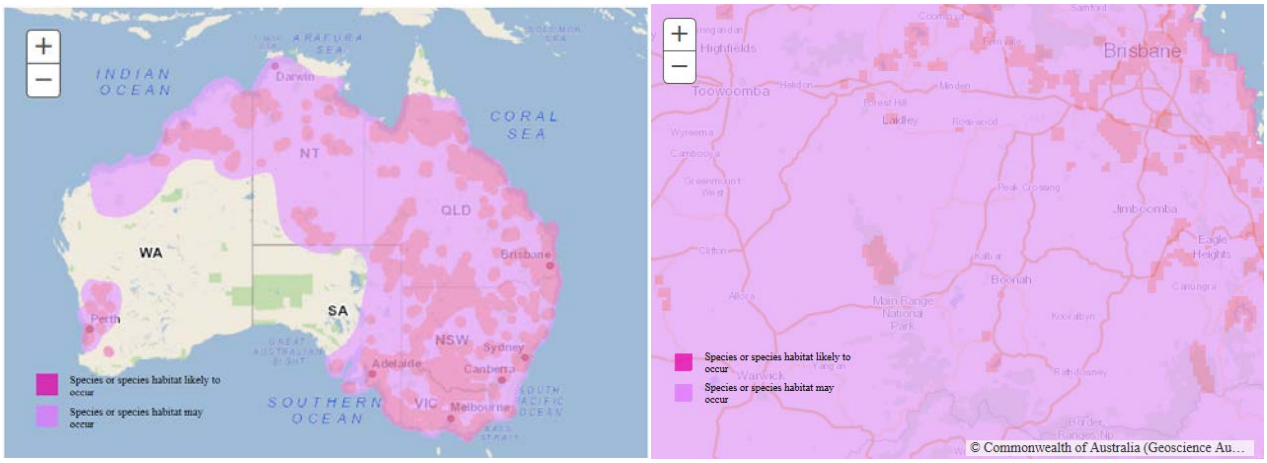


Figure 6.3 Distribution range of the Australian painted snipe

Source: DotEE (2018)

6.2.2.3 Distribution in relation to the Project

Rostratula australis has been identified as potentially occurring within the MNES study area. There are numerous database records within 50 km of the MNES study area. These occur in all directions around the Project with most occurring to the north-west, north, north-east and east. This includes several records within 5 km of the MNES study area. There are no existing records within or immediately adjacent to the MNES study area. The nearest records include several 2011 and 2012 records recorded at or close to Rosewood Lagoon (3 km north of the western section of the Project), 2000 and 2002 records from Lake Dyer, Laidley (16 km west of the western extent of the Project), and a 2013 record at Ripley's Lagoon, South Ripley (8.5 km north-east of the central section of the Project) (refer Figure 6.4).

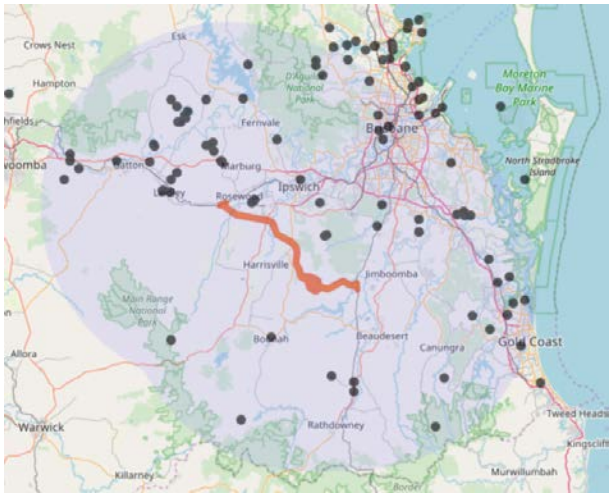


Figure 6.4 **Distribution range of the Australian painted snipe in relation to the Project**

Source: ALA (2020)

6.2.2.4 Biology and reproduction

The Australian painted snipe eats vegetation, worms, seeds, insects, molluscs, crustaceans and other invertebrates. They are mainly crepuscular and generally remain in dense cover when feeding, although they may forage over nearby mudflats and other open areas such as agricultural land or grassland (DotEE 2018).

The Australian painted snipe may breed in response to wetland conditions rather than during a particular season. The species has been recorded breeding in all months in Australia. Their breeding habitat requires shallow wetlands with areas of bare wet mud and with canopy cover nearby. The species nests usually occur on or near small islands in freshwater habitats. Females are known to lay two to six (typically three or four) eggs and may lay up to four clutches in a year and incubation takes 15 to 21 days. The females usually breed every two years (DotEE 2018).

This species is generally seen alone or in pairs or occasionally in small flocks. Flocking occurs during the breeding season, but are also known to form after the breeding season and at some locations where small groups regularly occur (DotEE 2018).

6.2.3 Habitat

The Australian painted snipe generally inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans. The species has also been observed to use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. The Australian painted snipe has been recorded nesting in and near swamps, canegrass swamps, flooded areas, including samphire, grazing land, among cumbungi, sedges, grasses, salt water couch, saltbush (*Halosarcia* sp.) and grass, in ground cover of water-buttons and grasses, at the base of tussocks and under low saltbush (DotEE 2018).

The Australian painted snipe requires suitable wetland areas even in drought conditions, but the species can move to suitable habitat if necessary (DotEE 2018).

6.2.4 Threatening processes

The following have been identified as potentially threatening processes to the Australian painted snipe:

- The loss and alteration of wetland habitat, particularly the drainage of wetlands and diversion of water to agriculture and reservoirs therefore reducing flooding and precluding the formation of temporary shallow wetlands (DotEE 2018)
- Grazing and trampling of wetland vegetation by livestock (DotEE 2018)

- The colonisation of invasive, noxious weeds could render habitats less suitable for the snipe and changes to fire regimes might be affecting savannah vegetation around wetlands in northern Australia (Garnett and Crowley 2000; DotEE 2018)
- Australian painted snipe nesting sites may also be vulnerable to introduced terrestrial predators such as the European red fox or feral cat (DotEE 2018).

6.2.5 Threat abatement/recovery plans

The following threat abatement/recovery plan has been identified as being relevant for this species:

- Department of Energy and the Environment (2019). Draft national recovery plan for the Australian painted snip (*Rostratula australis*), Commonwealth of Australia. Available from: **https://www.environment.nsw.gov.au/savingourspeciesapp/ViewFile.aspx?ReportProjectID=1292&ReportProfileID=10734**.

6.2.6 Summary of threat abatement/recovery plan

Threats identified in the Saving our Species plan includes:

- Drainage of wetland breeding sites
- Grazing and frequent fires in wetland habitat
- Herbicide, pesticide and other chemical use near wetlands
- Invasive native plants and exotic weeds reducing the health of wetland habitat
- Lack of knowledge on the reproduction of the species.

Management actions outline in the Saving our Species plan includes:

- Set environmental water quality parameters in long-term environmental water plans
- Control invasive vegetation
- Manage grazing and burning in wetlands creating a mosaic of habitat features
- Engage with landholders adjacent to wetlands providing education on the impact of chemical use, discuss non-toxic alternative and implement appropriate drainage management to avoid run-off
- Manage stock and fire regimes near wetlands
- Conduct research into the species to fill knowledge gaps
- Encourage the restoration of wetland habitat in an agricultural landscape
- Manage environmental water to ensure shallow muddy edge habitat during spring and summer.

6.2.7 References

Aviceda (2002). Photographic image of *Rostratula australis*. [Accessed 22 August 2018]

Department of the Environment and Energy (2018). *Rostratula australis* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=77037 [Accessed 22 August 2018].

Garnett, S.T. and Crowley G.M. (2000). *The Action Plan for Australian Birds 2000*. Canberra, ACT: Environment Australia and Birds Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/action/birds2000/index.html [Accessed 22 August 2018]

6.3 Black-breasted button-quail (*Turnix melanogaster*)

6.3.1 Status

EPBC Act – Vulnerable

6.3.2 Biology and ecology

6.3.2.1 Characteristic

The Black-breasted button-quail (*Turnix melanogaster*) is a relatively large, plump and pale-eyed quail. The males are about 18 cm long, with a wingspan of 32 to 35 cm, and weighing 65 g. The females tend to be larger weighing 100 g. Females are slightly larger than males and are the dominant sex. Female and male plumage also differs, with females having a black head and breast with white half-moon markings across the upper-breast and a chestnut marbled upper covered in black ladder markings and white streaks. Conversely, males have white markings on the face and neck covered with fine black dots and the upper-breast is a mottled chestnut and black (refer Photograph 6.3). Both sexes have grey bills, white-cream eyes and yellowish legs and feet (DotEE 2018; Pizzey and Knight 2007).

Photograph 6.3 Black-breasted button-quail (*Turnix melanogaster*)

Source: Jones (2010)

6.3.2.2 Known distribution

Black-breasted button-quails are distributed across southeastern Queensland from near Byfield in the north to the Border Ranges rainforests in the south, generally east of the Great Dividing Range (refer Figure 6.5); although there are records up to 300 km inland at locations at Palmgrove National Park and Barakula State Forest in Queensland. In northeastern NSW, they are restricted to the Northern Rivers and Tablelands (DotEE 2018; Marchant and Higgins 1993).

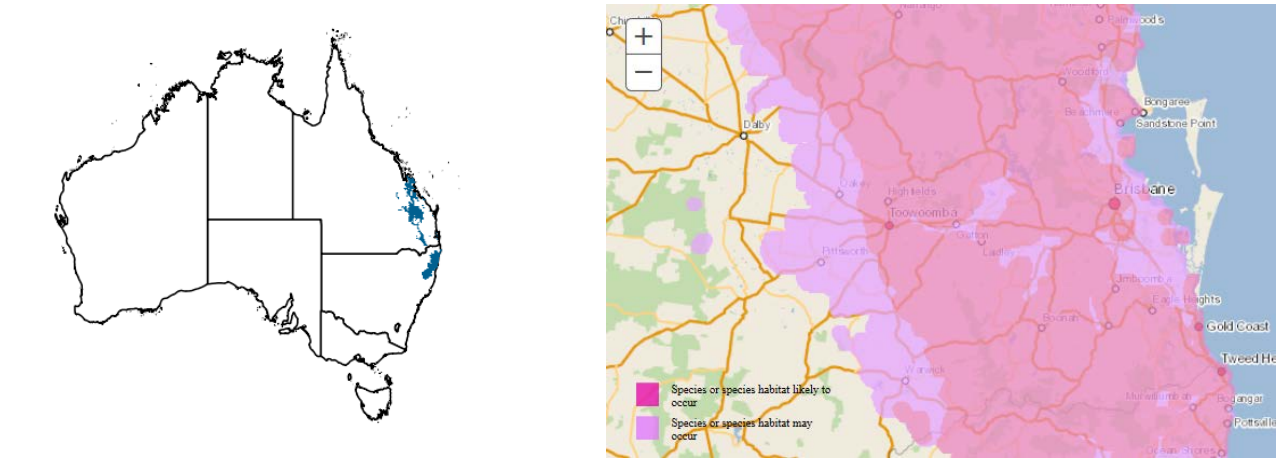


Figure 6.5 **Distribution range of the Black-breasted button-quail**

Source: ALA (2018), DotEE (2018)

6.3.2.3 Distribution in relation to the Project

Turnix melanogaster was not recorded during Project surveys which included targeted searches for the distinctive platelets the species leaves when foraging. Database records (i.e. AoLA) indicate this species has occurred within 50 km of the Project. The nearest database records are from the Flinders Goolman Conservation Estate within the Teviot Range recorded in 1980 and 2010 and approximately 5 km north of the disturbance footprint. There are recent records from the Rosewood area (2015) and Spring Mountain (2013) located 9 km and 14 km north of the Project respectively. There is also a very old record (1901) approximately 5 km south of the disturbance area to the south of the Flinders Peak area (refer Figure 6.6). Further away from the Project there are a number of confirmed records from all directions including commonly from north of Ipswich and west of Brisbane, and west of Boonah (AoLA 2020).

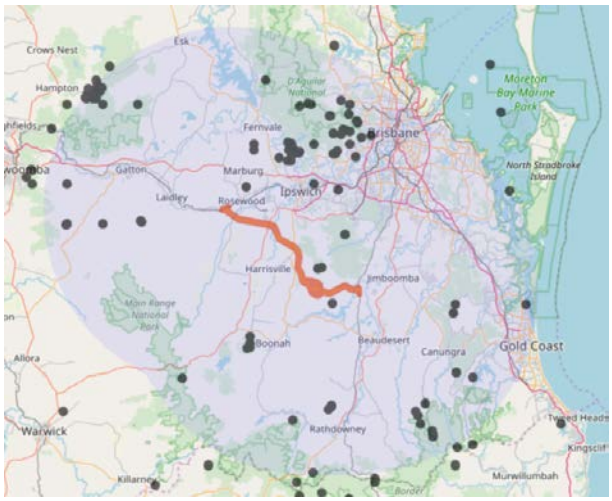


Figure 6.6 **Distribution range of the Black-breasted button-quail in relation to the Project**

Source: ALA (2020)

6.3.2.4 Biology and reproduction

Their principal food is invertebrates gathered from the leaf litter on the forest floor, however, seeds may also be consumed (DotEE 2018; Hughes and Hughes 1991).

The species is polyandrous (a single female mates with several males who incubate the eggs) and it has been seen in pairs or, more occasionally, in small groups. There is little known on the breeding habits of the Black-breasted button-quail, however they are assumed to breed throughout their range. Although they may exhibit limited migratory movements at night in response to resource availability. The breeding season occurs from September to April/May and between three and five eggs are laid. Nests consist of a scrape in the ground, lined with leaves, grass or moss. Nests are typically well-concealed and placed in the buttress root of a tree or sapling, the base of a fern or under a low bush or grass tussock (DotEE 2018).

6.3.3 Habitat

The Black-breasted button-quail is restricted to rainforests and forests, mostly in areas with 770 to 1,200 mm rainfall per annum in areas characterised by highly fertile soils. They prefer drier low closed forests, particularly semi-evergreen vine thicket, low microphyll vine forest, araucarian microphyll vine forest and araucarian notophyll vine forest. They may also be found in low, dense Acacia thickets and, in vegetation behind coastal sand dunes. In southeastern Queensland, the Black-breasted button-quail has been recorded on rare occasions in open Eucalypt forest; for example, birds have been recorded in Grey ironbark (*Eucalyptus siderophloia*) with a low sparse shrub layer of Eucalypt and Acacia seedlings, and a sparse ground cover of short tussock grasses and leaf litter. This species also heavily utilises areas infested with *Lantana camara*, particularly where this produces a dense leaf-litter below a thigh woody shrub layer. An dense leaf-litter layer is required for foraging and possibly also roosting (DotEE 2018).

6.3.4 Threatening processes

The following have been identified as potentially threatening processes to the Black-breasted button-quail:

- Massive clearance of forest for agriculture, forestry and urban development continues to be the biggest threat to the species. Sub-populations in the remaining fragmented habitats are affected by excessive grazing and trampling which may reduce the amount of understorey vegetation and deep leaf litter on which the species relies (Bennett 1985; Garnett and Crowley 2000).
- Frequent fire eliminates shrubby understorey in dry rainforest remnants and can also reduce the amount of leaf litter on the ground, rendering habitat unsuitable (Garnett and Crowley 2000)
- Being ground-nesters, they are also affected by predation by cats, foxes and pigs (Bennett 1985; Garnett and Crowley 2000).

6.3.5 Threat abatement/recovery plans

The following recovery plan has been identified as being relevant for this species:

- Mathieson, M.T. & G.C. Smith (2009). National recovery plan for the black-breasted button-quail Turnix melanogaster. Report to the Department of the Environment, Water, Heritage and the Arts, Canberra. Department of Environment and Resource Management, Brisbane. Available from: **http://www.environment.gov.au/resource/national-recovery-plan-black-breasted-button-quail-turnix-melanogaster**. In effect under the EPBC Act from 13-Nov-2009.

The following threat abatement plans have been identified as being relevant to this species:

- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats.** In effect under the EPBC Act from 23-Jul-2015.
- Department of the Environment and Energy (2017). Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa) (2017). Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/feral-pig-2017.** In effect under the EPBC Act from 18-Mar-2017.

- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Threat abatement plan for predation by the European red fox. DEWHA, Canberra. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox. In effect under the EPBC Act from 01-Oct-2008.

6.3.6 Summary of threat abatement/recovery plans

Threats specific to the Black-breasted button-quail in the strategy include:

- Very specific habitat requirements that are subject to development pressure
- Polyandrous breeding nature could result in genetic bottleneck given there are fewer females than males in the population
- Habitat loss, fragmentation and degradation
- Inappropriate fire regimes
- Predation by feral animals.

Objectives and actions outlined in the threat abatement plan for the Black-breasted button-quail include:

- Consolidate current information and define assessment and monitoring strategies determining where suitable habitat is occupied
- Protect key habitat for the species from human induced processes
- Maintain and improve the extent, condition and connectivity of suitable habitat
- Reduce the impacts of introduced predators and competitors
- Increase ecological knowledge of the species
- Review the operation of the recovery process.

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

The threats outlined in the threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) include:

- Impacts on plant species composition and succession
- Alterations to nutrient, water cycling and water quality
- Predation of native fauna and flora including small mammals, birds, reptiles, frogs, crayfish, eggs, invertebrates, fungi and all part of plants including fruit, seeds, roots, tubers, bulbs and foliage
- Digging and disturbance to substrate resulting in the destruction of plants threatening their survival and recruitment of new plants altering the floral composition and soil structure
- Disturbance caused by pigs can increase the incursion and recruitment of weeds and provide reservoirs for endemic animal diseases.

Threat abatement actions for feral pics (*Sus scrofa*) include:

- Implementation of control measures including trapping, aerial and ground shooting, poisoning and fencing

- Using tracking dogs to detect and flush out feral pigs by commercial harvesters
- Manipulating habitat by reducing watering point and crop waste
- Manage feral pigs within a policy, legislative and planning framework.

Threats identified in the threat abatement plan for predation by the European red fox include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for the European red fox include:

- Baiting
- Biological control
- Barriers
- Habitat management
- Shooting and bounties.

6.3.7 References

Atlas of Living Australia (2018). *Turnix (Austroturnix) melanogaster*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:03a6ee3f-e227-41e2-b2f3-6f6aea694a83 [Accessed 23 August 2018].

Bennett, S. (1985). The distribution and status of the Black-breasted Button-quail *Turnix melanogaster. Emu*. 85:157-162.

Department of the Environment and Energy (2018). *Turnix melanogaster* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=923 [Accessed 23 August 2018].

Garnett, S.T. and Crowley G.M. (2000). *The Action Plan for Australian Birds 2000*. Canberra, ACT: Environment Australia and Birds Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/action/birds2000/index.html.

Jones, G (2010). Photographic image of *Turnix melanogaster*. [Accessed 23 August 2018].

Marchant, S. and Higgins, P.J. eds. (1993). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2 - Raptors to Lapwings*. Melbourne, Victoria: Oxford University Press.

Pizzey, G. and Knight, F. (2007). *The Field Guide to the Birds of Australia*. Harper Collins publishing, Sydney.

6.4 Black-throated finch (*Poephila cincta cincta*)

6.4.1 Status

EPBC Act – Endangered

6.4.2 Biology and ecology

6.4.2.1 Characteristics

The Black-throated finch (southern sub-species) (*Poephila cincta cincta*) is a small stocky finch with a total body length of 12 cm and weighing about 15 g. The physical appearance of the finch is distinguishable by its bluish-grey head which features a short black stripe leading all the way through to the upper breast of the bird. The body of the finch is brown on the back, cinnamon on the breast and white on the rump which attaches to a black tail (refer Photograph 6.4). Plumage of both male and female finches are similar, however, female finches are smaller in size and have a slightly smaller throat patch compared to the male (DES 2018; OEH 2017).

Photograph 6.4 Black-throated finch (*Poephila cincta cincta*)

Source: OEH (2017)

6.4.2.2 Known distribution

The known distribution of the Black-throated finch (southern sub-species) once extended from Inverell in northeast NSW, through eastern Queensland into the Atherton Tablelands as well as west to central Queensland (refer Figure 6.7). However, the species is considered to be locally extinct within the southern portion of its range. The species can now only be found in Queensland, near Townsville and in the Galilee Basin of Central Queensland, as the finch is likely extirpated in NSW (DES 2018; OEH 2017).

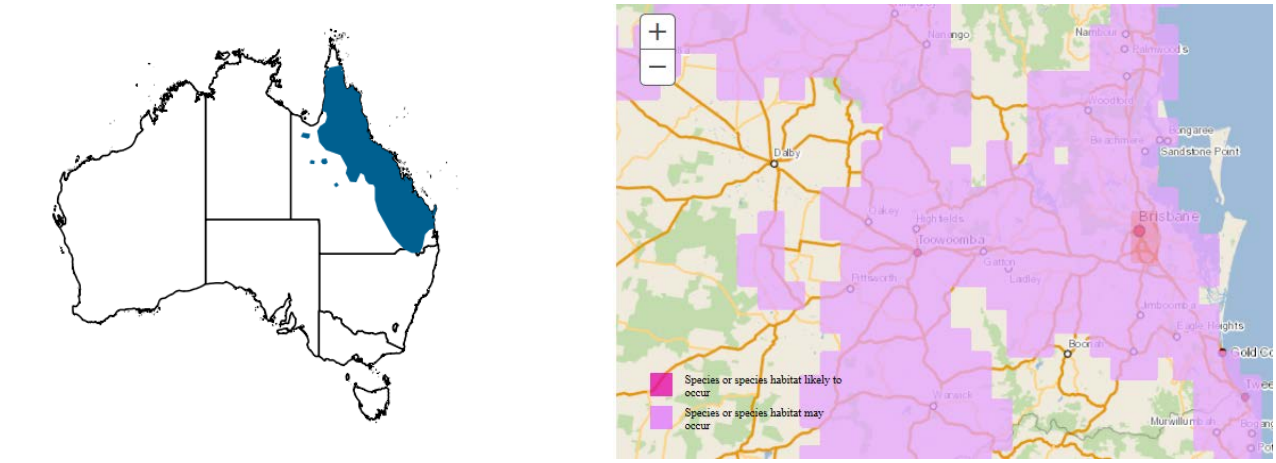


Figure 6.7 **Distribution range of the Black-throated finch**

Source: ALA (2018), DotEE (2018)

6.4.2.3 Distribution in relation to the Project

Poephila cincta cincta has been predicted to occur within the region and associated habitat within the MNES study area. However, there are no current records for this species within 50 km of the temporary and permanent disturbance footprint. Few historical records (i.e. AoLA, WildNet) exist for the species, the closest, more reliable record is form 1986 more than 100 km from the disturbance footprint to the east of Barakula State Forest.

Figure 6.8 **Distribution range of the Black-throated finch in relation to the Project**

Source: ALA (2020)

6.4.2.4 Biology and reproduction

This finch species forages in small flocks, consuming seeds on the ground of native grasses as well as plucking seeds directly from the seedheads. During the breeding season, the finch is known to consume insects such as flying termites (Birdlife 2018; DES 2018).

Black-throated finches pair for life and separate from the flock during breeding season despite nesting in colonies due to their social nature. The species is known to reuse abandoned nests as well as build fresh dome shaped nests with a side entrance. Built nests are woven from grass stems and lined with soft seedheads, plant down and feathers which are placed in trees or tree hollows between spring into early autumn (Birdlife 2018; DES 2018).

The female will lay between five to nine eggs per brood and up to two broods may be produced per year, with an incubation period of up to 12 days. Fledging has been recorded to occur after 21 days with the young being independent only after 40 days (DES 2018; OEH 2017).

6.4.3 Habitat

This species of finch is a highly social bird, roaming in flocks of 40 or more. Black-throated finch (southern sub-species) require habitats that supply year-round seeds for feeding. Typical areas inhibited by the bird include grassy woodland dominated by eucalypts, paperbarks, tea-tree, Melaleuca or acacias along water courses (riparian habitats) due to their significance in providing shelter, specially within highly fragmented and modified environments. Despite being considered sedentary the species may move in response to droughts (DES 2018; OEH 2017).

6.4.4 Threatening processes

The following have been identified as potentially threatening processes to the Black-throated finch:

- Spread and intensification of pastoralism
- Changes to fire regimes
- Increases in the density of native woody weeds among grassy savannas (Birdlife International 2016; DES 2018).

6.4.5 Threat abatement/recovery plans

The following recovery plan has been identified as being relevant for this species:

- Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service (2007). National recovery plan for the black-throated finch southern subspecies Poephila cincta cincta. Report to the Department of the Environment and Water Resources, Canberra. Department of Environment and Climate Change (NSW), Hurstville and Queensland Parks and Wildlife Service, Brisbane. Available from: **http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-black-throated-finch-southern-subspecies-poephila-cincta-cincta**. In effect under the EPBC Act from 08-Jan-2008.

The following threat abatement plans have been identified as being relevant to this species:

- Department of Sustainability, Environment, Water, Population and Communities (2012). Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses. Department of Sustainability, Environment, Water, Population and Communities. Available from: **http://www.environment.gov.au/resource/threat-abatement-plan-reduce-impacts-northern-australias-biodiversity-five-listed-grasses**. In effect under the EPBC Act from 11-Dec-2012.
- Department of the Environment and Energy (2016). Threat abatement plan for competition and land degradation by rabbits. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-rabbits-2016**. In effect under the EPBC Act from 07-Jan-2017.

6.4.6 Summary of threat abatement/recovery plans

Threats outlined in the National recovery plan for the black-throated finch southern subspecies *Poephila cincta cincta* include:

- Clearing and fragmentation of woodland, riverside, and wattle shrubland habitats
- Grazing impacts from livestock and rabbits
- Alteration of fuel load, vegetation structure and wet season food availability
- Fire causing alteration to habitat
- Invasive weed species including exotic grasses
- Illegal trapping of birds

- Predation by feral vertebrate pest species
- Hybridisation with escapees from sub-species.

Objectives and actions outlined in the National recovery plan for the black-throated finch southern subspecies *Poephila cincta cincta* include:

- Investigate and quantify threats faced by the species
- Determine distribution and abundance
- Protect and enhance habitat
- Investigate the viability of reintroducing captive breed stock
- Increase public awareness.

Threats identified in threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses includes:

- These highly invasive grasses can increase fuel loads
- Alter nitrogen cycling and water availability
- Degrade ecosystems through loss of habitat and biodiversity declines.

Management actions outlined in the threat abatement plan include:

- Determine the extent and spread pathways of infestation by the five listed grasses outlined in the plan
- Support and facilitate coordination management strategies through the design of tools, systems and guidelines
- Identify and prioritise key asset and areas for the implementation of management strategies
- Implement on the ground management strategies that are cost effective in high priority areas
- Monitor, evaluate and report back on the effectiveness of management programs.

Threats identified in the threat abatement plan for competition and land degradation by rabbits includes:

- Competition with native wildlife for food and shelter
- Prevention of plant regeneration
- Increased grazing pressure and damage to native vegetation
- Altering the regular process of plant succession
- Altering ecological communities and impacting soil structure and nutrient cycling contributing to serious erosion
- Increasing predation and reducing reproduction for native arboreal mammals and birds through the removal of critical habitat.

Threat abatement actions for rabbits include:

- Supress rabbit populations at the landscape scale below thresholds in identified priority areas
- Gain a better understanding of the impacts rabbits have and their interactions with other species and ecological processes
- Increase the effectiveness of rabbit control programs
- Increase engagement within the local community to provide awareness of the environmental impact of rabbits and the need for integrated control.

6.4.7 References

Atlas of Living Australia (2017). Poephila (Poephila) cincta. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:26d93abf-b5bf-43ea-91f3-4187e30619c5 [Accessed 22 August 2018].

Birdlife Australia (2018). Black-throated Finch. Available from: http://www.birdlife.org.au/bird-profile/black-throated-finch [Accessed 22 August 2018].

BirdLife International (2016). Poephila cincta. The IUCN Red List of Threatened. Available from: http://www.iucnredlist.org/details/22719692/0 [Accessed 22 August 2018].

Department of Environment and Science (2018). Black-throated finch (southern subspecies). Queensland Government. Available from: https://www.ehp.qld.gov.au/wildlife/animals-az/blackthroated_finch_southern_subspecies.html [Accessed 22 August 2018].

Office of Environment and Heritage (2017). Black-throated Finch - Profile. New South Wales Government. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10641 [Accessed 22 August 2018].

6.5 Coxen's fig-parrot (*Cyclopsitta diophthalma coxeni*)

6.5.1 Status

EPBC Act – Endangered

6.5.2 Biology and ecology

6.5.2.1 Characteristics

Coxen's fig-parrot (*Cyclopsitta diophthalma coxeni*) is a small parrot measuring between 15 to 16 cm in body length (DES 2011).

The adults are predominantly bright green, with a prominent yellow line along the flanks and the sides of the breast. The primary feathers exhibit blue edges, and bright red markings occur on the tertial feathers. Broad cream bands and grey-black edging occur on the undersides of the wings, and dark grey edging around the underside of the tail. Coxen fig-parrots have a distinctive facial pattern that consists of a patch of light-blue on the forehead, a curving band of red (edged and mottled with yellow) below the eye, and a curving band of violet-blue that borders the lower edge of the curving red band (DES 2011; OEH 2017) (refer Figure 6.9).

Both male and female species of Coxen's fig-parrot are very similar in appearance, however the female has a smaller blue patch as well as few to no red feathers on the forehead and a duller, less extensive orange-red cheek patch (DES 2011).

Figure 6.9 **Coxen's fig-parrot (*Cyclopsitta diophthalma coxeni*)**

Source: Coxen's Fig-Parrot Recovery Team (2001)

6.5.2.2 Known distribution

The Coxen's fig-parrot's known distribution is still evolving due to their hard to spot nature. However, historical records have localised scattered populations of the species to an area between Bundaberg, in Queensland, to Hastings River in NSW (DES 2011; OEH 2017) (refer Figure 6.10).

Figure 6.10 **Distribution range of the Coxen's fig-parrot**

Source: Birdlife International (2018), DotEE (2018)

6.5.2.3 Distribution in relation to the Project

Cyclopsitta diophthalma coxeni has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicated that the species is known from within 50 km of the temporary and permanent disturbance footprint. There are a number of AoLA (2020) records (largely pre-1990) within 50 km of the MNES study area, although the majority of these are from the Main Range and Lamington National Parks areas. Both are over 40 km south of the disturbance footprint comprise extensive tracts of rainforest. There are two records from the Boonah area located 18 km (1991 record) and 25 km south-west of the MNES study area. There are no reliable database records of the species occurrence from the year 2000 or later.

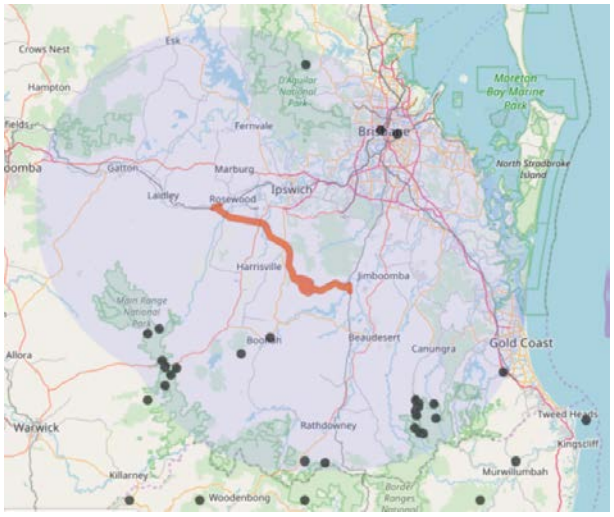


Figure 6.11 **Distribution range of the Coxen's fig-parrot in relation to the Project**

Source: ALA (2020)

6.5.2.4 Biology and reproduction

Coxen's fig-parrots are omnivorous, mainly feeding on seeds of near ripe or ripe fruits of native figs, and/or insect larvae, which may include the fig wasp. Favoured species include Moreton Bay fig (*Ficus macrophylla*), Green-leaved strangler fig (*F. watkinsiana*), but a variety of other *Ficus* sp. and other native fruits also eaten (DES 2011; Pizzey and Knight 1997).

The breeding biology of Coxen's fig-parrot is almost entirely unknown. The breeding season is thought to extend from October to December or January. The nest is established in a chamber that is excavated in the rotting wood of a decaying limb or trunk of a living or dead tree. The appearance of the nest and eggs is unknown, and no information is available on the incubation or fledging periods (Birdlife International 2018; DES 2011; DotEE 2018).

Coxen's fig-parrot is usually observed singly, in pairs or in small flocks of up to 12 birds (especially during winter). Communal roosting has not been recorded for this species, however it has been speculated that communal roosting may formerly have occurred, when the population size was greater. No information is available on the breeding dispersion in this species, but it is likely that they breed in solitary pairs, like other subspecies of the Double-eyed fig-parrot (Coxen's Fig-Parrot Recovery Team 2001; DES 2011).

6.5.3 Habitat

The Coxen's fig-parrot's preferred habitat are environments with thriving fig trees in lowland rainforest especially in alluvial areas. More recently however the species has adapted to a spectrum of rainforest types including coniferous, warm and cold subtropical as well as cool temperate rainforests between sea level and approximately 1,000 m above sea level (Birdlife International 2018; DES 2011).

The species have also been known to inhabit riparian corridors through woodlands, cleared land as well as isolated fruiting trees in gardens or farms consuming both fig and other fruiting rainforest species such as lichen, nectar and grubs (DES 2011; OEH 2017).

6.5.4 Threatening processes

The following have been identified as potentially threatening processes to the Coxen's fig-parrot:

- Rapid clearance of lowland rainforest which has led to increased fragmentation of habitats and isolated fig trees
- Invasion of habitats by invasive weeds
- Challenges in locating sufficient food sources

- Competition from other species with larger populations (Birdlife International 2018; Coxen's Fig-Parrot Recovery Team 2001).

6.5.5 Threat abatement/recovery plans

The following recovery plan has been identified as being relevant for this species:

- Coxen's Fig-Parrot Recovery Team (2001). Coxen's Fig-Parrot *Cyclopsitta diophthalma coxeni* Recovery Plan 2001-2005. Report to Environment Australia, Canberra, by Queensland Parks and Wildlife Service, Brisbane. Available from: **http://www.environment.gov.au/resource/coxens-fig-parrot-cyclopsitta-diophthalma-coxeni-recovery-plan-2001-2005**. In effect under the EPBC Act from 13-Oct-2003 as Cyclopsitta diophthalma coxeni.
- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from **https://www.environment.nsw.gov.au/savingourspeciesapp/Project.aspx?results=c&ProfileID=10195**. In effect under the BC Act 2016.

The following threat abatement plans have been identified as being relevant to this species:

- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats**. In effect under the EPBC Act from 23-Jul-2015.

6.5.6 Summary of threat abatement/recovery plan

The threats outlined in the Coxen's Fig-Parrot Recovery Plan include:

- Historical clearing of lowland subtropical rainforest for agricultural and housing in the 1860's causing decline in population numbers and range
- Inadequate extent and quality of habitat
- Fragmented habitat causing loss of connectivity between summer and winter areas, forcing birds to cross open areas and disjunct feeding grounds
- Disturbance to suspected breeding areas through logging and associated disturbance of subtropical rainforest/eucalypt ecotones
- Population decline resulting in a lack of social breading triggers, energy efficient communal food search effort and changes to social structures
- Higher susceptibility to disease and stochastic events such as drought
- Illegal robbing of nests for eggs, young and adults.

Recovery plan actions plans include:

- Establish a survey protocol and implement an ecological assessment and monitoring strategy to improve knowledge on size, distribution, nesting and ecology
- Undertake predictive modelling of distribution to refine current understanding of the range and to indicate potential field survey targets
- Investigate wild red-browed fig-parrots for their direct relevant to Coxen's fig-parrot, including dietary preference, activity patterns, flock size, movement patterns and communal roosting behaviour
- Undertake captive breeding and release to reduce the chance of extinction to species
- Assess the quantity, distribution and spatial arrangement of remnant habitat through mapping and investigation of food plants
- Develop management prescriptions for logging and regulate land use within identified species habitat
- Implement a community awareness strategy, incorporating government agencies, forestry and farming industries, researchers, funding bodies and special interest groups.

The Coxen's Fig-Parrot is assigned as a data-deficient species under the NSW *Saving our Species Program* and the objective of the strategy is to fill knowledge gaps in order to develop a targeted management strategy. State-wide conservation actions that have been identified for this species are:

- Encourage community participation to increase community awareness, opportunities for location of wild Coxen's Fig-Parrot populations and reduce opportunities for illegal trade of the species.
- Develop a survey protocol with techniques to minimize disruption to individual birds
- Conduct training in and undertake nest surveys to increase survey skill, indicate existence of fig-parrots in areas, likely areas of home ranges
- Monitor fruiting fig trees with historical records of visiting fig-parrots, or abundant fruit in known or suspected localities for fig-parrots
- Analyse prey remains for evidence of fig-parrots
- Use decoy birds to assist in attempts to locate wild populations
- Collect ecological data to characterize known sites
- Develop a records database to facilitate analysis of ecological data and undertake predictive modelling of distribution
- Implement an ecological monitoring strategy at occupied sites
- Investigate Red-browed Fig Parrot biology/ecology to assist in understanding the likely biology/ecology of the Coxen's Fig-Parrot
- Develop captive breeding protocols and refine husbandry techniques for raising, maintaining and releasing
- Protect active nest locations disturbance and keep site locations confidential.
- Monitor nest post-acquisition of eggs or chicks for impact of eggs or chicks being removed for the captive breeding program.
- Protect known or probable habitat through land use planning legislation.
- Undertake habitat rehabilitation/expansion in areas of known or probable habitat
- Propagate known and presumed food trees and distribute to landholders and community.

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

6.5.7 References

BirdLife International. (2018). Species factsheet: *Cyclopsitta coxeni*. Available from: http://www.birdlife.org [Accessed 22 August 2018].

Coxen's Fig-Parrot Recovery Team. (2001). Coxen's fig-parrot *Cyclopsitta diophthalma coxeni* recovery plan 2001-2005. Report to Environment Australia, Canberra. Queensland Parks and Wildlife Service, Brisbane.

Department of the Environment and Energy (2018). *Cyclopsitta diophthalma coxeni* (Coxen's Fig-Parrot) in Species Profile and Threats Database. Australian Government. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59714 [Accessed 22 August 2018].

Department of Environment and Science (2011). Double-eyed fig-parrot (Coxen's). Queensland Government. Available from: https://www.ehp.qld.gov.au/wildlife/animals-az/doubleeyed_figparrot_coxens.html [Accessed 22 August 2018].

Office of Environment and Heritage (2017). Coxen's Fig-Parrot - Profile. New South Wales Government. Available from: https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10195 [Accessed 22 August 2018].

6.6 Curlew sandpiper (*Calidris ferruginea*)

6.6.1 Status

EPBC Act – Critically Endangered Marine and Migratory (CAMBA)

6.6.2 Biology and ecology

6.6.2.1 Characteristic

The Curlew sandpiper (*Calidris ferruginea*) is a small sandpiper approximately 18 to 23 cm long with a wingspan of 38 to 41 cm and weighing about 57 g. The head is small and round with a black bill that is long and decurved with a slender tip, sometimes with a brown or green tinge at the base (refer Photograph 6.5). The sexes are similar, but females have a slightly larger and longer bill and a slightly paler underbelly in breeding plumage (DotEE 2018).

In breeding plumage, the head, neck and underbody are a rich chestnut-red with narrow black bars on the belly and flanks. There are black streaks on the crown, a dusky loral stripe, and white around the base of the bill. The feathers on the mantle and scapulars are black with large chestnut spots and grayish-white tips. The back and upper rump are dark brown, with a prominent square white patch across the lower rump and uppertail-covert (DotEE 2018).

During the breeding season the cap, ear-coverts, hindneck and sides of neck are pale brownish-grey with fine dark streaks changing to white on the lower face and throat. There is a narrow dark loral stripe and white supercilium from the bill to above the rear ear-coverts. The mantle, back, scapulars, tertials and innerwing-covert are pale brownish-grey with fine dark streaks. The underbody is white with a brownish-grey wash and fine dark streaks on the breast (DotEE 2018).

Photograph 6.5 Curlew sandpiper (*Calidris ferruginea*)

Source: Birdlife Australia (2018)

6.6.2.2 Known distribution

In Australia, Curlew sandpipers occur around the coasts and are also quite widespread inland (refer Figure 6.12). Records occur in all states and territories during the non-breeding season as well as the breeding season when immature birds remain in Australia rather than migrating north towards Siberia (DotEE 2018).

In Queensland, widespread records occur along the coast south of Cairns with sparsely scattered records inland. In NSW, they are widespread east of the Great Divide, especially in coastal regions. They are occasionally recorded in the Tablelands and are widespread in the Riverina and southwest NSW, with scattered records elsewhere (DotEE 2018).

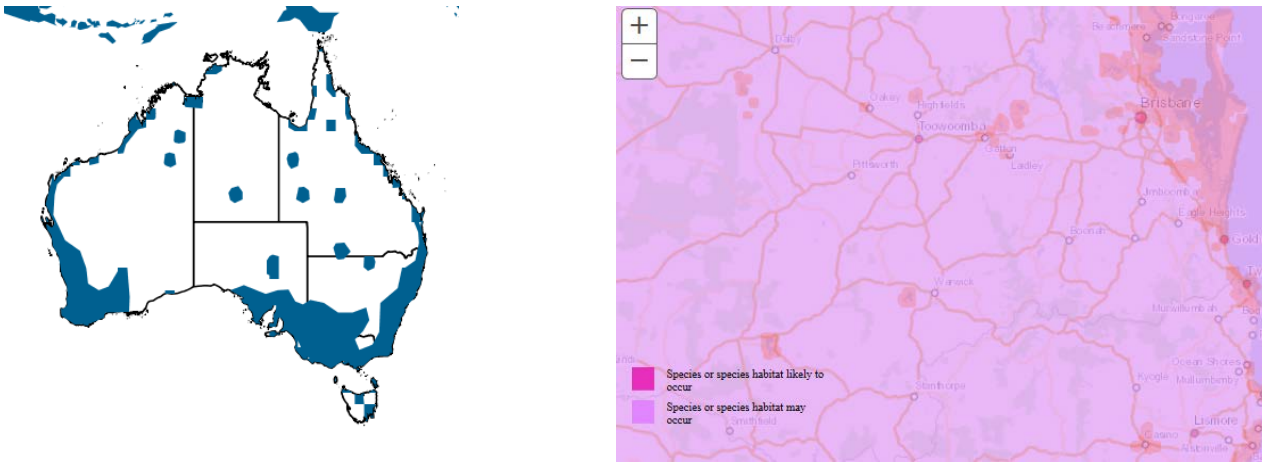


Figure 6.12 **Distribution range of the Curlew sandpiper**

Source: ALA (2018), DotEE (2018)

6.6.2.3 Distribution in relation to the Project

Database records (i.e. AoLA, WildNet) indicate the species is known from within 50 km of the temporary and permanent disturbance footprint. A single older record (<1982) is located on the edge of the MNES study area, however, this record has a high spatial uncertainty attached and no location information and has been disregarded. The closest recent inland record (2001) of the species to the Project is from dam (Lake Dyer) in the Laidley area approximately 15 km west of the western extent of the MNES study area (ALA 2020). There are also recent records from the wider Gatton area including 2017 and 2018 records from Lake Clarendon (25 km north-west of the Project), a 2009 record from Janke's Swamp (both locations 25 km north-west of the Project) and 2003 records from Atkinson's Lagoon (27 km north of the Project). The majority of records from the region are coastal or from inshore islands in Moreton Bay (refer Figure 6.13).

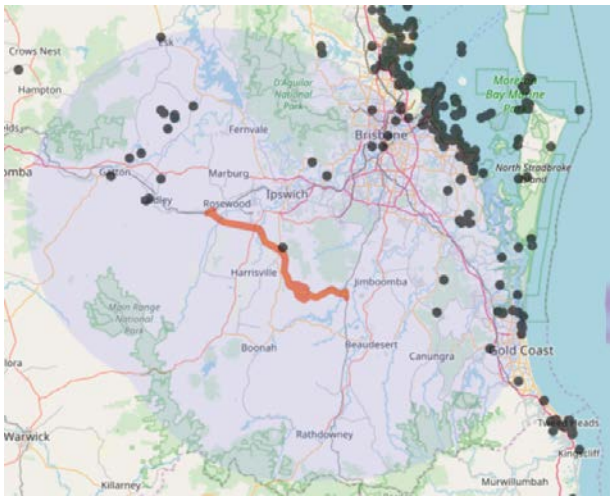


Figure 6.13 **Distribution range of the Curlew sandpiper in relation to the Project**

Source: ALA (2020)

6.6.2.4 Biology and reproduction

In Australia, the Curlew sandpiper forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds. Curlew sandpipers usually forage by pecking and probing in water, near the shore or on bare wet mud at the edge of wetlands. They glean from mud, from the surface of water, or in drier areas above the edge of the water. Curlew sandpipers may wade up to the belly, often with their heads submerged while probing. They often forage in mixed flocks, including with Red-necked stints (*Calidris ruficollis*). In tidal waters, the birds move onto the most recently exposed parts of the tidal flats and retreat in stages as the tide comes in. Supratidal feeding mainly occurs during the pre-migratory fattening periods (February- to April) (DotEE 2018).

This species does not breed in Australia and they move north to Siberia to breed and nest during June and July (Hayman et al. 1986).

6.6.3 Habitat

Curlew sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They have also been recorded inland around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters and wet mats of algae or waterweed, or on banks of beachcast seagrass or seaweed (DotEE 2018).

Curlew sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets around coastal and near-coastal lagoons and other wetlands. They occasionally roost in dunes and saltmarshes (DotEE 2018).

6.6.4 Threatening processes

The following have been identified as potentially threatening processes to the Curlew sandpiper:

- In non-breeding grounds in Australia, this species mostly occurs in highly populated areas and is therefore vulnerable to possible habitat alteration
- Threats to the Curlew sandpiper include the loss and fragmentation of feeding and roosting habitat from human development, human disturbance at roost and feeding sites, disturbance by wild dogs and pollution (DECC 2005; DotEE 2018, DECC 2005).

6.6.5 Threat abatement/recovery plans

There is no Commonwealth adopted recovery plan or threat abatement plans applicable to this species.

The following marine bioregional plan has been identified as being relevant for this species:

- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012). *Marine bioregional plan for the North-west Marine Region*. Prepared under the *Environment Protection and Biodiversity Conservation Act 1999*. Available from: http://www.environment.gov.au/topics/marine/marine-bioregional-plans/north-west. In effect under the EPBC Act from 27-Aug-2012.

6.6.6 Summary of threat abatement/recovery plan

Threats identified at the management sites include:

- Human disturbance at roosting and foraging sites from fishing, baiting, pets, boating, horses, 4WDing, biking and surfing
- Mangrove incursion into saltmarsh habitat

- Habitat loss from development such as major port expansions and transport related development
- Habitat loss from erosion, climate change inundation and sea-level rise.

Management activities to protect this species at the sites are:

- Educate recreational users and land managers on the impact of disturbance on birds to minimise the impact of recreational activity
- Install signage and exclusion fencing at significant foraging and roosting sites
- Protect habitat from degradation using methods such as raising the height of dikes or armouring works around intertidal feeding sites
- Identify and protect opportunities for wader habitat expansion by liaising with relevant agencies and land managers
- Continue monthly population monitoring and liaise with other regions to assess trends in the species across its range
- Monitor habitat usage were management strategies have been implemented to assess their effectiveness.

In terms of the Marine bioregional plan for the North-west Marine Region, the relevant management strategies for the Curlew sandpiper include:

- Increase the support from research organization
- Establish and manage a Commonwealth marine reserve network to provide protection and conservation of biodiversity
- Provide regional advice determining the significance of potential impacts
- Develop targeted collaborative programs to coordinate species recovery and environmental protection efforts
- Improve monitoring, evaluation and reporting on ecosystem health.

6.6.7 References

Atlas of Living Australia (2018). *Calidris (Erolia) ferruginea*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:fa188c0e-68ba-4b3f-8e8f-48734608c7d1 [Accessed 23 August 2018].

Birdlife Australia (2018). Curlew Sandpipers. (Image) [Online] Available from: http://birdlife.org.au/bird-profile/curlew-sandpiper [Accessed 22 August 2018].

Department of the Environment and Energy (2018). *Calidris ferruginea* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=856 [Accessed 22 August 2018].

Department of Environment and Climate Change, NSW (DECC) (2005). *Taren Point Shorebirds - profile*. NSW DECC. Available from: http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10800 [Accessed 22 August 2018].

6.7 Eastern bristlebird (*Dasyornis brachypterus*)

6.7.1 Status

EPBC Act – Endangered

6.7.2 Biology and ecology

6.7.2.1 Characteristics

The Eastern bristlebird (*Dasyornis brachypterus*) is a small ground dwelling bird with a large tail accounting for half of its 20 cm body length. The sturdy, grey-brown passerine has a dark cinnamon-brown upperpart, rufous-brown upperwing and uppertail which transitions into a grey-brown underpart which is faintly scalloped. Grey-brown feathering features on the bristlebird's belly and flanks, with a red iris in adults distinguishing it from juveniles who have a pale brown iris (refer Photograph 6.6). Female bristlebirds are very similar to males with the only distinguishable feature being there slightly smaller frame (Birdlife International 2016). The bristlebird is distinct in appearance due to its short wings, strong legs and bristles in front of the eyes that allow it to adapt perfectly to live amongst dense ground vegetation (DES 2013).

Photograph 6.6 Eastern bristlebird (*Dasyornis brachypterus*)

Source: ALA (2017)

6.7.2.2 Known distribution

The Eastern bristlebird is endemic to the southeast of Australia and occurs in three geographically-separate regional populations in southeastern Australia (refer Figure 6.14). One of the regional populations is known to roam habitats between the southern Queensland and northern NSW border with four populations comprising of 35 individual birds (OEH 2017; DES 2013; DotEE 2018).

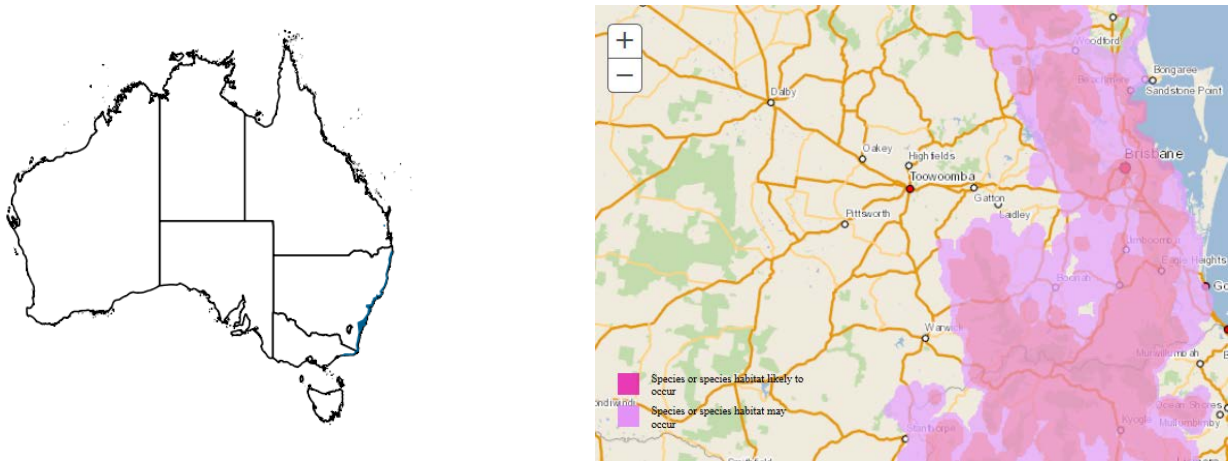


Figure 6.14 Distribution range of the Eastern bristlebird

Source: ALA (2017), DotEE (2018)

6.7.2.3 Distribution in relation to the Project

Dasyornis brachypterus has been predicted to occur within the region and associated habitat within the MNES study area. There are a number of records within 50 km of the MNES study area associated with the species known Queensland range extending from Main Range National Park east to Lamington National Park (over 40 km south of the MNES study area). It is noted AoLA records of the species have been generalised to protect the species and so may not reflect the actual occurrence location.

Figure 6.15 Distribution range of the Eastern bristlebird in relation to the Project

Source: ALA (2020)

6.7.2.4 Biology and reproduction

The Eastern bristlebird feed predominately on seeds, small fruits and invertebrates, but are also known to take fungi and occasionally nectar, food scraps and tadpoles. They are known to feed on the seeds or fruits of grasses and other plants (including *Acacia*, *Carex*, *Exocarpos* and, possibly, *Lycium ferocissimum*), and take nectar from *Banksia ericifolia* (DotEE 2018).

The Eastern bristlebird are known to breed from August to February. A small, globular nest is constructed with a side entrance, using grass, bark, sedges or reeds, and sometimes leaves. The nest is typically placed less than 1 m above the ground, in low dense vegetation, in or near the base of sedges, grasses, ferns and shrubs (DotEE 2018).

Clutches generally consist of two, or sometimes three, eggs. The eggs are incubated by a single parent (presumed to be the female), for at least three weeks. Both parents are known to feed the nestlings, during the fledging period of at least 16 days. Pairs readily desert their nests if disturbed, especially during the incubation period (Birdlife International 2016; DotEE 2018).

6.7.3 Habitat

The habitat of the bristlebird in Queensland has occurred within localised pockets of relatively open eucalypt forest located close to denser vegetation along creeks and rainforest, whilst in northern NSW, the bristlebird's known habitat is within open forest with understorey predominantly composed of dense tussock grass and sparse mid-storey, close to rainforest ecotone. The soil underlying these habitats are fertile and derived from basalts of the Main Range Volcanics (Birdlife International 2016; DES 2013; OEH 2017, DotEE 2018).

The species have also been known to inhabit shrubby montane heath vegetation on poorer soils consisting of *Melaleuca* spp., *Leptospermum grandifolium*, *Hakea teretifolia* and *Eucalyptus* woodland (Birdlife International 2016).

6.7.4 Threatening processes

The following have been identified as potentially threatening processes to the Eastern bristlebird:

- Inappropriate fire regimes leading to changes in habitat structure as the species requires frequent fires to ensure its preferred vegetation remains dense enough for cover and nesting, however, not frequent enough to eliminate tussocks, shrub and trees enabling invasion by weed species (Birdlife International 2016; DES 2013).

6.7.5 Threat abatement/recovery plans

The following recovery plan has been identified as being relevant for this species:

- OEH (2012). National Recovery Plan for Eastern Bristlebird *Dasyornis brachypterus*. Office of Environment and Heritage, Department of Premier and Cabinet (NSW), Sydney. Available from: **http://www.environment.gov.au/resource/national-recovery-plan-eastern-bristlebird-dasyornis-brachypterus**. In effect under the EPBC Act from 30-Jan-2014.

The following threat abatement plans have been identified as being relevant to this species:

- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats**. In effect under the EPBC Act from 23-Jul-2015.
- Department of the Environment and Energy (2017). Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa) (2017). Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/feral-pig-2017**. In effect under the EPBC Act from 18-Mar-2017.
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Threat abatement plan for predation by the European red fox. DEWHA, Canberra. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox**. In effect under the EPBC Act from 01-Oct-2008.

6.7.6 Summary of threat abatement/recovery plan

Threats specific to the Eastern bristlebird in the strategy include:

- Habitat clearing
- Fire
- Predation
- Disturbance of habitat by exotic herbivores
- Habitat degradation due to dieback or invasive weeds
- Small population size and genetic bottlenecks
- Climate change
- Human disturbance.

Objectives and actions outlined in the threat abatement plan for the Eastern bristlebird include:

- Prescribe appropriate fire regimes
- Control feral pest animals
- Control invasive weeds and plant-soil disease
- Conduct survey, monitoring and mapping to improve knowledge of all populations
- Understand population dynamics and monitor habitat conditions

- Locate potential habitat for new colonies
- Estimate accurately the population size for all populations
- Build populations up to a point of self-sustaining viability
- Increase knowledge of the ecology, threats and habitat management requirements for the species
- Increase community awareness and stakeholder engagement
- Ensure effective organisation and administration of recovery effort to ensure plan objectives are met.

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

The threats outlined in the threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) include:

- Impacts on plant species composition and succession
- Alterations to nutrient, water cycling and water quality
- Predation of native fauna and flora including small mammals, birds, reptiles, frogs, crayfish, eggs, invertebrates, fungi and all part of plants including fruit, seeds, roots, tubers, bulbs and foliage
- Digging and disturbance to substrate resulting in the destruction of plants threatening their survival and recruitment of new plants altering the floral composition and soil structure
- Disturbance caused by pigs can increase the incursion and recruitment of weeds and provide reservoirs for endemic animal diseases.

Threat abatement actions for feral pics (*Sus scrofa*) include:

- Implementation of control measures including trapping, aerial and ground shooting, poisoning and fencing
- Using tracking dogs to detect and flush out feral pigs by commercial harvesters
- Manipulating habitat by reducing watering point and crop waste
- Manage feral pigs within a policy, legislative and planning framework.

Threats identified in the threat abatement plan for predation by the European red fox include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for the European red fox include:

- Baiting
- Biological control
- Barriers
- Habitat management
- Shooting and bounties.

6.7.7 References

Atlas of Living Australia (2017). *Dasyornis* (*Dasyornis*) *brachypterus*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:d38d3f40-e9db-4acc-af04-d0ca566771c1 [Accessed 22 August 2018].

BirdLife International (2016). *Dasyornis brachypterus*. The IUCN Red List of Threatened. Available from: http://www.iucnredlist.org/details/22704507/0 [Accessed 22 August 2018].

Department of the Environment and Energy (2018). *Dasyornis brachypterus* (Eastern Bristlebird) in Species Profile and Threats Database. Australian Government. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=533 [Accessed 22 August 2018].

Department of Environment and Science (2013). Eastern Bristlebird. Queensland Government. Available from: https://www.ehp.qld.gov.au/wildlife/threatened-species/endangered/endangered-animals/eastern_bristlebird.html [Accessed 22 August 2018].

Office of Environment and Heritage (2017). Eastern Bristlebird - Profile. New South Wales Government. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10206 [Accessed 22 August 2018].

6.8 Eastern curlew (*Numenius madagascariensis*)

6.8.1 Status

EPBC Act – Critically Endangered Marine and Migratory (CAMBA)

6.8.2 Biology and ecology

6.8.2.1 Characteristic

The Eastern curlew (*Numenius madagascariensis*) is the largest wading bird that visits Australia, with the larger sex being the female which reaches up to 66 cm tall. The wingspan is about 110 cm, weighing approximately 900 g. It has an elongated, curved bill with a pinkish base for probing in mudflats, and long olive-grey legs. The feathers of the upper parts of the body are brown, with dark centres, and have broad pale rufous or olive-brown edges (refer Photograph 6.7). The tail is grey-brown with narrow dark banding on the feathers. The under parts are dark brownish-buff, becoming paler on the rear belly. There is fine dark streaking on the fore-neck and breast, which become thicker arrow-shaped streaks and barring on the fore-flanks. The upper belly and rear flanks have finer and sparser dark streaking. The underneath of the wing is whitish, but appears darker due to fine dark barring. Juveniles resemble adults but have a slightly shorter bill that grows with maturity and are typically paler with finer streaking on the breast. The Eeastern curlew has a mournful, haunting yet melodious call (DES 2017; TSSC 2015).

Photograph 6.7 Eastern curlew (*Numenius madagascariensis*)

Source: Jones (2011)

6.8.2.2 Known distribution

Within Australia, the Eastern curlew has a primarily coastal distribution. The species is found in all states and territories, particularly the north, east, and southeast regions, including Tasmania (refer Figure 6.16). Eastern curlews are rarely recorded inland. They migrate in late February to March to Russia and northeastern China to breed (DES 2017; TSSC 2015).

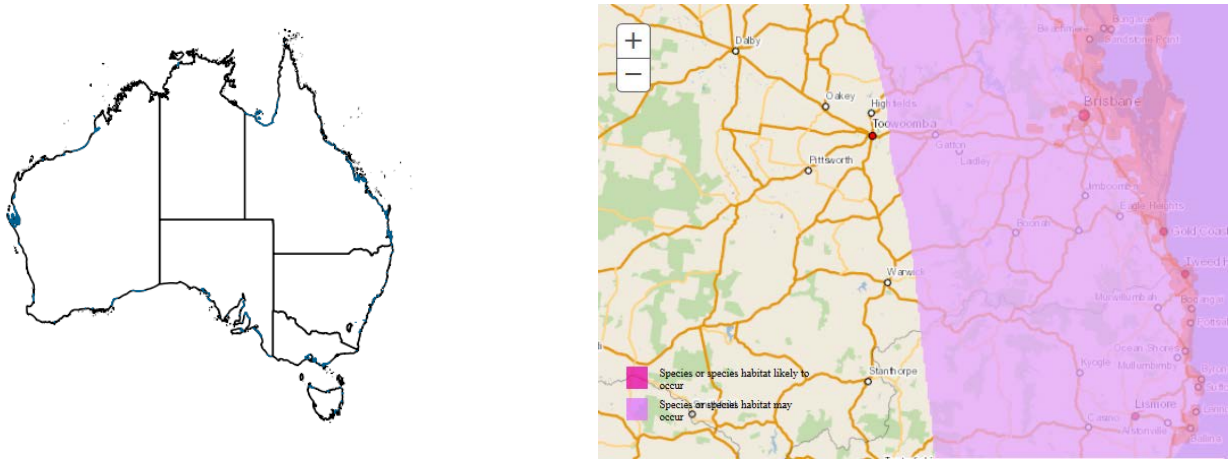


Figure 6.16 Distribution range of the Eastern curlew

Source: ALA (2018), DotEE (2018)

6.8.2.3 Distribution in relation to the Project

Numenius madagascariensis has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicate that the species is known from within 50 km of the temporary and permanent disturbance footprint. The closest reliable record (2012) for this species occurs approximately 30 km from the disturbance footprint at the southern extent of D'Aguilar National Park. Other records exist to the north-west, north but mostly in the coastal regions to the north-east, east and south-east.

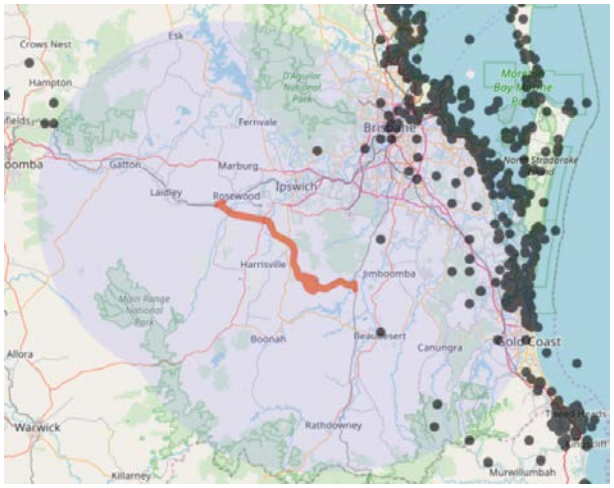


Figure 6.17 **Distribution range of the Eastern curlew in relation to the Project**

Source: ALA (2020)

6.8.2.4 Biology and reproduction

The Eastern curlew primarily eats crustaceans, small molluscs, mudskippers and some insects. Foraging by day and night, stalking slowly on sandy and muddy flats and picking from the surface or probing deep with its long bill (Birdlife Australia 2018).

The Eastern curlew does not breed in Australia. They breed in the northern hemisphere summer, from early May to late June, often in small colonies of two to three pairs (del Hoyo et al. 1996).

6.8.3 Habitat

The Eastern curlew can be found foraging and roosting in sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Zosteraceae). The species is known to inhabit ocean beaches, coral reefs, rock platforms, rocky islets, coastal saltworks and sewage farms. They are often recorded in saltmarshes and near mangrove forests (Marchant and Higgins 1993; TSSC 2015).

6.8.4 Threatening processes

The following have been identified as potentially threatening processes to the Eastern curlew:

- Human disturbance can cause shorebirds to interrupt their feeding or roosting and may influence the area of otherwise suitable feeding habitat. Disturbance to pre-migratory eastern curlews may adversely affect their capacity to migrate, as the birds will use energy reserves to avoid disturbance, rather than for migration (Close and Newman 1984).
- Coastal development, land reclamation, construction of barrages and stabilisation of water levels can disrupt water regimes and destroy feeding habitat (Australian Government 2009)
- Pollution and invasive plants around foraging areas may reduce the availability of food. These threats tend to be more extensive in eastern and southern Australia (Australian Government 2009; Close and Newman 1984; Garnett et al. 2011; Rogers et al. 2006).

6.8.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

6.8.6 References

Atlas of Living Australia (2018). *Numenius madagascariensis*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:21ab21e4-5cd7-4e68-9268-1b6db1a9c3aa [Accessed 22 August 2018].

Birdlife Australia (2018). Eastern Curlew. Available from: http://www.birdlife.org.au/bird-profile/eastern-curlew [Accessed 22 August 2018].

Department of the Environment and Science (2017). Eastern curlew. Available from: https://www.ehp.qld.gov.au/wildlife/animals-az/eastern_curlew.html. [Accessed 22 August 2018].

Threatened Species Scientific Committee (2015). Conservation Advice on eastern curlew (*Numenius madagascariensis*). Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/847-conservation-advice.pdf [Accessed 22 August 2018].

6.9 Painted honeyeater (*Grantiella picta*)

6.9.1 Status

EPBC Act – Vulnerable

6.9.2 Biology and ecology

6.9.2.1 Characteristic

Painted honeyeater (*Grantiella picta*) is a medium honeyeater, growing to a length of 14 to 15 cm in size. The Painted honeyeater weights around 20 to 25 g and has a black head and back, and bright yellow on the wings and upper tail and a bright pink bill (refer Photograph 6.8). The male is distinguished by white underparts with black streaks on flanks (above legs). The females are slightly smaller than the males and identified by brownish-black colouring with white underparts. Juveniles are browner and have a greyish coloured bill. The Painted honeyeater is known to use the same nest sites each season and are generally seen in pairs or singles, rarely in small flocks of up to six birds (DES 2018; DotEE 2018).

Photograph 6.8 Painted honeyeater (*Grantiella picta*)

Source: Chapman (2017)

6.9.2.2 Known distribution

The Painted honeyeater is endemic to Australia and its distribution over summer and spring stretches from inland central Victoria through scattered parts of NSW, the ACT and southern Queensland (refer Figure 6.18). During winter the Painted honeyeater is known to migrate further to North Queensland, around Cape York Peninsula, and eastern areas of the Northern Territory. The greatest concentrations of individuals and almost all breeding records are located on the inland slopes of the Great Dividing Range (DotE 2015). Opportunistic sightings have been recorded in far eastern parts of South Australia (DotEE 2018). Coastal records can be considered as vagrant and transient movements of inland birds.

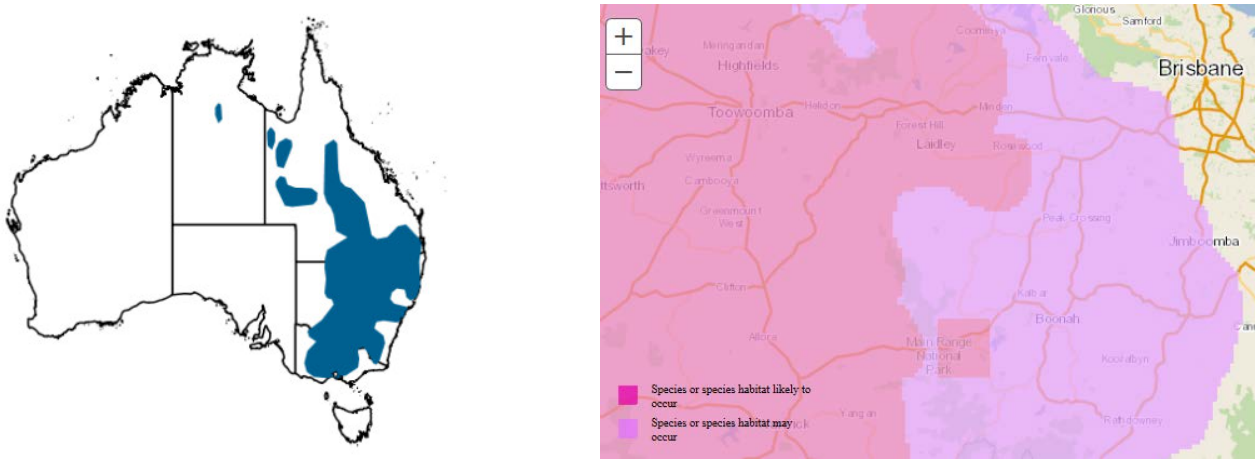


Figure 6.18 **Distribution range of the Painted honeyeater**

Source: ALA (2018), DotEE (2018)

6.9.2.3 Distribution in relation to the Project

Grantiella picta has been predicted to occur within the region and associated habitat within the MNES study area. Database records indicate this species does not occur within the MNES study area however has occurred within 50 km of the Project. The nearest database record is of uncertain provenance (no date) and located 28 km west of the Project at Lake Apex, Gatton. A second older bird atlas record (1977-1981) is located 26 km north-east of the Project (western Brisbane) but has a high spatial uncertainty. Other database records occurring largely to the west of the Project and are well outside of the 50 km buffer. The vast majority of records lie on the western slopes of the Great Dividing Range

Figure 6.19 **Distribution range of the Painted honeyeater in relation to the Project**

Source: ALA (2020)

6.9.2.4 Biology and reproduction

The Painted honeyeater is typically seen individually or in pairs, less frequently seen in small flocks of up to six birds. This species is known to consume fruit. The species is predominantly observed in areas where mistletoe is abundant. The species is known to have a mixed diet consisting of nectar, berries and insects, defining them an omnivorous and an obligate nectarivore (DotEE 2018).

The species nests in a variety of trees and have been documented to favour mistletoe as a nesting site. The foliage of mistletoe helps with concealment of the nest to protect from predators and subsequent nest failure (DotEE 2018).

The breeding season generally takes place between October through to March, and can be influenced by environmental conditions and the availability of food resources. Generally, the male Painted honeyeater will arrive at a nesting site several weeks before the female.

Both the male and female Painted honeyeaters maintain the nest, incubate the eggs, brood and feed the young. Nests are generally found approximately 15 m from the ground where the typical clutch consists of 2 eggs, but not uncommonly 1 to 3 eggs can be found. The species are known to raise 1 to 2 broods per season, where eggs are incubated for 13 to 15 days, and young fledge in 14 to 20 days. Box the female and male leave the nest at approximately the same time, generally five months after fledglings leave the nest and food resources decline (DES 2018; DotEE 2018).

6.9.3 Habitat

The Painted honeyeater is predominantly found in open forest, box-open woodland, eucalypt forest/woodlands, riparian woodlands and acacia woodlands. The Painted honeyeater inhabits environments that have a high prevalence of mistletoe which provides both nesting and food resources. Favourable species including needle-leaved mistletoe *(Amyema cabagei)* and grey mistletoe *(A. quandang)*. An identified key association between the Painted honeyeaters migration south-north is believed to be a result of mistletoe fruit availability and general mistletoe distribution and abundance (DotEE 2018).

6.9.4 Threatening processes

The following have been identified as potentially threatening processes to the Painted honeyeater:

- Habitat loss and fragmentation
- Grazing inhibiting tree recruitment for feed trees (DotEE 2018).

6.9.5 Threat abatement/recovery plans

There is no Commonwealth adopted recovery plan for the species and no threat abatement plan considered relevant to this species. The following NSW species action statement has been identified as relevant for this species:

- Office of Environment and Heritage (2016), *Saving our Species Programme*. Available from **https://www.environment.nsw.gov.au/savingourspeciesapp/Project.aspx?results=c&ProfileID=10357**. In effect under the BC Act 2016.

6.9.6 Summary of threat abatement/recovery plan

Threats identified in the Saving our Species plan includes:

- Degradation of open forest and woodland remnants along with the thinning of trees that bear mistletoe
- The loss of large, old trees that have heavy mistletoe infestations
- Habitat loss as a result of clearing woodlands and open forest
- Grazing pressure within grassy woodlands causing degradation and simplification of habitat

- Incursion from invasive weeds, particularly African boxthorn and invasive grasses
- Noisy minors causing aggressive exclusion in forest and woodland habitat.

Management actions identified in the Saving our Species plan includes:

- Encourage relevant landholders to enter into agreements that promote the protection, maintenance and recruitment of *Acacia* (*A. pendula* or *A. homalophylla*) woodland with mistletoe
- Incorporate into landholder agreements sensitive grazing regimes allowing suitable woodland habitat to regenerate
- Increase awareness with landholders of the importance of mistletoe as a resource for the Painted honeyeater and education around the fact that it is not harmful to healthy trees
- Revegetation of Brigalow, Boree and Yarran woodlands to provide connectivity between fragments, particularly in Painted honeyeater breeding habitat
- Encourage landholders to protect ground and mid-storey vegetation through the implementation of sensitive grazing techniques along with eliminating slashing or underscrubbing to retain floral and structural diversity
- Target removal of exotic grasses and promote regeneration of native grasses
- Measure the impact and abundance on Noisy miners implementing appropriate management strategies to reduce their impact
- Prioritise site protection in areas that function as drought refuges or source populations in programs that aim to protect, manage and restore habitat
- Implement research to fill knowledge gaps around restoring the structure and function of the ground layer, including soil structure in degraded habitat.

6.9.7 References

Atlas of Living Australia (2018), *Grantiella picta.* Viewed 17 August 2018, Available: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:de126daa-e11d-42e0-ace6-7873abe6c96b#.

BirdLife International (2018) Species factsheet: Grantiella picta. Downloaded from http://www.birdlife.org on 17/08/2018.

Department of the Environment and Energy (2018). Conservation Advice *Grantiella picta* painted honeyeater. Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/470-conservation-advice.pdf. In effect under the EPBC Act from 08 July 2015.

Department of Environment and Science (DES), Painted honeyeater – *Grantiella picta*, Wetland*Info*, Queensland, viewed 17 August 2018, https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?grantiella-picta.

6.10 Red goshawk (*Erythrotriorchis radiatus*)

6.10.1 Status

EPBC Act – Vulnerable

6.10.2 Biology and ecology

6.10.2.1 Characteristics

The Red goshawk (*Erythrotriorchis radiatus*) is a large, swift and powerful rufous-brown goshawk. This species of raptor is estimated to be of 45 to 58 cm in total body length with a wingspan of 110 to 135 cm. The Red goshawk is boldly mottled and streaked, with rufous scalloping on the back and upper wings, and massive yellowish legs and feet. The head of the bird is pale and streaked with darker feathers (refer Photograph 6.9). Females are typically larger than males, more powerfully built, paler and more heavily streaked below, showing some white on the under body. Red goshawk juveniles are distinguished from adults due to their rufous head (DES 2017; DotEE 2018).

Photograph 6.9 Red goshawk (*Erythrotriorchis radiatus*)

Source: ALA (2016)

6.10.2.2 Known distribution

The Red goshawk is distributed along the east coast of Queensland, Cape York Peninsula and across into northern regions of Australia (refer Figure 6.20). In Queensland, is it estimated that the species population is limited to the bioregions of the Wet Tropics, Cape York Peninsula and Mount Isa Inlier. However, surveying of the species in another three bioregions has yet to occur. Some adults of Red goshawk in southeast Australia have been known to migrate annually from the ranges down into the lowlands during winter period. The species is thought to be extinct in southeast Queensland as well as being very rare in NSW extending south to about 30˚S (DES 2017; OEH 2017).

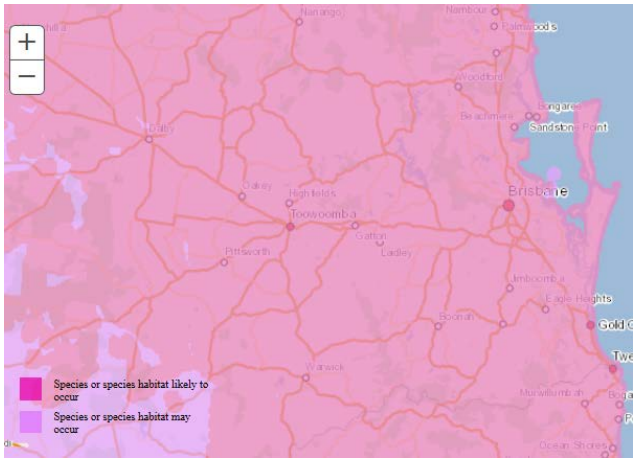


Figure 6.20 Distribution range of Red goshawk

Source: ALA (2016), DotEE (2018)

6.10.2.3 Distribution in relation to the Project

Erythrotriorchis radiatus has been identified as potentially occurring within the MNES study area. Database records indicate this species has been recorded within 50 km of the Project. It is noted available records (AoLA) have all been generalised in order to protect the species and so accurate locations have not been published. Recent database records in the region are relatively few. The nearest record is from 2009 and located 8 km north of the Project in the Rosewood area. A second record is from 1973 and located 9 km north-east of the Project in South Ripley (south of Ipswich). There are several more recent records (post 2000) to the north (Lowood area) and west of the Project (Gatton area and the Toowoomba Range) (ALA 2020).

Figure 6.21 Distribution range of Red goshawk in relation to the Project

Source: ALA (2020)

6.10.2.4 Biology and reproduction

The solitary Red goshawk is known to prey on birds such as Australian brush-turkeys, Kookaburras and Rainbow lorikeet as well as small mammals, reptiles and insects. The species is known to attack its prey from the air, gliding straight down or chasing it down. The male of the species will build nests using dead sticks lined with twigs and green leaves within an exposed fork in the upper quarter of a tree between 10 to 20 m above ground and used each year. Nest sites are usually located on an emergent tree within 1 km of permanent water (DES 2017; OEH 2017).

The breeding season for Red goshawk occurs from September to December with one to two eggs being laid by the females between August and October in the southeast regions. Females will incubate eggs for a period of 39 to 43 days with the young being fully fledged after eight weeks despite not being independent for at least another ten weeks (DES 2017).

6.10.3 Habitat

The Red goshawk typically occurs in both coastal and sub-coastal areas, in wooded and forested lands of tropical and warm-temperate Australia. Riverine forests are also used frequently. The Red goshawk nests in large trees, frequently the tallest and largest in a stand, which are typically within one kilometre of a permanent water source. This species typically avoids very dense, and very open habitats (Debus 1991; 1993; OEH 2017; Marchant and Higgins 1993).

In Queensland the species is known to inhabit cleared parts of eastern Queensland associated gorges and escarpment country whilst in NSW the preferred habitat includes mixed subtropical rainforest such as *Melaleuca* swamp forest as well as riparian *Eucalyptus* forest of coastal rivers (DES 2017; OEH 2017).

6.10.4 Threatening processes

The following have been identified as potentially threatening processes to the Red goshawk:

- Heavy habitat fragmentation caused by urban development, agriculture and forestry processes clearing extensive areas of forests
- Vulnerability of nests to storm damage and prey
- Development or noise dispersing food sources (DES 2017).

6.10.5 Threat abatement/recovery plans

No threat abatement plans have been identified as being relevant to this species.

The following recovery plan has been identified as being relevant for this species:

- Department of Environment and Resource Management (2012). National recovery plan for the red goshawk *Erythrotriorchis radiatus*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra. Queensland Department of Environment and Resource Management, Brisbane. Available from: **http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-red-goshawk-erythrotriorchis-radiatus**. In effect under the EPBC Act from 24-Jul-2012 as *Erythrotriorchis radiatus*.

6.10.6 Summary of threat abatement/recovery plan

Threats identified in the recovery plan for this species includes:

- Loss of habitat
- Fragmentation of existing habitat
- Reduction in nest sites through the loss of mature trees
- Reduction to the prey base
- Threats to prey availability
- Knowledge and communication gaps for this species
- Poor management practices.

Recover plan actions for this species include:

- Identify and map important Red goshawk habitat
- Protect and appropriately manage important habitat areas for the species to ensure its long-term survival
- Gain a better understanding regarding the reproductive success and survival for the Red goshawk
- Identify important populations for the species
- Increase community awareness and engagement in the conservation of the species.

6.10.7 References

Atlas of Living Australia (2016). Erythrotriorchis radiatus. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:1405a1d4-557c-40ac-9f44-a6d41e9136cd#overview [Accessed 22 August 2018].

Debus, S.J.S. (1991). An annotated list of NSW records of the Red goshawk. Australian Birds. 24:72- 89.

Debus, S.J.S. (1993). The status of the Red goshawk (Erythrotriorchis radiatus) in New South Wales. Olsen, P., ed. Australasian Raptor Studies. Page(s) 182-191. ARA-RAOU, Melbourne.

Department of the Environment and Energy (2018). Erythrotriorchis radiatus (Red Goshawk) in Species Profile and Threats Database. Australian Government. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=942 [Accessed 22 August 2018].

Department of Environment and Science (2017). Red Goshawk. Queensland Government. Available from: https://www.ehp.qld.gov.au/wildlife/threatened-species/endangered/endangered-animals/red_goshawk.html [Accessed 22 August 2018].

Marchant, S. and P.J. Higgins, eds. (1993). Handbook of Australian, New Zealand and Antarctic Birds. Volume 2 - Raptors to Lapwings. Melbourne, Victoria: Oxford University Press.

Office of Environment and Heritage (2017). Red Goshawk – Profile. New South Wales Government. Available from: https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10279 [Accessed 22 August 2018].

6.11 Regent honeyeater (*Anthochaera phrygia*)

6.11.1 Status

EPBC Act – Critically Endangered

6.11.2 Biology and ecology

6.11.2.1 Characteristic

The Regent honeyeater (*Anthochaera phrygia*) is approximately 20 to 23 cm in total length, and weighs between 31 to 50 g. This species is characterised by its striking black and yellow appearance. The head, neck and upper breast of the species features black feathering which transitions into a lemon-yellow back and leads to black wings with conspicuous yellow patches. The tail of the bird is predominantly black with yellow edging (refer Photograph 6.10). Males of the species are distinguished by yellowish warty bare skin surrounding the eye whilst females are noticeably smaller in size with a bare yellowish patch under the eye as well as less black on the throat. Young Regent honeyeaters resemble females, however have a browner and paler bill (Birdlife 2018; Curtis et al. 2012).

Photograph 6.10 Regent honeyeater (*Anthochaera phrygia*)

Source: Birdlife (2018)

6.11.2.2 Known distribution

The Regent honeyeater is a species endemic to southeast Australia, ranging from southeast Queensland to central Victoria (refer Figure 6.22). Despite historic records indicating that the species ranged widely, from Rockhampton, Queensland to Adelaide, the species is now restricted to the western slopes of the Great Diving Range (Birdlife 2018).

In southeast Queensland, the Regent Honeyeater's distribution ranges from the Cooloola Plains in the north to inland areas such as Dalby, and further south into areas such as Narrabri NSW. Regent honeyeater breeding occurs by a smaller number of the species regularly west of Warwick in Queensland (Curtis et al. 2012; DES 2017).

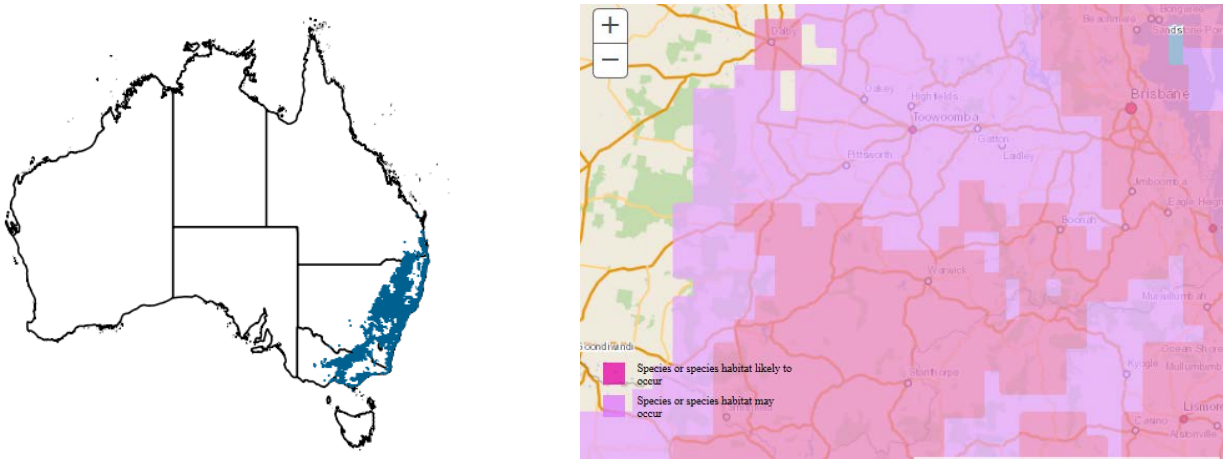


Figure 6.22 **Distribution range of the Regent honeyeater**

Source: ALA (2018), DotEE (2018)

6.11.2.3 Distribution in relation to the Project

Anthochaera phrygia has been predicted to occur within the region and associated habitat within the MNES study area. The species is transient in the Lockyer Valley / greater Brisbane region, being sporadically recorded in the winter months. It is noted AoLA records of the species have been generalised to protect the species and so may not reflect the actual occurrence location. There are a large number of records to the north of the Project from 2019 located within 20 km of the disturbance footprint. All of these records are likely associated with a well known pair of birds that occurred in urban parklands in the Springfield Lakes area over an extended period of time in winter 2019 (pers. comm. B Taylor) and located 18 km north-west of the Project. There are a number of other records from the wider Brisbane area to the north of the Project including relatively recently (2015) (refer Figure 6.23). Records to the south of the Project include Main Range National Park (2000) and an older record (<1980) from Mount Alford area. Both of these records are over 30 km south of the disturbance footprint (AoLA 2020).

Figure 6.23 **Distribution range of the Regent honeyeater in relation to the Project**

Source: ALA (2020)

6.11.2.4 Biology and reproduction

The Regent honeyeater's diet consists of nectar from key species such as Yellow Box (*Eucalyptus melliodora*), White Box (*Eucalyptus albens*) and Mugga Ironbark (*Eucalyptus sideroxylon*) as well as sugary exudates. The species is also known to consume insects particularly when breeding (Birdlife International 2016).

The species breeds as individual pairs or sometimes in loose colonies with the female honeyeater incubating eggs whilst both parents feed the young. The eggs are often laid in cup-shaped nest 1 m to 20 m above the ground in tree forks of eucalypts and sometimes among mistletoe. The nests are usually constructed of bark with soft material lining the nest (Birdlife 2018; Birdlife International 2016).

6.11.3 Habitat

The preferred habitat of the Regent honeyeater is wet areas containing fertile soils that provide reliable nectar seasonally in areas of creek flats, river valleys and lower slopes. They are also found in dry eucalypt woodland and open forest in both rural and urban environments with mature eucalypts (DES 2018).

Other habitats of the species include Swamp mahogany (E. robusta), Spotted gum (Corymbia maculata) and River she-oak (Casuarina cunninghamiana) with associated Mistletoe (Amyena cambagei) (DES 2018).

6.11.4 Threatening processes

The following have been identified as potentially threatening processes to the Regent honeyeater:

- Habitat loss, fragmentation and degradation as a result of clearing for agriculture and development
- Suppression of natural regeneration of overstorey tree species and shrub species as a result of overgrazing
- Competition from larger, aggressive species such as the Noisy miner, Noisy friarbird and Red wattlebird
- Disturbance to nesting sites leading to abandonment (OEH 2017).

6.11.5 Threat abatement/recovery plans

The following threat abatement plan has been identified as being relevant to this species:

- Department of the Environment and Energy (2016). Threat abatement plan for competition and land degradation by rabbits. Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-rabbits-2016**. In effect under the EPBC Act from 07-Jan-2017.

The following recovery plan has been identified as being relevant for this species:

- Department of the Environment (2016). National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*). Canberra, ACT: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-regent-honeyeater-anthochaera-phrygia-2016**. In effect under the EPBC Act from 04-May-2016 as Anthochaera phrygia.

6.11.6 Summary of threat abatement/recovery plan

Threats identified in the threat abatement plan for competition and land degradation by rabbits includes:

- Competition with native wildlife for food and shelter
- Prevention of plant regeneration
- Increased grazing pressure and damage to native vegetation
- Altering the regular process of plant succession

- Altering ecological communities and impacting soil structure and nutrient cycling contributing to serious erosion
- Increasing predation and reducing reproduction for native arboreal mammals and birds through the removal of critical habitat.

Threat abatement actions for rabbits include:

- Supress rabbit populations at the landscape scale below thresholds in identified priority areas
- Gain a better understanding of the impacts rabbits have and their interactions with other species and ecological processes
- Increase the effectiveness of rabbit control programs
- Increase engagement within the local community to provide awareness of the environmental impact of rabbits and the need for integrated control.

Threats identified in the National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*) include:

- A reduced population size
- The loss of habitat and further fragmentation
- Degradation of remaining habitat
- Competition with other nectivorous birds and the honeybee (*Apis mellifera*).

Recover plan actions for this species include:

- Improve Regent honeyeater habitat in extent and quality
- Utilise captive-bred birds to bolster wild populations until they become self-sustaining
- Better understand wild Regent honeyeater population parameters including size, structure and population trends
- Increase and maintain existing community awareness, understanding and involvement in the recovery program.

6.11.7 References

Atlas of Living Australia (2018). Anthochaera (Xanthomyza) phrygia. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:af9380ee-2f65-4213-bb6f-ea6baf92ad3e#overview [Accessed 17 August 2018].

Birdlife Australia (2018). Regent Honeyeater. Available from: http://www.birdlife.org.au/bird-profile/regent-honeyeater [Accessed 17 August 2018].

BirdLife International (2016). Anthochaera phrygia. The IUCN Red List of Threatened. Available from: http://www.iucnredlist.org/details/full/22704415/0 [Accessed 17 August 2018].

Curtis, Lee K. Dennis, Andrew J. McDonald, Keith R. Kyne, Peter M. Debus, Stephen J.S (2012). Queensland's Threatened Animals. CSIRO.

Department of Environment and Science (2017). Regent Honeyeater. Queensland Government. Available from: https://www.ehp.qld.gov.au/wildlife/animals-az/regent_honeyeater.html [Accessed 17 August 2018].

6.12 Squatter pigeon (Geophaps scripta scripta)

6.12.1 Status

EPBC Act – Vulnerable

6.12.2 Biology and ecology

6.12.2.1 Characteristics

The Squatter pigeon (*Geophaps scripta scripta)* (southern sub-species) is a heavily built, medium sized ground dwelling pigeon, measuring approximately 26 to 32 cm in total length with a wing span of 45 cm. Adults are generally grey-brown in colour, with black and white stripes on the face and throat, blue-grey skin around the eyes, dark brown (with some patches iridescent green or violet) wings, a blue-grey lower breast, and white flanks and lower belly (refer Photograph 6.11). Both sexes are of similar appearance, whilst juveniles are duller in colour, with patchy and less distinctive black and white facial stripes and paler facial skin (DotEE 2018; OEH 2017; NPWS 1999).

Photograph 6.11 Squatter pigeon southern sub-species (*Geophaps scripta scripta*)

Source: ALA (2016)

6.12.2.2 Known distribution

The Squatter pigeon (southern sub-species) was once found widespread nationally extending from southern NSW to the Burdekin River in northern Queensland (refer Figure 6.24). However, the species is now limited to an area from north Queensland to the northwest slopes of NSW, including southeast Queensland, the western slopes of the Great Diving Range, the Gwydir River region and the Liverpool Plains (Cooper et al. 2014; OEH 2017).

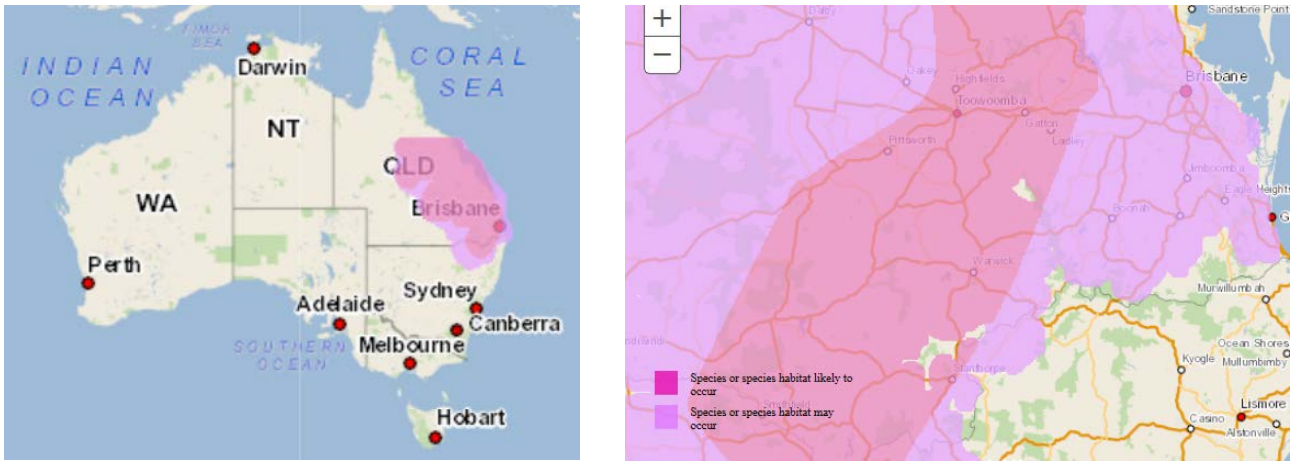


Figure 6.24 Distribution range of the southern Squatter pigeon

Source: DotEE (2018)

6.12.2.3 Distribution in relation to the Project

Geophaps scripta scripta has been identified as potentially occurring within the MNES study area. Database records (i.e. AoLA, WildNet) indicate that the species is known from within 50 km of the disturbance footprint with the nearest record (1984) occurring approximately 35 km to the north-west at Atkinsons Lagoon. Other records for this species from more recent records occur to the south-west and north-west of the Project.

Figure 6.25 Distribution range of the southern Squatter pigeon in relation to the Project

Source: ALA (2020)

6.12.2.4 Biology and reproduction

The Squatter pigeon (southern sub-species) forages on the ground for grass seeds, herbs, shrubs and insects. The Squatter pigeon is typically seen in pairs, or in small groups of up to 20 or more individuals and breed throughout the year. Breeding however is influenced by heavy rainfall which most commonly occurs during the dry season between May and June (DotEE 2018; OEH 2017; Pizzey and Knight 2007).

Squatter pigeon nests are depressions scraped into the ground beneath a tussock of grass, bush, fallen tree or log and sparsely lined with grass. The female lays two eggs which are smooth, lustrous, pale cream and oval with an incubation period of approximately 17 days by both parents. Southern Squatter pigeon chicks will remain in the nest for a further 2 to 3 weeks after hatching (Australian Bush Birds 2018; AWC 2017; DotEE 2018).

6.12.3 Habitat

The Squatter pigeon (southern sub-species) is known to inhabit grassy understorey of open eucalypt woodlands and plains featuring sandy areas within close proximity to water. Areas of semi-arid or arid landscape with sandy, open and short grass cover dissected by gravel ridges is the preferred habitat for the species. The ground cover in foraging and breeding habitat is typically patchy, consisting of native, perennial tussock grasses or a mix of perennial tussock grasses and low shrubs or forbs. This vegetated ground layer rarely exceeds 33% of the ground area. The remaining ground surface typically consists of bare patches of gravelly or dusty soil, and areas lightly covered in leaf litter and coarse, woody debris (e.g. fallen trees, logs and smaller debris). The species is also often found alongside tracks and roadsides (DotEE 2018; OEH 2017).

6.12.4 Threatening processes

The following have been identified as potentially threatening processes to the southern Squatter pigeon:

- Fragmentation and/or clearing of grassy woodland habitats for agriculture and development
- Overgrazing by domestic stock and feral rabbits of habitat

- Predation by feral cats and foxes
- Illegal shooting (OEH 2017).

6.12.5 Threat abatement/recovery plans

No recovery plan has been identified as being relevant to this species.

The following threat abatement plans has been identified as being relevant for this species:

- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats. In effect under the EPBC Act from 23-Jul-2015.
- Department of the Environment and Energy (2016). Threat abatement plan for competition and land degradation by rabbits. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-rabbits-2016. In effect under the EPBC Act from 07-Jan-2017.
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Threat abatement plan for predation by the European red fox. DEWHA, Canberra. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox. In effect under the EPBC Act from 01-Oct-2008.

6.12.6 Summary of threat abatement/recovery plan

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

Threats identified in the threat abatement plan for competition and land degradation by rabbits includes:

- Competition with native wildlife for food and shelter
- Prevention of plant regeneration
- Increased grazing pressure and damage to native vegetation
- Altering the regular process of plant succession
- Altering ecological communities and impacting soil structure and nutrient cycling contributing to serious erosion
- Increasing predation and reducing reproduction for native arboreal mammals and birds through the removal of critical habitat.

Threat abatement actions for rabbits include:

- Supress rabbit populations at the landscape scale below thresholds in identified priority areas
- Gain a better understanding of the impacts rabbits have and their interactions with other species and ecological processes
- Increase the effectiveness of rabbit control programs

- Increase engagement within the local community to provide awareness of the environmental impact of rabbits and the need for integrated control.

Threats identified in the threat abatement plan for predation by the European red fox include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for the European red fox include:

- Baiting
- Biological control
- Barriers
- Habitat management
- Shooting and bounties.

6.12.7 References

Atlas of Living Australia (2016). *Geophaps (Geophaps) scripta scripta*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:d5c52cd0-6d21-4322-a5c5-bc11a94d8c3a#overview [Accessed 22 August 2018].

Australian Bush Birds (2018). Squatter Pigeon - *Geophaps scripta*. Available from: http://www.australianwildlife.org/wildlife/squatter-pigeon.aspx [Accessed 22 August 2018].

Australian Wildlife Conservancy (2017). Species profile - Squatter Pigeon. Available from: http://www.australianwildlife.org/wildlife/squatter-pigeon.aspx [Accessed 22 August 2018].

Department of the Environment and Energy (2018). *Geophaps scripta scripta* (Squatter Pigeon) in Species Profile and Threats Database. Australian Government. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64440 [Accessed 22 August 2018].

National Parks and Wildlife Service (1999). Threatened Species Information – Squatter Pigeon. New South Wales Government. Available from: https://www.environment.nsw.gov.au/resources/nature/tsprofileSquatterPigeon.pdf [Accessed 22 August 2018].

Office of Environment and Heritage (2017). Squatter Pigeon (southern) - Profile. New South Wales Government. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10350# [Accessed 22 August 2018].

Pizzey, G. and Knight, F. 2007, The Field Guide to the Birds of Australia (8th edition) Harper Collins Publishers, NSW, Australia.

6.13 Swift parrot (*Lathamus discolor*)

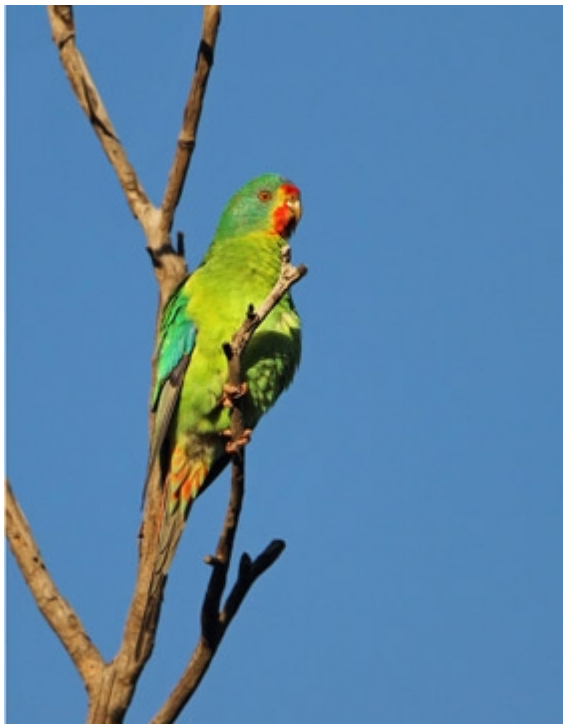
6.13.1 Status

EPBC Act – Critically Endangered, Marine

6.13.2 Biology and ecology

6.13.2.1 Characteristics

The Swift parrot (*Lathamus discolor*) is a small lorikeet-like parrot with a long slender tail measuring approximately 25 cm in body length and weighing 77 g. The Swift parrot is predominately bright green in colour, with dark-blue patches on the crown, a prominent red face, and the chin and throat are narrowly bordered with yellow. One of most distinctive features from a distance is its long 12 cm, thin tail, which is dark red (refer Photograph 6.12). The female Swift parrot is distinguishable from the male as it has slightly duller feathering with a creamy underwing bar (Birdlife 2018; DES 2017; OEH 2017).



Photograph 6.12 Swift parrot (*Lathamus discolor*)

Source: Birdlife (2018)

6.13.2.2 Known distribution

The Swift parrot is endemic to southeastern Australia. This species breeds only in Tasmania and migrates during the autumn and winter months to southeast Queensland as well as both coastal and the southwest slopes of NSW (DotEE 2018; OEH 2017) (refer Figure 6.26).

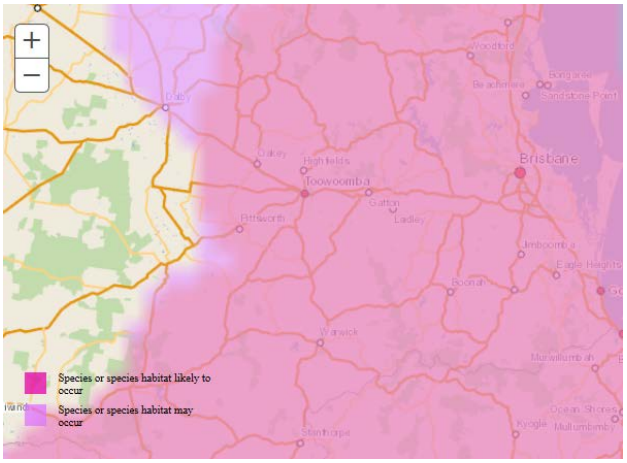


Figure 6.26 Distribution range of Swift parrot

Source: ALA (2018), DotEE (2018)

6.13.2.3 Distribution in relation to the Project

Lathamus discolor was identified in woodland adjacent to the disturbance footprint in the Rosewood area during protected plant surveys in June 2018 (EMM 2018). The nearest database record (AoLA) of Swift parrot is located 1.5 km from the disturbance footprint but of uncertain provenance (i.e. no date and location generalised to 0.1 degree). The species is an uncommon but regular visitor to south-east Queensland in the winter months. There are scattered records to the north and south-east of the Project. The nearest records are from 2019 in the Springfield Lakes area and a 1994 record near Beaudesert (20 km north and 16 km south of the eastern extent of the Project respectively) (AoLA 2020).

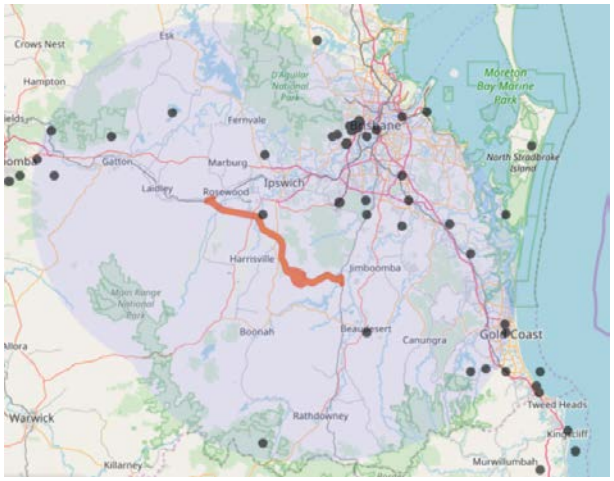


Figure 6.27 **Distribution range of Swift parrot in relation to the Project**

Source: ALA (2020)

6.13.2.4 Biology and reproduction

The Swift parrot feeds mostly on nectar, mainly from Eucalypts, but also eats psyllid insects and lerps (waxy secretion on Eucalypt leaves produced as a protection by young psyllid insects), seeds and fruit. Swift parrots are mostly arboreal foragers, foraging mainly in Eucalypts, but occasionally coming to the ground to feed on seeds, fallen flowers, fruit and lerp, and to drink (DotEE 2018; Higgins 1999; Mallick et al. 2004; Swift parrot Recovery Team 2011).

Swift parrot's breeding season occurs from mid-September to late-January in Tasmania. Nests are typically constructed in hollows of trunks, a branch or spout of a living or dead gum tree with nests known to be used each year. The typical nesting season begins in late September with females laying 3 to 5 eggs during October and November. The females incubate the eggs and fledging hatch from early December to late January (Birdlife 2018; DotEE 2018).

6.13.3 Habitat

The Swift parrot typically inhabits dry sclerophyll, Eucalypt forests, woodlands, suburban parks and even gardens with flowering fruit trees with records showing It occasionally inhabiting wet sclerophyll forests (Birdlife 2018; Swift parrot Recovery Team 2011).

In northern NSW and southeastern Queensland, Narrow-leaved ironbark (*Eucalyptus crebra*), Forest red gum (*E. tereticornis*) forests and Yellow box (*E. melliodora*) forest are commonly utilised by Swift parrots (OEH 2017). While on the western slopes Mugga ironbark (*E. sideroxylon*) and Grey Box (*E. microcarpa*) woodlands are used (DotEE 2018).

Habitats associated with the inland slopes of the Great Dividing Range, and along the eastern coastal plains, are considered the principal wintering grounds (DotEE 2018).

6.13.4 Threatening processes

The following have been identified as potentially threatening processes to the Swift parrot:

- Habitat loss associated with breeding sites as well as drought refugia habitat
- Habitat alteration through forestry operations, firewood collection and urbanisation in Tasmania
- Competition with noisy miner and aggressive honeyeaters
- Nest predation by gliders (DES 2017; OEH 2017).

6.13.5 Threat abatement/recovery plans

The following recovery plan has been identified as being relevant to this species:

- Saunders, D.L. & C.L. Tzaros (2011). National Recovery Plan for the Swift Parrot (Lathamus discolor). Birds Australia, Melbourne. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-swift-parrot-lathamus-discolor. In effect under the EPBC Act from 10-Feb-2012.

The following threat abatement plans has been identified as being relevant for this species:

- Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats. In effect under the EPBC Act from 23-Jul-2015.

6.13.6 Summary of threat abatement/recovery plan

Threats identified in the National Recovery Plan for the Swift parrot include:

- Habitat loss and alteration from forestry activities including fire wood harvesting
- Residential and industrial development
- Agricultural tree senescence and dieback
- Suppression of tree regeneration
- Frequent fires
- Climate change
- Mortality resulting in collision with wire netting or mesh fences
- Competition from large, aggressive honeyeaters
- Psittacine Beak and Feather Disease (PBFD), which can have devastating impacts depending on general conditions and parrot health
- Illegal poaching of wildlife
- The cumulative impact of all threats.

Threat abatement actions for this species include:

- The identification of the quality and extent of suitable habitat
- Managing and protecting suitable Swift parrot habitat at the landscape level
- Monitor and manage the impact of collisions, competition and disease
- Monitor population and habitat
- Increase community awareness and involvement in the recovery program
- Report on and review the recovery process.

Threats identified in the threat abatement plan for predation by feral cats include:

- Predation on native species causing a critical decline in many species across animal groups
- Competition for food with species they share dietary overlap and disease transmission
- Contributed to the extinction of many ground nesting bird species and the decline of small mammals.

Threat abatement actions for feral cats include:

- Effectively control cats in different landscapes
- Improve effectiveness of existing control measures for feral cats
- Develop and maintain alternative strategies for the recovery of threatened species
- Gain public support for feral cat management and promote responsible cat ownership.

6.13.7 References

Atlas of Living Australia (2018). Lathamus discolor. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:3f12e573-a7b7-45e7-a6e4-aeae9bc3a9ed [Accessed 22 Aug. 2018].

Birdlife Australia (2018). Swift Parrot. Available from: http://www.birdlife.org.au/bird-profile/swift-parrot [Accessed 22 August 2018].

Department of the Environment and Energy (2018). Lathamus discolor (Swift Parrot) in Species Profile and Threats Database. Australian Government. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=744 [Accessed 22 August 2018].

Department of Environment and Science (2011). Swift parrot. Queensland Government. Available from: https://www.ehp.qld.gov.au/wildlife/animals-az/swift_parrot.html [Accessed 22 August 2018].

Office of Environment and Heritage (2017). Swift Parrot - Profile. New South Wales Government. Available from: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10455 [Accessed 22 August 2018].

6.14 White-throated needletail (*Hirundapus caudacutus*)

6.14.1 Status

EPBC Act – Vulnerable, Marine and Migratory (Bonn/CAMBA/JAMBA/ROKAMBA)

6.14.2 Biology and ecology

6.14.2.1 Characteristic

The White-throated needletail (*Hirundapus caudacutus*) is a large swift with a thickset, cigar-shaped body, a stubby tail and pointed wings (refer Photograph 6.13). This species typically measures 20 cm in length and approximately 115 to 120 g in weight. Adults exhibit a dark-olive head and neck, with an iridescent gloss on the crown, whilst the mantle and the back are paler and greyish. The upperwings are blackish (often with a greenish gloss), with a contrasting white patch at the base of the trailing edge. The face is dark-olive with a narrow, white band across the forehead, and lores and a white patch on the chin and throat. The underparts are generally dark-olive except for a U-shaped band across the rear flanks, the vent and the undertail coverts, and the undertail is black with a greenish gloss (DotEE 2018).

Photograph 6.13 White-throated needletail (*Hirundapus caudacutus*)

Source: Burrows (2017)

6.14.2.2 Known distribution

White-throated needletails breed in Asia, from central and south-eastern Siberia and Mongolia, east to the Maritime Territories of Russia, Sakhalin and the Kuril Islands and south to northern Japan and north-eastern China. Most White-throated needletails spend the non-breeding season in Australia, and occasionally in New Guinea and New Zealand (DotEE 2018).

The White-throated needletail is considered widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (DotEE 2018) (refer Figure 6.28).

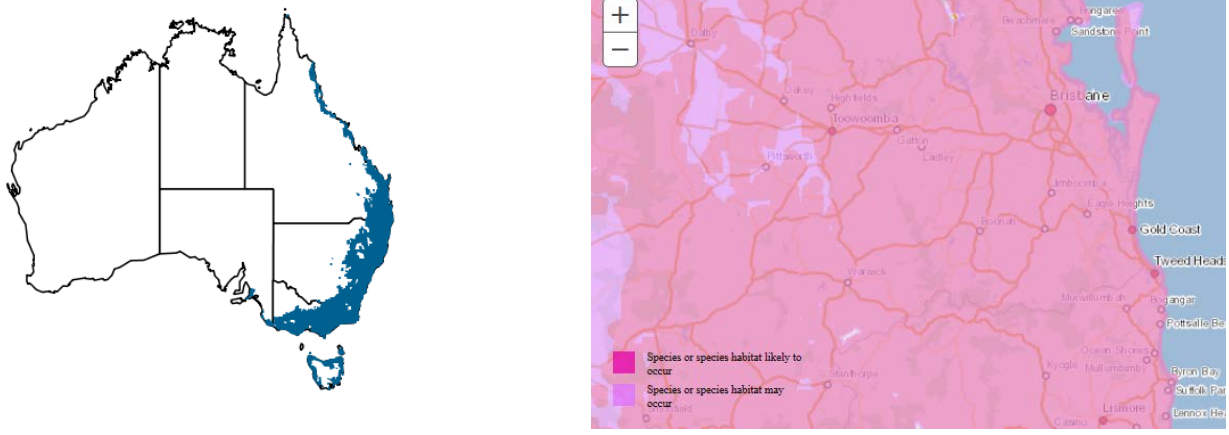


Figure 6.28 Distribution range of the White-throated needletail

Source: ALA (2018), DotEE (2018)

6.14.2.3 Distribution in relation to the Project

Database records (i.e. AoLA & WildNet) indicated that *Hirundapus caudacutus* has been identified as potentially occurring within the temporary and permanent disturbance footprint. Species records exist from within approximately 5 km of the disturbance footprint at Mount Forbes dated 2018. A number of other records exist for the species in all directions around the Project.

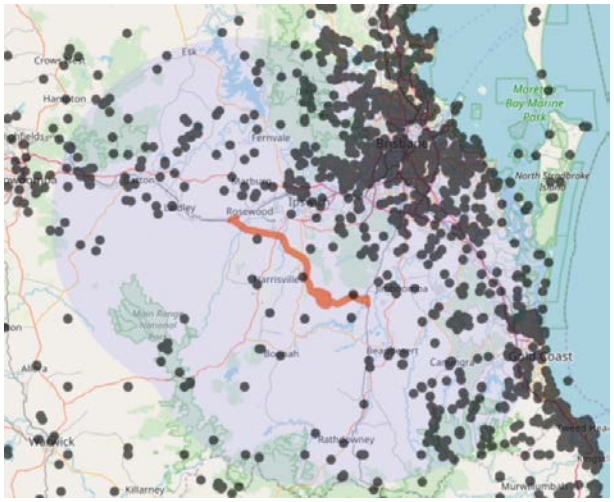


Figure 6.29 **Distribution range of the White-throated needletail in relation to the Project**

Source: ALA (2020)

6.14.2.4 Biology and reproduction

In Australia the White-throated needletail has been recorded eating a wide variety of insects, including beetles, cicadas, flying ants, bees, etc (DotEE 2018).

White-throated needletails are non-breeding migrants in Australia. Breeding takes place in northern Asia from April to October (DotEE 2018).

6.14.3 Habitat

In Australia, the White-throated needletail is almost exclusively aerial, flying at heights of less than 1 m up to more than 1,000 m above the ground. White-throated needletails often forage along the edges of low pressure systems, which both lift their food sources, and assist with their flight. The species has been recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows (DotEE 2018).

This species is known to occur over most types of habitat, however, they are most often recorded above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy. In coastal areas, they are soften seen flying over sandy beaches or mudflats, and often around coastal cliffs and areas with prominent updraughts, such as ridges and sand-dunes (DotEE 2018).

6.14.4 Threatening processes

There appear to be few threats to the populations of White-throated Needletails in Australia, but there is always the potential threat of habitat destruction and predation by feral animals (DotEE 2018).

6.14.5 Threat abatement/recovery plans

No threat abatement/recovery plan has been identified as being relevant for this species (DotEE 2018).

6.14.6 References

Atlas of Living Australia (2018). *Hirundapus caudacutus*. Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:21205690-54fd-452a-9772-d3e1f8780dff# [Accessed 24 August 2018].

Burrows S. (2017). *Hirundapus caudacutus* (Image) [Online] Available from: https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:21205690-54fd-452a-9772-d3e1f8780dff# [Accessed 24 August 2018].

Department of the Environment and Energy (2018). *Hirundapus caudacutus* in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=682 [Accessed 24 August 2018].

7 Threatened ecological communities

7.1 Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community

7.1.1 Status

EPBC Act – Endangered

7.1.2 Ecology

7.1.2.1 Characteristic and defining features

The ecological community occurs on unconsolidated sediments, including alluvium deposits, and is typically found on hydrosols saturated with water for long periods. It can be found in areas with either saline, brackish or relatively fresh groundwater. Coastal Swamp Oak Forest mostly occurs in areas less than 20 m above sea level, and typically occurs with 30 km from the coast, however, this can vary depending on the catchment (TSSC 2011).

The ecological community can be either woodland or forest depending on location and disturbance history. Canopy is typically dominated by Coastal Swamp Oak (*Casuarina glauca*) with a sparse mid canopy/shrub layer (refer Photograph 7.1). Some Eucalypt species can emerge from the canopy but are characteristically sparse. The groundlayer is often dominated by native grasses and sedges. Climbing and epiphytic plants are characteristic of the community type. In areas where drainage is impeded the community may manifest primarily as sedgeland with a sparse canopy of predominately Coastal Swamp Oak. In areas of freshwater inundation *Melaleaca* species may occur in the canopy, sub-canopy or as emergents.

Photograph 7.1 Coastal Swamp Oak forest

Source: M White (DotEE) 2011

In Queensland, Coastal Swamp Oak Forest TEC occur within the following REs:

- RE 12.1.1 (Casuarina glauca woodland on margins of marine clay plains) (listed as ‘of concern’),
- RE 12.3.20 (Melaleuca quinquenervia, Casuarina glauca +/- Eucalyptus tereticornis, E. siderophloia open forest on low coastal alluvial plains) (listed as ‘endangered’), where the canopy is dominated by Casuarina glauca. (Queensland Herbarium 2016)

7.1.2.2 Known distribution

The ecological community primarily occurs from south-east Queensland to southern NSW, within the South Eastern Queensland (TSSC 2011) (refer Figure 7.1).

Figure 7.1 **Distribution range of Coastal Swamp Oak Forest TEC**

Source: DotEE (2018)

7.1.2.3 Distribution in relation to the Project

Coastal Swamp Oak Forest has been predicted to occur within the region and associated habitat within the MNES study area. However, there are no current records for this species within 50 km of the temporary and permanent disturbance footprint. No affiliated REs exists within the disturbance footprint and was detected through PMST database searches.

7.1.3 Threatening processes

The following have been identified as potentially threatening processes to Swamp Oak Forest TEC:

- Land clearing
- Loss of habitat due to climate change
- Invasive weeds and pest species
- Introduction and spread of diseases such as Chytrid fungus and Psittacine Circoviral disease.

7.1.4 Threat abatement/recovery plans

No threat abatement/recovery plan has not been determined for this threatened ecological community as the main threats and priority actions required to address them are largely understood. These are addressed as follows:

- Department of the Environment and Energy (2018). Conservation advice (incorporating listing advice) for the Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community. Canberra: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/141-conservation-advice.pdf. In effect under the EPBC Act from 20-Mar-2018.

7.1.5 Summary of threat abatement/recovery plans

The threats outlined in the conservation advice for the Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community include:

- Clearing and fragmentation
- Weeds
- Invasive fauna including feral pigs, feral cats, the European red fox, rabbits
- Impacts from agriculture including from grazing
- Changes to hydrology resulting from flood mitigation and drainage works
- Inappropriate fire regimes
- Impacts as a result of recreational activities
- Impacts of climate change through sea level rise
- These threats rarely occur in isolation often interacting with one another.

Objectives and actions outlined in the conservation advice for the Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community include:

- Protect the ecological community
- Planning to minimise further clearing
- Manage actions to minimise impact
- Minimise the indirect impacts on this TEC
- Prevent the introduction and spread of exotic species
- Manage recreational pressures
- Restore the ecological community
- Manage invasive flora and fauna pest species
- Mitigate trampling, browsing and grazing
- Introduce appropriate fire regimes
- Undertake restoration
- Communicate and support key stakeholders
- Research and monitor remnant patches.

7.1.6 References

Department of the Environment (2019). Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community in Community and Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed 2019-05-28T09:35:05AEST.

Threatened Species Scientific Committee (2011). Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community, advice to the Minister for Sustainability, Environment, Water, Population and Communities from the Threatened Species Scientific Committee on an Amendment to the List of Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) [Accessed 28 May 2019].

Queensland Herbarium (2016). Regional Ecosystem Description Database (REDD) Version 10.0. Queensland Department of Science, Information Technology and Innovation. Brisbane.

7.2 Lowland rainforest of subtropical Australia

7.2.1 Status

EPBC Act – Critically Endangered

7.2.2 Ecology

7.2.2.1 Characteristic and defining features

The ecological community occurs prominently on basalt and alluvial soils, including sand and old or elevated alluvial soils as well as floodplain alluvia. Lowland rainforest mostly occurs in areas less than 300 m above sea level, with high annual rainfall (>1,300 mm) and typically occurs more than 2 km from the coast, however, it can (and does) intergrade with littoral rainforest in some coastal areas (TSSC 2011).

The ecological community is generally a 20 to 30 m tall, closed forest (canopy cover 70%). Tree species with compound leaves are common and leaves are relatively large (notophyll to mesophyll). Plant species diversity and richness is very high (refer Photograph 7.2). The canopy comprises a range of tree species but in some areas a particular species may dominate e.g. Bangalow palm (*Archontophoenix cunninghamiana*) or Cabbage palm (*Livistona australis*). The canopy is often multilayered consisting of an upper, discontinuous layer of emergents, over the main canopy and subcanopy. Below the canopy is an understorey of sparse shrubs and seedlings. Canopy emergents such as Hoop pine (*Araucaria cunninghamii*) and *Ficus* spp. may be 40 to 50 m tall and have large spreading crowns. The understorey contains a sparse layer of species such as Narrow-leaved palm lily (*Cordyline stricta*), Walking stick palm (*Linospadix monostachya*), Lawyer vine (*Calamus muelleri*) and Rough maidenhair fern (*Adiantum hispidulum*) (TSSC 2011).

Photograph 7.2 Lowland rainforest TEC

Source: Steve Parish (2015)

In Queensland, Lowland rainforest TEC occur within the following REs:

- 12.3.1 Complex to simple notophyll vine forest- Gallery rainforest (notophyll vine forest) on alluvial plains (endangered)
- 12.5.13 Microphyll to notophyll vine forest +/- *Araucaria cunninghamii* (endangered)
- 12.8.3 Complex notophyll vine forest – complex notophyll vine forest on Cainozoic igneous rocks (no concern)
- 12.8.4 Complex notophyll vine forest with *Araucaria* spp. on Cainozoic igneous rocks (no concern)
- 12.8.13 Araucarian complex microphyll vine forest on Cainozoic igneous rocks (of concern)

- 12.11.1 Simple notophyll vine forest often with abundant *Archontophoenix cunninghamiana* (“gully vine forest”) on metamorphics +/- interbedded volcanics (no concern)
- 12.11.10 Notophyll vine forest +/- *Araucaria cunninghamii* on metamorphics +/- interbedded volcanics (no concern)
- 12.12.1 Simple notophyll vine forest usually with abundant *Archontophoenix cunninghamiana* (“gully vine forest”) on Mesozoic to Proterozoic igneous rocks (of concern)
- 12.12.16 Notophyll vine forest on Mesozoic to Proterozoic igneous rocks (no concern) (TSSC 2011).

7.2.2.2 Known distribution

The ecological community primarily occurs from Maryborough in Queensland to the Clarence River (near Grafton) in NSW. The ecological community also includes isolated areas between the Clarence River and Hunter River such as the Bellinger and Hastings valleys (TSSC 2011) (refer Figure 7.2).

Figure 7.2 **Distribution range of Lowland rainforest TEC**

Source: DotEE (2018)

7.2.2.3 Distribution in relation to the Project

Lowland Rainforest has been predicted to occur within the region and associated habitat within the MNES study area. However, there are no current records for this species within 50 km of the temporary and permanent disturbance footprint. No affiliated REs exists within the disturbance footprint and was detected through PMST database searches.

7.2.3 Threatening processes

The following have been identified as potentially threatening processes to Lowland rainforest TEC:

- Land clearing
- Impacts associated with fragmentation of remnants
- Weeds
- Private native forestry (TSSC 2011).

7.2.4 Threat abatement/recovery plans

No recovery plan has been identified as being relevant for this community.

The following threat abatement plan has been identified as being relevant for this community:

- Department of the Environment and Energy (2018). Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi*. Canberra: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/threat-abatement-plan-disease-natural-ecosystems-caused-phytophthora-cinnamomi-2018. In effect under the EPBC Act from 22-Feb-2019.

7.2.5 Summary of threat abatement/recovery plans

The consequences of potential infection outlined in the threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomic* include:

- Inability of infected plants to develop new shoots, flowers, fruit and seed
- Complete loss of some flora populations
- Dramatic alteration to the structure and composition of native plant communities
- A severe reduction in primary productivity and functionality
- Irreversible habitat loss and degradation of dependent flora and fauna
- Loss of shelter and nesting sites and food sources resulting in major declines of fauna.

Objectives and actions outlined in the threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomic include:

- Identifying and prioritising the protection of biodiversity assets that are, or may be, impacted by Phytophthora including listed threatened species, ecological communities and areas where non-listed species or ecological communities that may become eligible for listing under the EPBC Act occur
- Reduce the spread and mitigate the impacts of Phytophthora to protect priority biodiversity assets and areas where non-listed species or ecological communities that may become eligible for listing under the EPBC Act
- Inform the community through education on the impacts that Phytophthora has on biodiversity and actions to mitigate these impacts
- Encourage research on Phytophthora species and option to manage infestations and protect biodiversity assets.

7.2.6 References

Department of the Environment and Energy (2018). Lowland Rainforest of Subtropical Australia in Species Profile and Threats Database, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=101 [Accessed 31 August 2018].

Steve Parish (2015). Subtropical Rainforest (Image) [Online] Available from: https://www.steveparish-natureconnect.com.au/nature-centre/subtropical-rainforest/ [Accessed 30 August 2018].

Threatened Species Scientific Committee (2011). Lowland Rainforest of Subtropical Australia, advice to the Minister for Sustainability, Environment, Water, Population and Communities from the Threatened Species Scientific Committee on an Amendment to the List of Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) [Accessed 31 August 2018].

7.3 Swamp tea-tree (*Melaleuca irbyana)* forest of southeast Queensland

7.3.1 Status

EPBC Act – Critically Endangered

7.3.2 Ecology

7.3.2.1 Characteristic and defining features

The Swamp tea-tree TEC is characterised by high densities of Swamp Tea-trees *(Eucalyptus irbyana)*, usually about 8 to 12 m high underneath an open canopy of eucalypt trees. Commonly found eucalypt trees in Swamp tea-tree forests include Narrow-leaved ironbark (*Eucalyptus crebra*), Silver-leaved ironbark (*E. melanophloia*), Grey box (*E. moluccana*) or Queensland blue gum (*E. tereticornis*). The understorey is comprised of grass, sedges, herbs, sparse shrubs and vines (refer Photograph 7.3).

Photograph 7.3 Swamp Tea-tree TEC

Source: Firn (n.d.)

In Queensland, Swamp tea-tree TEC occur within the following regional ecosystems REs:

- 12.9-10.11 *Melaleuca irbyana* low open forest or thicket. Emergent *Eucalyptus moluccana, E. crebra, E. tereticornis* or *Corymbia citriodora* subsp. *variegata* may be present. Occurs on Mesozoic sediments where drainage of soils is impeded
- 12.3.18 *Melaleuca irbyana* low open forest or thicket. Emergent *Eucalyptus moluccana, E. crebra, E. tereticornis* or *Corymbia citriodora* subsp. *variegata* may be present. Occurs on Quaternary alluvial plains where drainage of soils is impeded.

7.3.2.2 Known distribution

Swamp Tea-tree TEC are endemic to southeastern Queensland and are known to occur in the local government areas of Beaudesert, Boonah, Logan, Ipswich, Laidley and Esk (refer Figure 7.3). The Swamp Tea-tree forests are found to grow on poorly draining clay soils, on the plains and low hills of the Moreton basin. The clay soils drain slowly and are known to become waterlogged after heavy rains, resulting in numerous temporary ponds. Swamp Tea-tree forests are associated with seasonally cracking clays, known as Tea-tree clays and generally have a pH of 5.6 to 6.0 that area low in nutrient levels (DEH 2005; DotEE 2018).

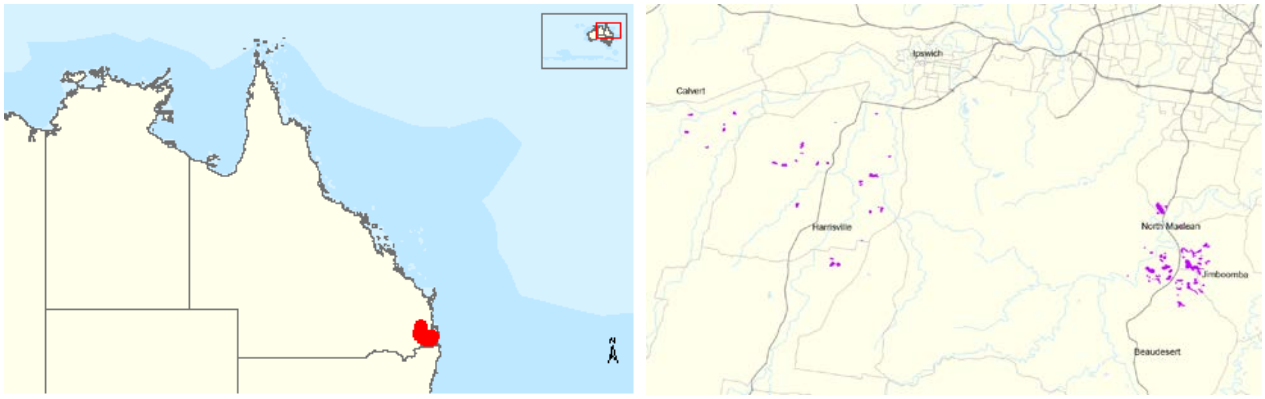


Figure 7.3 **Distribution range of Swamp tea-tree TEC**

Source: DotEE (2018)

7.3.2.3 Distribution in relation to the Project

Swamp Tea-tree was identified as having the potential to occur within the MNES study area during desktop searches. Predictive habitat mapping indicates that approximately 57.06 ha of suitable habitat is predicted to occur within the MNES study area and 5.75 ha within the disturbance footprint.

7.3.3 Threatening processes

The following have been identified as potentially threatening processes to the Swamp tea-tree TEC:

- Very restricted geographic distribution
- Modification of waterways which disrupt seed dispersal and germination
- Fragmentation from urban and pastoral land, clearing, grazing, invasion by weeds and feral animals
- Clearing of mature trees (DEE 2005).

7.3.4 Threat abatement/recovery plans

No recovery plan has been identified as being relevant for this community.

The following threat abatement plans has been identified as being relevant for this community:

- Department of Sustainability, Environment, Water, Population and Communities (2011). Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/resource/threat-abatement-plan-biological-effects-including-lethal-toxic-ingestion-caused-cane-toads. In effect under the EPBC Act from 06-Jul-2011.
- Department of the Environment and Energy (2018). Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi. Canberra: Commonwealth of Australia. Available from: **http://www.environment.gov.au/biodiversity/threatened/publications/threat-abatement-plan-disease-natural-ecosystems-caused-phytophthora-cinnamomi-2018**. In effect under the EPBC Act from 22-Feb-2019.

7.3.5 Summary of threat abatement/recovery plans

The threats outlined in the threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads include:

- Predation by cane toads
- Larval competition with frog tadpoles or mosquitoes
- Parasite transfer

- Competition for terrestrial food
- Competition for shelter sites.

Threat abatement actions for cane toads (*Rhinella marina*) include:

- $11 million in funding from the Australian Government provided for the development of a broad-scale control method
- $9 million in funding from the Australian Government for research and management activities
- Identification of native species, ecological communities and off-shore islands that are known to have a high to moderate risk
- Identify the impacts that toads have on listed native species and ecological communities
- Where the impact is expected to be high on native species and ecological communities establish support research techniques in aiding the recovery of priority native species and ecological communities
- Develop a prioritisation tool to aid in the direction of resources for the protection of native species and ecological communities.

The consequences of potential infection outlined in the threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomic* include:

- Inability of infected plants to develop new shoots, flowers, fruit and seed
- Complete loss of some flora populations
- Dramatic alteration to the structure and composition of native plant communities
- A severe reduction in primary productivity and functionality
- Irreversible habitat loss and degradation of dependent flora and fauna
- Loss of shelter and nesting sites and food sources resulting in major declines of fauna.

Objectives and actions outlined in the threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomic* include:

- Identifying and prioritising the protection of biodiversity assets that are, or may be, impacted by Phytophthora including listed threatened species, ecological communities and areas where non-listed species or ecological communities that may become eligible for listing under the EPBC Act occur
- Reduce the spread and mitigate the impacts of Phytophthora to protect priority biodiversity assets and areas where non-listed species or ecological communities that may become eligible for listing under the EPBC Act
- Inform the community through education on the impacts that Phytophthora has on biodiversity and actions to mitigate these impacts
- Encourage research on Phytophthora species and option to manage infestations and protect biodiversity assets.

7.3.6 References

Accad, A., Nelder, V.J., Wilson, B.A. and Neihus, R.E. (2003). Remnant Vegetation in Queensland: Analysis of Remnant Vegetation 1997-1999-2000-2001, including Regional Ecosystem Information. Brisbane: Queensland Herbarium, Environmental Protection Agency.

Boulton, SC, Kingston, MB and Turnbull, JW, (1998). Bremer Basin Vegetation Study for Ipswich City Council. ECOGRAPH Ecological and Geographical Information Systems Consultants, Limpinwood via Murwillumbah.

Cooper, S, Walker B and Low, T (1995). Conservation survey, status and management of *Melaleuca irbyana* and freshwater wetland communities. Unpublished report prepared for Ipswich City Council, Ipswich, 86 pages.

Department of the Environment and Energy (2005). *Swamp Tea-tree (Melaleuca irbyana) Forest of Southeast Queensland,* accessed 20 August 2018, available: <www.environment.gov.au/node/14555>.

Department of the Environment (2018), Swamp Tea-tree (*Melaleuca irbyana*) Forest of Southeast Queensland in Community and Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed 2018-08-21T20:26:39AEST.

Department of the Environment and Heritage (2005), Swamp Tea-tree (*Melaleuca irbyana*) Forest of Southeast Queensland, accessed 18 August 2018, available: http://www.environment.gov.au/system/files/resources/ca330310-bb3f-4651-b83f-40f30140378f/files/swamp-tea-tree-forest-information-sheet.pdf.

Firn, J (unknown), *Melaleuca irbyana* project, Queensland University for Technology, Brisbane Australia, accessed 18 August 2018, available: https://jenniferfirn.wordpress.com/melaleuca-irbyana-project/.

Ipswich City Council (1998). Purga Nature Reserve Fact Sheet, Ipswich City Council Department of Conservation, Parks and Sport, Ipswich, Queensland.

Queensland Department of Primary Industries (2001). Swamp Tea Tree Protection at Mutdapilly Research Station. Queensland Department of Primary Industries News, Queensland.

Queensland Government, (2014), *Species profile – Melaleuca irbyana (Myrtaceae),* accessed 20 August 2018, available: https://environment.ehp.qld.gov.au/species-search/details/?id=26403.

Threatened Species Scientific Committee (2005). *Commonwealth Listing Advice on Swamp Tea-tree* (*Melaleuca irbyana*) *Forest of Southeast Queensland*. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/swamp-tea-tree-forest.html. In effect under the EPBC Act from 16 April 2005.

7.4 White box-yellow box-Blakely's red gum grassy woodland and derived native grassland (also known as Box-gum grassy woodland and derived grassland)

7.4.1 Status

EPBC Act – Critically endangered

7.4.2 Ecology

7.4.2.1 Characteristic and defining features

White box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC is a open woodland communities, which have a tussock grass layer, patchy shrub layer and tree layer predominantly made up of *Eucalyptus albens*, *E. melliodora* and *E. blakelyi*. Intact sites contain a high diversity of trees, shrubs, climbing plants, grasses and especially herbs. Tree cover is generally discontinuous and consists of widely-spaced trees of medium height (refer Photograph 7.4). This ecological community occurs on moderate to highly fertile soils at altitudes of 170 m to 1,200 m (NSWSC 2002; OEH 2017; Yates and Hobbs 1997).

Photograph 7.4 White box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC

Source: Oliver (n.d.)

In Queensland, White box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC is considered to be analogous to the following regional ecosystems REs:

- 11.3.23 *Eucalyptus conica, E. tereticornis, Angophora floribunda* ± *E. melliodora* ± *E. nobilis grassy* woodland
- 11.8.2a *Eucalyptus tereticornis* and *E. melliodora* occurring on low hills
- 11.8.8 *Eucalyptus albens* ± *E. crebra* ± *E. tereticornis* ± *Callitris baileyi* grassy woodland
- 11.9.9a *Eucalyptus albens* ± *E. crebra* ± *E. tereticornis* ± *Callitris baileyi* woodland
- 12.8.16 *Eucalyptus crebra*, generally with *E. tereticornis* and *E. melliodora* ± *E. albens* grassy woodland (only at the far western edge of the bioregion)
- 13.3.4 *Eucalyptus conica, E. microcarpa or E. moluccana, E. melliodora* grassy woodland
- 13.3.1 *Eucalyptus blakelyi* grassy woodland or open forest +/- *E. bridgesiana +/- E. melliodora* on Cainozoic alluvial plains
- 13.11.3 *Eucalyptus crebra, E. dealbata, E. albens* grassy woodland
- 13.11.4 *Eucalyptus melanophloia, E. dealbata, E. albens* ± *Callitris glaucophylla* grassy woodland.
- 13.11.8 Woodland of *E. melliodora* and/or *E. microcarpa/moluccana* on rolling hills, depressions and lower slopes around drainage lines
- 13.12.8 Woodland of *E. melliodora* and/or *E. microcarpa/ moluccana +/- conica*, on undulating plains and lower slopes in granite basins
- 13.12.9 Woodland to open forest of *E. blakelyi* and/or *E. calignosa* or *E. mckieana* on plains and rolling hills in granite basins (TSSC 2006).

7.4.2.2 Known distribution

White box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC occur in an arc along the western slopes and tablelands of the Great Dividing Range from southern Queensland through NSW to central Victoria (Beadle 1981) (refer Figure 7.4).

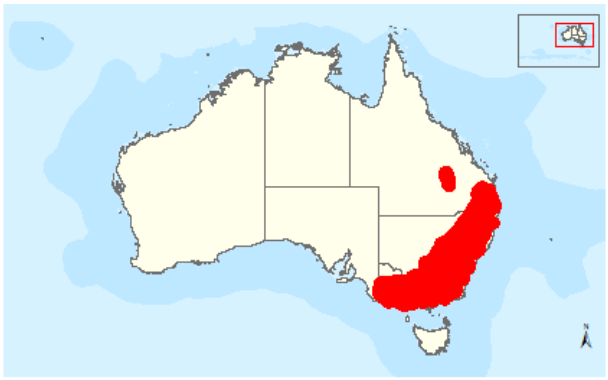


Figure 7.4 **Distribution range of White box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC**

Source: DotEE (2018)

7.4.2.3 Distribution in relation to the Project

White box-yellow box-Blakely's red gum grassy woodland and derived native grassland has been predicted to occur within the region and associated habitat within the MNES study area. However, there are no current records for this species within 50 km of the temporary and permanent disturbance footprint. No affiliated REs exists within the disturbance footprint and was detected through PMST database searches.

7.4.3 Threatening processes

The following have been identified as potentially threatening processes to White box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC:

- Habitat loss, degradation and fragmentation from agricultural, forestry, mining, infrastructure and residential development
- Degradation by over grazing and trampling
- Degradation of remnants by non-native plant species
- Increased nutrient status due to application of fertilisers to native groundcover
- Altered fire regimes.
- Lack of community knowledge
- Human disturbance by off road vehicles, camping, other recreational activities (OEH 2017).

The following recovery plan has been identified for this community:

- Department of Environment, Climate Change and Water NSW (2010). *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. Department of Environment, Climate Change and Water NSW, Sydney. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/white-box-yellow-box-blakelys-red-gum-grassy-woodland-and-derived-native-grassland-national. In effect under the EPBC Act from 22-Mar-2013.

The following threat abatement plans have been identified as being relevant for this community:

- Department of Sustainability, Environment, Water, Population and Communities (2011). Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/resource/threat-abatement-plan-biological-effects-including-lethal-toxic-ingestion-caused-cane-toads. In effect under the EPBC Act from 06-Jul-2011.

- Department of the Environment and Energy (2017). Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa) (2017). Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/feral-pig-2017. In effect under the EPBC Act from 18-Mar-2017.
- Department of the Environment and Energy (2018). Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi*. Canberra: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/threat-abatement-plan-disease-natural-ecosystems-caused-phytophthora-cinnamomi-2018. In effect under the EPBC Act from 22-Feb-2019.

7.4.4 Summary of threat abatement/recovery plans

Threats identified in the National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland include:

- Land use and management change
- Agricultural and horticultural development
- Public Infrastructure upgrades in travelling stock routes (TSRs)
- Firewood collection and 'tidying up'
- Changed fire regimes
- Increase in soil nutrients and use of chemicals
- Mowing and slashing regimes
- Revegetation management
- Weed invasion
- Climate change
- Salinity
- Acid soils
- Declining tree health and regeneration
- Increased grazing pressure from invasive herbivores
- Disease – *Phytophthora cinnamomic*
- Collection and removal of native flora.

Recovery actions identified in the National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland include:

- Collect baseline data on the locations, quality and management regimes of remnant sites
- Extent and condition mapping
- Component species surveys
- Protection of existing habitat in priority areas including on private land
- Engagement with the community, particularly where remnants occur on private land to provide information on appropriate management and with Aboriginal communities.

Summary of baseline information actions undertaken to date:

- The establishment of databases comprising of information on CMN members (land managers with Box-Gum Grassy Woodland remnants), remnant locations, composition of flora and fauna species and remnant condition from surveys of CMN members' sites and other sites

- Minimum condition criteria and assessment method developed to assist land managers in identification of listed ecological communities
- Development of regional models using remote sensing
- Mapping of Box-Gum Grassy Woodland extent
- Surveys conducted during research programs through various organisations.

The threats outlined in the threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads include:

- Predation by cane toads
- Larval competition with frog tadpoles or mosquitoes
- Parasite transfer
- Competition for terrestrial food
- Competition for shelter sites.

Threat abatement actions for cane toads (*Rhinella marina*) include:

- $11 million in funding from the Australian Government provided for the development of a broad-scale control method
- $9 million in funding from the Australian Government for research and management activities
- Identification of native species, ecological communities and off-shore islands that are known to have a high to moderate risk
- Identify the impacts that toads have on listed native species and ecological communities
- Where the impact is expected to be high on native species and ecological communities establish support research techniques in aiding the recovery of priority native species and ecological communities
- Develop a prioritisation tool to aid in the direction of resources for the protection of native species and ecological communities.

The threats outlined in the threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) include:

- Impacts on plant species composition and succession
- Alterations to nutrient, water cycling and water quality
- Predation of native fauna and flora including small mammals, birds, reptiles, frogs, crayfish, eggs, invertebrates, fungi and all part of plants including fruit, seeds, roots, tubers, bulbs and foliage
- Digging and disturbance to substrate resulting in the destruction of plants threatening their survival and recruitment of new plants altering the floral composition and soil structure
- Disturbance caused by pigs can increase the incursion and recruitment of weeds and provide reservoirs for endemic animal diseases.

Threat abatement actions for feral pics (*Sus scrofa*) include:

- Implementation of control measures including trapping, aerial and ground shooting, poisoning and fencing
- Using tracking dogs to detect and flush out feral pigs by commercial harvesters
- Manipulating habitat by reducing watering point and crop waste
- Manage feral pigs within a policy, legislative and planning framework.

The consequences of potential infection outlined in the threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomic* include:

- Inability of infected plants to develop new shoots, flowers, fruit and seed
- Complete loss of some flora populations

- Dramatic alteration to the structure and composition of native plant communities
- A severe reduction in primary productivity and functionality
- Irreversible habitat loss and degradation of dependent flora and fauna
- Loss of shelter and nesting sites and food sources resulting in major declines of fauna.

Objectives and actions outlined in the threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomic include:

- Identifying and prioritising the protection of biodiversity assets that are, or may be, impacted by Phytophthora including listed threatened species, ecological communities and areas where non-listed species or ecological communities that may become eligible for listing under the EPBC Act occur
- Reduce the spread and mitigate the impacts of Phytophthora to protect priority biodiversity assets and areas where non-listed species or ecological communities that may become eligible for listing under the EPBC Act
- Inform the community through education on the impacts that Phytophthora has on biodiversity and actions to mitigate these impacts
- Encourage research on Phytophthora species and option to manage infestations and protect biodiversity assets.

7.4.5 References

Department of the Environment and Energy (2018). White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, Department of the Environment and Energy, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=43 [Accessed 4 September 2018].

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Threatened Species Scientific Committee (2006). Advice to the Minister for the Environment and Heritage from the Threatened Species Scientific Committee (TSSC) on Amendments to the List of Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* [Accessed 4 September 2018].

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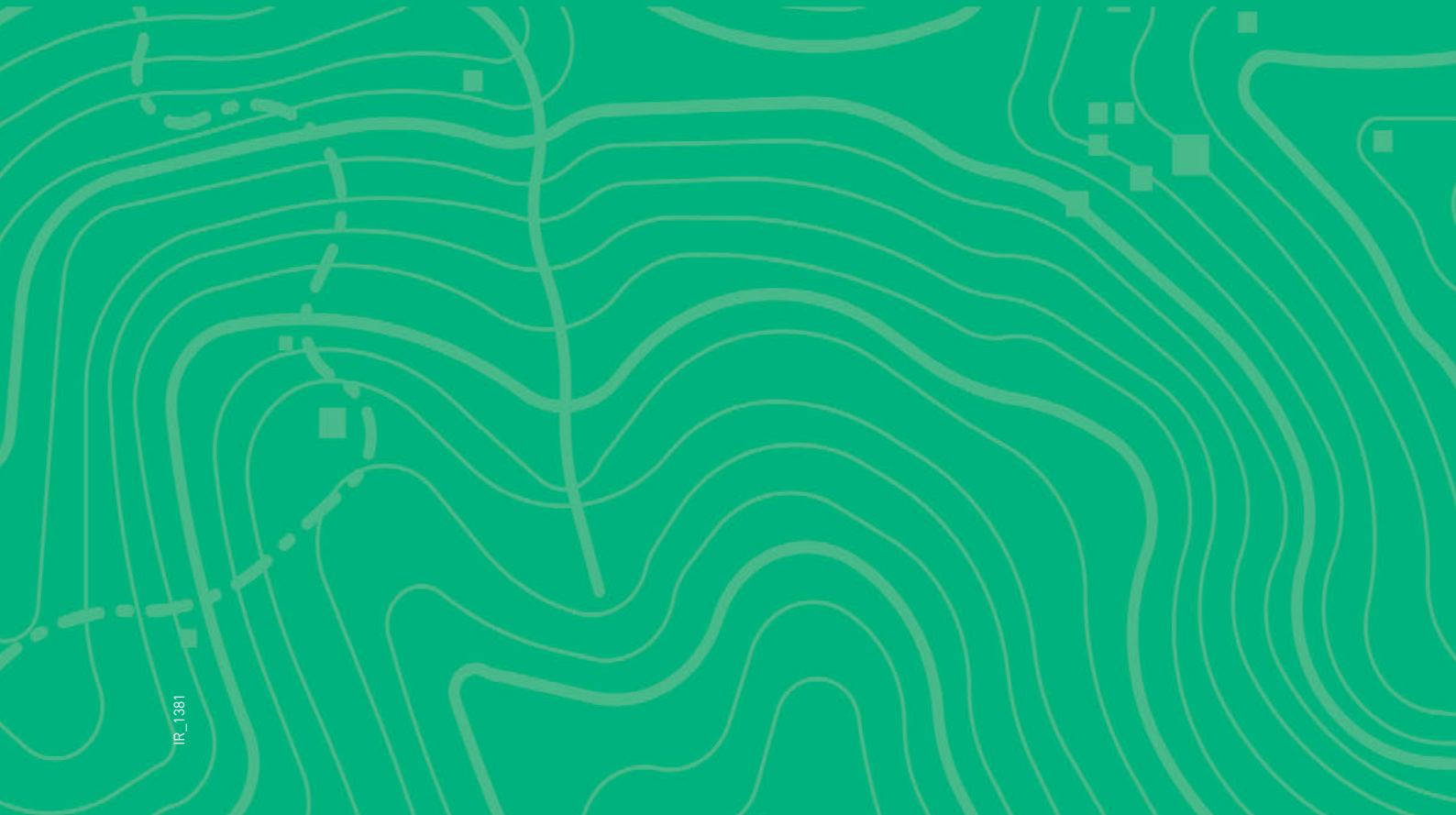
APPENDIX K

Matters of National Environmental Significance Technical Report

Appendix C Herbarium confirmation letters

CALVERT TO KAGARU ENVIRONMENTAL IMPACT STATEMENT



IR_1381

Queensland
Government

Department of
Environment and Science

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@qld.gov.au
http://www.qld.gov.au/herbarium

Enquiries Tony Bean
Telephone 07 3896 9318
Your reference
Our reference ARB:mh 567/18

19 July 2018

Chris Schell
Aurecon Australia
Locked Bag 331
BRISBANE Qld 4001

Dear Chris

The botanical specimens received by the Queensland Herbarium on 10 July 2018 have been identified as:

#Melaleuca irbyana, confirmed. This species is listed as Endangered under Queensland's *Nature Conservation Act 1992*.
#Notelaea lloydii. This species is listed as Vulnerable under Queensland's *Nature Conservation Act 1992*.

These specimens have been kept for incorporation into the Herbarium collection, with thanks.

There is a charge of $114.40 (minimum charge 1hr) for these identifications.

Yours sincerely

G.P.Guymer
Director

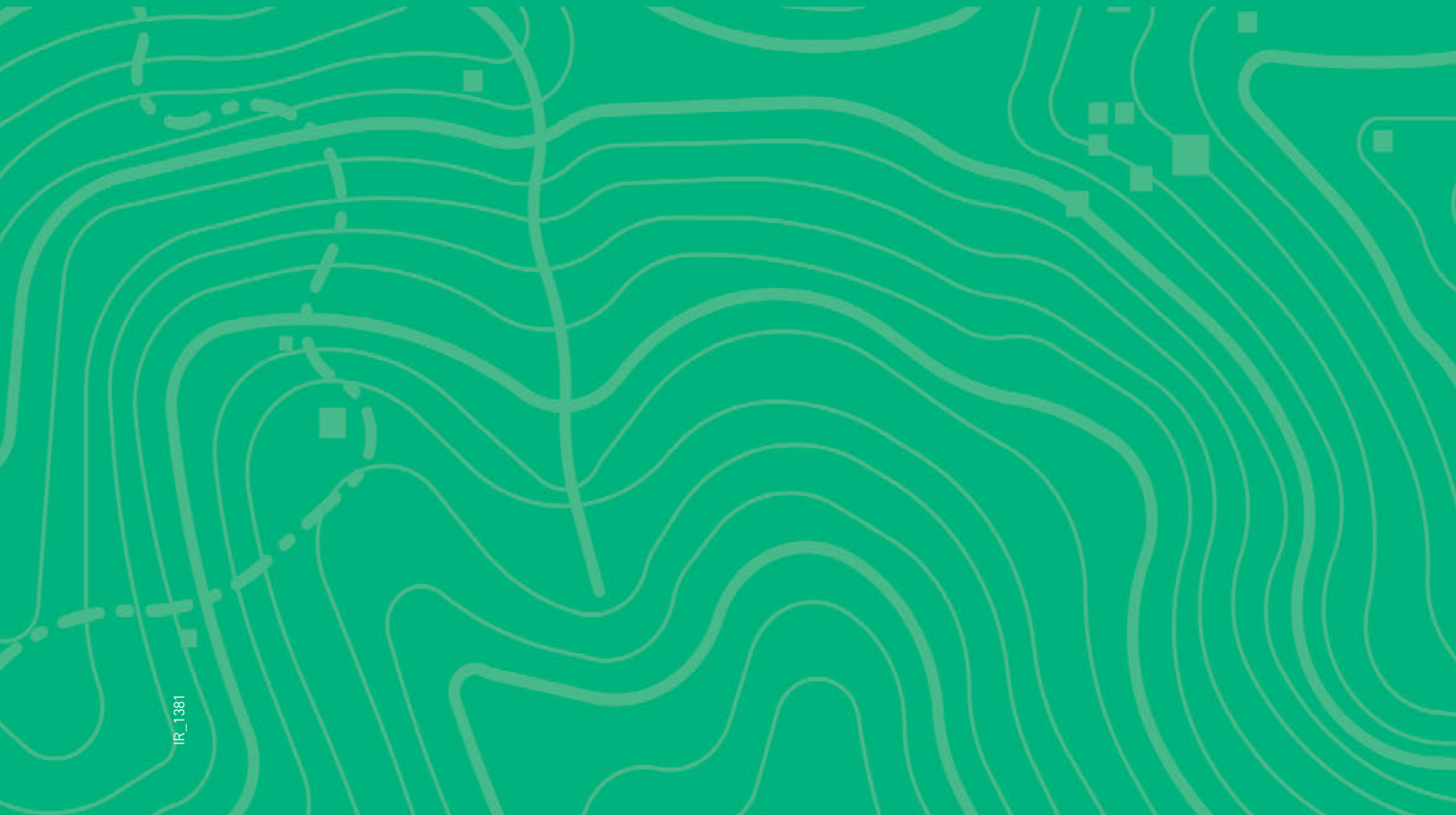
Download a full version of Census of the Queensland Flora 2017
https://data.qld.gov.au/dataset/census-of-the-queensland-flora-2017

APPENDIX K

Matters of National Environmental Significance Technical Report

Appendix D Database Search Results

CALVERT TO KAGARU ENVIRONMENTAL IMPACT STATEMENT



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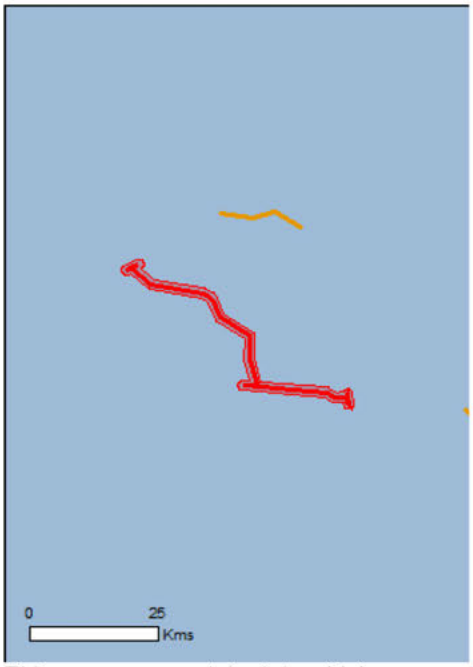
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 06/02/20 12:26:38



Coordinates
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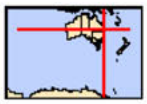

Summary

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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	47
Listed Migratory Species:	16

Other Matters Protected by the EPBC Act

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

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

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	22
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	34
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Moreton bay	30 - 40km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area
Swamp Tea-tree (Melaleuca irbyana) Forest of South-east Queensland	Critically Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Cyclopsitta diophthalma_coxeni Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta_scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Fish		
Maccullochella mariensis Mary River Cod [83806]	Endangered	Translocated population known to occur within area
Neoceratodus forsteri Australian Lungfish, Queensland Lungfish [67620]	Vulnerable	Species or species habitat known to occur within area
Insects		
Argynnis hyperbius inconstans Australian Fritillary [88056]	Critically Endangered	Species or species habitat may occur within area
Phyllodes imperialis smithersi Pink Underwing Moth [86084]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or

Name	Status	Type of Presence
		related behaviour known to occur within area
Plants		
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Bertya ernestiana a shrub [78349]	Vulnerable	Species or species habitat may occur within area
Bosistoa transversa Three-leaved Bosistoa, Yellow Satinheart [16091]	Vulnerable	Species or species habitat likely to occur within area
Cupaniopsis shirleyana Wedge-leaf Tuckeroo [3205]	Vulnerable	Species or species habitat may occur within area
Cupaniopsis tomentella Boonah Tuckeroo [3322]	Vulnerable	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Fontainea venosa [24040]	Vulnerable	Species or species habitat may occur within area
Lepidium peregrinum Wandering Pepper-cress [14035]	Endangered	Species or species habitat may occur within area
Macadamia integrifolia Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat may occur within area
Macadamia tetraphylla Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut [6581]	Vulnerable	Species or species habitat may occur within area
Notelaea ipsviciensis Cooneana Olive [81858]	Critically Endangered	Species or species habitat may occur within area
Notelaea lloydii Lloyd's Olive [15002]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Phebalium distans Mt Berryman Phebalium [81869]	Critically Endangered	Species or species habitat may occur within area
Planchonella eerwah Shiny-leaved Condoo, Black Plum, Wild Apple [17340]	Endangered	Species or species habitat likely to occur within area
Samadera bidwillii Quassia [29708]	Vulnerable	Species or species habitat likely to occur within area
Sophora fraseri [8836]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Reptiles		
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area
Saiphos reticulatus Three-toed Snake-tooth Skink [88328]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Gum Tips	QLD

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		

Name	Status	Type of Presence
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat may occur within area

Caveat

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

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

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

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

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

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

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

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

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

Coordinates

-27.66388 152.53775,-27.65499 152.55935,-27.66085 152.54634,-27.68574 152.58139,-27.69984 152.67169,-27.70561 152.68423,-27.71032 152.68766,-27.73737 152.70122,-27.76608 152.75306,-27.80238 152.75203,-27.84216 152.76576,-27.84221 152.74164,-27.85263 152.88747,-27.86143 152.90258,-27.86006 152.9206,-27.85566 152.92369,-27.87076 152.92539,-27.86538 152.92198

Acknowledgements

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

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: Planning.Support@des.qld.gov.au

Disclaimer

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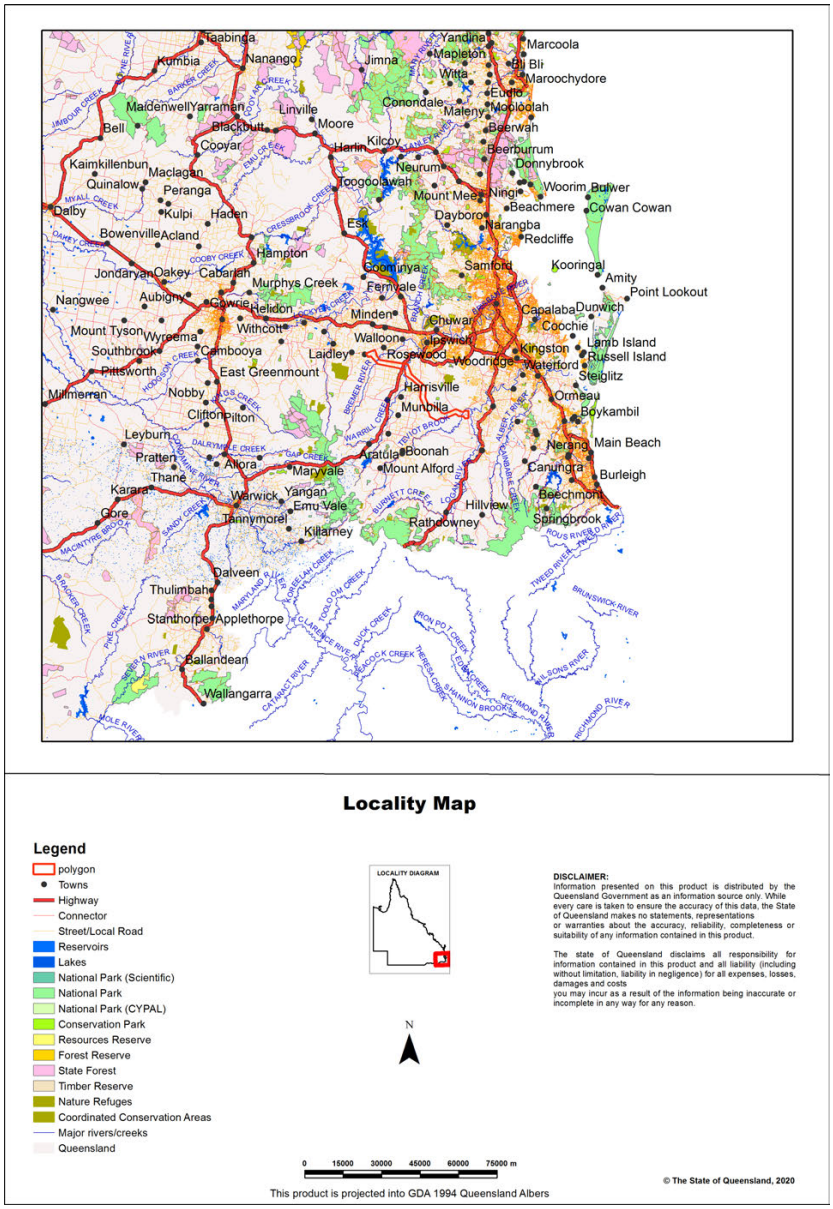
Table of Contents

Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI

Size (ha)	11,221.47
Local Government(s)	Scenic Rim Regional, Logan City, Ipswich City
Bioregion(s)	Southeast Queensland
Subregion(s)	Moreton Basin
Catchment(s)	Logan-Albert, Brisbane



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992* ;

- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004* ;

- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;

- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;

- Regulated vegetation under the *Vegetation Management Act 1999* that is:

    • Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;

    • Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;

    • Category R areas on the regulated vegetation management map;

    • Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;

    • Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;

- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;

- Wetlands in a wetland protection area of wetlands of high ecological significance shown on the Map of Referable Wetlands under the Environmental Protection Regulation 2008;

- Wetlands and watercourses in high ecological value waters defined in the Environmental Protection (Water) Policy 2009, schedule 2;

- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0.0 ha	0.0 %
1b Protected Areas- nature refuges	15.03 ha	0.1%
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	70.68 ha	0.6%
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways **	0.0 km	Not applicable
7 Threatened species and Iconic species	1292.18 ha	11.5%
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	825.13 ha	7.4%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	1653.46 ha	14.7%
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0.0 ha	0.0 %
8d Regulated Vegetation - Essential habitat	2506.44 ha	22.3%
8e Regulated Vegetation - intersecting a watercourse **	247.8 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	442.18 ha	3.9%
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

1b. Protected Areas - nature refuges

Name
Gum Tips Nature Refuge

2. State Marine Parks - highly protected zones

(no results)

3. Fish habitat areas (A and B areas)

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(no results)

5. High Ecological Significance wetlands on the Map of Referable Wetlands

Natural wetlands that are 'High Ecological Significance' (HES) on the Map of Referable Wetlands are present.

6a. High Ecological Value (HEV) waters - wetlands

(no results)

6b. High Ecological Value (HEV) waters - waterways

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7. Threatened wildlife and special least concern animal

Threatened species and iconic species	Act	Species least concern animal	Koala Bushland Habitat	Dugong Protection	VMA Essential 2014 Habitat
Threat wildlife & Spec LeastC animals	NCA, VMA	None	Koala Bushland	None	Essential
Threat wildlife & Spec LeastC animals	NCA, VMA	None	None	None	Essential
Threat wildlife & Spec LeastC animals	NCA	None	Koala Bushland	None	None
Threat wildlife & Spec LeastC animals	NCA, VMA	None	Koala Bushland	None	None
Threat wildlife & Spec LeastC animals	NCA, VMA	None	None	None	None
Threat wildlife & Spec LeastC animals	NCA, VMA	None	None	None	Essential Regrowth

Threatened and special least concern species records

Scientific name	Common name	NCA status	EPBC status
Petrogale penicillata	brush-tailed rock-wallaby	V	V
Cupaniopsis tomentella	Boonah tuckeroo	V	V
Planchonella eerwah	None	E	E

Note: The Threatened and Special Least Concern Animal (7) layer originates from the previous MSES version (4.1, dated at 2014). The layer does not represent all currently listed species and is subject to review.

**Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL). Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)*

To request a species list for an area, or search for a species profile, access Wildlife Online at:
https://www.qld.gov.au/environment/plants-animals/species-list/

Refer to **Map 3 - MSES - Species** for an overview of the relevant MSES.

MSES - Regulated Vegetation

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Regional ecosystem	Vegetation management polygon	Vegetation management status
12.3.19	E-dom	rem_end
12.9-10.3	O-dom	rem_oc
12.3.8	O-dom	rem_oc
12.3.3d	E-dom	rem_end
12.3.18	E-dom	rem_end
12.9-10.27	E-dom	rem_end
12.9-10.2/12.9-10.7	O-subdom	rem_oc
12.3.3	E-dom	rem_end
12.9-10.2/12.9-10.7/12.9-10.17	O-subdom	rem_oc

Regional ecosystem	Vegetation management polygon	Vegetation management status
12.9-10.7	O-dom	rem_oc
12.3.3/12.3.7	E-dom	rem_end
12.9-10.2/12.9-10.17a/12.9-10.16	O-subdom	rem_oc
12.9-10.16	O-dom	rem_oc
12.9-10.2/12.9-10.7/12.9-10.3/12.9-10.17a	O-subdom	rem_oc
12.9-10.2/12.9-10.7/12.9-10.17a/12.9-10.3	O-subdom	rem_oc
12.9-10.2/12.9-10.7/12.9-10.17a	O-subdom	rem_oc
12.9-10.2/12.9-10.7/12.9-10.17a/12.9-10.16	O-subdom	rem_oc
12.3.3/12.3.8	E-dom	rem_end
12.9-10.11	E-dom	rem_end

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Regional ecosystem	Vegetation management polygon	Vegetation management status
12.9-10.2/12.9-10.7/12.9-10.19/12.9-10.5/12.9-10.3	O-subdom	hvr_oc
12.9-10.2/12.9-10.7	O-subdom	hvr_oc
12.3.3d	E-dom	hvr_end
12.3.3	E-dom	hvr_end
12.9-10.3	O-dom	hvr_oc
12.3.18	E-dom	hvr_end
12.3.19	E-dom	hvr_end
12.9-10.7	O-dom	hvr_oc
12.9-10.27	E-dom	hvr_end
12.3.3d/12.3.3	E-dom	hvr_end
12.9-10.11	E-dom	hvr_end
12.3.8	O-dom	hvr_oc
12.3.3/12.3.7	E-dom	hvr_end
12.9-10.2/12.9-10.7/12.9-10.17	O-subdom	hvr_oc
12.9-10.2/12.9-10.7/12.9-10.17a/12.9-10.16	O-subdom	hvr_oc
12.9-10.15/12.9-10.17	E-dom	hvr_end
12.9-10.2/12.9-10.7/12.9-10.17a/12.9-10.3	O-subdom	hvr_oc
12.9-10.2/12.9-10.17a/12.9-10.16	O-subdom	hvr_oc
12.9-10.2/12.9-10.3	O-subdom	hvr_oc

For further information relating to regional ecosystems in general, go to:
https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/
For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:
https://environment.ehp.qld.gov.au/regional-ecosystems/

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Not applicable

8d. Regulated Vegetation - Essential habitat

Values are present

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Regulated vegetation map category	Map number	RVM rule
B	9442	2
C	9442	3
C	0	3
B	0	2
A	0	1
A	9442	1

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

9a. Legally secured offset areas - offset register areas

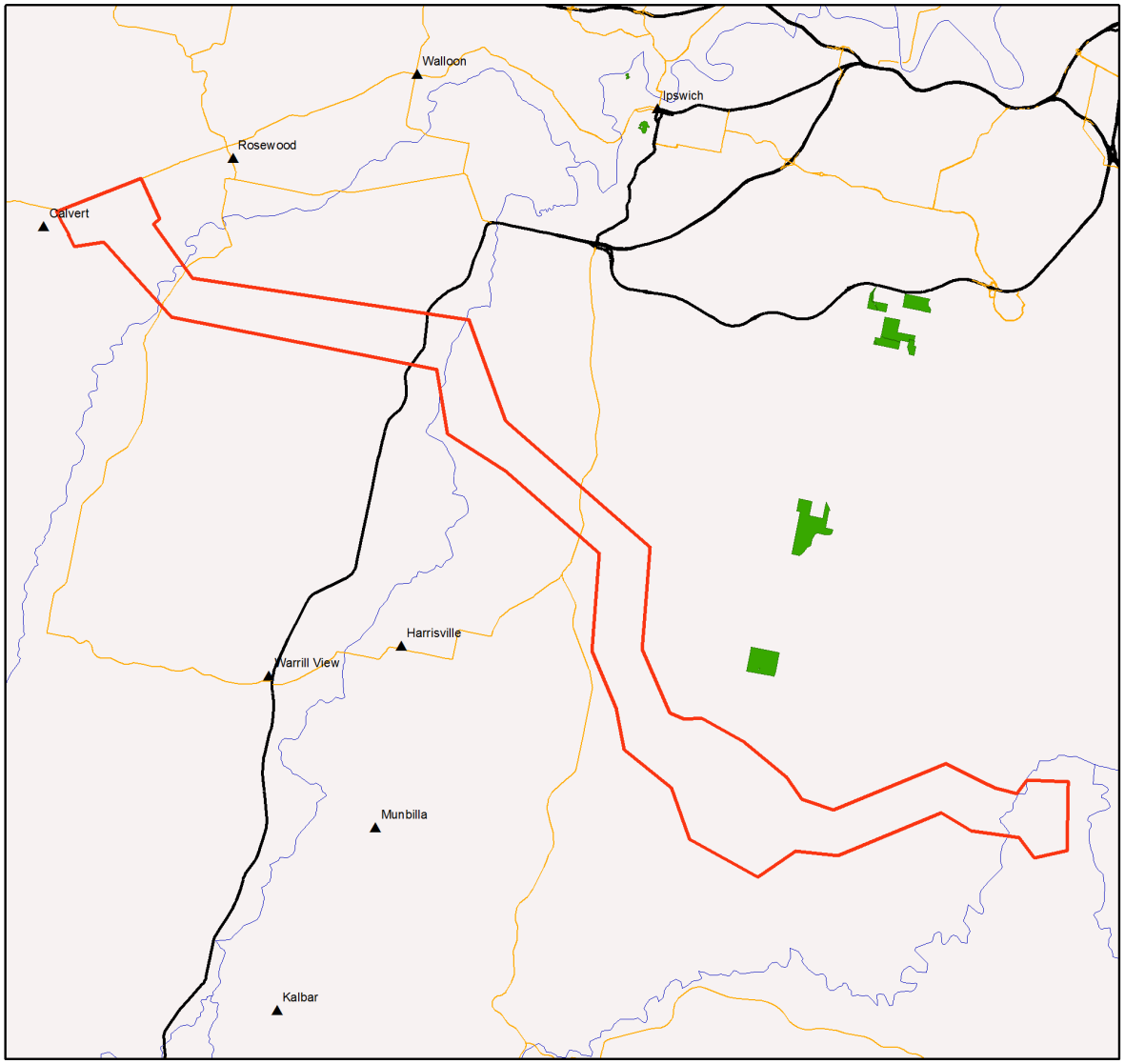
(no results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

Map 1 - MSES - State Conservation Areas

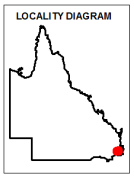


MSES - State Conservation Areas

Area of Interest

- polygon
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Protected area (estates)
- Declared fish habitat area (A and B areas)
- Marine park (highly protected)

LOCALITY DIAGRAM

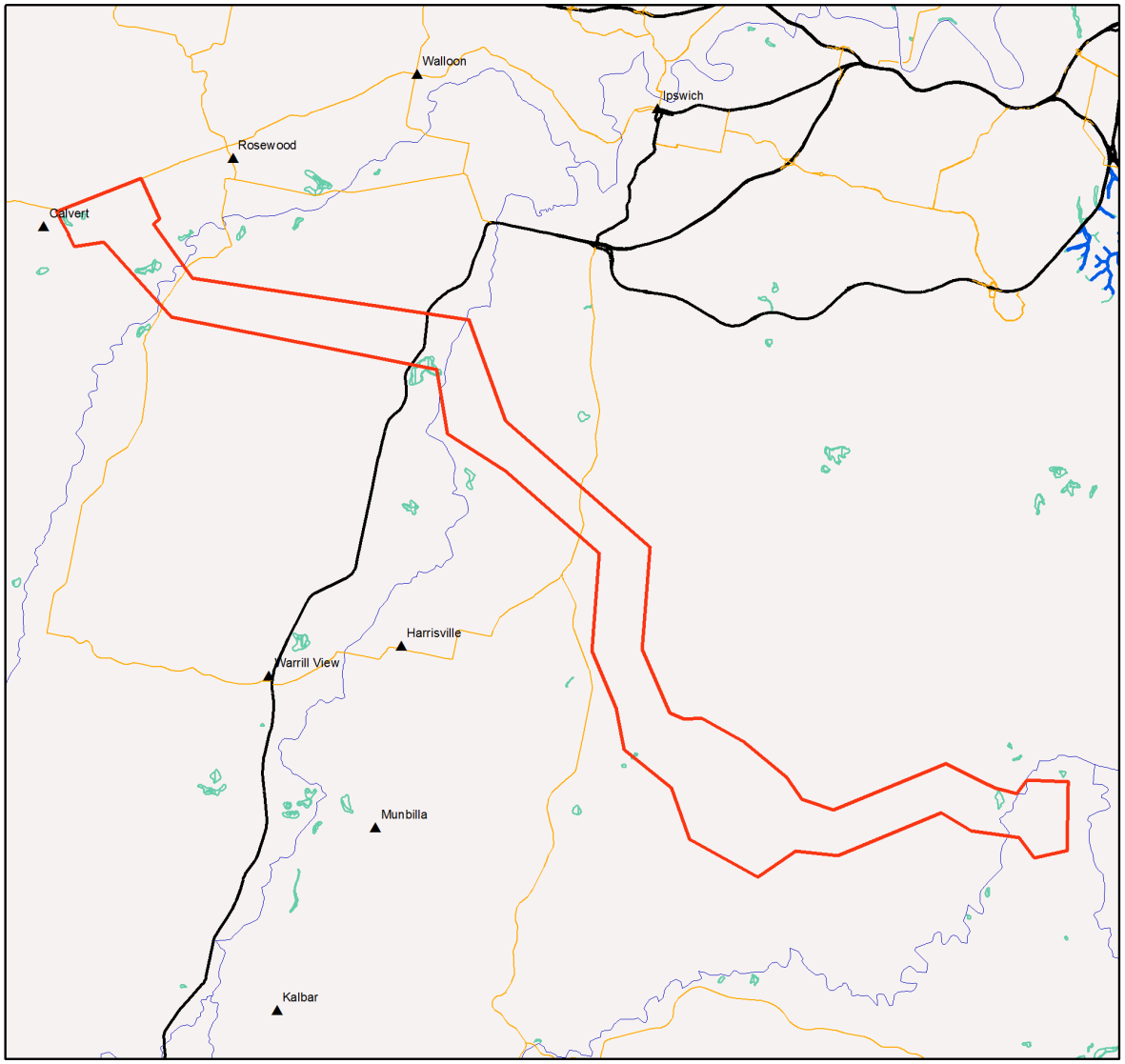


N

0 2300 4600 6900 9200 11500 m

This product is projected into GDA 1994 Queensland Albers

Map 2 - MSES - Wetlands and Waterways

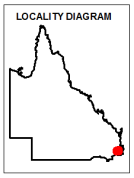


MSES - Wetlands and Waterways

Area of Interest

- polygon
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Declared high ecological value waters (watercourse)
- Strategic environmental area (designated precinct)
- Declared high ecological value waters (wetland)
- High ecological significance wetlands

LOCALITY DIAGRAM



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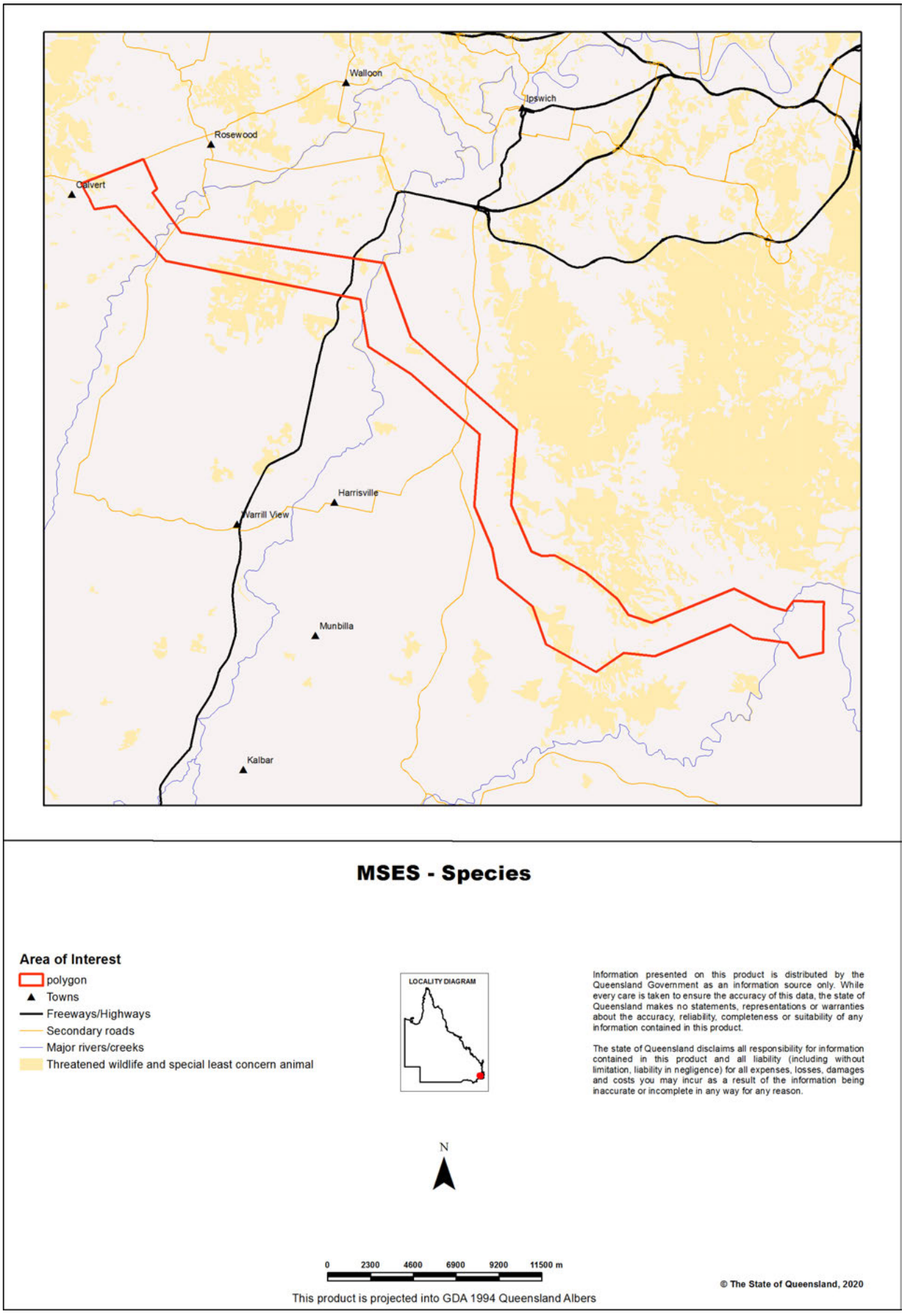
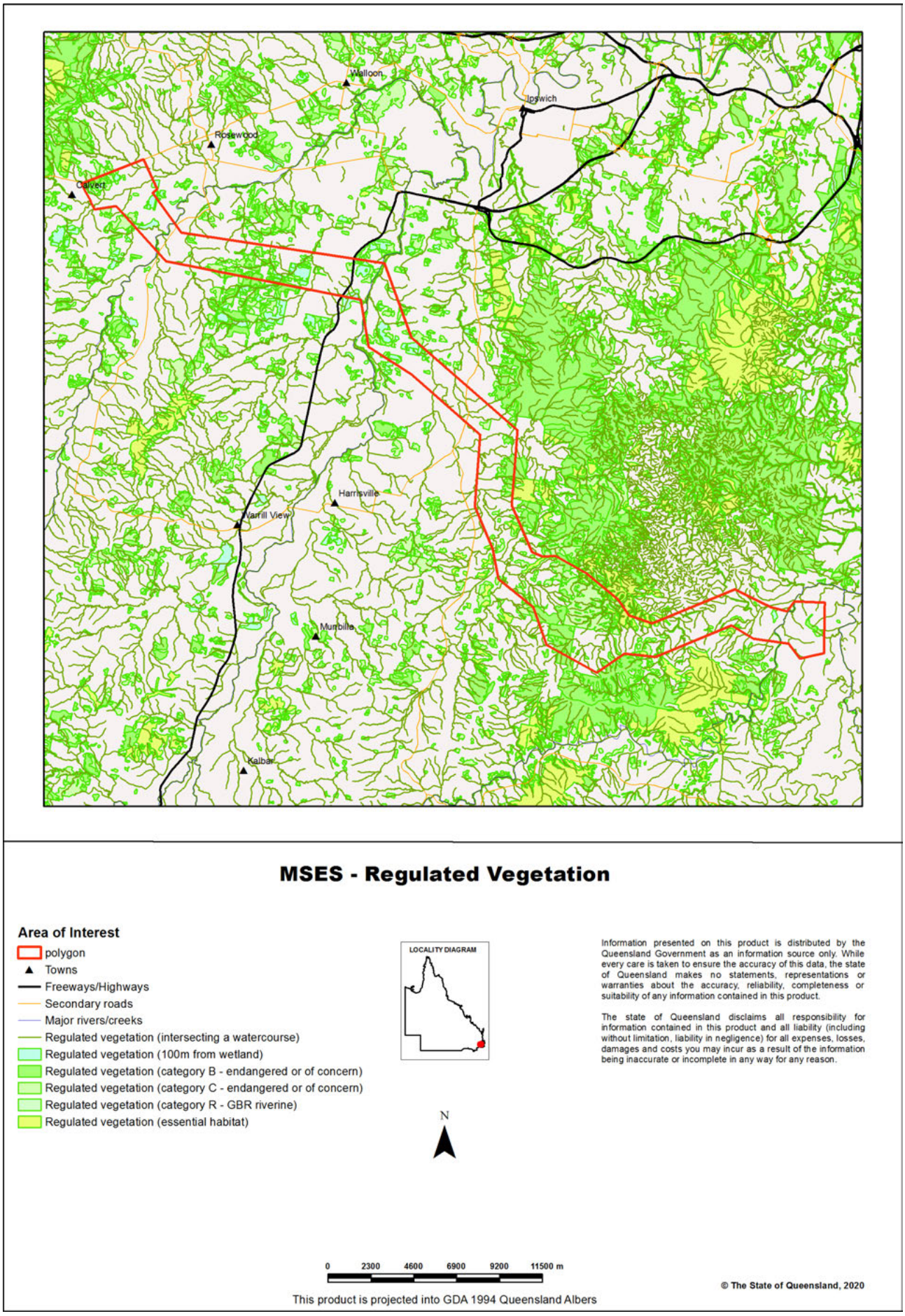
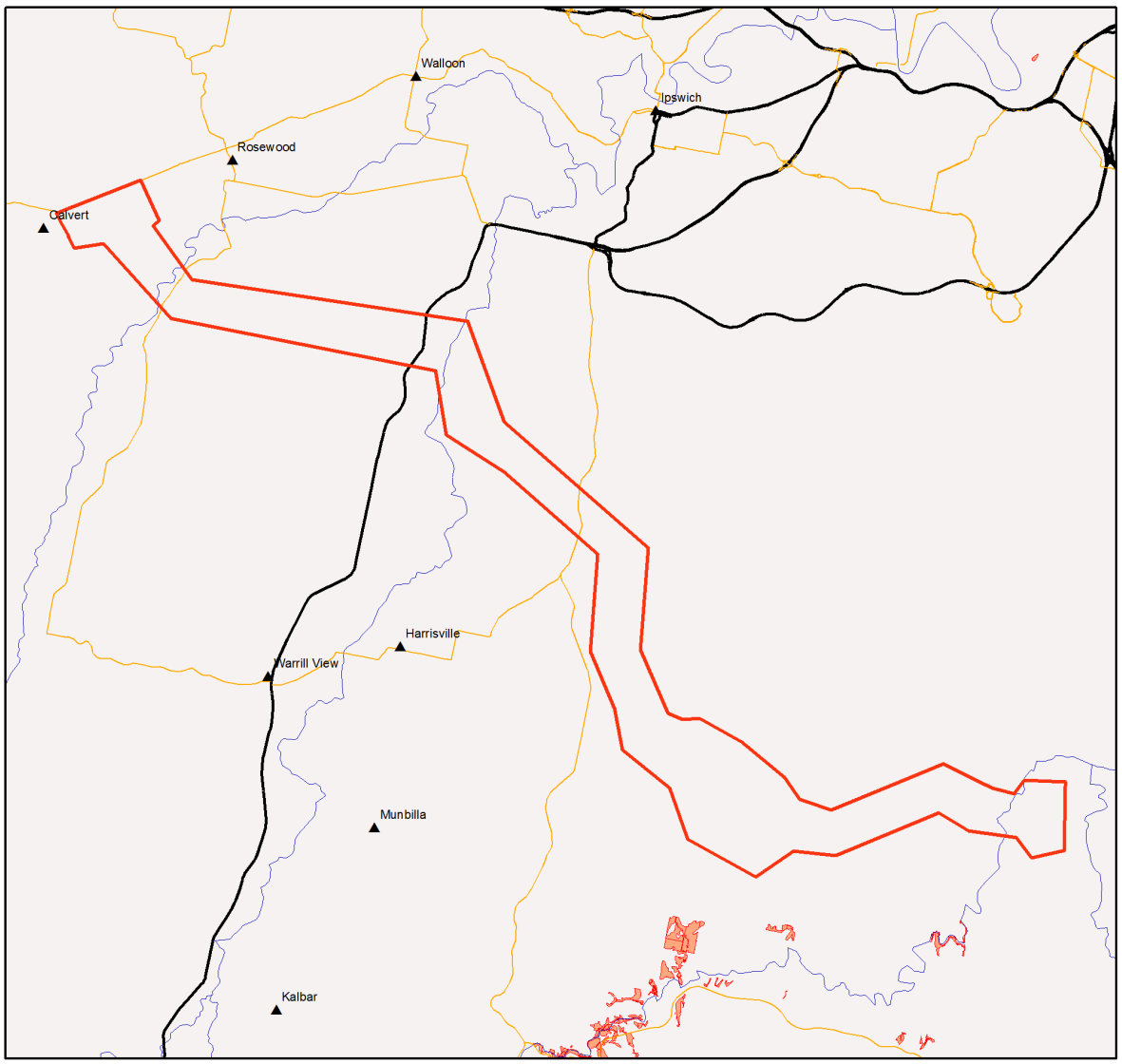
Map 3 - MSES - Species



Map 4 - MSES - Regulated Vegetation



Map 5 - MSES - Offset Areas

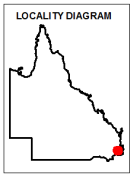


MSES - Offsets

Area of Interest

- polygon
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Legally secured offset area (offset register)
- Legally secured offset area (vegetation offsets)

LOCALITY DIAGRAM



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0 2300 4600 6900 9200 11500 m

This product is projected into GDA 1994 Queensland Albers

Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" can be downloaded from:

http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html .

Appendix 2 - Source Data

The datasets listed below are available on request from:

http://qldspatial.information.qld.gov.au/catalogue/custom/index.page

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	**current QSpatial data (http://qspatial.information.qld.gov.au)**
Protected Areas-Estates and Nature Refuges	- Protected areas of Queensland - Nature Refuges - Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Referable Wetland - wetland layers: - Wetland management area wetlands - Wetland protection area wetlands
wetlands in HEV waters	HEV waters: - EPP Water (multiple locations) intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 4, 2015) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000) - latest version 1.4
Wildlife habitat (threatened and special least concern)	-WildNet database species records - habitat suitability models (various)
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map - latest version 8.0
VMA Essential Habitat	Vegetation management - essential habitat map - latest version 4.41
VMA Wetlands	Vegetation management wetlands map - latest version 2.41
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map - latest version 1.41

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DES	- Department of Environment and Science
EP Act	- *Environmental Protection Act 1994*
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- *Nature Conservation Act 1992*
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- *Vegetation Management Act 1999*

Atlas of Living Australia flora and fauna species records within the Ecology Study area

Accessed: 7th February 2020, 08:50 AEDT

Kingdom	Family	Species	Common Name	NCA Status	EPBC Status
Animals	Acanthizidae	Acanthiza chrysorrhoa	yellow-rumped thornbill	C	
Animals	Acanthizidae	Acanthiza lineata	striated thornbill	C	
Animals	Acanthizidae	Acanthiza nana	yellow thornbill	C	
Animals	Acanthizidae	Acanthiza pusilla	brown thornbill	C	
Animals	Acanthizidae	Acanthiza reguloides	buff-rumped thornbill	C	
Animals	Acanthizidae	Gerygone mouki	brown gerygone	C	
Animals	Acanthizidae	Gerygone olivacea	white-throated gerygone	C	
Animals	Acanthizidae	Gerygone olivacea	white-throated gerygone	C	
Animals	Acanthizidae	Sericornis citreogularis	yellow-throated scrubwren	C	
Animals	Acanthizidae	Sericornis frontalis	white-browed scrubwren	C	
Animals	Acanthizidae	Smicrornis brevirostris	weebill	C	
Animals	Accipitridae	Accipiter cirrocephalus	collared sparrowhawk	C	
Animals	Accipitridae	Accipiter fasciatus	brown goshawk	C	
Animals	Accipitridae	Accipiter novaehollandiae	grey goshawk	C	
Animals	Accipitridae	Aquila audax	wedge-tailed eagle	C	
Animals	Accipitridae	Aviceda subcristata	Pacific baza	C	
Animals	Accipitridae	Circus approximans	swamp harrier	C	
Animals	Accipitridae	Circus assimilis	spotted harrier	C	
Animals	Accipitridae	Elanus axillaris	black-shouldered kite	C	
Animals	Accipitridae	Haliastur sphenurus	whistling kite	C	
Animals	Accipitridae	Hieraaetus morphnoides	little eagle	C	
Animals	Accipitridae	Lophoictinia isura	square-tailed kite	C	

Animals	Accipitridae	Milvus migrans	black kite	C	
Animals	Acrocephalidae	Acrocephalus australis	Australian reed-warbler	C	
Animals	Aegothelidae	Aegotheles cristatus	Australian owlet-nightjar	C	
Animals	Agamidae	Intellagama lesueurii	eastern water dragon	C	
Animals	Agamidae	Pogona barbata	bearded dragon	C	
Animals	Alaudidae	Mirafra javanica	Horsfield's bushlark	C	
Animals	Alcedinidae	Ceyx azureus	azure kingfisher	C	
Animals	Ambassidae	Ambassis agassizii	Agassiz's glassfish		
Animals	Anatidae	Anas castanea	chestnut teal	C	
Animals	Anatidae	Anas gracilis	grey teal	C	
Animals	Anatidae	Anas superciliosa	Pacific black duck	C	
Animals	Anatidae	Aythya australis	hardhead	C	
Animals	Anatidae	Chenonetta jubata	Australian wood duck	C	
Animals	Anatidae	Cygnus atratus	black swan	C	
Animals	Anatidae	Dendrocygna eytoni	plumed whistling-duck	C	
Animals	Anatidae	Malacorhynchus membranaceus	pink-eared duck	C	
Animals	Apodidae	Hirundapus caudacutus	white-throated needletail	V	V
Animals	Ardeidae	Ardea intermedia	intermediate egret	C	
Animals	Ardeidae	Ardea pacifica	white-necked heron	C	
Animals	Ardeidae	Egretta novaehollandiae	white-faced heron	C	
Animals	Artamidae	Artamus leucorynchus	white-breasted woodswallow	C	
Animals	Artamidae	Artamus personatus	masked woodswallow	C	
Animals	Artamidae	Artamus superciliosus	white-browed woodswallow	C	
Animals	Artamidae	Cracticus nigrogularis	pied butcherbird	C	
Animals	Artamidae	Cracticus torquatus	grey butcherbird	C	
Animals	Atherinidae	Craterocephalus stercusmuscarum	flyspecked hardyhead		

Animals	Bovidae	Bos taurus	European cattle		
Animals	Bufonidae	Rhinella marina	cane toad		
Animals	Burhinidae	Burhinus grallarius	bush stone-curlew	C	
Animals	Cacatuidae	Cacatua galerita	sulphur-crested cockatoo	C	
Animals	Cacatuidae	Cacatua sanguinea	little corella	C	
Animals	Cacatuidae	Cacatua tenuirostris	long-billed corella	C	
Animals	Cacatuidae	Eolophus roseicapilla	galah	C	
Animals	Cacatuidae	Nymphicus hollandicus	cockatiel	C	
Animals	Campephagidae	Coracina novaehollandiae	black-faced cuckoo-shrike	C	
Animals	Campephagidae	Coracina papuensis	white-bellied cuckoo-shrike	C	
Animals	Campephagidae	Coracina tenuirostris	cicadabird	C	
Animals	Campephagidae	Lalage leucomela	varied triller	C	
Animals	Canidae	Vulpes vulpes	red fox		
Animals	Chelidae	Chelodina longicollis	eastern snake-necked turtle	C	
Animals	Ciconiidae	Ephippiorhynchus asiaticus	black-necked stork	C	
Animals	Cisticolidae	Cisticola exilis	golden-headed cisticola	C	
Animals	Climacteridae	Climacteris erythrops	red-browed treecreeper	C	
Animals	Colubridae	Dendrelaphis punctulatus	green tree snake	C	
Animals	Columbidae	Geopelia humeralis	bar-shouldered dove	C	
Animals	Columbidae	Geopelia striata	peaceful dove	C	
Animals	Columbidae	Geopelia striata	peaceful dove	C	
Animals	Columbidae	Leucosarcia melanoleuca	wonga pigeon	C	
Animals	Columbidae	Lopholaimus antarcticus	topknot pigeon	C	
Animals	Columbidae	Macropygia amboinensis	brown cuckoo-dove	C	
Animals	Columbidae	Ocyphaps lophotes	crested pigeon	C	
Animals	Columbidae	Phaps chalcoptera	common bronzewing	C	

Animals	Columbidae	Ptilinopus magnificus	wompoo fruit-dove	C	
Animals	Columbidae	Streptopelia chinensis	spotted dove		
Animals	Coraciidae	Eurystomus orientalis	dollarbird	C	
Animals	Corvidae	Corvus coronoides	Australian raven	C	
Animals	Corvidae	Corvus orru	Torresian crow	C	
Animals	Cuculidae	Cacomantis flabelliformis	fan-tailed cuckoo	C	
Animals	Cuculidae	Cacomantis pallidus	pallid cuckoo	C	
Animals	Cuculidae	Cacomantis variolosus	brush cuckoo	C	
Animals	Cuculidae	Centropus phasianinus	pheasant coucal	C	
Animals	Cuculidae	Chalcites basalis	Horsfield's bronze-cuckoo	C	
Animals	Cuculidae	Chalcites lucidus	shining bronze-cuckoo	C	
Animals	Cuculidae	Eudynamys orientalis	eastern koel	C	
Animals	Cuculidae	Eudynamys orientalis	eastern koel	C	
Animals	Cuculidae	Scythrops novaehollandiae	channel-billed cuckoo	C	
Animals	Cyprinidae	Carassius auratus	goldfish		
Animals	Dasyuridae	Planigale maculata	common planigale	C	
Animals	Diplodactylidae	Nebulifera robusta	robust velvet gecko	C	
Animals	Elapidae	Cryptophis nigrescens	eastern small-eyed snake	C	
Animals	Elapidae	Hoplocephalus bitorquatus	pale-headed snake	C	
Animals	Elapidae	Pseudechis porphyriacus	red-bellied black snake	C	
Animals	Elapidae	Pseudonaja textilis	eastern brown snake	C	
Animals	Eleotridae	Gobiomorphus australis	striped gudgeon		
Animals	Eleotridae	Hypseleotris compressa	empire gudgeon		
Animals	Eleotridae	Hypseleotris galii	firetail gudgeon		
Animals	Eleotridae	Hypseleotris klunzingeri	western carp gudgeon		
Animals	Eleotridae	Philypnodon grandiceps	flathead gudgeon		
Animals	Eleotridae	Philypnodon macrostomus	dwarf flathead gudgeon		

Animals	Estrildidae	Lonchura castaneothorax	chestnut-breasted mannikin	C	
Animals	Estrildidae	Lonchura punctulata	nutmeg mannikin		
Animals	Estrildidae	Neochmia temporalis	red-browed finch	C	
Animals	Falconidae	Falco berigora	brown falcon	C	
Animals	Falconidae	Falco cenchroides	nankeen kestrel	C	
Animals	Falconidae	Falco longipennis	Australian hobby	C	
Animals	Falconidae	Falco peregrinus	peregrine falcon	C	
Animals	Gekkonidae	Gehyra dubia	dubious dtella	C	
Animals	Gomphidae	Hemigomphus gouldii	southern vicetail		
Animals	Halcyonidae	Dacelo leachii	blue-winged kookaburra	C	
Animals	Halcyonidae	Dacelo novaeguineae	laughing kookaburra	C	
Animals	Halcyonidae	Todiramphus macleayii	forest kingfisher	C	
Animals	Halcyonidae	Todiramphus sanctus	sacred kingfisher	C	
Animals	Hirundinidae	Hirundo neoxena	welcome swallow	C	
Animals	Hirundinidae	Petrochelidon ariel	fairy martin	C	
Animals	Hirundinidae	Petrochelidon nigricans	tree martin	C	
Animals	Hylidae	Litoria brevipalmata	green thighed frog	C	
Animals	Hylidae	Litoria caerulea	common green treefrog	C	
Animals	Hylidae	Litoria dentata	bleating treefrog	C	
Animals	Hylidae	Litoria fallax	eastern sedgefrog	C	
Animals	Hylidae	Litoria latopalmata	broad palmed rocketfrog	C	
Animals	Hylidae	Litoria nasuta	striped rocketfrog	C	
Animals	Hylidae	Litoria peronii	emerald spotted treefrog	C	
Animals	Hylidae	Litoria rubella	ruddy treefrog	C	
Animals	Jacanidae	Irediparra gallinacea	comb-crested jacana	C	
Animals	Leporidae	Lepus europaeus	European brown hare		
Animals	Limnodynastidae	Limnodynastes peronii	striped marshfrog	C	
Animals	Limnodynastidae	Limnodynastes salmini	salmon striped frog	C	

Animals	Limnodynastidae	Limnodynastes tasmaniensis	spotted grassfrog	C	
Animals	Limnodynastidae	Limnodynastes terraereginae	scarlet sided pobblebonk	C	
Animals	Macropodidae	Macropus giganteus	eastern grey kangaroo	C	
Animals	Macropodidae	Macropus rufogriseus	red-necked wallaby	C	
Animals	Macropodidae	Petrogale penicillata	brush-tailed rock-wallaby	V	V
Animals	Maluridae	Malurus cyaneus	superb fairy-wren	C	
Animals	Maluridae	Malurus lamberti	variegated fairy-wren	C	
Animals	Maluridae	Malurus melanocephalus	red-backed fairy-wren	C	
Animals	Megaluridae	Megalurus gramineus	little grassbird	C	
Animals	Megaluridae	Megalurus timoriensis	tawny grassbird	C	
Animals	Megapodiidae	Alectura lathami	Australian brush-turkey	C	
Animals	Melanotaeniidae	Melanotaenia duboulayi	crimsonspotted rainbowfish		
Animals	Meliphagidae	Acanthorhynchus tenuirostris	eastern spinebill	C	
Animals	Meliphagidae	Caligavis chrysops	yellow-faced honeyeater	C	
Animals	Meliphagidae	Entomyzon cyanotis	blue-faced honeyeater	C	
Animals	Meliphagidae	Lichmera indistincta	brown honeyeater	C	
Animals	Meliphagidae	Manorina melanocephala	noisy miner	C	
Animals	Meliphagidae	Meliphaga lewinii	Lewin's honeyeater	C	
Animals	Meliphagidae	Melithreptus albogularis	white-throated honeyeater	C	
Animals	Meliphagidae	Melithreptus lunatus	white-naped honeyeater	C	
Animals	Meliphagidae	Myzomela sanguinolenta	scarlet honeyeater	C	
Animals	Meliphagidae	Philemon citreogularis	little friarbird	C	
Animals	Meliphagidae	Philemon corniculatus	noisy friarbird	C	

Animals	Meliphagidae	Plectorhyncha lanceolata	striped honeyeater	C	
Animals	Meliphagidae	Ptilotula fusca	fuscous honeyeater	C	
Animals	Meropidae	Merops ornatus	rainbow bee-eater	C	
Animals	Monarchidae	Grallina cyanoleuca	magpie-lark	C	
Animals	Monarchidae	Monarcha melanopsis	black-faced monarch	SL	
Animals	Monarchidae	Myiagra inquieta	restless flycatcher	C	
Animals	Monarchidae	Myiagra rubecula	leaden flycatcher	C	
Animals	Motacillidae	Anthus novaeseelandiae	Australasian pipit	C	
Animals	Muridae	Rattus rattus	black rat		
Animals	Myobatrachidae	Crinia parinsignifera	beeping froglet	C	
Animals	Myobatrachidae	Pseudophryne major	great brown broodfrog	C	
Animals	Myobatrachidae	Uperoleia rugosa	chubby gungan	C	
Animals	Nectariniidae	Dicaeum hirundinaceum	mistletoebird	C	
Animals	Neosittidae	Daphoenositta chrysoptera	varied sittella	C	
Animals	Oriolidae	Oriolus sagittatus	olive-backed oriole	C	
Animals	Oriolidae	Sphecotheres vieilloti	Australasian figbird	C	
Animals	Orthonychidae	Orthonyx temminckii	Australian logrunner	C	
Animals	Pachycephalidae	Colluricincla harmonica	grey shrike-thrush	C	
Animals	Pachycephalidae	Colluricincla megarhyncha	little shrike-thrush	C	
Animals	Pachycephalidae	Pachycephala rufiventris	rufous whistler	C	
Animals	Paradisaeidae	Ptiloris paradiseus	paradise riflebird	C	
Animals	Pardalotidae	Pardalotus punctatus	spotted pardalote	C	
Animals	Pardalotidae	Pardalotus striatus	striated pardalote	C	
Animals	Peramelidae	Isoodon macrourus	northern brown bandicoot	C	
Animals	Percichthyidae	Macquaria novemaculeata	Australian bass		
Animals	Petauridae	Petaurus breviceps	sugar glider	C	
Animals	Petauridae	Petaurus norfolcensis	squirrel glider	C	
Animals	Petroicidae	Eopsaltria australis	eastern yellow robin	C	

Animals	Petroicidae	Microeca fascinans	jacky winter	C	
Animals	Petroicidae	Petroica goodenovii	red-capped robin	C	
Animals	Petroicidae	Petroica rosea	rose robin	C	
Animals	Petroicidae	Tregellasia capito	pale-yellow robin	C	
Animals	Phalangeridae	Trichosurus vulpecula	common brushtail possum	C	
Animals	Phascolarctidae	Phascolarctos cinereus	koala	V	V
Animals	Phasianidae	Coturnix ypsilophora	brown quail	C	
Animals	Phasianidae	Pavo cristatus	Indian peafowl		
Animals	Pittidae	Pitta versicolor	noisy pitta	C	
Animals	Plotosidae	Tandanus tandanus	freshwater catfish		
Animals	Podargidae	Podargus strigoides	tawny frogmouth	C	
Animals	Podicipedidae	Tachybaptus novaehollandiae	Australasian grebe	C	
Animals	Psittacidae	Alisterus scapularis	Australian king-parrot	C	
Animals	Psittacidae	Glossopsitta concinna	musk lorikeet	C	
Animals	Psittacidae	Parvipsitta pusilla	little lorikeet	C	
Animals	Psittacidae	Platycercus eximius	eastern rosella	C	
Animals	Psittacidae	Trichoglossus chlorolepidotus	scaly-breasted lorikeet	C	
Animals	Psophodidae	Psophodes olivaceus	eastern whipbird	C	
Animals	Ptilonorhynchidae	Ailuroedus crassirostris	green catbird	C	
Animals	Ptilonorhynchidae	Ptilonorhynchus violaceus	satin bowerbird	C	
Animals	Ptilonorhynchidae	Sericulus chrysocephalus	regent bowerbird	C	
Animals	Pygopodidae	Delma plebeia	common delma	C	
Animals	Rallidae	Fulica atra	Eurasian coot	C	
Animals	Rallidae	Gallinula tenebrosa	dusky moorhen	C	
Animals	Rallidae	Gallirallus philippensis	buff-banded rail	C	
Animals	Retropinnidae	Retropinna semoni	Australian smelt		
Animals	Rhipiduridae	Rhipidura albiscapa	grey fantail	C	
Animals	Rhipiduridae	Rhipidura rufifrons	rufous fantail	SL	

Animals	Scincidae	Anomalopus verreauxii	three-clawed worm-skink	C	
Animals	Scincidae	Carlia vivax	tussock rainbow-skink	C	
Animals	Scincidae	Ctenotus spaldingi	straight-browed ctenotus	C	
Animals	Scincidae	Lampropholis delicata	dark-flecked garden sunskink	C	
Animals	Strigidae	Ninox strenua	powerful owl	V	
Animals	Sturnidae	Acridotheres tristis	common myna		
Animals	Sturnidae	Acridotheres tristis	common myna		
Animals	Sturnidae	Sturnus vulgaris	common starling		
Animals	Tachyglossidae	Tachyglossus aculeatus	short-beaked echidna	SL	
Animals	Terapontidae	Leiopotherapon unicolor	spangled perch		
Animals	Threskiornithidae	Plegadis falcinellus	glossy ibis	SL	
Animals	Threskiornithidae	Threskiornis spinicollis	straw-necked ibis	C	
Animals	Turdidae	Zoothera heinei	russet-tailed thrush	C	
Animals	Typhlopidae	Anilios wiedii	brown-snouted blind snake	C	
Fungi	Agaricaceae	Bovista cunninghamii		C	
Fungi	Agaricaceae	Chlorophyllum molybdites	green-spored parasol	C	
Fungi	Agaricaceae	Podaxis beringamensis		C	
Fungi	Amanitaceae	Amanita vaginata		C	
Fungi	Cladoniaceae	Cladonia floerkeana		C	
Fungi	Cladoniaceae	Thysanothecium scutellatum		C	
Fungi	Sclerodermataceae	Pisolithus marmoratus		C	
Plants	Acanthaceae	Brunoniella australis	blue trumpet	C	
Plants	Adoxaceae	Sambucus gaudichaudiana	white elder	C	
Plants	Alismataceae	Damasonium minus	starfruit	C	
Plants	Amaranthaceae	Achyranthes aspera		C	
Plants	Amaranthaceae	Gomphrena celosioides	gomphrena weed		
Plants	Apiaceae	Centella asiatica		C	

Plants	Apocynaceae	Alstonia constricta	bitterbark	C	
Plants	Apocynaceae	Gomphocarpus physocarpus	balloon cottonbush		
Plants	Apocynaceae	Marsdenia coronata	slender milkvine	V	
Plants	Apocynaceae	Parsonsia straminea	monkey rope	C	
Plants	Asteraceae	Apowollastonia spilanthoides		C	
Plants	Asteraceae	Baccharis halimifolia	groundsel bush		
Plants	Asteraceae	Camptacra barbata		C	
Plants	Asteraceae	Cassinia laevis		C	
Plants	Asteraceae	Cirsium vulgare	spear thistle		
Plants	Asteraceae	Cyanthillium cinereum		C	
Plants	Asteraceae	Erigeron bonariensis			
Plants	Asteraceae	Euchiton japonicus		C	
Plants	Asteraceae	Euchiton sphaericus		C	
Plants	Asteraceae	Glossocardia bidens	native cobbler's pegs	C	
Plants	Asteraceae	Lagenophora fimbriata		C	
Plants	Asteraceae	Lagenophora gracilis		C	
Plants	Asteraceae	Ozothamnus diosmifolius	white dogwood	C	
Plants	Asteraceae	Senecio madagascariensis	fireweed		
Plants	Asteraceae	Solenogyne bellioides		C	
Plants	Asteraceae	Tagetes minuta	stinking roger		
Plants	Asteraceae	Vittadinia sulcata	native daisy	C	
Plants	Bignoniaceae	Pandorea pandorana	wonga vine	C	
Plants	Brassicaceae	Lepidium africanum	common peppercress		
Plants	Bryaceae	Rosulabryum subfasciculatum		C	
Plants	Cactaceae	Opuntia stricta			
Plants	Cactaceae	Opuntia tomentosa	velvety tree pear		
Plants	Caesalpiniaceae	Barklya syringifolia	golden shower tree	C	
Plants	Campanulaceae	Lobelia concolor		C	

Plants	Campanulaceae	Lobelia purpurascens	white root	C	
Plants	Campanulaceae	Lobelia stenophylla		C	
Plants	Campanulaceae	Wahlenbergia gracilis	sprawling bluebell	C	
Plants	Chenopodiaceae	Dysphania multifida			
Plants	Chenopodiaceae	Einadia polygonoides	knotweed goosefoot	C	
Plants	Chenopodiaceae	Maireana microphylla		C	
Plants	Clusiaceae	Hypericum gramineum		C	
Plants	Commelinaceae	Commelina diffusa	wandering jew	C	
Plants	Commelinaceae	Murdannia graminea	murdannia	C	
Plants	Convolvulaceae	Dichondra repens	kidney weed	C	
Plants	Crassulaceae	Bryophyllum delagoense			
Plants	Cupressaceae	Callitris baileyi	Bailey's cypress	NT	
Plants	Cyperaceae	Bolboschoenus fluviatilis		C	
Plants	Cyperaceae	Carex appressa		C	
Plants	Cyperaceae	Carex inversa	knob sedge	C	
Plants	Cyperaceae	Cyperus flaccidus		C	
Plants	Cyperaceae	Cyperus mirus		C	
Plants	Cyperaceae	Cyperus scariosus		C	
Plants	Cyperaceae	Cyperus sculptus		C	
Plants	Cyperaceae	Cyperus sesquiflorus			
Plants	Cyperaceae	Cyperus trinervis		C	
Plants	Cyperaceae	Eleocharis dietrichiana		C	
Plants	Cyperaceae	Eleocharis philippinensis		C	
Plants	Cyperaceae	Fimbristylis dichotoma	common fringe-rush	C	
Plants	Cyperaceae	Fimbristylis ferruginea		C	
Plants	Entodontaceae	Entodon mackaviensis		C	
Plants	Euphorbiaceae	Homalanthus stillingiifolius		C	
Plants	Fabaceae	Desmodium brachypodum	large ticktrefoil	C	
Plants	Fabaceae	Desmodium rhytidophyllum		C	
Plants	Fabaceae	Hardenbergia violacea		C	

Plants	Fabaceae	Indigofera linnaei	Birdsville indigo	C	
Plants	Fabaceae	Jacksonia scoparia		C	
Plants	Funariaceae	Funaria hygrometrica		C	
Plants	Goodeniaceae	Goodenia gracilis		C	
Plants	Goodeniaceae	Velleia paradoxa	spur velleia	C	
Plants	Hemerocallidaceae	Dianella brevipedunculata		C	
Plants	Hemerocallidaceae	Dianella rara		C	
Plants	Johnsoniaceae	Tricoryne elatior	yellow autumn lily	C	
Plants	Juncaceae	Juncus polyanthemus		C	
Plants	Juncaceae	Juncus usitatus		C	
Plants	Lamiaceae	Callicarpa longifolia		C	
Plants	Lamiaceae	Mentha satureioides	native pennyroyal	C	
Plants	Lentibulariaceae	Utricularia aurea	golden bladderwort	C	
Plants	Linderniaceae	Lindernia alsinoides		C	
Plants	Lythraceae	Ammannia multiflora	jerry-jerry	C	
Plants	Malvaceae	Sida rhombifolia			
Plants	Marsileaceae	Marsilea mutica	shiny nardoo	C	
Plants	Menyanthaceae	Nymphoides indica	water snowflake	C	
Plants	Mimosaceae	Acacia aulacocarpa		C	
Plants	Mimosaceae	Acacia concurrens		C	
Plants	Mimosaceae	Acacia falcata	sickle wattle	C	
Plants	Mimosaceae	Acacia maidenii	Maiden's wattle	C	
Plants	Mimosaceae	Acacia podalyriifolia	Queensland silver wattle	C	
Plants	Moraceae	Ficus obliqua		C	
Plants	Myrtaceae	Angophora leiocarpa	rusty gum	C	
Plants	Myrtaceae	Corymbia clarksoniana		C	
Plants	Myrtaceae	Corymbia tessellaris	Moreton Bay ash	C	
Plants	Myrtaceae	Eucalyptus crebra	narrow-leaved red ironbark	C	
Plants	Myrtaceae	Lophostemon suaveolens	swamp box	C	
Plants	Myrtaceae	Melaleuca irbyana		E	

Plants	Nymphaeaceae	Nymphaea gigantea		C	
Plants	Oleaceae	Jasminum dianthifolium		C	
Plants	Oleaceae	Notelaea lloydii	Lloyd's native olive	V	V
Plants	Onagraceae	Ludwigia octovalvis	willow primrose	C	
Plants	Oxalidaceae	Oxalis perennans		C	
Plants	Pentapetaceae	Melhania oblongifolia		C	
Plants	Phyllanthaceae	Phyllanthus virgatus		C	
Plants	Picrodendraceae	Petalostigma pubescens	quinine tree	C	
Plants	Plantaginaceae	Bacopa floribunda		C	
Plants	Plantaginaceae	Plantago debilis	shade plantain	C	
Plants	Poaceae	Aristida gracilipes		C	
Plants	Poaceae	Axonopus fissifolius			
Plants	Poaceae	Capillipedium spicigerum	spicytop	C	
Plants	Poaceae	Chloris gayana	rhodes grass		
Plants	Poaceae	Chloris truncata		C	
Plants	Poaceae	Chrysopogon sylvaticus		C	
Plants	Poaceae	Cymbopogon refractus	barbed-wire grass	C	
Plants	Poaceae	Digitaria ciliaris	summer grass		
Plants	Poaceae	Echinochloa colona	awnless barnyard grass		
Plants	Poaceae	Enteropogon unispiceus		C	
Plants	Poaceae	Eragrostis elongata		C	
Plants	Poaceae	Eremochloa bimaculata	poverty grass	C	
Plants	Poaceae	Eriochloa procera	slender cupgrass	C	
Plants	Poaceae	Heteropogon contortus	black speargrass	C	
Plants	Poaceae	Imperata cylindrica	blady grass	C	
Plants	Poaceae	Melinis repens	red natal grass		
Plants	Poaceae	Panicum simile		C	
Plants	Poaceae	Paspalidium caespitosum	brigalow grass	C	
Plants	Poaceae	Paspalidium distans	shotgrass	C	
Plants	Poaceae	Paspalum distichum	water couch		

Plants	Poaceae	Sporobolus creber		C	
Plants	Poaceae	Themeda triandra	kangaroo grass	C	
Plants	Poaceae	Tragus australianus	small burr grass	C	
Plants	Polygonaceae	Persicaria decipiens	slender knotweed	C	
Plants	Pontederiaceae	Eichhornia crassipes	water hyacinth		
Plants	Portulacaceae	Calandrinia pickeringii		C	
Plants	Portulacaceae	Portulaca pilosa			
Plants	Rhamnaceae	Alphitonia excelsa	soap tree	C	
Plants	Rubiaceae	Oldenlandia galioides		C	
Plants	Rubiaceae	Spermacoce multicaulis		C	
Plants	Rutaceae	Coatesia paniculata		C	
Plants	Rutaceae	Flindersia collina	broad-leaved leopard tree	C	
Plants	Santalaceae	Exocarpos cupressiformis	native cherry	C	
Plants	Sapotaceae	Planchonella eerwah		E	E
Plants	Scrophulariaceae	Eremophila debilis	winter apple	C	
Plants	Solanaceae	Solanum nigrum			
Plants	Stackhousiaceae	Stackhousia muricata		C	
Plants	Typhaceae	Typha orientalis	broad-leaved cumbungi	C	
Plants	Verbenaceae	Glandularia aristigera			
Plants	Verbenaceae	Lantana montevidensis	creeping lantana		
Plants	Verbenaceae	Verbena rigida			
Plants	Viscaceae	Notothixos incanus		C	
Plants	Viscaceae	Viscum articulatum	flat mistletoe	C	

WildNet Records
Species List

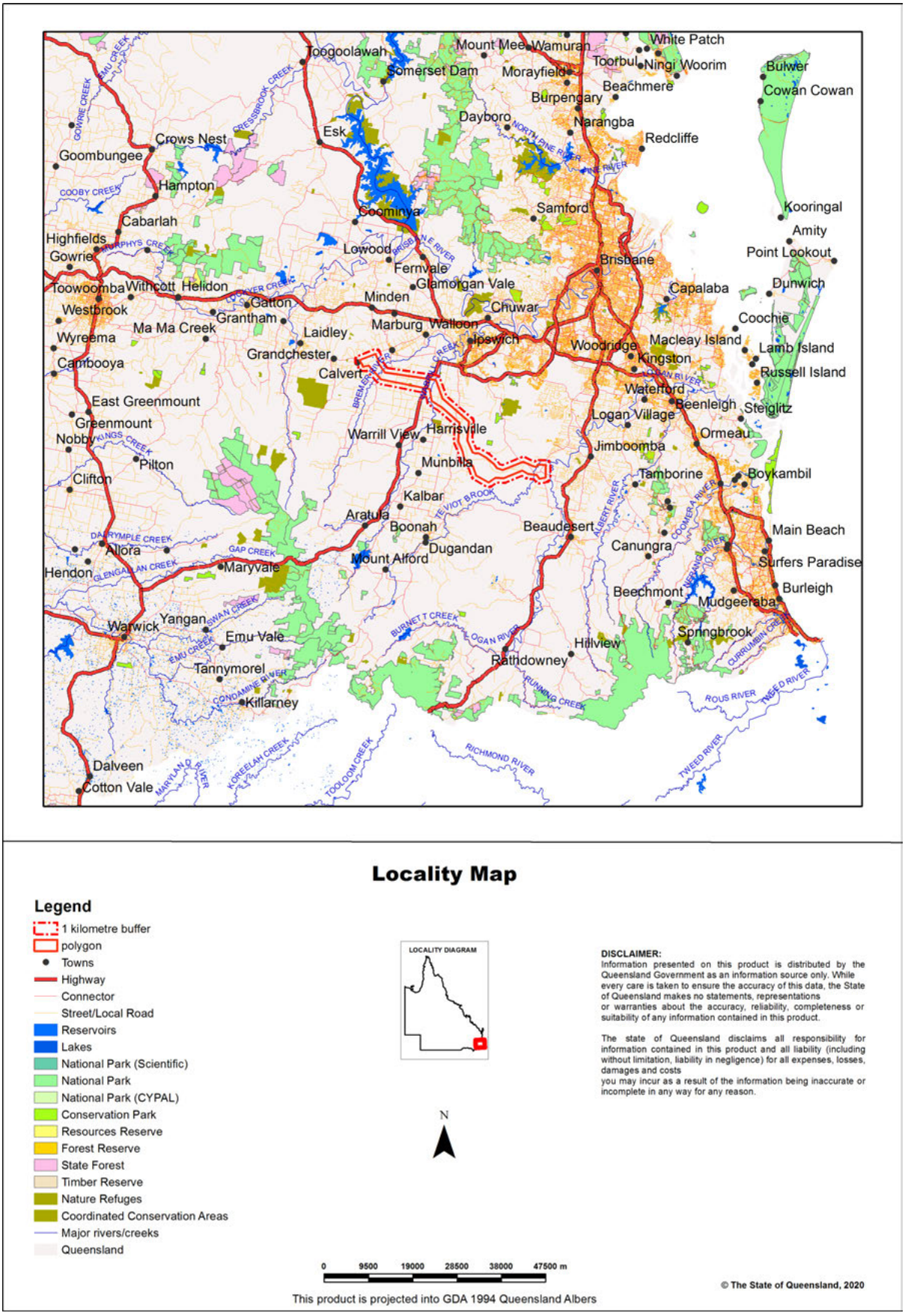
For the selected area of interest 11221.47ha

Current as at 06/02/2020

WildNetspecieslist

Queensland Government

Map 1. Locality Map



Summary Information

The following table provides an overview of the area of interest .

Table 1. Area of interest details

Size (ha)	11,221.47
Local Government(s)	Scenic Rim Regional, Logan City, Ipswich City
Bioregion(s)	Southeast Queensland
Subregion(s)	Moreton Basin
Catchment(s)	Logan-Albert, Brisbane

Protected Area(s)
No estates or reserves are located within the area of interest.

World Heritage Area(s)
No World Heritage Areas are located within the area of interest.

Ramsar Area(s)
No Ramsar Areas are located within the area of interest.

Species List

Introduction
This Species List report is derived only from records from the WildNet database managed by the Department of Environment and Science. Other data sources may provide additional information on species occurrence.

The WildNet dataset is constantly being enhanced and the taxonomic and status information revised. If a species does not occur in the report, it does not mean it doesn't occur there and listed species may also no longer inhabit the area.

Table 2 lists the animals recorded within the area of interest and its one kilometre buffer.

Table 3 lists the plants recorded within the area of interest and its one kilometre buffer.

Table 4 lists the fungi recorded within the area of interest and its one kilometre buffer.

Table 5 lists the protists recorded within the area of interest and its one kilometre buffer.

Table 2. Animals recorded within the area of interest and its one kilometre buffer

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
26896	Actinopterygii	Ambassidae	*Ambassis agassizii*	Agassiz's glassfish	None	None	0	7	16/04/2014
26908	Actinopterygii	Anguillidae	*Anguilla australis*	southern shortfin eel	None	None	0	2	15/11/2005
26910	Actinopterygii	Anguillidae	*Anguilla reinhardtii*	longfin eel	None	None	0	15	16/04/2014
26920	Actinopterygii	Atherinidae	*Craterocephalus stercusmuscarum*	flyspecked hardyhead	None	None	0	3	16/04/2014
26938	Actinopterygii	Cichlidae	*Oreochromis mossambica*	Mozambique mouthbrooder	None	None	0	4	16/04/2014
26939	Actinopterygii	Cichlidae	*Tilapia mariae*	spotted tilapia	None	None	0	1	17/10/2012
26943	Actinopterygii	Cyprinidae	*Cyprinus carpio*	European carp	None	None	0	13	16/04/2014
26952	Actinopterygii	Eleotridae	*Gobiomorphus australis*	striped gudgeon	None	None	0	12	16/04/2014
26954	Actinopterygii	Eleotridae	*Hypseleotris compressa*	empire gudgeon	None	None	0	6	23/04/2013

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
26955	Actinopterygii	Eleotridae	*Hypseleotris galii*	firetail gudgeon	None	None	0	17	16/04/2014
26956	Actinopterygii	Eleotridae	*Hypseleotris klunzingeri*	western carp gudgeon	None	None	0	9	16/04/2014
26968	Actinopterygii	Eleotridae	*Philypnodon grandiceps*	flathead gudgeon	None	None	0	11	16/04/2014
26969	Actinopterygii	Eleotridae	*Philypnodon macrostomus*	dwarf flathead gudgeon	None	None	0	3	16/04/2012
27024	Actinopterygii	Melanotaeniidae	*Melanotaenia duboulayi*	crimsonspotted rainbowfish	None	None	0	14	16/04/2014
27035	Actinopterygii	Mugilidae	*Mugil cephalus*	sea mullet	None	None	0	9	16/04/2014
27043	Actinopterygii	Percichthyidae	*Macquaria novemaculeata*	Australian bass	None	None	0	1	01/11/2010
27054	Actinopterygii	Plotosidae	*Tandanus tandanus*	freshwater catfish	None	None	0	3	02/10/2009
27055	Actinopterygii	Poeciliidae	*Gambusia holbrooki*	mosquitofish	None	None	0	17	16/04/2014
27059	Actinopterygii	Pseudomugilidae	*Pseudomugil signifer*	Pacific blue eye	None	None	0	2	21/10/2004
27061	Actinopterygii	Retropinnidae	*Retropinna semoni*	Australian smelt	None	None	0	4	16/04/2014
27089	Actinopterygii	Terapontidae	*Leiopotherapon unicolor*	spangled perch	None	None	0	8	16/04/2014
716	Amphibia	Bufonidae	*Rhinella marina*	cane toad	None	None	0	4	16/01/2004
643	Amphibia	Hylidae	*Cyclorana brevipes*	superb collared frog	C	None	0	1	16/01/2004
627	Amphibia	Hylidae	*Litoria caerulea*	common green treefrog	C	None	0	6	31/03/2015
628	Amphibia	Hylidae	*Litoria chloris*	orange eyed treefrog	C	None	0	2	31/03/2015
617	Amphibia	Hylidae	*Litoria dentata*	bleating treefrog	C	None	0	2	16/01/2004
608	Amphibia	Hylidae	*Litoria fallax*	eastern sedgefrog	C	None	0	4	16/01/2004
611	Amphibia	Hylidae	*Litoria gracilenta*	graceful treefrog	C	None	0	2	16/01/2004
614	Amphibia	Hylidae	*Litoria latopalmata*	broad palmed rocketfrog	C	None	0	4	31/12/2010
604	Amphibia	Hylidae	*Litoria nasuta*	striped rocketfrog	C	None	0	2	31/12/1999
596	Amphibia	Hylidae	*Litoria peronii*	emerald spotted treefrog	C	None	0	1	31/12/1999
600	Amphibia	Hylidae	*Litoria rubella*	ruddy treefrog	C	None	0	3	16/01/2004
681	Amphibia	Limnodynastidae	*Limnodynastes peronii*	striped marshfrog	C	None	0	2	31/12/1999
682	Amphibia	Limnodynastidae	*Limnodynastes salmini*	salmon striped frog	C	None	0	1	31/12/1999
684	Amphibia	Limnodynastidae	*Limnodynastes tasmaniensis*	spotted grassfrog	C	None	0	3	16/01/2004
680	Amphibia	Limnodynastidae	*Platyplectrum ornatum*	ornate burrowing frog	C	None	0	1	16/01/2004
696	Amphibia	Myobatrachidae	*Crinia parinsignifera*	beeping froglet	C	None	0	2	16/01/2004
698	Amphibia	Myobatrachidae	*Crinia signifera*	clicking froglet	C	None	0	1	16/01/2004
659	Amphibia	Myobatrachidae	*Pseudophryne major*	great brown broodfrog	C	None	1	1	31/12/1994

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
639	Amphibia	Myobatrachidae	*Uperoleia rugosa*	chubby gungan	C	None	1	2	16/01/2004
1419	Aves	Acanthizidae	*Acanthiza chrysorrhoa*	yellow-rumped thornbill	C	None	0	7	10/02/2006
1421	Aves	Acanthizidae	*Acanthiza lineata*	striated thornbill	C	None	0	1	20/11/2002
1422	Aves	Acanthizidae	*Acanthiza nana*	yellow thornbill	C	None	0	1	31/12/1992
1423	Aves	Acanthizidae	*Acanthiza pusilla*	brown thornbill	C	None	0	1	20/11/2002
1425	Aves	Acanthizidae	*Acanthiza reguloides*	buff-rumped thornbill	C	None	0	1	20/07/2002
1410	Aves	Acanthizidae	*Gerygone mouki*	brown gerygone	C	None	0	1	20/11/2002
1396	Aves	Acanthizidae	*Gerygone olivacea*	white-throated gerygone	C	None	0	11	10/02/2006
1403	Aves	Acanthizidae	*Pyrrholaemus sagittatus*	speckled warbler	C	None	0	4	10/02/2006
1381	Aves	Acanthizidae	*Sericornis citreogularis*	yellow-throated scrubwren	C	None	0	1	20/11/2002
1382	Aves	Acanthizidae	*Sericornis frontalis*	white-browed scrubwren	C	None	0	3	20/11/2002
1371	Aves	Acanthizidae	*Smicrornis brevirostris*	weebill	C	None	0	8	10/02/2006
1742	Aves	Accipitridae	*Accipiter cirrocephalus*	collared sparrowhawk	C	None	0	1	20/11/2002
1729	Aves	Accipitridae	*Accipiter fasciatus*	brown goshawk	C	None	0	4	10/02/2006
1730	Aves	Accipitridae	*Accipiter novaehollandiae*	grey goshawk	C	None	0	1	20/11/2002
1732	Aves	Accipitridae	*Aquila audax*	wedge-tailed eagle	C	None	0	4	20/11/2002
1721	Aves	Accipitridae	*Aviceda subcristata*	Pacific baza	C	None	0	4	25/07/2003
1722	Aves	Accipitridae	*Circus approximans*	swamp harrier	C	None	0	2	31/12/1999
1723	Aves	Accipitridae	*Circus assimilis*	spotted harrier	C	None	0	1	24/09/1988
1725	Aves	Accipitridae	*Elanus axillaris*	black-shouldered kite	C	None	0	3	24/03/2001
1718	Aves	Accipitridae	*Haliaeetus leucogaster*	white-bellied sea-eagle	C	None	0	3	31/12/2010
1707	Aves	Accipitridae	*Haliastur sphenurus*	whistling kite	C	None	0	2	04/11/1993
1973	Aves	Aegothelidae	*Aegotheles cristatus*	Australian owlet-nightjar	C	None	0	2	25/07/2003
1652	Aves	Alaudidae	*Mirafra javanica*	Horsfield's bushlark	C	None	0	2	20/07/2002
1776	Aves	Alcedinidae	*Ceyx azureus*	azure kingfisher	C	None	0	2	20/07/2002
1992	Aves	Anatidae	*Anas castanea*	chestnut teal	C	None	0	2	27/07/1999
1993	Aves	Anatidae	*Anas gracilis*	grey teal	C	None	0	7	10/02/2006
1998	Aves	Anatidae	*Anas superciliosa*	Pacific black duck	C	None	0	20	17/10/2012
1999	Aves	Anatidae	*Aythya australis*	hardhead	C	None	0	4	20/07/2002
2003	Aves	Anatidae	*Chenonetta jubata*	Australian wood duck	C	None	0	15	25/07/2003
2005	Aves	Anatidae	*Cygnus atratus*	black swan	C	None	0	3	06/05/2000

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
1980	Aves	Anatidae	*Malacorhynchus membranaceus*	pink-eared duck	C	None	0	2	27/07/1999
1996	Aves	Anatidae	*Spatula rhynchotis*	Australasian shoveler	C	None	0	4	25/07/2003
1987	Aves	Anatidae	*Stictonetta naevosa*	freckled duck	C	None	0	2	14/12/1980
1279	Aves	Anhingidae	*Anhinga novaehollandiae*	Australasian darter	C	None	0	1	27/07/1999
1971	Aves	Apodidae	*Hirundapus caudacutus*	white-throated needletail	V	V	0	1	20/11/2002
1829	Aves	Ardeidae	*Ardea alba modesta*	eastern great egret	C	None	0	3	06/05/2000
1831	Aves	Ardeidae	*Ardea intermedia*	intermediate egret	C	None	0	3	06/05/2000
1832	Aves	Ardeidae	*Ardea pacifica*	white-necked heron	C	None	0	4	27/07/1999
1830	Aves	Ardeidae	*Bubulcus ibis*	cattle egret	C	None	0	9	25/11/2001
1826	Aves	Ardeidae	*Egretta novaehollandiae*	white-faced heron	C	None	0	11	20/07/2002
1654	Aves	Artamidae	*Cracticus nigrogularis*	pied butcherbird	C	None	0	19	25/09/2004
1656	Aves	Artamidae	*Cracticus torquatus*	grey butcherbird	C	None	0	14	17/10/2012
1644	Aves	Artamidae	*Gymnorhina tibicen*	Australian magpie	C	None	0	40	17/10/2012
1645	Aves	Artamidae	*Strepera graculina*	pied currawong	C	None	0	5	20/11/2002
1956	Aves	Burhinidae	*Burhinus grallarius*	bush stone-curlew	C	None	0	1	31/12/1999
1191	Aves	Cacatuidae	*Cacatua galerita*	sulphur-crested cockatoo	C	None	0	13	20/11/2002
1194	Aves	Cacatuidae	*Cacatua sanguinea*	little corella	C	None	0	1	10/02/2001
21967	Aves	Cacatuidae	*Cacatua tenuirostris*	long-billed corella	C	None	0	4	25/11/2001
1193	Aves	Cacatuidae	*Eolophus roseicapilla*	galah	C	None	0	21	17/10/2012
1173	Aves	Cacatuidae	*Nymphicus hollandicus*	cockatiel	C	None	0	13	31/05/2001
1636	Aves	Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike	C	None	0	23	24/12/2004
1639	Aves	Campephagidae	*Coracina tenuirostris*	cicadabird	C	None	0	1	20/11/2002
1640	Aves	Campephagidae	*Lalage leucomela*	varied triller	C	None	0	1	20/11/2002
1642	Aves	Campephagidae	*Lalage tricolor*	white-winged triller	C	None	0	1	31/12/1999
27774	Aves	Charadriidae	*Vanellus miles*	masked lapwing	C	None	0	2	25/07/2003
1933	Aves	Charadriidae	*Vanellus miles novaehollandiae*	masked lapwing (southern subspecies)	C	None	0	9	25/07/2003
1820	Aves	Ciconiidae	*Ephippiorhynchus asiaticus*	black-necked stork	C	None	0	4	05/03/2013
1294	Aves	Cisticolidae	*Cisticola exilis*	golden-headed cisticola	C	None	0	5	24/03/2001

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
1626	Aves	Climacteridae	*Climacteris erythrops*	red-browed treecreeper	C	None	0	1	20/11/2002
1617	Aves	Climacteridae	*Cormobates leucophaea*	white-throated treecreeper	C	None	0	1	20/11/2002
1810	Aves	Columbidae	*Geopelia humeralis*	bar-shouldered dove	C	None	0	9	20/07/2002
1797	Aves	Columbidae	*Geopelia striata*	peaceful dove	C	None	0	10	10/02/2006
1787	Aves	Columbidae	*Leucosarcia melanoleuca*	wonga pigeon	C	None	0	1	20/11/2002
1789	Aves	Columbidae	*Lopholaimus antarcticus*	topknot pigeon	C	None	0	1	20/11/2002
1791	Aves	Columbidae	*Macropygia amboinensis*	brown cuckoo-dove	C	None	0	1	20/11/2002
1793	Aves	Columbidae	*Ocyphaps lophotes*	crested pigeon	C	None	0	16	07/02/2008
1795	Aves	Columbidae	*Phaps chalcoptera*	common bronzewing	C	None	0	8	10/02/2006
1770	Aves	Columbidae	*Ptilinopus magnificus*	wompoo fruit-dove	C	None	0	1	20/11/2002
1779	Aves	Coraciidae	*Eurystomus orientalis*	dollarbird	C	None	0	13	24/12/2004
1609	Aves	Corvidae	*Corvus orru*	Torresian crow	C	None	0	39	17/10/2012
1751	Aves	Cuculidae	*Centropus phasianinus*	pheasant coucal	C	None	0	7	25/01/2006
1744	Aves	Cuculidae	*Chalcites basalis*	Horsfield's bronze-cuckoo	C	None	0	1	10/04/2001
1745	Aves	Cuculidae	*Chalcites lucidus*	shining bronze-cuckoo	C	None	0	1	20/11/2002
1738	Aves	Cuculidae	*Eudynamys orientalis*	eastern koel	C	None	0	2	24/12/2004
1740	Aves	Cuculidae	*Scythrops novaehollandiae*	channel-billed cuckoo	C	None	0	2	24/12/2004
1601	Aves	Dicruridae	*Dicrurus bracteatus*	spangled drongo	C	None	0	2	20/11/2002
1366	Aves	Estrildidae	*Lonchura castaneothorax*	chestnut-breasted mannikin	C	None	0	1	31/12/1992
1369	Aves	Estrildidae	*Neochmia modesta*	plum-headed finch	C	None	0	1	10/02/2001
1342	Aves	Estrildidae	*Taeniopygia bichenovii*	double-barred finch	C	None	0	10	24/12/2004
1343	Aves	Estrildidae	*Taeniopygia guttata*	zebra finch	C	None	0	1	17/10/2012
1716	Aves	Falconidae	*Falco berigora*	brown falcon	C	None	0	5	31/12/2010
1704	Aves	Falconidae	*Falco cenchroides*	nankeen kestrel	C	None	0	13	15/08/2001
1691	Aves	Falconidae	*Falco longipennis*	Australian hobby	C	None	0	2	15/01/2000
1692	Aves	Falconidae	*Falco peregrinus*	peregrine falcon	C	None	0	2	17/10/2006
1766	Aves	Halcyonidae	*Dacelo leachii*	blue-winged kookaburra	C	None	0	5	31/12/1992
1767	Aves	Halcyonidae	*Dacelo novaeguineae*	laughing kookaburra	C	None	0	24	24/12/2004

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
1760	Aves	Halcyonidae	*Todiramphus macleayii*	forest kingfisher	C	None	0	1	31/12/1999
1762	Aves	Halcyonidae	*Todiramphus sanctus*	sacred kingfisher	C	None	0	9	25/01/2006
1572	Aves	Hirundinidae	*Hirundo neoxena*	welcome swallow	C	None	0	18	17/10/2012
1585	Aves	Hirundinidae	*Petrochelidon ariel*	fairy martin	C	None	0	4	10/02/2006
1573	Aves	Hirundinidae	*Petrochelidon nigricans*	tree martin	C	None	0	2	10/02/2001
1928	Aves	Jacanidae	*Irediparra gallinacea*	comb-crested jacana	C	None	0	2	27/07/1999
1570	Aves	Maluridae	*Malurus cyaneus*	superb fairy-wren	C	None	0	12	17/10/2012
1558	Aves	Maluridae	*Malurus melanocephalus*	red-backed fairy-wren	C	None	0	25	25/07/2003
1291	Aves	Megaluridae	*Cincloramphus cruralis*	brown songlark	C	None	0	1	12/01/1992
1292	Aves	Megaluridae	*Cincloramphus mathewsi*	rufous songlark	C	None	0	1	12/01/1992
1289	Aves	Megaluridae	*Megalurus timoriensis*	tawny grassbird	C	None	0	2	10/02/2001
1694	Aves	Megapodiidae	*Alectura lathami*	Australian brush-turkey	C	None	0	1	20/11/2002
1523	Aves	Meliphagidae	*Caligavis chrysops*	yellow-faced honeyeater	C	None	0	4	20/11/2002
1539	Aves	Meliphagidae	*Entomyzon cyanotis*	blue-faced honeyeater	C	None	0	5	20/07/2002
1497	Aves	Meliphagidae	*Lichmera indistincta*	brown honeyeater	C	None	0	6	14/05/2004
1500	Aves	Meliphagidae	*Manorina melanocephala*	noisy miner	C	None	0	24	17/10/2012
1504	Aves	Meliphagidae	*Meliphaga lewinii*	Lewin's honeyeater	C	None	0	1	20/11/2002
1507	Aves	Meliphagidae	*Melithreptus albogularis*	white-throated honeyeater	C	None	0	16	14/05/2004
1485	Aves	Meliphagidae	*Melithreptus lunatus*	white-naped honeyeater	C	None	0	1	20/11/2002
1489	Aves	Meliphagidae	*Myzomela sanguinolenta*	scarlet honeyeater	C	None	0	3	20/07/2002
1493	Aves	Meliphagidae	*Philemon citreogularis*	little friarbird	C	None	0	9	10/02/2006
1494	Aves	Meliphagidae	*Philemon corniculatus*	noisy friarbird	C	None	0	9	25/09/2004
1471	Aves	Meliphagidae	*Plectorhyncha lanceolata*	striped honeyeater	C	None	0	6	10/02/2006
1764	Aves	Meropidae	*Merops ornatus*	rainbow bee-eater	C	None	0	17	31/12/2010
1589	Aves	Monarchidae	*Grallina cyanoleuca*	magpie-lark	C	None	0	27	07/02/2008
1595	Aves	Monarchidae	*Monarcha melanopsis*	black-faced monarch	SL	None	0	1	20/11/2002
1600	Aves	Monarchidae	*Myiagra inquieta*	restless flycatcher	C	None	0	3	20/07/2002
1455	Aves	Motacillidae	*Anthus novaeseelandiae*	Australasian pipit	C	None	0	1	20/07/2002

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
1611	Aves	Nectariniidae	*Dicaeum hirundinaceum*	mistletoebird	C	None	0	9	10/02/2006
1453	Aves	Neosittidae	*Daphoenositta chrysoptera*	varied sittella	C	None	0	4	20/11/2002
1442	Aves	Oriolidae	*Oriolus sagittatus*	olive-backed oriole	C	None	0	6	24/12/2004
1444	Aves	Oriolidae	*Sphecotheres vieilloti*	Australasian figbird	C	None	0	6	20/11/2002
1447	Aves	Orthonychidae	*Orthonyx temminckii*	Australian logrunner	C	None	0	1	20/11/2002
1449	Aves	Pachycephalidae	*Colluricincla harmonica*	grey shrike-thrush	C	None	0	4	20/11/2002
1429	Aves	Pachycephalidae	*Falcunculus frontatus*	crested shrike-tit	C	None	0	1	20/11/2002
1436	Aves	Pachycephalidae	*Pachycephala pectoralis*	golden whistler	C	None	0	8	14/05/2004
1437	Aves	Pachycephalidae	*Pachycephala rufiventris*	rufous whistler	C	None	0	16	10/02/2006
1415	Aves	Paradisaeidae	*Ptiloris paradiseus*	paradise riflebird	C	None	0	1	20/11/2002
1389	Aves	Pardalotidae	*Pardalotus punctatus*	spotted pardalote	C	None	0	3	20/07/2002
1392	Aves	Pardalotidae	*Pardalotus striatus*	striated pardalote	C	None	0	26	25/09/2004
1284	Aves	Pelecanidae	*Pelecanus conspicillatus*	Australian pelican	C	None	0	3	08/10/2000
1347	Aves	Petroicidae	*Eopsaltria australis*	eastern yellow robin	C	None	0	2	20/11/2002
1339	Aves	Petroicidae	*Microeca fascinans*	jacky winter	C	None	0	1	20/07/2002
1329	Aves	Petroicidae	*Petroica goodenovii*	red-capped robin	C	None	0	3	10/02/2006
1332	Aves	Petroicidae	*Petroica rosea*	rose robin	C	None	0	8	10/02/2006
1321	Aves	Petroicidae	*Tregellasia capito*	pale-yellow robin	C	None	0	1	20/11/2002
1261	Aves	Phalacrocoracidae	*Microcarbo melanoleucos*	little pied cormorant	C	None	0	4	07/04/2001
1264	Aves	Phalacrocoracidae	*Phalacrocorax varius*	pied cormorant	C	None	0	2	06/05/2000
1687	Aves	Phasianidae	*Coturnix ypsilophora*	brown quail	C	None	0	3	16/05/2000
1326	Aves	Pittidae	*Pitta versicolor*	noisy pitta	C	None	0	1	20/11/2002
1955	Aves	Podargidae	*Podargus strigoides*	tawny frogmouth	C	None	0	5	20/07/2002
1249	Aves	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian grebe	C	None	0	6	25/07/2003
1318	Aves	Pomatostomidae	*Pomatostomus temporalis*	grey-crowned babbler	C	None	0	6	25/09/2004
1180	Aves	Psittacidae	*Alisterus scapularis*	Australian king-parrot	C	None	0	4	20/11/2002
1147	Aves	Psittacidae	*Parvipsitta pusilla*	little lorikeet	C	None	0	7	14/05/2004
1136	Aves	Psittacidae	*Platycercus adscitus*	pale-headed rosella	C	None	0	25	14/05/2004

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
21976	Aves	Psittacidae	*Platycercus adscitus palliceps*	pale-headed rosella (southern form)	C	None	0	2	25/09/2004
1138	Aves	Psittacidae	*Platycercus elegans*	crimson rosella	C	None	0	2	20/11/2002
1139	Aves	Psittacidae	*Platycercus eximius*	eastern rosella	C	None	0	1	31/12/1999
1124	Aves	Psittacidae	*Trichoglossus chlorolepidotus*	scaly-breasted lorikeet	C	None	0	25	24/12/2004
1125	Aves	Psittacidae	*Trichoglossus haematodus moluccanus*	rainbow lorikeet	C	None	0	11	20/11/2002
1623	Aves	Psophodidae	*Psophodes olivaceus*	eastern whipbird	C	None	0	3	20/11/2002
1177	Aves	Ptilonorhynchidae	*Ailuroedus crassirostris*	green catbird	C	None	0	1	20/11/2002
1320	Aves	Ptilonorhynchidae	*Ptilonorhynchus violaceus*	satin bowerbird	C	None	0	1	20/11/2002
1308	Aves	Ptilonorhynchidae	*Sericulus chrysocephalus*	regent bowerbird	C	None	0	1	20/11/2002
1686	Aves	Rallidae	*Fulica atra*	Eurasian coot	C	None	0	3	06/05/2000
1673	Aves	Rallidae	*Gallinula tenebrosa*	dusky moorhen	C	None	0	5	17/10/2012
1675	Aves	Rallidae	*Gallirallus philippensis*	buff-banded rail	C	None	0	1	31/12/1999
1662	Aves	Rallidae	*Porphyrio melanotus*	purple swamphen	C	None	0	5	02/04/2001
1893	Aves	Recurvirostridae	*Himantopus himantopus*	black-winged stilt	C	None	0	3	06/05/2000
1575	Aves	Rhipiduridae	*Rhipidura albiscapa*	grey fantail	C	None	0	16	14/05/2004
1576	Aves	Rhipiduridae	*Rhipidura leucophrys*	willie wagtail	C	None	0	33	24/12/2004
1578	Aves	Rhipiduridae	*Rhipidura rufifrons*	rufous fantail	SL	None	0	1	20/11/2002
1879	Aves	Scolopacidae	*Calidris melanotos*	pectoral sandpiper	SL	None	0	1	16/11/1980
1843	Aves	Scolopacidae	*Numenius madagascariensis*	eastern curlew	E	CE	0	1	18/07/1999
1102	Aves	Strigidae	*Ninox boobook*	southern boobook	C	None	0	3	20/11/2002
1107	Aves	Strigidae	*Ninox strenua*	powerful owl	V	None	0	1	31/12/2010
1314	Aves	Sturnidae	*Acridotheres tristis*	common myna	None	None	0	8	15/10/2001
1303	Aves	Sturnidae	*Sturnus vulgaris*	common starling	None	None	0	6	10/02/2001
1822	Aves	Threskiornithidae	*Platalea flavipes*	yellow-billed spoonbill	C	None	0	2	27/07/1999
1823	Aves	Threskiornithidae	*Platalea regia*	royal spoonbill	C	None	0	2	27/07/1999
1825	Aves	Threskiornithidae	*Plegadis falcinellus*	glossy ibis	SL	None	0	1	27/07/1999
1812	Aves	Threskiornithidae	*Threskiornis molucca*	Australian white ibis	C	None	0	5	07/02/2008
1800	Aves	Threskiornithidae	*Threskiornis spinicollis*	straw-necked ibis	C	None	0	12	07/02/2008

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
1276	Aves	Timaliidae	*Zosterops lateralis*	silvereye	C	None	0	12	10/02/2006
1463	Aves	Turdidae	*Zoothera heinei*	russet-tailed thrush	C	None	0	1	20/11/2002
1108	Aves	Tytonidae	*Tyto delicatula*	eastern barn owl	C	None	0	1	18/07/1992
1084	Mammalia	Bovidae	*Bos taurus*	European cattle	None	None	0	1	31/12/1999
1067	Mammalia	Canidae	*Canis familiaris*	dog	None	None	0	1	31/12/1999
1071	Mammalia	Canidae	*Vulpes vulpes*	red fox	None	None	0	2	18/05/2001
803	Mammalia	Dasyuridae	*Dasyurus maculatus maculatus*	spotted-tailed quoll (southern subspecies)	V	E	0	1	31/12/2009
808	Mammalia	Dasyuridae	*Phascogale tapoatafa tapoatafa*	brush-tailed phascogale	C	None	0	1	18/05/2018
811	Mammalia	Dasyuridae	*Planigale maculata*	common planigale	C	None	0	1	31/12/1999
793	Mammalia	Dasyuridae	*Sminthopsis murina*	common dunnart	C	None	0	2	31/12/2010
832	Mammalia	Leporidae	*Lepus europaeus*	European brown hare	None	None	0	3	31/12/1999
901	Mammalia	Macropodidae	*Macropus giganteus*	eastern grey kangaroo	C	None	0	3	25/09/2004
904	Mammalia	Macropodidae	*Macropus rufogriseus*	red-necked wallaby	C	None	0	3	24/03/2001
890	Mammalia	Macropodidae	*Petrogale penicillata*	brush-tailed rock-wallaby	V	V	0	1	31/12/1993
885	Mammalia	Macropodidae	*Wallabia bicolor*	swamp wallaby	C	None	0	1	17/10/2012
731	Mammalia	Muridae	*Rattus rattus*	black rat	None	None	0	2	10/02/2006
784	Mammalia	Peramelidae	*Isoodon macrourus*	northern brown bandicoot	C	None	0	1	31/12/1992
877	Mammalia	Petauridae	*Petaurus breviceps*	sugar glider	C	None	0	4	31/12/2010
879	Mammalia	Petauridae	*Petaurus norfolcensis*	squirrel glider	C	None	0	4	31/12/2010
859	Mammalia	Phalangeridae	*Trichosurus vulpecula*	common brushtail possum	C	None	0	2	24/03/2001
860	Mammalia	Phascolarctidae	*Phascolarctos cinereus*	koala	V	V	0	942	01/01/2012
2455	Mammalia	Pseudocheiridae	*Petauroides volans volans*	southern greater glider	V	V	0	1	31/12/1999
838	Mammalia	Tachyglossidae	*Tachyglossus aculeatus*	short-beaked echidna	SL	None	0	1	31/12/1999
554	Reptilia	Agamidae	*Intellagama lesueurii*	eastern water dragon	C	None	0	2	17/10/2012
556	Reptilia	Agamidae	*Pogona barbata*	bearded dragon	C	None	0	4	31/03/2015
63	Reptilia	Chelidae	*Chelodina longicollis*	eastern snake-necked turtle	C	None	0	1	31/12/1999
512	Reptilia	Colubridae	*Dendrelaphis punctulatus*	green tree snake	C	None	0	1	31/12/1999
391	Reptilia	Diplodactylidae	*Nebulifera robusta*	robust velvet gecko	C	None	0	1	31/12/1999

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
457	Reptilia	Elapidae	*Cryptophis nigrescens*	eastern small-eyed snake	C	None	0	1	31/12/1999
479	Reptilia	Elapidae	*Hoplocephalus bitorquatus*	pale-headed snake	C	None	1	1	31/12/1996
462	Reptilia	Elapidae	*Pseudechis porphyriacus*	red-bellied black snake	C	None	0	4	24/03/2015
454	Reptilia	Elapidae	*Pseudonaja textilis*	eastern brown snake	C	None	0	1	31/12/1999
420	Reptilia	Gekkonidae	*Gehyra dubia*	dubious dtella	C	None	0	1	31/12/1999
321	Reptilia	Pygopodidae	*Delma plebeia*	common delma	C	None	0	6	31/03/2015
308	Reptilia	Scincidae	*Anomalopus verreauxii*	three-clawed worm-skink	C	None	0	1	31/12/1999
34646	Reptilia	Scincidae	*Carlia pectoralis*	open-litter rainbow skink	C	None	0	2	31/03/2015
277	Reptilia	Scincidae	*Carlia vivax*	tussock rainbow-skink	C	None	0	1	31/12/1999
31898	Reptilia	Scincidae	*Cryptoblepharus pulcher pulcher*	elegant snake-eyed skink	C	None	0	1	31/12/1999
240	Reptilia	Scincidae	*Ctenotus spaldingi*	straight-browed ctenotus	C	None	0	1	31/12/1999
184	Reptilia	Scincidae	*Lampropholis delicata*	dark-flecked garden sunskink	C	None	0	2	24/03/2015
83	Reptilia	Typhlopidae	*Anilios wiedii*	brown-snouted blind snake	C	None	0	1	31/12/1999

Table 3. Plants recorded within the area of interest and its one kilometre buffer

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
17767	Equisetopsida	Acanthaceae	*Brunoniella australis*	blue trumpet	C	None	0	1	20/04/2001
13379	Equisetopsida	Alismataceae	*Damasonium minus*	starfruit	C	None	2	2	16/04/1991
18101	Equisetopsida	Amaranthaceae	*Achyranthes aspera*	None	C	None	0	1	20/04/2001
18026	Equisetopsida	Amaranthaceae	*Alternanthera denticulata*	lesser joyweed	C	None	1	1	16/04/1991
32727	Equisetopsida	Amaranthaceae	*Alternanthera denticulata var. micrantha*	None	C	None	1	1	29/04/1990
17051	Equisetopsida	Amaranthaceae	*Gomphrena celosioides*	gomphrena weed	None	None	0	1	20/04/2001
11782	Equisetopsida	Amaranthaceae	*Guilleminea densa*	small matweed	None	None	1	1	07/03/2001
15545	Equisetopsida	Apiaceae	*Centella asiatica*	None	C	None	0	1	20/04/2001
9484	Equisetopsida	Apocynaceae	*Alstonia constricta*	bitterbark	C	None	0	1	20/04/2001
17050	Equisetopsida	Apocynaceae	*Gomphocarpus physocarpus*	balloon cottonbush	None	None	1	2	20/04/2001
11205	Equisetopsida	Apocynaceae	*Marsdenia coronata*	slender milkvine	V	None	1	2	13/02/2017
16526	Equisetopsida	Apocynaceae	*Parsonsia straminea*	monkey rope	C	None	0	1	20/04/2001
15835	Equisetopsida	Asteraceae	*Acmella grandiflora var. brachyglossa*	None	C	None	1	2	18/02/2015

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
22801	Equisetopsida	Asteraceae	*Ageratum conyzoides subsp. conyzoides*	None	None	None	1	1	08/05/1962
35061	Equisetopsida	Asteraceae	*Apowollastonia spilanthoides*	None	C	None	0	1	20/04/2001
15612	Equisetopsida	Asteraceae	*Baccharis halimifolia*	groundsel bush	None	None	0	2	07/07/2014
15572	Equisetopsida	Asteraceae	*Camptacra barbata*	None	C	None	1	2	27/11/2015
14738	Equisetopsida	Asteraceae	*Cassinia laevis*	None	C	None	0	1	20/04/2001
15546	Equisetopsida	Asteraceae	*Centipeda minima subsp. minima*	None	C	None	1	1	16/04/1991
8398	Equisetopsida	Asteraceae	*Chrysocephalum apiculatum*	yellow buttons	C	None	1	2	20/04/2001
14001	Equisetopsida	Asteraceae	*Cirsium vulgare*	spear thistle	None	None	0	2	17/10/2012
22237	Equisetopsida	Asteraceae	*Cyanthillium cinereum*	None	C	None	0	2	20/04/2001
11069	Equisetopsida	Asteraceae	*Eclipta platyglossa*	None	C	None	0	1	20/04/2001
34823	Equisetopsida	Asteraceae	*Eclipta platyglossa subsp. platyglossa*	None	C	None	2	2	16/04/1991
35896	Equisetopsida	Asteraceae	*Erigeron bonariensis*	None	None	None	0	1	20/04/2001
8401	Equisetopsida	Asteraceae	*Euchiton sphaericus*	None	C	None	1	1	01/12/2015
9092	Equisetopsida	Asteraceae	*Glossocardia bidens*	native cobbler's pegs	C	None	0	1	20/04/2001
36072	Equisetopsida	Asteraceae	*Lagenophora fimbriata*	None	C	None	5	5	01/12/2015
15269	Equisetopsida	Asteraceae	*Lagenophora gracilis*	None	C	None	0	1	20/04/2001
8366	Equisetopsida	Asteraceae	*Ozothamnus diosmifolius*	white dogwood	C	None	0	1	20/04/2001
10486	Equisetopsida	Asteraceae	*Senecio madagascariensis*	fireweed	None	None	1	2	12/08/2017
10442	Equisetopsida	Asteraceae	*Solenogyne bellioides*	None	C	None	1	1	01/12/2015
14957	Equisetopsida	Asteraceae	*Vittadinia dissecta var. hirta*	None	C	None	0	1	20/04/2001
14959	Equisetopsida	Asteraceae	*Vittadinia sulcata*	native daisy	C	None	1	1	07/12/2006
22235	Equisetopsida	Asteraceae	*Xanthium occidentale*	None	None	None	0	1	20/04/2001
16570	Equisetopsida	Bignoniaceae	*Pandorea pandorana*	wonga vine	C	None	0	2	20/04/2001
10854	Equisetopsida	Brassicaceae	*Lepidium africanum*	common peppercress	None	None	1	1	01/12/2015
26204	Equisetopsida	Bryaceae	*Rosulabryum subfasciculatum*	None	C	None	1	1	13/10/2015
19352	Equisetopsida	Cactaceae	*Opuntia stricta*	None	None	None	0	1	04/07/2014
9535	Equisetopsida	Cactaceae	*Opuntia tomentosa*	velvety tree pear	None	None	0	3	04/07/2014
15614	Equisetopsida	Caesalpiniaceae	*Barklya syringifolia*	golden shower tree	C	None	1	1	12/12/1987
33856	Equisetopsida	Campanulaceae	*Lobelia concolor*	None	C	None	0	1	20/04/2001
16766	Equisetopsida	Campanulaceae	*Lobelia purpurascens*	white root	C	None	0	1	20/04/2001
13864	Equisetopsida	Campanulaceae	*Lobelia stenophylla*	None	C	None	2	2	16/04/1991
36488	Equisetopsida	Campanulaceae	*Wahlenbergia capillaris*	None	C	None	0	1	20/04/2001

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15918	Equisetopsida	Campanulaceae	*Wahlenbergia gracilis*	sprawling bluebell	C	None	0	1	20/04/2001
18013	Equisetopsida	Casuarinaceae	*Allocasuarina luehmannii*	bull oak	C	None	0	2	07/07/2014
33690	Equisetopsida	Chenopodiaceae	*Dysphania multifida*	None	None	None	1	1	23/01/2018
17320	Equisetopsida	Chenopodiaceae	*Einadia polygonoides*	knotweed goosefoot	C	None	1	1	16/04/1991
14431	Equisetopsida	Chenopodiaceae	*Maireana microphylla*	None	C	None	0	1	20/04/2001
34403	Equisetopsida	Clusiaceae	*Hypericum involutum*	None	C	None	1	1	16/04/1991
10033	Equisetopsida	Commelinaceae	*Commelina diffusa*	wandering jew	C	None	0	2	24/12/2004
16599	Equisetopsida	Commelinaceae	*Murdannia graminea*	murdannia	C	None	0	1	24/12/2004
17422	Equisetopsida	Convolvulaceae	*Dichondra repens*	kidney weed	C	None	0	1	20/04/2001
17176	Equisetopsida	Convolvulaceae	*Evolvulus alsinoides*	None	C	None	0	1	20/04/2001
21934	Equisetopsida	Crassulaceae	*Bryophyllum delagoense*	None	None	None	1	2	18/02/2014
14785	Equisetopsida	Cyperaceae	*Bolboschoenus fluviatilis*	None	C	None	0	1	20/04/2001
17686	Equisetopsida	Cyperaceae	*Carex appressa*	None	C	None	0	1	20/04/2001
14779	Equisetopsida	Cyperaceae	*Carex inversa*	knob sedge	C	None	2	2	18/02/2015
14662	Equisetopsida	Cyperaceae	*Cyperus eragrostis*	None	None	None	0	1	17/10/2012
13966	Equisetopsida	Cyperaceae	*Cyperus flaccidus*	None	C	None	1	1	16/04/1991
10924	Equisetopsida	Cyperaceae	*Cyperus mirus*	None	C	None	1	1	18/02/2015
11453	Equisetopsida	Cyperaceae	*Cyperus platystylis*	None	C	None	1	1	20/02/2013
17475	Equisetopsida	Cyperaceae	*Cyperus polystachyos var. polystachyos*	None	C	None	0	1	17/10/2012
14667	Equisetopsida	Cyperaceae	*Cyperus scariosus*	None	C	None	0	1	20/04/2001
10327	Equisetopsida	Cyperaceae	*Cyperus sculptus*	None	C	None	3	3	16/04/2006
11954	Equisetopsida	Cyperaceae	*Cyperus sesquiflorus*	None	None	None	1	1	16/04/1991
17485	Equisetopsida	Cyperaceae	*Cyperus trinervis*	None	C	None	1	1	16/04/1991
17340	Equisetopsida	Cyperaceae	*Eleocharis cylindrostachys*	None	C	None	1	1	12/04/1930
9816	Equisetopsida	Cyperaceae	*Eleocharis dietrichiana*	None	C	None	1	1	20/02/2013
11072	Equisetopsida	Cyperaceae	*Eleocharis philippinensis*	None	C	None	1	1	16/04/1991
17107	Equisetopsida	Cyperaceae	*Fimbristylis dichotoma*	common fringe-rush	C	None	0	1	20/04/2001
17108	Equisetopsida	Cyperaceae	*Fimbristylis ferruginea*	None	C	None	0	1	20/04/2001
34090	Equisetopsida	Cyperaceae	*Schoenoplectus subulatus*	None	C	None	0	1	17/10/2012
14577	Equisetopsida	Elatinaceae	*Elatine gratioloides*	waterwort	C	None	0	1	17/10/2012
24665	Equisetopsida	Entodontaceae	*Entodon mackaviensis*	None	C	None	1	1	07/09/2011
13642	Equisetopsida	Fabaceae	*Desmodium brachypodum*	large ticktrefoil	C	None	1	1	18/02/2015

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15460	Equisetopsida	Fabaceae	*Desmodium rhytidophyllum*	None	C	None	0	1	20/04/2001
15356	Equisetopsida	Fabaceae	*Glycine tabacina*	glycine pea	C	None	1	1	29/04/1990
15309	Equisetopsida	Fabaceae	*Hardenbergia violacea*	None	C	None	0	1	20/04/2001
15296	Equisetopsida	Fabaceae	*Indigofera linnaei*	Birdsville indigo	C	None	0	1	20/04/2001
15260	Equisetopsida	Fabaceae	*Jacksonia scoparia*	None	C	None	0	1	20/04/2001
11444	Equisetopsida	Fabaceae	*Lablab purpureus*	lablab	None	None	1	1	08/06/1995
19911	Equisetopsida	Fabaceae	*Lespedeza juncea*	None	C	None	0	1	20/04/2001
14426	Equisetopsida	Fabaceae	*Macroptilium lathyroides*	None	None	None	0	1	20/04/2001
14918	Equisetopsida	Fabaceae	*Zornia dyctiocarpa var. dyctiocarpa*	None	C	None	1	1	16/04/1991
24712	Equisetopsida	Funariaceae	*Funaria hygrometrica*	None	C	None	1	1	07/09/2011
11010	Equisetopsida	Goodeniaceae	*Goodenia gracilis*	None	C	None	3	3	27/11/2015
9253	Equisetopsida	Goodeniaceae	*Goodenia hederacea*	None	C	None	0	1	20/04/2001
11360	Equisetopsida	Goodeniaceae	*Velleia paradoxa*	spur velleia	C	None	2	2	16/04/1991
13239	Equisetopsida	Hemerocallidaceae	*Dianella brevipedunculata*	None	C	None	1	2	07/12/2006
12843	Equisetopsida	Hemerocallidaceae	*Dianella rara*	None	C	None	1	1	01/12/2015
14594	Equisetopsida	Hemerocallidaceae	*Dianella revoluta*	None	C	None	0	1	20/04/2001
15350	Equisetopsida	Hemerocallidaceae	*Geitonoplesium cymosum*	scrambling lily	C	None	0	1	20/04/2001
15286	Equisetopsida	Hypoxidaceae	*Hypoxis pratensis var. pratensis*	None	C	None	1	1	29/04/1990
15974	Equisetopsida	Johnsoniaceae	*Tricoryne elatior*	yellow autumn lily	C	None	0	1	24/12/2004
13895	Equisetopsida	Juncaceae	*Juncus polyanthemus*	None	C	None	1	3	20/02/2013
16846	Equisetopsida	Juncaceae	*Juncus usitatus*	None	C	None	1	2	20/04/2001
15243	Equisetopsida	Lamiaceae	*Mentha satureioides*	native pennyroyal	C	None	0	1	20/04/2001
15339	Equisetopsida	Laxmanniaceae	*Eustrephus latifolius*	wombat berry	C	None	0	1	20/04/2001
12409	Equisetopsida	Laxmanniaceae	*Lomandra*	None	None	None	0	1	17/10/2012
16771	Equisetopsida	Laxmanniaceae	*Lomandra filiformis*	None	C	None	1	1	01/12/2015
16770	Equisetopsida	Laxmanniaceae	*Lomandra filiformis subsp. filiformis*	None	C	None	2	2	18/02/2015
16777	Equisetopsida	Laxmanniaceae	*Lomandra multiflora subsp. multiflora*	None	C	None	0	1	20/04/2001
14166	Equisetopsida	Lentibulariaceae	*Utricularia aurea*	golden bladderwort	C	None	1	1	04/04/1991
9417	Equisetopsida	Lentibulariaceae	*Utricularia gibba*	floating bladderwort	C	None	1	1	20/02/2013
36239	Equisetopsida	Linderniaceae	*Lindernia procumbens*	None	C	None	1	1	16/04/1991
11979	Equisetopsida	Lythraceae	*Ammannia multiflora*	jerry-jerry	C	None	1	1	16/04/1991

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
22197	Equisetopsida	Malvaceae	*Sida hackettiana*	None	C	None	0	1	20/04/2001
16146	Equisetopsida	Malvaceae	*Sida rhombifolia*	None	None	None	0	1	20/04/2001
12358	Equisetopsida	Marsileaceae	*Marsilea mutica*	shiny nardoo	C	None	0	1	20/04/2001
14327	Equisetopsida	Menyanthaceae	*Nymphoides indica*	water snowflake	C	None	0	1	20/04/2001
15827	Equisetopsida	Mimosaceae	*Acacia aulacocarpa*	None	C	None	0	1	20/04/2001
15790	Equisetopsida	Mimosaceae	*Acacia concurrens*	None	C	None	0	1	20/04/2001
21915	Equisetopsida	Mimosaceae	*Acacia disparrima subsp. disparrima*	None	C	None	0	5	07/07/2014
15799	Equisetopsida	Mimosaceae	*Acacia falcata*	sickle wattle	C	None	0	1	20/04/2001
15772	Equisetopsida	Mimosaceae	*Acacia maidenii*	Maiden's wattle	C	None	0	1	20/04/2001
15694	Equisetopsida	Mimosaceae	*Acacia salicina*	doolan	C	None	0	1	07/07/2014
14370	Equisetopsida	Mimosaceae	*Neptunia gracilis forma gracilis*	None	C	None	0	1	20/04/2001
17143	Equisetopsida	Moraceae	*Ficus obliqua*	None	C	None	0	1	20/04/2001
17999	Equisetopsida	Myrtaceae	*Angophora leiocarpa*	rusty gum	C	None	0	1	20/04/2001
26382	Equisetopsida	Myrtaceae	*Corymbia citriodora subsp. variegata*	None	C	None	0	21	04/11/2014
6534	Equisetopsida	Myrtaceae	*Corymbia clarksoniana*	None	C	None	0	1	20/04/2001
6572	Equisetopsida	Myrtaceae	*Corymbia tessellaris*	Moreton Bay ash	C	None	0	9	07/07/2014
17252	Equisetopsida	Myrtaceae	*Eucalyptus crebra*	narrow-leaved red ironbark	C	None	2	25	07/07/2014
17221	Equisetopsida	Myrtaceae	*Eucalyptus melanophloia*	None	C	None	0	1	20/04/2001
34185	Equisetopsida	Myrtaceae	*Eucalyptus melanophloia subsp. melanophloia*	None	C	None	0	5	07/07/2014
17229	Equisetopsida	Myrtaceae	*Eucalyptus moluccana*	gum-topped box	C	None	0	1	04/11/2014
12465	Equisetopsida	Myrtaceae	*Eucalyptus siderophloia*	None	C	None	0	1	04/11/2014
17204	Equisetopsida	Myrtaceae	*Eucalyptus tereticornis*	None	C	None	0	2	17/10/2012
16730	Equisetopsida	Myrtaceae	*Lophostemon suaveolens*	swamp box	C	None	0	1	20/04/2001
26403	Equisetopsida	Myrtaceae	*Melaleuca irbyana*	None	E	None	8	11	17/12/2018
31375	Equisetopsida	Myrtaceae	*Melaleuca viminalis*	None	C	None	0	1	17/10/2012
15857	Equisetopsida	Myrtaceae	*Waterhousea floribunda*	weeping lilly pilly	C	None	0	1	17/10/2012
6877	Equisetopsida	Nyctaginaceae	*Boerhavia sp. (St George A.Hill AQ399299)*	None	C	None	1	1	06/02/1972
29765	Equisetopsida	Nymphaeaceae	*Nymphaea gigantea*	None	C	None	2	2	01/04/2010
33129	Equisetopsida	Oleaceae	*Jasminum dianthifolium*	None	C	None	1	2	18/02/2015
9680	Equisetopsida	Oleaceae	*Notelaea lloydii*	Lloyd's native olive	V	V	1	1	06/06/2018

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
13420	Equisetopsida	Onagraceae	*Ludwigia octovalvis*	willow primrose	C	None	0	1	20/04/2001
16731	Equisetopsida	Onagraceae	*Ludwigia peploides subsp. montevidensis*	None	C	None	0	1	20/04/2001
5779	Equisetopsida	Orchidaceae	*Dockrillia linguiformis*	tongue orchid	C	None	0	1	20/04/2001
9457	Equisetopsida	Oxalidaceae	*Oxalis corniculata*	None	None	None	0	1	20/04/2001
12740	Equisetopsida	Oxalidaceae	*Oxalis perennans*	None	C	None	1	1	16/04/1991
36076	Equisetopsida	Passifloraceae	*Passiflora pallida*	None	None	None	1	1	12/08/2017
16532	Equisetopsida	Passifloraceae	*Passiflora suberosa*	corky passion flower	None	None	0	1	20/04/2001
16660	Equisetopsida	Pentapetaceae	*Melhania oblongifolia*	None	C	None	1	1	22/03/2010
16473	Equisetopsida	Phyllanthaceae	*Phyllanthus virgatus*	None	C	None	0	1	20/04/2001
16505	Equisetopsida	Picrodendraceae	*Petalostigma pubescens*	quinine tree	C	None	0	1	20/04/2001
14824	Equisetopsida	Plantaginaceae	*Bacopa floribunda*	None	C	None	1	1	16/04/1991
12727	Equisetopsida	Plantaginaceae	*Plantago debilis*	shade plantain	C	None	2	2	18/02/2015
15670	Equisetopsida	Poaceae	*Alloteropsis semialata*	cockatoo grass	C	None	1	1	09/09/1985
11121	Equisetopsida	Poaceae	*Aristida gracilipes*	None	C	None	0	1	20/04/2001
9973	Equisetopsida	Poaceae	*Axonopus fissifolius*	None	None	None	0	1	20/04/2001
15604	Equisetopsida	Poaceae	*Bothriochloa bladhii subsp. bladhii*	None	C	None	2	2	16/04/1991
10316	Equisetopsida	Poaceae	*Bothriochloa decipiens var. decipiens*	None	C	None	0	1	20/04/2001
14774	Equisetopsida	Poaceae	*Capillipedium spicigerum*	spicytop	C	None	0	1	20/04/2001
15550	Equisetopsida	Poaceae	*Chloris divaricata var. divaricata*	slender chloris	C	None	0	1	20/04/2001
15551	Equisetopsida	Poaceae	*Chloris gayana*	rhodes grass	None	None	0	1	20/04/2001
14753	Equisetopsida	Poaceae	*Chloris truncata*	None	C	None	0	1	20/04/2001
11103	Equisetopsida	Poaceae	*Chrysopogon sylvaticus*	None	C	None	0	1	20/04/2001
15485	Equisetopsida	Poaceae	*Cymbopogon refractus*	barbed-wire grass	C	None	0	1	20/04/2001
15486	Equisetopsida	Poaceae	*Cynodon dactylon*	None	None	None	0	1	20/04/2001
15467	Equisetopsida	Poaceae	*Dichanthium sericeum subsp. sericeum*	None	C	None	1	1	12/04/1930
10401	Equisetopsida	Poaceae	*Dichanthium setosum*	None	C	V	1	1	05/04/2018
15420	Equisetopsida	Poaceae	*Digitaria ciliaris*	summer grass	None	None	1	1	12/04/1930
34493	Equisetopsida	Poaceae	*Dinebra decipiens var. decipiens*	None	C	None	1	1	18/02/2015
14567	Equisetopsida	Poaceae	*Echinochloa colona*	awnless barnyard grass	None	None	2	2	12/04/1930
15409	Equisetopsida	Poaceae	*Enteropogon unispiceus*	None	C	None	0	1	20/04/2001
15390	Equisetopsida	Poaceae	*Eragrostis brownii*	Brown's lovegrass	C	None	0	1	20/04/2001
15361	Equisetopsida	Poaceae	*Eragrostis elongata*	None	C	None	1	1	16/04/1991
15380	Equisetopsida	Poaceae	*Eremochloa bimaculata*	poverty grass	C	None	0	1	20/04/2001

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
15331	Equisetopsida	Poaceae	*Eriochloa procera*	slender cupgrass	C	None	1	1	12/04/1930
15320	Equisetopsida	Poaceae	*Heteropogon contortus*	black speargrass	C	None	1	2	20/04/2001
15290	Equisetopsida	Poaceae	*Imperata cylindrica*	blady grass	C	None	0	1	20/04/2001
14437	Equisetopsida	Poaceae	*Leersia hexandra*	swamp rice grass	C	None	1	1	12/04/1930
29093	Equisetopsida	Poaceae	*Megathyrsus maximus*	None	None	None	0	1	17/10/2012
27900	Equisetopsida	Poaceae	*Megathyrsus maximus var. pubiglumis*	None	None	None	0	1	20/04/2001
9154	Equisetopsida	Poaceae	*Melinis repens*	red natal grass	None	None	0	1	20/04/2001
9599	Equisetopsida	Poaceae	*Panicum decompositum*	None	C	None	0	1	20/04/2001
15173	Equisetopsida	Poaceae	*Panicum decompositum var. decompositum*	None	C	None	1	1	12/04/1930
13607	Equisetopsida	Poaceae	*Panicum effusum*	None	C	None	0	1	20/04/2001
18424	Equisetopsida	Poaceae	*Panicum simile*	None	C	None	1	1	12/04/1930
15184	Equisetopsida	Poaceae	*Paspalidium caespitosum*	brigalow grass	C	None	1	1	18/02/2015
14345	Equisetopsida	Poaceae	*Paspalidium distans*	shotgrass	C	None	0	1	20/04/2001
15134	Equisetopsida	Poaceae	*Paspalum dilatatum*	paspalum	None	None	0	1	20/04/2001
10818	Equisetopsida	Poaceae	*Paspalum distichum*	water couch	None	None	0	1	20/04/2001
15001	Equisetopsida	Poaceae	*Sporobolus creber*	None	C	None	1	1	12/04/1930
14974	Equisetopsida	Poaceae	*Themeda triandra*	kangaroo grass	C	None	1	3	17/10/2012
11356	Equisetopsida	Poaceae	*Tragus australianus*	small burr grass	C	None	1	1	12/04/1930
13155	Equisetopsida	Polygonaceae	*Persicaria decipiens*	slender knotweed	C	None	1	1	20/02/2013
17370	Equisetopsida	Pontederiaceae	*Eichhornia crassipes*	water hyacinth	None	None	1	2	20/02/2013
17793	Equisetopsida	Portulacaceae	*Calandrinia pickeringii*	None	C	None	1	1	16/04/1991
19434	Equisetopsida	Portulacaceae	*Portulaca pilosa*	None	None	None	0	1	20/04/2001
8916	Equisetopsida	Pteridaceae	*Cheilanthes sieberi*	None	C	None	0	1	20/04/2001
9659	Equisetopsida	Rhamnaceae	*Alphitonia excelsa*	soap tree	C	None	0	3	07/07/2014
8448	Equisetopsida	Rubiaceae	*Oldenlandia galioides*	None	C	None	1	1	16/04/1991
8388	Equisetopsida	Rubiaceae	*Oldenlandia subulata*	None	C	None	1	1	29/04/1990
16139	Equisetopsida	Rubiaceae	*Spermacoce multicaulis*	None	C	None	0	1	20/04/2001
18226	Equisetopsida	Rutaceae	*Citrus x limon*	None	None	None	0	1	20/04/2001
27796	Equisetopsida	Rutaceae	*Coatesia paniculata*	None	C	None	1	1	07/11/2000
13349	Equisetopsida	Rutaceae	*Flindersia collina*	broad-leaved leopard tree	C	None	0	1	20/04/2001
17180	Equisetopsida	Santalaceae	*Exocarpos cupressiformis*	native cherry	C	None	0	1	20/04/2001
5210	Equisetopsida	Sapotaceae	*Planchonella eerwah*	None	E	E	3	3	12/12/1987
8631	Equisetopsida	Scrophulariaceae	*Eremophila debilis*	winter apple	C	None	0	1	20/04/2001

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
26202	Equisetopsida	Sematophyllaceae	*Sematophyllum subhumile*	None	C	None	1	1	07/09/2011
29813	Equisetopsida	Solanaceae	*Solanum jucundum*	None	C	None	1	1	08/07/2015
13788	Equisetopsida	Solanaceae	*Solanum nigrum*	None	None	None	0	1	20/04/2001
34650	Equisetopsida	Solanaceae	*Solanum viarum*	None	None	None	1	1	10/09/2012
12554	Equisetopsida	Stackhousiaceae	*Stackhousia muricata*	None	C	None	0	1	20/04/2001
15989	Equisetopsida	Typhaceae	*Typha orientalis*	broad-leaved cumbungi	C	None	0	1	20/04/2001
34284	Equisetopsida	Verbenaceae	*Glandularia aristigera*	None	None	None	0	1	20/04/2001
19905	Equisetopsida	Verbenaceae	*Lantana camara*	lantana	None	None	0	4	04/07/2014
13853	Equisetopsida	Verbenaceae	*Lantana montevidensis*	creeping lantana	None	None	0	14	04/07/2014
7796	Equisetopsida	Verbenaceae	*Phyla canescens*	None	None	None	1	1	28/02/2013
27944	Equisetopsida	Verbenaceae	*Verbena litoralis var. litoralis*	None	None	None	1	1	12/04/1930
30780	Equisetopsida	Verbenaceae	*Verbena rigida*	None	None	None	0	1	20/04/2001
36152	Equisetopsida	Violaceae	*Afrohybanthus stellarioides*	None	C	None	0	2	24/12/2004
14132	Equisetopsida	Viscaceae	*Notothixos incanus*	None	C	None	1	2	23/09/2007

Table 4. Fungi recorded within the area of interest and its one kilometre buffer

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
28022	Agaricomycetes	Agaricaceae	*Bovista cunninghamii*	None	C	None	1	1	09/02/2016
25531	Agaricomycetes	Amanitaceae	*Amanita*	None	None	None	1	1	06/03/2012
25511	Agaricomycetes	Amanitaceae	*Amanita vaginata*	None	C	None	1	1	08/03/2012
34600	Agaricomycetes	Sclerodermataceae	*Pisolithus marmoratus*	None	C	None	1	1	15/06/2015
28204	Dacrymycetes	Dacrymycetaceae	*Dacryopinax spathularia*	None	C	None	1	1	10/03/2016
23096	Lecanoromycetes	Caliciaceae	*Dirinaria applanata*	None	C	None	1	1	22/06/2016
34907	Lecanoromycetes	Cladoniaceae	*Cladia muelleri*	None	C	None	1	1	22/06/2016
23027	Lecanoromycetes	Cladoniaceae	*Cladonia floerkeana*	None	C	None	2	2	22/06/2016
23778	Lecanoromycetes	Cladoniaceae	*Thysanotheciu m scutellatum*	None	C	None	1	1	10/04/2014
23370	Lecanoromycetes	Parmeliaceae	*Parmotrema crinitum*	None	C	None	1	1	22/02/2016
23448	Lecanoromycetes	Parmeliaceae	*Parmotrema tinctorum*	None	C	None	1	1	22/06/2016

Table 5. Protists recorded within the area of interest and its one kilometre buffer

No species found within the area of interest and its one kilometre buffer.

Species table headings and codes

Taxon Id: Unique identifier of the taxon from the WildNet database.

NCA: Queensland conservation status of the taxon under the *Nature Conservation Act 1992* (Endangered (E), Extinct in the Wild (PE), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern(C)).

EPBC: Australian conservation status of the taxon under the *Environment Protection and Biodiversity Conservation Act 1999* (Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V)).

Specimens: The number of specimen-backed records of the taxon.

Records: The total number of records of the taxon.

Last record: Date of latest record of the taxon.

Links and Support

Other sites that deliver species information from the WildNet database include:

- Species profile search - access species information approved for publication including species names, statuses, notes, images, distribution maps and records
- Species lists - generate species lists for Queensland protected areas, forestry areas, local governments and areas defined using coordinates
- Biomaps - view biodiversity information, including species information approved for publication, and generate reports
- Qld wildlife data API - access species information approved for publication such as notes, images and records etc.
- Wetland*Maps* - view species records, survey locations etc. approved for publication
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- Generalised distribution and densities of Queensland wildlife - Queensland species distributions and densities generalised to a 10 km grid resolution
- Conservation status of Queensland wildlife - access current lists of priority species for Queensland including nomenclature and status information
- Queensland Confidential Species - the list of species flagged as confidential in the WildNet database.

Other useful sites for accessing biodiversity data include:

- Queensland Government Data
- Atlas of Living Australia
- OZCAM - Online Zoological Collections of Australian Museums
- AVH - Australia's Virtual Herbarium
- Protected Matters Search Tool

Please direct queries about this report to the WildNet Team.

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WildNet Records
Conservation Significant Species List

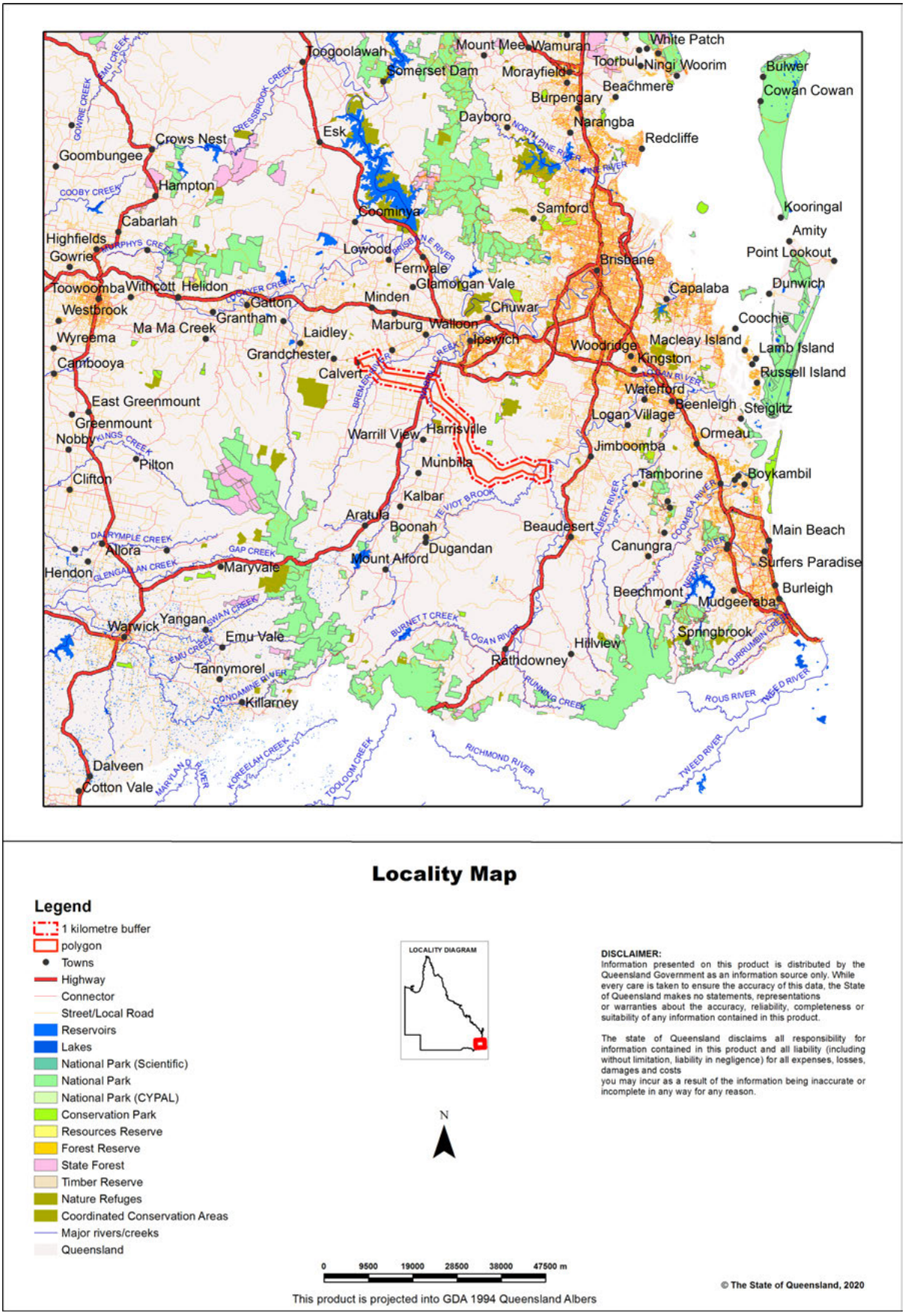
For the selected area of interest 11221.47ha

Current as at 06/02/2020

WildNetCSspecieslist

Queensland Government

Map 1. Locality Map



Summary Information

The following table provides an overview of the area of interest .

Table 1. Area of interest details

Size (ha)	11,221.47
Local Government(s)	Scenic Rim Regional, Logan City, Ipswich City
Bioregion(s)	Southeast Queensland
Subregion(s)	Moreton Basin
Catchment(s)	Logan-Albert, Brisbane

Protected Area(s)
No estates or reserves are located within the area of interest.

World Heritage Area(s)
No World Heritage Areas are located within the area of interest.

Ramsar Area(s)
No Ramsar Areas are located within the area of interest.

Conservation Significant Species List

Introduction
This Conservation Significant Species List report is derived only from records from the WildNet database managed by the Department of Environment and Science. Other data sources may provide additional information on species occurrence.

Conservation significant species are species listed:

- as threatened or near threatened under the Nature Conservation Act 1992;
- as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* or
- migratory species protected under the following international agreements:
  - Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
  - China-Australia Migratory Bird Agreement
  - Japan-Australia Migratory Bird Agreement
  - Republic of Korea-Australia Migratory Bird Agreement

The WildNet dataset is constantly being enhanced and the taxonomic and status information revised. If a species does not occur in the report, it does not mean it doesn't occur there and listed species may also no longer inhabit the area.

Table 2 lists the species recorded within the area of interest and its one kilometre buffer.

Table 2. Conservation significant species recorded within the area of interest and its one kilometre buffer

Taxon Id	Kingdom	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
1971	Animalia	Aves	Apodidae	*Hirundapus caudacutus*	white-throated needletail	V	V	0	1	20/11/2002
1595	Animalia	Aves	Monarchidae	*Monarcha melanopsis*	black-faced monarch	SL	None	0	1	20/11/2002
1578	Animalia	Aves	Rhipiduridae	*Rhipidura rufifrons*	rufous fantail	SL	None	0	1	20/11/2002
1879	Animalia	Aves	Scolopacidae	*Calidris melanotos*	pectoral sandpiper	SL	None	0	1	16/11/1980

Taxon Id	Kingdom	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
1843	Animalia	Aves	Scolopacidae	*Numenius madagascariensis*	eastern curlew	E	CE	0	1	18/07/1999
1107	Animalia	Aves	Strigidae	*Ninox strenua*	powerful owl	V	None	0	1	31/12/2010
1825	Animalia	Aves	Threskiornithidae	*Plegadis falcinellus*	glossy ibis	SL	None	0	1	27/07/1999
803	Animalia	Mammalia	Dasyuridae	*Dasyurus maculatus maculatus*	spotted-tailed quoll (southern subspecies)	V	E	0	1	31/12/2009
890	Animalia	Mammalia	Macropodidae	*Petrogale penicillata*	brush-tailed rock-wallaby	V	V	0	1	31/12/1993
860	Animalia	Mammalia	Phascolarctidae	*Phascolarctos cinereus*	koala	V	V	0	942	01/01/2012
2455	Animalia	Mammalia	Pseudocheiridae	*Petauroides volans volans*	southern greater glider	V	V	0	1	31/12/1999
838	Animalia	Mammalia	Tachyglossidae	*Tachyglossus aculeatus*	short-beaked echidna	SL	None	0	1	31/12/1999
11205	Plantae	Equisetopsida	Apocynaceae	*Marsdenia coronata*	slender milkvine	V	None	1	2	13/02/2017
26403	Plantae	Equisetopsida	Myrtaceae	*Melaleuca irbyana*	None	E	None	8	11	17/12/2018
9680	Plantae	Equisetopsida	Oleaceae	*Notelaea lloydii*	Lloyd's native olive	V	V	1	1	06/06/2018
10401	Plantae	Equisetopsida	Poaceae	*Dichanthium setosum*	None	C	V	1	1	05/04/2018
5210	Plantae	Equisetopsida	Sapotaceae	*Planchonella eerwah*	None	E	E	3	3	12/12/1987

Taxon Id: Unique identifier of the taxon from the WildNet database.

NCA: Queensland conservation status of the taxon under the *Nature Conservation Act 1992* (Endangered (E), Extinct in the Wild (PE), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern(C)).

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Department of Environment and Science

Environmental Reports

Biodiversity and Conservation Values

Biodiversity Planning Assessments and Aquatic Conservation Assessments

For the selected area of interest

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or Area of Interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "Central co-ordinates" option, the resulting assessment area encompasses an area extending from 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: biodiversity.planning@des.qld.gov.au

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Table of Contents

Summary Information

Tables 1 to 8 provide an overview of the AOI with respect to selected topographic and environmental values.

Table 1: Area of interest details:

Size (ha)	11,221.47
Local Government(s)	Scenic Rim Regional, Logan City, Ipswich City
Bioregion(s)	Southeast Queensland
Subregion(s)	Moreton Basin
Catchment(s)	Logan-Albert, Brisbane

The following table identifies available Biodiversity Planning Assessments (BPAs) and Aquatic Conservation Assessments (ACAs) with respect to the AOI.

Table 2: Available Biodiversity Planning and Aquatic Conservation Assessments

Assessment Type	Assessment Area and Version
Biodiversity Planning Assessment(s)	Southeast Queensland v4.1
Aquatic Conservation Assessment(s) (riverine)	South East Queensland Catchments v1.1
Aquatic Conservation Assessment(s) (non-riverine)	South East Queensland Catchments v1.1

Table 3: Remnant regional ecosystems within the AOI as per the Qld Herbarium's 'biodiversity status'

Biodiversity Status	Area (Ha)	% of AOI
Endangered	148.21	1.32
Of concern	363.18	3.24
No concern at present	666.18	5.94

The following table identifies the extent and proportion of the user specified area of interest (AOI) which is mapped as being of "State", "Regional" or "Local" significance via application of the Queensland Department of Environment and Science's *Biodiversity Assessment and Mapping Methodology* (BAMM).

Table 4: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	1,057.66	9.43
State	591.58	5.27
Regional	320.65	2.86
Local or Other Values	59.57	0.53

Table 5: Non-riverine wetlands intersecting the AOI

Non-riverine wetland types intersecting the area of interest	#
Number of Palustrine wetlands	9
Number of Lacustrine wetlands	10
Total number of non-riverine wetlands	19

NB. The figures presented in the table above are derived from the relevant non-riverine Aquatic Conservation Assessment(s). Later releases of wetland mapping produced via the Queensland Wetland Mapping Program may provide more recent information in regards to wetland extent.

Table 6: Named waterways intersecting the AOI

Name	Permanency
BREMER RIVER	Non-perennial
PURGA CREEK	Non-perennial
TEVIOT BROOK	Non-perennial
WARRILL CREEK	Perennial
WESTERN CREEK	Non-perennial
WOOLLAMAN CREEK	Non-perennial

Refer to **Map 1** for general locality information.

The following two tables identify the extent and proportion of the user specified AOI which is mapped as being of "Very High", "High", "Medium", "Low", or "Very Low" aquatic conservation value for riverine and non-riverine wetlands via application of the Queensland Department of Environment and Science's *Aquatic Biodiversity Assessment and Mapping Method* (AquaBAMM).

Table 7: Summary table, aquatic conservation significance (riverine)

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0
High	0.0	0.0
Medium	7,280.59	64.88
Low	2,659.35	23.7
Very Low	1,281.78	11.42

Table 8: Summary table, aquatic conservation significance (non-riverine)

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
Very High	81.38	0.73
High	0.0	0.0
Medium	14.46	0.13
Low	0.0	0.0
Very Low	13.05	0.12

Biodiversity Planning Assessments

Introduction

The Department of Environment and Science (DES) attributes biodiversity significance on a bioregional scale through a Biodiversity Planning Assessment (BPA). A BPA involves the integration of ecological criteria using the *Biodiversity assessment and Mapping Methodology* (BAMM) and is developed in two stages: 1) **diagnostic criteria**, and 2) **expert panel criteria**. The diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion, while the expert panel criteria allows for the refinement of the mapped information from the diagnostic output by incorporating local knowledge and expert opinion.

The BAMM methodology has application for identifying areas with various levels of significance solely for biodiversity reasons. These include threatened ecosystems or taxa, large tracts of habitat in good condition, ecosystem diversity, landscape context and connection, and buffers to wetlands or other types of habitat important for the maintenance of biodiversity or ecological processes. While natural resource values such as dryland salinity, soil erosion potential or land capability are not dealt with explicitly, they are included to some extent within the biodiversity status of regional ecosystems recognised by the DES.

Biodiversity Planning Assessments (BPAs) assign three levels of overall biodiversity significance.

- **State significance** - areas assessed as being significant for biodiversity at the bioregional or state scales. They also include areas assessed by other studies/processes as being significant at national or international scales. In addition, areas flagged as being of State significance due to the presence of endangered, vulnerable and/or near threatened taxa, are identified as "State Habitat for EVNT taxa".
- **Regional significance** - areas assessed as being significant for biodiversity at the subregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance.
- **Local significance and/or other values** - areas assessed as not being significant for biodiversity at state or regional scales. Local values are of significance at the local government scale.

For further information on released BPAs and a copy of the underlying methodology, go to:

http://www.qld.gov.au/environment/plants-animals/biodiversity/planning/

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

http://qspatial.information.qld.gov.au/geoportal/

The following table identifies the extent and proportion of the user specified AOI which is mapped as being of "State", "Regional" or "Local" significance via application of the BAMM.

Table 9: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	1,057.66	9.43
State	591.58	5.27
Regional	320.65	2.86
Local or Other Values	59.57	0.53

Refer to **Map 2** for further information.

Diagnostic Criteria

Diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion. These criteria are diagnostic in that they are used to filter the available data and provide a "first-cut" or initial determination of biodiversity significance. This initial assessment is then combined through a second group of other essential criteria.

A description of the individual diagnostic criteria is provided in the following sections.

Criteria A. Habitat for EVNT taxa: Classifies areas according to their significance based on the presence of endangered, vulnerable and/or rare (EVNT) taxa. EVNT taxa are those scheduled under the *Nature Conservation Act 1992* and/or the

Environment Protection and Biodiversity Conservation Act 1999. It excludes highly mobile fauna taxa which are instead considered in Criterion H and brings together information on EVNT taxa using buffering of recorded sites or habitat suitability models (HSM) where available.

Criteria B. Ecosystem value: Classifies on the basis of biodiversity status of regional ecosystems, their extent in protected areas (presence of poorly conserved regional ecosystems), the presence of significant wetlands; and areas of national importance such as the presence of Threatened Ecological Communities, World Heritage areas and Ramsar sites. Ecosystem value is applied at a bioregional (**B1**) and regional (**B2**) scale.

Criteria C. Tract size: Measures the relative size of tracts of vegetation in the landscape. The size of any tract is a major indicator of ecological significance, and is also strongly correlated with the long-term viability of biodiversity values. Larger tracts are less susceptible to ecological edge effects and are more likely to sustain viable populations of native flora and fauna than smaller tracts.

Criteria D. Relative size of regional ecosystems: Classifies the relative size of each regional ecosystem unit within its bioregion (**D1**) and its subregion (**D2**). Remnant units are compared with all other occurrences with the same regional ecosystem. Large examples of a regional ecosystem are more significant than smaller examples of the same regional ecosystem because they are more representative of the biodiversity values particular to the regional ecosystem, are more resilient to the effects of disturbance, and constitute a significant proportion of the total area of the regional ecosystem.

Criteria F. Ecosystem diversity: Is an indicator of the number of regional ecosystems occurring within an area. An area with high ecosystem diversity will have many regional ecosystems and ecotones relative to other areas within the bioregion.

Criteria G. Context and connection: Represents the extent to which a remnant unit incorporates, borders or buffers areas such as significant wetlands, endangered ecosystems; and the degree to which it is connected to other vegetation.

A summary of the biodiversity status based upon the diagnostic criteria is provided in the following table.

Table 10: Summary of biodiversity significance based upon diagnostic criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Remnant contains at least 1 Endangered or 2 Vulnerable or Near Threatened species (A)	941.62	8.39
State	Remnant contains at least 1 Endangered or 2 Vulnerable or Near Threatened species (A) & Nat. Threatened Ecol. Community (B1)	116.04	1.03
State	Remnant contains at least 1 Endangered RE (B1)	17.84	0.16
Regional	Remnant contains at least 1 Vulnerable or Near Threatened species (A)	611.89	5.45
Regional	Remnant contains at least one Of Concern RE (B1)	90.14	0.8
Regional	Remnant is part of a Tract that is one of the largest in the bioregion (C) & Remnant has high connectivity or buffers an endangered RE or Significant Wetland (G)	46.99	0.42
Local or Other Values	Refer to diagnostic data for additional information	204.94	1.83

Assessment of diagnostic criteria with respect to the AOI

The following table reflects an assessment of the individual diagnostic criteria noted above in regards to the AOI.

Table 11: Assessment of individual diagnostic criteria with respect to the AOI

Diagnostic Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
A: Habitat for EVNT Taxa	1,057.68	9.4	613.42	5.5	282.32	2.5	76.01	0.7
B1: Ecosystem Value (Bioregion)	151.43	1.3	403.62	3.6	619.94	5.5		
B2: Ecosystem Value (Subregion)	141.46	1.3	336.72	3.0	696.81	6.2		
C: Tract Size	338.23	3.0	268.33	2.4	31.77	0.3	536.66	4.8
D1: Relative RE Size (Bioregion)	23.93	0.2	42.83	0.4	208.4	1.9	899.83	8.0
D2: Relative RE Size (Subregion)	23.93	0.2	42.83	0.4	208.4	1.9	899.83	8.0
F: Ecosystem Diversity	35.27	0.3	311.25	2.8	495.94	4.4	332.53	3.0
G: Context and Connection	124.52	1.1	192.01	1.7	593.76	5.3	264.7	2.4

Other Essential Criteria

Other essential criteria (also known as expert panel criteria) are based on non-uniform information sources and which may rely more upon expert opinion than on quantitative data. These criteria are used to provide a "second-cut" determination of biodiversity significance, which is then combined with the diagnostic criteria for an overall assessment of relative biodiversity

significance. A summary of the biodiversity status based upon the other essential criteria is provided in the following table.

Table 12: Summary of biodiversity significance based upon other essential criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Remnant contains Core Habitat for Priority Taxa (H)	11.1	0.1
State	Remnant contains Core Habitat for Priority Taxa (H) & Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I)	2.5	0.02
State	Remnant contains Core Habitat for Priority Taxa (H) & Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I) & Remnant forms part of a bioregional corridor (J)	6.05	0.05
State	Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I)	24.15	0.22
State	Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I) & Remnant forms part of a bioregional corridor (J)	184.09	1.64
State	Remnant forms part of a bioregional corridor (J)	390.39	3.48
Regional	Remnant contains Core Habitat for Priority Taxa (H)	29.54	0.26
Regional	Remnant contains Core Habitat for Priority Taxa (H) & Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I)	1.95	0.02
Regional	Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I)	64.71	0.58
Regional	Remnant forms part of a bioregional corridor (J)	129.53	1.15
Local	Refer to Expert Panel data for additional information	35.98	0.32

A description of each of the other essential criteria and associated assessment in regards to the AOI is provided in the following sections.

Criteria H. Essential and general habitat for priority taxa: Priority taxa are those which are at risk or of management concern, taxa of scientific interest as relictual (ancient or primitive), endemic taxa or locally significant populations (such as a flying fox camp or heronry), highly specialised taxa whose habitat requirements are complex and distributions are not well correlated with any particular regional ecosystem, taxa important for maintaining genetic diversity (such as complex spatial patterns of genetic variation, geographic range limits, highly disjunct populations), taxa critical for management or monitoring of biodiversity (functionally important or ecological indicators), or economic and culturally important taxa.

Criteria I. Special biodiversity values: areas with special biodiversity values are important because they contain multiple taxa in a unique ecological and often highly biodiverse environment. Areas with special biodiversity values can include the following:

- Ia - centres of endemism - areas where concentrations of taxa are endemic to a bioregion or subregion are found.
- Ib - wildlife refugia (Morton *et al*. 1995), for example, islands, mound springs, caves, wetlands, gorges, mountain ranges and topographic isolates, ecological refuges, refuges from exotic animals, and refuges from clearing. The latter may include large areas that are not suitable for clearing because of land suitability/capability.
- Ic - areas with concentrations of disjunct populations.
- Id - areas with concentrations of taxa at the limits of their geographic ranges.
- Ie - areas with high species richness.
- If - areas with concentrations of relictual populations (ancient and primitive taxa).
- Ig - areas containing REs with distinct variation in species composition associated with geomorphology and other environmental variables.
- Ih - an artificial waterbody or managed/manipulated wetland considered by the panel/s to be of ecological significance.

- Ii - areas with a high density of hollow-bearing trees that provide habitat for animals.
- Ij - breeding or roosting sites used by a significant number of individuals.
- Ik - climate change refuge.

The following table identifies the value and extent area of the Other Essential Criteria H and I within the AOI.

Table 13: Relative importance of expert panel criteria (H and I) used to access overall biodiversity significance with respect to the AOI

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
H: Core Habitat Priority Taxa	17.15	0.2	34.0	0.3	235.55	2.1	888.29	7.9
Ia: Centres of Endemism			218.43	1.9				
Ib: Wildlife Refugia	76.19	0.7	207.27	1.8				
Ic: Disjunct Populations								
Id: Limits of Geographic Ranges					218.43	1.9		
Ie: High Species Richness			67.66	0.6				
If: Relictual Populations								
Ig: Variation in Species Composition								
Ih: Artificial Wetland								
Ii: Hollow Bearing Trees			67.66	0.6				
Ij: Breeding or Roosting Site								
Ik: Climate Refugia								

NB. Whilst biodiversity values associated with Criteria I may be present within the site (refer to tables 12 and 15), for the New England Tableland and Central Queensland Coast BPAs, area and % area figures associated with Criteria Ia through to Ij cannot be listed in the table above (due to slight variations in data formats between BPAs).

Criteria J. Corridors: areas identified under this criterion qualify either because they are existing vegetated corridors important for contiguity, or cleared areas that could serve this purpose if revegetated. Some examples of corridors include riparian habitats, transport corridors and "stepping stones".

Bioregional and subregional conservation corridors have been identified in the more developed bioregions of Queensland through the BPAs, using an intensive process involving expert panels. Map 3 displays the location of corridors as identified under the Statewide Corridor network. The Statewide Corridor network incorporates BPA derived corridors and for bioregions where no BPA has been assessed yet, corridors derived under other planning processes. *Note: as a result of updating and developing a statewide network, the alignment of corridors may differ slightly in some instances when compared to those used in individual BPAs.*

The functions of these corridors are:

- **Terrestrial** Bioregional corridors, in conjunction with large tracts of remnant vegetation, maintain ecological and evolutionary processes at a landscape scale, by:

  • Maintaining long term evolutionary/genetic processes that allow the natural change in distributions of species and connectivity between populations of species over long periods of time;

  • Maintaining landscape/ecosystems processes associated with geological, altitudinal and climatic gradients, to allow for ecological responses to climate change;

  • Maintaining large scale seasonal/migratory species processes and movement of fauna;

  • Maximising connectivity between large tracts/patches of remnant vegetation;

  • Identifying key areas for rehabilitation and offsets; and

- **Riparian** Bioregional Corridors also maintain and encourage connectivity of riparian and associated ecosystems.

The location of the corridors is determined by the following principles:

- Terrestrial

  • Complement riparian landscape corridors (i.e. minimise overlap and maximise connectivity);

  • Follow major watershed/catchment and/or coastal boundaries;

  • Incorporate major altitudinal/geological/climatic gradients;

  • Include and maximise connectivity between large tracts/patches of remnant vegetation;

  • Include and maximise connectivity between remnant vegetation in good condition; and

- Riparian

  • Located on the major river or creek systems within the bioregion in question.

The total extent of remnant vegetation triggered as being of "State", "Regional" or "Local" significance due to the presence of an overlying BPA derived terrestrial or riparian corridor within the AOI, is provided in the following table. For further information on how remnant vegetation is triggered due to the presence of an overlying BPA derived corridor, refer to the relevant landscape BPA expert panel report(s).

Table 14: Extent of triggered remnant vegetation due to the presence of BPA derived corridors with respect to the AOI

Biodiversity Significance	Area (Ha)	% of AOI
State	580.53	5.17
Regional	129.53	1.15
Local	0.0	0.0

NB: area figures associated with the extent of corridor triggered remnant vegetation are only available for those bioregions where a BPA has been undertaken.

Refer to **Map 3** for further information.

Threatening process/condition (Criteria K) - areas identified by experts under this criterion may be used to amend (upgrade or downgrade) biodiversity significance arising from the "first-cut" analysis. The condition of remnant vegetation is affected by threatening processes such as weeds, ferals, grazing and burning regime, selective timber harvesting/removal, salinity, soil erosion, and climate change.

Assessment of Criteria K with respect to the AOI is not currently included in the "Biodiversity and Conservation Values" report, as it has not been applied to the majority of Queensland due to data/information limitations and availability.

Special Area Decisions

Expert panel derived "Special Area Decisions" are used to assign values to Other Essential Criteria. The specific decisions which relate to the AOI in question are listed in the table below.

Table 15: Expert panel decisions for assigning levels of biodiversity significance with respect to the AOI

Decision Number	Description	Panel Recommended Significance	Criteria Values
seq_fa_02	Lowland rainforest & wet sclerophyll forest	State	Ib (wildlife refugia): VERY HIGH
seqs_fl_30	Teviot Range - Flinders Peak centred on a cluster of intrusive volcanic plugs of Tertiary age (Mts Blaine, Catherine, Goolman, Perry, Welcome, Flinders Peak and Ivorys Rock)	Regional	Ia (SEQ endemic taxa): HIGH Ib (wildlife refugia): HIGH Id (limits of geographic range): MEDIUM
seqs_fl_31	Purga wetland	Regional	Ib (wildlife refugia): VERY HIGH
seqs_l_22	Terrestrial bioregional corridors	State or Regional	Criterion J
seqs_l_49	Riparian bioregional corridors	State	Criterion J
seqs_l_57	Riparian lowland forest systems (other than riparian/gallery rainforests systems)	State	Ib (wildlife refugia): VERY HIGH Ie (high species richness: HIGH Ii (hollow bearing trees): HIGH

Expert panel decision descriptions:

seq_fa_02

Across the entire bioregion, all rainforest and wet sclerophyll forest with a rainforest understory at elevations of < 300m asl be designated as being of State significance. Based on importance for mesic fauna (e.g. Richmond birdwing Ornithoptera richmondia, giant barred-frog Mixophyes iteratus, Fleay's barred-frog Mixophyes fleayi, Coxen's fig-parrot Cyclopsitta diophthalma coxeni), and as drought/fire refugia.

seqs_fl_30

- SEQ endemic taxa (Criterion Ia): Arundinella montana, Cupaniopsis tomentella, Eucalyptus major, Marsdenia coronata, Notelaea lloydii, Planchonella eerwah, Rhodamnia dumicola, Tephrosia sp. (The Grampians L.H.Bird AQ565381), Zieria scopulus (Note - some of the above taxa are based on input at Panel and are not listed in WILDNET).
- Wildlife refugia (Criterion Ib): area to west is changing from rural to urban as part of implementation of SEQ Regional Plan.
- Taxa at limits of geographic range Criterion Id): Acacia obtusifolia, Melaleuca comboynensis - both species occur along Border Ranges to south.

seqs_fl_31

- Wildlife refugia (Criterion Ib): wetland contains an unusual floodplain with anastomotic channels in deep cracking clay soils, with adjacent slopes containing Melaleuca irbyana seasonally flooded forests. Area includes tributaries, floodplain, elevated intermittent marshes and seasonal to permanent low-lying waterholes.

seqs_l_22

The expert panel reviewed the existing bioregional corridors for southern SEQ. Corridors were assigned as being of State or Regional significance.

For further information, refer to section 2.3.2 and 3.2 of this report.

seqs_l_49

The riparian bioregional corridors provide connectivity through lowland areas of SEQ.

See Table 4 for list of waterways considered riparian corridors.

For further information, refer to sections 2.3.2 and 3.2 of this report.

seqs_l_57

Riparian lowland forest ecosystems are important components of the lowland landscape, frequently exhibiting higher species richness and abundance than surrounding habitats. They act as movement pathways along riparian systems for a number of species, especially birds. They also often provide critical resources for many species in terms of food, shelter and nesting sites. For example, the seasonal flowering of melaleuca is important for species of honeyeaters, whilst narrow bands of flooded gum along watercourses are significant habitat for koalas Phascolarctos cinereus, especially in times of drought. Large trees in these systems also act as a source of nest hollows for many species of birds, bats and arboreal mammals. (Lovett Price 2007)

Due to historical and preferential clearing in SEQ, remaining systems are often heavily fragmented and have undergone a substantial reduction in their extent. In many areas, condition is often poor and subject to considerable weed problems.

Values include:

- Wildlife refugia (Criterion Ib).
- High species richness (Criterion Ie).
- Larger trees in such systems are often a significant source of nest hollows (Criterion Ii).

Note - for the same decision relevant to the northern portion of the SEQ bioregion refer to seqn_l_50.

Aquatic Conservation Assessments

Introduction

The Aquatic Biodiversity Assessment and Mapping Method or AquaBAMM (Clayton *et al.* 2006), was developed to assess conservation values of wetlands in queensland, and may also have application in broader geographical contexts. It is a comprehensive method that uses available data, including data resulting from expert opinion, to identify relative wetland conservation/ecological values within a specified study area (usually a catchment). The product of applying this method is an Aquatic Conservation Assessment (ACA) for the study area.

An ACA using AquaBAMM is non-social, non-economic and identifies the conservation/ecological values of wetlands at a user-defined scale. It provides a robust and objective conservation assessment using criteria, indicators and measures that are founded upon a large body of national and international literature. The criteria, each of which may have variable numbers of indicators and measures, are naturalness (aquatic), naturalness (catchment), diversity and richness, threatened species and ecosystems, priority species and ecosystems, special features, connectivity and representativeness. An ACA using AquaBAMM is a powerful decision support tool that is easily updated and simply interrogated through a geographic information system (GIS).

Where they have been conducted, ACAs can provide a source of baseline wetland conservation/ecological information to support natural resource management and planning processes. They are useful as an independent product or as an important foundation upon which a variety of additional environmental and socio-economic elements can be added and considered (i.e. an early input to broader 'triple-bottom-line' decision-making processes). An ACA can have application in:

- determining priorities for protection, regulation or rehabilitation of wetlands and other aquatic ecosystems
- on-ground investment in wetlands and other aquatic ecosystems
- contributing to impact assessment of large-scale development (e.g. dams)
- water resource and strategic regional planning prcesses

For a detailed explanation of the methodology please refer to the summary and expert panel reports relevant to the ACA utilised in this assessment. These reports can be accessed at Wetland *Info*:

http://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

http://qspatial.information.qld.gov.au/geoportal/

Explanation of Criteria

Under the AquaBAMM, eight criteria are assessed to derive an overall conservation value. Similar to the Biodiversity Assessment and Mapping Methodology, the criteria may be primarily diagnostic (quantitative) or primarily expert opinion (qualitative) in nature. The following sections provide a brief description of each of the 8 criteria.

Criteria 1. Naturalness - Aquatic: This attribute reflects the extent to which a wetland's (riverine, non-riverine, estuarine) aquatic state of naturalness is affected through relevant influencing indicators which include: presence of exotic flora and fauna; presence of aquatic communities; degree of habitat modification and degree of hydrological modification.

Criteria 2. Naturalness - Catchment: The naturalness of the terrestrial systems of a catchment can have an influence on many wetland characteristics including: natural ecological processes e.g. nutrient cycling, riparian vegetation, water chemistry, and flow. The indicators utilised to assess this criterion include: presence of exotic flora and/or fauna; riparian, catchment and flow modification.

Criteria 3. Naturalness - Diversity and Richness: This criterion is common to many ecological assessment methods and can include both physical and biological features. It includes such indicators as species richness, riparian ecosystem richness and geomorphological diversity.

Criteria 4. Threatened Species and Ecosystems: This criterion evaluates ecological rarity characteristics of a wetland. This includes both species rarity and rarity of communities / assemblages. The communities and assemblages are best represented by regional ecosystems. Species rarity is determined by NCA and EPBC status with Endangered, Vulnerable or Near-threatened species being included in the evaluation. Ecosystem rarity is determined by regional ecosystem biodiversity status i.e. Endangered, Of Concern, or Not of Concern.

Criteria 5. Priority Species and Ecosystems: Priority flora and fauna species lists are expert panel derived. These are aquatic, semi-aquatic and riparian species which exhibit at least 1 particular trait in order to be eligible for consideration. For

flora species the traits included:

- It forms significant macrophyte beds (in shallow or deep water).
- It is an important food source.
- It is important/critical habitat.
- It is implicated in spawning or reproduction for other fauna and/or flora species.
- It is at its distributional limit or is a disjunct population.
- It provides stream bank or bed stabilisation or has soil binding properties.
- It is a small population and subject to threatening processes.

Fauna species are included if they meet at least one of the following traits:

- It is endemic to the study area (>75 per cent of its distribution is in the study area/catchment).
- It has experienced, or is suspected of experiencing, a serious population decline.
- It has experienced a significant reduction in its distribution and has a naturally restricted distribution in the study area/catchment.
- It is currently a small population and threatened by loss of habitat.
- It is a significant disjunct population.
- It is a migratory species (other than birds).
- A significant proportion of the breeding population (>one per cent for waterbirds, >75 per cent other species) occurs in the waterbody (see Ramsar criterion 6 for waterbirds).
- Limit of species range.

See the individual expert panel reports for the priority species traits specific to an ACA.

Criteria 6. Special Features: Special features are areas identified by flora, fauna and ecology expert panels which exhibit characteristics beyond those identified in other criteria and which the expert panels consider to be of the highest ecological importance. Special feature traits can relate to, but are not solely restricted to geomorphic features, unique ecological processes, presence of unique or distinct habitat, presence of unique or special hydrological regimes e.g. spring-fed streams. Special features are rated on a 1 - 4 scale (4 being the highest).

Criteria 7. Connectivity: This criterion is based on the concept that appropriately connected aquatic ecosystems are healthy and resilient, with maximum potential biodiversity and delivery of ecosystem services.

Criteria 8. Representativeness: This criterion applies primarily to non-riverine assessments, evaluates the rarity and uniqueness of a wetland type in relation to specific geographic areas. Rarity is determined by the degree of wetland protection within "protected Areas" estate or within an area subject to the *Fisheries Act 1994*, *Coastal Protection and Management Act 1995*, or *Marine Parks Act 2004*. Wetland uniqueness evaluates the relative abundance and size of a wetland or wetland management group within geographic areas such as catchment and subcatchment.

Riverine Wetlands

Riverine wetlands are all wetlands and deepwater habitats within a channel. The channels are naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water. AquaBAMM, when applied to riverine wetlands uses a discrete spatial unit termed subsections. A subsection can be considered as an area which encompasses discrete homogeneous stream sections in terms of their natural attributes (i.e. physical, chemical, biological and utilitarian values) and natural resources. Thus in an ACA, an aquatic conservation significance score is calculated for each subsection and applies to all streams within a subsection, rather than individual streams as such.

Please note, the area figures provided in Tables 16 and 17, are derived using the extent of riverine subsections within the AOI. Refer to **Map 5** for further information. A summary of the conservation significance of riverine wetlands within the AOI is provided in the following table.

Table 16: Overall level/s of riverine aquatic conservation significance

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
High	0.0	0.0
Medium	7,280.59	64.88
Low	2,659.35	23.7
Very Low	1,281.78	11.42

The individual aquatic conservation criteria ratings for riverine wetlands within the AOI are listed below.

Table 17: Level/s of riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
1. Naturalness aquatic			2,834.80	25.3	8,386.93	74.7		
2. Naturalness catchment			4,400.05	39.2	3,565.03	31.8	3,256.65	29.0
3. Diversity and richness	814.15	7.3	5,549.38	49.5	4,784.25	42.6	73.95	0.7
4. Threatened species and ecosystems					8,599.21	76.6		
5. Priority species and ecosystems	2,671.77	23.8	1,812.18	16.1	5,456.01	48.6		
6. Special features								
7. Connectivity	1,219.97	10.9			1,522.92	13.6	8,478.84	75.6
8. Representative-ness								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to riverine wetlands within the AOI.

Table 18: Expert panel decisions for assigning overall levels of riverine aquatic conservation significance

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

Non-riverine Wetlands

Non-riverine wetlands include both lacustrine and palustrine wetlands, however, do not currently incorporate estuarine, marine or subterranean wetland types. A summary of the conservation significance of non-riverine wetlands within the AOI is provided in the following table. Refer to **Map 6** for further information.

Table 19: Overall level/s of non-riverine aquatic conservation significance

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
Very High	81.38	0.73
High	0.0	0.0
Medium	14.46	0.13
Low	0.0	0.0
Very Low	13.05	0.12

The following table provides an assessment of non-riverine wetlands within the AOI and associated aquatic conservation criteria values.

Table 20: Level/s of non-riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
1. Naturalness aquatic			25.13	0.2	54.66	0.5	29.1	0.3
2. Naturalness catchment			4.94		56.7	0.5	47.25	0.4
3. Diversity and richness	28.65	0.3	22.51	0.2	49.41	0.4	8.32	0.1
4. Threatened species and ecosystems	79.93	0.7	13.57	0.1	1.61			
5. Priority species and ecosystems	30.49	0.3	50.03	0.4	14.15	0.1		
6. Special features	81.38	0.7						
7. Connectivity								
8. Representative-ness	68.32	0.6	13.06	0.1				

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to non-riverine wetlands within the AOI.

Table 21: Expert panel decisions for assigning overall levels of non-riverine aquatic conservation significance.

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
br_nr_ec_01	Oxbows	Bremer	6.3.1	4
br_nr_ec_02	Purga wetlands	Bremer	6.3.1	4
br_nr_ec_03	Ephemeral wetlands	Bremer	5.2.1, 6.3.1	4, 4
br_nr_fa_01	Aratula wetlands	Bremer	5.1.4	4
lg_nr_ec_04	Ephemeral wetlands	Logan	5.2.1, 6.3.1	4,4

4 is the highest rating/value

Expert panel decision descriptions:

br_nr_ec_01

Oxbow lakes RE 12.3.7c. Similar refugial values to RE 12.3.8 (possibly better as they are wetter for longer). Old palaeo-channels that have near permanent water and provide fish refuge in times of floods. Characterised by hollow forming bluegums.

br_nr_ec_02

Melaleuca irbayana present (EPBC Act threatened ecological community), oxbow lakes, 10 to 15 semi-permanent and permanent pools. Diverse habitat of small wetlands. Not captured in the wetland mapping except for some small wetlands.

br_nr_ec_03

Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.

br_nr_fa_01

Significant waterbird habitat.

lg_nr_ec_04

Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.

Threatened and Priority Species

Introduction

This chapter contains a list of threatened and priority flora and/or fauna species that have been recorded on, or within 4km of the Assessment Area.

The information presented in this chapter with respect to species presence is derived from compiled databases developed primarily for the purpose of BPAs and ACAs. Data is collated from a number of sources and is updated periodically.

It is important to note that the list of species provided in this report, may differ when compared to other reports generated from other sources such as the State government's WildNet, Herbrecs or the federal government's EPBC database for a number of reasons.

Records for threatened and priority species are filtered and checked based on a number of rules including:

- Taxonomic nomenclature - current scientific names and status,
- Location - cross-check co-ordinates with location description,
- Taxon by location - requires good knowledge of the taxon and history of the record,
- Duplicate records - identify and remove,
- Expert panels - check records and provide new records,
- Flora cultivated records excluded,
- Use precise records less than or equal to 2000m,
- Use recent records greater than or equal to 1975 animals, greater than or equal to 1950 plants.

Threatened Species

Threatened species are those species classified as "Endangered" or "Vulnerable" under the *Environment Protection and Biodiversity Conservation Act 1999* or "Endangered", "Vulnerable" or "Near threatened" under the *Nature Conservation Act 1992*.

The following threatened species have been recorded on, or within approximately 4km of the AOI.

Table 22: Threatened species recorded on, or within 4km of the AOI

Species	Common name	NCA status	EPBC status	Back on Track rank	Migratory species*	Wetland species**	Identified flora/fauna
Adelotus brevis	tusked frog	V		Medium		Y	FA
Callitris baileyi	Bailey's cypress	NT		High			FL
Cupaniopsis tomentella	Boonah tuckeroo	V	V	Low			FL
Dasyurus maculatus maculatus	spotted-tailed quoll (southern subspecies)	V	E	High			FA
Marsdenia coronata	slender milkvine	V		Low			FL
Melaleuca irbyana		E		Medium			FL
Ninox strenua	powerful owl	V		Medium			FA
Notelaea lloydii	Lloyd's native olive	V	V	Low			FL
Numenius madagascariensis	eastern curlew	E	CE	Low	Y	Y	FA
Petauroides volans	greater glider	V	V	Low			FA
Petrogale penicillata	brush-tailed rock-wallaby	V	V	High			FA

Species	Common name	NCA status	EPBC status	Back on Track rank	Migratory species*	Wetland species**	Identified flora/fauna
Phascolarctos cinereus	koala	V	V	Low			FA
Phascolarctos cinereus	Koala	V	V				FA
Planchonella eerwah		E	E	Low			FL
Rostratula australis	Australian painted snipe	V	E	Medium		Y	FA
Sophora fraseri	brush sophora	V	V	Low			FL
Turnix melanogaster	black-breasted button-quail	V	V	Critical			FA

NB. Please note that the threatened species listed in this section are based upon the most recently compiled DES internal state-wide threatened species dataset. This dataset may contain additional records that were not originally available for inclusion in the relevant individual BPAs and ACAs.

**JAMBA - Japan-Australia Migratory Bird Agreement; CAMBA - China-Australia Migratory Bird Agreement; ROKAMBA - Republic of Korea-Australia Migratory Bird Agreement; CMS - Convention on the Conservation of Migratory Species*.

***Y - wetland indicator species*.

BPA Priority Species

A list of BPA priority species that have been recorded on, or within approximately 4km of the AOI is contained in the following table.

Table 23: Priority species recorded on, or within 4km of the AOI

Species	Common name	Back on Track rank	Identified flora/fauna
Cheramoeca leucosterna	White-backed Swallow	Low	FA
Cherax dispar	Lobby	Low	FA
Cyclorana alboguttata	Greenstripe Frog	Low	FA
Cyclorana brevipes	Superb Collared Frog	Low	FA
Delma plebeia	Common Delma	Medium	FA
Ephippiorhynchus asiaticus	Black-necked Stork	Low	FA
Erythrina numerosa			FL
Fastosarion papillosa	Black-tasselled Semi-slug		FA
Gossia hillii			FL
Limnodynastes salmini	Salmon Striped Frog	Low	FA
Litoria brevipalmata	Green-thighed Frog	Medium	FA
Litoria dentata	Bleating Treefrog	Low	FA
Melithreptus gularis	Black-chinned Honeyeater	Low	FA
Mormopterus norfolkensis	East-coast Freetail Bat	Low	FA
Mugil cephalus	Sea Mullet	Low	FA
Nautiliropa omicron	Red-flamed Pinwheel Snail		FA
Phascogale tapoatafa tapoatafa	Brush-tailed Phascogale	Low	FA
Pomatostomus temporalis	Grey-crowned Babbler		FA
Pseudechotrida bordaensis	Lamington Carnivorous Snail		FA

Species	Common name	Back on Track rank	Identified flora/fauna
Pteropus alecto	Black Flying-fox	Low	FA
Rhodamnia dumicola	rib-fruited malletwood		FL
Rhodamnia rubescens			FL
Scoteanax rueppellii	Greater Broad-nosed Bat	Medium	FA
Squamagenia separanda	Pine Rivers Bristle Snail		FA
Syzygium oleosum	blue cherry		FL
Terrycarlessia bullacea	Bunya Mountains Carnivorous Snail		FA
Trachystoma petardi	Pinkeye Mullet	Low	FA

NB. Please note that the list of priority species is based on those species identified in the BPAs, however records for these species may be more recent than the originals used. furthermore, the BPA priority species databases are updated from time to time. At each update, the taxonomic details for all species are amended as necessary to reflect current taxonomic name and/or status changes.

ACA Priority Species

A list of ACA priority species used in riverine and non-riverine ACAs that have been recorded on, or within approximately 4km of the AOI are contained in the following tables.

Table 24: Priority species recorded on, or within 4 km of the AOI - riverine

Species	Common name	Back on Track rank	Identified flora/fauna
Acrocephalus australis	Australian Reed-Warbler	L	FA
Anguilla australis	Southern Shortfin Eel	L	FA
Anguilla reinhardtii	Longfin Eel	L	FA
Ardea ibis	Cattle Egret	Low	FA
Ardea modesta	Eastern Great Egret	Low	FA
Castanospermum australe	black bean		FL
Casuarina glauca	swamp she-oak		FL
Eucalyptus tereticornis			FL
Ficus coronata	creek sandpaper fig		FL
Ficus fraseri	white sandpaper fig		FL
Ficus macrophylla			FL
Haliaeetus leucogaster	White-bellied Sea-Eagle	L	FA
Hydrilla verticillata	hydrilla		FL
Macquaria novemaculeata	Australian Bass	L	FA
Melaleuca viminalis		L	FL
Mugil cephalus	Sea Mullet	L	FA
Rostratula australis	Australian Painted Snipe	M	FA
Trachystoma petardi	Pinkeye Mullet	L	FA
Typha domingensis			FL
Typha orientalis	broad-leaved cumbungi		FL

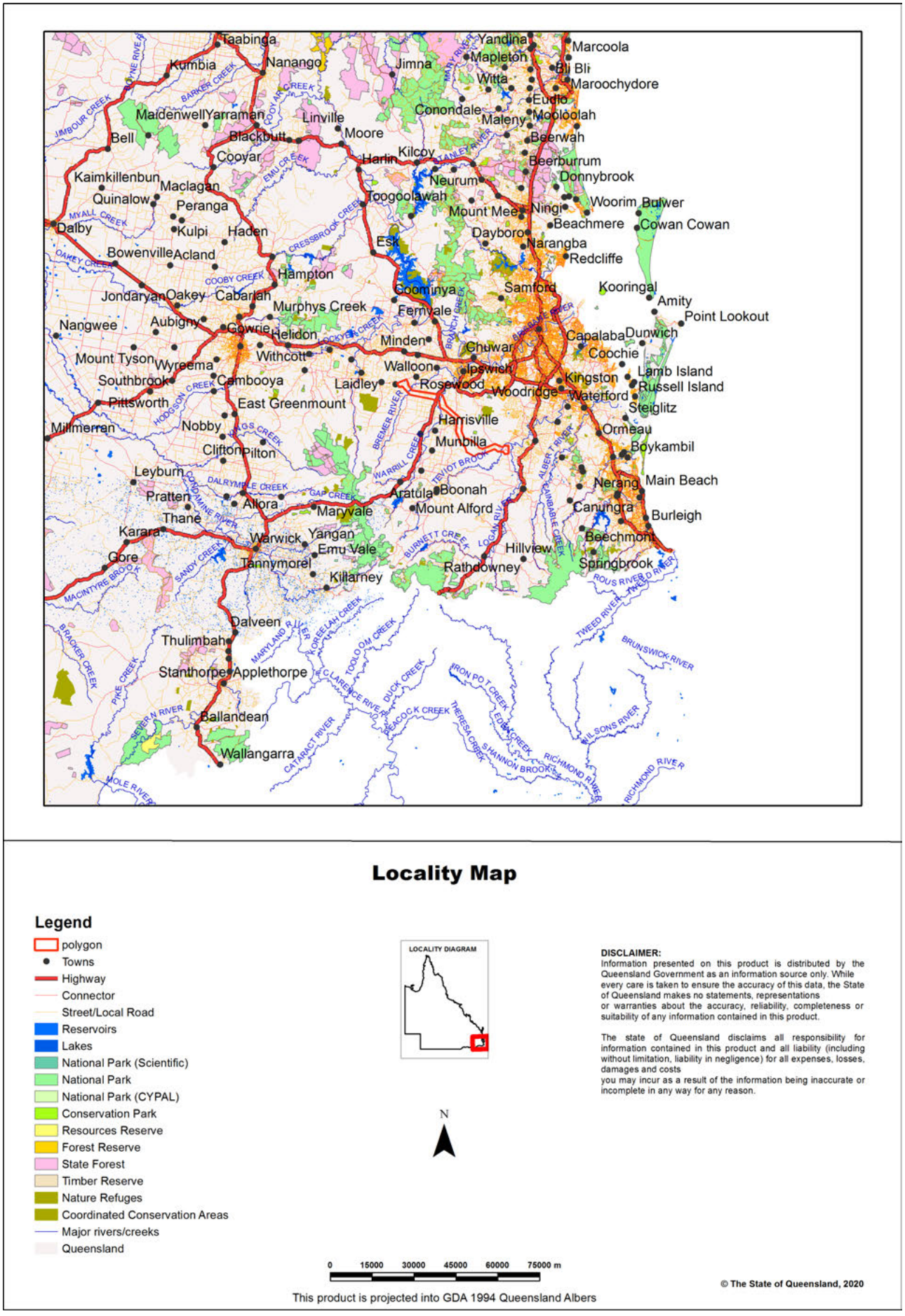
Table 25: Priority species recorded on, or within 4 km of the AOI - non-riverine

Species	Common name	Back on Track rank	Identified flora/fauna
Acrocephalus australis	Australian Reed-Warbler	L	FA
Anguilla australis	Southern Shortfin Eel	L	FA
Anguilla reinhardtii	Longfin Eel	L	FA
Ardea ibis	Cattle Egret	Low	FA
Ardea modesta	Eastern Great Egret	Low	FA
Calidris melanotos	Pectoral Sandpiper	L	FA
Cherax dispar	Lobby	L	FA
Cyclorana alboguttata	Greenstripe Frog	L	FA
Cyclorana brevipes	Superb Collared Frog	L	FA
Eucalyptus tereticornis			FL
Haliaeetus leucogaster	White-bellied Sea-Eagle	L	FA
Limnodynastes salmini	Salmon Striped Frog	L	FA
Plegadis falcinellus	Glossy Ibis	L	FA
Rostratula australis	Australian Painted Snipe	M	FA
Tringa stagnatilis	Marsh Sandpiper	L	FA
Typha domingensis			FL
Typha orientalis	broad-leaved cumbungi		FL

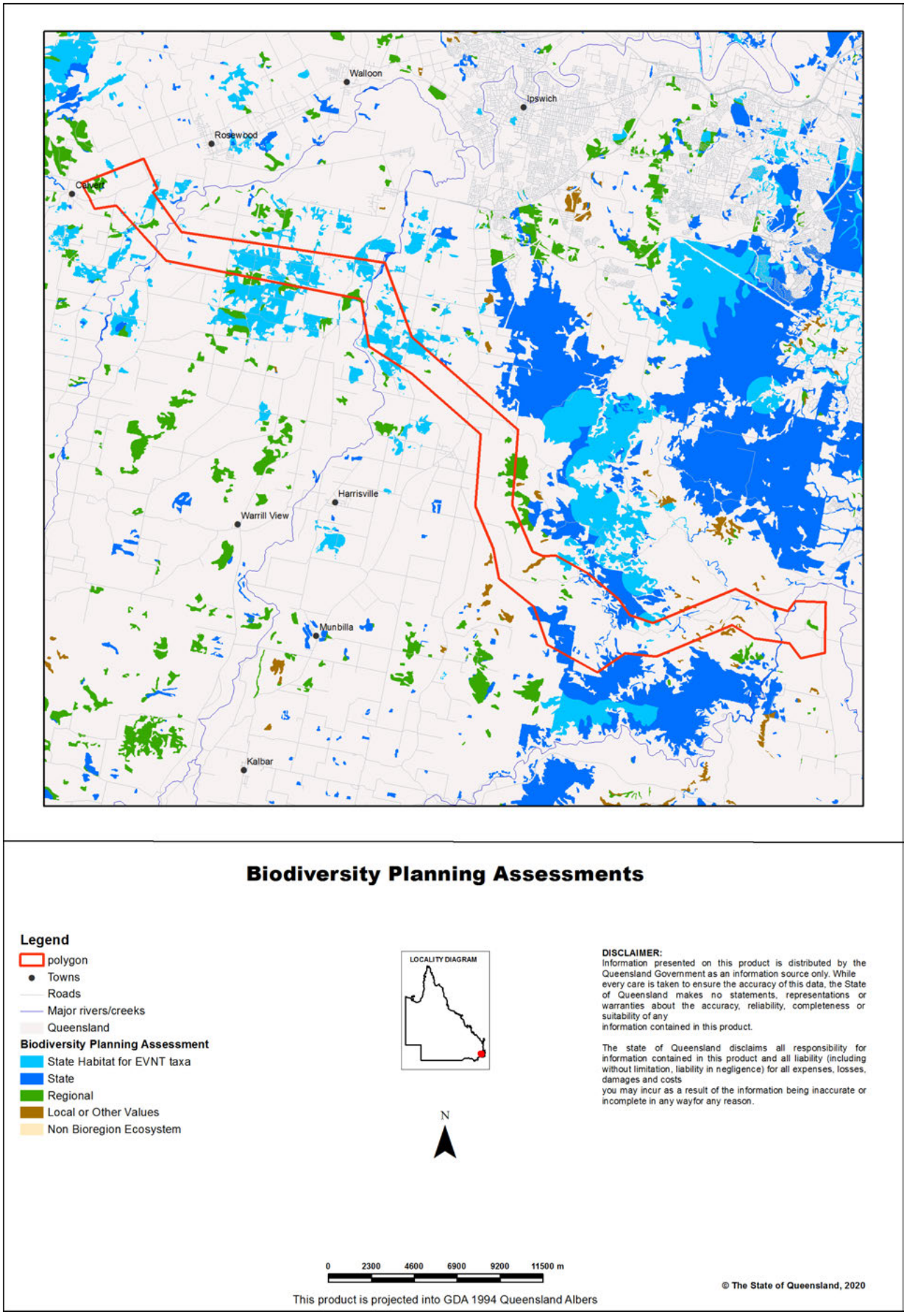
NB. Please note that the priority species records used in the above two tables are comprised of those adopted for the released individual ACAs. The ACA riverine and non-riverine priority species databases are updated from time to time to reflect new release of ACAs. At each update, the taxonomic details for all ACAs records are amended as necessary to reflect current taxonomic name and/or status changes.

Maps

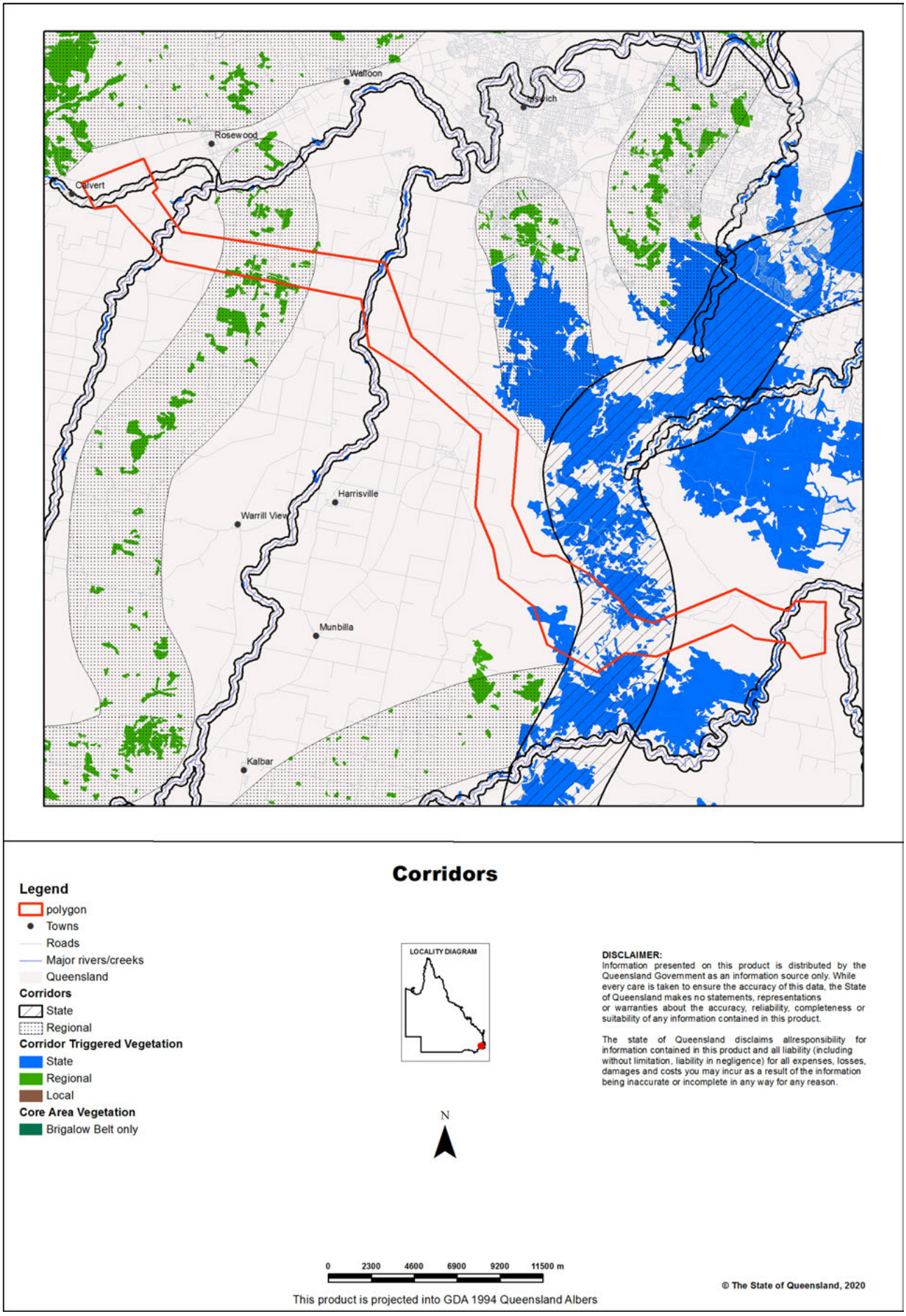
Map 1 - Locality Map



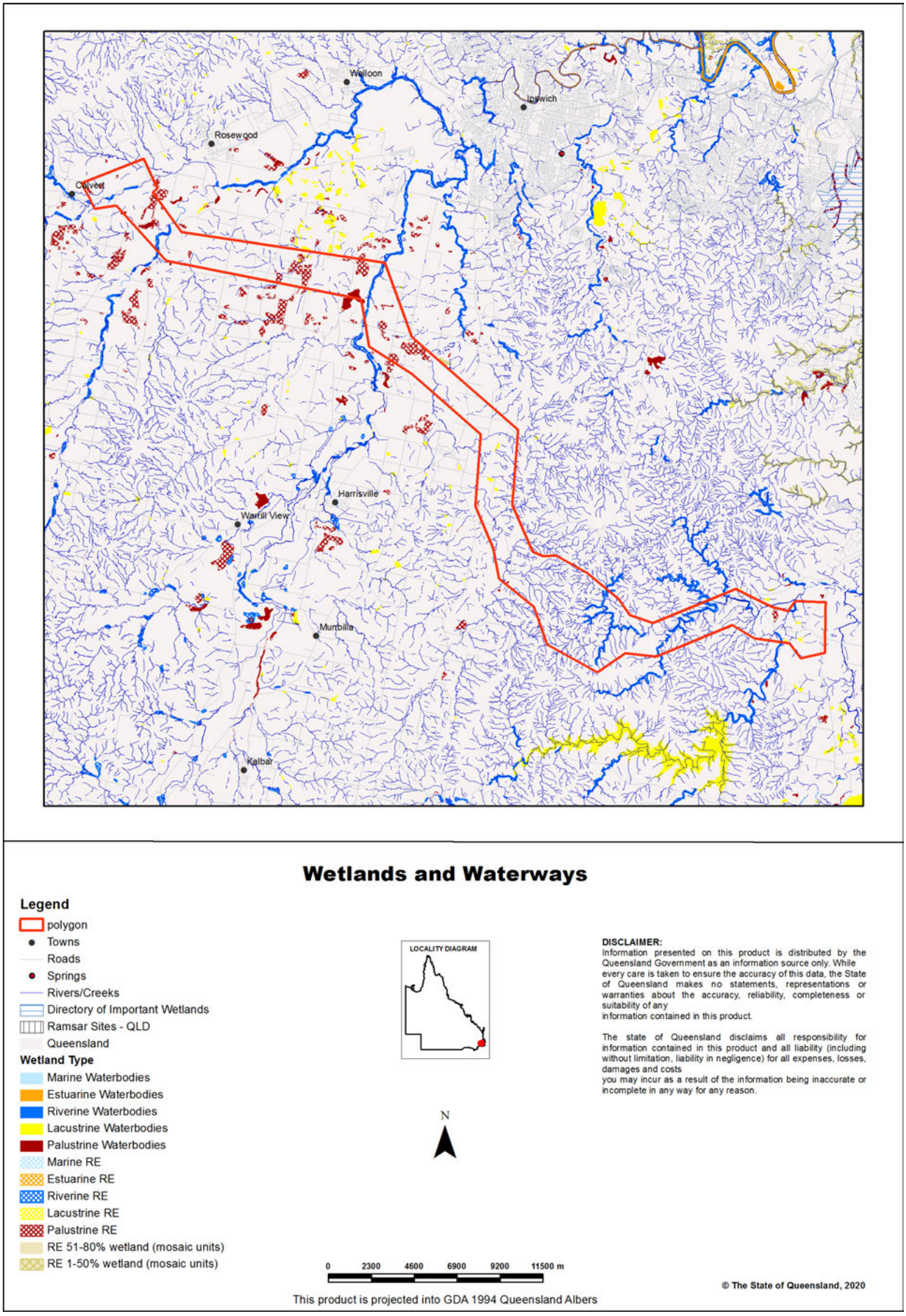
Map 2 - Biodiversity Planning Assessment (BPA)



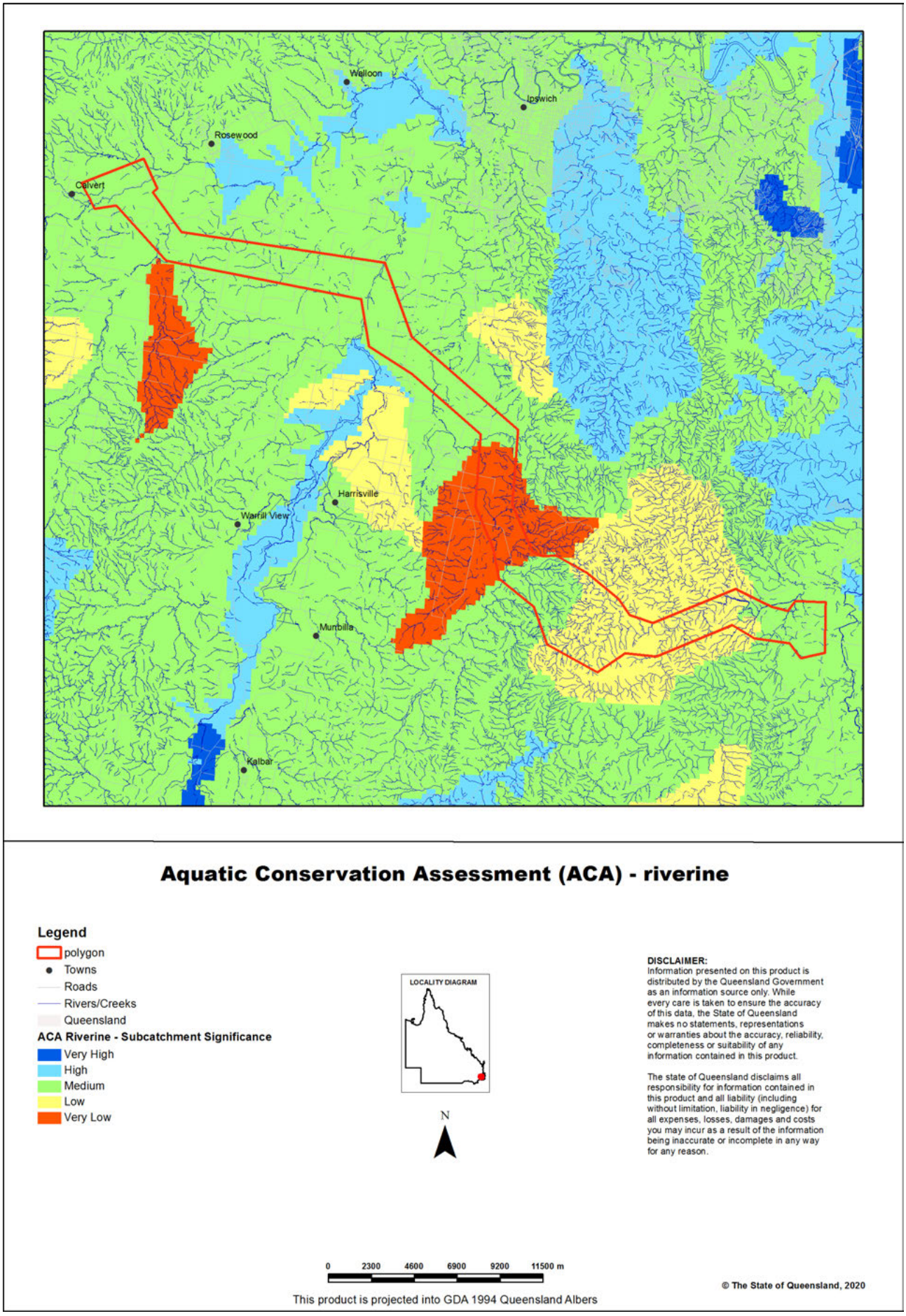
Map 3 - Corridors



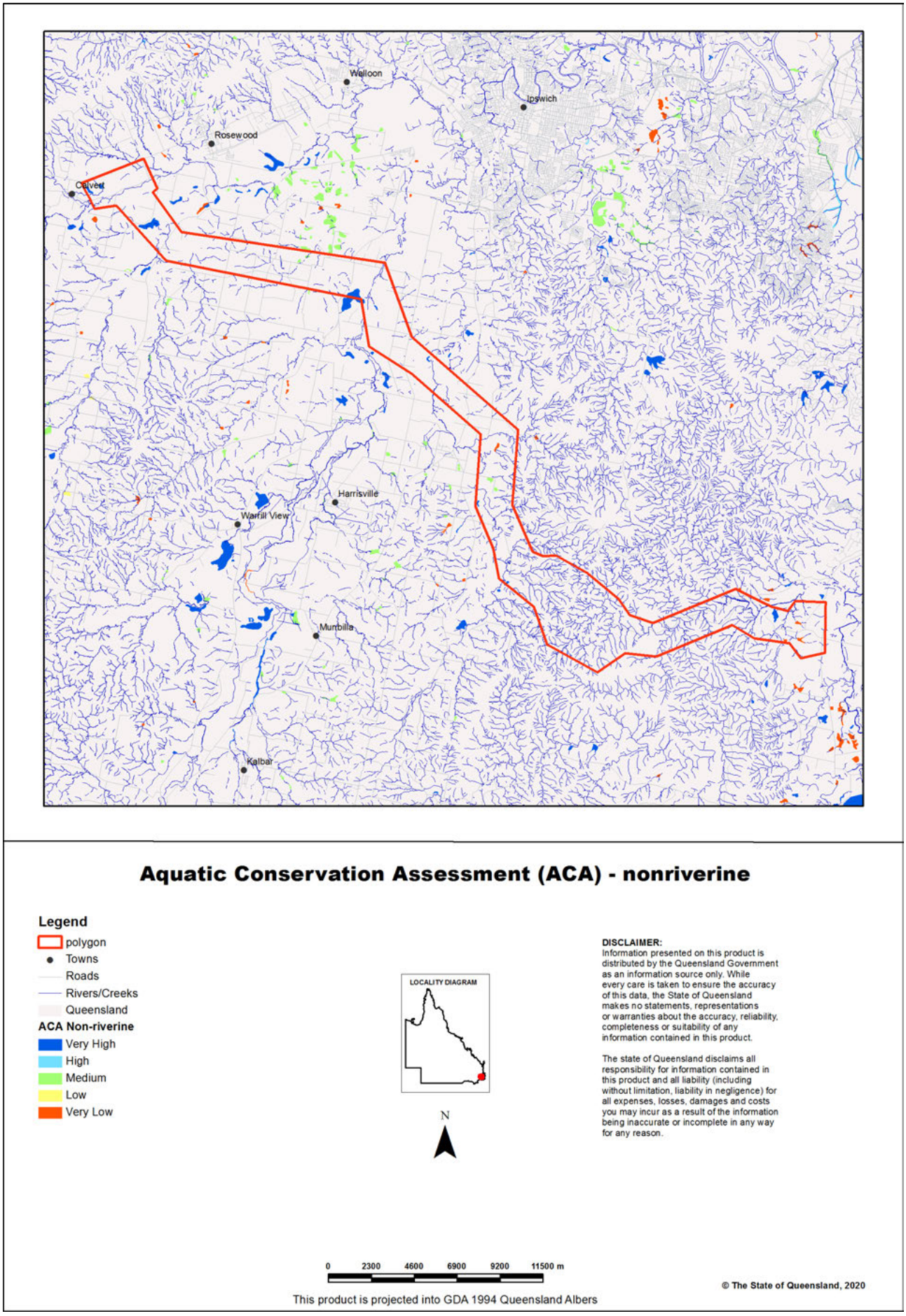
Map 4 - Wetlands and waterways



Map 5 - Aquatic Conservation Assessment (ACA) - riverine



Map 6 - Aquatic Conservation Assessment (ACA) - non-riverine



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Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

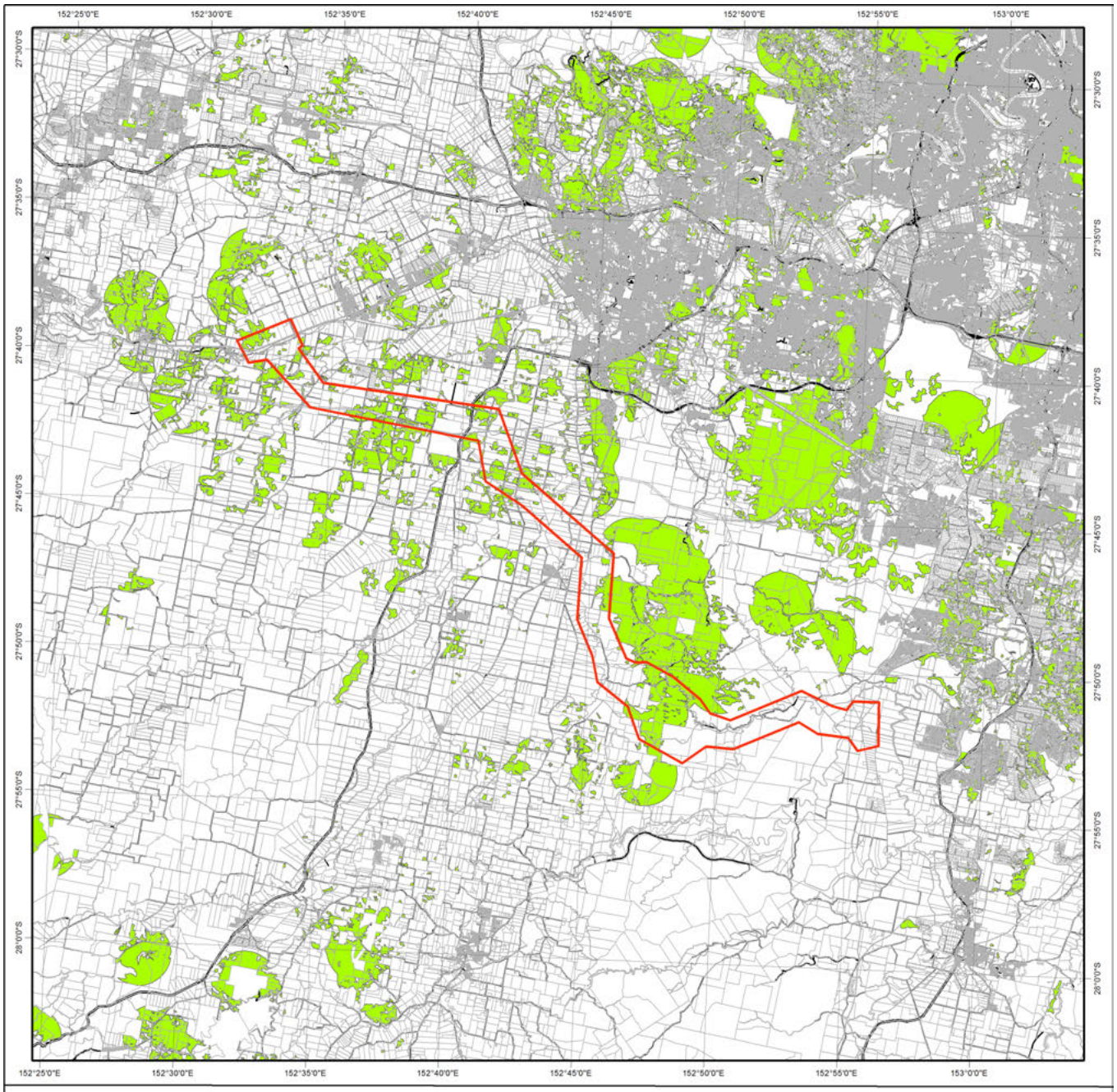
Theme	Datasets
Aquatic Conservation Assessments Non-riverine*	Combination of the following datasets: Cape York Peninsula Non-riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Non-riverine v1.3 Lake Eyre and Bulloo Basins v1.1 QMDB Non-riverine ACA v1.4 Southeast Queensland ACA v1.1 WBB Non-riverine ACA v1.1
Aquatic Conservation Assessments Riverine*	Combination of the following datasets: Cape York Peninsula Riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Riverine v1.1 Lake Eyre and Bulloo Basins v1.1 QMDB Riverine ACA v1.4 Southeast Queensland ACA v1.1 WBB Riverine ACA v1.1
Biodiversity Planning Assessments*	Combination of the following datasets: Brigalow Belt BPA v2.1 Cape York Peninsula BPA v1.1 Central Queensland Coast BPA v1.3 Channel Country BPA v1.1 Desert Uplands BPA v1.3 Einasleigh Uplands BPA v1.1 Gulf Plains BPA v1.1 Mitchell Grass Downs BPA v1.1 Mulga Lands BPA v1.4 New England Tableland v2.3 Southeast Queensland v4.1 Wet Tropics v1.1
Statewide BPA Corridors*	Statewide corridors v1.5
Threatened Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.
BPA Priority Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.
ACA Priority Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.

***These datasets are available at:**

http://dds.information.qld.gov.au/DDS

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
ACA	- Aquatic Conservation Assessment
AQUABAMM	- Aquatic Biodiversity Assessment and Mapping Methodology
BAMM	- Biodiversity Assessment and Mapping Methodology
BoT	- Back on Track
BPA	- Biodiversity Planning Assessment
CAMBA	- China-Australia Migratory Bird Agreement
DES	- Department of Environment and Science
EPBC	- *Environment Protection and Biodiversity Conservation Act 1999*
EVNT	- Endangered, Vulnerable, Near Threatened
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
JAMBA	- Japan-Australia Migratory Bird Agreement
NCA	- *Nature Conservation Act 1992*
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
ROKAMBA	- Republic of Korea-Australia Migratory Bird Agreement

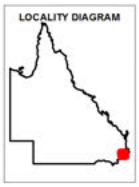


Protected Plants Flora Survey Trigger Map

Legend

- polygon
- High risk area
- Cadastral line
  Property boundaries shown are provided as a locational aid only
- Freeways / motorways / highways
- Secondary roads / streets

LOCALITY DIAGRAM



N

0 2,400 4,800 7,200 9,600 12,000 m

This product is projected into:
GDA 1994 Queensland Albers

This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Science at palm@ehp.qld.gov.au

Disclaimer:
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

Protected plants flora survey trigger map

The protected plants flora survey trigger map identifies 'high risk areas' where endangered, vulnerable or near threatened plants are known to exist or are likely to exist. Under the *Nature Conservation Act 1992* (the Act) it is an offence to clear protected plants that are 'in the wild' unless you are authorised or the clearing is exempt, for more information see section 89 of the Act.

Please see the Department of Environment and Science webpage on the clearing of protected plants for information on what exemptions may apply in your circumstances, whether you may need to undertake a flora survey, and whether you may need a protected plants clearing permit.

Updates to the data informing the flora survey trigger map

The flora survey trigger map will be reviewed, and updated if necessary, at least every 12 months to ensure the map reflects the most up-to-date and accurate data available.

Species information

Please note that flora survey trigger maps do not identify species associated with 'high risk areas'. While some species information may be publicly available, for example via the Queensland Spatial Catalogue, the Department of Environment and Science does not provide species information on request. Regardless of whether species information is available for a particular high risk area, clearing plants in a high risk area may require a flora survey and/or clearing permit. Please see the Department of Environment and Science webpage on the clearing of protected plants for more information.

Flying fox camp locations in Queensland

DISCLAIMER
This map has been prepared with all due diligence and care, based on the best available information at the time of publication. Neither the Department nor the Queensland Government holds any responsibility for any errors or omissions within this document. Any decisions made by other parties based on this document are solely the responsibility of those parties.

Legend

- Major urban centres
- Regional towns
- EHP monitored roosts
- Other camp locations
- Highways and main roads

0 25 50 100 150 200 250 km

Horizontal datum: GDA94
Projection: geographical coordinates
Produced by
Department of Environment and Heritage Protection

140°0'0"E
145°0'0"E
150°0'0"E
10°0'0"S
15°0'0"S
20°0'0"S
25°0'0"S
30°0'0"S

Thursday Island
Weipa (Andoom)
Weipa
Coen
Hope Vale
Cooktown
Annan River - Oaky Creek
Newell Beach / Mossman River Estuary
Mossman
Kuranda
Cairns
Blackfellow Creek
Fishery Falls
Almaden
Millaa Millaa
Innisfail
Whitehaven Road
Castaways
Bilyana Road
Dunk Island
Cardwell Oyster Point
Porters Creek
Dungeness
Ingham
South Townsville
Townsville
Nome
Mouth of Barramundi Creek
Armstrong Creek
Bowen
Elliot River
Daydream Island
Palm Creek
Repulse Creek
Kelsey Creek
Keswick Island
Redcliffevale
North Eton
Mackay
Moranbah, Forrest Drive
Sarina
Marion Creek
Moranbah
Dysart
Clermont
Middlemount
Clermont, Capella Street
Yeppoon, Ross Creek
Yaamba
Long Island
Rockhampton
Emerald
Blackwater
Wowan
Raglan Creek
Gladstone
Canoe Point
Callide Creek
Miriam Vale
Biloela
Moura
Theodore
Monto
Moore Park Beach
Bundaberg
Eidsvold
Taroom
Murgon, Douglas Street
Gympie
Wandoan
Chinchilla, Dorney Street
Waraba Creek (Colburn Wy)
Burrya Mountains
Brisbane
Ipswich
Logan
Gold Coast
Toowoomba
Stanthorpe
Texas
Goondiwindi
Mungindi
Dirranbandi
St George
Surat
Roma
Mitchell
Miles
Injune
Augathella
Charleville
Warrego
Quilpie
Cunnamulla
Thargomindah
Windorah
Birdsville
Tambo
Blackall
Springsure
Barcaldine
Jericho
Alpha
Longreach
Aramac
Winton
Boulia
Julia Creek
Richmond
Hughenden
Charters Towers
Cloncurry
Mount Isa
Camooweal
Gunpowder
Boodjamulla N.P.
Croydon
Georgetown
Normanton
Karumba
Burketown

Flying fox camp locations
SOUTH EAST REGION

Queensland Government

DISCLAIMER
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Legend

- flying fox camps (current on 10 Feb 2016)
- Major urban centres
- Regional centres
- Roads
- Principal rivers
- Local government boundaries
- Urban areas
- Water bodies

Protected Areas of Queensland

- National Park
- National Park (CYPAL)
- Regional Park
- Forest Reserve
- State Forest
- Timber Reserve

0 2.5 5 10 15 20 25 km

Horizontal datum: GDA94
Projection: geographical coordinates
Produced by
Department of Environment and Heritage Protection

CHERBOURG SHIRE COUNCIL
GYMPIE REGIONAL COUNCIL
SUNSHINE COAST REGIONAL COUNCIL
SOUTH BURNETT REGIONAL COUNCIL
SOMERSET REGIONAL COUNCIL
MORETON BAY REGIONAL COUNCIL
TOOWOOMBA REGIONAL COUNCIL
BRISBANE CITY COUNCIL
REDLAND CITY COUNCIL
IPSWICH CITY COUNCIL
LOGAN CITY COUNCIL
LOCKYER VALLEY REGIONAL COUNCIL
SCENIC RIM REGIONAL COUNCIL
GOLD COAST CITY COUNCIL
SOUTHERN DOWNS REGIONAL COUNCIL

Goomeri
Gympie
Cooroy
Tewantin
Nambour
Buderim
Maroochydore
Caloundra
Nanango
Yarraman
Blackbutt
Kilcoy
Caboolture
Redcliffe
Esk
Crows Nest
Gatton
Laidley
Rosewood
Ipswich
Brisbane
Logan
Beenleigh
Beaudesert
Boonah
Southport
Surfers Paradise
Gold Coast
Coolangatta
Tweed Heads
Warwick

152°0'0"E
152°30'0"E
153°0'0"E
153°30'0"E
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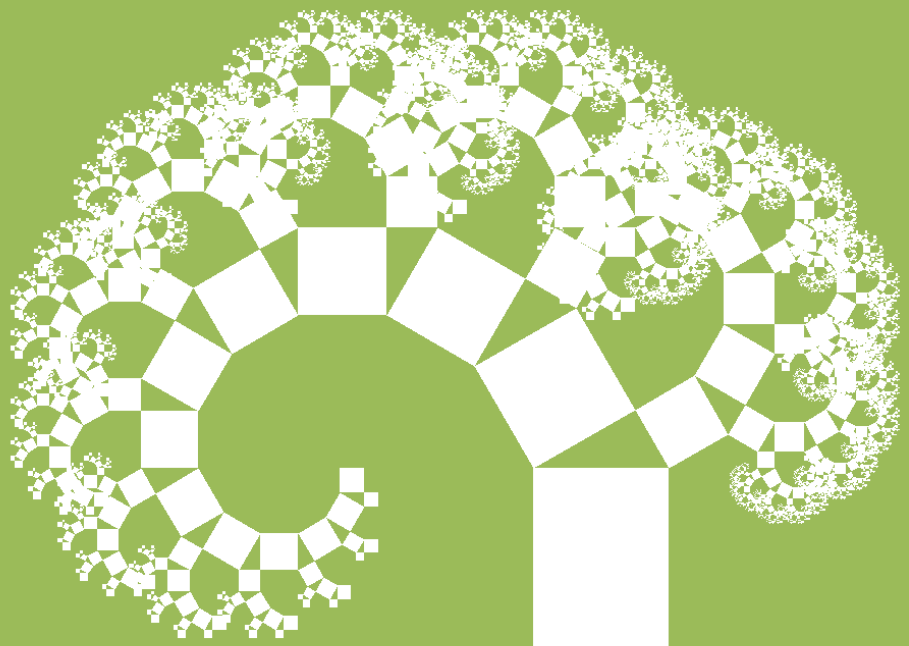
28°0'0"S
28°30'0"S



Modelled potential habitat

For the selected area of interest 11221.47ha

Current as at 06/02/2020

Queensland Government

Introduction

Species lists in this report are derived from Maxent pre-clear potential habitat models and buffered point coverages produced by the Queensland Herbarium for NCA listed 'endangered' or 'vulnerable' species, EPBC listed 'critically endangered', 'endangered' or 'vulnerable' species and other priority species.

The models utilise records of fauna species occurrence compiled for the purpose of Biodiversity Assessment by the Queensland Department of Environment and Resource Management (EPA 2002) and specimen backed flora records compiled from the Queensland Herbarium's Herbrecs database. All records have a location precision of better than 2000 m, and all fauna records are less than 50 years old. Models were constrained within an occurrence mask for each species, defined by a buffer of 200 km around a convex hull that encompasses all records. All models were based on seven environmental layers, annual mean temperature, temperature seasonality (coefficient of variation), annual precipitation, mean moisture index of the lowest quarter moisture index, pre-clearing broad vegetation group (1:1M), land zone and taxonomic ruggedness. Climate layers were modelled using Anuclim software on an 83 m digital elevation model. A mask of Queensland's road network was used to down-weight species records collected along roads. Model performance was assessed by comparing the area under the ROC curve (AUC) with the 95th percentile AUC from 1000 null models for each species created by randomly selecting locations from within the minimum convex hull of species presence records. For species with very restricted ranges, model performance was further tested using randomly selected locations from within the species mask. Thresholds were applied (either equal training sensitivity and specificity logistic threshold or 10th percentile training presence logistic threshold, whichever was highest) in order to convert model output to a prediction of potential habitat. Any presence records excluded by the threshold applied were incorporated into the output with a 1km buffer. The output was clipped to the species mask and simplified using a majority filter algorithm to remove outlying orphan cells in the model output. The resulting shapefile defines the modelled pre-clear potential habitat for selected threatened and priority species.

If a species is not listed in the report, it does not indicate that its habitat is absent from the queried location and conversely, species listed may not currently inhabit the area.

Threatened fauna species

Threatened fauna species modelled to have pre-clear potential habitat within the area of interest , with an area of 11221.47ha hectares

Threatened Species animals

Class	Scientific name	Common name	NCA Status	EPBC Status	Area (ha)
birds	*Cyclopsitta diophthalma coxeni*	Coxen's fig-parrot	E	E	25.45
birds	*Grantiella picta*	painted honeyeater	V	V	304.91
birds	*Lathamus discolor*	swift parrot	E	CE	11123.98
birds	*Calyptorhynchus lathami*	glossy black-cockatoo	V	None	5446.14
birds	*Erythrotriorchis radiatus*	red goshawk	E	V	11220.17
birds	*Geophaps scripta scripta*	squatter pigeon (southern subspecies)	V	V	7379.39
birds	*Botaurus poiciloptilus*	Australasian bittern	C	E	9695.84
birds	*Turnix melanogaster*	black-breasted button-quail	V	V	4834.53
birds	*Rostratula australis*	Australian painted snipe	V	E	11218.66
birds	*Ninox strenua*	powerful owl	V	None	6412.11
mammals	*Petrogale penicillata*	brush-tailed rock-wallaby	V	V	1113.63
mammals	*Nyctophilus corbeni*	eastern long-eared bat	V	V	368.82
mammals	*Phascolarctos cinereus*	koala	V	V	10840.7
mammals	*Chalinolobus dwyeri*	large-eared pied bat	V	V	96.09
mammals	*Dasyurus maculatus maculatus*	spotted-tailed quoll (southern subspecies)	V	E	5351.17
mammals	*Pteropus poliocephalus*	grey-headed flying-fox	C	V	7913.65
mammals	*Potorous tridactylus tridactylus*	long-nosed potoroo	V	V	8.36
reptiles	*Hemiaspis damelii*	grey snake	E	None	7613.91
reptiles	*Delma torquata*	collared delma	V	V	7979.31

Threatened flora species

Threatened flora species modelled to have pre-clear potential habitat within the selected area

Threatened Species plants

Class	Scientific name	Common name	NCA Status	EPBC Status	Area (ha)
cycads	*Cycas megacarpa*	None	E	E	229.08

Class	Scientific name	Common name	NCA Status	EPBC Status	Area (ha)
higher dicots	*Fontainea venosa*	None	V	V	34.48
higher dicots	*Melaleuca irbyana*	None	E	None	6657.19
higher dicots	*Bertya opponens*	None	C	V	7747.84
higher dicots	*Corchorus cunninghamii*	None	E	E	93.54
higher dicots	*Rhaponticum australe*	None	V	V	90.74
higher dicots	*Notelaea lloydii*	Lloyd's native olive	V	V	5092.27
higher dicots	*Planchonella eerwah*	None	E	E	3982.66
higher dicots	*Bosistoa transversa*	three-leaved bosistoa	C	V	71.59
higher dicots	*Marsdenia coronata*	slender milkvine	V	None	4601.85
higher dicots	*Leptospermum oreophilum*	None	V	None	286.14
higher dicots	*Lepidium peregrinum*	None	C	E	27.92
higher dicots	*Sophora fraseri*	brush sophora	V	V	573.57
higher dicots	*Pomaderris coomingalensis*	None	E	None	1898.48
higher dicots	*Denhamia parvifolia*	None	V	V	14.11
higher dicots	*Gossia gonoclada*	None	E	E	346.06
higher dicots	*Samadera bidwillii*	None	V	V	294.37
higher dicots	*Cossinia australiana*	None	E	E	976.87
higher dicots	*Cupaniopsis tomentella*	Boonah tuckeroo	V	V	216.52
higher dicots	*Polianthion minutiflorum*	None	V	V	1528.5
higher dicots	*Thesium australe*	toadflax	V	V	3309.91
monocots	*Dichanthium setosum*	None	C	V	3194.99
monocots	*Cyperus clarus*	None	V	None	2849.65
monocots	*Arthraxon hispidus*	None	V	V	9730.19
monocots	*Dichanthium queenslandicum*	None	V	E	31.81

Links and support

Modelled potential habitat for selected threatened and priority species in Queensland - access the geodatabase of modelled potential habitat for Queensland's threatened species.

Disclaimer

WetlandMaps Report

For selected area of interest

Current as at 06/02/2020

Environmental Reports - General Information

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is ot present within the Area of Interest(AOI) (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no matters of interest have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Important Note to User

Information presented in this report is based upon the mapping of water bodies and wetland regional ecosystems across Queensland. The Queensland wetland mapping was produced using existing information including water body mapping derived from Landsat satellite imagery, regional ecosystem mapping, topographic data, and a springs database. The result is a consistent wetland map for the whole of Queensland.

Ancillary data, such as higher resolution imagery (for example SPOT and aerial photographs), other vegetation and wetland mapping, geology, soil and land system mapping was also used in attributing and assessing the derived Queensland Wetlands Program wetland mapping products.

The wetland mapping was done in accordance with a detailed peer reviewed methodology which included quality assurance measures for all steps in the process. For more detailed information on how the Queensland Wetlands Program wetland mapping was produced, please see the Wetland Mapping and Classification Methodology.

Disclaimer

The State of Queensland, as represented by this department, gives no warranty in relation to the data (including without limitation, accuracy, reliability, completeness or fitness for a particular purpose) hosted on this website.

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Summary Information

The following table provides an overview of the area of interest.

Table 1. Area of interest details

Size (ha)	11,221.47
Local Government(s)	Scenic Rim Regional, Logan City, Ipswich City
Bioregion(s)	Southeast Queensland
Subregion(s)	Moreton Basin
Catchment(s)	Logan-Albert, Brisbane
Drainage sub-basin	Logan River, Bremer River

NRM Regions

The following NRM region(s) are in the area of interest:

Healthy Land and Water

Water Resource Plan Boundaries

The following Water Resource Plan(s) are in the area of interest:

Logan Basin

Moreton

Great Artesian Basin and Other Regional Aquifers

Learn more about how Wetlands are mapped in Queensland:

Queensland Wetlands Mapping Definitions

Wetlands are areas of permanent or periodic/intermittent inundation, with water that is static or flowing fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6 metres. To be a wetland the area must have one or more of the following attributes:

- at least periodically the land supports plants or animals that are adapted to and dependent on living in wet conditions for at least part of their life cycle, or
- the substratum is predominantly undrained soils that are saturated, flooded or ponded long enough to develop anaerobic conditions in the upper layers, or
- the substratum is not soil and is saturated with water, or covered by water at some time.

Examples under this definition **include**:

- those areas shown as a river, stream, creek, swamp, lake, marsh, waterhole, wetland, billabong, pool or spring on the latest Sunmap 1:25,000, 1:50,000, 1:100,000 or 1:250,000 topographic map
- areas defined as wetlands on local or regional maps prepared with the aim of mapping wetlands
- wetland regional ecosystems (REs) as defined by the Queensland Herbarium (Environmental Protection Agency 2005a)
- areas containing recognised hydrophytes as provided by the Queensland Herbarium
- saturated parts of the riparian zone
- artificial wetlands such as farm dams
- water bodies not connected to rivers or flowing water such as billabongs and rock pools.

Examples under this definition **exclude**:

- areas that may be covered by water but are not wetlands according to the definition

- floodplains that are intermittently covered by flowing water but do not meet the hydrophytes and soil criteria
- riparian zone above the saturation level.

Wetland Systems

Riverine wetlands are all wetlands and deepwater habitats within a channel. The channels are naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water.

Palustrine wetlands are primarily vegetated non-channel environments of less than 8 hectares. They include billabongs, swamps, bogs, springs, soaks etc, and have more than 30% emergent vegetation.

Lacustrine wetlands are large, open, water-dominated systems (for example, lakes) larger than 8ha. This definition also applies to modified systems (for example, dams), which are similar to lacustrine systems (for example, deep, standing or slow-moving waters).

Marine wetlands include the area of ocean from the coastline or estuary, extending to the jurisdictional limits of Queensland waters (3 nautical mile limit). This definition differs from that in Ramsar, as it includes waters deeper than 6m below the lowest astronomical tide.

Estuarine wetlands are those with oceanic water sometimes diluted with freshwater run-off from the land.

Subterranean wetlands are wetlands occurring below the surface of the ground and that are fed by groundwater i.e. caves and aquifers. These wetlands provide water to groundwater dependent ecosystems.

Methodology and Wetland Classification: https://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/wetland-background/

Links and support

Other sites that deliver wetland related information include:

Wetland*Summary* tool: https://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/

Queensland Spatial Catalogue: http://qldspatial.information.qld.gov.au/catalogue/custom/index.page

Queensland Globe: https://qldglobe.information.qld.gov.au/

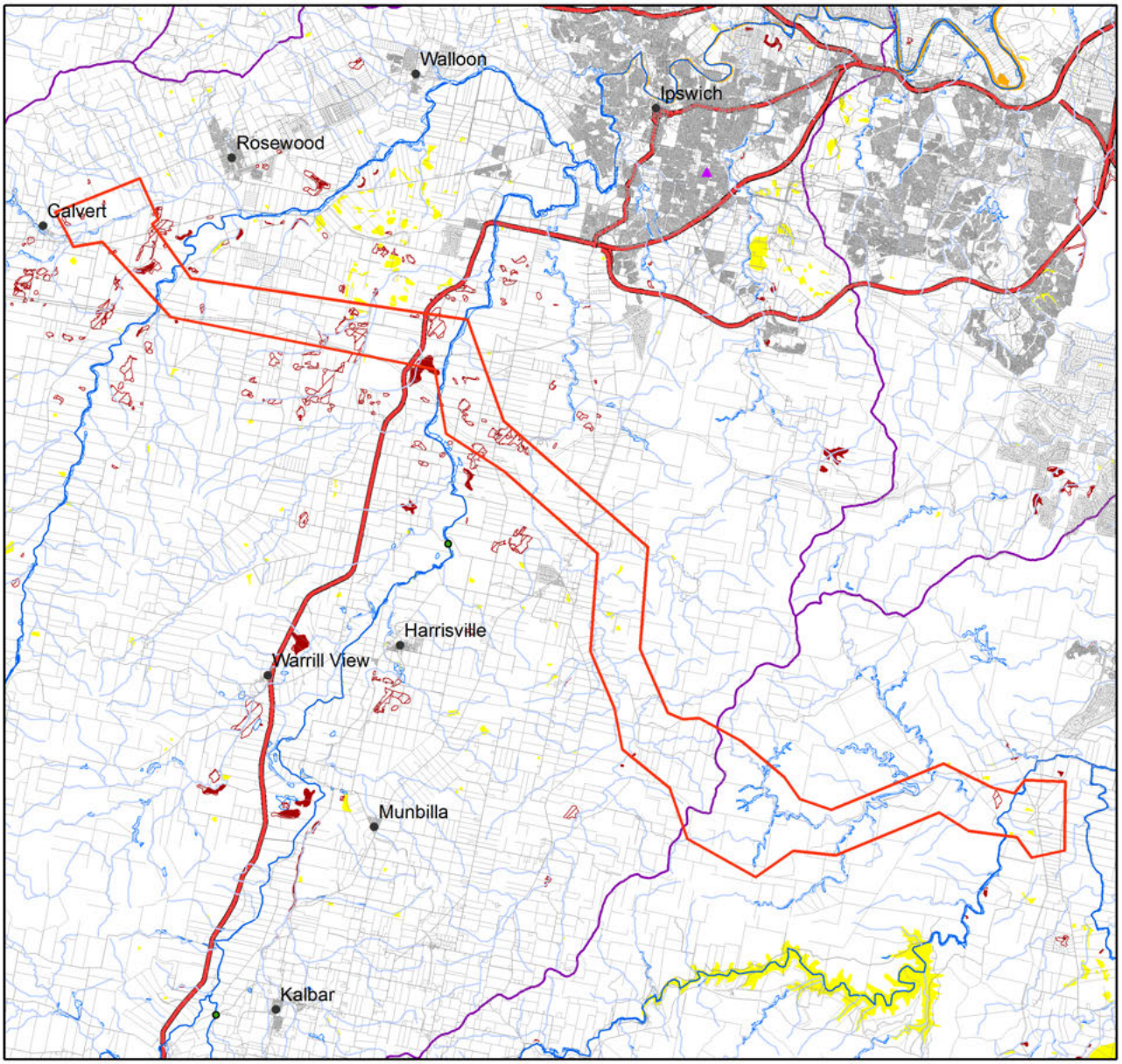
Environmental reports online: https://environment.ehp.qld.gov.au/report-request/environment/

Wetland on-line education modules: https://wetlandinfo.des.qld.gov.au/wetlands/resources/training/

Regional Ecosystem Mapping information: : https://www.qld.gov.au/environment/plants-animals/plants/herbarium/mapping-ecosystems

Aquatic Conservation Assessments: : https://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca/

Groundwater Dependant Ecosystems information: https://wetlandinfo.des.qld.gov.au/wetlands/ecology/aquatic-ecosystems-natural/groundwater-dependent/



Legend

- polygon
- Springs
- Dams and weirs
- Towns
- Highways
- Roads
- Cadastral boundaries
- Sub-basin

Wetland Mapping

Wetland System - Water Bodies

- Marine Waterbodies
- Estuarine Waterbodies
- Riverine Waterbodies
- Lacustrine Waterbodies
- Palustrine Waterbodies

Wetland System - Regional Ecosystems

- Marine RE
- Estuarine RE
- Riverine RE
- Lacustrine RE
- Palustrine RE
- RE 51_80% wetland (mosaic units)

Riverine System Drainage Lines

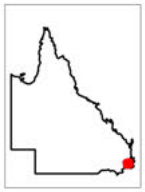
- Major
- Minor

Queensland Wetland Map

Queensland Government

Australian Government

Queensland Wetlands Program



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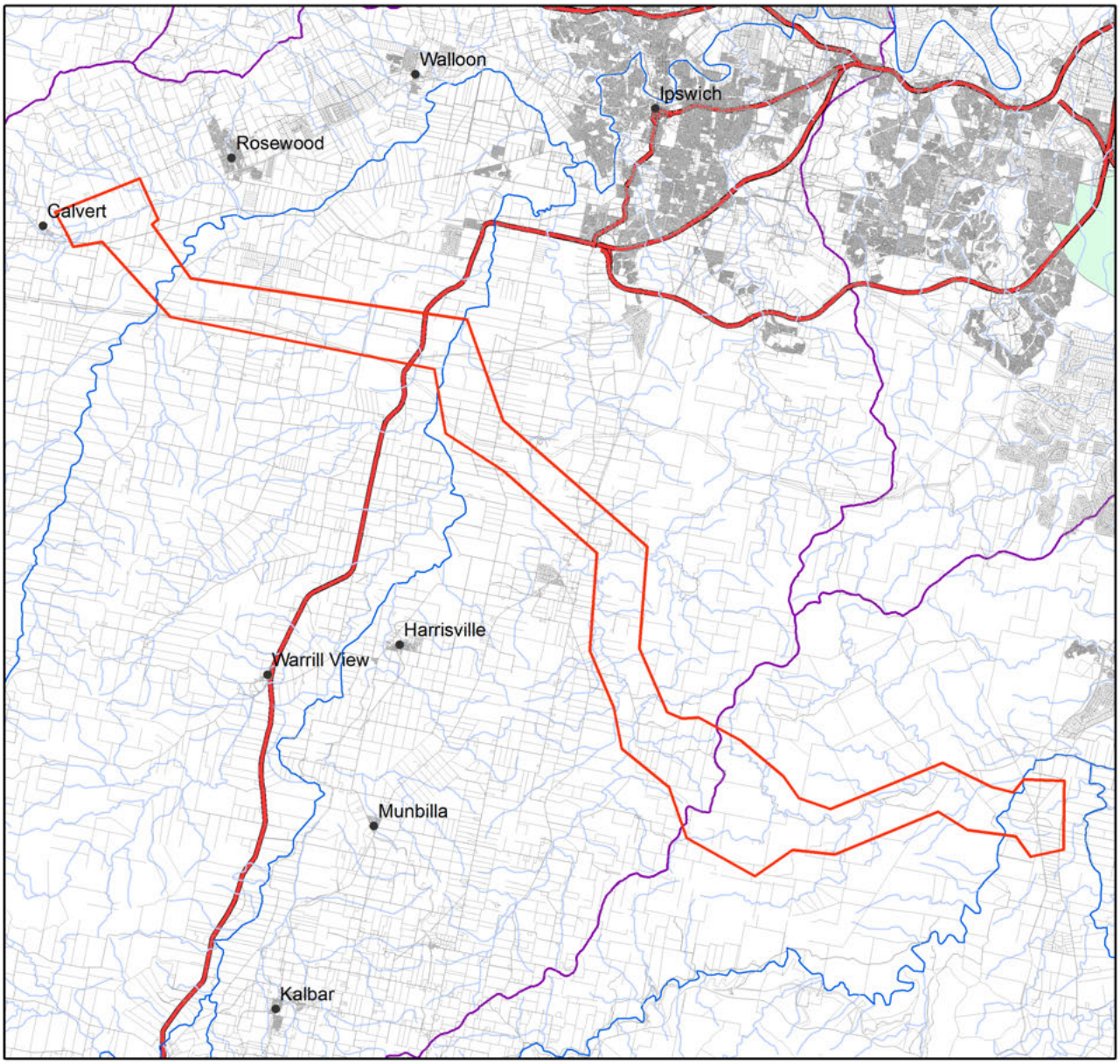
0 2300 4600 6900 9200 11500 m

Horizontal Datum: Geographic Datum of Australia 1994 (GDA94)

This map was produced by the Queensland Wetlands Program, Department of Environment and Science, February 2020.

For further information contact: wetlands@des.qld.gov.au



Queensland Wetlands of Importance Map

Legend

- polygon
- Towns
- Cadastral boundaries
- Highways
- Roads
- Sub-basin
- Directory of Important Wetlands
- Ramsar Wetlands

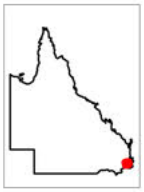
Riverine System Drainage Lines

- Major
- Minor

Queensland Government

Australian Government

Queensland Wetlands Program



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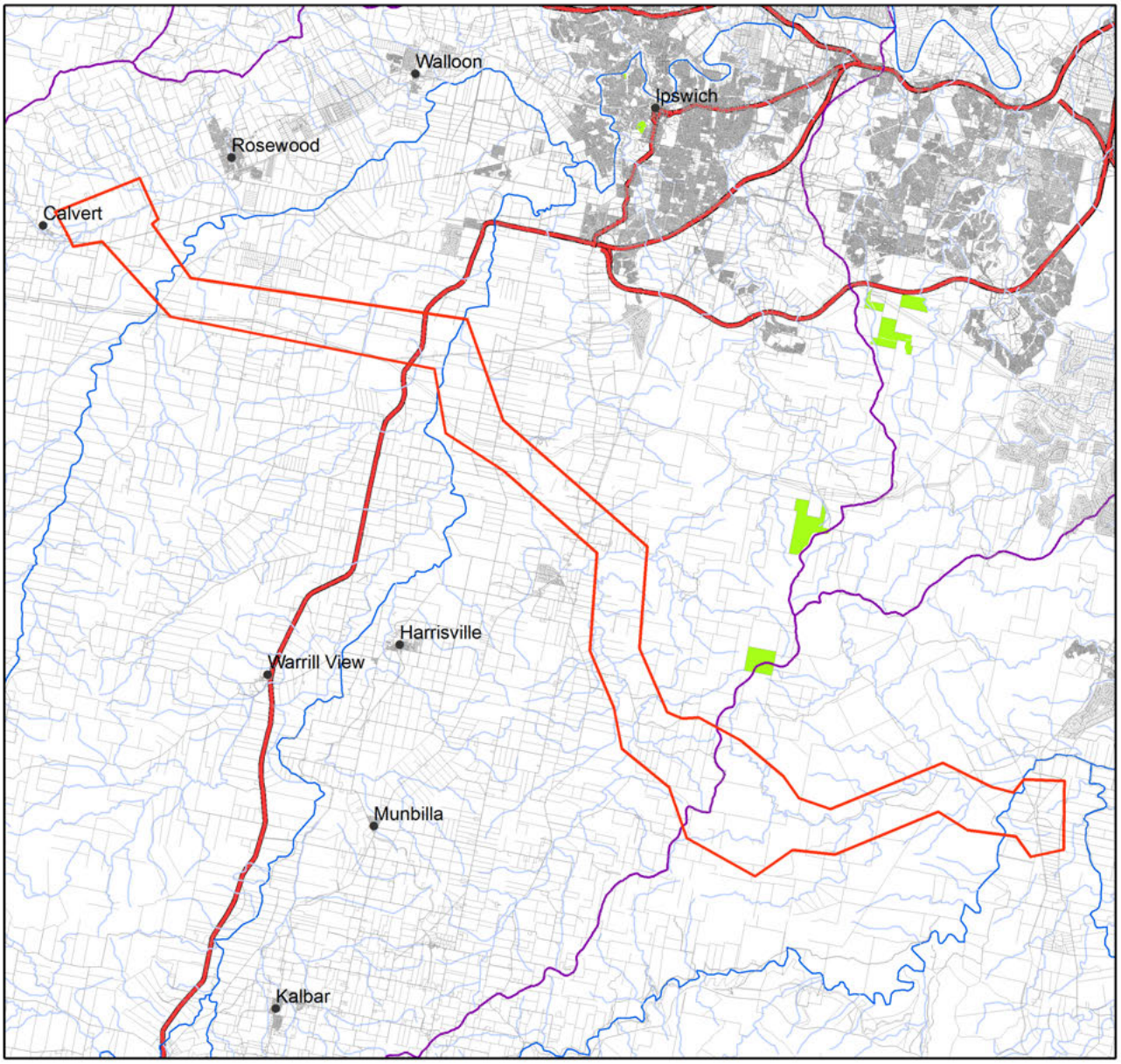


Queensland Protected Area Map

Legend

- polygon
- Towns
- Cadastral boundaries
- Highways
- Roads
- Sub-basin

Riverine System Drainage Lines

- Major
- Minor

Protected Areas

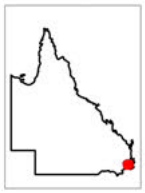
- National Park
- National Park (Scientific)
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve

Marine Parks

- General Use Zone
- Habitat Protection Zone
- Estuarine Conservation Zone
- Conservation Park Zone
- Buffer Zone
- Scientific Research Zone
- Marine National Park Zone
- Preservation Zone

Queensland Government
Australian Government

Queensland Wetlands Program



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0 2300 4600 6900 9200 11500 m

Horizontal Datum: Geographic Datum of Australia 1994 (GDA94)

This map was produced by the Queensland Wetlands Program, Department of Environment and Science, February 2020.

For further information contact: wetlands@des.qld.gov.au

Wetland habitat types in the AOI. Total area: 575.74ha

Wetland Class	Habitat type	Area (ha)
Riverine	Riverine	195.05
Palustrine	Coastal/ Sub-Coastal non-floodplain tree swamps (Melaleuca and Eucalypt)	137.01
Palustrine	Coastal/ Sub-coastal floodplain tree swamps (Melaleuca and Eucalypt)	131.74
Palustrine	Coastal/ Sub-coastal floodplain grass, sedge and herb swamps	82.04
Lacustrine	Artificial/ highly modified wetlands (dams, ring tanks, irrigation channel	29.63
None	Coastal/ Sub-coastal floodplain grass, sedge and herb swamps	0.27

Queensland wetland habitat typology: Major wetland habitat types for wetland conceptual models and wetland management profiles

Wetland name	Conceptual model	Wetland profile
Mangrove Wetlands	Not developed	Mangrove Wetlands
Saltmarsh Wetlands	Not developed	Saltmarsh Wetlands
Coastal and subcoastal saline swamps of all substrates, water regimes, topographic types and vegetation communities	Coastal and subcoastal saline swamps	Coastal grass-sedge wetlands
Coastal and subcoastal non-floodplain tree swamps (Melaleuca and Eucalypt) of all substrates and water regimes	Coastal and subcoastal non-floodplain tree swamps - melaleuca and eucalypt	Coastal and subcoastal tree swamps
Coastal and subcoastal non-floodplain wet heath swamps of all substrates and water regimes	Coastal and subcoastal non-floodplain wet heath swamps	Coastal and subcoastal wet heath swamps
Coastal and subcoastal non-floodplain grass, sedge and herb swamps of all substrates and water regimes	Coastal and subcoastal non-floodplain grass, sedge and herb swamps	Coastal grass-sedge wetlands
Coastal and subcoastal spring swamps of all substrates, water types, water regimes and vegetation communities	Coastal and subcoastal spring swamps	Great Artesian Basin spring wetlands
Coastal and subcoastal floodplain tree swamps - melaleuca and eucalypt of all substrates and water regimes	Coastal and subcoastal floodplain tree swamps - melaleuca and eucalypt	Coastal and subcoastal tree swamps
Coastal and subcoastal floodplain wet heath swamps of all substrates and water regimes	Coastal and subcoastal floodplain wet heath swamps	Coastal and subcoastal wet heath swamps
Coastal and subcoastal floodplain, grass, sedge herb swamps of all substrates and water regimes	Coastal and subcoastal floodplain grass, sedge, herb swamps	Coastal grass-sedge wetlands
Coastal and subcoastal tree swamps - palm of all substrates, topographic types and water regimes	Coastal and subcoastal floodplain tree swamps - palm	Coastal Palm Swamps
Coastal and subcoastal Floodplain Lakes of all substrates, water types and water regimes	Coastal and subcoastal Floodplain Lakes	Coastal and subcoastal floodplain lakes and non-floodplain soil lakes
Coastal and subcoastal non-floodplain rock lakes of all water types and water regimes	Coastal and subcoastal non-floodplain rock lakes	Coastal and subcoastal non-floodplain rock lakes
Coastal and subcoastal non-floodplain sand lakes (window) of all water types and water regimes	Coastal and subcoastal non-floodplain sand lakes - window	Coastal non-floodplain sand lakes

Wetland name	Conceptual model	Wetland profile
Coastal and subcoastal non-floodplain sand lakes (perched) of all water types and water regimes	Coastal and subcoastal non-floodplain sand lakes - perched	Coastal non-floodplain sand lakes
Coastal and subcoastal non-floodplain soil lakes of all water types and water regimes	Coastal and subcoastal non-floodplain soil lakes	Coastal and subcoastal floodplain lakes and non-floodplain soil lakes
Arid and semi-arid saline swamps of all substrates, water regimes, topographic types and vegetation communities	Arid and semi-arid saline swamps	Semi-arid swamps
Arid and semi-arid fresh tree swamps of all substrates, and water regimes and topographic types	Arid and semi-arid tree swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid lignum swamps of all substrates, and water regimes and topographic types	Arid and semi-arid lignum swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid grass, sedge, herb swamps of all substrates, water regimes and topographic types	Arid and semi-arid grass, sedge, herb swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid fresh non-floodplain tree swamps of all substrates and water regimes	Arid and semi-arid non-floodplain tree swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid fresh non-floodplain lignum swamps of all substrates and water regimes	Arid and semi-arid non-floodplain lignum swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid fresh non-floodplain grass, sedge, herb swamps of all substrates and water regimes	Arid and semi-arid non-floodplain grass, sedge, herb swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid, non-floodplain swamps - springs of all substrates, water regimes and vegetation communities	Arid and semi-arid spring swamps	Great Artesian Basin spring wetlands
Arid and semi-arid, saline lakes of all substrates, topographic types and water regimes	Arid and semi-arid saline lakes	Arid and semi-arid lakes
Arid and semi-arid, floodplain lakes of all, substrates and water regimes	Arid and semi-arid floodplain lakes	Arid and semi-arid lakes
Arid and semi-arid, non-floodplain Lakes of all substrates and water regimes	Arid and semi-arid non-floodplain lakes	Arid and semi-arid lakes
Arid/ semi-arid, non-floodplain (clay pans) lakes of all substrates and water regimes	Arid and semi-arid fresh non-floodplain lakes (clay pans)	Arid and semi-arid lakes
Arid and semi-arid, Permanent Lakes permanently inundated lakes of all substrates, water types, topographic types and vegetation communities	Arid and semi-arid permanent lakes	Arid and semi-arid lakes

Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the input coordinates.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no matters of interest have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Important Note to User

Information presented in this report is based upon the Queensland Herbarium's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Natural Resources, Mines and Energy website

https://www.dnrme.qld.gov.au/

Please direct queries about these reports to: Queensland.Herbarium@dsiti.qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.

Table of Contents

Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

Table 1: Area of interest details:

Size (ha)	11,221.47
Local Government(s)	Scenic Rim Regional, Logan City, Ipswich City
Bioregion(s)	Southeast Queensland
Subregion(s)	Moreton Basin
Catchment(s)	Logan-Albert, Brisbane

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

Table 2: Summary table, biodiversity status of regional ecosystems within the AOI

Biodiversity Status	Area (Ha)	% of AOI
Endangered	148.21	1.32
Of concern	363.18	3.24
No concern at present	666.18	5.94
Total remnant vegetation	1,177.57	10.49

Refer to **Map 2** for further information.

Regional Ecosystems

1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and are usually distinguished by differences in dominant species, frequently in the shrub or ground layers and are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2017) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Natural Resources, Mines and Energy website.

https://www.dnrme.qld.gov.au/

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss*, or
- 10-30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare** regional ecosystem subject to a threatening process.***

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.****

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

**Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

***Rare regional ecosystem: pre-clearing extent (1000 ha); or patch size (100 ha and of limited total extent across its range).*

****Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

*****Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.*

2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

Table 3: Remnant regional ecosystems, description and status within the AOI

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
12.3.18	Melaleuca irbyana low open forest on alluvial plains	Endangered	23.4	0.21
12.3.19	Eucalyptus moluccana and/or Eucalyptus tereticornis and E. crebra open forest to woodland, with a sparse to mid-dense understorey of Melaleuca irbyana on alluvial plains	Endangered	17.32	0.15
12.3.3	Eucalyptus tereticornis woodland on Quaternary alluvium	Endangered	1.93	0.02
12.3.3d	Eucalyptus tereticornis woodland on Quaternary alluvium	Endangered	10.44	0.09
12.3.7	Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca spp. fringing woodland	Of concern	67.75	0.6
12.3.8	Swamps with Cyperus spp., Schoenoplectus spp. and Eleocharis spp.	Of concern	76.9	0.69
12.9-10.11	Melaleuca irbyana low open forest on sedimentary rocks	Endangered	26.84	0.24
12.9-10.16	Araucarian microphyll to notophyll vine forest on Cainozoic and Mesozoic sediments	Of concern	6.3	0.06
12.9-10.17	Eucalyptus acmenoides, E. major, E. siderophloia +/- Corymbia citriodora subsp. variegata open fores on sedimentary rocks	No concern at present	6.95	0.06
12.9-10.17a	Eucalyptus acmenoides, E. major, E. siderophloia +/- Corymbia citriodora subsp. variegata open fores on sedimentary rocks	No concern at present	89.12	0.79
12.9-10.2	Corymbia citriodora subsp. variegata +/- Eucalyptus crebra open forest on sedimentary rocks	No concern at present	570.11	5.08
12.9-10.27	Corymbia citriodora subsp. variegata and/or E. moluccana, E. tereticornis, E. crebra open forest with Melaleuca irbyana understorey on sedimentary rocks	Endangered	68.28	0.61
12.9-10.3	Eucalyptus moluccana open forest on sedimentary rocks	Of concern	15.24	0.14
12.9-10.7	Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp., E. melanophloia woodland on sedimentary rocks	Of concern	196.99	1.76
non-rem	None	None	10,044.05	89.51

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

Table 4 provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

Table 4: Remnant regional ecosystems within the AOI, additional information

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
12.3.18	Pre-clearing 2000 ha; Remnant 2017 100 ha	21b	Palustrine wetland (e.g. vegetated swamp).	No representation
12.3.19	Pre-clearing 3000 ha; Remnant 2017 300 ha	13d	Floodplain (other than floodplain wetlands).	No representation
12.3.3	Pre-clearing 438000 ha; Remnant 2017 40000 ha	16c	Floodplain (other than floodplain wetlands).	Low
12.3.3d	Pre-clearing 438000 ha; Remnant 2017 40000 ha	13d	Floodplain (other than floodplain wetlands).	Low
12.3.7	Pre-clearing 118000 ha; Remnant 2017 60000 ha	16a	Riverine wetland or fringing riverine wetland.	Low
12.3.8	Pre-clearing 7000 ha; Remnant 2017 4000 ha	34c	Palustrine wetland (e.g. vegetated swamp).	Low
12.9-10.11	Pre-clearing 2000 ha; Remnant 2017 200 ha	21b	Palustrine wetland (e.g. vegetated swamp).	No representation
12.9-10.16	Pre-clearing 24000 ha; Remnant 2017 9000 ha	5a	None	High
12.9-10.17	Pre-clearing 65000 ha; Remnant 2017 31000 ha	9a	None	Medium
12.9-10.17a	Pre-clearing 65000 ha; Remnant 2017 31000 ha	28e	None	Medium
12.9-10.2	Pre-clearing 222000 ha; Remnant 2017 87000 ha	10b	None	Low
12.9-10.27	Pre-clearing 5000 ha; Remnant 2017 400 ha	10b	None	No representation
12.9-10.3	Pre-clearing 95000 ha; Remnant 2017 27000 ha	13d	None	Low
12.9-10.7	Pre-clearing 248000 ha; Remnant 2017 41000 ha	13c	None	Low
non-rem	None	None	None	None

Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented, No representation.

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

Table 5: Remnant regional ecosystems within the AOI, special values

Regional Ecosystem	Special Values
12.3.18	Habitat for listed plant species Melaleuca irbyana and Marsdenia coronata.
12.3.19	Habitat for listed plant species Melaleuca irbyana.
12.3.3	Habitat for threatened plant species including Rhaponticum australe. 12.3.3a: Habitat for threatened plant species including occasional Rhaponticum australe. 12.3.3b: Habitat for threatened flora species including Melaleuca irbyana. 12.3.3c: Habitat for threatened flora species including Melaleuca irbyana and Marsdenia coronata. 12.3.3d: Habitat for threatened plant species including Rhaponticum australe.
12.3.3d	Habitat for threatened plant species including Rhaponticum australe. 12.3.3a: Habitat for threatened plant species including occasional Rhaponticum australe. 12.3.3b: Habitat for threatened flora species including Melaleuca irbyana. 12.3.3c: Habitat for threatened flora species including Melaleuca irbyana and Marsdenia coronata. 12.3.3d: Habitat for threatened plant species including Rhaponticum australe.
12.3.7	Habitat for an extensive range of aquatic flora and fauna.
12.3.8	Provides wetland habitat for a plant and fauna. 12.3.8a: Provides wetland habitat for a plant and fauna.
12.9-10.11	Habitat for threatened plant species including Melaleuca irbyana. 12.9-10.11a: Habitat for threatened flora species including Melaleuca irbyana.
12.9-10.16	Habitat for threatened plant species including Alectryon ramiflorus, Planchonella eerwah, Plectranthus omissus, Sarcochilus weinthalii, Cupaniopsis shirleyana, C. tomentella and near threatened species including Hernandia bivalvis.
12.9-10.17	Potential habitat for NCA listed species: Acacia acrionastes, Arundinella grevillensis, Cupaniopsis tomentella, Gonocarpus hirtus, Grevillea linsmithii, Leionema obtusifolium, Macrozamia pauli-guilielmi, Marsdenia coronata, Marsdenia longiloba, Notelaea l
12.9-10.17a	Potential habitat for NCA listed species: Acacia acrionastes, Arundinella grevillensis, Cupaniopsis tomentella, Gonocarpus hirtus, Grevillea linsmithii, Leionema obtusifolium, Macrozamia pauli-guilielmi, Marsdenia coronata, Marsdenia longiloba, Notelaea l
12.9-10.2	Habitat for threatened plant species including Notelaea lloydii, Grevillea quadricauda, Westringia sericea, Plectranthus habrophyllus
12.9-10.27	Habitat for listed plant species Melaleuca irbyana.
12.9-10.3	Potential habitat for NCA listed species: Callitris baileyi, Haloragis exalata subsp. velutina, Picris conyzoides, Sophora fraseri
12.9-10.7	Potential habitat for NCA listed species: Callitris baileyi, Graptophyllum reticulatum, Melaleuca formosa, Melaleuca irbyana, Paspalidium grandispiculatum, Plectranthus habrophyllus, Polianthion minutiflorum, Zieria inexpectata
non-rem	None

3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional)

scales.

A comprehensive description of BVGs is available at:

https://publications.qld.gov.au/dataset/redd/resource/

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

Table 6: Broad vegetation groups (1 million) within the AOI

BVG (1 Million)	Description	Area (Ha)	% of AOI
None	None	10,044.05	89.51
10b	Moist open forests to woodlands dominated by Corymbia citriodora (spotted gum). (land zones 12, 11, 9, 5, 8) (SEQ, CQC, EIU, WET)	638.39	5.69
13c	Woodlands of Eucalyptus crebra (sens. lat.) (narrow-leaved red ironbark), E. drepanophylla (grey ironbark), E. fibrosa (dusky-leaved ironbark), E. shirleyi (shirley's silver-leaved ironbark) on granitic and metamorphic ranges (land zones 12, 11, 9, [5]) (BRB, EIU, SEQ, NET, CQC)	196.99	1.76
13d	Woodlands dominated by Eucalyptus moluccana (gum-topped box) (or E. microcarpa (inland grey box)) on a range of substrates. (land zone 5, 9, 3, 11, 12) (BRB, SEQ, EIU, CQC, [NET, WET])	42.99	0.38
16a	Open forest and woodlands dominated by Eucalyptus camaldulensis (river red gum) (or E. tereticornis (blue gum)) and/or E. coolabah (coolabah) (or E. microtheca (coolabah)) fringing drainage lines. Associated species may include Melaleuca spp., Corymbia tessellaris (carbeen), Angophora spp., Casuarina cunninghamiana (riveroak). Does not include alluvial areas dominated by herb and grasslands or alluvial plains that are not flooded. (land zone 3) (MGD, BRB, GUP, CHC, MUL, DEU, EIU, NWH, SEQ, [NET, WET]) (All bioregions except CYP and CQC)	67.75	0.6
16c	Woodlands and open woodlands dominated by Eucalyptus coolabah (coolabah) or E. microtheca (coolabah) or E. largiflorens (black box) or E. tereticornis (blue gum) or E. chlorophylla on floodplains. Does not include alluvial areas dominated by herb and grasslands or alluvial plains that are not flooded. (land zone 3) (All bioregions except WET, principally GUP, BRB, MUL).	1.93	0.02
21b	Low open woodlands and tall shrublands of Melaleuca citrolens or M. stenostachya or other Melaleuca spp. (land zones 5, 3, 7, 10, 11, 12) (GUP, CYP, EIU, DEU, BRB, [SEQ])	50.25	0.45
28e	Low open forest to woodlands dominated by Lophostemon suaveolens (swamp box) (or L. confertus (brush box)) or Syncarpia glomulifera (turpentine) frequently with Allocasuarina spp. on rocky hill slopes. (land zones 12, 9, 3, 11, [10, 8]) (CQC, WET, SEQ, BRB, [CYP])	89.12	0.79
34c	Palustrine wetlands. Freshwater swamps on coastal floodplains dominated by sedges and grasses such as Oryza spp., Eleocharis spp. (spikerush) or Baloskion spp. (cord rush) / Leptocarpus tenax / Gahnia sieberiana (sword grass) / Lepironia spp. (land zones 3, 2, [1]) (CYP, GUP, BRB, SEQ, WET, [CQC])	76.9	0.69
5a	Araucarian notophyll/microphyll and microphyll vine forests of southern coastal bioregions. (land zones 8, 11, 5, 9) (SEQ)	6.3	0.06

BVG (1 Million)	Description	Area (Ha)	% of AOI
9a	Moist to dry eucalypt open forests to woodlands, dominated by a variety of species including Eucalyptus acmenoides (narrow-leaved white stringybark), E. carnea (broad-leaved white mahogany), E. propinqua (small-fruited grey gum), E. siderophloia (red ironbark), E. tindaliae (Queensland white stringybark), E. racemosa, Corymbia intermedia (pink bloodwood), C. trachyphloia (yellow bloodwood), E. planchoniana (Planchon's stringybark), E. baileyana (Bailey's stringybark), E. moluccana (gum-topped box) and Angophora leiocarpa (rusty gum). (land zones 11, 9-10, 8, 12, 5, 3) (SEQ).	6.95	0.06

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

The descriptions are compiled using site survey data from the Queensland Herbarium's CORVEG database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2012 (PDF)* section 3.3.1 of:

https://publications.qld.gov.au/dataset/redd/resource/

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community.

http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

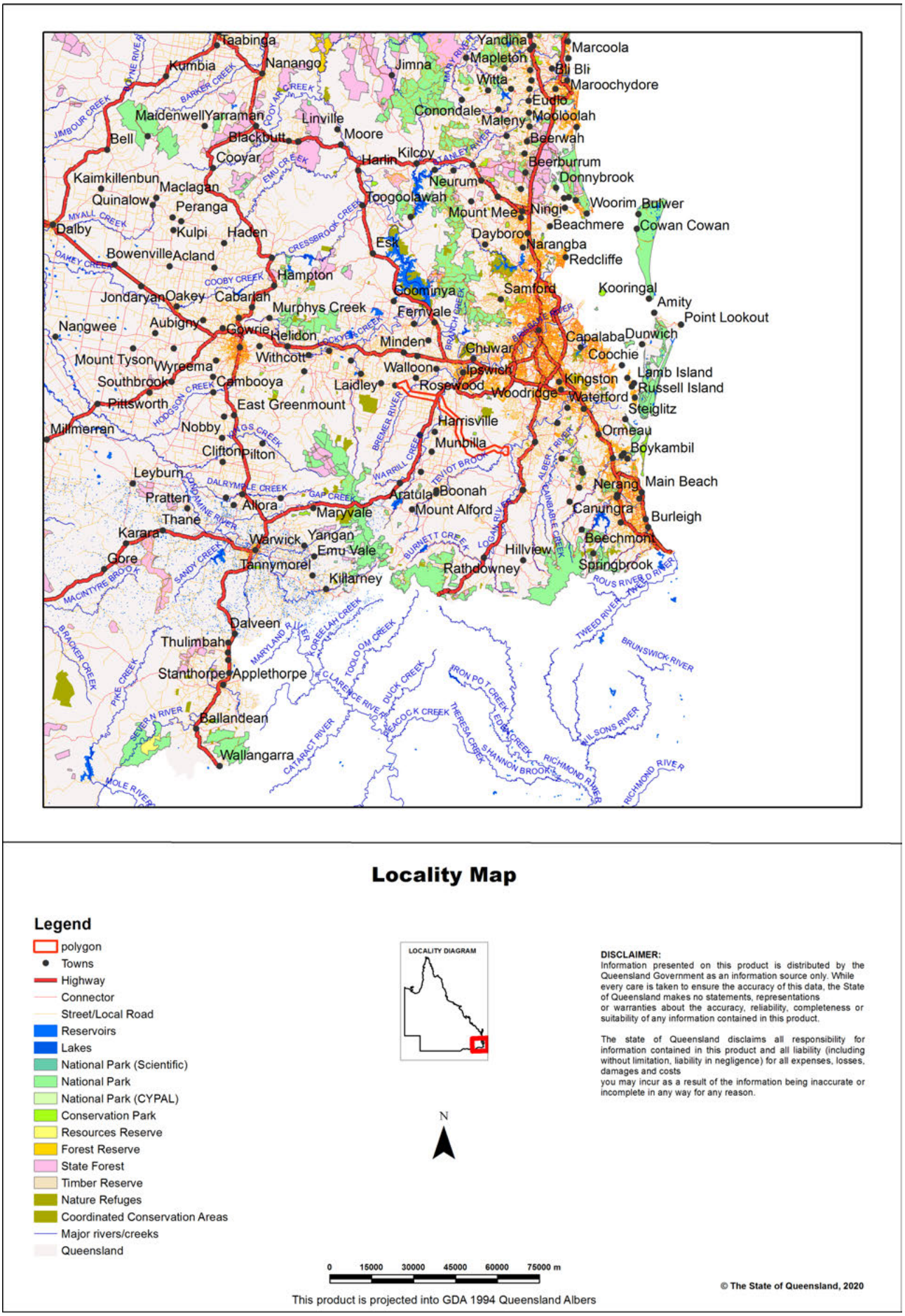
Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
12.3.18	Not currently available	Not currently available
12.3.19	Not currently available	Not currently available
12.3.3	Available	Not currently available
12.3.3d	Available	Not currently available
12.3.7	Available	Not currently available
12.3.8	Not currently available	Not currently available

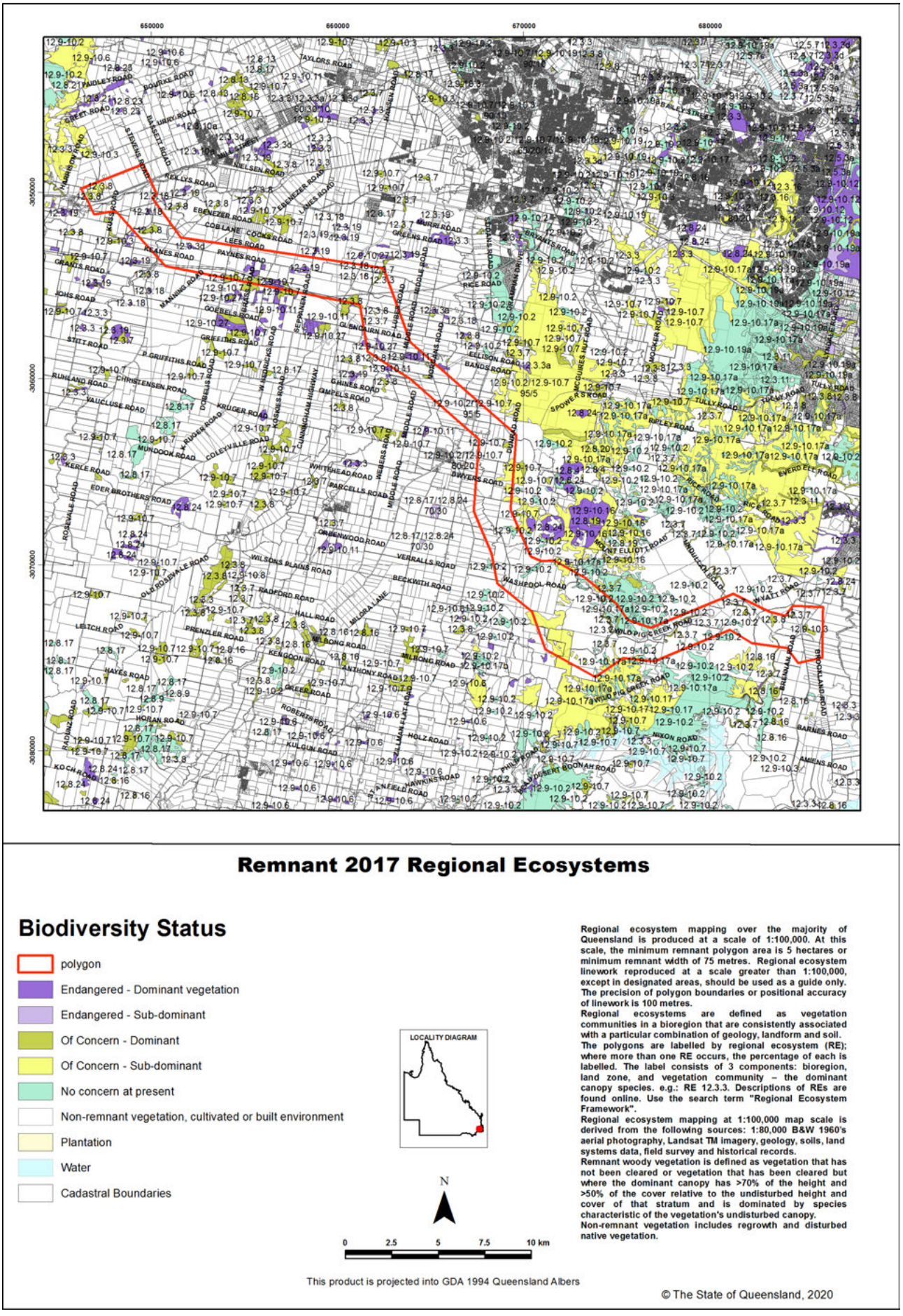
Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
12.9-10.11	Not currently available	Not currently available
12.9-10.16	Not currently available	Not currently available
12.9-10.17	Not currently available	Not currently available
12.9-10.17a	Not currently available	Not currently available
12.9-10.2	Available	Not currently available
12.9-10.27	Not currently available	Not currently available
12.9-10.3	Available	Not currently available
12.9-10.7	Available	Not currently available
non-rem	Not currently available	Not currently available

Maps

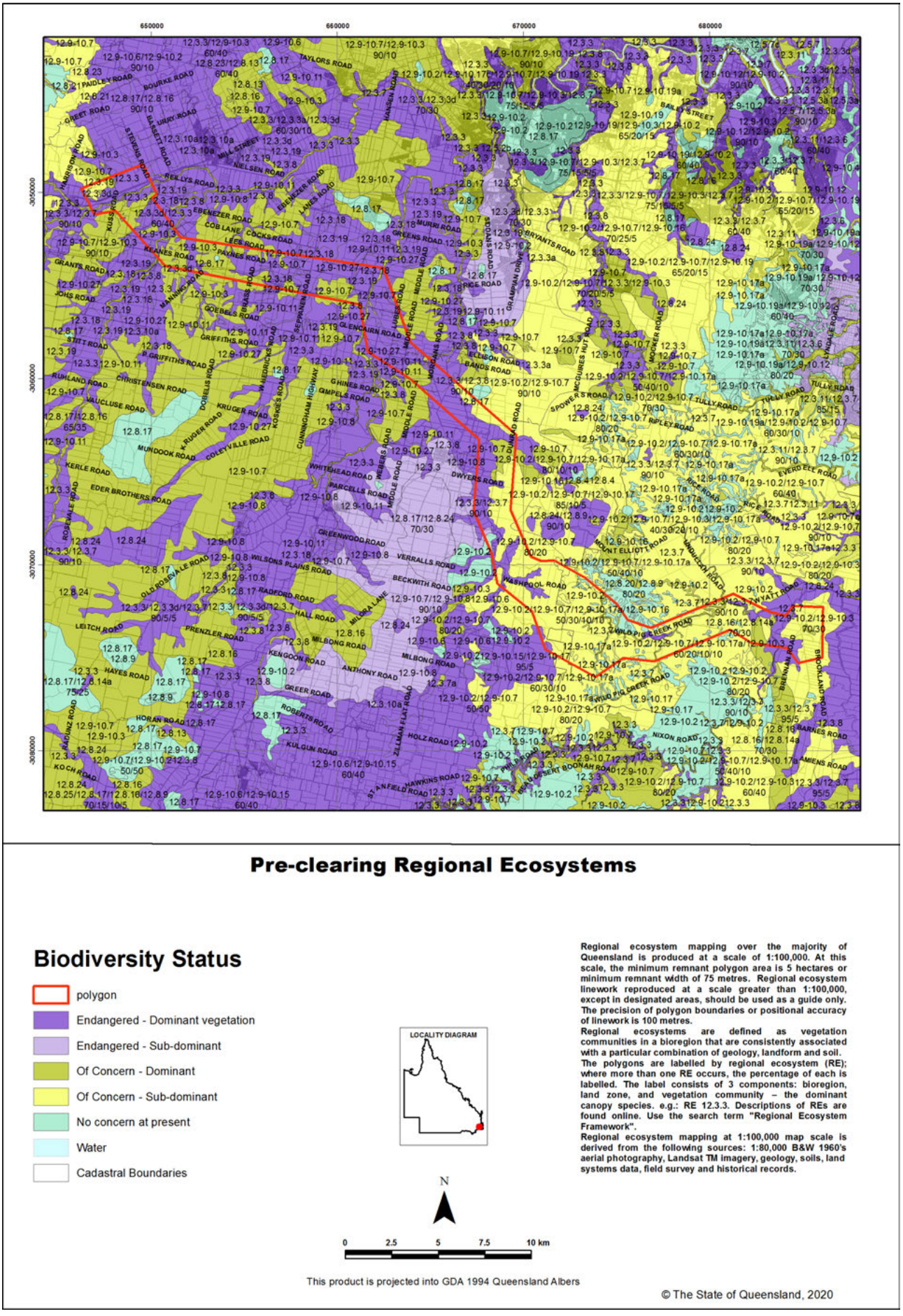
Map 1 - Location



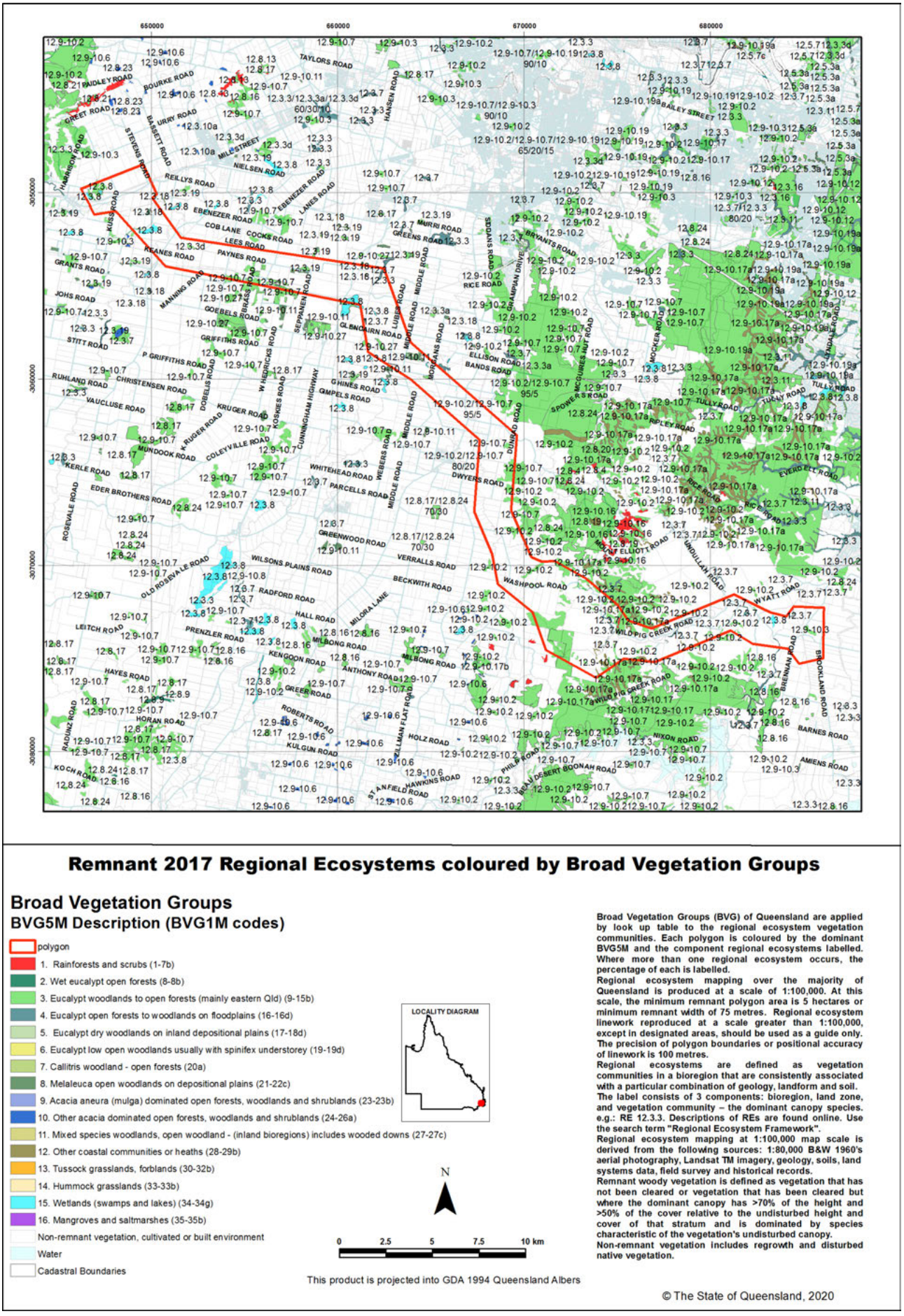
Map 2 - Remnant 2017 regional ecosystems



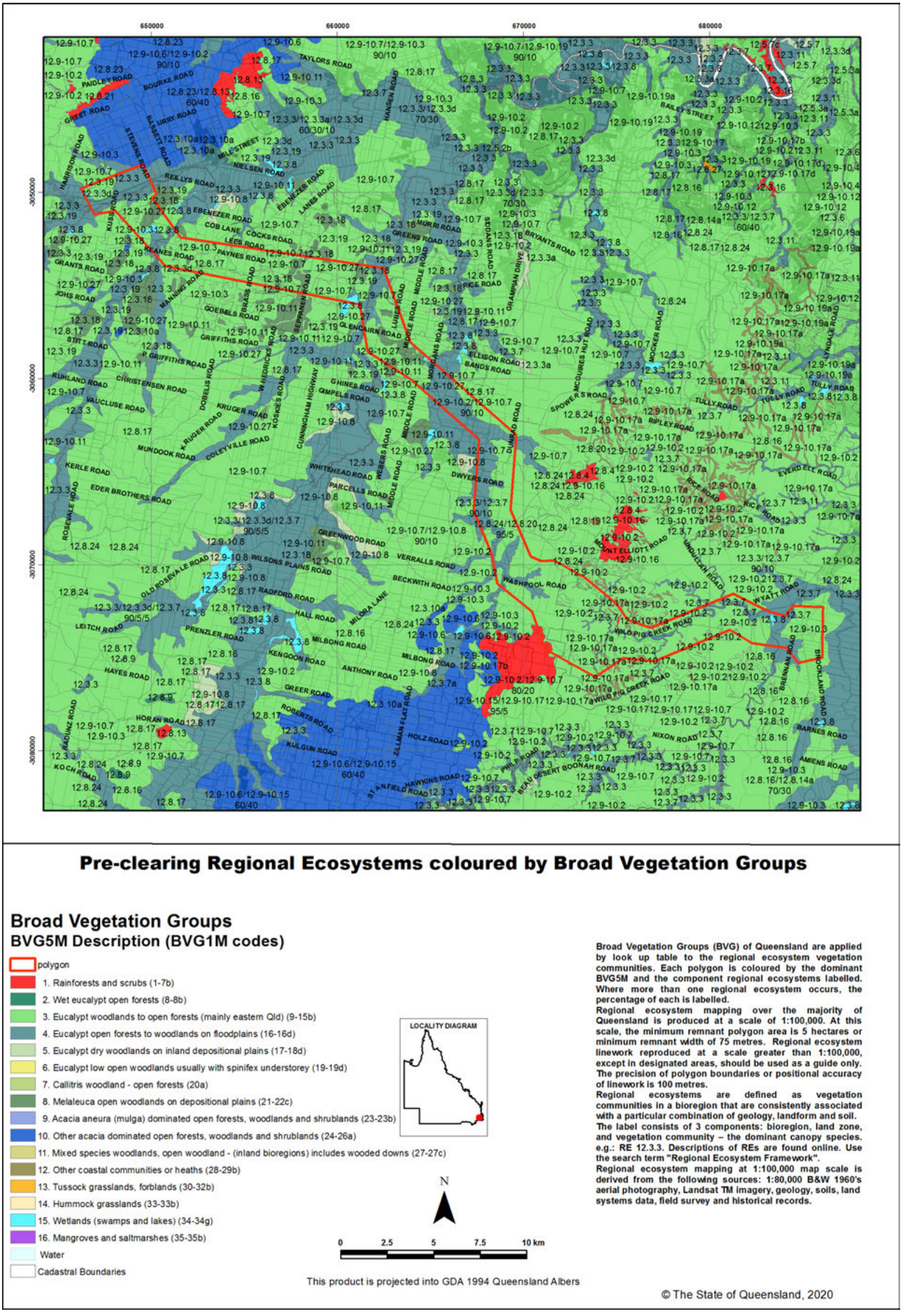
Map 3 - Pre-clearing regional ecosystems



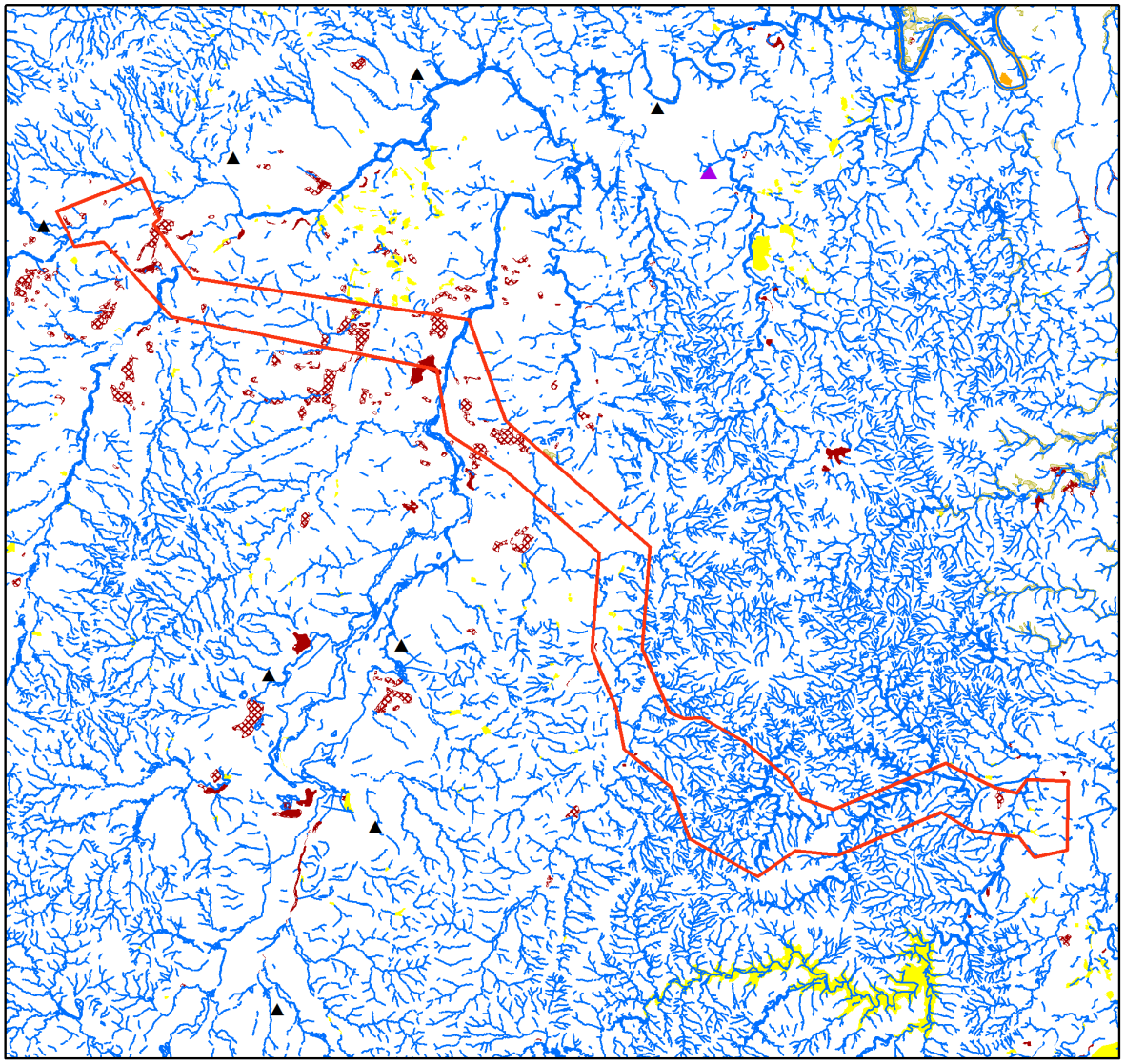
Map 4 - Remnant 2017 regional ecosystems by BVG (5M)



Map 5 - Pre-clearing regional ecosystems by BVG (5M)



Map 6 - Wetlands and waterways



Queensland Wetland Data

Legend

- polygon
- Towns

Queensland Wetland Data

- Riverine Drainage Lines
- Springs

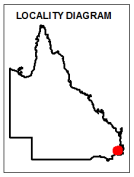
Wetland System - Water Bodies

- Marine Waterbodies
- Estuarine Waterbodies
- Riverine Waterbodies
- Lacustrine Waterbodies
- Palustrine Waterbodies

Wetland System - Regional Ecosystems

- Marine RE
- Estuarine RE
- Riverine RE
- Lacustrine RE
- Palustrine RE
- RE 51-80% wetland (mosaic units)
- RE 1-50% wetland (mosaic units)

LOCALITY DIAGRAM



N

0 2300 4600 6900 9200 11500 m

This product is projected into GDA 1994 Queensland Albers

Accuracy information: The positional accuracy of wetland data mapped at a scale of 1:100,000 is +/-100m with a minimum polygon size of 5ha or 75m wide for linear features, except for areas along the east coa st which are mapped at the 1:50,000 scale with a positional accuracy of +/-50m, with a minimum polygon size of 1ha or 35m wide for linear features. Wetlands smaller than 1ha are not delineated on the wetland data. Consideration of the effects of mapped scale is necessary when interpret ing data at a larger scale, e.g. 1:25,000. For property assessment, digital linework should be used as a guide only. The extent of wetlands depicted on this map is based on rectified 2013 Landsat ETM+ imagery supplied by Statewide Landcover and Trees Study (SLATS), Department of Environment and Science. The extent of water bodies is based on the maximum extent of inundation derived from available Landsat imagery up to and including the 2013 imagery.

Links and Other Information Sources

The Department of Environment and Science's Website -

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/

provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from:

https://publications.qld.gov.au/dataset/redd/resource/

The methodology for mapping regional ecosystems can be downloaded from:

https://publications.qld.gov.au/dataset/redd/resource/

Technical descriptions for regional ecosystems can be obtained from:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

Benchmarks can be obtained from:

http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Government Information System portal,

http://dds.information.qld.gov.au/dds/

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link:

http://www.dnrm.qld.gov.au/mapping-data/queensland-globe

References

Neldner, V.J., Niehus R.E., Wilson, B.A. McDonald, W.J.F., Ford, A.J. and Accad, A. (2017) The Vegetation of Queensland. Descriptions of Broad Vegetation Groups. Version 3.0. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts.

(https://publications.qld.gov.au/dataset/redd/resource/78209e74-c7f2-4589-90c1-c33188359086)

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S. and Butler, D.W. (2017) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. Version 4.0. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts.

(https://publications.qld.gov.au/dataset/redd/resource/6dee78ab-c12c-4692-9842-b7257c2511e4)

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

The dataset listed below is available for download from:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/download/

- Regional Ecosystem Description Database

The datasets listed below are available for download from:

http://dds.information.qld.gov.au/dds/

- Biodiversity status of pre-clearing and 2017 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas

Appendix 2 - Acronyms and Abbreviations

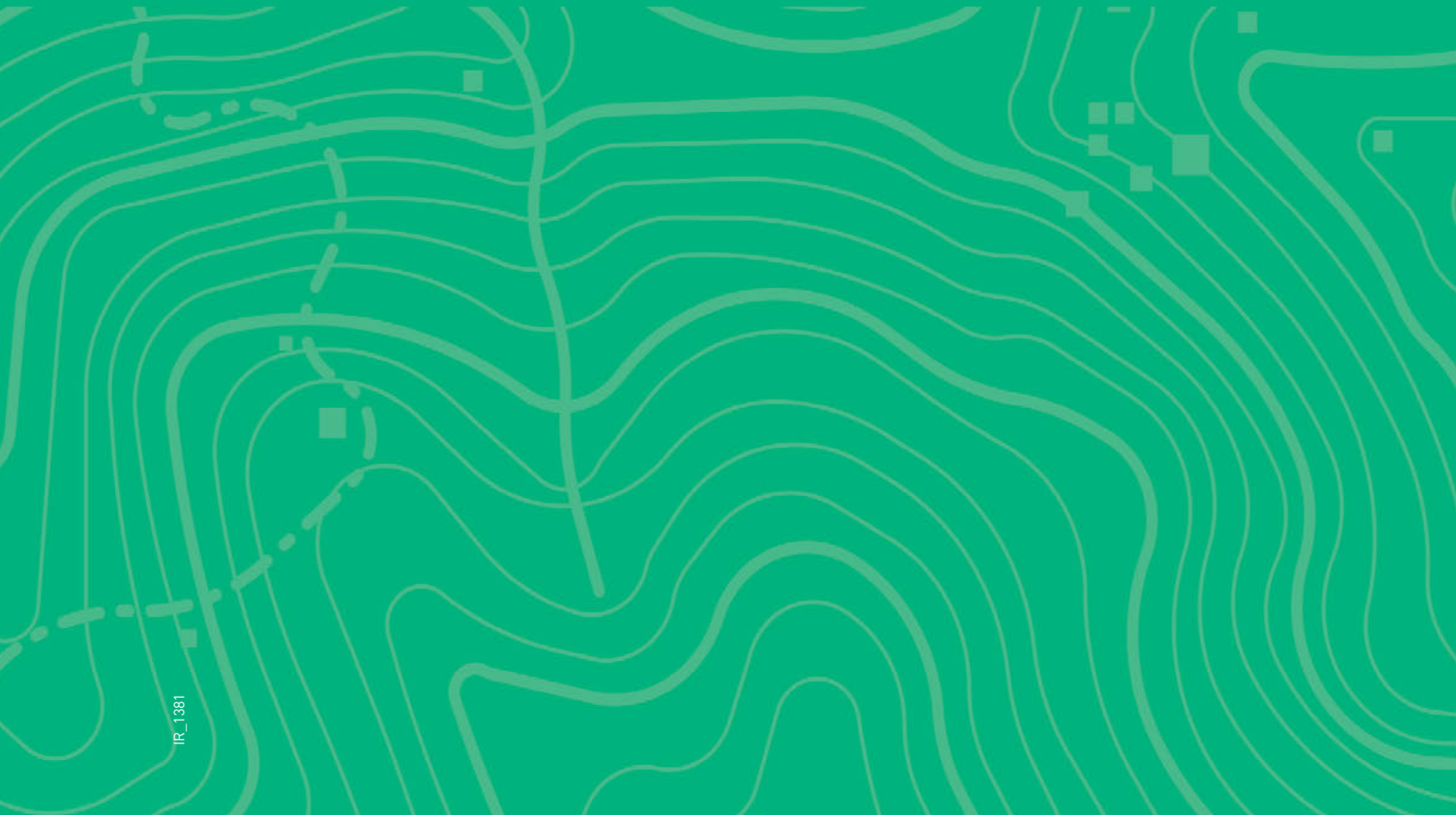
AOI	- Area of Interest
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
VMA	- *Vegetation Management Act 1999*

APPENDIX K

Matters of National Environmental Significance Technical Report

Appendix E Flora Species List

CALVERT TO KAGARU ENVIRONMENTAL IMPACT STATEMENT



IR_1381

Flora species recorded during Autumn 2016 GHD and Spring 2017 FFJV field assessments undertaken as part of the project EIS

Family	Species name	Common name	Conservation status		Native/ non-native	Restricted matter
			NC Act	EPBC Act		
Acanthaceae	*Rostellularia adscendens*	Pink tongues	LC	-	Native	-
Adiantacae	*Adiantum hispidulum*	Rough maidenhair fern	SLC	-	Native	-
Adiantaceae	*Cheilanthes sieberi subsp. sieberi*	Rock fern	SLC	-	Native	-
Amaranthaceae	*Achyranthes aspera*	Chaff flower	LC	-	Native	-
Amaranthaceae	*Alteranthera pungens*	Kakhi weed	-	-	Non-native	-
Amaranthaceae	*Alternanthera denticulata*	Lesser joyweed	LC	-	Native	-
Amaranthaceae	*Gomphrena celosioides*	Gomphrena weed	-	-	Non-native	-
Anthericaceae	*Tricoryne elatior*	Yellow autumn-lily	LC	-	Native	-
Apocynaceae	*Alstonia constricta*	Bitterbark	LC	-	Native	-
Apocynaceae	*Alyxia ruscifolia*	Chainfruit	LC	-	Native	-
Apocynaceae	*Asclepias curassavica*	Red-head cottonbush	-	-	Non-native	-
Apocynaceae	*Carissa ovata*	Currantbush	LC	-	Native	-
Apocynaceae	*Gomphocarpus fruticosus*	Swan plant	-	-	Non-native	-
Apocynaceae	*Gomphocarpus physocarpus*	Balloon cottonbush	-	-	Non-native	-
Apocynaceae	*Hoya australis subsp. australis*	Wax flower	LC	-	Native	-
Apocynaceae	*Parsonsia straminea*	Monkey rope	LC	-	Native	-
Apocynaceae	*Secamone elliptica*	Corky milk vinw	LC	-	Native	-
Araucariaceae	*Araucaria cunninghamiana (planted)*	Hoop pine	LC	-	Native	-
Aristolochiaceae	*Aristolochia elegans*	Dutchman's pipe	-	-	Non-native	Category 3
Asparagaceae	*Asparagus africanus*	Asparagus fern	-	-	Non-native	Category 3
Asteraceae	*Ageratina riparia*	Mist flower	-	-	Non-native	-
Asteraceae	*Ageratum houstonianum*	Blue billygoat weed	-	-	Non-native	-
Asteraceae	*Ambrosia artemisiifolia*	Annual ragweed	-	-	Non-native	-

Family	Species name	Common name	Conservation status		Native/ non-native	Restricted matter
			NC Act	EPBC Act		
Asteraceae	*Aster subulatus*	Wild aster	-	-	Non-native	-
Asteraceae	*Baccharis halimifolia*	Groundsel bush	-	-	Non-native	Category 3
Asteraceae	*Bidens pilosa*	Cobbler's peg	-	-	Non-native	-
Asteraceae	*Centipeda minima*	Spreading sneezeweed	LC	-	Native	-
Asteraceae	*Chrysocephalum apiculatum*	Yellow buttons	LC	-	Native	-
Asteraceae	*Cirsium vulgare*	Spear thistle	-	-	Non-native	-
Asteraceae	*Erigeron bonariensis*	Flaxleaf fleabane	-	-	Non-native	-
Asteraceae	*Erigeron parva*	-	-	-	Non-native	-
Asteraceae	*Erigeron sumatrensis*	-	-	-	Non-native	-
Asteraceae	*Cyanthillium cinereum*	Veronia	LC	-	Native	-
Asteraceae	*Emilia sonchifolia*	Lilac tasselflower	-	-	Non-native	-
Asteraceae	*Hypochaeris glabra*	Cat's ear	-	-	Non-native	-
Asteraceae	*Ozothamnus diosmifolius*	White dogwood	LC	-	Native	-
Asteraceae	*Parthenium hysterophorus*	Parthenium weed	-	-	Non-native	Category 3
Asteraceae	*Pterocaulon redolens*	A herb	LC	-	Native	-
Asteraceae	*Senecio madagascariensis*	Fireweed	-	-	Non-native	Category 3
Asteraceae	*Sonchus oleraceus*	Sow thistle	-	-	Non-native	-
Asteraceae	*Tagetes minuta*	Stinking roger	-	-	Non-native	-
Asteraceae	*Tridax procumbens*	Tridax	-	-	Non-native	-
Asteraceae	*Vittadinia dissecta*	-	LC	-	Native	-
Asteraceae	*Xanthium occidentale*	Noogoora burr	-	-	Non-native	-
Asteraceae	*Zinnia peruviana*	Peruvian zinia	-	-	Non-native	-
Bignoniaceae	*Pandorea pandorana*	Wonga wonga vine	LC	-	Native	-
Boraginaceae	*Heliotropium amplexicaule*	Blue heliotrope	-	-	Non-native	-
Cactaceae	*Opuntia stricta*	Common prickly pear	-	-	Non-native	Category 3
Cactaceae	*Opuntia tomentosa*	Velvety tree pear	-	-	Non-native	Category 3

Family	Species name	Common name	Conservation status		Native/ non-native	Restricted matter
			NC Act	EPBC Act		
Caesalpiniaceae	*Chamaecrista rotundifolia*	Round-leafed cassia	-	-	Non-native	-
Campanulaceae	*Lobelia purpurascens*	White root	SLC	-	Native	-
Campanulaceae	*Wahlenbergia gracilis*	Sprawling bluebell	SLC	-	Native	-
Casuarinaceae	*Allocasuarina littoralis*	Black she-oak	LC	-	Native	-
Casuarinaceae	*Allocasuarina sp*	Shoak	LC	-	Native	-
Casuarinaceae	*Allocasuarina torulosa*	Mountain oak	LC	-	Native	-
Casuarinaceae	*Casuarina cunninghamiana*	River she-oak	LC	-	Native	-
Chenopodiaceae	*Einadia nutans*	Climbing saltbush	LC	-	Native	-
Chenopodiaceae	*Enchylaena tomentosa*	Ruby saltbush	LC	-	Native	-
Chenopodiaceae	*Maireana microphylla*	Small-leaf bluebush	LC	-	Native	-
Chenopodiaceae	*Sclerolaena muricata*	Black roly-poly	LC	-	Native	-
Commelinaceae	*Commelina diffusa*	Wandering jew	LC	-	Native	-
Commelinaceae	*Murdannia graminea*	Grass lily	LC	-	Native	-
Convolvulaceae	*Dichondra repens*	Kidney weed	LC	-	Native	-
Convolvulaceae	*Evolvulus alsinoides*	Slender dwarf morning-glory	LC	-	Native	-
Convolvulaceae	*Ipomoea cairica*	Coastal morning glory	-	-	Non-native	-
Crassulaceae	*Bryophyllum delagoense*	Mother of millions	-	-	Non-native	Category 3
Cyperaceae	*Carex appressa*	Tall sedge	LC	-	Native	-
Cyperaceae	*Cyperus sp*	Sedge	LC	-	Native	-
Cyperaceae	*Cyperus bifax*	Nutgrass	LC	-	Native	-
Cyperaceae	*Cyperus difformis*	Dirty dora	LC	-	Native	-
Cyperaceae	*Cyperus exaltatus*	Tall flatsedge	LC	-	Native	-
Cyperaceae	*Cyperus gracilis*	Slender flat-sedge	LC	-	Native	-
Cyperaceae	*Cyperus polystachyos*	Bunchy sedge	LC	-	Native	-
Cyperaceae	*Cyperus trinervis*	Flatsedge	LC	-	Native	-
Cyperaceae	*Eleocharis cylindrostachys*	-	LC	-	Native	-
Cyperaceae	*Fimbristylis dichotoma*	Common fringe-rush	LC	-	Native	-

Family	Species name	Common name	Conservation status		Native/ non-native	Restricted matter
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Cyperaceae	*Gahnia aspera*	Rough saw-sedge	LC	-	Native	-
Cyperaceae	*Lepironia articulata*	Grey rush	LC	-	Native	-
Dennstaedtiaceae	*Pteridium esculentum*	Common bracken	LC	-	Native	-
Euphorbiaceae	*Alchornea ilicifolia*	Native holly	LC	-	Native	-
Euphorbiaceae	*Euphorbia hirta*	Asthma weed	-	-	Non-native	-
Euphorbiaceae	*Homalanthus stillingiifolius*	Small-leaved bleeding heart	LC	-	Native	-
Euphorbiaceae	*Mallotus philippensis*	Red kamala	LC	-	Native	-
Euphorbiaceae	*Ricinus communis*	Castor oil bush	-	-	Non-native	-
Fabacae	*Crotalaria mitchellii*	Yellow rattlepod	LC	-	Native	-
Fabacae	*Jacksonia scoparia*	Dogwood	LC	-	Native	-
Fabacae	*Macroptilium lathyroides*	Phasey bean	-	-	Non-native	-
Fabacae	*Rhynchosia minima*	Rhynchosia	LC	-	Native	-
Fabacae	*Stylosanthes scabra*	Stylo	-	-	Non-native	-
Fabaceae	*Desmodium rhytidophyllum*	Hairy trefoil	LC	-	Native	-
Fabaceae	*Glycine tabacina*	Glycine pea	LC	-	Native	-
Fabaceae	*Hardenbergia violacea*	Purple coral pea	LC	-	Native	-
Fabaceae	*Macroptilium atropurpureum*	Siratro	-	-	Non-native	-
Fabaceae	*Macroptilium lathyroides var. semierectum*	Cow pea	-	-	Non-native	-
Fabaceae	*Medicago polymorpha*	Burr medic	-	-	Non-native	-
Fabaceae	*Rhynchosia minima var. minima*	Least snout-bean	LC	-	Native	-
Goodeniaceae	*Goodenia hederacea*	Forest goodenia	LC	-	Native	-
Hemerocallidaceae	*Dianella brevipedunculata*	Blue flax lily	LC	-	Native	-
Hemerocallidaceae	*Dianella caerulea*	Blue flax lily	LC	-	Native	-

Family	Species name	Common name	Conservation status		Native/ non-native	Restricted matter
			NC Act	EPBC Act		
Hemerocallidaceae	*Dianella revoluta*	Blue flax lily	LC	-	Native	-
Hypericaceae	*Hypericum gramineum*	Small St. John's wort	LC	-	Native	-
Juncaceae	*Juncus continuus*	A rush	LC	-	Native	-
Juncaceae	*Juncus usitatus*	-	LC	-	Native	-
Lamiaceae	*Plectranthus sp.*	-	-	-	Non-native	-
Lauraceae	*Cinnamomum camphora*	Camphor laurel	-	-	Non-native	Category 3
Lauraceae	*Cassytha pubescens*	Downy devil's twine	LC	-	Native	-
Lauraceae	*Neolitsea dealbata*	Bolly gum	LC	-	Native	-
Laxmanniaceae	*Eustrephus latifolius*	Wombat berry	LC	-	Native	-
Laxmanniaceae	*Laxmannia gracilis*	Slender wire lily	LC	-	Native	-
Laxmanniaceae	*Lomandra filiformis*	Wattle matrush	LC	-	Native	-
Laxmanniaceae	*Lomandra hystrix*	-	LC	-	Native	-
Laxmanniaceae	*Lomandra longifolia*	Spiny-head mat-rush	LC	-	Native	-
Laxmanniaceae	*Lomandra multiflora subsp. multiflora*	Many-flowered mat-rush	LC	-	Native	-
Loranthaceae	*Amyema miquelii*	Box mistletoe	LC	-	Native	-
Malvaceae	*Malvastrum americanum var. americanum*	Spiked malvastrum	-	-	Non-native	-
Malvaceae	*Sida cordifolia*	Flannelweed	-	-	Non-native	-
Malvaceae	*Sida hackettiana*	Golden rod	LC	-	Native	-
Marsileaceae	*Marsilea drummondii*	Common nardoo	LC	-	Native	-
Marsileaceae	*Marsilea hirsuta*	Hairy nardoo	LC	-	Native	-
Meliaceae	*Melia azedarach*	White cedar	LC	-	Native	-
Menyanthaceae	*Nymphoides indica*	Water snowflake	LC	-	Native	-
Mimosaceae	*Acacia complanata*	Flat-stemmed wattle	LC	-	Native	-
Mimosaceae	*Acacia concurrens*	Black wattle	LC	-	Native	-

Family	Species name	Common name	Conservation status		Native/ non-native	Restricted matter
			NC Act	EPBC Act		
Mimosaceae	*Acacia disparrima*	Hickory wattle	LC	-	Native	-
Mimosaceae	*Acacia fimbriata*	Fringed wattle	LC	-	Native	-
Mimosaceae	*Acacia harpophlylla*	Brigalow	LC	-	Native	-
Mimosaceae	*Acacia leiocalyx*	Black wattle	LC	-	Native	-
Mimosaceae	*Acacia maidenii*	Maiden's wattle	LC	-	Native	-
Mimosaceae	*Acacia salicina*	Doolan	LC	-	Native	-
Mimosaceae	*Acacia sp*	Wattle	LC	-	Native	-
Mimosaceae	*Leucaena leucocephala*	Leucaena	-	-	Non-native	-
Mimosaceae	*Neptunia gracilis*	Native sensitive plant	LC	-	Native	-
Mimosaceae	*Vachellia farnesiana*	Mimosa bush	-	-	Non-native	-
Moraceae	*Ficus opposita*	Sandpaper fig	LC	-	Native	-
Moraceae	*Ficus rubiginosa*	Rusty fig	LC	-	Native	-
Moraceae	*Ficus rubiginosa forma rubiginosa*	Port Jackson fig	LC	-	Native	-
Moraceae	*Maclura cochinchinensis*	Cockspur thorn	LC	-	Native	-
Moraceae	*Streblus brunonianus*	Whalebone tree	LC	-	Native	-
Myrtaceae	*Angophora subvelutina*	Broadleaf apple	LC	-	Native	-
Myrtaceae	*Corymbia citriodora subsp. citriodora*	Spotted gum	LC	-	Native	-
Myrtaceae	*Corymbia citriodora subsp. variegata*	Spotted gum	LC	-	Native	-
Myrtaceae	*Corymbia intermedia*	Pink bloodwood	LC	-	Native	-
Myrtaceae	*Corymbia tessellaris*	Moreton Bay ash	LC	-	Native	-
Myrtaceae	*Eucalyptus acmenoides*	White mahogany	LC	-	Native	-
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved red ironbark	LC	-	Native	-
Myrtaceae	*Eucalyptus grandis (planted)*	Flooded gum	LC	-	Native	-
Myrtaceae	*Eucalyptus moluccana*	Gum-topped box	LC	-	Native	-

Family	Species name	Common name	Conservation status		Native/ non-native	Restricted matter
			NC Act	EPBC Act		
Myrtaceae	*Eucalyptus siderophloia*	Grey ironbark	LC	-	Native	-
Myrtaceae	*Eucalyptus tereticornis*	Queensland bluegum	LC	-	Native	-
Myrtaceae	*Eucalytpus melanophloia*	Silver-leaved ironbark	LC	-	Native	-
Myrtaceae	*Lophostemon confertus*	Brush box	LC	-	Native	-
Myrtaceae	*Lophostemon suaveolens*	Swamp box	LC	-	Native	-
Myrtaceae	*Melaleuca irbyana*	Swamp tea-tree	E	-	Native	-
Myrtaceae	*Melaleuca viminalis*	Weeping bottlebrush	LC	-	Native	-
Nymphaeaceae	*Nymphaea gigantea*	Giant waterlily	LC	-	Native	-
Oleaceae	*Jasminum didymum subsp. didymum*	Jasmine	LC	-	Native	-
Oleaceae	*Jasminum simplicifolium*	Native jasmine	LC	-	Native	-
Oleaceae	*Jasminum simplicifolium subsp. australiense*	Stiff jasmine	LC	-	Native	-
Oleaceae	*Notelaea lloydii*	Loyd's native olive	V	V	Native	-
Oleaceae	*Notelaea longifolia*	Large-leaved olive	LC	-	Native	-
Oleaceae	*Notelaea microcarpa*	Native olive	LC	-	Native	-
Onagraceae	*Ludwigia peploides subsp. montevidensis*	Water primrose	LC	-	Native	-
Orchidaceae	*Cymbidium canaliculatum*	Black orchid	SLC	-	Native	-
Orchidaceae	*Dockrillia linguiformis*	Tongue orchid	SLC	-	Native	-
Oxalidaceae	*Oxalis perennans*	Native oxalis	LC	-	Native	-
Passifloraceae	*Passiflora suberosa*	Corky passion flower	-	-	Non-native	-
Philydraceae	*Philydrum lanuginosum*	Wooly frogmouth	LC	-	Native	-
Phyllanthaceae	*Breynia oblongifolia*	Coffee bush	LC	-	Native	-
Picrodendraceae	*Petalostigma pubescens*	Quinine tree	LC	-	Native	-
Pittosporaceae	*Bursaria spinosa*	Sweet bursaria	LC	-	Native	-
Poaceae	*Ancistrachne uncinulata*	Hooky grass	LC	-	Native	-
Poaceae	*Aristida calycina*	Dark wiregrass	LC	-	Native	-
Poaceae	*Aristida holathera*	Erect kerosene grass	LC	-	Native	-
Poaceae	*Aristida personata*	Purple wiregrass	LC	-	Native	-
Poaceae	*Aristida sp*	Wiregrass	LC	-	Native	-
Poaceae	*Aristida vagans*	Threeawn speargrass	LC	-	Native	-
Poaceae	*Austrostipa ramosissima*	Stout bamboo grass	LC	-	Native	-

Family	Species name	Common name	Conservation status		Native/ non-native	Restricted matter
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Poaceae	*Bothriochloa decipens*	Pitted bluegrass	LC	-	Native	-
Poaceae	*Cenchrus ciliaris*	Buffle grass	-	-	Non-native	-
Poaceae	*Chloris divaricata*	Slender chloris	LC	-	Native	-
Poaceae	*Chloris gayana*	Rhodes grass	-	-	Non-native	-
Poaceae	*Chloris truncata*	Windmill grass	LC	-	Native	-
Poaceae	*Chloris ventricosa*	Tall chloris	LC	-	Native	-
Poaceae	*Cymbopogon refractus*	Barbed-wire grass	LC	-	Native	-
Poaceae	*Cynodon dactylon*	Green couch	LC	-	Native	-
Poaceae	*Dichanthium aristatum*	Angelton grass	-	-	Non-native	-
Poaceae	*Dichanthium sericeum*	Queensland bluegrass	LC	-	Native	-
Poaceae	*Dinebra decipiens var. decipiens*	A grass	LC	-	Native	-
Poaceae	*Eleusine indica*	Goose grass	-	-	Non-native	-
Poaceae	*Eragrostis brownii*	Brown's lovegrass	LC	-	Native	-
Poaceae	*Eragrostis elongata*	Clustered lovegrass	LC	-	Native	-
Poaceae	*Eragrostis sororia*	-	LC	-	Native	-
Poaceae	*Heteropogon contortus*	Black speargrass	LC	-	Native	-
Poaceae	*Imperata cylindrica*	Blady grass	LC	-	Native	-
Poaceae	*Leersia hexandra*	Swamp ricegrass	LC	-	Native	-
Poaceae	*Leptochloa digitata*	Umbrella canegrass	LC	-	Native	-
Poaceae	*Megathyrsus maximus*	Guinea grass	-	-	Non-native	-
Poaceae	*Megathyrsus maximus var. maximus*	Guinea grass	-	-	Non-native	-
Poaceae	*Melinis repens*	Red natal grass	-	-	Non-native	-
Poaceae	*Oplismenus aemulus*	Creeping shade grass	LC	-	Native	-
Poaceae	*Panicum decompositum var. decompositum*	Native millet	LC	-	Native	-
Poaceae	*Panicum effusum*	Hairy panic	LC	-	Native	-
Poaceae	*Panicum queenlandicum*	Coolabah grass	LC	-	Native	-
Poaceae	*Panicum simile*	-	LC	-	Native	-
Poaceae	*Paspalidium caespitosum*	Brigalow grass	LC	-	Native	-
Poaceae	*Paspalidium distans*	Shot grass	LC	-	Native	-
Poaceae	*Paspalum dilatatum*	Dallas grass	-	-	Non-native	-
Poaceae	*Setaria sphacelata*	South African pigeon grass	-	-	Non-native	-
Poaceae	*Sporobolus creber*	Slender rat's tail grass	LC	-	Native	-
Poaceae	*Sporobolus elongatus*	Hairy grass	LC	-	Native	-

Family	Species name	Common name	Conservation status		Native/ non-native	Restricted matter
			NC Act	EPBC Act		
Poaceae	*Sporobolus natalensis*	Giant rat's tail grass	-	-	Non-native	-
Poaceae	*Themeda triandra*	Kangaroo grass	LC	-	Native	-
Poaceae	*Tragus australianus*	Burr grass	LC	-	Native	-
Poaceae	*Urochloa mutica*	Para grass	LC	-	Native	-
Poaceae	*Bothriochloa bladhii*	Forest bluegrass	LC	-	Native	-
Polygalaceae	*Persicaria attenuata*	Knotweed	LC	-	Native	-
Polygalaceae	*Persicaria decipens*	Slender knotweed	LC	-	Native	-
Polygalaceae	*Persicaria orientalis*	-	LC	-	Native	-
Pontederiaceae	*Eichhornia crassipes*	Water hyacinth	-	-	Non-native	Category 3
Portulacaceae	*Portulaca australis*	Portulaca	LC	-	Native	-
Portulacaceae	*Portulaca pilosa*	Hairy portulaca	LC	-	Native	-
Proteaceae	*Grevillea robusta*	Silky oak	LC	-	Native	-
Protecaceae	*Persoonia sericea*	Silky geebung	LC	-	Native	-
Rhamnaceae	*Alphitonia excelsa*	Soap tree	LC	-	Native	-
Santalaceae	*Exocarpos cupressiformis*	Native cherry	LC	-	Native	-
Sapindaceae	*Alectryon diversifolius*	Scrub boonaree	LC	-	Native	-
Sapindaceae	*Alectryon tomentosus*	Hairy birds eye	LC	-	Native	-
Sapindaceae	*Atalaya hemiglauca - Incidental*	Whitewood	LC	-	Native	-
Sapindaceae	*Cardiospermum grandiflorum*	Balloon vine	-	-	Non-native	Category 3
Sapindaceae	*Cupaniopsis parvifolia*	Small-leaved tuckeroo	LC	-	Native	-
Sapindaceae	*Dodonaea triquetra*	Large-leaved hop bush	LC	-	Native	-
Sapindaceae	*Jagera pseudorhus var. pseudorhus*	Pinkfoam bark	LC	-	Native	-
Scrophulariaceae	*Eremophila debilis*	Winter apple	LC	-	Native	-
Scrophulariaceae	*Myoporum acuminatum*	Coastal boobialla	LC	-	Native	-
Smilacaceae	*Smilax australis*	Barbed-wire vine	LC	-	Native	-
Solanaceae	*Datura ferox*	Thorn apple	-	-	Non-native	-
Solanaceae	*Solanum mauritianum*	Wild tobacco	-	-	Non-native	-
Solanaceae	*Solanum torvum*	Devil's fig	-	-	Non-native	-
Sparrmanniaceae	*Grewia latifolia*	Dysentery plant	LC	-	Native	-
Sterculiaceae	*Brachychiton populneus*	Kurrajong	SLC	-	Native	-
Typhaceae	*Typha orientalis*	Broad-leaved cumbungi	LC	-	Native	-
Ulmaceae	*Aphananthe philippinensis*	Rough-leaved elm	LC	-	Native	-
Ulmaceae	*Celtis sinensis*	Chinese elm	-	-	Non-native	Category 3
Verbenaceae	*Glandularia aristigera*	Mayne's pest	-	-	Non-native	-
Verbenaceae	*Lantana camara*	Lantana	-	-	Non-native	Category 3

Family	Species name	Common name	Conservation status		Native/ non-native	Restricted matter
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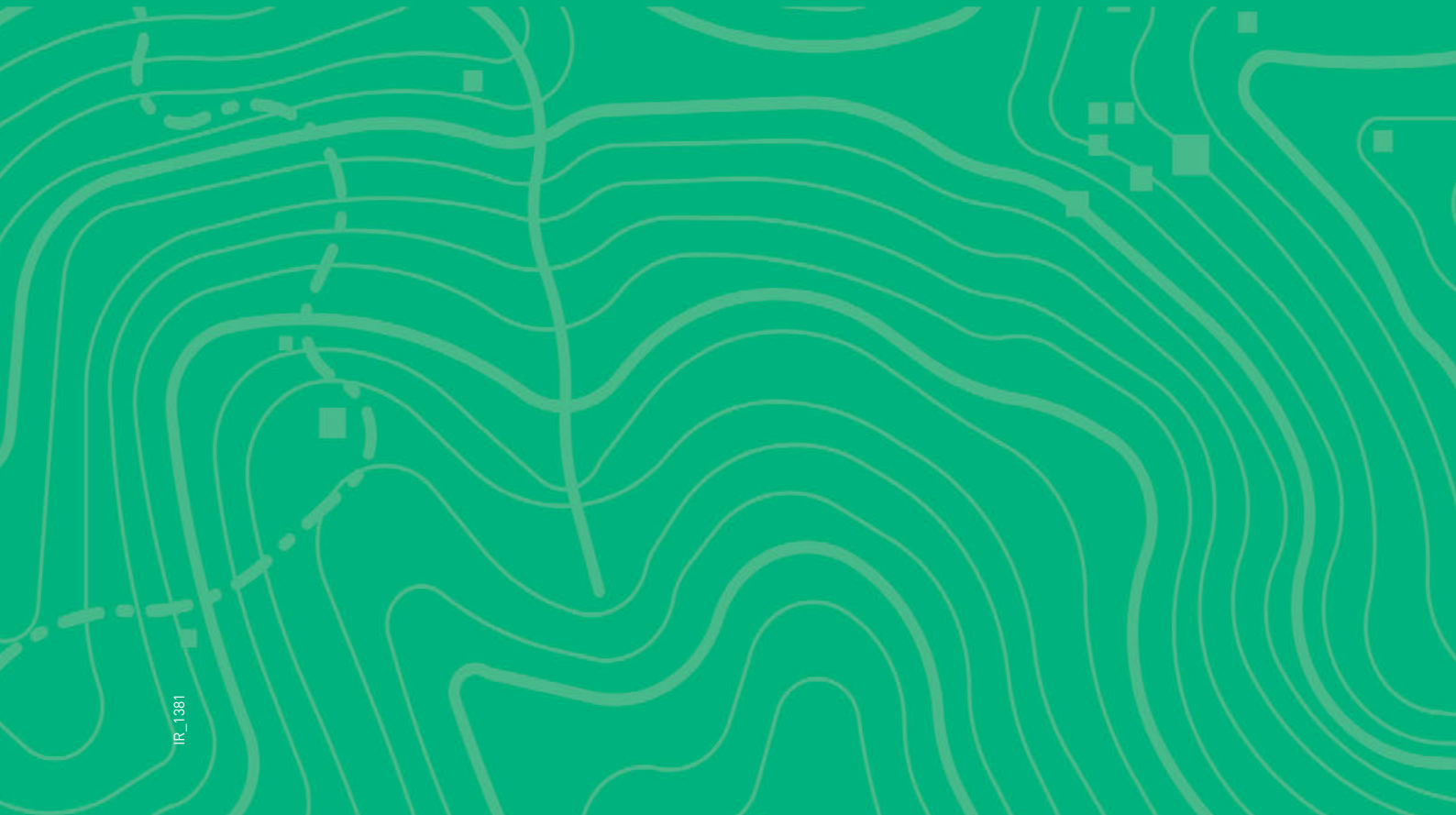
Verbenaceae	*Lantana montevidensis*	Creeping lantana	-	-	Non-native	Category 3
Verbenaceae	*Phyla canescens*	Lippia	-	-	Non-native	-
Verbenaceae	*Verbena litoralis var. litoralis*	A herb	-	-	Non-native	-
Vitaceae	*Clematicissus opaca*	Pepper vine	LC	-	Native	-
Xanthorrhoeaceae	*Xanthorrhoea johnsonii*	Johnson's grass tree	SLC	-	Native	-

APPENDIX K

Matters of National Environmental Significance Technical Report

Appendix F Fauna Species List

CALVERT TO KAGARU ENVIRONMENTAL IMPACT STATEMENT



IR_1381

Fauna species recorded during Autumn 2016 GHD and Spring 2017 FFJV field assessments undertaken as part of the project EIS

Family	Species name	Common name	Conservation status		Native/non-native	Restricted matter
			NC Act	EPBC Act		
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped thornbill	LC	-	Native	-
Acanthizidae	*Acanthiza nana*	Yellow thornbill	LC	-	Native	-
Acanthizidae	*Acanthiza pusilla*	Brown thornbill	LC	-	Native	-
Acanthizidae	*Acanthiza reguloides*	Buff-rumped thornbill	LC	-	Native	-
Acanthizidae	*Gerygone albogularis*	White-throated gerygone	LC	-	Native	-
Acanthizidae	*Gerygone fusca*	Western gerygone	LC	-	Native	-
Acanthizidae	*Gerygone olivacea*	Gerygone	LC	-	Native	-
Acanthizidae	*Pyrrholaemus sagittatus*	Specked warbler	LC	-	Native	-
Acanthizidae	*Sericornis frontalis*	White-browed scrubwren	LC	-	Native	-
Acanthizidae	*Smicrornis brevirostris*	Weebill	LC	-	Native	-
Accipitridae	*Accipiter fasciatis*	Brown goshawk	LC	-	Native	-
Accipitridae	*Aquila audax*	Wedge-tailed eagle	LC	-	Native	-
Accipitridae	*Aviceda subcristata*	Pacific baza	LC	-	Native	-
Accipitridae	*Haliaeetus leucogaster*	White-bellied sea-eagle	LC	-	Native	-
Accipitridae	*Haliastur sphenurus*	Whistling kite	LC	-	Native	-
Aegothelidae	*Aegotheles chrisoptus*	Australian owlet-nightjar	LC	-	Native	-
Agamidae	*Physignathus lesueurii*	Eastern water dragon	LC	-	Native	-
Agamidae	*Pogona barbata*	Bearded dragon	LC	-	Native	-
Ambassidae	*Ambassis agassizii*	Agassiz's glass fish	LC	-	Native	-
Anatidae	*Anas castanea*	Chestnut teal	LC	-	Native	-
Anatidae	*Anas gracilis*	Grey teal	LC	-	Native	-
Anatidae	*Chenonetta jubata*	Australian wood duck	LC	-	Native	-
Anatidae	*Cygnus atratus*	Black swan	LC	-	Native	-
Anhingidae	*Anhinga novaehollandiae*	Australasian darter	LC	-	Native	-
Ardeidae	*Ardea alba modesta*	Eastern great egret	SLC	-	Native	-
Ardeidae	*Ardea ibis*	Cattle egret	LC	Marine	Native	-
Ardeidae	*Ardea pacifica*	White-necked heron	LC	-	Native	-
Ardeidae	*Egretta novaehollandiae*	White-faced heron	LC	-	Native	-
Artamidae	*Artamus cinereus dealbatus*	Black-faced woodswallow	LC	-	Native	-
Artamidae	*Artamus leucorynchus*	White-breasted woodswallow	LC	-	Native	-
Artamidae	*Artamus personatus*	Masked woodswallow	LC	-	Native	-
Artamidae	*Artamus superciliosus*	White-browed woodswallow	LC	-	Native	-
Artamidae	*Cracticus nigrogularis*	Pied butcherbird	LC	-	Native	-
Artamidae	*Cracticus tibicen*	Australian magpie	LC	-	Native	-
Artamidae	*Cracticus torquatus*	Grey butcherbird	LC	-	Native	-
Artamidae	*Strepera graculina*	Pied butcherbird	LC	-	Native	-
Artamidae	*Strepera graculina graculina*	Pied currawong	LC	-	Native	-
Boidae	*Morelia spilota*	Carpet python	LC	-	Native	-
Bufonidae	*Rhinella marina*	Cane toad	-	-	Non-native	-

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Cacatuidae	*Cacatua galerita*	Sulphur-crested cockatoo	LC	-	Native	-
Cacatuidae	*Cacatua tenuirostris*	Long-billed corella	LC	-	Native	-
Cacatuidae	*Calyptorhynchus lathami*	Glossy black-cockatoo (ort)	V	-	Native	-
Cacatuidae	*Eolophus roseicapillus*	Galah	LC	-	Native	-
Campephagidae	*Coracina lineata*	Barred cuckoo-shrike	LC	-	Native	-
Campephagidae	*Coracina novaehollandiae*	Black-faced cuckoo-shrike	LC	-	Native	-
Campephagidae	*Coracina papuensis*	White-bellied cuckoo-shrike	LC	-	Native	-
Canidae	*Canis lupus familiaris*	Dog (den)	-	-	Non-native	Category 3
Canidae	*Vulpes vulpes*	Red fox (den)	-	-	Non-native	Category 3
Caprimulgidae	*Eurostopodus argus*	Spotted nightjar	LC	-	Native	-
Charadriidae	*Vanellus miles*	Masked lapwing	LC	-	Native	-
Charadriidae	*Vanellus tricolor*	Banded lapwing	LC	-	Native	-
Cisticolidae	*Cisticola exilis*	Golden-headed cisticola	LC	-	Native	-
Climacteridae	*Cormobates leucophaea*	White-throated treecreeper	LC	-	Native	-
Columbidae	*Geopelia humeralis*	Bar-shouldered dove	LC	-	Native	-
Columbidae	*Geopelia placida*	Peaceful dove	LC	-	Native	-
Columbidae	*Ocyphaps lophotes*	Crested pigeon	LC	-	Native	-
Columbidae	*Phaps chalcoptera*	Common brownzewing	LC	-	Native	-
Corvidae	*Corvus coronoides*	Australian raven	LC	-	Native	-
Corvidae	*Corvus orru*	Torresian crow	LC	-	Native	-
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed cuckoo	LC	-	Native	-
Cuculidae	*Cacomantis variolosus*	Brush cuckoo	LC	-	Native	-
Cuculidae	*Calcites lucidus*	Shining bronze-cuckoo	LC	-	Native	-
Cuculidae	*Centropus phasianinus*	Pheasant coucal	LC	-	Native	-
Cuculidae	*Chrysococcyx basalis*	Horsfield's bronze-cuckoo	LC	-	Native	-
Dasyuridae	*Antechinus flavipes*	Yellow-footed antechinus	LC	-	Native	-
Dicruridae	*Dicrurus bracteatus bracteatus*	Spangled drongo (eastern Australia)	LC	-	Native	-
Dicruridae	*Rhipidura rufifrons*	Rufous fantail	SLC	Migratory	Native	-
Elapidae	*Pseudechis porphyriacus*	Red-bellied black snake	LC	-	Native	-
Elapidae	*Pseudonaja textilis*	Eastern brown snake	LC	-	Native	-
Eleotridae	*Hypseleotris galii*	Fire-tail gudgen	LC	-	Native	-
Eleotridae	*Hypseleotris klunzingeri*	Western carp gudgeon	LC	-	Native	-
Estrildidae	*Neochmia temporalis*	Red-browed finch	LC	-	Native	-
Estrildidae	*Taeniopygia bichenovii*	Double-barred finch	LC	-	Native	-
Falconidae	*Falco cenchroides*	Nankeen kestrel	LC	-	Native	-
Falconidae	*Falco peregrinus*	Peregrine falcon	LC	-	Native	-
Gekkonidae	*Gehyra dubia*	Dubious dtella	LC	-	Native	-
Halcyonidae	*Dacelo novaeguineae*	Laughing kookaburra	LC	-	Native	-
Hirundinidae	*Hirundo neoxena*	Welcome swallow	LC	-	Native	-
Hirundinidae	*Petrochelidon nigricans*	Tree martin	LC	-	Native	-
Hylidae	*Litoria caerulea*	Green tree frog	LC	-	Native	-

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Hylidae	*Litoria latoppalmata*	Broad-palmed rocket frog	LC	-	Native	-
Hylidae	*Litoria peronii*	Emerald-spotted tree frog	LC	-	Native	-
Jacanidae	*Irediparra gallinacea*	Comb-crested jacana	LC	-	Native	-
Laridae	*Hydroprogne caspia*	Caspian tern	SLC	-	Native	-
Leporidae	*Lepus europaeus*	European brown hare	-	-	Non-native	Category 3
Leporidae	*Oryctolagus cuniculus*	European rabbit	-	-	Non-native	Category 3
Macropodiae	Macropod	Macropod (scats)	LC	-	Native	-
Macropodidae	*Macropus giganteus*	Eastern grey kangaroo	LC	-	Native	-
Macropodidae	*Macropus parryi*	Whiptail wallaby	LC	-	Native	-
Macropodidae	*Macropus rufogriseus*	Red-necked wallaby	LC	-	Native	-
Maluridae	*Malurus cyaneus*	Superb fairy-wren	LC	-	Native	-
Maluridae	*Malurus lamberti*	Variegated fairy-wren	LC	-	Native	-
Maluridae	*Malurus melanocephalus*	Red-backed fairy-wren	LC	-	Native	-
Meliphagidae	*Entomyzon cyanotis*	Blue-faced honeyeater	LC	-	Native	-
Meliphagidae	*Lichenostomus chrysops*	Yellow-faced honeyeater	LC	-	Native	-
Meliphagidae	*Lichenostomus pencillatus*	White-plumed honeyeater	LC	-	Native	-
Meliphagidae	*Lichenostomus virescens*	Singing honeyeater	LC	-	Native	-
Meliphagidae	*Lichmera indistincta*	Brown honeyeater	LC	-	Native	-
Meliphagidae	*Manorina melanocephala*	Noisy miner	LC	-	Native	-
Meliphagidae	*Meliphaga lewinii*	Lewin's honeyeater	LC	-	Native	-
Meliphagidae	*Melithreptus albogularis*	White-throated honeyeater	LC	-	Native	-
Meliphagidae	*Myzomela sanguinolenta*	Scarlet honeyeater	LC	-	Native	-
Meliphagidae	*Nesoptilotis leucotis*	White-eared honeyeater	LC	-	Native	-
Meliphagidae	*Philemon citreogularis*	Little friarbird	LC	-	Native	-
Meliphagidae	*Philemon corniculatus*	Noisy friarbird	LC	-	Native	-
Meliphagidae	*Plectorhyncha lanceolata*	Striped honeyeater	LC	-	Native	-
Meropidae	*Merops ornatus*	Rainbow bee-eater	LC	Marine	Native	-
Miniopteridae	*Miniopterus australis*	Little bent-winged bat	LC	-	Native	-
Miniopteridae	*Miniopterus orianae oceanensis*	Eastern bent-winged bat	LC	-	Native	-
Molossidae	*Austronomus australis*	White-striped freetail bat	LC	-	Native	-
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	LC	-	Native	-
Monarchidae	*Myiagra inquieta*	Restless flycatcher	LC	-	Native	-
Monarchidae	*Myiagra rubecula*	leaden flycatcher	LC	-	Native	-
Motacillidae	*Anthus novaeseelandiae*	Australasian pipit	LC	-	Native	-
Muridae	*Rattus rattus*	Black rat	-	-	Non-native	-
Myobatrachidae	*Crinia sp*	Frog	LC	-	Native	-
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird	LC	-	Native	-
Neosittidae	*Daphoenositta chrysoptera*	Varied sittella	LC	-	Native	-
Oriolidae	*Oriolus sagittatus*	Olive-backed oriole	LC	-	Native	-
Pachycephalidae	*Colluricincla harmonica*	Grey shrike-thrush	LC	-	Native	-

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Pachycephalidae	*Colluricincla megarhyncha*	Little shrike-thrush	LC	-	Native	-
Pachycephalidae	*Pachydephala rufiventris*	Rufous whistler	LC	-	Native	-
Pardalotidae	*Pardalotus punctatus*	Spotted pardalote	LC	-	Native	-
Pardalotidae	*Pardalotus striatus*	Striated pardalote	LC	-	Native	-
Peramelidae	*Isoodon macrourus*	Northern brown bandicoot	LC	-	Native	-
Permelidae	*Isoodon* sp	Bandicoot (diggings)	LC	-	Native	-
Petauridae	*Petaurus norfolcensis*	Squirrel glider	LC	-	Native	-
Petauride	*Petaurus* sp	Glider (scratches)	LC	-	Native	-
Petroicidae	*Eopsaltria australis*	Eastern yellow robin	LC	-	Native	-
Petroicidae	*Microeca fascinans*	Jacky winter	LC	-	Native	-
Petroicidae	*Petroica rosea*	Rose robin	LC	-	Native	-
Petroicidae	*Tregellasia capito*	Pale yellow robin	LC	-	Native	-
Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little pied commorant	LC	-	Native	-
Phalangeridae	*Trichosurus vulpecula*	Common brushtail possum (scat)	LC	-	Native	-
Phascolarctidae	*Phascolarctos cinereus*	Koala	V	V	Native	-
Podargidae	*Podargus strigoides*	Tawny frogmouth	LC	-	Native	-
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian grebe	LC	-	Native	-
Poeciliidae	*Gambusia holbrooki*	Mosquito fish	-	-	Non-native	Category 3
Psittacidae	*Alisterus scapularis*	Australian king-parrot	LC	-	Native	-
Psittacidae	*Trichoglossus chlorolepidotus*	Scaly-breasted lorikeet	LC	-	Native	-
Psittacidae	*Trichoglossus haematodus moluccanus*	Rainbow lorikeet	LC	-	Native	-
Psittaculidae	*Glossapsitta pusilla*	Little lorikeet	LC	-	Native	-
Psittaculidae	*Neophema pulchella*	Turquoise parrot	LC	-	Native	-
Psittaculidae	*Platycercus adscitus*	Pale-headed rosella	LC	-	Native	-
Psophodidae	*Psophodes olivaceus*	Eastern whipbird	LC	-	Native	-
Rallidae	*Fulica atra*	Eurasian coot	LC	-	Native	-
Rallidae	*Gallinula tenebrosa*	Dusky moorhen	LC	-	Native	-
Recurvirostridae	*Cladorhynchus leucocephalus*	Banded stilt	LC	-	Native	-
Rhinolophidae	*Rhinolophus megaphyllus*	Southern horseshoe bat	LC	-	Native	-
Rhipiduridae	*Rhipidura albiscapa*	Grey fantail	LC	-	Native	-
Rhipiduridae	*Rhipidura leucophrys*	Willie wagtail	LC	-	Native	-
Scincidae	*Carlia pectoralis*	Open-litter rainbow skink	LC	-	Native	-
Scincidae	*Carlia vivax*	Lively skink	LC	-	Native	-
Scincidae	*Cryptoblepharus australis*	Inland snake-eyed skink	LC	-	Native	-
Scincidae	*Cryptoblepharus pulcher*	Wall skink	LC	-	Native	-
Scincidae	*Ctenotus taeniolatus*	Eastern copper-tailed skink	LC	-	Native	-
Scincidae	*Eulamprus martini*	Dark bar-sided skink	LC	-	Native	-

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Scincidae	*Eulamprus quoyii*	Eastern water-skink	LC	-	Native	-
Scincidae	*Lampropholis delicata*	Grass skink	LC	-	Native	-
Scincidae	*Lygisaurus foliorum*	Iridescent litter skink	LC	-	Native	-
Scincidae	*Morethia taeniopleura*	Fire-tailed skink	LC	-	Native	-
Strigidae	*Ninox novaeseelandiae*	Southern boobook	LC	-	Native	-
Suidae	*Sus scrofa*	Pig (scats)	-	-	Non-native	Category 3
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked echidna (diggings and scats)	SL	-	Native	-
Terapontidae	*Leiopotherapon unicolor*	Spangled perch	LC	-	Native	-
Threskiornithidae	*Plegadis falcinellus*	Glossy ibis	SLC	Migratory	Native	-
Threskiornithidae	*Threskiornis molucca*	Australian white ibis	LC	-	Native	-
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked ibis	LC	-	Native	-
Timaliidae	*Zosterops lateralis cornwalli*	Silvereye (eastern)	LC	-	Native	-
Varanidae	*Varanus varius*	Lace monitor	LC	-	Native	-
Vespertilionidae	*Chalinolobus gouldii*	Gould's wattled bat	LC	-	Native	-
Vespertilionidae	Chalinolobus nigrogriseus	Hoary bat	LC	-	Native	-
Zosteropidae	*Zosterops lateralis*	Silvereye	LC	-	Native	-