



APPENDIX 14 – AQUATIC ECOLOGY ASSESSMENT

NEW LENTON COAL PTY LTD
NEW LENTON COAL PROJECT

NEW LENTON MINE AQUATIC ECOLOGY ASESMENT

PREPARED FOR
NEW LENTON COAL PTY LTD

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NEW LENTON MINE AQUATIC ECOLOGY

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LIST OF ABBREVIATIONS

%	percent
>	greater than
<	less than
°C	degrees Celsius
µg/L	microgram(s) per litre
µm	micrometre(s)
µS/cm	microSiemen(s) per centimetre
AARC	AARC Environmental Solutions Pty Ltd
ALA	Atlas of Living Australia
ANZECC Guidelines	ANZECC Guidelines for Fresh and Marine Water Quality
ANZECC	Australia and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AusRivAS	Australian River Assessment System
AVH	Australasian Virtual Herbarium
Biosecurity Act	<i>Biosecurity Act 2014</i>
BoM	Bureau of Meteorology
CE	Critically Endangered
cm	centimetre(s)
DAF	Department of Agriculture and Fisheries
DES	Department of Environment and Science
DNRME	Department of Natural Resources, Mines and Energy
DO	dissolved oxygen
DoEE	Department of the Environment and Energy
E	Endangered

EA	Environmental Authority
EC	electrical conductivity
EMOS	Environmental Management Overview Strategy
EO Act	<i>Environmental Offsets Act 2014</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPC	Exploration Permit (Coal)
EPP (Water)	<i>Environmental Protection (Water) Policy 2009</i>
ESA	Environmentally Sensitive Area
EV	environmental value
Ext	Extinct
Fisheries Act	<i>Fisheries Act 1994</i>
g	gram(s)
GBO	general biosecurity obligation
GDA	Geocentric Datum of Australia
GDE	Groundwater Dependent Ecosystem
ha	hectare(s)
IESC	Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development
Int.	Introduced
ISQG	Interim Sediment Quality Guidelines
km	kilometre(s)
km ²	square kilometre(s)
LC	Least Concern
LJV	Lenton Joint Venture
LMM	Lenton Management and Marketing Pty Ltd
LOR	limit of reporting
m	metre(s)
mg/kg	milligram(s) per kilogram

mg/L	milligram(s) per litre
ML	Mining Lease
MLES	Matter(s) of Local Environmental Significance
mm	millimetre(s)
MNES	Matter(s) of National Environmental Significance
MSES	Matter(s) of State Environmental Significance
mV	megavolt
N	nitrogen
NATA	National Association of Testing Authorities
NC Act	<i>Nature Conservation Act 1992</i>
NCWR	<i>Nature Conservation (Wildlife) Regulation 2006</i>
ND	no data
NHG	New Hope Group Pty Ltd
NL	Not Listed
NLC	New Lenton Coal Pty Ltd
NLM	New Lenton Mine (the Project)
NT	Near Threatened
NTU	Nephelometric Turbidity Units
OIP	'Other' Invasive Plant
PMST	EPBC Act Protected Matters Search Tool
ppm	parts per million
Qld	Queensland
REMP	Receiving Environment Monitoring Program
RIP	'Restricted' Invasive Plant
SLC	Special Least Concern
SPRAT	Species Profile and Threats Database
SQO	Sediment Quality Objective
TEC	Threatened Ecological Community

V	Vulnerable
VM Act	<i>Vegetation Management Act 1999</i>
WIS	Wetland Indicator Species
WoNS	Weeds of National Significance
WPA	Wetland Protection Area
WQO	water quality objective

1.0 INTRODUCTION

AARC Environmental Solutions Pty Ltd (AARC) was commissioned by New Lenton Coal Pty Ltd (NLC) to assess the aquatic ecological values of the New Lenton Mine (NLM) (the Project). An assessment has been undertaken of ecosystems and ecological process relating to the surface water resources on the Project to support the NLC approval requirements.

NLC is a subsidiary company of New Hope Group Pty Ltd (NHG), and has a 90 percent (%) controlling interest in the joint venture company Lenton Management and Marketing Pty Ltd (LMM). The joint venture is also known as the Lenton Joint Venture (LJV). The remaining 10% balance is held by Formosa Plastics Group, a subsidiary company of Mai-Lao Power Corporation. LMM holds the New Lenton Mining Lease (ML) 70337, where it plans to develop an open-cut coal mine.

1.1 BACKGROUND

The Project was granted State approval in June 2008 for the mining of 1.5 million tonnes per annum of product coal over a production life of 10-12 years. No referral was made to the Commonwealth Department of Environment and Energy (DoEE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The site is currently approved under the conditions laid out in Environmental Authority (EA) EPML00475513.

To support the development of an Environmental Management Overview Strategy (EMOS), a flora and fauna assessment of ML 70337 was undertaken in 2004 which included a component of aquatic ecology work within the Project ML.

Mining activities have yet to commence for the Project. An EA Amendment and EPBC Act Referral is proposed by NLC for a modified project design. This report is intended to support the environmental assessment of the Project under the *Environmental Protection Act 1994* (EP Act) and the EPBC Act.

Table 1 describes the aquatic ecology surveys undertaken to date over the Project area. The findings of all surveys have been consolidated into this report.

Table 1 Summary of New Lenton Mine aquatic ecology assessments

Year	Season	Description	Conducted By	Referred to in this Report
2004	Spring	Baseline assessment of flora and fauna to support the EMOS. (aquatic trapping component)	Central Queensland University	Spring (2004) survey
2018	Summer	Assessment of aquatic ecological values to support EPBC referral.	AARC	Summer (2018) survey
2018	Autumn	Assessment of ecological values identified during road realignment assessment to support the change in Project design.	AARC	Autumn (2018) survey
2019	Autumn	Assessment of ecological values identified during gap analysis to support the change in Project design.	AARC	Autumn (2019) survey

1.2 PURPOSE OF THE CONSOLIDATED REPORT

This report aims to collate the previous assessments and recent studies outlined in Table 1, for the purpose of presenting one consolidated aquatic ecology assessment to support the New Lenton Mine EA Amendment and EPBC Referral.

This consolidated report seeks to identify aquatic ecological values pertaining to the proposed Project, in accordance with current approval requirements and guidelines for both State and Commonwealth legislation. To assess the ecological values of the site, the following scope of works was undertaken:

- updated desktop assessment of the environmental values and potential constraints associated with the Project, including database searches to identify species and communities of conservation significance known from the region;
- consolidation of all field studies previously undertaken that employed industry accepted survey methods to identify baseline aquatic ecological values of the Project. This included surveys with a targeted focus on Commonwealth and State conservation significant species and riparian / aquatic communities;
- preparation of this report consolidating the findings of all previous aquatic ecology assessments and characterising the aquatic values of the Project area; and
- assessment of the potential for Project related impacts to identified State and Commonwealth aquatic values of conservation significance.

1.3 PROJECT LOCATION

The Project is situated in the Brigalow Belt (north) bioregion and lies within the northern Bowen Basin of central Queensland (Qld). It is located approximately 65 kilometres (km) north of Moranbah and 120 km southwest of Mackay within the Isaac Regional Council local government area. The regional location of the Project is illustrated in Figure 1.

The New Lenton Mine ML 70337 occupies an area of 1,206 hectares (ha), and is bounded by Exploration Permit (coal) (EPC) 766 and EPC 865 to the north, west and south, and the Burton Coal Mine (ML 70109) to the east.



Figure 1 Project location

1.4 STUDY AREA

The entirety of ML 70337 has formed the basis of the field studies and aquatic ecology assessments previously undertaken; however, some additional work was completed over areas adjacent to the ML. This included two sites to the south of the ML surveyed during the external road realignment options study (for relocation of the Suttor Development Road) where the proposed options crossed water features.

1.5 LOCAL WATERWAYS AND TOPOGRAPHY

The proposed mine is situated in the upper Isaac River sub-catchment of the Fitzroy River Basin. The NLM lies on the Isaac River floodplain, in association with the upper reaches of the Isaac River. After leaving the Project, the Isaac River flows in a generally southern direction crossing the Peak Downs Highway near Moranbah, then continues east forming a series of braided channels and finally veers southeast to join the Mackenzie River. The Project also lies within the Great Barrier Reef catchment.

The catchment landform is relatively flat with an altitude of approximately 305 meters (m) above sea level, some minor undulations occur across much of the ML and some rocky complexes located along the southwest boundary.

The Project contains several unnamed drainage features (as determined under the *Water Act 2000*), in the form of first and second order streams. Ti-tree Creek runs in a generally southeast direction across the centre of the ML before joining with the Isaac River downstream of the lease. Hill Creek also runs roughly southeast across the northern boundary of the lease and joins with the Isaac River shortly after it enters the lease. Ti-tree Creek has recently been determined a drainage feature, whilst Hill Creek and the Isaac River are both determined watercourses (under the *Water Act 2000*). No natural wetlands occur on the Project, however there are a few dams constructed throughout the site.

Burton Gorge Dam, a man-made structure that supplies water to the region, is located approximately 5 km downstream of the Project. The Burton Gorge Dam is identified to hold the following environmental values: aquatic ecosystems, stock water, recreation (primary, secondary and visual), drinking water, industrial use and cultural and spiritual values (DES 2013a). Surface water use in the immediate receiving environment of the Project is primarily stock watering.

Waterways and topography of the Project are illustrated through Figure 2.

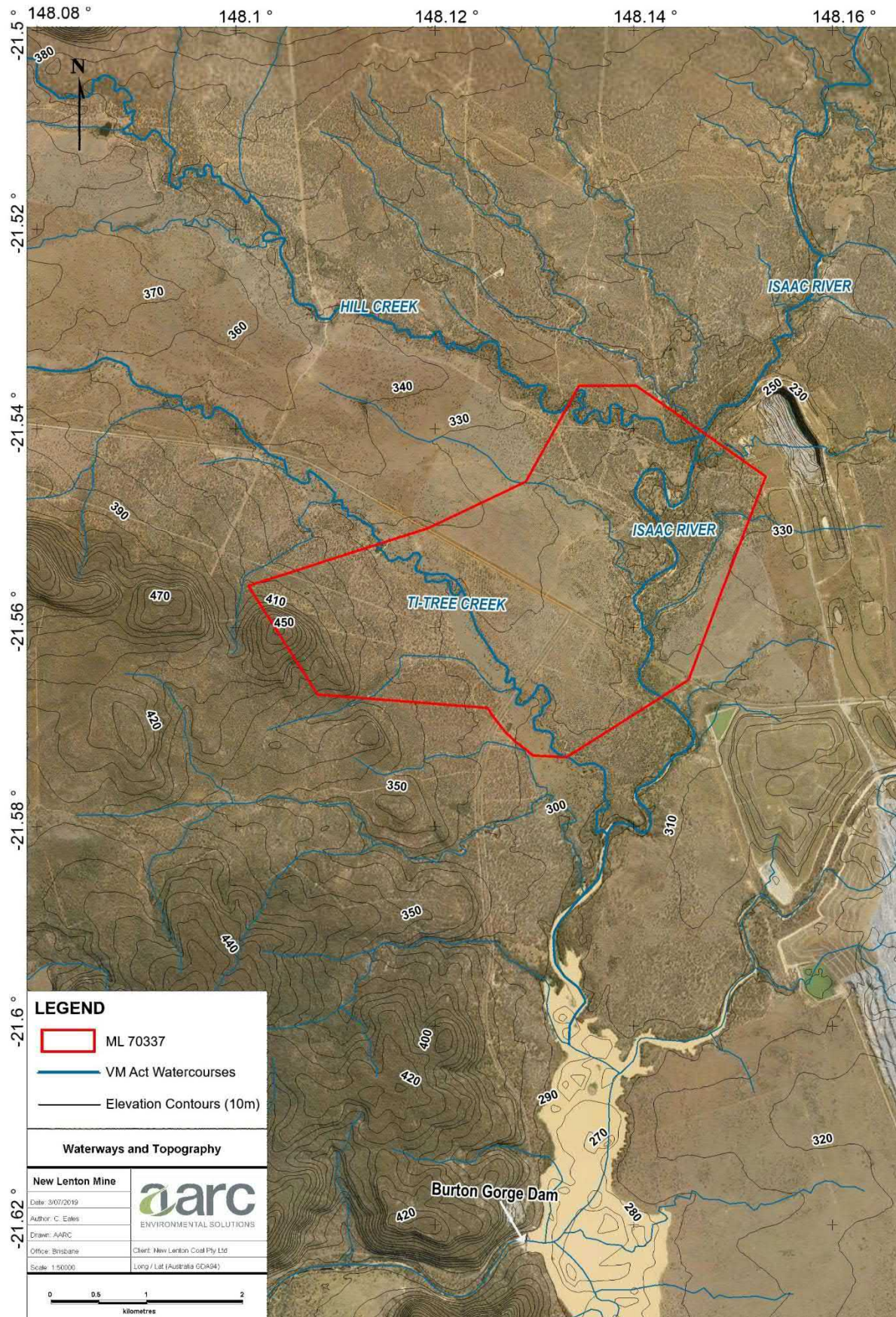


Figure 2 Waterways and topography

1.6 GEOLOGY

The Project lies within the Bowen Basin, which occupies approximately 160,000 square kilometres (km²) of central Qld, extending from Goondiwindi in the south, to Collinsville in the north. The basin, up to 10,000 m thick, is comprised of Permian fluvial sediments and volcanic rock to the east, and successions of coal and non-marine clastics to the west. Coal and fluvial clastics continued to be deposited through to the Early Triassic. The Bowen Basin contains multiple gas fields and coal resources.

The geology of the broader Project area includes a Cenozoic cover less than 10 m thick and Triassic sandstones that crop over much of the area. Closer to the Isaac River and over the Project, the Permo-Triassic sediments are covered by up to 15 m of alluvium, which is predominantly clays with basal sand and gravel layers.

1.7 REGIONAL CLIMATE

The climate in the Project region is characterised by sub-tropical conditions with warm humid summers and mild winters. Climate data for the region has been sourced from the Bureau of Meteorology (BoM) based on data collected from the Collinsville Post Office weather station (Station no. 33013) between 1955 and 2019 (BoM 2019). Mean monthly rainfall and mean minimum and maximum temperatures for the region are displayed in Figure 3.

Mean annual rainfall is approximately 703.5 millimetres (mm), and monthly rainfall means indicate the wet season predominantly occurs between November and March. The hottest months of the year typically occur between October and April with mean monthly maximums above 30 degrees Celsius (°C). The coldest months occur between June and August when mean monthly minimums are approximately 10°C. The mean annual maximum temperature for the region is 30.2 °C while the mean annual minimum temperature is 16.4°C.

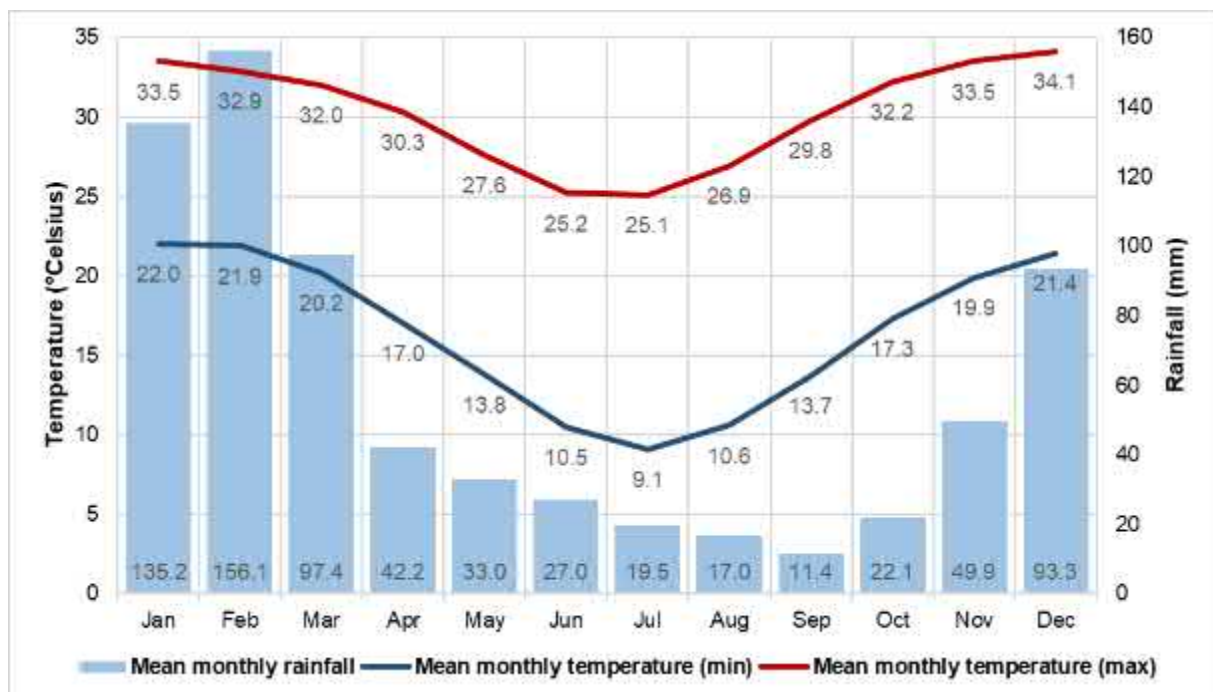


Figure 3 Mean temperature and regional rainfall

1.8 CURRENT LAND USE

The current land use at the Project is cattle grazing for beef production. Several dams, cattle yards and windmills are located within the surrounding property.

Immediately to the east of the Project is the Burton Coal Mine (open cut), where the land is subject to coal mining and exploration activities, and contains existing infrastructure that is proposed to be utilised by the NLM. The coal preparation plant and run-of-mine coal stockpile are located to the southeast of the NLM, while the Murrumbidgee rail loop and loading facility are located to the south, at the end of the Murrumbidgee Haul Road.

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2.0 RELEVANT LEGISLATION AND POLICY

Commonwealth and State legislation, policies and guidelines relevant to the assessment of terrestrial ecological values on the Project is discussed below.

2.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Under the Commonwealth EPBC Act, an action will require approval from the Federal Environment Minister if the action has, will have, or is likely to have a significant impact on a Matter of National Environmental Significance (MNES). Each MNES and its relevance to the Project is outlined in Table 2.

Table 2 Matters of National Environmental Significance and their relevance to NLM

Matters of National Environmental Significance	Relevant to the Project
World Heritage Properties	No
National Heritage Places	No
Wetlands of international importance (under the Ramsar Convention)	No
Listed threatened species and ecological communities	Yes
Migratory species protected under international agreements	Yes
Commonwealth marine areas	No
The Great Barrier Reef Marine Park	No
Nuclear actions	No
A water resource, in relation to coal seam gas development and large coal mining development	Yes

This report assesses the Project's potential impacts on listed threatened species and communities; migratory species; and aquatic ecology elements of surface water resources. This report does not seek to assess potential impacts to stygofauna, or the quality and quantity of water resources (other than how this relates to aquatic ecological values). Groundwater Dependant Ecosystems (GDEs) have been assessed in the *New Lenton Mine: Terrestrial Ecology Assessment* (AARC 2019).

The *EPBC Act Environmental Offsets Policy* (DoEE 2012) outlines the Australian Government's position on the use of environmental offsets. Environmental offsets can be used under the EPBC Act to maintain or enhance the health, diversity and productivity of the environment as it relates to matters protected by the EPBC Act. This policy only applies to projects where a significant residual impact on a MNES is proposed. Environmental offsets can be applied as an approval condition under the EPBC Act, for developments that have undergone assessment. They may be used when a development will result in a significant residual impact on a matter protected by the EPBC Act, but are not applicable to all approvals under the EPBC Act. Offsets should not be applied where the impacts of a development are considered to be minor in nature, or could reasonably be mitigated.

2.2 NATURE CONSERVATION ACT 1992

The most relevant components of the *Qld Nature Conservation Act 1992* (NC Act) to the Project, are the sections which pertain to Wildlife and Habitat Conservation. The classes of wildlife to which the NC Act applies includes protected wildlife, which is defined as Extinct wildlife; Endangered wildlife; Vulnerable wildlife; Near Threatened wildlife; and Least Concern wildlife.

Species listed under the above classes are published in the associated *Nature Conservation (Wildlife) Regulation 2006* (NCWR). 'Threatening processes' should be identified if they occur within the Project. The NC Act defines 'threatening processes' as any process that is capable of:

- a) threatening the survival of any protected area, area of major interest, protected wildlife, community of native wildlife or native wildlife habitat; or
- b) affecting the capacity of any protected area, area of major interest, protected wildlife, community of native wildlife or native wildlife habitat to sustain natural processes.

The NC Act is relevant to the Project for any protected flora or fauna species (as detailed in the NCWR) found on the Project.

2.3 BIOSECURITY ACT

The Qld *Biosecurity Act 2014* (Biosecurity Act) provides comprehensive biosecurity measures to safeguard our economy, agricultural and tourism industries, environment and way of life, from pests (e.g. wild dogs and weeds), diseases (e.g. foot-and-mouth disease), and contaminants (e.g. lead on grazing land).

Biosecurity matters are separated into three broad categories:

- A '**prohibited matter**' is a biosecurity matter that is not found in Queensland but would have a significant adverse impact on our health, way of life, and the economy or the environment if it entered the State. Prohibited matters must be reported to Biosecurity Queensland within 24 hours and all reasonable steps taken to minimise the risks of the prohibited matter and not make the situation worse.
- A '**restricted matter**' is a biosecurity matter found in Qld and has a significant impact on human health, social amenity, the economy or the environment. Restricted matters are further broken down into seven categories, with each category placing restrictions on the dealings with the biosecurity matter or actions required to be taken to minimise the spread and adverse impact of the biosecurity matter.
- An '**other matter**' is a biosecurity matter that is not a prohibited or restricted matter. Everyone is obligated to take all reasonable and practical steps to minimise the risks associated with other biosecurity matters under their control.

The Biosecurity Act is relevant to the Project in regard to the control and management of invasive plant and animal species.

2.4 ENVIRONMENTAL OFFSETS (QLD)

The Queensland environmental offsets framework consists of the:

1. *Environmental Offsets Act 2014* (EO Act);
2. *Environmental Offsets Regulation 2014*; and
3. *Queensland Environmental Offsets Policy 2014* (DES 2018a).

The offsets framework requires environmental offsets to be delivered where an activity is likely to result in a significant residual impact on a prescribed environmental matter. The *Significant Residual Impact*

Guideline (DES 2014) is used to determine whether the residual impacts are considered to be significant.

2.5 FISHERIES ACT 1994

The Queensland *Fisheries Act 1994* (Fisheries Act) protects all aquatic ecosystems from unauthorised disturbance. The main purpose of the Fisheries Act is to provide for:

- the protection of fisheries;
- the protection of marine fish;
- the protection of marine plants; and
- the facilitation of management plans.

As of the 3rd July 2017, the Fisheries Act requires waterway barrier works to be developed in accordance with the accepted development requirements. The accepted development requirements are those outlined in *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF 2018). Waterway barrier works include bridges with instream components that may block or reduce water flow within a waterway.

2.6 ENVIRONMENTAL PROTECTION (WATER) POLICY 2009

The *Environmental Protection (Water) Policy 2009* (EPP (Water)) is subordinate legislation under the *Environmental Protection Act 1994*. The EPP (Water) provides a framework for:

1. identifying environmental values (EVs) for Queensland waters, and deciding water quality objectives (WQOs) to protect or enhance those EVs; and
2. including the identified EVs and WQOs under Schedule 1 of the EPP (Water).

The EPP (Water) is relevant to the Project with regard to the protection of EVs occurring in the Isaac River and associated tributaries.

The EVs and WQOs for waters occurring on or surrounding the Project are provided in the document titled *Environmental Protection (Water) Policy 2009; Isaac River Sub-basin Environmental Values and Water Quality Objectives* (DES 2013a).

3.0 DESKTOP ASSESSMENT

Several desktop assessments have been conducted to collate information on aquatic ecological values identified in the region. These searches included previous surveys, community records and other sources. A review of databases facilitated the formulation of specific field survey techniques to target certain flora and fauna species known from the region.

The desktop assessment has been updated to include information as currently relevant. Database search results can be found in Appendix A. The following database searches have been undertaken:

1. Environmental Reports Online (search based on ML boundary);
 - a. Aquatic Conservation Assessments;
 - b. Matters of State Environmental Significance;
 - c. Regional Ecosystems;
2. Environmentally Sensitive Area (ESA) Mapping (search based on ML boundary);
3. Regulated Vegetation Management Report (search based on central coordinate point);
4. Protected Plants Flora Survey Trigger Map (search based on central coordinate point);
5. EPBC Act Protected Matters Search Tool (PMST) (two searches based on central coordinate point with 10 km and 50 km buffers);
6. Wildlife Online Species List Request;
 - a. Rare and Threatened Species (two searches based on central coordinate point with 10 km and 50 km buffers);
 - b. Introduced Species (search based on central coordinate point with 50 km buffer); and
7. WildNet Records Conservation Significant Species List (two searches based on circular area selected over the Project to best mimic a 'central point with buffer'; areas selected were roughly equivalent to 10 km and 50 km buffers with report areas of approximately 33,000 ha and 782,000 ha respectively).

Additional resources that provide species records and related information such as the Atlas of Living Australia (ALA) (ALA 2019) and the Australasian Virtual Herbarium (AVH) (AVH 2019) were consulted where appropriate, such as to support determinations of the likelihood of individual species occurring.

The EPCs surrounding the Project have had flora, fauna and aquatic assessments previously undertaken by URS in 2013 (URS 2013a; URS 2013b; URS 2013c), with documentation made available to support the development of likelihood tables and make determinations on the potential for impacts.

The following sections address items of nature conservation relevant to the Project, that have been identified within the desktop assessment.

3.1 WETLAND HABITATS

A review of the Department of Environment and Science (DES) interactive Wetlands Map database and the Map of Referable Wetlands revealed that two types of waterbodies are present within the Project. Riverine wetlands have been identified in association with the Isaac River and lacustrine wetlands occur sporadically as dams and other artificial waterbodies. No wetlands of national or international importance have been recorded in or adjacent to the Project. The Aquatic Conservation Assessments defines the Project area as having a sub-catchment conservation significance of medium (82.54%) and high (17.46%). Wetland mapping over the Project area is presented in Appendix A.

3.2 WATERWAYS FOR FISH PASSAGE

Waterways, as defined by the Fisheries Act, include rivers, creeks, streams, watercourses or inlets of the sea.

The *Queensland Waterways for Waterway Barrier Works* (DAF 2013) mapping indicates the level of 'risk' associated with undertaking waterway barrier works within Qld waterways. Waterways with higher stream orders, steeper slopes, higher flow rates, greater number of fish present and fish with stronger swimming abilities obtain a higher level of risk.

In consideration of these factors, the Isaac River is mapped as being at major risk of adverse impact from waterway barrier works on fish movement. Hill Creek is indicated as being of high risk of adverse impact, and Ti-tree Creek is indicated as being of moderate risk of adverse impact. All other un-named tributaries that are mapped waterways within the Project area are indicated as being of low to moderate risk of adverse impact from waterway barrier works on fish movement (Appendix A).

The type of waterway barrier being proposed (e.g. culverts, bed-level crossings) within these waterways determines the assessment requirements for the development.

3.3 SPECIES OF CONSERVATION SIGNIFICANCE

Species of conservation significance identified from the desktop assessment and subsequent field surveys, were assigned a likelihood of occurrence based on the criteria identified in Table 3. Targeted searches were undertaken in the field for species identified as either being likely to occur, or having potential to occur, within the study area, based on the desktop sources. The methodology was applied again after surveys to determine the likelihood of occurrence once site-based information became available.

Table 3 Criteria adopted for likelihood of occurrence determination

Likelihood of Occurrence	Criteria
Unlikely	- species or species habitat may occur, is likely to occur or is known to occur from the broader search area (based on database searches); but - preferred habitat has not been identified within the study area; and there are no confirmed species records within 10 km of the study area; or - preferred habitat occurs within the study area, but there are no confirmed species records within 50 km of the study area.
Potential	- species or species habitat may occur, is likely to occur or is known to occur from the broader search area (based on database searches); and - preferred habitat occurs within the study area; but there are no confirmed species records within 10 km of the study area; however, there are confirmed species records within 50 km of the study area; or - species indicated as likely during desktop assessment, but field surveys revealed no evidence of occurrence in the study area.
Likely	preferred habitat occurs within the study area; and confirmed species records within 10 km of the study area; however, species not yet confirmed as occurring within the study area.
Known	confirmed species records within the study area (generally as a result of a field survey).

The PMST, Wildlife Online and WildNet database searches identified no threatened or near threatened aquatic flora species with potential to occur within 50 km of the NLM (Appendix A).

The database searches identified eight aquatic fauna species of conservation significance with potential to occur within 50 km of the NLM (Appendix A). Each aquatic fauna species, its protection status, habitat requirements, and likelihood of occurrence is outlined in Appendix B. Desktop assessments to determine the likelihood of each species to occur on the study area were undertaken prior to conducting the field surveys, for the purpose of determining targeted species and suitable habitat to undertake targeted searches. The assessment was based on the knowledge of ecologists, habitat suitability, previous surveys conducted near the Project and scientific literature.

The assessment of likelihood of occurrence considered that one of the original eight species had potential to occur within the study area. *Adelotus brevis* (tusked frog) is listed as Vulnerable under the NC Act, and not listed under the EPBC Act.

Species solely listed under the EPBC Act as migratory or marine species, are discussed in the *New Lenton Mine: Terrestrial Ecology Assessment* (AARC 2019). Whilst many of these species have an association in some form to the aquatic environment, they are highly mobile and not exclusively confined to aquatic environs.

Included in the above list of eight conservation significant aquatic fauna species is one species, *Ornithorhynchus anatinus* (platypus), which is listed as Special Least Concern under the NC Act.

3.4 SURROUNDING CONDITIONS

The EPCs surrounding the Project have had flora, fauna and aquatics assessments previously undertaken by URS in 2013 (URS 2013a; URS 2013b, URS 2013c), with documentation made available to support the desktop assessment.

The aquatics survey assessed conditions of Isaac River, Hill Creek, and Ti-tree Creek. The assessment identified low levels of dissolved oxygen (DO) across sites and high levels of turbidity and EC along Ti-tree Creek. Macroinvertebrate sampling described the environmental conditions of the waterways surrounding the Project as being high in nutrients and/or salinity.

4.0 ENVIRONMENTAL VALUES AND OBJECTIVES

4.1 ENVIRONMENTAL VALUES

The waterways of the Project fall within the Isaac and Lower Connors River catchment. The *EPP (Water) Central Queensland Mapping* (WQ1301 – Isaac River sub-basin, Surface Water) identifies several watercourses (rivers/creeks) on and surrounding the Project.

Environmental Values are defined as the qualities of water that make it suitable for supporting aquatic ecosystems and a variety of human water uses (DES 2013a). The *EPP (Water)* specifies that the EVs for this catchment are those set out in the *EPP (Water) for the Isaac River Sub-basin EVs and WQOs Basin No. 130 (part)* (DES 2013a). This document identifies eleven EVs in the Isaac River sub-basin, two of which are deemed as relevant EVs for the waters surrounding the Project; namely protection of aquatic ecosystem values and suitability for stock watering.

4.2 WATER QUALITY OBJECTIVES

The *EPP (Water)* provides WQOs to support and protect the different EVs identified for waters within the Isaac River sub-basin. WQOs are provided in two main parts,

1. for the purposes of protecting the aquatic ecosystem EV; and
2. for EVs other than aquatic ecosystems (human use EVs such as stock watering).

Where more than one EV applies to receiving waters (e.g. aquatic ecosystem and stock watering), the most stringent WQO for each water quality indicator will then be adopted to protect all identified EVs. Aquatic ecosystem WQOs are more stringent than objectives for stock watering, and as such form the basis of site-specific targets and criteria. Table 4 provides the guideline WQOs identified for protection of aquatic ecosystems.

Table 4 Guideline values for the protection of aquatic ecosystem EV

Upper Isaac River Catchment Waters (refer plans WQ1301, WQ1310)		
Management Intent (level of protection)	WQOs to protect aquatic ecosystem EV	
Aquatic ecosystem (moderately disturbed)	Parameter	Water Quality Objective
	Ammonia N	<20 µg/L
	Oxidised N	<60 µg/L
	Organic N	<420 µg/L
	Total nitrogen	<500 µg/L
	Filterable reactive phosphorus	<20 µg/L
	Total phosphorus	<50 µg/L
	Chlorophyll a	<5.0 µg/L
	Dissolved oxygen	85% – 110% saturation
	Turbidity	<50 NTU
	Suspended solids	<55 mg/L
	pH	6.5 – 8.5
	Conductivity (EC) baseflow	<720 µS/cm
	Conductivity (EC) high flow	<250 µS/cm
	Sulphate	<25 mg/L

Upper Isaac River Catchment Waters (refer plans WQ1301, WQ1310)		
Management Intent (level of protection)	WQOs to protect aquatic ecosystem EV	
Stock watering	Aluminium	5 mg/L
	Arsenic	0.5 (up to 5 ³) mg/L
	Beryllium	ND
	Boron	5 mg/L
	Cadmium	0.01 mg/L
	Chromium	1 mg/L
	Cobalt	1 mg/L
	Copper	0.4 (sheep), 1 (cattle), 5 (pigs), 5 (poultry)
	Fluoride	2 mg/L
	Iron	not sufficiently toxic
	Lead	0.1 mg/L
	Manganese	not sufficiently toxic
	Mercury	0.002 mg/L
	Molybdenum	0.15 mg/L
	Nickel	1 mg/L
	Selenium	0.02 mg/L
	Uranium	0.2 mg/L
	Vanadium	ND
	Zinc	20 mg/L

Notes: N nitrogen
 EC electrical conductivity
 ND no data
 µg/L micrograms per litre
 mg/L milligrams per litre
 NTU Nephelometric Turbidity Units
 µS/cm microSiemens per centimetre

4.3 SEDIMENT QUALITY OBJECTIVES

Baseline levels of metals in sediments are important, to investigate the accrual of any pollutants. Stream sediment quality objectives for the Project are adopted from the Interim Sediment Quality Guideline (ISQG) values (ANZECC & ARMCANZ 2018) (Table 5).

Table 5 Sediment quality objectives

Contaminant	Sediment Quality Guideline Value (mg/kg)	
	Low Value	High Value
Arsenic	20	70
Cadmium	1.5	10
Chromium	80	370
Copper	65	270
Lead	50	220
Nickel	21	52
Mercury	0.15	1
Zinc	200	410

Notes: mg/kg milligram per kilogram

5.0 METHODOLOGY

5.1 FIELD SURVEY GUIDELINES

Field surveys have been undertaken at irregular intervals since 2004 covering a range of seasonal and climatic conditions. Over the study period several updates to existing survey guideline material occurred, as well as the introduction of entirely new material.

At the time of reporting the material that has guided methodology is as follows:

- *Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009* (DES 2018b);
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ 2018);
- *Australian River Assessment System (AusRivAS) Physical Assessment Protocol* (Parsons et al. 2002);
- *Queensland AusRivAS Sampling and Processing Manual* (Conrick & Cockayne 2001); and
- *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (V3.0)* (Eyre et al. 2018).

5.2 SURVEY SEASONALITY

Surveys were undertaken during the wet to post-wet period to maximise the opportunity of water being available onsite, and aquatic dependant species, especially those of a transient nature, to potentially occur within the Project.

Spring (2004) Survey

This survey was undertaken across the Project as a generic baseline assessment to identify the biodiversity values, identify threatening processes and make management recommendations for the maintenance of biodiversity. It was a primarily terrestrial survey; conducted during the spring survey season over eight days from the 30th August to 7th September 2004. The conditions preceding the survey were dry, as is typical of the region, and aquatic fauna trapping was undertaken in the only water available onsite during this survey; an artificial dam with no surrounding remnant vegetation.

Summer (2018) Survey

The first aquatic survey undertaken across the Project was conducted during the wet season over six days from the 22nd to 27th February 2018. Weather conditions were typical of the region during the summer months, with episodic periods of heavy rainfall followed by hot and humid conditions.

Prior to the field survey, some 135 mm of rainfall was recorded in February 2018 at the Moranbah Airport Weather Station, and during the survey, a further 46 mm was recorded. Rainfall data was not available from the Burton Weather Station for the survey period. However, high rainfall events recorded in February caused the Isaac River to flow, with constant flow for approximately 12 days before quickly subsiding. During the survey, conditions were warm with daily temperatures reaching a maximum of 33°C. Humidity reached 100% on the 23rd and 24th February and remained high for the rest of the survey.

Autumn (2018) Survey

A survey was undertaken across proposed road realignment corridor options (for the Suttor Development Road) located off-lease, that included two 'dry' aquatic sites where the re-alignment options crossed creeks. This survey was conducted during the post-wet season over five days from the 30th April to 4th May 2018.

Prior to the field survey; no rainfall was recorded at the Burton weather station from the 7 March 2018 to the commencement of the survey. At the Moranbah Airport Weather Station, only 13 mm of rainfall was recorded in March 2018 and 8 mm of rainfall in April 2018 prior to the survey. During the survey, no rainfall was recorded either at the Burton Weather Station or in the region (Moranbah Airport Weather Station) and conditions were warm with daily temperatures reaching a maximum of 26°C.

Autumn (2019) Survey

A final survey was undertaken during the post-wet season over seven days from the 2nd to 8th April 2019.

In the month prior to undertaking the survey, 44.2 mm of rain fell during March at the Burton Weather Station. No rain fell on site during the survey. Warm temperature conditions reached a maximum of 29°C.

5.3 AQUATIC SITE LOCATIONS

An examination of local watercourses was conducted to achieve an even sampling distribution across the variety of aquatic habitat types. Survey sites were selected to incorporate all waterways within the study area and to provide background data for upstream and downstream of the proposed mining area.

A total of nine aquatic sites were established across the three surveys. The aquatic sites are outlined in Table 6 and illustrated in Figure 4.

Table 6 Aquatic site locations

Site Name	Site Description	AGD 84 Zone 55		GDA 94 Zone 55		Survey Season	Status
		Easting	Northing	Easting	Northing		
Isaac River							
LAq01	Upstream entry of Isaac River into ML 70337.	618580	7617082	618693	7617261	Summer 2018	Wet
LAq02	Isaac River north of the Suttor Developmental Road.	617965	7615498	618077	7615676	Summer 2018	Wet
LAq03	Downstream exit of Isaac River from ML 70337, south of the Suttor Developmental Road.	618088	7614551	618200	7614729	Summer 2018	Wet
LRAq01	Isaac River downstream of ML 70337.	618222	7614451	618334	7614630	Autumn 2018	Dry
Ti-Tree Creek							
LAq05	Upstream entry of Ti-tree Creek into ML 70337, but downstream of dam.	615443	7616264	615554	7616443	Summer 2018	Wet
LAq04	Ti-tree Creek downstream of Ellensfield Road.	616724	7614426	616836	7614605	Summer 2018	Wet
LRAq02	Ti-Tree Creek downstream of ML 70337.	617462	7613794	617574	7613973	Autumn 2018	Dry
Un-named Tributary							
LGAq01	Upstream entry of unnamed tributary into ML 70337, upstream of dam.	616782	7616889	617068	7617182	Summer 2019	Dry
Dam	Artificial dam on un-named tributary.	617590	7616518	617777	7616684	Spring 2004	Wet
LGAq02	Unnamed tributary, downstream of gully, upstream of Isaac River confluence.	617697	7616323	617849	7616996	Summer 2019	Dry

Notes: GDA Geocentric Datum of Australia
AGD Australian Geodetic Datum

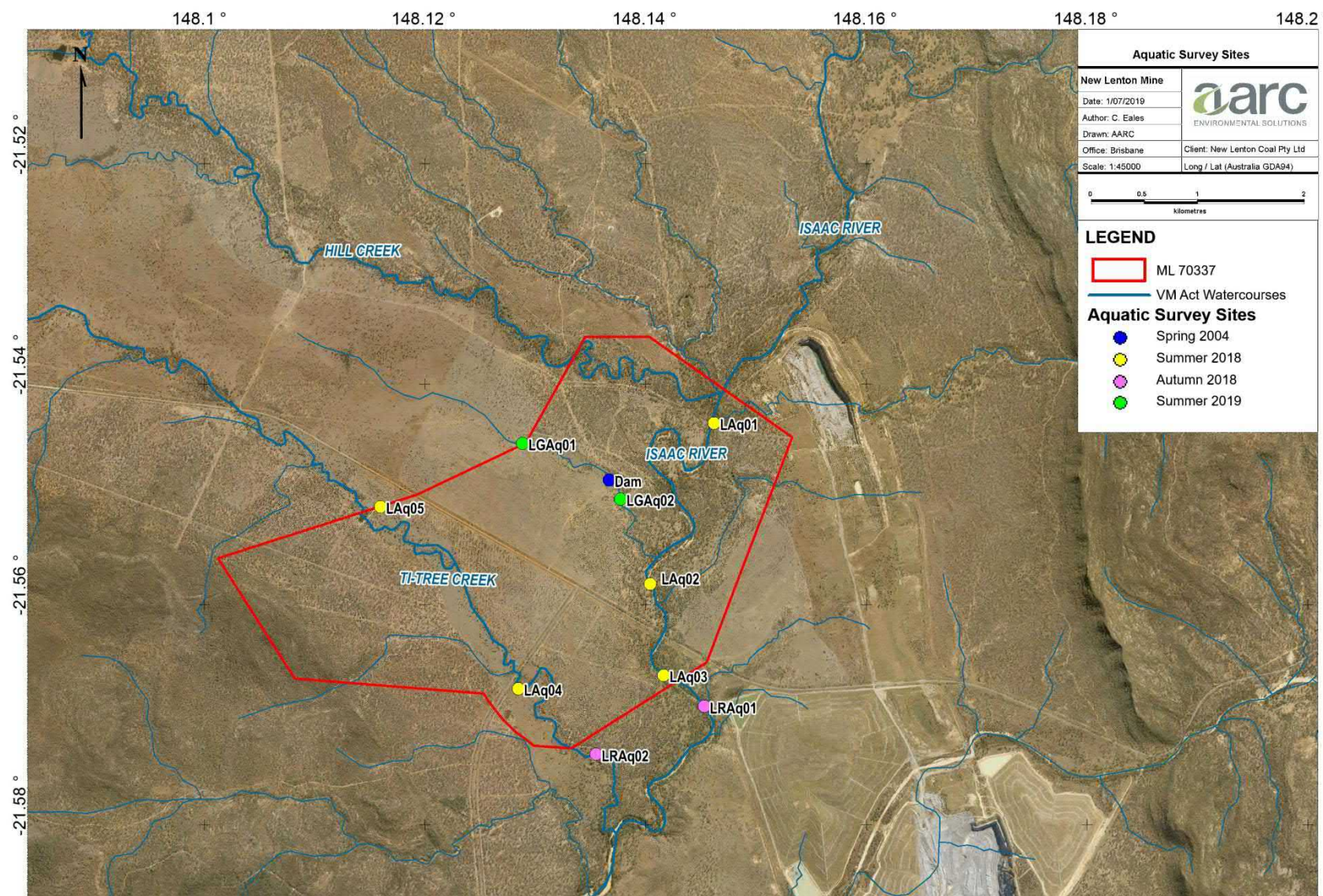


Figure 4 Aquatic site locations

5.4 SURFACE WATER SAMPLING

Water quality sampling was carried out in accordance with the *Qld Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009* (DES 2018b). Field readings of pH, DO, turbidity, EC and temperature were recorded using a multi-parameter water quality meter that was laboratory calibrated to the manufacturers' specifications.

Grab samples were collected at a depth of 10 to 20 centimetres (cm) where sufficient water was available. Water quality samples were sent to a National Association of Testing Authorities (NATA) accredited laboratory and analysed under laboratory testing conditions.

5.5 STREAM SEDIMENT SAMPLING

Sediment quality sampling was undertaken in accordance with the *Qld Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009* (DES, 2018b). Five sub-samples (approximately 500 grams (g) each) of stream-bed substrate, were taken at each site along a 50 m transect in the riverbed. Samples were collected using a non-metallic shovel. Sub-samples were mixed in a plastic bucket to obtain a composite sample (approximately 500 g) then sealed in sterilised sample bags and sent to a NATA accredited laboratory for analysis of trace metals and particle size.

5.6 RIPARIAN VEGETATION ASSESSMENT

The *New Lenton Mine: Terrestrial Ecology Assessment* (AARC 2019) describes the flora values of the Project including vegetation communities identified and a ground verified vegetation map. The focus of the aquatic flora assessment was to describe the environmental values of the aquatic ecosystems. At each sampling site, a meandering 100 m transect in the aquatic/riparian corridor was traversed on foot, recording every species encountered. Species that could not be identified in the field were sent to the Queensland Herbarium for identification.

5.7 AQUATIC FAUNA

As described above, a terrestrial ecology assessment has been previously undertaken to describe the terrestrial fauna values of the Project (AARC 2019). The focus of the aquatic fauna assessment was to describe aquatic fauna values of the Project site only.

Aquatic fauna survey methodologies are described in the following sub-sections.

5.7.1 Opera House Trap

Opera house traps are a medium net and frame trap with funnel shaped openings. A small pouch inside the net can be equipped with bait. Aquatic animals enter through the large outside opening but find it difficult to exit from the small inside opening. The opera house traps are designed for any aquatic animal that is small enough to fit through the trap entrance, but large enough that it cannot fit through the netting.

At each aquatic fauna site, three opera house traps are deployed from the bank of the watercourse and left for a minimum of 4 nights. The traps are positioned in the water approximately 20 meters apart, so they are not fully submerged, and an air pocket remains. This ensures any animals trapped inside that need to surface for oxygen (i.e. turtles) can continue to do so. Traps are checked daily, and all captured animals identified and released.

At each aquatic site during the summer (2018) survey, three opera house traps were deployed from the bank of the waterway and left for a minimum of 4 nights. No opera house trapping was conducted at the

autumn (2018) or autumn (2019) survey sites, as no surface water was present. Trapping was undertaken at one site during the spring (2004) survey.

5.7.2 Box Trap

Box traps are small rectangular traps made of a fine mesh to capture aquatic fauna. The trap has an internal bait pouch, and circular openings which aquatic animals enter through, finding it difficult to exit. With the finer mesh, and smaller openings, the box trap is designed to retain smaller animals than the Opera House traps. The traps are spaced approximately 20 m from each other and are checked and re-baited every day. Aquatic animals caught in traps are identified at site and released.

At each aquatic site during the summer (2018) survey period, three box traps were deployed from the bank of the waterway and left for a minimum of 4 nights. No box trapping was conducted at the autumn (2018) or autumn (2019) survey sites, as no surface water was present. Trapping was undertaken at one site during the spring (2004) survey.

5.7.3 Seine Net

A seine net is a long net with weights attached to the bottom edge of the net and floats attached to the top of the net, so it can be correctly orientated in the water column. The net is deployed in an arc with the intention of capturing as many fish species as possible. The net is then dragged onto the bank where the species are identified and released.

Seine netting was conducted at two aquatic sites during the summer (2018) survey period, where suitable habitat was available for sampling. The net is deployed 2-3 times or until an adequate suite of aquatic fauna species have been identified. Seine netting was also undertaken at one site during the spring (2004) survey. No seine netting was conducted during the autumn (2018) or autumn (2019) survey sites, as no surface water was present.

5.8 MACROINVERTEBRATE SAMPLING

Macroinvertebrate sampling was conducted in accordance with the *AusRivAS Sampling and Processing Manual* (Conrick & Cockayne 2001) and the *Qld Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009* (DES 2018b). Macroinvertebrate sampling was undertaken during the summer (2018) survey at three sites where potential habitat was available.

Along a 10 m stretch of the waterbody, a 250 micrometre D-frame net was used to sample macroinvertebrates at each aquatic site containing sufficient suitable aquatic habitat. This procedure targets various micro-habitats including riffles, runs, pool beds and edge/backwaters. Due to the ephemeral nature of the creeks and in the receiving environment, micro-habitats available for sampling were limited to pool beds and edge habitats. Ideally site sampling should include sampling in shallow and deep sections to target the various micro-habitats, however, this was not possible at any of the sites due to the limited water levels and sampling occurred across only one depth.

Macroinvertebrates were live picked at the site, placed in a preservative solution, and sent to an AusRivAS accredited laboratory for identification. The nets were checked thoroughly for damage before use and washed between sites to ensure no cross contamination of samples.

5.9 HABITAT BIOASSESSMENT

The AusRivAS Macroinvertebrate Sampling and Habitat Assessment field sheets were used to document the reach environs, site conditions (e.g. channel alteration, erosion, etc.), instream habitat and other relevant observations.

Photographs were taken at each site, including the left and right banks, upstream and downstream and other relevant habitat features. Habitat bioassessment was undertaken during the summer (2018) survey.

5.10 CONDITION ASSESSMENT

The condition assessment is an evaluation of the possible impacts to aquatic environmental values caused by major disturbances within the waterway. Each category is scored from one to five, one indicating a 'very major' disturbance, and five indicating an 'indiscernible' disturbance. This assessment evaluated the influence of:

- agriculture upstream;
- major extractive industry (current or historical) upstream;
- major urban area upstream;
- major point source wastewater discharge upstream;
- dam or major weir;
- alteration to seasonal flow regime;
- alteration to the riparian zone;
- erosion and damage by stock on riparian zone and banks;
- major geomorphological change on stream channel; and
- alteration to instream conditions and habitats.

The condition assessment was undertaken at all sites with the exception of the 2004 (spring) survey 'dam' site.

6.0 RESULTS AND DISCUSSION

6.1 SURFACE WATER QUALITY

Across the surveys, surface water was available for sampling during the summer (2018) survey. Surface water analysis was not conducted in the spring (2004), autumn (2018) or autumn (2019) surveys.

The results from the summer (2018) surface water quality analysis were compared to the EPP (Water) WQOs for the protection of aquatic ecosystems and livestock drinking water in the Isaac River sub-basin (Table 7, Table 8, Table 9, Table 10 and Table 11). Additionally, where applicable, results were compared to the ANZECC Guidelines for 95% protection.

Generally, water quality at all sites was consistent with guideline values and water quality objectives for the catchment. However, the measured baseline water quality did exceed objectives or guideline values in the following circumstances:

- Turbidity levels at each site exceeded the EPP (Water) WQO for aquatic ecosystem values of 50 NTU. This was most obvious at LAq05, located at the upstream entry point of Ti-tree Creek, a pastoral drainage feature with significant impacts from cattle grazing and earthworks surrounding the dam. Elevated turbidity levels across all sites is likely attributed to high rainfall events and increased flow rates in the catchment in the days prior to the field survey. Deposition of fine sediments from runoff and overland flow is common following increased rainfall and sporadic rain events.
- Suspended solids exceeded the EPP (Water) WQO for aquatic ecosystem values at LAq05 (Ti-tree Creek upstream); likely also an outcome of increased runoff and overland flow. LAq05 was identified as having poor bank vegetative structure, increased stock access, and a dam.
- Dissolved aluminium, copper and zinc concentrations exceeded ANZECC Guideline values for 95% protection at all sites. As well as dissolved silver at LAq03 (Isaac River, downstream of the Suttor Development Road) and LAq04 (Ti-tree Creek, downstream of Ellensfield Road).
- Total aluminium and copper concentrations at all sites exceeded the ANZECC Guideline values for 95% protection. As well as nickel concentrations at LAq05 and Zinc at LAq04 and LAq05 (all located on Ti-tree Creek).
- Petroleum hydrocarbons exceeded WQO at only LAq04 (Ti-tree Creek, downstream of Ellensfield Road). The carbon range fractions showing exceedances included C15-C28 and C29-C36. The source of this type of contamination is possibly oil, diesel, heavy fuel oils, lubricating oils, waxes and asphalts and pitch chemicals. This contamination was not present at the further upstream or downstream sites located on Ti-tree Creek (LAq05 and LAq03); indicating that the contamination has occurred close to the sample site. LAq04 was located immediately downstream of Ellensfield Road, and contaminants were likely a direct run off from the road into the waterway.

Exceedances of the WQO are highlighted orange in the following tables. The elevated concentrations are thought to be representative of the local baseline water quality in ephemeral systems. Flow events in these waterways often contain elevated sediments and other contaminants from surrounding agricultural practices.

Table 7 Physico-chemical water quality results

Parameter	Unit	LOR	WQO	Isaac River			Ti-tree Creek	
				LAq01	LAq02	LAq03	LAq04	LAq05
pH Value	<i>pH unit</i>	0.01	6.5-8.5^a	6.81	7.20	7.27	6.99	7.50
Electrical Conductivity at 25°C	<i>µS/cm</i>	1	<720^a	166	178	182	187	175
Total Dissolved Solids (Calc.)	<i>mg/L</i>	1	n/a	108	116	118	122	114
Suspended Solids	<i>mg/L</i>	5	<55^a	38	46	40	32	196
Turbidity	<i>NTU</i>	0.1	<50^a	70.9	74.1	73.5	84.0	264

Notes: a WQO for aquatic ecosystems
LOR limit of reporting

Table 8 In-situ water quality results

Parameter	Unit	WQO	Isaac River			Ti-tree Creek	
			LAq01	LAq02	LAq03	LAq04	LAq05
Temperature	<i>°C</i>	-	24.5	23.3	32.4	28.4	28.9
Dissolved Oxygen	<i>%/L</i>	-	100	100.9	102.8	15.2	72
Dissolved Oxygen	<i>ppm</i>	-	8.01	7.58	7.15	1.13	4.73
Specific Conductance	<i>µS/cm</i>	-	167.9	181.9	185.6	176.9	182.9
Electrical Conductivity	<i>µS/cm</i>	720^a	166.4	192.3	211.6	188.5	194.7
Total Dissolved Solids	<i>mg/L</i>	-	109.12	117.66	120.623	114.971	119.05
pH	<i>pH unit</i>	6.5-8.5^a	8.1	7.97	8.07	7.52	8.28
Oxygen Reduction Potential	<i>mV</i>	-	64.4	78.8	91.5	-134.9	47
Turbidity	<i>NTU</i>	<50^a	70	76	70.3	164.5	445

Notes: a WQO for aquatic ecosystems
Ppm parts per million
mV megavolt

Table 9 Dissolved metal water quality results (mg/L)

Dissolved Metals	Unit	WQO	Isaac River			Ti-tree Creek	
			LAq01	LAq02	LAq03	LAq04	LAq05
Aluminium	0.01	0.055 ^a	2.3	0.33	0.84	1.94	3.55
Arsenic	0.001	0.024 ^a	<0.001	<0.001	<0.001	0.001	<0.001
Barium	0.001	-	0.087	0.1	0.078	0.054	0.065
Beryllium	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	0.05	0.37 ^a	<0.05	0.07	0.05	<0.05	<0.05
Cadmium	0.0001	0.002 ^a	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	0.001	-	<0.001	<0.001	<0.001	0.002	0.006
Cobalt	0.001	-	<0.001	<0.001	<0.001	0.002	0.003
Copper	0.001	0.0014 ^a	0.002	0.002	0.002	0.004	0.006
Lead	0.001	0.0034 ^a	<0.001	<0.001	<0.001	<0.001	0.001
Manganese	0.001	1.9 ^a	0.033	0.048	0.017	0.18	0.116
Mercury	0.001	0.0006 ^a	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	0.001	0.15 ^b	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	0.001	0.011 ^a	0.001	0.001	<0.001	0.007	0.01
Selenium	0.01	0.011 ^a	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	0.001	0.00005 ^a	<0.001	<0.001	0.002	0.001	<0.001
Uranium	0.001	0.2 ^b	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	0.01	-	<0.01	<0.01	<0.01	0.01	0.05
Zinc	0.005	0.008 ^a	0.023	0.018	0.036	0.018	0.014

Notes: a WQO for aquatic ecosystems
b WQO Livestock Drinking Water

Table 10 Total metal water quality results (mg/L)

Total Metals	LOR	WQO	Isaac River			Ti-tree Creek	
			LAq01	LAq02	LAq03	LAq04	LAq05
Aluminium	0.01	0.055 ^a	3.08	2.54	2.78	3.57	20.2
Arsenic	0.001	0.024 ^a	<0.001	<0.001	0.002	0.002	0.001
Barium	0.001	-	0.064	0.074	0.077	0.045	0.066
Beryllium	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	0.05	0.37 ^a	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	0.0001	0.002 ^a	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Chromium	0.001	1 ^b	0.001	0.002	0.002	0.005	0.031
Cobalt	0.001	1 ^b	<0.001	0.001	0.001	0.003	0.007
Copper	0.001	0.0014 ^a	0.003	0.003	0.003	0.004	0.011
Lead	0.001	0.0034 ^a	0.001	0.001	0.002	<0.001	0.002
Manganese	0.001	1.9 ^a	0.065	0.062	0.059	0.186	0.184
Mercury	0.001	0.0006 ^a	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	0.001	0.15 ^b	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	0.001	0.011 ^a	0.002	0.003	0.002	0.009	0.032
Selenium	0.01	0.011 ^a	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	0.001	0.00005 ^a	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	0.001	0.2 ^b	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	0.01	-	<0.01	<0.01	<0.01	0.01	0.06
Zinc	0.005	0.008	0.007	<0.005	<0.005	0.012	0.027

Notes: a WQO for aquatic ecosystems
b WQO Livestock Drinking Water

Table 11 Petroleum hydrocarbon water quality results (µg/L)

Petroleum Hydrocarbon	LOR	WQO	Isaac River			Ti-tree Creek	
			LAq01	LAq02	LAq03	LAq04	LAq05
C6 - C9 Fraction	20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	100	<100	<100	<100	<100	240	<100
C29 - C36 Fraction	50	<50	<50	<50	<50	60	<50
C10 - C36 Fraction (sum)	50	<50	<50	<50	<50	300	<50

6.2 STREAM SEDIMENT QUALITY

The results from the sediment quality analysis are displayed below in Table 12, Table 13, and Figure 5; along with the relevant low and high Sediment Quality Objectives (SQOs). Orange shading highlights an exceedance of the SQO-high value, while blue shading highlights an exceedance of SQO-low value.

Nickel levels at LAq04 (Ti-tree Creek, downstream of Ellensfield Road) exceeded the SQG-high value (52 mg/kg), and nickel levels at LRAq02 (Ti-tree Creek, downstream of Project) and LAq05 (Ti-tree Creek, upstream) exceeded the SQO-low value. Each of these sites occur along Ti-tree Creek, with no other exceedances of SQO-high or low trigger values identified during the sediment quality assessment.

The results for Beryllium, Boron, Cadmium, and Selenium were below the limit of reporting at all sites (and subsequently SQO values).

The particle size analysis in Figure 5 shows that the Isaac River sites (LAq01, LAq02, LAq03, and LRAq01) are almost exclusively sand sediment, with some occasional gravel. Ti-tree Creek (LAq04, LAq05, and LRAq02) has a higher fine sediment composition, which was reflected in the typically silty clay base encountered. The unnamed tributary (LGAq01 and LGAq02) had a similar sandy-clay sediment composition to Ti-tree Creek, with both waterways flowing through an alluvial plain with a high concentration in fine particles (clay and silt).

The elevated concentration of nickel in Ti-tree Creek are thought to be representative of the local baseline sediment in small ephemeral drainages.

6.3 PHYSICAL ASSESSMENT

At each aquatic site the full *AusRivAS Physical Assessment Protocol* (Parsons *et al.* 2002) was followed. This assessment looks at the physical degradation of the banks for receiving waterways (bank shape, bank slope, artificial bank stability features etc.), quality characteristics (e.g. sediment, water oils and odours, turbidity, etc.), and erosion characteristics.

The AusRivAS Physical Assessments are detailed in Appendix C, and accompanied by images of each site and a description of vegetation. The summarised erosion specific observations for each site are included below in Table 14.

Across all sites, erosion on the banks of the receiving waters was observed. Although some levels of erosion are expected in the natural landscape, more extensive erosion was observed at sites LAq05 (Ti-tree Creek, upstream), LGAq01 and LGAq02 (both on the un-named tributary). The leading cause of local erosion appeared to be stock access, runoff and the influence of agricultural clearing.

Table 12 Stream sediment total metals analysis (mg/kg)

Metal	SQG Low	SQG High	LOR	Isaac River				Ti-tree Creek			Un-named Tributary	
				LAq01	LAq02	LAq03	LRAq01	LAq04	LAq05	LRAq02	LGAq01	LGAq02
Arsenic	20	70	5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Barium	-	-	10	20	50	30	30	170	130	80	140	170
Beryllium	-	-	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Boron	-	-	50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium	1.5	10	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	80	370	2	7	8	10	7	76	44	26	20	16
Cobalt	-	-	2	2	3	3	2	29	16	10	11	11
Copper	65	270	5	<5	<5	<5	<5	29	14	10	10	16
Lead	50	220	5	<5	<5	<5	<5	7	<5	<5	6	9
Manganese	-	-	5	89	221	127	95	867	615	333	446	573
Nickel	21	52	2	4	4	5	4	86	45	26	17	17
Selenium	-	-	5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Vanadium	-	-	5	11	12	18	11	59	37	28	38	36
Zinc	200	410	5	8	6	9	6	49	24	14	12	34

Table 13 Stream sediment particle size analysis (%)

Particle Size	Isaac River				Ti-tree Creek			Un-named Tributary	
	LAq01	LAq02	LAq03	LRAq01	LAq04	LAq05	LRAq02	LGAq01	LGAq02
+75µm	99	98	98	99	10	51	76	47	54
+150µm	99	98	98	99	6	42	70	41	44
+300µm	80	86	96	94	4	26	54	21	22
+425µm	45	60	90	72	4	19	32	11	13
+600µm	16	29	75	40	3	14	14	6	9
+1180µm	2	7	41	7	2	10	4	2	4
+2.36mm	<1	1	15	<1	<1	6	<1	<1	2
+4.75mm	<1	<1	8	<1	<1	2	<1	<1	<1
+9.5mm	<1	<1	5	<1	<1	<1	<1	<1	<1
+19.0mm	<1	<1	<1	<1	<1	<1	<1	<1	<1
+37.5mm	<1	<1	<1	<1	<1	<1	<1	<1	<1
+75.0mm	<1	<1	<1	<1	<1	<1	<1	<1	<1

Key µm micrometre(s)

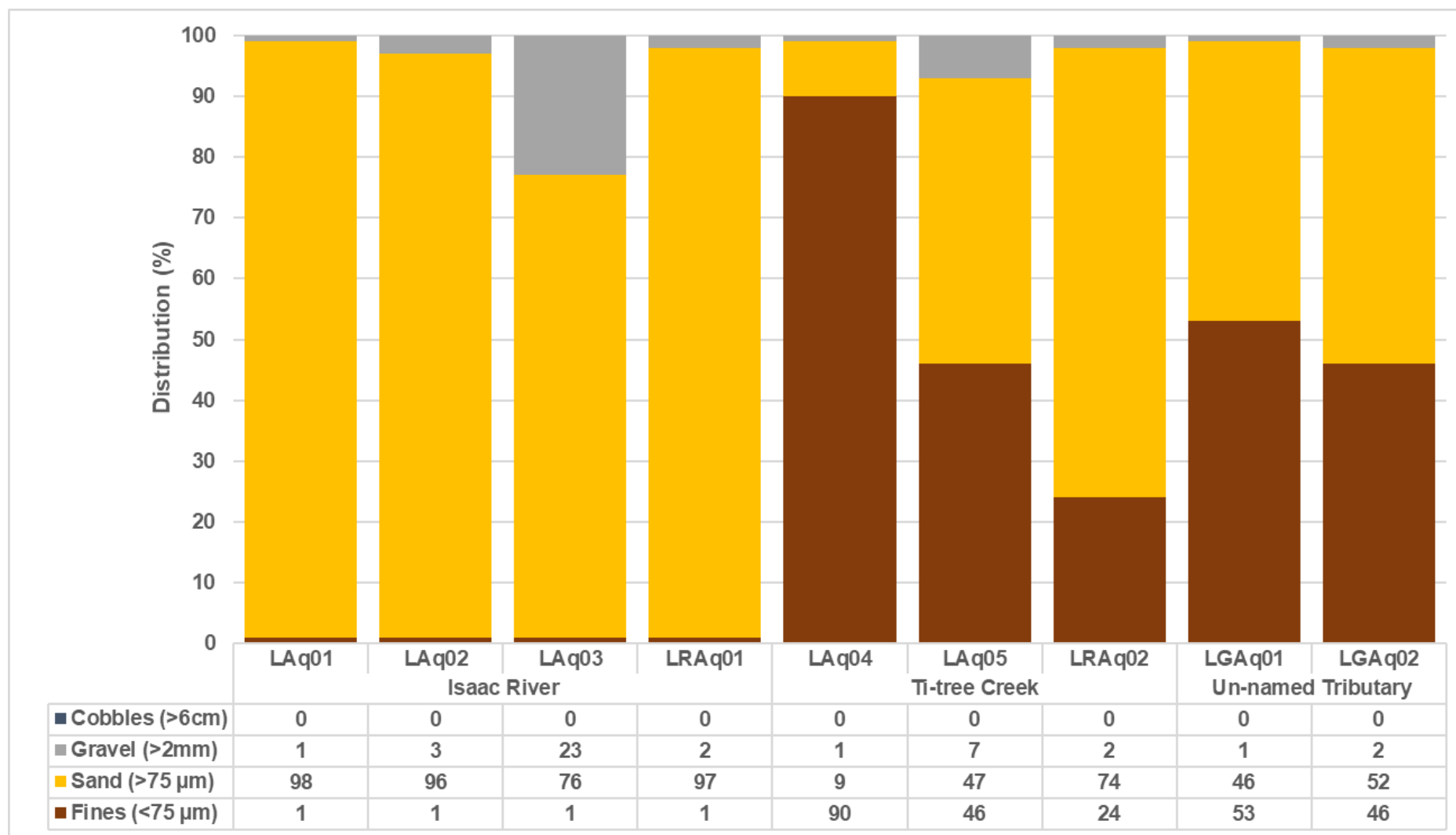


Figure 5 Stream sediment particle size classification

Table 14 Erosion assessment

Criterion	Isaac River				Ti-tree Creek			Un-named Tributary	
	LAq01	LAq02	LAq03	LRAq01	LAq04	LAq05	LRAq02	LGAq01	LGAq02
Bare Ground Extent of bare ground including eroded areas or those not supporting vegetation, due to some form of disturbance that would otherwise be expected to be vegetated.	Low	Low	Low	Low	Some	High	High	High	Moderate
Exposed Tree Roots Tree roots exposed due to any disturbances.	Moderate	Moderate	Moderate	Low	Low	Low	High	Moderate	High
Gully Erosion Visible gully erosion adjacent to the watercourse.	Low	Low	Low	Some	Low	Moderate	High	Low	High
Bank Slumping Evidence of Slumping banks along the watercourse.	Moderate	Moderate	Moderate	Low	Low	Low	Moderate	Low	High
Local Catchment Erosion Erosion in the surrounding catchment on the approach to the site.	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Moderate

Notes: Observations were scored according to the following categories [None, Low (1-10%), Some (10-50%), Moderate (50-75%), or High (>75%)

6.4 HABITAT BIOASSESSMENT

A habitat bioassessment was performed at selected sites using a modified version of the AusRivAS protocols (Conrick & Cockayne 2001). AusRivAS is a nationally standardised method for undertaking an assessment of the biological health of inland rivers within Australia.

The assessment considered morphological characteristics of waterways only; including the broad habitat type, channel pattern, water level and flow, substrate character and cover, bed and bank stability, and riparian cover at each site. Each criterion is assessed and scored, with a cumulative score out of 135 calculated for each site, with higher numbers indicating more favourable habitats normally associated with healthy waterways. The framework used for interpreting the habitat bioassessment scores is provide below in Table 15.

Table 15 AusRivAS habitat bioassessment cumulative score key

Habitat Bioassessment Score	Interpretation
0 – 35	Habitat is poor. There is limited habitat availability for in-stream fauna. There is little variation in velocity and depth of water, and the creek bed consists of a single sediment type. The water body typically consists of a small, shallow pool. Streamside vegetation, if present, consists of grasses and sedges. There is moderate to significant erosion on the banks.
36 – 70	Habitat variety is moderate. This could be due to leaf litter and other vegetation or detritus in the water, or the presence of boulders and rocks. The streamside vegetation consists mainly of grasses and sedges. There is moderate evidence of bank erosion, and the percentage of vegetative cover on the banks is less than 50%.
71 – 100	Habitat is relatively good. The bank is stable, there is variety in depth and velocity within the water body and substrate type is variable and tending towards boulders and rocks. Streamside vegetation is of trees and shrubs, adding to the bank stability. The percentage of streamside cover by vegetation is relatively high.
101 – 135	Indicates a pristine and favourable habitat. There is no bank erosion and the dominant vegetation is trees. There is great variety in depth and velocity, and the habitat is quite complex, offering many types of protection for fauna. This is usually afforded by logs and branches, leaf litter, variety in substrate type, variety in water depth, and presence of vegetation living within the water body.

Habitat bioassessments were completed during the summer (2018) survey. These scores represent the range of variables governing habitat quality present for macroinvertebrates. The habitat bioassessment scores from the aquatic sites within the study area fell into the moderate and poor categories (refer to Figure 6).

Of these, LAq05 exhibited the lowest score (35) representing limited habitat availability for instream fauna. This site is located on the upstream entry point of Ti-tree Creek and was scored due to impacts associated with a small drainage feature from a farmer's dam, exposure to various agriculture and grazing practices, and a heavy infestation of *Parthenium hysterophorus* (parthenium weed).

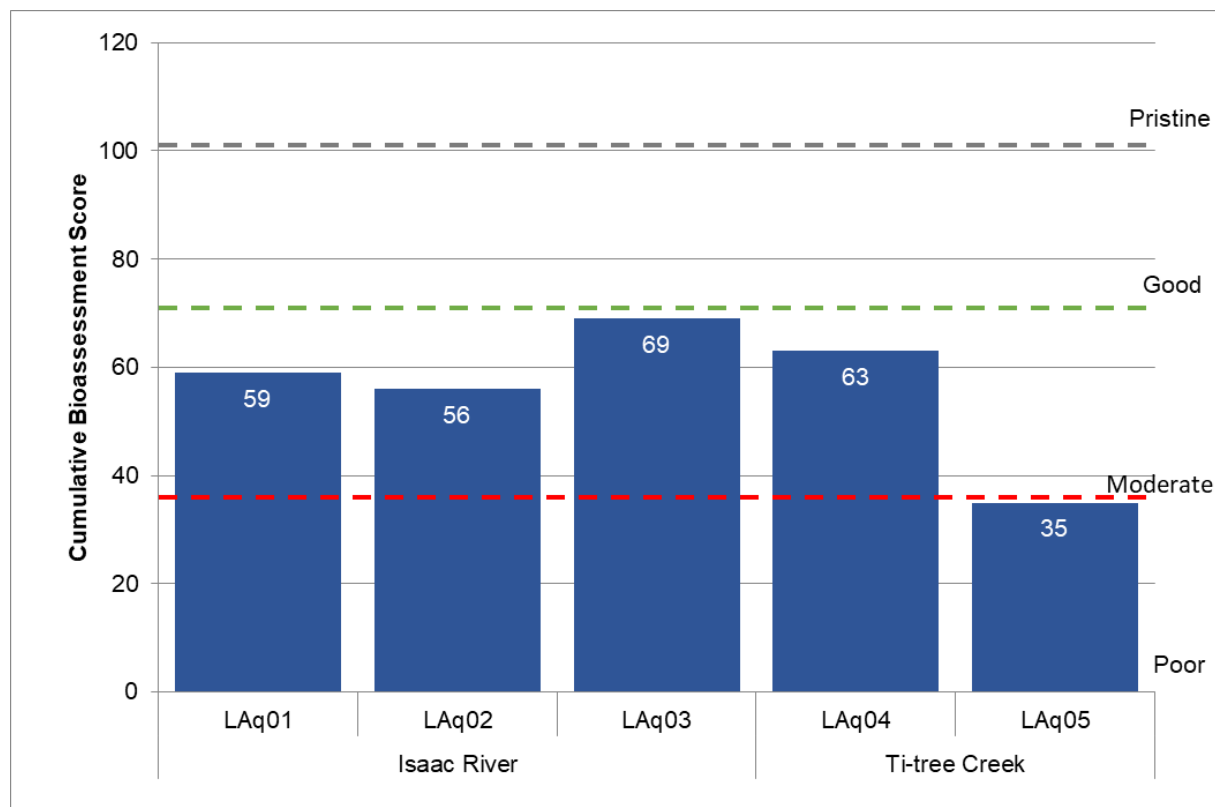


Figure 6 Habitat bioassessment scores

6.5 CONDITION ASSESSMENT

The condition assessment was performed at all aquatic monitoring sites using a modified version of the AusRivAS protocols (Conrick and Cockayne 2001). The AusRivAS condition assessment is a nationally standardised methodology for undertaking an assessment of the biological health of inland rivers.

The assessment considers the relative impact/influence of ten different upstream activities on the waterways; including agriculture, major extractive industry, major urban areas, waste water discharge, dams/weirs, alteration to seasonal flow, alteration to riparian zone, erosion damage by stock, major geomorphological changes, and alteration activities to instream conditions and habitats.

Each surveyed site was given a score out of five for each impact activity and a cumulative score out of 50, with higher scores indicating a decreasing impact of upstream activities. A summary of the condition assessment scores are provided below in Figure 7.

The effect of upstream impacts on biological health of waterways within the Project area was low across most sites. However, scores of moderate to low were determined for LAq05 (Ti-tree Creek, upstream), LGAq01 and LGAq02 (both on the un-named tributary), due to the effect of localised clearing and grazing impacts.

The most significant alteration to stream flow was identified as damage to riparian banks by stock access and erosion. The current land use across the Project area is predominantly cattle grazing, which is reliant on natural waterways in the absence of regular watering stations. Erosional effects from stock access are amplified during periods of high flow and heavy rainfall, resulting in gullies and scarps in and around the key waterways associated with the Project.

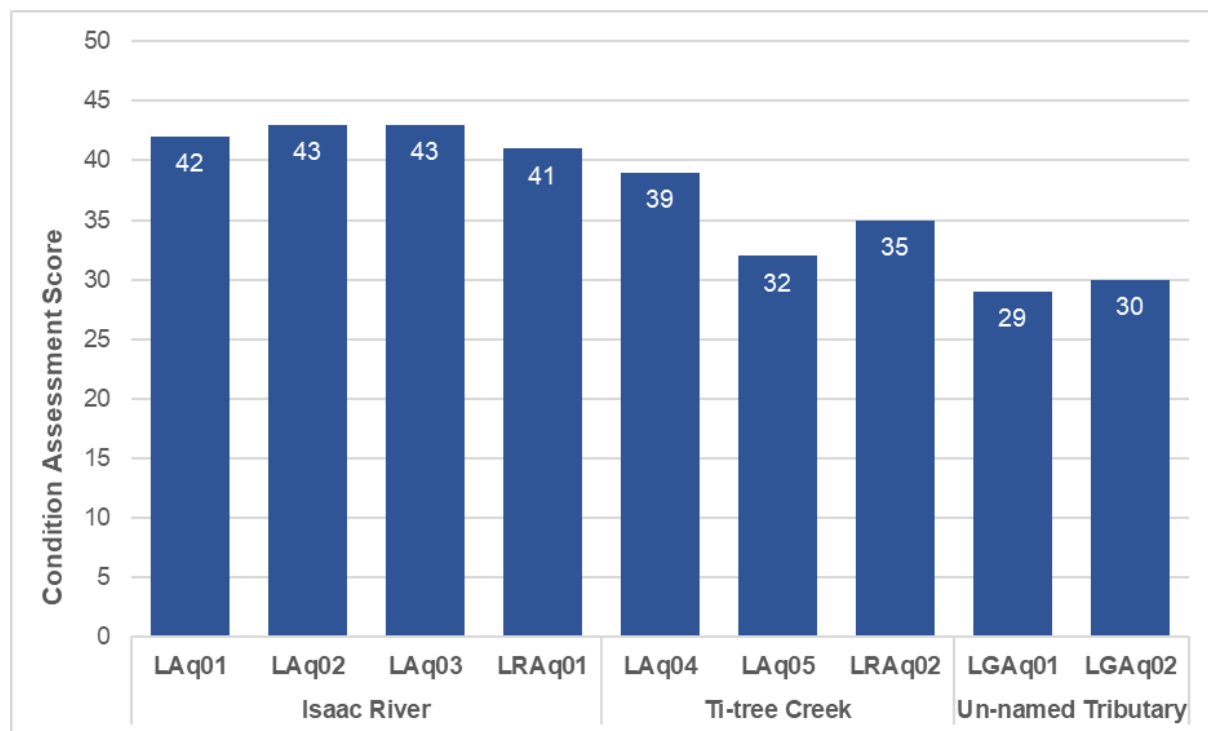


Figure 7 Condition assessment score

6.6 MACROINVERTEBRATES

The Isaac River is highly ephemeral, due to its sandy bed and the typically intermittent rainfall in the sub-basin. According to AusRivAS, water needs to be present within a system for four weeks for a macroinvertebrate community to be mature enough for adequate sampling. Many macroinvertebrate taxa use a water source for only a small component of their life cycle (Hauer & Lamberti 2017). The abrupt flow and quick cessation of this system due to intermittent rainfall events rarely leads to flows being present long enough for development of a macroinvertebrate population suitable for sampling.

Macroinvertebrate sampling was only conducted at three out of seven aquatic sites, due to lack of suitable habitat for sampling. Flow had been recorded in the Isaac River within the Project for a maximum of seven days, from heavy rainfall immediately preceding the summer (2018) survey. Over the course of the survey, flow ceased and began to dry rapidly, leaving only shrinking isolated pools. Following sampling, the Isaac River was completely dry within ten days. The complete cycle of dry, to flow, back to dry, took approximately three weeks.

The intermittent flow and absence of water in some sections of the Isaac River made sampling across all sites unfeasible. No suitable habitat or flow was recorded for the survey sites during the autumn (2018) or autumn (2019) surveys.

As a result of the poor sampling conditions, the total abundance of macroinvertebrates recorded was very low; two individual specimens were recorded at LAq02 (Isaac River), one at LAq03 (Isaac River) and four at LAq04 (Ti-tree Creek). This is likely a result of the abrupt flow pattern, and underdeveloped populations available during the small sampling window. Although low, these results are typical of highly ephemeral systems such as the Isaac River. Due to the lack of macroinvertebrates present in the sampling, no meaningful results can be drawn from statistical analysis of such a small sample size.

6.7 RIPARIAN FLORA ASSESSMENT

A total of 89 flora species, represented across 36 families were identified during the riparian flora assessment. The full list of flora species identified within the study area is provided in Appendix D, and a description of the vegetation is provided for each site within Appendix C. No flora species of conservation significance were identified within the study area, and the Protected Plants Flora Survey Trigger Map does not identify any areas within the study area as high risk (current as at July 2019).

Species richness (Figure 8) was moderate to low at riparian monitoring sites, likely due to several external environmental pressures, such as exotic weed invasion, vegetation clearing and stock access.

Remnant vegetation was present at the four aquatic monitoring sites located on the Isaac River (LAq01, LAq02, LAq03, and LRAq01), and a decrease in species richness correlated to the five sites on Ti-tree Creek and the un-named tributary, all without remnant vegetation present (LAq04, LAq05, LRAq02, LGAq01, and LGAq02). The highest species count was observed at site LRAq01 (Isaac River, downstream of the Project) with 39 species, however one third were introduced. The lowest species richness was recorded at site LGAq01 (lease entry point of un-named tributary) with seven species, only one of which was introduced.

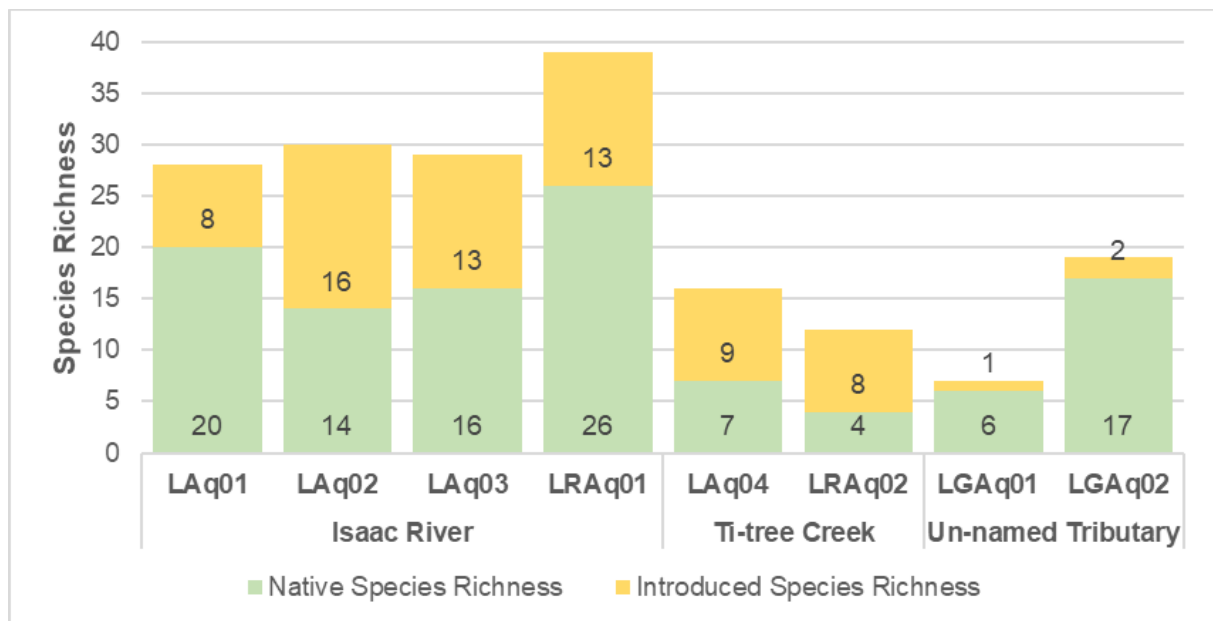


Figure 8 Flora species richness

6.7.1 Weeds of Management Concern

A total of 29 introduced flora species were identified during the aquatic assessment. Introduced and invasive weed species recorded on the Project site are listed below in Table 16, alongside their respective State and Commonwealth status'.

LAq04, located immediately downstream of Ellensfield Road on Ti-tree Creek, was recorded as being heavily dominated by invasive species, specifically *Vachellia nilotica* (prickly acacia). LAq01, LAq02 and LAq03 (Isaac River sites) all observed minor amounts of *Lantana camara* (lantana), whilst *Parthenium hysterophorus* (Parthenium) was recorded at all but one aquatic monitoring site.

Historically, the study area has been used for cattle grazing, and as such, areas of high disturbance are present. Approximately half of the Project has undergone clearing to develop improved pastureland, with areas of high and repeat disturbance being areas adjacent to dams, stockyards and old watering

troughs. As a result, favourable conditions for weeds have led to local dominance of exotic grasses and other weeds. The banks of the Isaac River and its tributaries have been heavily invaded by *Megathyrsus maximus* (green panic). A variety of other common weeds are present in the ground layer throughout the riparian vegetation, and are commonly known to occur throughout the broader region.

Two flora species were identified in the riparian zone that are listed as 'other' invasive plants under the Biosecurity Act. These species are not listed as 'prohibited' or 'restricted', however everyone is obligated to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. This is known as the general biosecurity obligation (GBO).

Five flora species were identified in the riparian zone that are listed as 'restricted' invasive plants under the Biosecurity Act. Restricted invasive plants are established in Queensland and seriously threaten agriculture, the natural environment, livestock, human health and people's livelihoods. Under the Biosecurity Act, *Harrisia martinii* (Harrisia cactus), *Lantana camara* (lantana), *Opuntia stricta* (prickly pear), *Parthenium hysterophorus* (Parthenium), and *Vachellia nilotica* (prickly acacia) must not be given away, sold, or released into the environment without a permit. Everyone has a GBO to take all reasonable and practical steps to minimise the risks associated with these invasive species.

Of the above listed 'restricted' invasive species, with the exception of *Harrisia martinii* (Harrisia cactus), the remaining four are classified by the Australian Government as a Weed of National Significance (WoNS) based on their invasiveness, potential for spread and environmental, social and economic impacts. Landowners and land managers at all levels are responsible for managing WoNS.

Table 16 Introduced and invasive weeds recorded

Species Name	Common Name	State Status	Commonwealth Status
Introduced species			
<i>Argemone ochroluca</i>	Yellow poppy	Int.	-
<i>Bothriochloa pertusa</i>	Indian bluegrass	Int.	-
<i>Cenchrus ciliaris</i>	Buffel grass	Int.	-
<i>Clitoria ternatea</i>	Blue pea	Int.	-
<i>Crotalaria alata</i>		Int.	-
<i>Crotalaria laburnifolia</i>		Int.	-
<i>Cyperus involucratus</i>	Sedge	Int.	-
<i>Erigeron bonariensis</i>		Int.	-
<i>Macroptilium atropurpureum</i>	Siratro	Int.	-
<i>Malvastrum americanum</i>	Spiked malvastrum	Int.	-
<i>Megathyrsus maximus</i>	Green panic	Int.	-
<i>Melinis repens</i>	Red natal	Int.	-
<i>Mimosa pudica</i>	Common sensitive plant	Int.	-
<i>Oxalis corniculata</i>	Creeping woodsorrel	Int.	-
<i>Portulaca oleracea</i>	Pigweed	Int.	-
<i>Sida cordifolia</i>	Flannel sida	Int.	-
<i>Sida rhombifolia</i>	Arrow-leaf sida	Int.	-
<i>Sida subspicata</i>	Spiked sida	Int.	-

Species Name	Common Name	State Status	Commonwealth Status
<i>Stylosanthes scabra</i>	Shrubby stylo	Int.	-
<i>Urochloa mosambicensis</i>	Sabi grass	Int.	-
<i>Verbesina encelioides</i>	Crownbeard	Int.	-
<i>Xanthium occidentale</i>	Noogoora burr	Int.	-
'Other' Invasive Plants			
<i>Passiflora foetida</i>	Stinking passionflower	OIP	-
<i>Ricinus communis</i>	Castor oil plant tree	OIP	-
'Restricted' Invasive Plants			
<i>Harrisia martinii</i>	Harrisia cactus	RIP	-
<i>Lantana camara</i>	Lantana	RIP	WoNS
<i>Opuntia stricta</i>	Prickly pear	RIP	WoNS
<i>Parthenium hysterophorus</i>	Parthenium	RIP	WoNS
<i>Vachellia nilotica</i>	Prickly acacia	RIP	WoNS

Notes: Int. indicates the species is not native to Australia.
OIP indicates the species is listed as an 'other' invasive plant under the *Biosecurity Act 2014*.
RIP indicates the species is listed as a 'restricted' invasive plant under the *Biosecurity Act 2014*.
WoNS indicates the species is listed by the Australian Weeds Committee as a Weed of National Significance.

6.8 AQUATIC FAUNA SPECIES

A total of 11 aquatic fauna species have been recorded within the study area. A complete list of fauna species recorded is provided in Appendix E, which comprised:

- three crustacea;
- five fishes; and
- three amphibians.

6.8.1 Fauna Species of Conservation Significance

No aquatic fauna species of conservation significance were identified within the study area.

Eight aquatic fauna species of conservation significance was identified in the desktop assessment with potential to occur within 50 km of the Project. At the desktop level, *Adelotus brevis* (tusked frog) was the only species assessed with potential to occur onsite, however it was not identified during the field studies.

The Project has been determined unlikely to have a potential impact on any of eight aquatic fauna species identified during the desktop assessment (Appendix B).

The following sub-sections describe the aquatic fauna values identified onsite.

6.8.2 Amphibians

Litoria inermis (Bumpy rocket frog) and *Litoria latopalmata* (Broad-palmed frog) were recorded from the dam on the un-named tributary during the 2004 (spring) survey, and *Limnodynastes tasmaniensis* (spotted grass frog) at LAq04 (Ti-tree Creek) during the summer (2018) survey. All species are considered common within the Project distribution, and are not recognised 'wetland indicator species'. *Limnodynastes tasmaniensis* (spotted grass frog) was also recorded in its larval stage (tadpole) in large numbers (through box traps)(Photo Plate 1).

Habitat Values

Amphibian habitat within the Project varies seasonally due to the ephemeral nature of the watercourses and drainage lines. Although higher order watercourses are likely to support amphibian habitation and breeding throughout wet season periods, most drainage lines are likely to provide only temporary aquatic habitat values during heavy rainfall periods. During the dry season, the sand-based watercourses offer potential habitat for burrowing species capable of spending extensive periods underground awaiting rain. The Project contains few permanent water sources that provide habitat potential for non-burrowing amphibians to persist throughout the dry season. During the wet season, habitat variation and suitability increases in response to increased rainfall.



Photo Plate 1 *Limnodynastes tasmaniensis* (spotted marsh frog) tadpoles at LAq04

6.8.3 Fish

A total of five fish species were positively identified onsite during field surveys. These species include; *Leiopotherapon unicolor* (Spangled perch), within the dam, and *Nematalosa erebi* (bony bream), *Melanotaenia splendida* (eastern rainbowfish), *Ambassis agassizii* (Agassiz's glassfish) (Photo Plate 2) and *Mogurnda adspersa* (southern purplespotted gudgeon) (Photo Plate 3), all within the Isaac River. No invasive fish species were recorded within the Project during the period of monitoring.

Habitat Values

Australia yields a low diversity of freshwater fish species, predominantly due to its large areas of arid and semi- arid land, as well as the ephemeral nature of large areas of catchments (Allen, Midgely & Allen 2002). Due to the ephemeral nature of the waterways present within the Project, the overall habitat available to freshwater fishes is relatively low. For most of the year, the waterways onsite are vastly unconnected with other aquatic habitats. This results in shallow, still pools of water, with limited refuge, breeding or feeding areas.

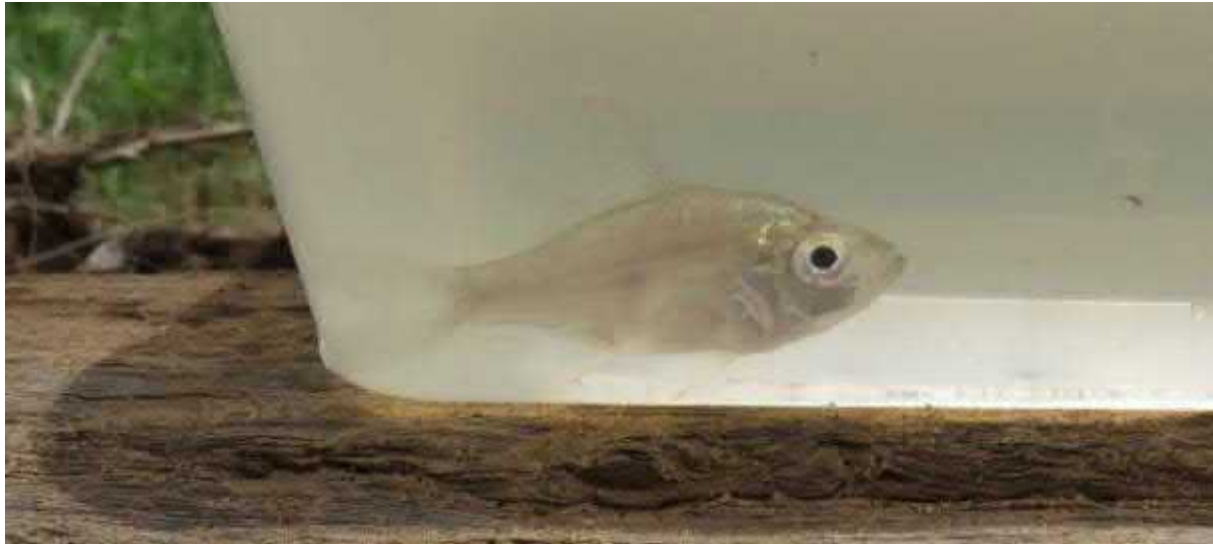


Photo Plate 2 *Ambassis agassizii* (Agassiz's glassfish) at LAq03



Photo Plate 3 *Mogurnda adspersa* (southern purplespotted gudgeon) at LAq03

6.8.4 Crustaceans

At LAq03 (Isaac River), an immature redclaw crayfish (*Cherax quadricarinatus*) was captured in a box trap. One Australian freshwater prawn (*Macrobrachium australiense*) was identified at LAq02 (Isaac River), while an inland freshwater crab (*Austrothelphusa transversa*) (Photo Plate 4) was identified at LAq04 (Ti-tree Creek). The inland freshwater crab is capable of burrowing up to one metre deep in heavy clay to avoid desiccation during periods of prolonged estivation (Waltham 2016).

Habitat Values

Crustacean species living in highly ephemeral waterways display their own unique adaptation to cope with the harsh environment. Many crustaceans can survive long periods outside of a waterbody by extracting oxygen from air with their gills. This can only occur if the gills are kept moist so many species dig burrows to reach moist soil and remain in estivation until water returns to the system. Mechanisms for desiccation resistance are observed in many species, including those that were identified during field surveys.



Photo Plate 4 *Austrothelphusa transversa* (inland freshwater crab) at LAq04

7.0 SUMMARY OF AQUATIC VALUES

The following sections summarise the results and conclusions of the aquatic ecology assessment of the proposed New Lenton Mine.

7.1 SURFACE WATER QUALITY

The Project waterways are typically representative of slightly to moderately disturbed aquatic environments found throughout central Qld. Some exceedances of WQOs, as outlined in the EPP (Water) for the Isaac River sub-basin and ANZECC Guideline values protection for 95% of species, were identified.

These exceedances are summarised below in Table 17, and are likely attributed to high rainfall events, and increased flow rates in the catchment in the days prior to the field survey. Deposition of fine sediments from runoff and overland flow is common following increased rainfall and sporadic rain events. Upstream and local grazing practices are likely influences, with stock access to waterways stressing bank vegetative structure and contributing to bank erosion. Emissions and leaks from vehicles using locals roads, are the likely cause of the increased occurrence of petroleum hydrocarbons in areas immediately downstream.

Table 17 Surface Water Quality Exceedances

Parameter	Exceedance
Turbidity	Levels exceeded the WQO for aquatic ecosystem value at all sites sampled.
Suspended solids	Levels exceeded the WQO for aquatic ecosystem value at the Ti-tree Creek upstream entry point to the lease (LAq05).
Dissolved aluminium, copper and zinc concentrations	Levels exceeded ANZECC guideline values for 95% protection at all sites sampled.
Dissolved silver	Levels exceeded ANZECC guideline values for 95% protection at both sites downstream of roads; LAq03 (Isaac River, downstream of the Suttor Development Road) and LAq04 (Ti-tree Creek, downstream of Ellensfield Road).
Total aluminium and copper concentrations	Levels exceeded ANZECC guideline values for 95% protection at all sites sampled.
Nickel concentrations	Levels exceeded the ANZECC guideline values for 95% protection at the Ti-tree Creek upstream entry point to the lease (LAq05).
Zinc concentrations	Levels exceeded the ANZECC guideline values for 95% protection at two Ti-tree Creek sites; LAq04 (downstream of Ellensfield Road) and LAq05 (upstream lease entry point).
Petroleum hydrocarbons	Exceeded WQO at Ti-tree Creek, immediately downstream of Ellensfield Road (LAq04).

7.2 STREAM SEDIMENT QUALITY

Nickel levels at Ti-tree Creek, immediately downstream of Ellensfield Road (LAq04) exceeded the SQO-high value, whilst nickel levels at both other Ti-tree Creek sites LRAq02 (downstream of Project) and LAq05 (upstream lease entry point) exceeded the SQO-low value. No other exceedances of SQO-high or low values were identified during the sediment quality assessment, with the results at all other sites

well below the SQO-low values. Elevated nickel levels are assumed to be linked to upstream agricultural land uses in the Ti-tree Creek catchment.

7.3 ISAAC RIVER

The Isaac River is a determined watercourse under the Water Act, which has a wide bed and is a highly ephemeral system, primarily made up of sandy sediments with some gravel. Water quality observed within the Isaac, was reflective of a large ephemeral system in a slightly to moderately disturbed condition, typical of other systems in central Queensland which are influenced by the agricultural industry. Turbidity levels were high, likely due to the flows occurring during sampling, and elevated concentrations of dissolved aluminium, copper and zinc were noted at all sites, as well as elevated silver concentrations downstream of the Suttor Developmental Road.

The Isaac River ranked in the moderate category for bioassessment scores. It has a remnant and healthy riparian strip, that is sometimes accompanied by a continuous band of woodland on the adjacent floodplain. The banks are typically vegetated, providing structural support, with few bare zones. However the wide flat river bed has a limited occurrence of logs, overhangs, pools or boulders. The river therefore provides minimal habitat for aquatic fauna species or macroinvertebrates, which was reflected in the relatively few species trapped and limited presence of macroinvertebrates.

The Isaac River sites ranked best onsite during the condition assessment, due to the presence of adjacent vegetation and steep banks that limited direct stock access. Also due to the remnant vegetation strip, the Isaac River had the highest flora species richness, however it was still subject to heavy weed invasion in most areas, with the waterway providing the ready spread of weeds.

The Isaac River is mapped as a MSES waterway, providing for fish passage with a risk category of 'high', if waterway barrier works are undertaken.

7.4 TI-TREE CREEK

Ti-tree Creek is a determined drainage feature under the Water Act. The morphology of this feature varies from a narrow bed cut deeply into the sediment, to a wide drain with no defined banks. It displays a far high proportion of fine sediments such as silt and clay, with a varying sand component. Due to these less porous sediments, Ti-tree Creek will typically maintain a small number of standing pools, for longer than the Isaac River. Water quality was reflective of a small ephemeral system in a slightly to moderately disturbed condition, typical of systems influenced by the central Queensland agricultural industry. Turbidity levels were considerably higher, due to finer sediments and adjacent clearing, and metals concentrations were also generally more elevated, likely due to the smaller size of the drainage system resulting in less dilution. Elevated petroleum hydrocarbons were present at the site immediately downstream of Ellensfield Road, and was likely due to the influence of the road and passing vehicles.

Ti-tree Creek ranked in the poor to moderate categories for bioassessment scores. Few areas had any form of supporting vegetation, and the feature was mostly surrounded by cleared pastureland. Banks were frequently bare, or vegetated by ground layer species only, with few woody stems to provide greater structural support. As with the Isaac River, limited logs, overhangs, pools or boulders, were available to provide habitat for aquatic fauna species or macroinvertebrates. This was also reflected in the relatively few species trapped and limited number of macroinvertebrates observed.

Ti-tree Creek sites ranked moderately during the condition assessment, generally due to the absence of adjacent vegetation and direct stock access. Floristic biodiversity was low, and sites were recorded as hosting a greater number of introduced species than native species. The waterway, disturbance from clearing, and direct stock access, all contribute to the spread of invasive species.

Ti-tree Creek is mapped as a MSES waterway, providing for fish passage with a risk category of 'moderate' if undertaking waterway barrier works. An existing farm dam is present on the upstream boundary of ML 70337.

7.5 UN-NAMED TRIBUTARY

The un-named tributary is a determined drainage feature under the Water Act., This feature displays few bends, resulting in fast flow rates, which cause widespread erosion. As with Ti-tree Creek, it consists of a high proportion of fine sediments such as silts and clay, with a varying sand component. Water quality sampling was not undertaken due to the system being dry at time of the surveys, however stream sediment results were consistent with the Project, and no elevated concentrations were noted at sites on this system. Due to the influence of erosion and a significant proportion of fine sediments, it is considered likely that turbidity levels would be elevated during flow conditions. This is possibly reflected in the results at Isaac River site LAq02, which occurs shortly after this features drains into the Isaac River. Turbidity levels were elevated at all Isaac River sites, however they were highest at LAq02 (after the confluence), before decreasing again at LAq03.

Few areas along this drainage feature had any form of supporting vegetation, being mostly surrounded by cleared pastureland. Banks were frequently bare, and barely vegetated by even ground layer species, most of which had been heavily grazed. Little to no microhabitat is available for aquatic fauna species or macroinvertebrates, and it is envisaged that a low abundance of aquatic fauna and macroinvertebrates would be recorded in this creek.

The sites on this feature ranked lowest during the condition assessment, generally due to the significant absence of any adjacent vegetation, direct stock access and severe erosion in some areas. Floristic biodiversity was low to moderate; however these sites recorded the fewest introduced species.

This tributary is mapped as a MSES waterway providing for fish passage with a risk category of 'low' if undertaking waterway barrier works. Two existing farm dams occur on this feature, one just upstream of the lease boundary, and one approximately mid-way towards the confluence with the Isaac River.

7.6 CONCLUSIONS

The waterways of the Project are highly ephemeral, experiencing only periodic and rapid flows. Extensive clearing for agricultural purposes has been undertaken across much of the Project area., This has resulted in the removal of riparian vegetation, which has led to a decrease in faunal habitat, including instream debris that contributes to aquatic fauna microhabitats. The removal of vegetation has also led to bank instability and erosion across many areas of the Project, which is exacerbated by direct stock access to the waterways.

The presense of weeds is high throughout the Project area, including several weeds of management concern such as restricted invasive plants under the Biosecurity Act, and WoNS. The Isaac River has retained a strip of riparian vegetation, however like the other waterways at the site, this provides little aquatic faunal habitat, with flows draining very quickly.

The existing water and stream sediment quality of the Project waterways is slightly to moderately disturbed, which is typical of the region and likely due to current and historical agricultural practices.

8.0 POTENTIAL IMPACTS

The following potential impacts on environmental values have been identified for the Project:

- Clearing and construction activities within the Project waterways such as the development of creek crossings (in association with the haul road), creek diversion and levees, may cause fauna death or injury, and reduce habitat and connectivity for aquatic flora and fauna species. Direct impacts are likely to reflect the concept design as shown in Figure 9.
- Permanent infrastructure located in Project waterways, such as creek crossings may restrict fish passage.
- The creek diversion of Ti-Tree Creek has the potential to impact aquatic environmental values via its potential to;
 - Increase risk of receiving environment contamination during the construction phase;
 - Reduce habitat availability in the artificially created channel, particularly during early establishment;
 - Contribute additional sediment loads to the Isaac River during construction and post establishment;
 - Result in a reduction in catchment and flow in the stretch of Ti-Tree Creek downstream of the mine, before the confluence with the Isaac River. The change in hydrology has the potential to influence aquatic ecosystems and habitat values; and
 - Alter the flow regime downstream of the confluence. This has potential to increase erosion in high flow events and may affect aquatic ecosystems and habitat values.
- If not managed appropriately, the handling and storage of chemicals and hydrocarbons, presents the potential for contaminants to enter soil and surface water and impact on aquatic ecosystems.
- Disturbance on site has the potential to result in erosion and sedimentation and mine affected water has the potential to impact on aquatic ecosystems if it is not contained.
- Water release events from the Project have the potential to introduce pollutants and alter water conditions of the Project and its receiving waters. Such events have the potential to impact aquatic ecosystem values and stock watering, both onsite and further downstream.
- Project disturbance has the potential to create or enhance conditions for pest fauna species, these already being favourable. This could occur through increased resource availability (e.g. artificial sources of food and water) and improved site access. An increased abundance of pest fauna species has the potential to result in increased predation on native animals and impacts on aquatic ecosystem values.
- The Project has the potential to increase the abundance of introduced and invasive flora species. Weed species of management concern may quickly colonise disturbed areas if left untreated.

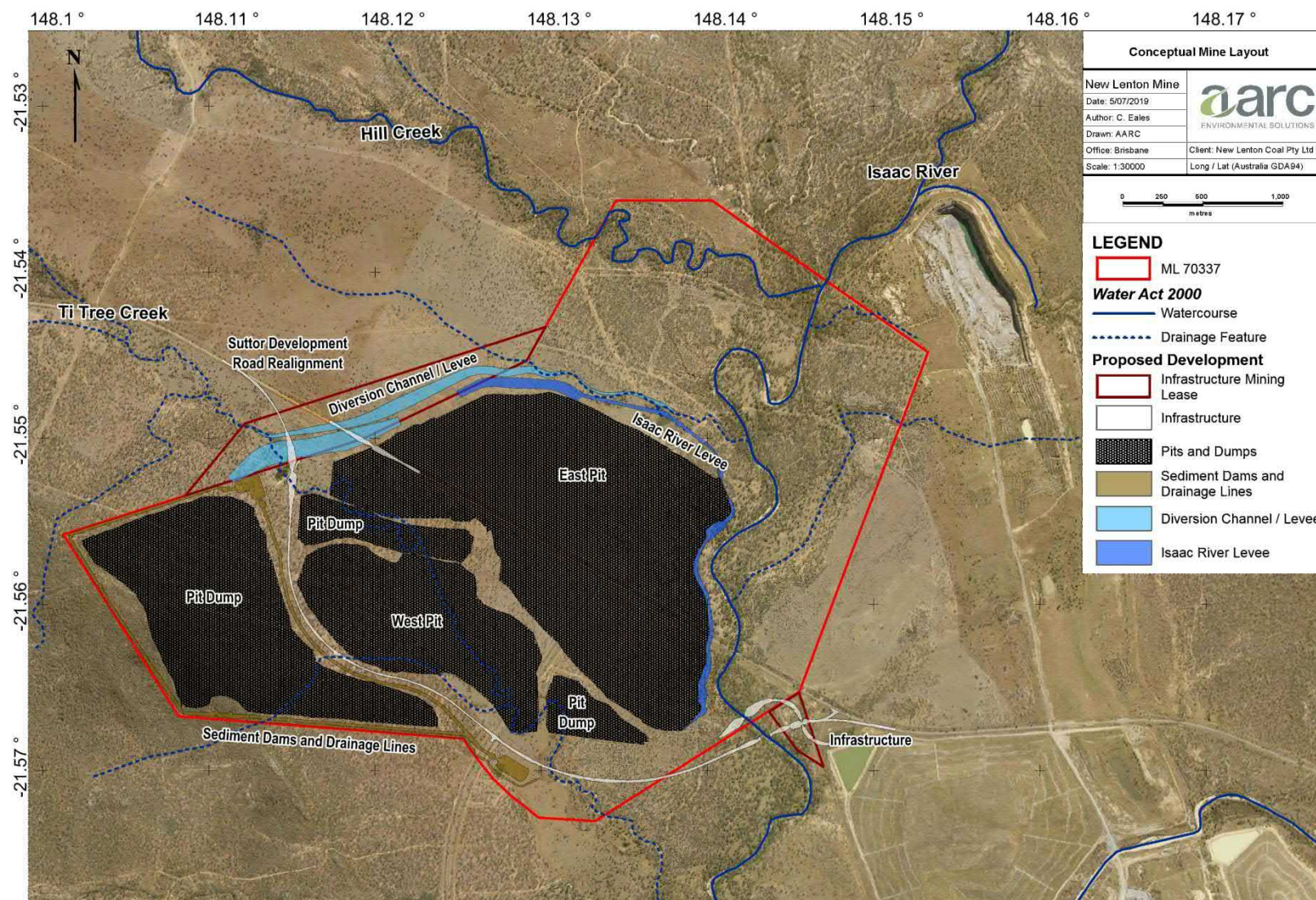


Figure 9 Conceptual Project Layout

9.0 MITIGATION MEASURES

Strategies suggested to minimise the impacts of the NLM on the aquatic environmental values, and recommendations regarding rehabilitation of the Project site, are outlined below.

9.1 GENERAL AQUATIC MANAGEMENT STRATEGIES

The following general management strategies are recommended for the Project:

- Appropriate erosion and sediment controls should be installed and maintained to minimise erosion and sediment generation from disturbed areas. Monitoring of susceptible landforms will assist in early detection and prevention.
- Adequate spill management procedures and spill kits should be available for protection of aquatic environmental values, particularly during the construction phases of development.
- A Site Water Management Plan for the NLM should be developed and adhered to during all stages of the Project, and updated throughout the life of mine to reflect current best practices. This Plan should address containment of mine affected water, and include controls to ensure release water does not significantly impact the water quality of the Isaac River. This management plan should be developed in consideration of the existing conditions outlined within the Projects EA.
- Waterway crossings necessary for the construction of the Project (i.e. the Isaac River), should be designed to minimise impacts on fish passage, seasonal water flows, and disturbance to riparian vegetation.
- The Ti-tree Creek diversion could be designed and/or rehabilitated to provide natural features and similar conditions to the original waterway, including stream hydraulics, geomorphology, instream habitat, bank profiles and bank vegetation.
- A progressive rehabilitation strategy should be developed and implemented for the Project in accordance with current regulations. This strategy should include provision for monitoring of rehabilitation progress over the life of the operation. Where practical, rehabilitation of aquatic ecosystems should aim to replace/augment the pre-clearance riparian vegetation communities of the Project, with landforms, species composition and densities designed to achieve this aim.
- A Receiving Environment Monitoring Program (REMP) should be developed to monitor and record the effects of mining activities on the receiving environment. The receiving environment, for purposes of the REMP, would incorporate the waters of the Isaac River and connected watercourses within 15 km downstream of Project release points. The REMP should be developed in consideration of existing EA conditions (Conditions C4, C5, and C6).
- All staff and contractors should receive environmental awareness training, to ensure they are aware of their environmental responsibilities, particularly in relation to impact mitigation measures. Such training should include the identification of priority weed species, biosecurity responsibilities and chemical spill mitigation.
- It is expected that with effective implementation of mitigation measures and adequate engineering controls, the risk to aquatic values will be managed to an appropriate level. Monitoring programs should be implemented to validate the effectiveness of management controls and identify opportunities for continual improvement during the mine life.

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Appendix A Database Search Results



Queensland Government

Department of Environment and Science

Environmental Reports

Biodiversity and Conservation Values

Biodiversity Planning Assessments and Aquatic Conservation Assessments

For the selected area of interest
ml: 70337

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

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.



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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: ml: 70337

Size (ha)	1,207.06
Local Government(s)	Isaac Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Northern Bowen Basin
Catchment(s)	Fitzroy

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)	Brigalow Belt v2.1
Aquatic Conservation Assessment(s) (riverine)	Great Barrier Reef Catchments v1.3
Aquatic Conservation Assessment(s) (non-riverine)	Great Barrier Reef Catchments v1.3

Table 3: Remnant regional ecosystems within the AOI as per the Qld Herbarium's 'biodiversity status'

Biodiversity Status	Area (Ha)	% of AOI
Endangered	10.19	0.84
Of concern	549.35	45.51
No concern at present	160.93	13.33

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	0.0	0.0
State	720.44	59.69
Regional	0.0	0.0
Local or Other Values	18.24	1.51

Table 5: Non-riverine wetlands intersecting the AOI

Non-riverine wetland types intersecting the area of interest	#
Number of Palustrine wetlands	0
Number of Lacustrine wetlands	1
Total number of non-riverine wetlands	1

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
HILL CREEK	Non-perennial
ISAAC RIVER	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	210.79	17.46
Medium	996.28	82.54
Low	0.0	0.0
Very Low	0.0	0.0

Table 8: Summary table, aquatic conservation significance (non-riverine)

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0
High	0.0	0.0
Medium	0.0	0.0
Low	0.0	0.0
Very Low	1.75	0.14

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	0.0	0.0
State	720.44	59.69
Regional	0.0	0.0
Local or Other Values	18.24	1.51

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 RE (B1) & Nat. Threatened Ecol. Community (B1)	10.19	0.84
State	Remnant contains at least one Of Concern RE (B1) & Nat. Threatened Ecol. Community (B1)	396.93	32.88
Regional	Remnant contains at least one Of Concern RE (B1)	152.39	12.62
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)	126.72	10.5
Local or Other Values	Refer to diagnostic data for additional information	50.69	4.2

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					454.32	37.6	282.63	23.4
B1: Ecosystem Value (Bioregion)	407.13	33.7	152.4	12.6	160.93	13.3		
B2: Ecosystem Value (Subregion)			10.19	0.8	710.27	58.8		
C: Tract Size	700.06	58.0					20.4	1.7
D1: Relative RE Size (Bioregion)							720.46	59.7
D2: Relative RE Size (Subregion)			265.81	22.0	78.72	6.5	375.93	31.1
F: Ecosystem Diversity	5.92	0.5	596.02	49.4	118.52	9.8		
G: Context and Connection	304.81	25.3	254.3	21.1	161.35	13.4		

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 Special Biodiversity Values (view Expert Panel data for further information) (I)	236.82	19.62
State	Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I) & Remnant forms part of a bioregional corridor (J)	95.07	7.88
State	Remnant forms part of a bioregional corridor (J)	378.91	31.39
Regional	Remnant forms part of a bioregional corridor (J)	0.44	0.04
Local	Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I)	1.75	0.14

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 assess 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								
Ia: Centres of Endemism			95.08	7.9				
Ib: Wildlife Refugia	236.82	19.6	95.08	7.9	1.75	0.1		

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
Ic: Disjunct Populations								
Id: Limits of Geographic Ranges								
Ie: High Species Richness								
If: Relictual Populations								
Ig: Variation in Species Composition								
Ih: Artificial Wetland								
Ii: Hollow Bearing Trees			95.08	7.9				
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	473.98	39.27
Regional	0.44	0.04
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
brbn_I_17a	None	None	None
brbn_I_18b	None	None	None
brbn_I_83	Core areas	State	Ib (refugia): VH
brbn_I_84	Carborough, Kerlong ranges and Redcliffe Vale Sandstone Massives	State	Ia (endemic richness): H; Ib (refugia): H; Ii (hollow-density): H
brbn_I_93	Locally significant natural palustrine & lacustrine wetlands	Local	Ib (refugia): M

Expert panel decision descriptions:

brbn_I_17a

None

brbn_I_18b

None

brbn_I_83

Tracts are defined as patches of continuous remnant vegetation. The size of any tract is a major indicator of ecological significance and is 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. These areas can be considered core nodes/refugia in which a large proportion of the bioregions biodiversity is represented.

A modified tract size analysis (Criterion C) (EHP 2014) was used to identify and delineate discrete tracts of remnant vegetation at a bioregion scale. For the purpose of the assessment, a core area was identified as a relatively contiguous area of remnant vegetation (disregarding small perforations, or linear breaks) and which was generally greater than 5km in width (based upon the minimum width of the terrestrial corridor network). Tracts of greater than 10,000ha were included.

Refer to brbs_I_16 for the southern BRB implementation of this decision.

brbn_I_84

The ranges and massives exhibit unique flora, fauna and geomorphological characteristics. The landscape contains gorge areas and although not the same elevation as Carnarvon, parts are still relatively high at an altitude of 600 to 700m. Lake Elphinstone, at the eastern edge, is thought to have been formed in relatively recent geological time and is assumed to have been created through an unusual rainfall event. Groundwater Dependent Ecosystems (GDEs) are present, which might play a refugial role for some species.

The area has mature ecosystems which, from a fauna perspective, supply good habitat complexes of hollow-bearing trees. These provide habitat for species such as the vulnerable greater glider *Petauroides volans*. Examples of bioregional endemic taxa found within these ranges include *Corymbia aureola*, *Cerbera dumicola* and *Dianella fruticans*. Species adapted to drier areas such as *Brachychiton* spp. occur on the flanks of Redcliffe Tableland. Other threatened species found on these ranges include northern quoll *Dasyurus hallucatus* and squatter pigeon *Geophaps s. scripta* along with priority taxa such as *Carlia rubigo*.

brbn_I_93

The panel considered that relatively natural palustrine and lacustrine wetlands and waterbodies within the Brigalow Belt bioregion act as important refugia, especially during periods of drought.

Whilst State significant wetlands are captured under Criterion B1, and regionally significant wetlands under the decision brbn_I_92, the panel agreed that all remaining relatively natural wetland complexes of less than 5ha in size be classed as being of at least local significance.

Refer to brbn_I_48 for the southern BRB implementation of this decision.

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 processes

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	210.79	17.46
Medium	996.28	82.54
Low	0.0	0.0
Very Low	0.0	0.0

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	210.78	17.5					996.28	82.5
2. Naturalness catchment	1,207.06	100.0						
3. Diversity and richness			210.78	17.5	996.28	82.5		
4. Threatened species and ecosystems			1,207.06	100.0				
5. Priority species and ecosystems								
6. Special features								
7. Connectivity					1,113.68	92.3	93.38	7.7
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	0.0	0.0
High	0.0	0.0
Medium	0.0	0.0
Low	0.0	0.0
Very Low	1.75	0.14

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					1.75	0.1		
2. Naturalness catchment			1.75	0.1				
3. Diversity and richness								
4. Threatened species and ecosystems								
5. Priority species and ecosystems								
6. Special features								
7. Connectivity								
8. Representative-ness								

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)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

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
<i>Bertya opposens</i>		C	V				FL
<i>Phascogale cinereus</i>	Koala	V	V	Low			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
<i>Eucalyptus tenuipes</i>	narrow-leaved white mahogany	None	FL

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

(no results)

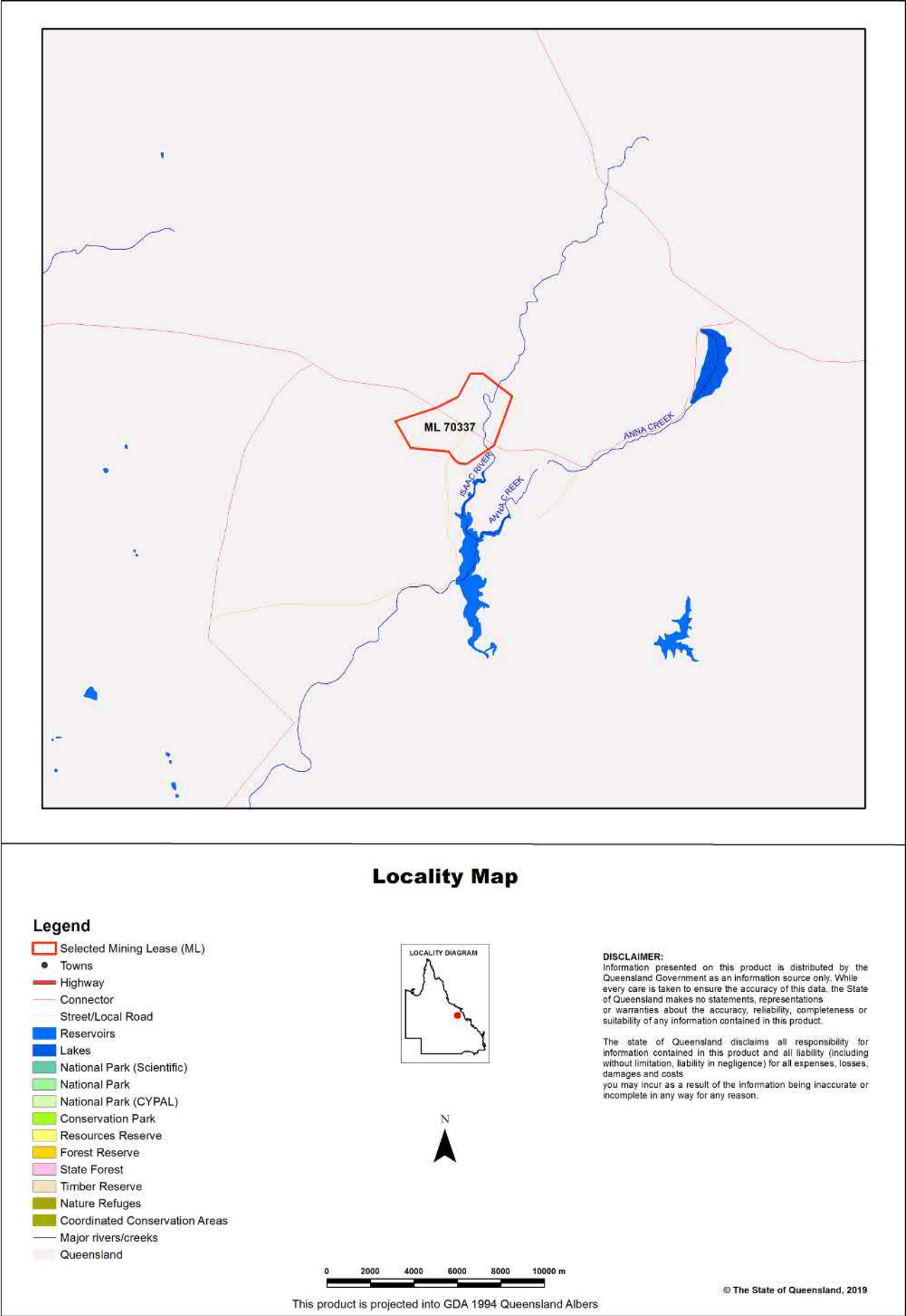
Table 25: Priority species recorded on, or within 4 km of the AOI - non-riverine

(no results)

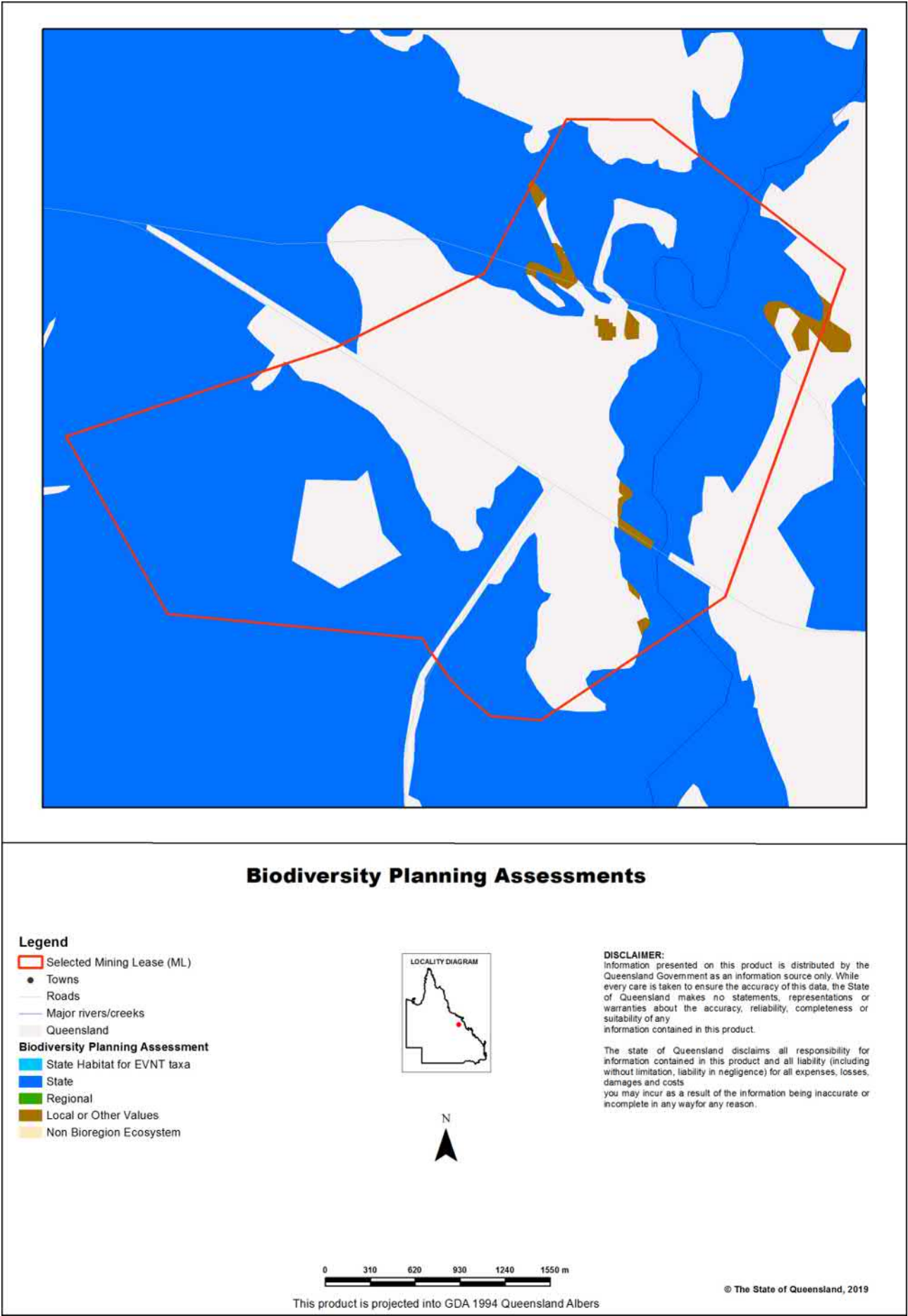
NB. Please note that the priority species records used in the above two tables are comprised of those adopted for the released individual ACAs. The ACA riverine and non-riverine priority species databases are updated from time to time to reflect new release of ACAs. At each update, the taxonomic details for all ACAs records are amended as necessary to reflect current taxonomic name and/or status changes.

Maps

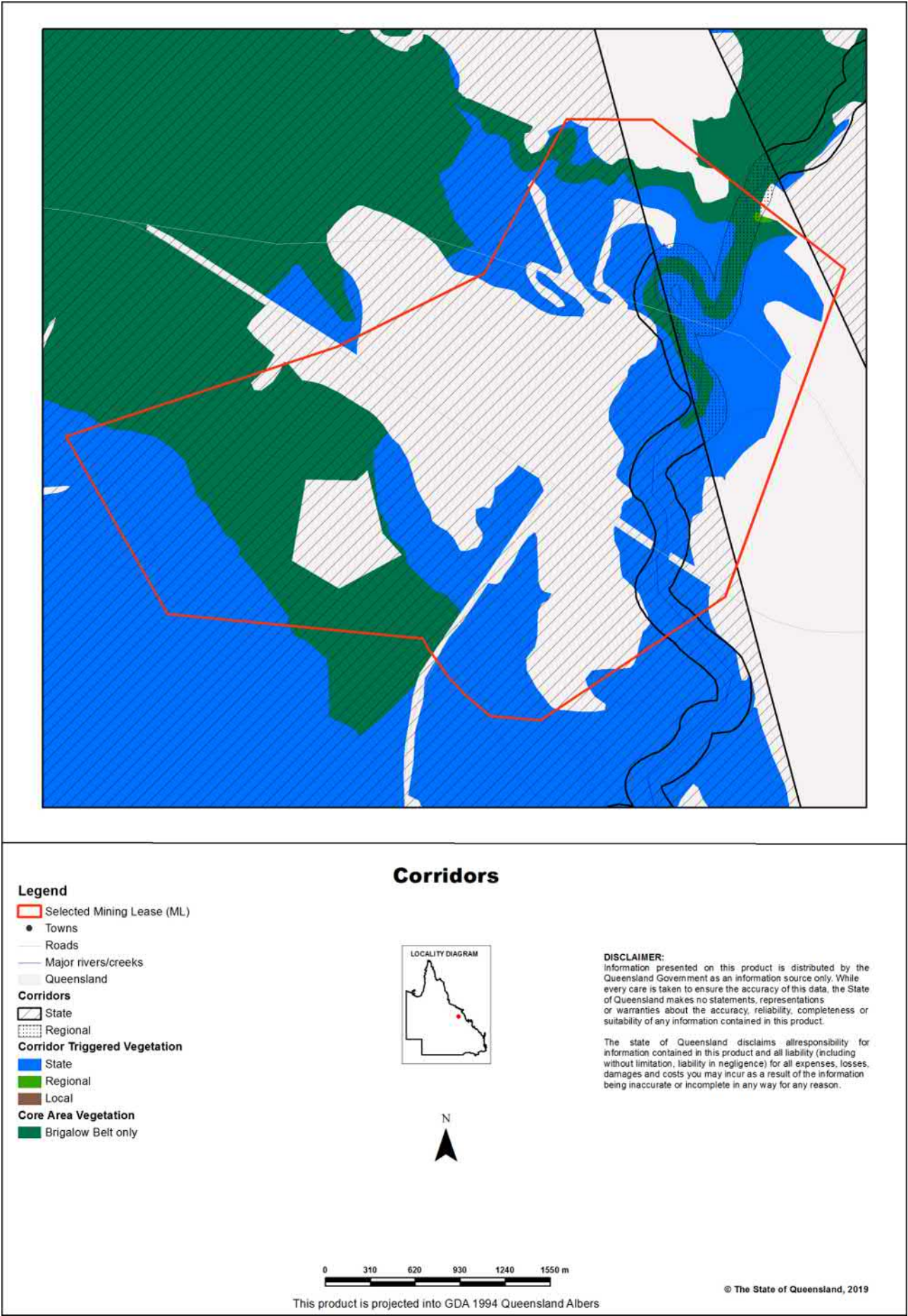
Map 1 - Locality Map



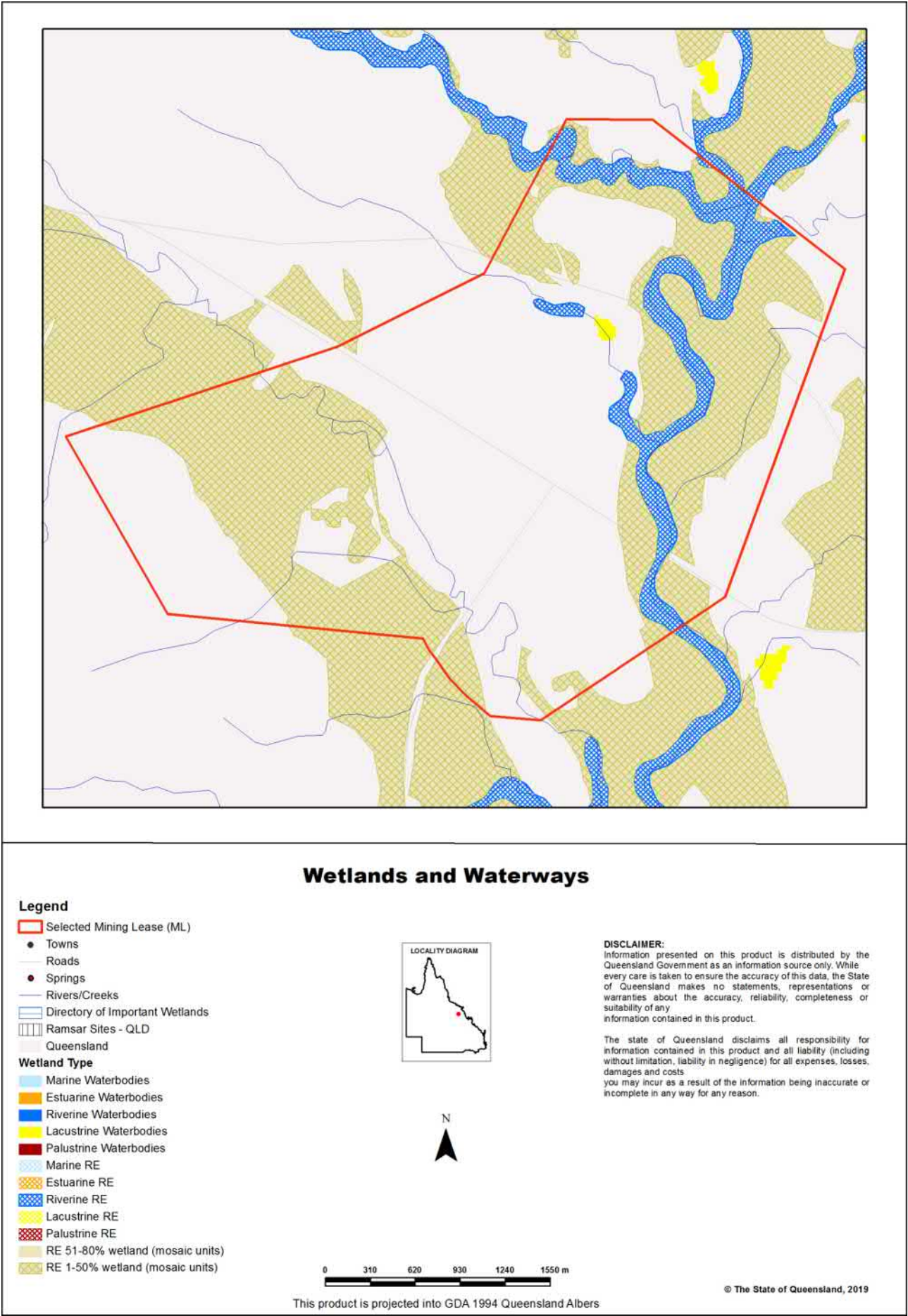
Map 2 - Biodiversity Planning Assessment (BPA)



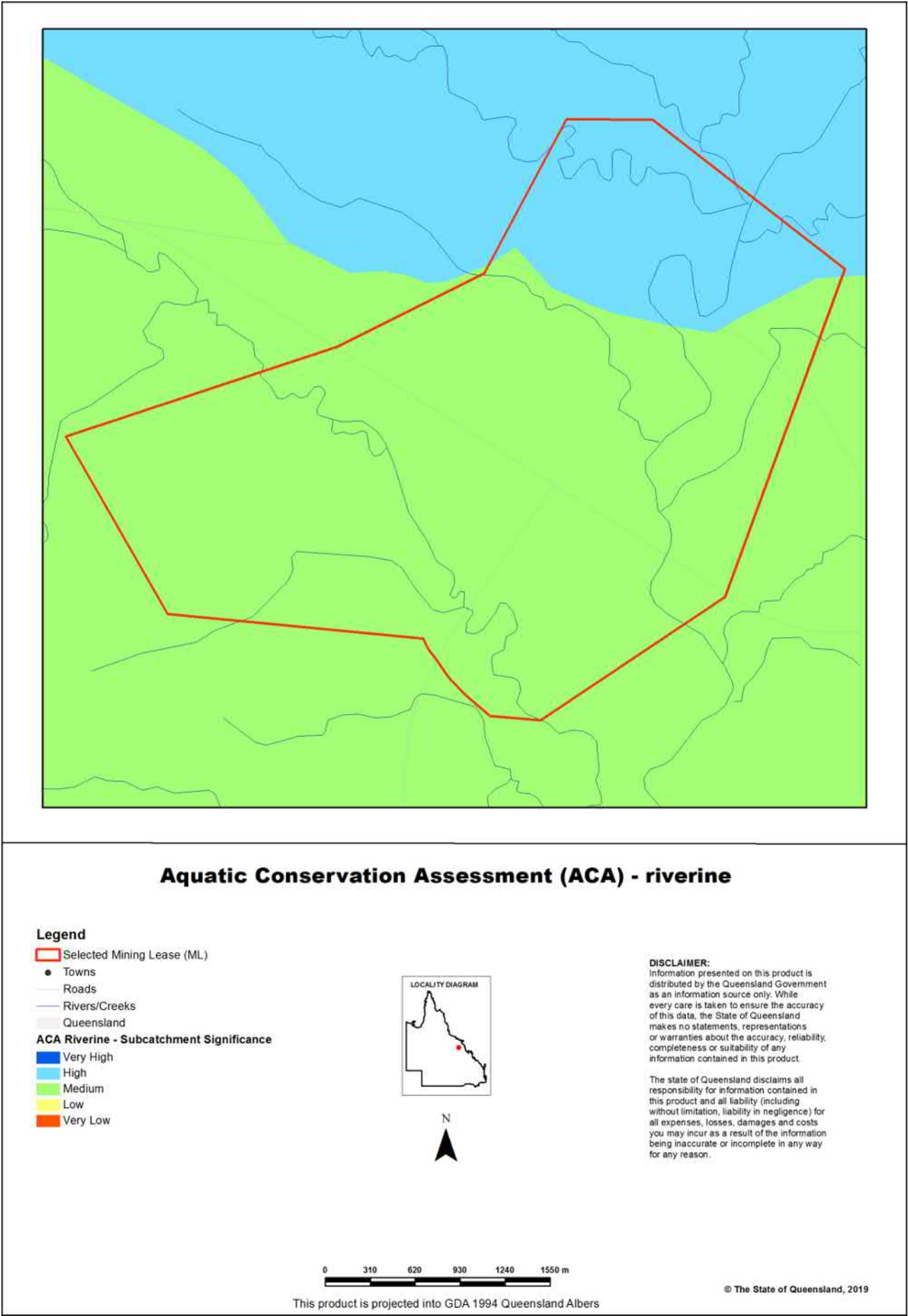
Map 3 - Corridors



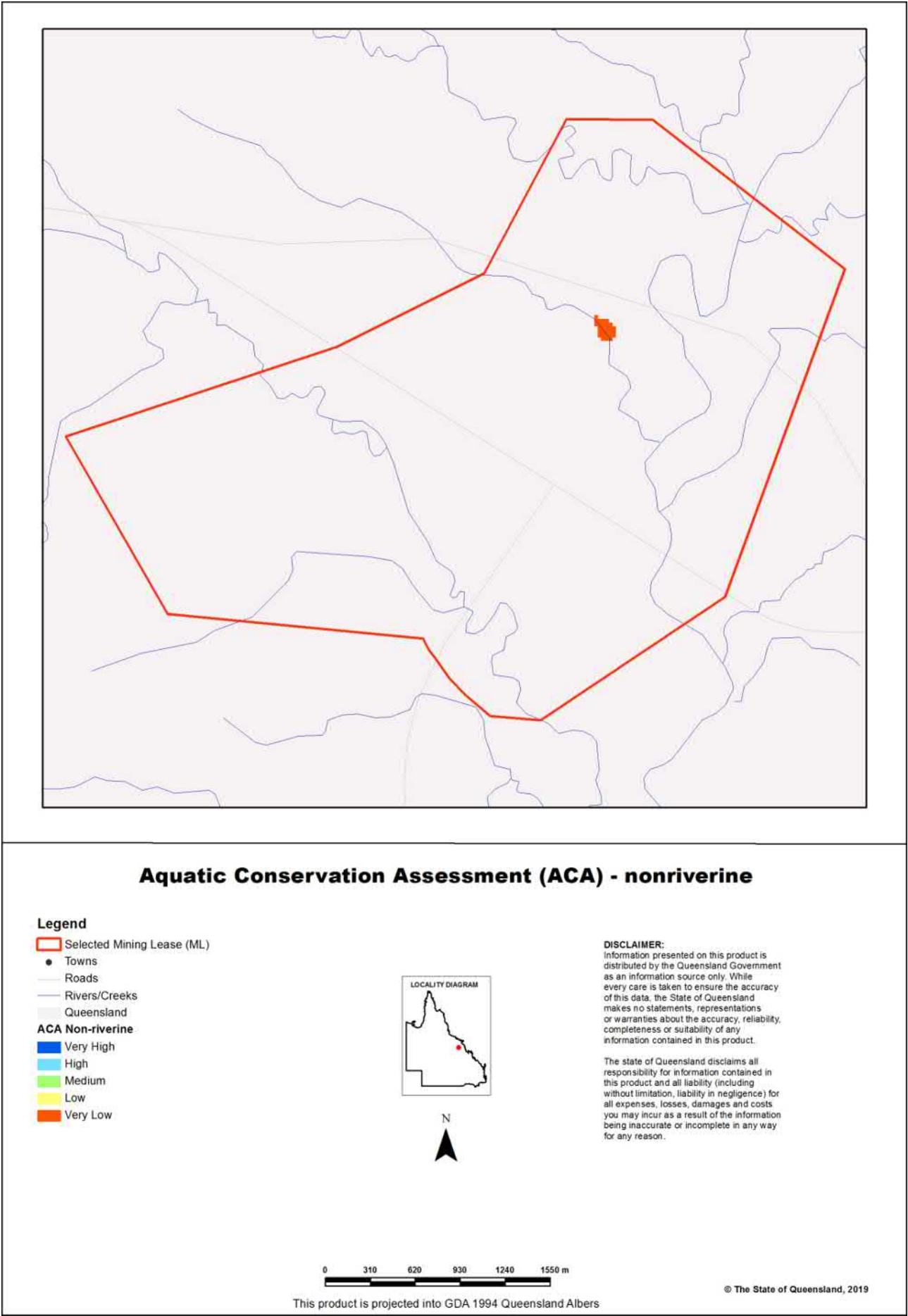
Map 4 - Wetlands and waterways



Map 5 - Aquatic Conservation Assessment (ACA) - riverine



Map 6 - Aquatic Conservation Assessment (ACA) - non-riverine



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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
Statewide BPA Corridors*	Statewide corridors v1.4
Threatened Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.
BPA Priority Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.
ACA Priority Species	An internal DES database compiled from Wildnet, Herbrecks, 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	- <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	- Endangered, Vulnerable, Near Threatened
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
JAMBA	- Japan-Australia Migratory Bird Agreement
NCA	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
ROKAMBA	- Republic of Korea-Australia Migratory Bird Agreement



Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
ml: 70337

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

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.



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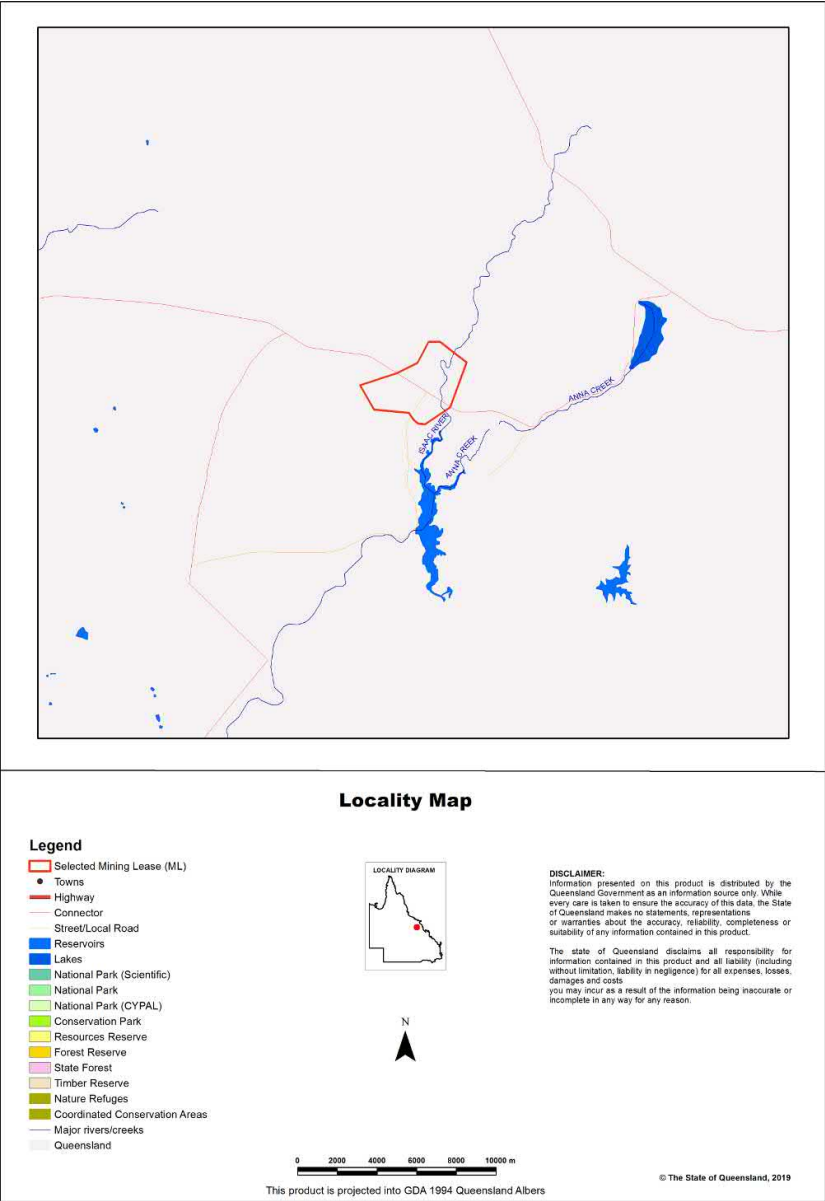
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Assessment Area Details

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 ml: 70337

Size (ha)	1,207.06
Local Government(s)	Isaac Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Northern Bowen Basin
Catchment(s)	Fitzroy



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	0.0 ha	0.0 %
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	0.0 ha	0.0 %
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	0.0 ha	0.0 %
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	478.4 ha	39.6%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	10.6 ha	0.9%
8c Regulated Vegetation - Category R (GBR riverine regrowth)	1.73 ha	0.1%
8d Regulated Vegetation - Essential habitat	0.0 ha	0.0 %
8e Regulated Vegetation - intersecting a watercourse **	19.3 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0.0 ha	0.0 %
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

(no results)

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

(no results)

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

(no results)

Threatened and special least concern species records

(no results)

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
11.3.2/11.3.25	O-dom	rem_oc
11.9.7a	O-dom	rem_oc
11.9.5	E-dom	rem_end

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.3.2/11.3.25	O-dom	hvr_oc
11.9.7a	O-dom	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)

Regulated vegetation map category	Map number	RVM rule
R	8554	4

8d. Regulated Vegetation - Essential habitat

Not applicable

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Not applicable

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets**9a. Legally secured offset areas - offset register areas**

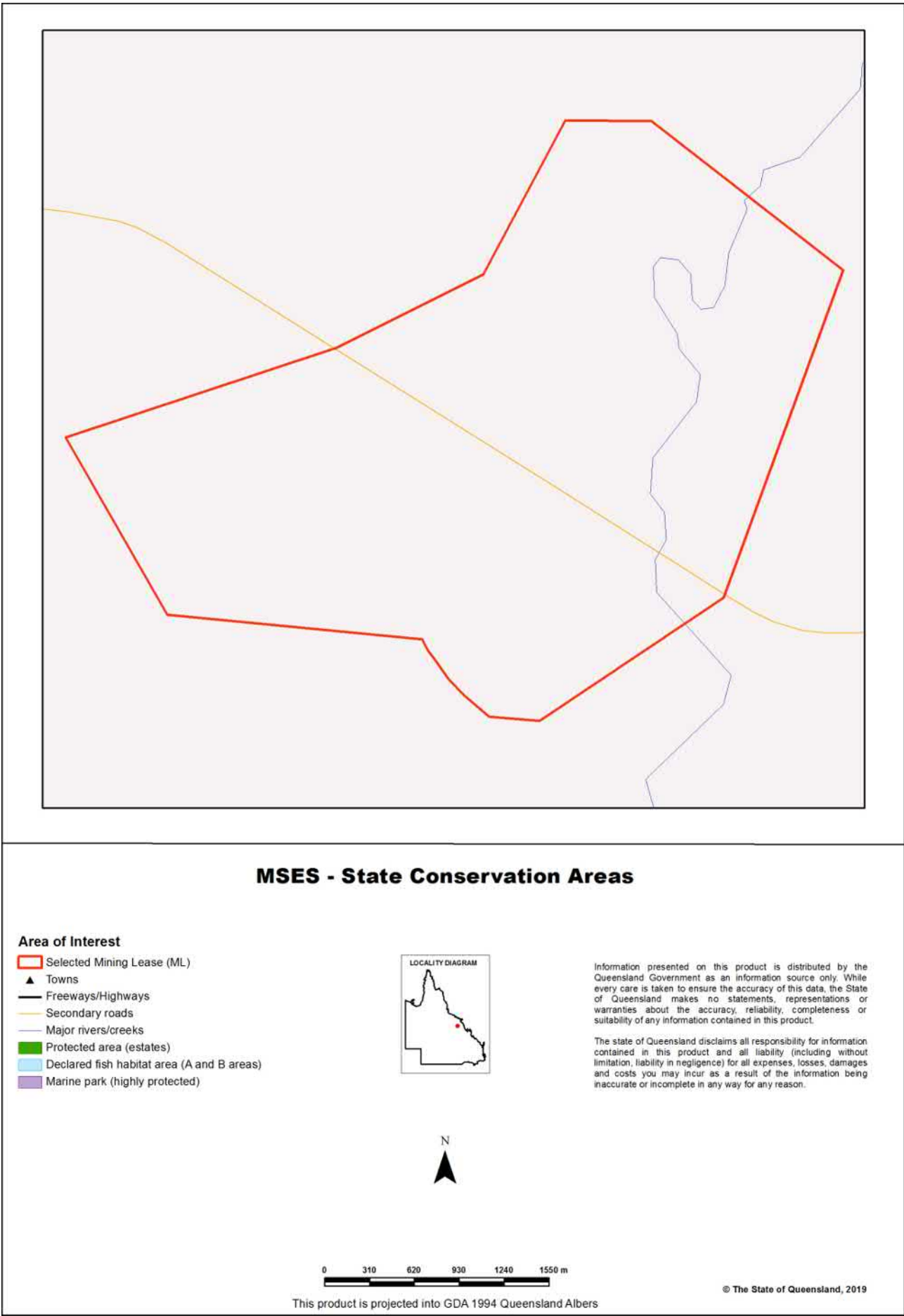
(no results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

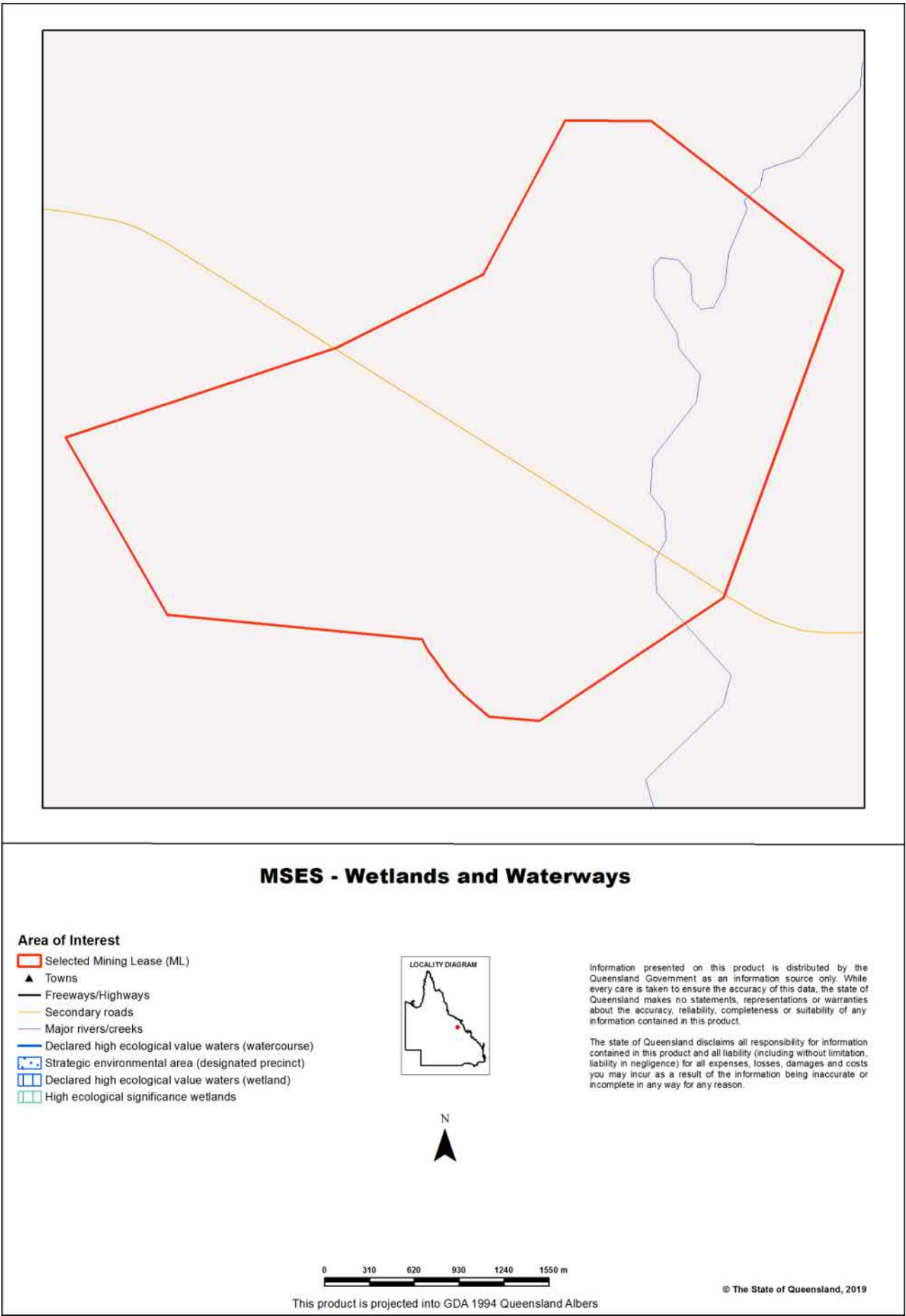
(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

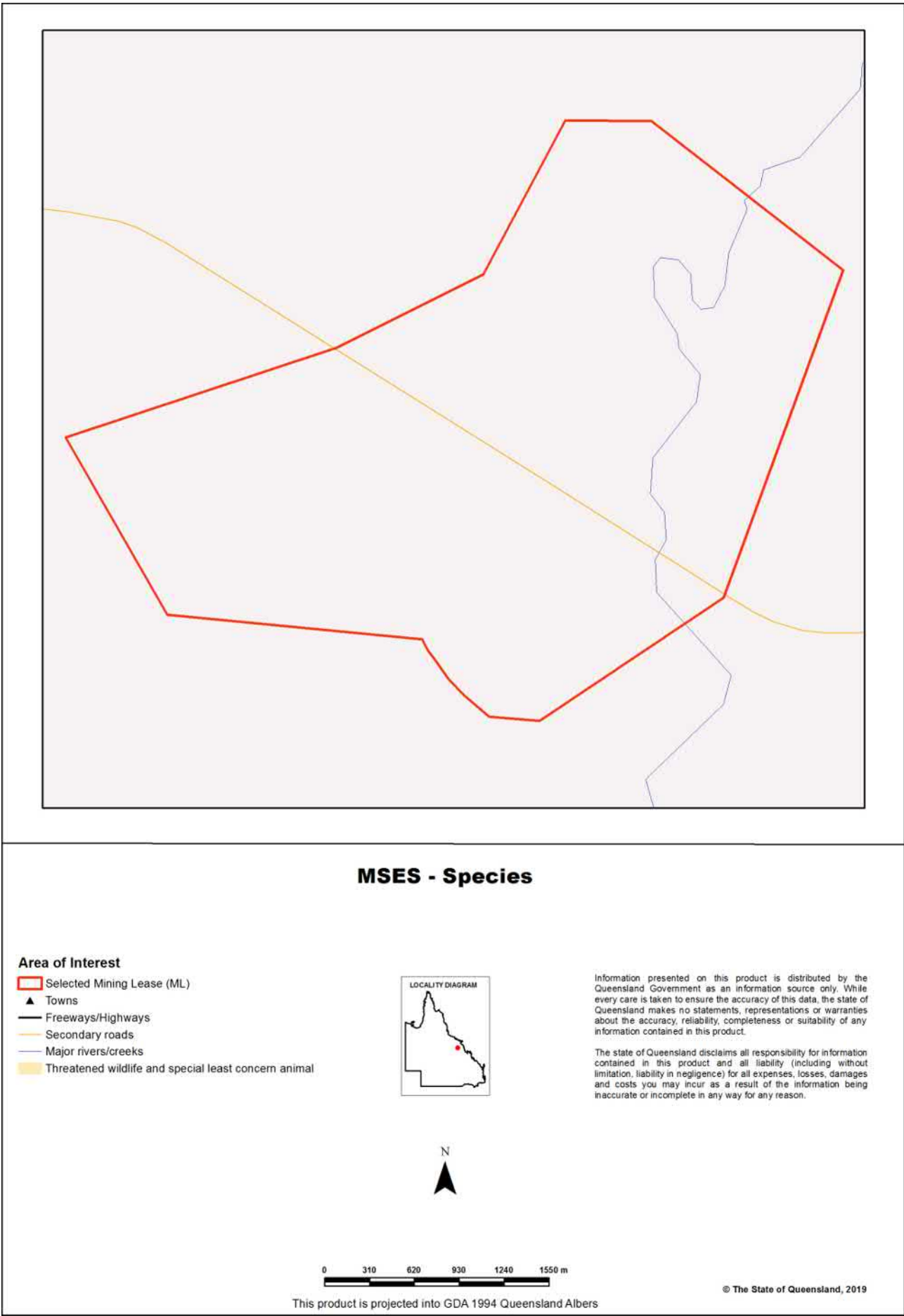
Map 1 - MSES - State Conservation Areas



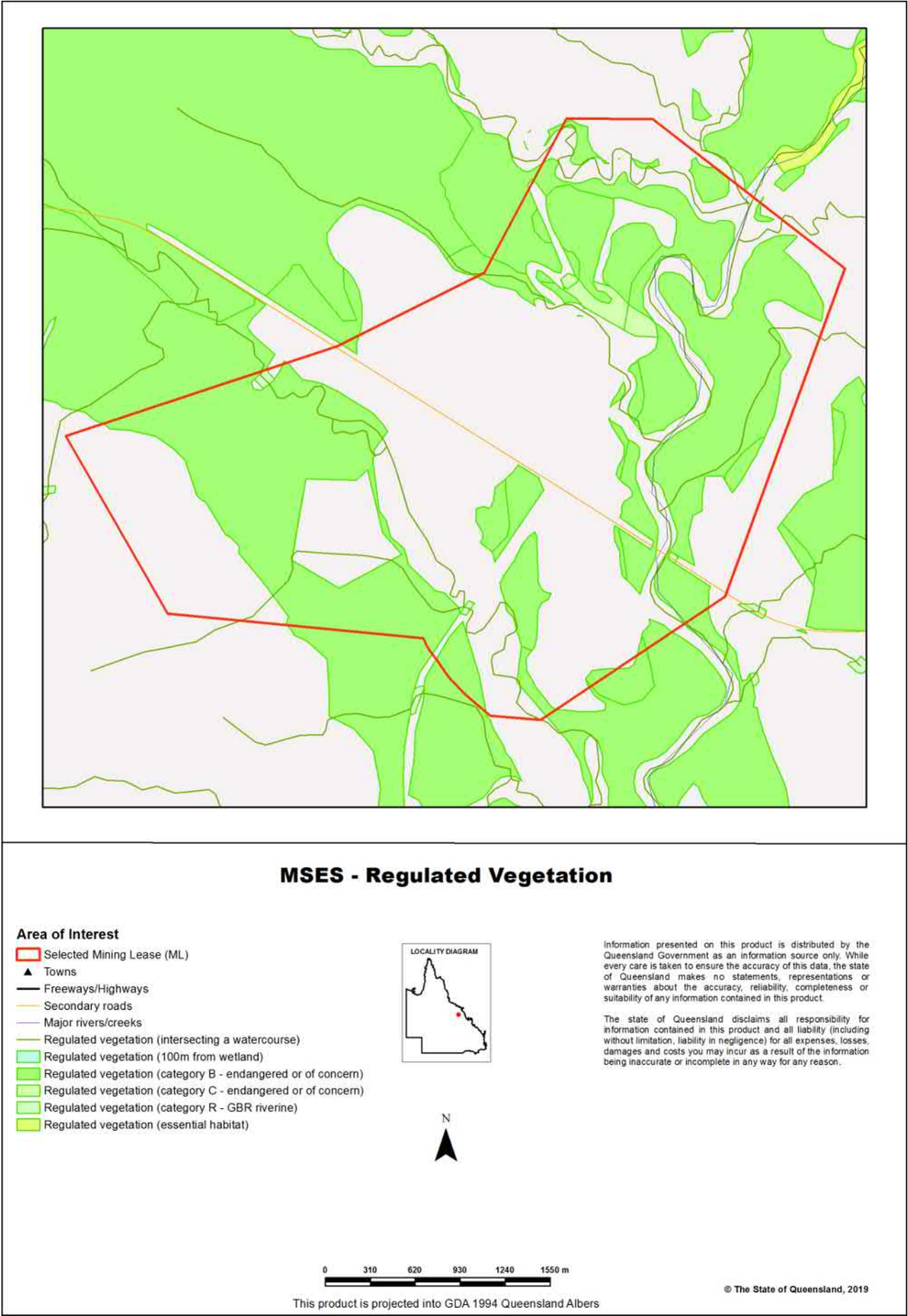
Map 2 - MSES - Wetlands and Waterways



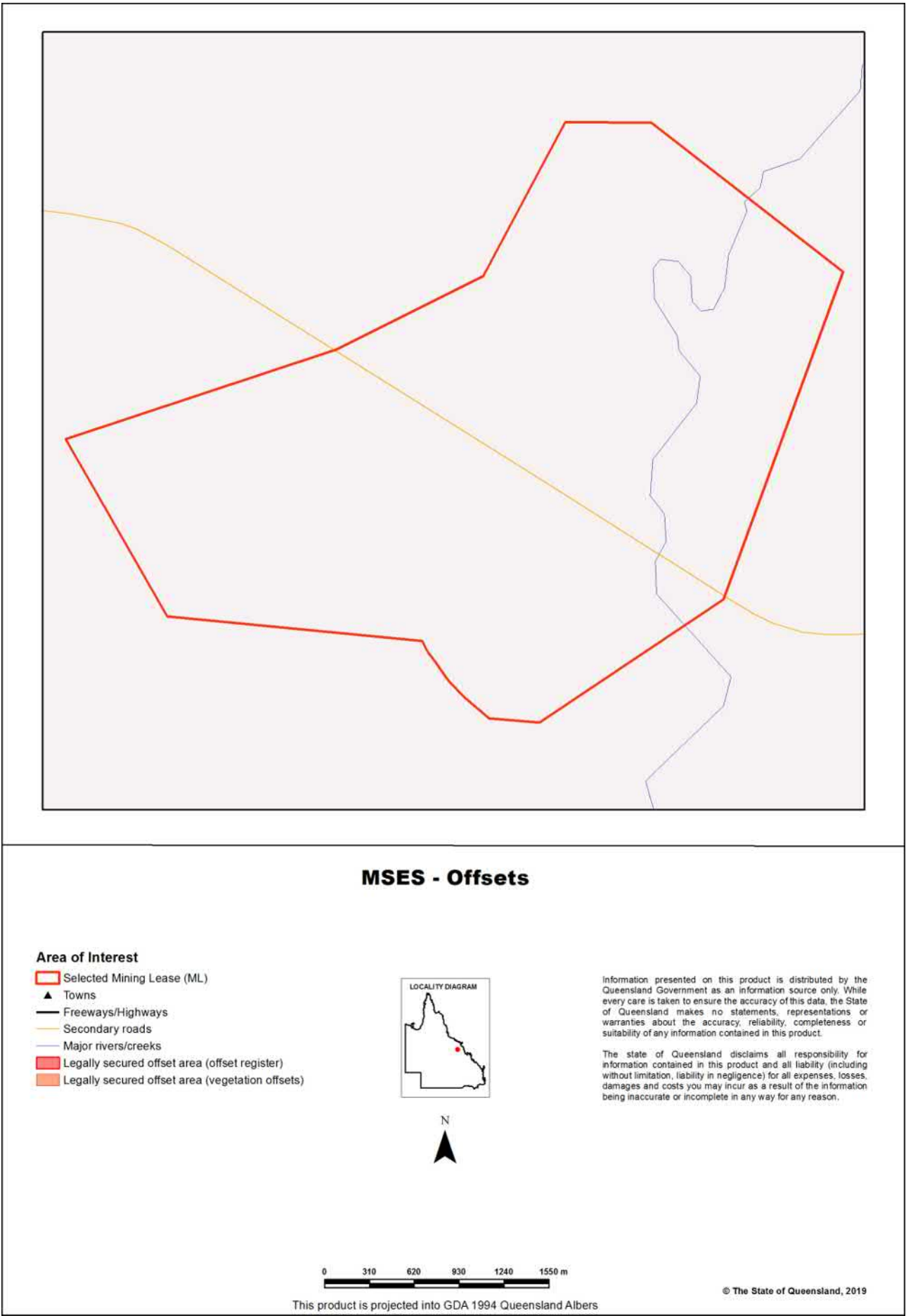
Map 3 - MSES - Species



Map 4 - MSES - Regulated Vegetation



Map 5 - MSES - Offset Areas



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	- <i>Environmental Protection Act 1994</i>
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	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- <i>Vegetation Management Act 1999</i>



Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
ml: 70337

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.



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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: ml: 70337

Size (ha)	1,207.06
Local Government(s)	Isaac Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Northern Bowen Basin
Catchment(s)	Fitzroy

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	10.19	0.84
Of concern	549.35	45.51
No concern at present	160.93	13.33
Total remnant vegetation	720.46	59.69

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
11.10.3	Acacia catenulata or A. shirleyi open forest on coarse-grained sedimentary rocks. Crests and scarps	No concern at present	68.4	5.67
11.10.4a	Eucalyptus decorticans, Lysicarpus angustifolius +/- Eucalyptus spp., Corymbia spp., Acacia spp. woodland on coarse-grained sedimentary rocks	No concern at present	26.68	2.21
11.3.2	Eucalyptus populnea woodland on alluvial plains	Of concern	377.25	31.25
11.3.25	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	Of concern	100.89	8.36
11.9.2	Eucalyptus melanophloia +/- E. orgadophila woodland on fine-grained sedimentary rocks	No concern at present	65.85	5.46
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks	Endangered	10.19	0.84
11.9.7a	Eucalyptus populnea, Eremophila mitchellii shrubby woodland on fine-grained sedimentary rocks	Of concern	71.21	5.9
non-rem	None	None	486.6	40.31

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 SOI. 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
11.10.3	Pre-clearing 378000 ha; Remnant 2017 331000 ha	24a	None	Medium
11.10.4a	Pre-clearing 493000 ha; Remnant 2017 471000 ha	12a	None	High
11.3.2	Pre-clearing 1926000 ha; Remnant 2017 506000 ha	17a	Contains palustrine wetland (e.g. in swales).	Low

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
11.3.25	Pre-clearing 795000 ha; Remnant 2017 512000 ha	16a	Riverine wetland or fringing riverine wetland.	Low
11.9.2	Pre-clearing 374000 ha; Remnant 2017 142000 ha	17b	None	Medium
11.9.5	Pre-clearing 2272000 ha; Remnant 2017 163000 ha	25a	None	Low
11.9.7a	Pre-clearing 512000 ha; Remnant 2017 104000 ha	17a	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
11.10.3	Habitat for threatened flora species including <i>Acacia deuteroneura</i> , <i>A. lauta</i> , <i>A. wardellii</i> and <i>Bertya calycina</i> .
11.10.4a	Habitat for threatened flora species including <i>Acacia curranii</i> , <i>A. handonis</i> , <i>A. islana</i> , <i>A. lauta</i> , <i>Bertya calycina</i> , <i>Calytrix islensis</i> and <i>Eucalyptus beaniana</i> and the near threatened flora species <i>A. pubicosta</i> and <i>Eucalyptus curtisii</i> .
11.3.2	Habitat for threatened flora species <i>Homopholis belsonii</i> .
11.3.25	Shown to be associated with a high fauna species richness in the Taroom area (Venz et al. 2002). Within parts of the Fitzroy catchment, this RE is known habitat for the threatened freshwater turtle <i>Rheodytes leukops</i> . Known to be important habitat for other riparian freshwater turtle species.
11.9.2	None
11.9.5	Habitat for threatened fauna species including <i>Jalmenus eubulus</i> , pale imperial hairstreak butterfly (Eastwood et al. 2008)
11.9.7a	None
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	486.6	40.31
12a	Dry woodlands to open woodlands dominated by ironbarks such as <i>Eucalyptus decorticans</i> (gum-topped ironbark), <i>E. fibrosa</i> subsp. <i>nubila</i> (blue-leaved ironbark), or <i>E. crebra</i> (narrow-leaved red ironbark) and/or bloodwoods such as <i>Corymbia trachyphloia</i> (yellow bloodwood), <i>C. leichhardtii</i> (rustyjacket), <i>C. watsoniana</i> (Watson's yellow bloodwood), <i>C. lamprophylla</i> , <i>C. peltata</i> (yellowjacket). Occasionally <i>E. thozetiana</i> (mountain yapunyah), <i>E. cloeziana</i> (Gympie messmate) or <i>E. mediocris</i> are dominant. Mostly on sub-coastal/inland hills with shallow soils. (land zones 10, 7, 9) (BRB, DEU, SEQ, GUP)	26.68	2.21
16a	Open forest and woodlands dominated by <i>Eucalyptus camaldulensis</i> (river red gum) (or <i>E. tereticornis</i> (blue gum)) and/or <i>E. coolabah</i> (coolabah) (or <i>E. microtheca</i> (coolabah)) fringing drainage lines. Associated species may include <i>Melaleuca</i> spp., <i>Corymbia tessellaris</i> (carbeen), <i>Angophora</i> spp., <i>Casuarina cunninghamiana</i> (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)	100.89	8.36
17a	Woodlands dominated by <i>Eucalyptus populnea</i> (poplar box) (or <i>E. brownii</i> (Reid River box)) on alluvium, sand plains and footslopes of hills and ranges. (land zones 3, 5, 10, 9, 4, 11, 12, [8]) (BRB, MUL, DEU, MUL, EIU)	448.46	37.15
17b	Woodlands to open woodlands dominated by <i>Eucalyptus melanophloia</i> (silver-leaved ironbark) (or <i>E. shirleyi</i> (shirley's silver-leaved ironbark)) on sand plains and footslopes of hills and ranges. (land zones 5, 12, 3, 11, 9, 7) (BRB, DEU, EIU, SEQ, NET, GUP, NWH)	65.85	5.46
24a	Low woodlands to tall shrublands dominated by <i>Acacia</i> spp. on residuals. Species include <i>A. shirleyi</i> (lancewood), <i>A. catenulata</i> (bendee), <i>A. microsperma</i> (bowyakka), <i>A. clivicola</i> , <i>A. sibirica</i> , <i>A. rhodoxylon</i> (rosewood) and <i>A. leptostachya</i> (Townsville wattle). (land zones 7, 10, 5, 12, 11, [9, 3]) (MUL, CHC, BRB, GUP, EIU, MGD, DEU, NWH, [CYP])	68.4	5.67
25a	Open forests to woodlands dominated by <i>Acacia harpophylla</i> (brigalow) sometimes with <i>Casuarina cristata</i> (belah) on heavy clay soils. Includes areas co-dominated with <i>A. cambagei</i> (gidgee) and/or emergent eucalypts (land zones 4, 9, 3, 11, 7, 12, [5, 8]) (BRB, MUL, MGD, DEU, [SEQ])	10.19	0.84

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/>

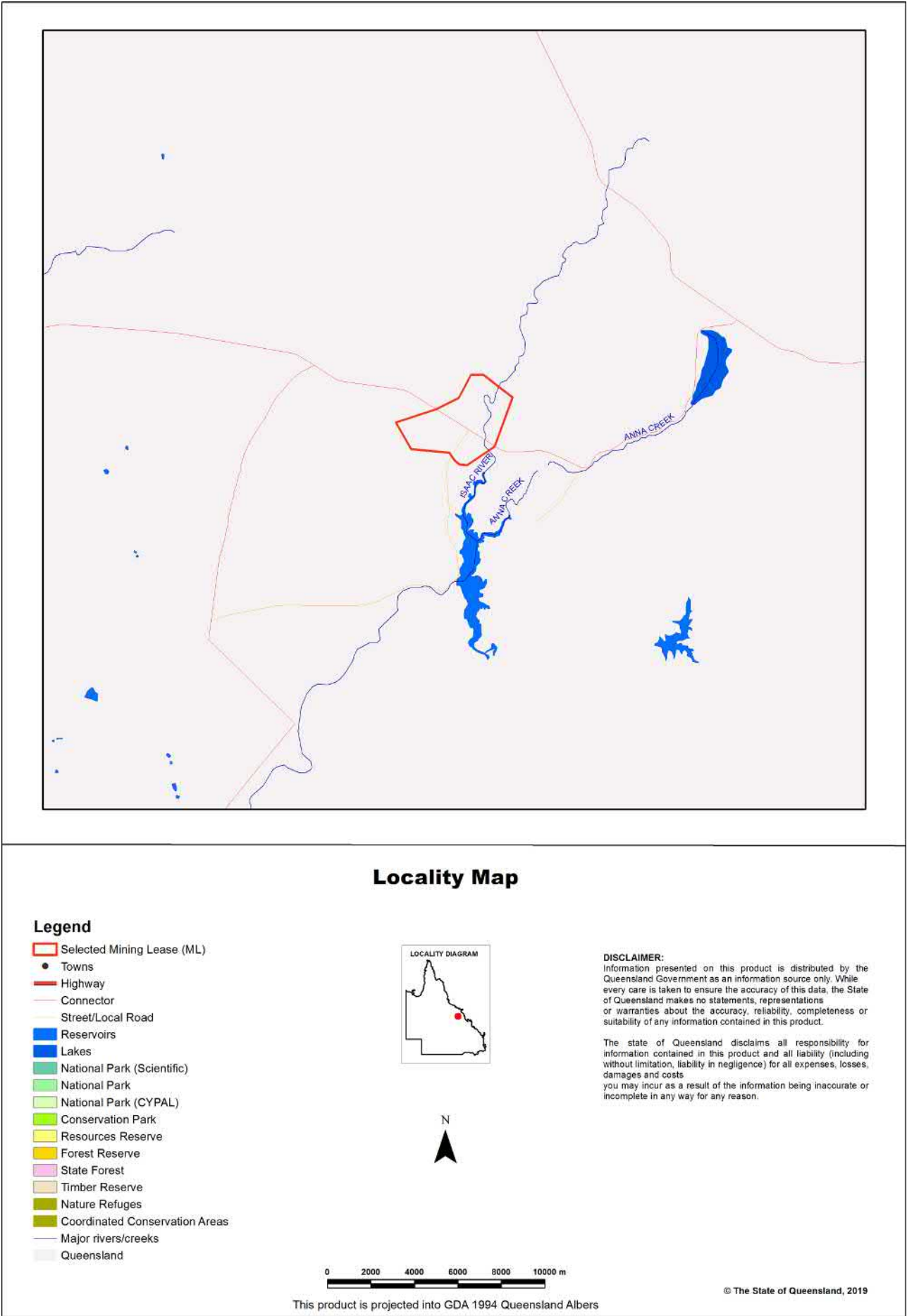
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance 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

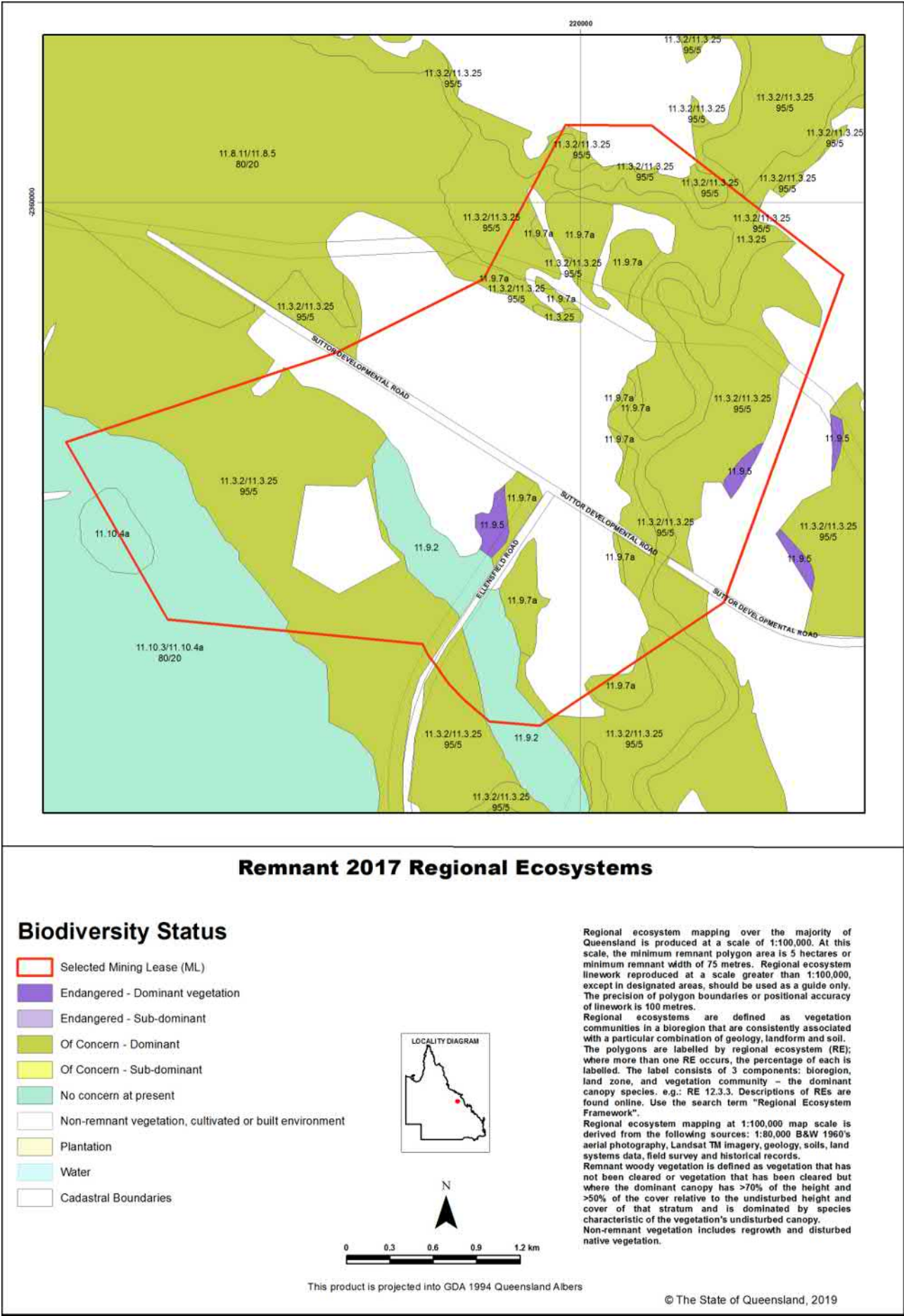
Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
11.10.3	Available	Available
11.10.4a	Available	Not currently available
11.3.2	Available	Available
11.3.25	Available	Available
11.9.2	Available	Not currently available
11.9.5	Available	Available
11.9.7a	Available	Not currently available
non-rem	Not currently available	Not currently available

Maps

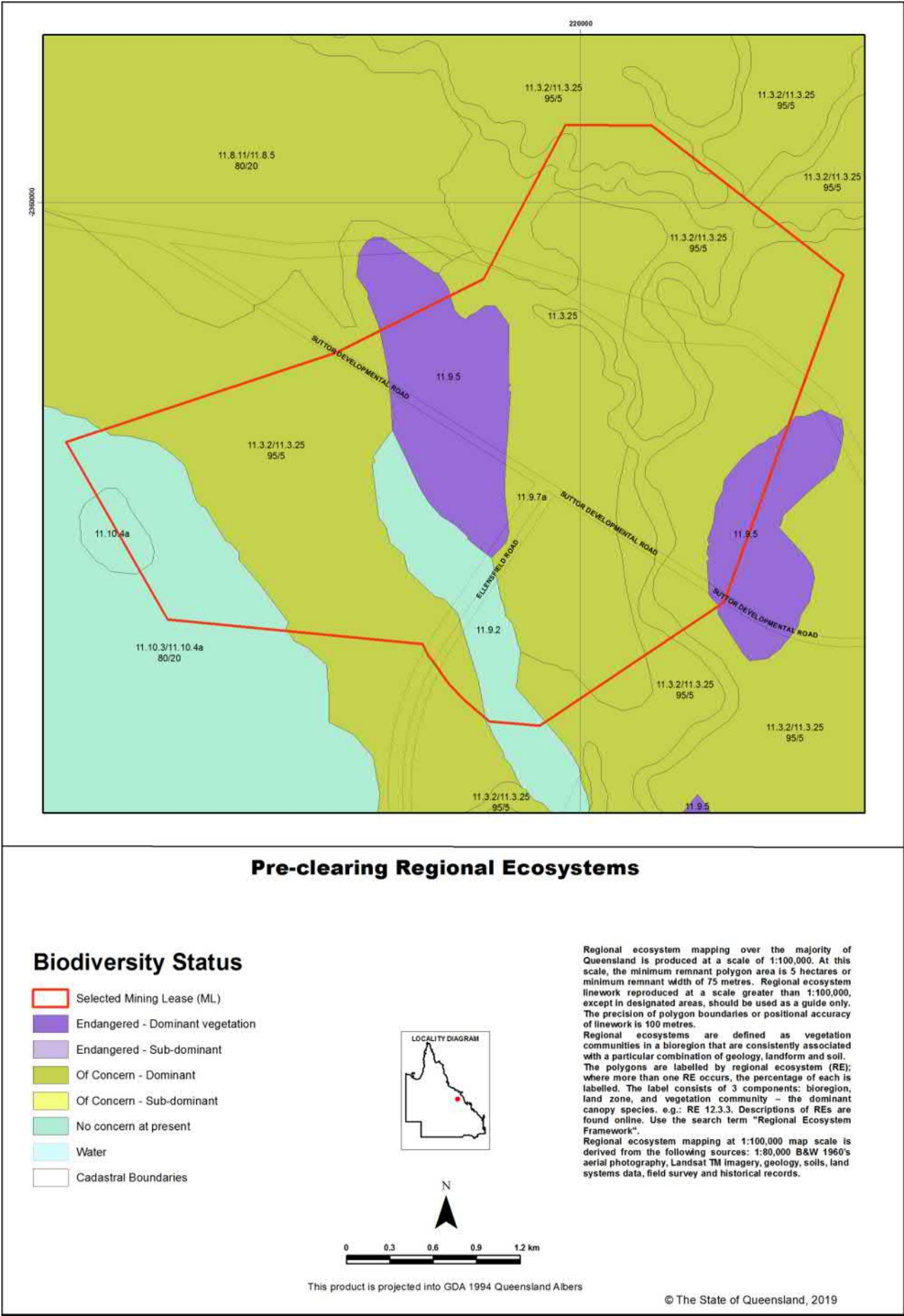
Map 1 - Location



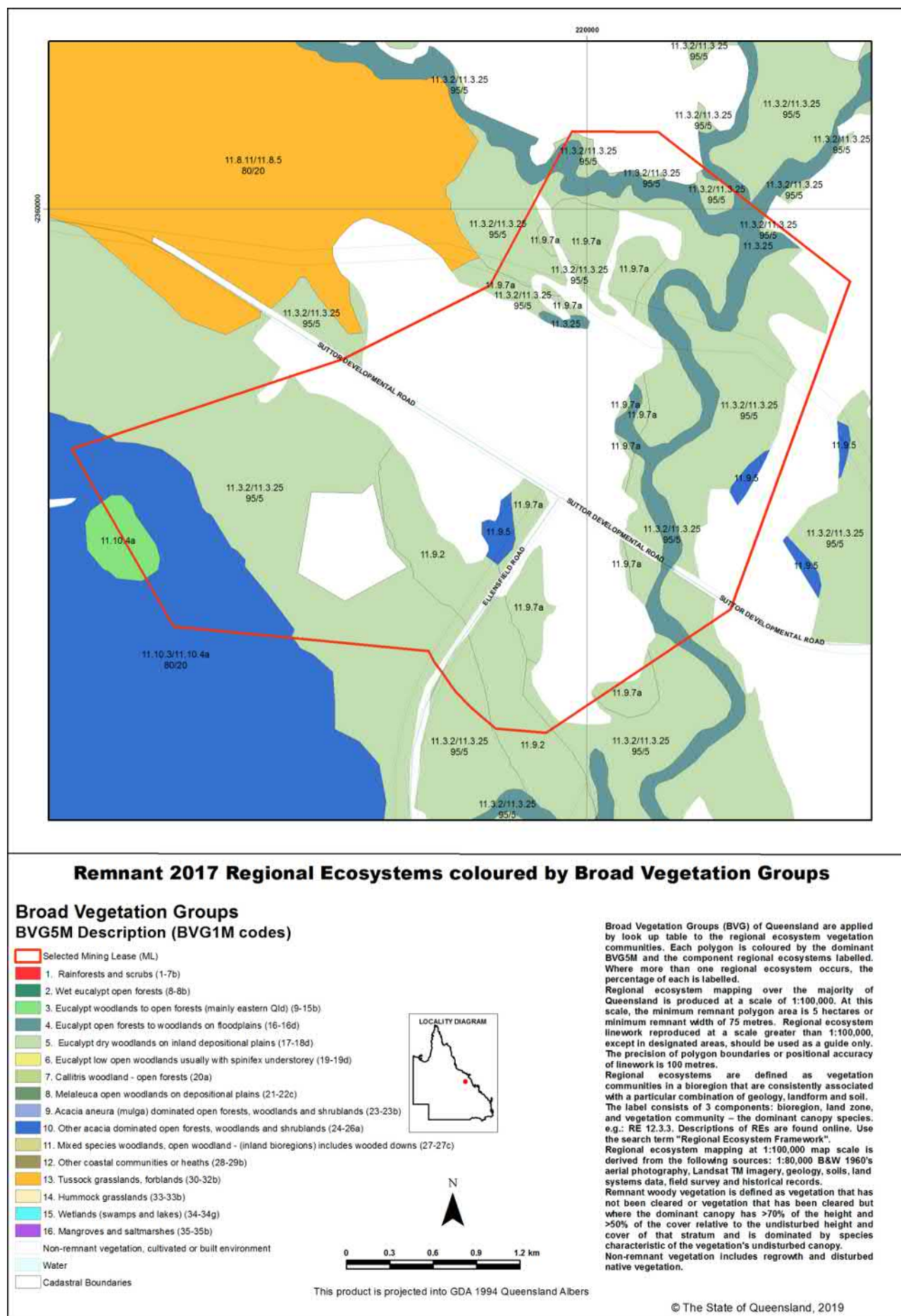
Map 2 - Remnant 2017 regional ecosystems



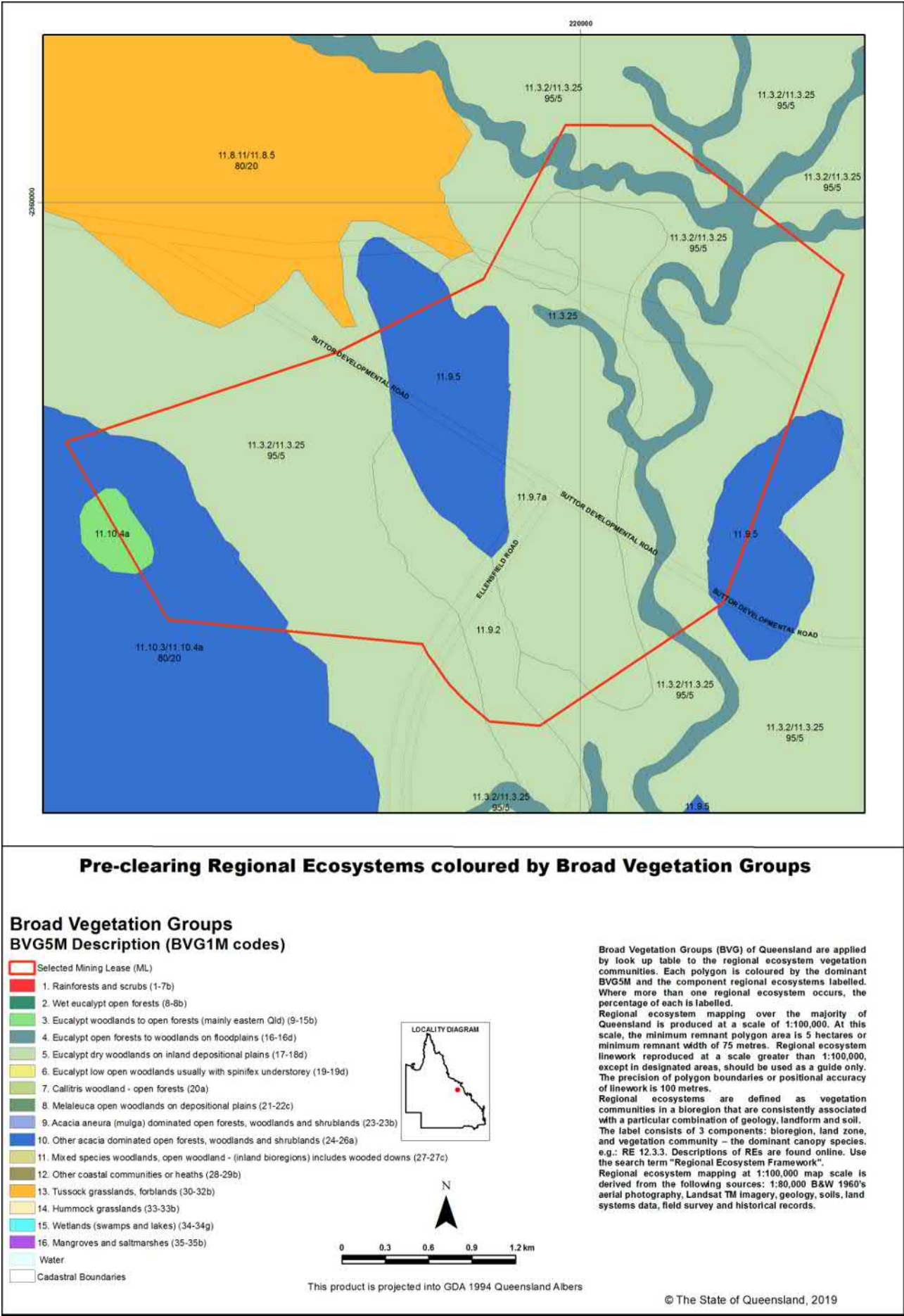
Map 3 - Pre-clearing regional ecosystems



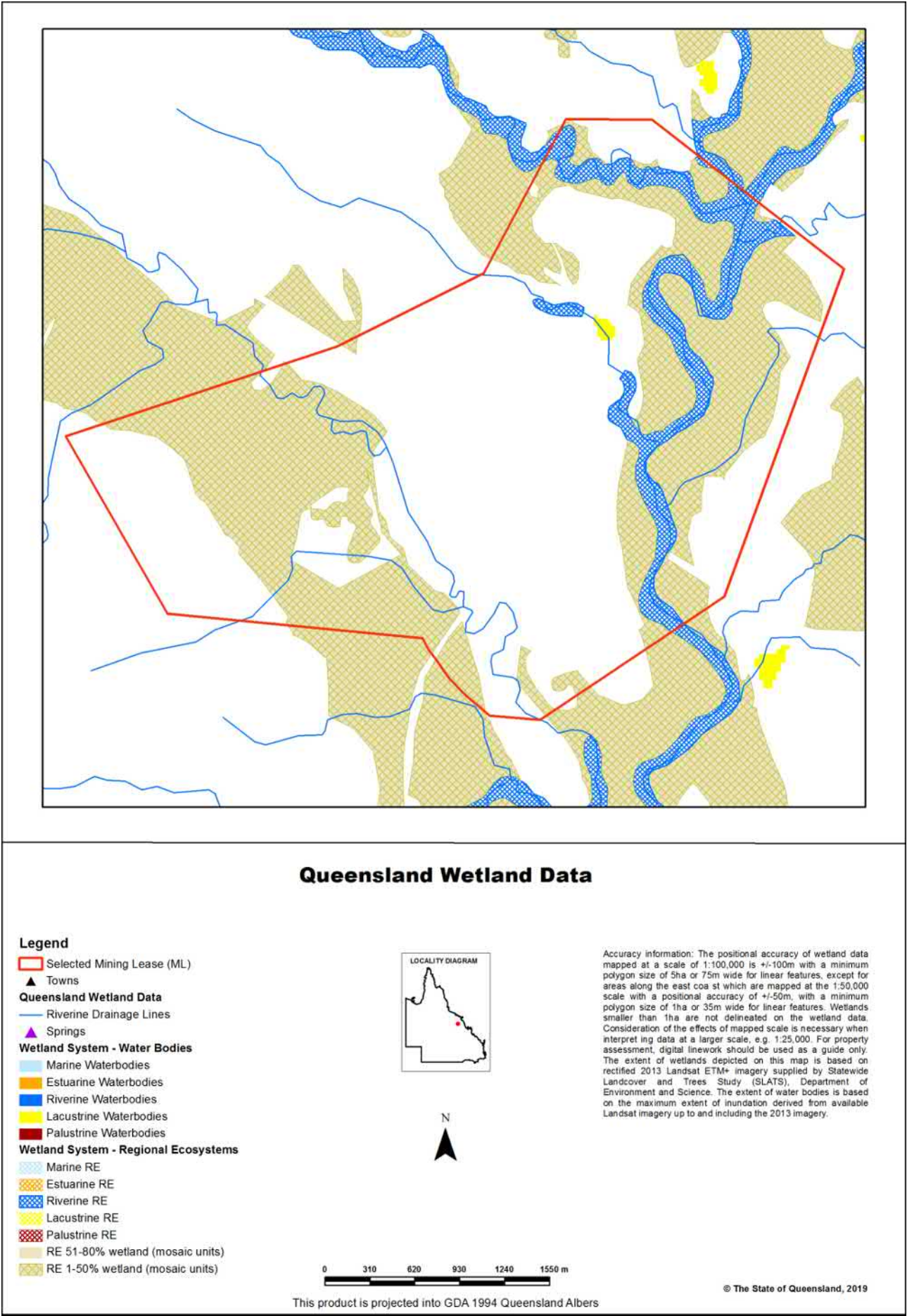
Map 4 - Remnant 2017 regional ecosystems by BVG (5M)



Map 5 - Pre-clearing regional ecosystems by BVG (5M)



Map 6 - Wetlands and waterways



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

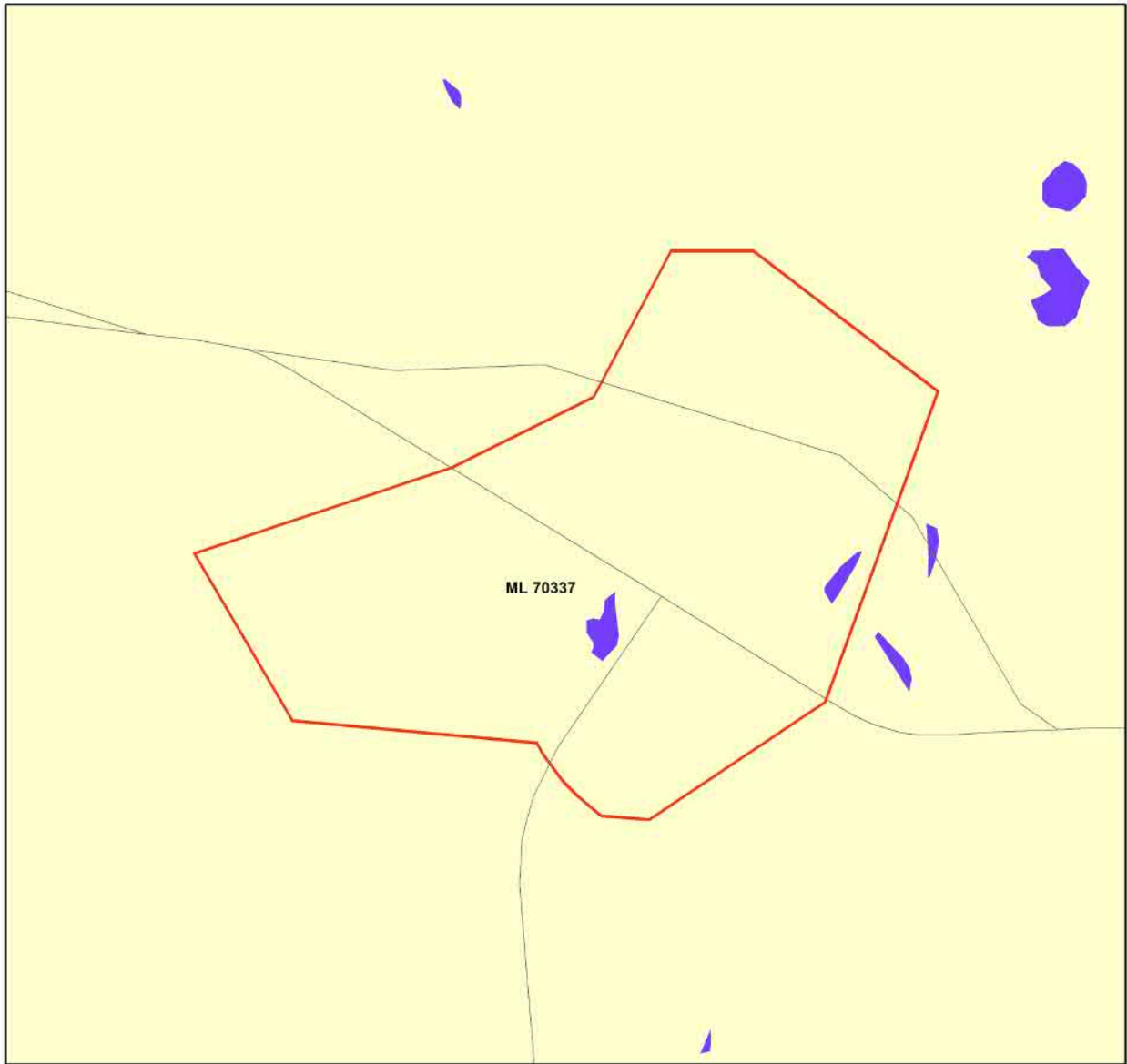
The datasets listed below are available for download from:

<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	- <i>Vegetation Management Act 1999</i>



ENVIRONMENTALLY SENSITIVE AREAS - Mining Activities

- Selected Mining Lease (ML)

CATEGORY A

National Parks

Conservation Parks

Forest Reserves

Wet Tropics World Heritage Area

Great Barrier Reef Marine Park Area

Marine Parks other than General Use Zones

CATEGORY B

World Heritage Areas

Queensland Heritage Register Places

Ramsar Sites

Cultural Heritage Registered Areas and DLA's other than Stanbroke

Special Forestry Areas

Fish Habitat Areas

Koala Plan

Coordinated Conservation Areas

Endangered Regional Ecosystems (Biodiversity Status)

General Use Zones of Marine Parks

Marine Plants
- CATEGORY C

Nature Refuges

Resources Reserve

State Forests

Timber Reserves

Declared Catchment Areas

Declared Irrigation Areas

Drainage Areas

River Improvement Areas

Stanbroke DLA

Coastal Management District

Dams and Weirs

OTHERS

Towns

Roads

Repealed Wild River Nominated Waterways

Repealed Wild River Preservation Areas

Repealed Wild River High Preservation Areas

Mahogany Glider Habitat

Directory of Important Wetlands

Queensland



0 440 880 1,320 1,760 2,200 m

This product is projected into GDA 1994 MGA Zone 55

Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, The State of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

The State of Queensland disclaims all responsibility for information contained in this product and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

External contributors (non-government parties) of the data for this product are: Great Barrier Reef Marine Park Authority

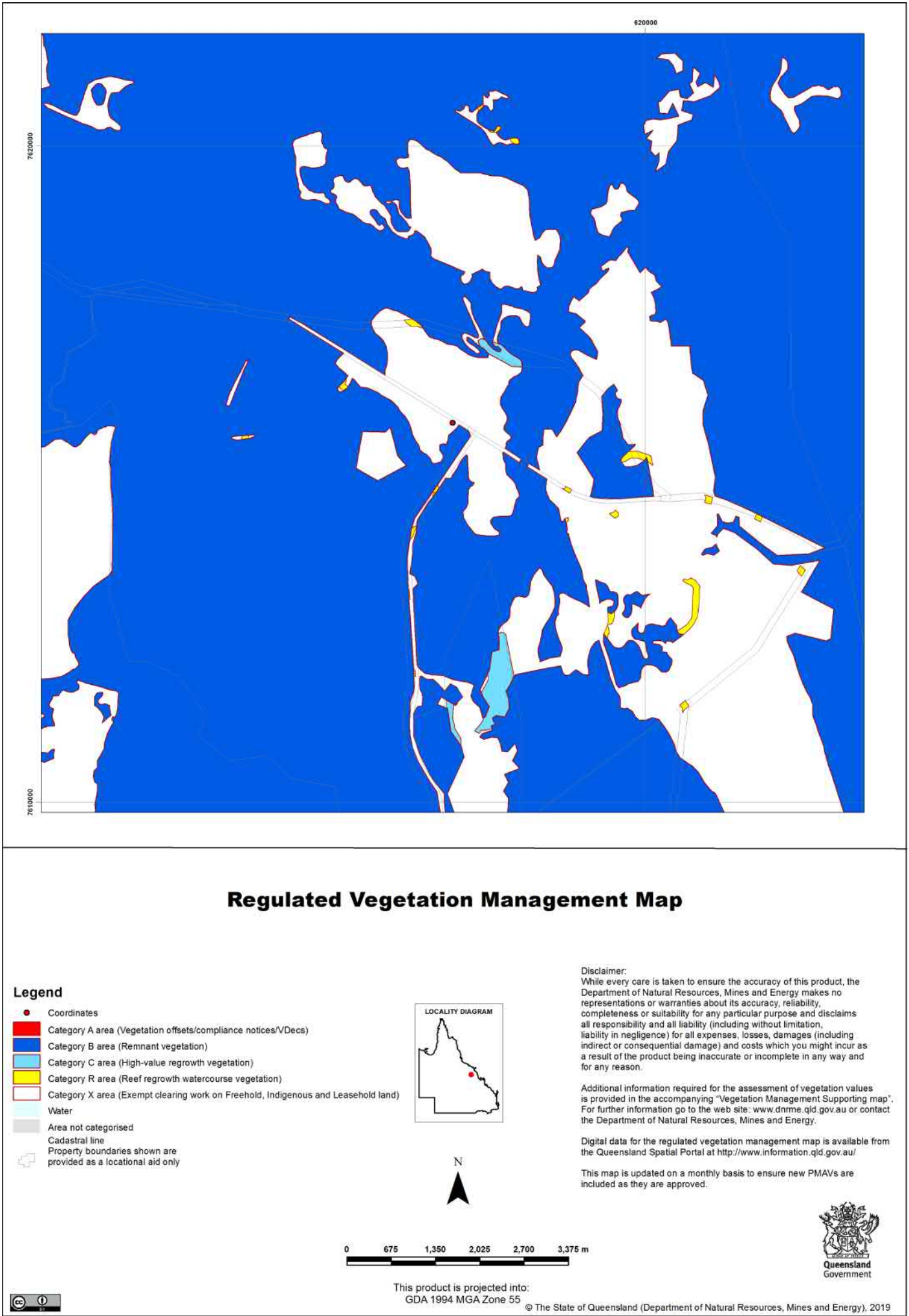
Regional ecosystem mapping (remnant biodiversity status) may incorporate amendments, resulting from property level assessments, to the release version of the mapping available on QSpatial.

NOTE TO USER: Themes presented in this map are indicative only. Field survey may be required to verify the 'true' spatial extent and value. Not all environmentally sensitive areas are presented in this map. A user should refer to the particular circumstances relevant to their situation to assess the 'completeness' of themes provided.

The user should note that some boundaries and indicated values are ambient and may change over time (e.g. regional ecosystem boundaries and conservation status, watercourse mapping etc).

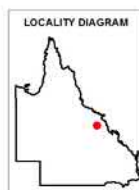
The user should be aware that due to multiple overlapping themes/layers present, some themes/layers may be obscured by others. Ordering in the Legend does not accurately reflect the order by which themes/layers are displayed.

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- Coordinates
- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystem
- Category A or B area under Section 20AH
- These areas are edged in yellow and filled with the remnant RE Status
- Category C or R area containing endangered regional ecosystems
- Category C or R area containing of concern regional ecosystems
- Category C or R area that is a least concern regional ecosystem
- Category C area under Section 20AI
- These areas are edged in purple and filled with the remnant RE Status
- Category X area
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourses and drainage features on the vegetation management w
- and drainage features map
- (Stream order shown as black number against stream where available)
- Roads
- National Parks, State Forest and other reserves
- Cadastral line
- Property boundaries shown are
- provided as a locational aid only



0 480 960 1,440 1,920 2,400 m

This product is projected into:
GDA 1994 MGA Zone 55

Labels for Essential Habitat are centred on the area of enquiry.

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/- 100 metres.

Disclaimer:

Disclaimer: While every care is taken to ensure the accuracy of this product, the Department of Natural Resources, Mines and Energy 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 you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

Additional information may be required for the purposes of land clearing or assessment of a regional ecosystem map or PMAV applications. For further information go to the web site: www.dnrme.qld.gov.au or contact the Department of Natural Resources, Mines and Energy.

Digital data for the vegetation management watercourse and drainage feature map, vegetation management wetlands map, essential habitat map and the vegetation management remnant and regional ecosystem map are available from the Queensland Spatial Portal at <http://www.information.qld.gov.au/>

Vegetation Management Act 1999 - Extract from the essential habitat database

Essential habitat is required for assessment under the:

- State Development Assessment Provisions - State Code 16: Native vegetation clearing which sets out the matters of interest to the state for development assessment under the *Planning Act 2016*; and
- Accepted development vegetation clearing codes made under the *Vegetation Management Act 1999*

Essential habitat for one or more of the following species is found on and within 1.1 km of the identified subject lot/s on the accompanying essential habitat map.

This report identifies essential habitat in Category A, B and Category C areas.

The numeric labels on the essential habitat map can be cross referenced with the database below to determine which essential habitat factors might exist for a particular species.

Essential habitat is compiled from a combination of species habitat models and buffered species records.

The Department of Natural Resources, Mines and Energy website (<http://www.dnrme.qld.gov.au>) has more information on how the layer is applied under the State Development Assessment Provisions - State Code 16: Native vegetation clearing and the *Vegetation Management Act 1999*.

Regional ecosystem is a mandatory essential habitat factor, unless otherwise stated.

Essential habitat, for protected wildlife, means a category A area, a category B area or category C area shown on the regulated vegetation management map-

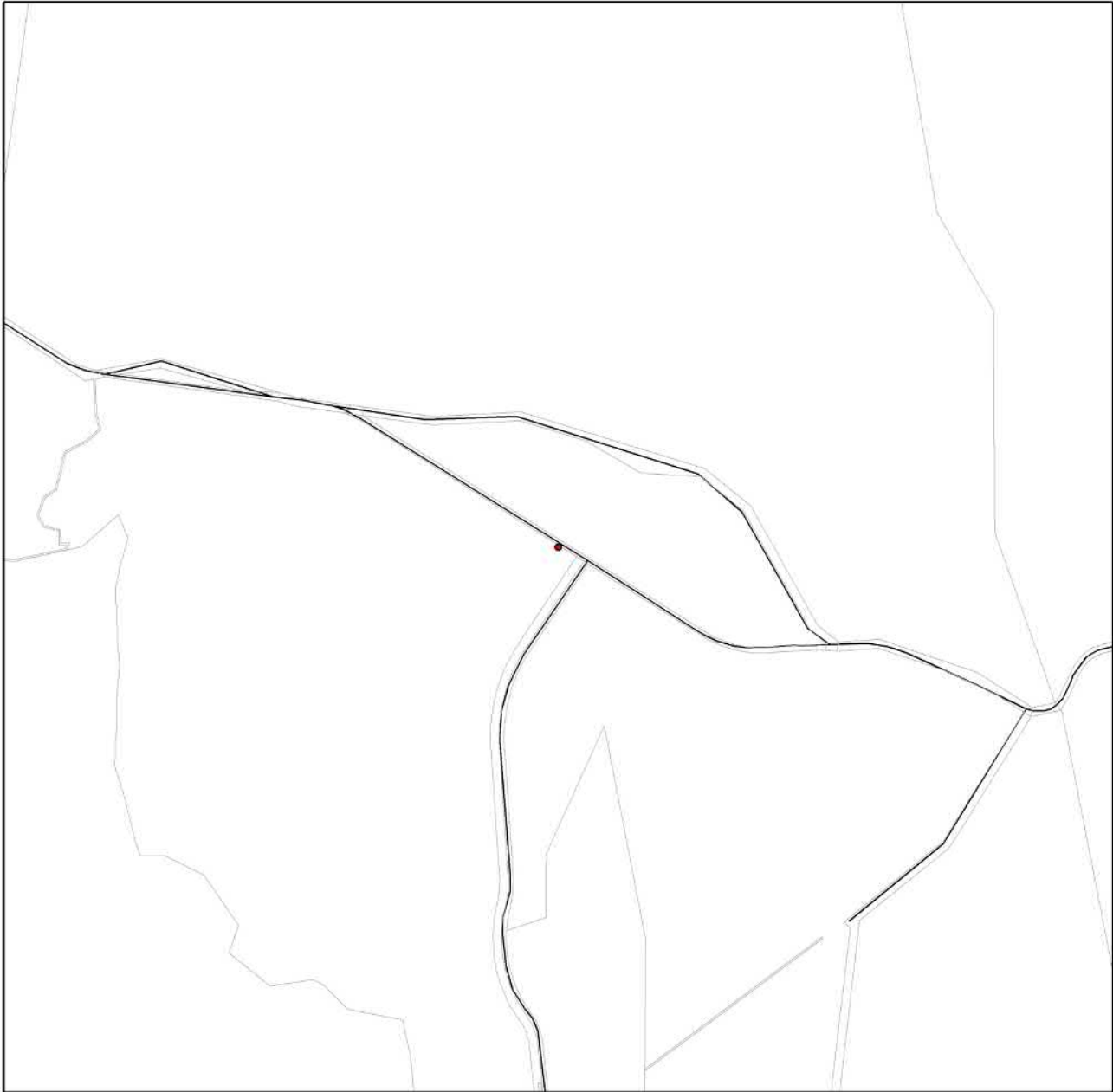
- 1) that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or
- 2) in which the protected wildlife, at any stage of its life cycle, is located.

Protected wildlife includes endangered, vulnerable or near-threatened native wildlife prescribed under the *Nature Conservation Act 1992*.

Essential habitat in Category A and/or Category B and/or Category C

Label	Scientific Name	Common Name	NCA Status	Vegetation Community	Altitude	Soils	Position in Landscape
483	Denisonia maculata	ornamental snake	V	Riparian woodland/open forest and shrub/woodland including Brigalow Acacia harpophylla; into drier habitats in summer.	100-450m.	Cracking clay with gilgai/soil crack microrrelief and sandy loam substrates.	Near freshwater waterholes/creeks and low lying poorly drained areas that are frequently inundated by freshwater.
848	Petauroides volans	greater glider	V	Tall mature open wet and dry eucalypt forest (Eucalyptus &/or Corymbia spp.) to low open eucalypt woodland; presence of hollow-bearing trees.	Sea level to 1300m.	Usually on soils of relatively high fertility.	None

Label	Regional Ecosystem (mandatory unless otherwise specified)
483	10.3.2, 10.3.3, 10.3.4, 10.3.7, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.27, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7, 10.4.8, 10.5.5, 10.9.1, 10.9.6, 10.9.7, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.9, 11.3.10, 11.3.12, 11.3.15, 11.3.21, 11.3.23, 11.3.24, 11.3.25, 11.3.27, 11.3.28, 11.3.31, 11.3.34, 11.3.37, 11.3.38, 11.3.40, 11.4.2, 11.4.3, 11.4.4, 11.4.6, 11.4.7, 11.4.8, 11.4.9, 11.4.11, 11.5.2, 11.5.3, 11.5.16, 11.8.11, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.7, 11.9.11, 11.9.12, 11.9.14, 11.11.15, 11.12.6
848	7.3.7, 7.3.8, 7.3.9, 7.3.12, 7.3.13, 7.3.14, 7.3.16, 7.3.19, 7.3.20, 7.3.21, 7.3.25, 7.3.26, 7.3.39, 7.3.40, 7.3.42, 7.3.43, 7.3.44, 7.3.45, 7.3.47, 7.3.48, 7.3.50, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.8.7, 7.8.8, 7.8.10, 7.8.15, 7.8.16, 7.8.17, 7.8.18, 7.8.19, 7.11.5, 7.11.6, 7.11.13, 7.11.14, 7.11.16, 7.11.18, 7.11.19, 7.11.20, 7.11.21, 7.11.31, 7.11.32, 7.11.33, 7.11.34, 7.11.35, 7.11.37, 7.11.38, 7.11.41, 7.11.42, 7.11.43, 7.11.44, 7.11.45, 7.11.46, 7.11.47, 7.11.48, 7.11.49, 7.11.50, 7.11.51, 7.12.4, 7.12.5, 7.12.17, 7.12.21, 7.12.22, 7.12.23, 7.12.24, 7.12.25, 7.12.26, 7.12.27, 7.12.28, 7.12.29, 7.12.30, 7.12.33, 7.12.34, 7.12.35, 7.12.51, 7.12.52, 7.12.53, 7.12.54, 7.12.55, 7.12.56, 7.12.58, 7.12.59, 7.12.60, 7.12.61, 7.12.62, 7.12.63, 7.12.65, 7.12.66, 7.12.69, 9.3.1, 9.3.2, 9.3.3, 9.3.5, 9.3.6, 9.3.8, 9.3.10, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.24, 9.4.1, 9.4.2, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.13, 9.5.14, 9.5.15, 9.5.16, 9.5.17, 9.7.1, 9.7.2, 9.7.3, 9.7.4, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.4, 9.8.5, 9.8.9, 9.8.10, 9.8.11, 9.10.1, 9.10.3, 9.10.4, 9.10.5, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.10, 9.11.12, 9.11.13, 9.11.14, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.21, 9.11.22, 9.11.23, 9.11.24, 9.11.25, 9.11.26, 9.11.28, 9.11.29, 9.11.30, 9.11.31, 9.11.32, 9.12.1, 9.12.2, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.14, 9.12.15, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.25, 9.12.26, 9.12.27, 9.12.28, 9.12.29, 9.12.30, 9.12.31, 9.12.32, 9.12.33, 9.12.35, 9.12.36, 9.12.37, 9.12.38, 9.12.39, 9.12.40, 9.12.44, 10.3.2, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.7, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.7, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.7.1, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.10.1, 11.10.2, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.16, 11.12.17, 11.12.19, 11.12.20, 12.2.5, 12.2.6, 12.2.7, 12.2.8, 12.2.10, 12.2.11, 12.3.2, 12.3.3, 12.3.4, 12.3.5, 12.3.6, 12.3.7, 12.3.9, 12.3.10, 12.3.11, 12.3.12, 12.3.14, 12.3.15, 12.3.18, 12.3.19, 12.3.20, 12.5.1, 12.5.2, 12.5.3, 12.5.4, 12.5.5, 12.5.6, 12.5.7, 12.5.8, 12.5.10, 12.5.11, 12.5.12, 12.7.1, 12.7.2, 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, 12.8.20, 12.8.23, 12.8.24, 12.8.25, 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, 12.9-10.8, 12.9-10.11, 12.9-10.12, 12.9-10.13, 12.9-10.14, 12.9-10.17, 12.9-10.18, 12.9-10.19, 12.9-10.20, 12.9-10.21, 12.9-10.23, 12.9-10.24, 12.9-10.25, 12.9-10.26, 12.9-10.27, 12.9-10.28, 12.9-10.29, 12.11.2, 12.11.3, 12.11.5, 12.11.6, 12.11.7, 12.11.8, 12.11.9, 12.11.14, 12.11.15, 12.11.16, 12.11.17, 12.11.18, 12.11.19, 12.11.20, 12.11.21, 12.11.22, 12.11.23, 12.11.24, 12.11.25, 12.11.26, 12.11.27, 12.11.28, 12.12.2, 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, 12.12.14, 12.12.15, 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, 13.3.1, 13.3.2, 13.3.3, 13.3.4, 13.3.5, 13.3.7, 13.9.2, 13.11.1, 13.11.2, 13.11.3, 13.11.4, 13.11.5, 13.11.6, 13.11.8, 13.11.9, 13.12.1, 13.12.2, 13.12.3, 13.12.4, 13.12.5, 13.12.6, 13.12.8, 13.12.9, 13.12.10



Protected Plants Flora Survey Trigger Map

Legend

- Coordinates
- High risk area
- ⊕ Cadastral line
Property boundaries shown are provided as a locational aid only
- Freeways / motorways / highways
- Secondary roads / streets



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.



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: 10/06/19 15:40:04

[Summary](#)

[Details](#)

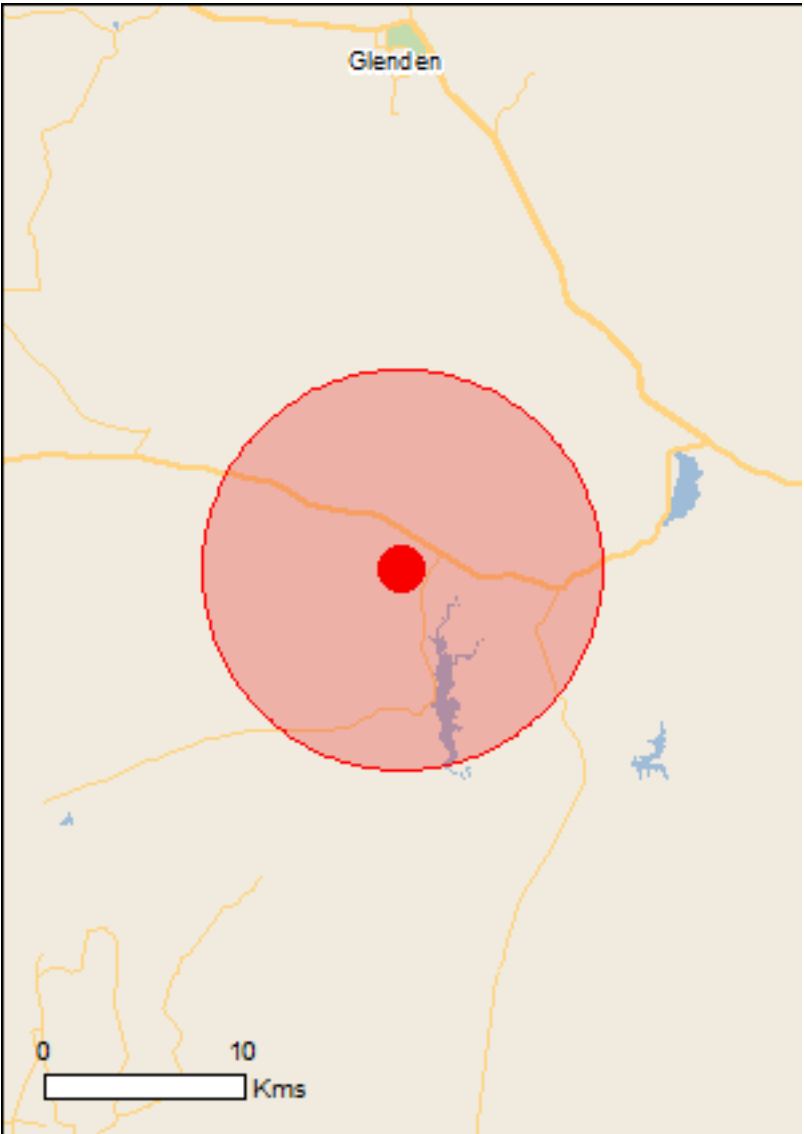
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

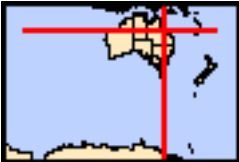
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km



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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	22
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. 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:	16
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:	None
Regional Forest Agreements:	None
Invasive Species:	20
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

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
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Community likely to occur within area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area

Listed Threatened Species

[Resource Information]

Name	Status	Type of Presence
Birds		

Calidris ferruginea Curlew Sandpiper [856]	Critically 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 known to occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area

Fish

Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
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Mammals

Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat may 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 may occur within area
Plants		
Cycas ophiolitica [55797]	Endangered	Species or species habitat likely to occur within area
Dichanthium queenslandicum King Blue-grass [5481]	Endangered	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat may occur within area
Eucalyptus raveretiana Black Ironbox [16344]	Vulnerable	Species or species habitat may occur within area
Omphalea celata [64586]	Vulnerable	Species or species habitat likely to occur within area
Samadera bidwillii Quassia [29708]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat likely to occur within area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur within area
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	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
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Motacilla flava Yellow Wagtail [644]		Species or species habitat may 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 may 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
Pandion haliaetus Osprey [952]		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 likely 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 may 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

Name	Threatened	Type of Presence
Chrysococcyx osculans Black-eared Cuckoo [705]		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 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 likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

Invasive Species

[[Resource Information](#)]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
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
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur

Name	Status	Type of Presence
		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
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		
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat may occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		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
Vachellia nilotica Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to 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

-21.56512 148.11595

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.



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: 30/04/19 10:25:49

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

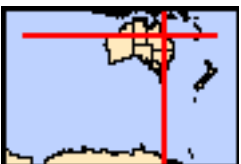
[Acknowledgements](#)



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[Coordinates](#)

[Buffer: 50.0Km](#)



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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	31
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:	5
Regional Forest Agreements:	None
Invasive Species:	29
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

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
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Community likely to occur within area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area

Listed Threatened Species

[Resource Information]

Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	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
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area
Fish		
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species

Name	Status	Type of Presence
habitat may occur within area		
Frogs		
Taudactylus eungellensis Eungella Day Frog [1887]	Endangered	Species or species habitat likely to occur within area
Mammals		
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known 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
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Plants		
Cycas ophiolitica [55797]	Endangered	Species or species habitat likely to occur within area
Dichanthium queenslandicum King Blue-grass [5481]	Endangered	Species or species habitat known to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus raveretiana Black Ironbox [16344]	Vulnerable	Species or species habitat known to occur within area
Omphalea celata [64586]	Vulnerable	Species or species habitat known to occur within area
Ozothamnus eriocephalus [56133]	Vulnerable	Species or species habitat known to occur within area
Samadera bidwillii Quassia [29708]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area
Lerista allanae Allan's Lerista, Retro Slider [1378]	Endangered	Species or species habitat may occur within area
Lerista vittata Mount Cooper Striped Skink, Mount Cooper Striped Lerista [1308]	Vulnerable	Species or species habitat may occur within area
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	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 known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		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 known to 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 known 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 may 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

Name	Threatened	Type of Presence
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species 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 likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may 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 may 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
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		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 known to 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 known 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 likely to 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 may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Homevale	QLD
Homevale 1	QLD
Homevale 2	QLD
Newlands	QLD
Redcliffe Vale	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		
Anas platyrhynchos Mallard [974]		Species or species

Name	Status	Type of Presence
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		habitat likely to occur within area 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
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
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		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
Feral deer Feral deer species in Australia [85733]		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 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
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat may occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		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
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Vachellia nilotica Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		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

Nationally Important Wetlands	[Resource Information]
Name	State
Lake Elphinstone	QLD

Caveat

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

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World 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

-21.56512 148.11595

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.



Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point

Species: All

Type: All

Status: Rare and threatened species

Records: All

Date: All

Latitude: -21.5571

Longitude: 148.1307

Distance: 10

Email: cphillips@aacrc.net.au

Date submitted: Thursday 13 Jun 2019 14:24:03

Date extracted: Thursday 13 Jun 2019 14:30:02

The number of records retrieved = 2

Disclaimer

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through independent means as to the accuracy and completeness of this information.

No statements, representations or warranties are made about the accuracy or completeness of this information. The State of Queensland disclaims all responsibility for this information and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern subspecies)		V	V	1
animals	mammals	Pseudocheiridae	<i>Petauroides volans minor</i>	northern greater glider		V	V	5

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ().

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).

This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.

This number is output as 999 if it equals or exceeds this value.



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: 30/04/19 10:25:49

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

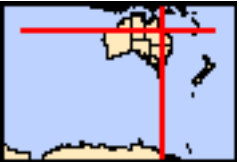
[Acknowledgements](#)



This map may contain data which are
©Commonwealth of Australia
(Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 50.0Km



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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	31
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:	5
Regional Forest Agreements:	None
Invasive Species:	29
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

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
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Community likely to occur within area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area

Listed Threatened Species

[Resource Information]

Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	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
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area
Fish		
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species

Name	Status	Type of Presence
habitat may occur within area		
Frogs		
Taudactylus eungellensis Eungella Day Frog [1887]	Endangered	Species or species habitat likely to occur within area
Mammals		
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known 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
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Plants		
Cycas ophiolitica [55797]	Endangered	Species or species habitat likely to occur within area
Dichanthium queenslandicum King Blue-grass [5481]	Endangered	Species or species habitat known to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus raveretiana Black Ironbox [16344]	Vulnerable	Species or species habitat known to occur within area
Omphalea celata [64586]	Vulnerable	Species or species habitat known to occur within area
Ozothamnus eriocephalus [56133]	Vulnerable	Species or species habitat known to occur within area
Samadera bidwillii Quassia [29708]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area
Lerista allanae Allan's Lerista, Retro Slider [1378]	Endangered	Species or species habitat may occur within area
Lerista vittata Mount Cooper Striped Skink, Mount Cooper Striped Lerista [1308]	Vulnerable	Species or species habitat may occur within area
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	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
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Migratory Terrestrial Species

Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
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Hirundapus caudacutus White-throated Needletail [682]		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 known to 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 known to occur within area
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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 may occur within area
--	--	--

Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
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Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
--	--	--

Name	Threatened	Type of Presence
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species 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 likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may 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 may 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
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		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 known to 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 known 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 likely to 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 may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Homevale	QLD
Homevale 1	QLD
Homevale 2	QLD
Newlands	QLD
Redcliffe Vale	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		
Anas platyrhynchos Mallard [974]		Species or species

Name	Status	Type of Presence
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		habitat likely to occur within area 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
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
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		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
Feral deer Feral deer species in Australia [85733]		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 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
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat may occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		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
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Vachellia nilotica Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		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

Nationally Important Wetlands	[Resource Information]
Name	State
Lake Elphinstone	QLD

Caveat

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

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World 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

-21.56512 148.11595

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.



Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point

Species: All

Type: All

Status: Rare and threatened species

Records: All

Date: All

Latitude: -21.5571

Longitude: 148.1307

Distance: 10

Email: cphillips@aacrc.net.au

Date submitted: Thursday 13 Jun 2019 14:24:03

Date extracted: Thursday 13 Jun 2019 14:30:02

The number of records retrieved = 2

Disclaimer

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Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern subspecies)		V	V	1
animals	mammals	Pseudocheiridae	<i>Petauroides volans minor</i>	northern greater glider		V	V	5

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ().

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).

This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.

This number is output as 999 if it equals or exceeds this value.



Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Status: Rare and threatened species
Records: All
Date: All
Latitude: -21.5571
Longitude: 148.1307
Distance: 50
Email: cphillips@aacrc.net.au
Date submitted: Friday 07 Jun 2019 15:32:20
Date extracted: Friday 07 Jun 2019 15:40:13

The number of records retrieved = 37

Disclaimer

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Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Limnodynastidae	<i>Adelotus brevis</i>	tusked frog		V		4
animals	amphibians	Myobatrachidae	<i>Taudactylus liemi</i>	Eungella tinkersfrog		NT		16/2
animals	amphibians	Myobatrachidae	<i>Rheobatrachus vitellinus</i>	northern gastric brooding frog		E	EX	1
animals	amphibians	Myobatrachidae	<i>Taudactylus eungellensis</i>	Eungella dayfrog		E	E	20/8
animals	birds	Accipitridae	<i>Erythrotriorchis radiatus</i>	red goshawk		E	V	4
animals	birds	Cacatuidae	<i>Calyptorhynchus lathami erebus</i>	glossy black-cockatoo (northern)		V		18
animals	birds	Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern subspecies)		V	V	123
animals	birds	Meliphagidae	<i>Bolemoreus hindwoodi</i>	Eungella honeyeater		V		274
animals	birds	Strigidae	<i>Ninox strenua</i>	powerful owl		V		2
animals	insects	Lycaenidae	<i>Jalmenus eubulus</i>	pale imperial hairstreak		V		2
animals	mammals	Emballonuridae	<i>Taphozous australis</i>	coastal sheath-tail bat		NT		3
animals	mammals	Megadermatidae	<i>Macroderma gigas</i>	ghost bat		E	V	3
animals	mammals	Phascolarctidae	<i>Phascolarctos cinereus</i>	koala		V	V	24
animals	mammals	Pseudocheiridae	<i>Petauroides volans minor</i>	northern greater glider		V	V	86
animals	mammals	Pseudocheiridae	<i>Petauroides volans</i>	greater glider		V	V	1
animals	reptiles	Elapidae	<i>Denisonia maculata</i>	ornamental snake		V	V	107/1
animals	reptiles	Elapidae	<i>Acanthophis antarcticus</i>	common death adder		V		3
plants	Equisetopsida	Amaranthaceae	<i>Kelita uncinella</i>			E		14/14
plants	Equisetopsida	Apocynaceae	<i>Cerbera dumicola</i>			NT		8/5
plants	Equisetopsida	Apocynaceae	<i>Marsdenia pumila</i>			V		1/1
plants	Equisetopsida	Asteraceae	<i>Ozothamnus eriocephalus</i>			V	V	10/8
plants	Equisetopsida	Capparaceae	<i>Capparis humistrata</i>			E		1/1
plants	Equisetopsida	Combretaceae	<i>Macropteranthus leiocaulis</i>			NT		2/2
plants	Equisetopsida	Euphorbiaceae	<i>Bertya pedicellata</i>			NT		9/8
plants	Equisetopsida	Euphorbiaceae	<i>Bertya sharpeana</i>	Mt. Coolum bertya		NT		2/2
plants	Equisetopsida	Euphorbiaceae	<i>Omphalea celata</i>			V	V	13/13
plants	Equisetopsida	Euphorbiaceae	<i>Trigonostemon inopinatus</i>			V		1/1
plants	Equisetopsida	Lamiaceae	<i>Plectranthus graniticola</i>			V		5/5
plants	Equisetopsida	Lycopodiaceae	<i>Phlegmariurus tetrastichoides</i>			V	V	2/2
plants	Equisetopsida	Myrtaceae	<i>Sannantha papillosa</i>			E		1/1
plants	Equisetopsida	Poaceae	<i>Dichanthium queenslandicum</i>			V	E	30/30
plants	Equisetopsida	Poaceae	<i>Digitaria porrecta</i>			NT		4/4
plants	Equisetopsida	Rhamnaceae	<i>Polianthion minutiflorum</i>			V	V	1/1
plants	Equisetopsida	Rutaceae	<i>Acronychia eungellensis</i>			NT		5/5
plants	Equisetopsida	Sapindaceae	<i>Sarcotoechia heterophylla</i>			NT		9/9
plants	Equisetopsida	Solanaceae	<i>Solanum adenophorum</i>			E		2/2
plants	Equisetopsida	Solanaceae	<i>Solanum graniticum</i>			E		2/2

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Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: All
Type: Introduced
Status: All
Records: All
Date: All
Latitude: -21.5571
Longitude: 148.1307
Distance: 50
Email: cphillips@aacrc.net.au
Date submitted: Friday 07 Jun 2019 15:32:51
Date extracted: Friday 07 Jun 2019 15:40:03

The number of records retrieved = 205

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Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufonidae	<i>Rhinella marina</i>	cane toad	Y			127
animals	birds	Passeridae	<i>Passer domesticus</i>	house sparrow	Y			1
animals	mammals	Bovidae	<i>Bos sp.</i>	cattle	Y			16
animals	mammals	Canidae	<i>Canis lupus familiaris</i>	dog	Y			3
animals	mammals	Canidae	<i>Canis sp.</i>		Y			16
animals	mammals	Canidae	<i>Vulpes vulpes</i>	red fox	Y			1
animals	mammals	Cervidae	<i>Cervus timorensis</i>	rusa deer	Y			1
animals	mammals	Cervidae	<i>Axis axis</i>	chital	Y			3
animals	mammals	Felidae	<i>Felis catus</i>	cat	Y			47
animals	mammals	Leporidae	<i>Oryctolagus cuniculus</i>	rabbit	Y			26
animals	mammals	Leporidae	<i>Lepus europaeus</i>	European brown hare	Y			4
animals	mammals	Muridae	<i>Mus musculus</i>	house mouse	Y			26/2
animals	mammals	Muridae	<i>Rattus rattus</i>	black rat	Y			6
animals	mammals	Suidae	<i>Sus scrofa</i>	pig	Y			26
animals	ray-finned fishes	Cichlidae	<i>Oreochromis mossambica</i>	Mozambique mouthbrooder	Y			2
animals	reptiles	Gekkonidae	<i>Hemidactylus frenatus</i>	house gecko	Y			1
plants	Equisetopsida	Acanthaceae	<i>Hypoestes phyllostachya</i>		Y			2/1
plants	Equisetopsida	Acanthaceae	<i>Thunbergia grandiflora</i>	sky flower	Y			2/2
plants	Equisetopsida	Amaranthaceae	<i>Aerva javanica</i>		Y			2/2
plants	Equisetopsida	Amaranthaceae	<i>Amaranthus hybridus</i>	redshank	Y			1/1
plants	Equisetopsida	Amaranthaceae	<i>Gomphrena celosioides</i>	gomphrena weed	Y			5/1
plants	Equisetopsida	Amaranthaceae	<i>Alternanthera pungens</i>	khaki weed	Y			2/1
plants	Equisetopsida	Anacardiaceae	<i>Schinus terebinthifolius</i>		Y			2/2
plants	Equisetopsida	Apiaceae	<i>Cyclospermum leptophyllum</i>		Y			2/2
plants	Equisetopsida	Apocynaceae	<i>Araujia sericifera</i>	white moth vine	Y			1/1
plants	Equisetopsida	Apocynaceae	<i>Asclepias curassavica</i>	red-head cottonbush	Y			4/3
plants	Equisetopsida	Apocynaceae	<i>Gomphocarpus physocarpus</i>	balloon cottonbush	Y			3/2
plants	Equisetopsida	Aristolochiaceae	<i>Aristolochia elegans</i>	calico-flower	Y			1/1
plants	Equisetopsida	Asteraceae	<i>Ageratum conyzoides</i> subsp. <i>conyzoides</i>		Y			1/1
plants	Equisetopsida	Asteraceae	<i>Verbesina encelioides</i> var. <i>encelioides</i>		Y			2/2
plants	Equisetopsida	Asteraceae	<i>Thymophylla tenuiloba</i> var. <i>tenuiloba</i>		Y			1/1
plants	Equisetopsida	Asteraceae	<i>Emilia sonchifolia</i> var. <i>sonchifolia</i>		Y			4/3
plants	Equisetopsida	Asteraceae	<i>Emilia sonchifolia</i> var. <i>javanica</i>		Y			1/1
plants	Equisetopsida	Asteraceae	<i>Crassocephalum crepidioides</i>	thickhead	Y			3/3
plants	Equisetopsida	Asteraceae	<i>Symphytotrichum subulatum</i>		Y			3/1
plants	Equisetopsida	Asteraceae	<i>Parthenium hysterophorus</i>	parthenium weed	Y			11/5
plants	Equisetopsida	Asteraceae	<i>Sphagneticola trilobata</i>		Y			2/2
plants	Equisetopsida	Asteraceae	<i>Gamochaeta pensylvanica</i>		Y			1/1
plants	Equisetopsida	Asteraceae	<i>Acanthospermum hispidum</i>	star burr	Y			4/3
plants	Equisetopsida	Asteraceae	<i>Verbesina encelioides</i>	crownbeard	Y			1/1
plants	Equisetopsida	Asteraceae	<i>Ageratum houstonianum</i>	blue billygoat weed	Y			1
plants	Equisetopsida	Asteraceae	<i>Xanthium occidentale</i>		Y			2/1
plants	Equisetopsida	Asteraceae	<i>Taraxacum officinale</i>	dandelion	Y			1/1
plants	Equisetopsida	Asteraceae	<i>Hypochaeris radicata</i>	catsear	Y			3/3
plants	Equisetopsida	Asteraceae	<i>Gamochaeta coarctata</i>		Y			1/1
plants	Equisetopsida	Asteraceae	<i>Galinsoga parviflora</i>	yellow weed	Y			1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	Equisetopsida	Asteraceae	<i>Erigeron bonariensis</i>		Y			1/1
plants	Equisetopsida	Asteraceae	<i>Calyptracarpus vialis</i>	creeping cinderella weed	Y			2/1
plants	Equisetopsida	Asteraceae	<i>Ageratum conyzoides</i>	billygoat weed	Y			1/1
plants	Equisetopsida	Asteraceae	<i>Flaveria trinervia</i>		Y			1/1
plants	Equisetopsida	Asteraceae	<i>Emilia sonchifolia</i>		Y			7
plants	Equisetopsida	Asteraceae	<i>Tridax procumbens</i>	tridax daisy	Y			7/6
plants	Equisetopsida	Asteraceae	<i>Sonchus oleraceus</i>	common sowthistle	Y			6
plants	Equisetopsida	Asteraceae	<i>Eclipta prostrata</i>	white eclipta	Y			2/2
plants	Equisetopsida	Asteraceae	<i>Zinnia peruviana</i>	wild zinnia	Y			2/2
plants	Equisetopsida	Asteraceae	<i>Bidens bipinnata</i>	bipinnate beggar's ticks	Y			1
plants	Equisetopsida	Asteraceae	<i>Cirsium vulgare</i>	spear thistle	Y			4/3
plants	Equisetopsida	Asteraceae	<i>Tagetes minuta</i>	stinking roger	Y			4/3
plants	Equisetopsida	Asteraceae	<i>Bidens pilosa</i>		Y			1/1
plants	Equisetopsida	Basellaceae	<i>Anredera cordifolia</i>	Madeira vine	Y			1/1
plants	Equisetopsida	Bignoniaceae	<i>Crescentia cujete</i>		Y			1/1
plants	Equisetopsida	Boraginaceae	<i>Heliotropium indicum</i>		Y			2/2
plants	Equisetopsida	Brassicaceae	<i>Lepidium didymum</i>		Y			1/1
plants	Equisetopsida	Brassicaceae	<i>Cardamine flexuosa</i>	wood bittercress	Y			1/1
plants	Equisetopsida	Brassicaceae	<i>Lepidium africanum</i>	common peppergrass	Y			2/2
plants	Equisetopsida	Brassicaceae	<i>Lepidium virginicum</i>	Virginian peppergrass	Y			2/2
plants	Equisetopsida	Brassicaceae	<i>Sisymbrium officinale</i>	hedge mustard	Y			2/2
plants	Equisetopsida	Byttneriaceae	<i>Melochia pyramidata</i>		Y			4/3
plants	Equisetopsida	Cactaceae	<i>Opuntia stricta</i>		Y			3
plants	Equisetopsida	Cactaceae	<i>Harrisia martinii</i>		Y			11
plants	Equisetopsida	Cactaceae	<i>Opuntia tomentosa</i>	velvety tree pear	Y			17/1
plants	Equisetopsida	Caesalpiniaceae	<i>Senna septemtrionalis</i>		Y			2/2
plants	Equisetopsida	Caesalpiniaceae	<i>Senna occidentalis</i>	coffee senna	Y			3/3
plants	Equisetopsida	Caryophyllaceae	<i>Stellaria media</i>	chickweed	Y			2/2
plants	Equisetopsida	Caryophyllaceae	<i>Drymaria cordata subsp. cordata</i>		Y			1/1
plants	Equisetopsida	Chenopodiaceae	<i>Dysphania ambrosioides</i>		Y			1/1
plants	Equisetopsida	Cleomaceae	<i>Cleome monophylla</i>		Y			1/1
plants	Equisetopsida	Commelinaceae	<i>Tradescantia fluminensis</i>		Y			1/1
plants	Equisetopsida	Convolvulaceae	<i>Ipomoea indica</i>	blue morning-glory	Y			1/1
plants	Equisetopsida	Cucurbitaceae	<i>Sechium edule</i>	choko	Y			1/1
plants	Equisetopsida	Cucurbitaceae	<i>Cucumis anguria var. anguria</i>	West Indian gherkin	Y			4
plants	Equisetopsida	Cyperaceae	<i>Cyperus compressus</i>		Y			3/3
plants	Equisetopsida	Cyperaceae	<i>Cyperus sesquiflorus</i>		Y			1/1
plants	Equisetopsida	Cyperaceae	<i>Cyperus rotundus</i>	nutgrass	Y			2/1
plants	Equisetopsida	Cyperaceae	<i>Cyperus esculentus</i>	yellow nutgrass	Y			1/1
plants	Equisetopsida	Euphorbiaceae	<i>Euphorbia hirta</i>		Y			2/2
plants	Equisetopsida	Euphorbiaceae	<i>Euphorbia hyssopifolia</i>		Y			8
plants	Equisetopsida	Euphorbiaceae	<i>Euphorbia thymifolia</i>		Y			1/1
plants	Equisetopsida	Euphorbiaceae	<i>Ricinus communis</i>	castor oil bush	Y			1/1
plants	Equisetopsida	Fabaceae	<i>Crotalaria alata</i>		Y			2/2
plants	Equisetopsida	Fabaceae	<i>Macroptilium lathyroides var. semierectum</i>		Y			2/1
plants	Equisetopsida	Fabaceae	<i>Crotalaria juncea</i>	sunhemp	Y			3/3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	Equisetopsida	Fabaceae	<i>Desmodium intortum</i>		Y			1/1
plants	Equisetopsida	Fabaceae	<i>Desmodium tortuosum</i>	Florida beggar-weed	Y			1/1
plants	Equisetopsida	Fabaceae	<i>Desmodium triflorum</i>		Y			2/1
plants	Equisetopsida	Fabaceae	<i>Desmodium uncinatum</i>		Y			7/7
plants	Equisetopsida	Fabaceae	<i>Stylosanthes hamata</i>		Y			1/1
plants	Equisetopsida	Fabaceae	<i>Stylosanthes scabra</i>		Y			19/3
plants	Equisetopsida	Fabaceae	<i>Crotalaria goreensis</i>	gambia pea	Y			1/1
plants	Equisetopsida	Fabaceae	<i>Stylosanthes humilis</i>	Townsville stylo	Y			1
plants	Equisetopsida	Fabaceae	<i>Alysicarpus vaginalis</i>		Y			2/1
plants	Equisetopsida	Fabaceae	<i>Crotalaria laburnifolia</i>		Y			1/1
plants	Equisetopsida	Fabaceae	<i>Macroptilium atropurpureum</i>	siratro	Y			2/1
plants	Equisetopsida	Fabaceae	<i>Trifolium repens</i> var. <i>repens</i>	white clover	Y			1/1
plants	Equisetopsida	Fabaceae	<i>Crotalaria incana</i> subsp. <i>incana</i>		Y			1/1
plants	Equisetopsida	Fabaceae	<i>Crotalaria pallida</i> var. <i>obovata</i>		Y			4/3
plants	Equisetopsida	Fabaceae	<i>Crotalaria lanceolata</i> subsp. <i>lanceolata</i>		Y			1/1
plants	Equisetopsida	Fabaceae	<i>Clitoria ternatea</i>	butterfly pea	Y			3/1
plants	Equisetopsida	Juncaceae	<i>Juncus bufonius</i>	toad rush	Y			1/1
plants	Equisetopsida	Lamiaceae	<i>Leucas lavandulifolia</i>		Y			4/4
plants	Equisetopsida	Lamiaceae	<i>Salvia misella</i>		Y			1/1
plants	Equisetopsida	Malvaceae	<i>Sida spinosa</i>	spiny sida	Y			5/3
plants	Equisetopsida	Malvaceae	<i>Sida cordifolia</i>		Y			19/3
plants	Equisetopsida	Malvaceae	<i>Sida rhombifolia</i>		Y			14/1
plants	Equisetopsida	Malvaceae	<i>Abutilon guineense</i>		Y			3/3
plants	Equisetopsida	Malvaceae	<i>Malvastrum americanum</i>		Y			2
plants	Equisetopsida	Malvaceae	<i>Malvastrum coromandelianum</i> subsp. <i>coromandelianum</i>		Y			1/1
plants	Equisetopsida	Mimosaceae	<i>Prosopis pallida</i>		Y			1/1
plants	Equisetopsida	Mimosaceae	<i>Vachellia farnesiana</i>		Y			3/1
plants	Equisetopsida	Mimosaceae	<i>Leucaena leucocephala</i> subsp. <i>leucocephala</i>		Y			1/1
plants	Equisetopsida	Myrsinaceae	<i>Lysimachia arvensis</i>		Y			1/1
plants	Equisetopsida	Oleaceae	<i>Jasminum mesnyi</i>		Y			1/1
plants	Equisetopsida	Oleaceae	<i>Ligustrum sinense</i>	small-leaved privet	Y			1/1
plants	Equisetopsida	Oxalidaceae	<i>Oxalis corniculata</i>		Y			1/1
plants	Equisetopsida	Papaveraceae	<i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	Mexican poppy	Y			1/1
plants	Equisetopsida	Passifloraceae	<i>Passiflora foetida</i>		Y			3/3
plants	Equisetopsida	Passifloraceae	<i>Passiflora subpeltata</i>	white passion flower	Y			3/3
plants	Equisetopsida	Phytolaccaceae	<i>Phytolacca octandra</i>	inkweed	Y			3/3
plants	Equisetopsida	Plantaginaceae	<i>Scoparia dulcis</i>	scoparia	Y			11/5
plants	Equisetopsida	Plantaginaceae	<i>Mecardonia procumbens</i>		Y			2/2
plants	Equisetopsida	Poaceae	<i>Cynodon dactylon</i>		Y			2
plants	Equisetopsida	Poaceae	<i>Hyparrhenia rufa</i>		Y			1/1
plants	Equisetopsida	Poaceae	<i>Cenchrus ciliaris</i>		Y			33/6
plants	Equisetopsida	Poaceae	<i>Paspalum urvillei</i>	vasey grass	Y			2/2
plants	Equisetopsida	Poaceae	<i>Sorghum halepense</i>	Johnson grass	Y			2/1
plants	Equisetopsida	Poaceae	<i>Cenchrus purpureus</i>		Y			4/3
plants	Equisetopsida	Poaceae	<i>Cenchrus setigerus</i>		Y			1/1
plants	Equisetopsida	Poaceae	<i>Digitaria ciliaris</i>	summer grass	Y			4/3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	Equisetopsida	Poaceae	<i>Echinochloa colona</i>	awnless barnyard grass	Y			14/10
plants	Equisetopsida	Poaceae	<i>Paspalum dilatatum</i>	paspalum	Y			4/3
plants	Equisetopsida	Poaceae	<i>Setaria sphacelata</i>		Y			3/3
plants	Equisetopsida	Poaceae	<i>Urochloa decumbens</i>		Y			2/2
plants	Equisetopsida	Poaceae	<i>Eriochloa meyeriana</i>		Y			2/2
plants	Equisetopsida	Poaceae	<i>Melinis minutiflora</i>	molasses grass	Y			1
plants	Equisetopsida	Poaceae	<i>Paspalum conjugatum</i>	sourgrass	Y			2/2
plants	Equisetopsida	Poaceae	<i>Sporobolus fertilis</i>	giant Parramatta grass	Y			5/4
plants	Equisetopsida	Poaceae	<i>Axonopus fissifolius</i>		Y			2/2
plants	Equisetopsida	Poaceae	<i>Bothriochloa pertusa</i>		Y			27/6
plants	Equisetopsida	Poaceae	<i>Themeda quadrivalvis</i>	grader grass	Y			3/2
plants	Equisetopsida	Poaceae	<i>Cenchrus polystachios</i>		Y			1/1
plants	Equisetopsida	Poaceae	<i>Dichanthium annulatum</i>	sheda grass	Y			2/1
plants	Equisetopsida	Poaceae	<i>Dichanthium aristatum</i>	angleton grass	Y			10/8
plants	Equisetopsida	Poaceae	<i>Dichanthium caricosum</i>		Y			1/1
plants	Equisetopsida	Poaceae	<i>Eragrostis tenuifolia</i>	elastic grass	Y			5/5
plants	Equisetopsida	Poaceae	<i>Echinochloa crus-galli</i>	barnyard grass	Y			1/1
plants	Equisetopsida	Poaceae	<i>Eragrostis cilianensis</i>		Y			3/3
plants	Equisetopsida	Poaceae	<i>Moorochloa eruciformis</i>		Y			2/2
plants	Equisetopsida	Poaceae	<i>Sporobolus pyramidalis</i>		Y			3/3
plants	Equisetopsida	Poaceae	<i>Urochloa mosambicensis</i>	sabi grass	Y			8/2
plants	Equisetopsida	Poaceae	<i>Sporobolus jacquemontii</i>		Y			2/2
plants	Equisetopsida	Poaceae	<i>Sporobolus coromandelianus</i>		Y			1/1
plants	Equisetopsida	Poaceae	<i>Dinebra panicea</i> var. <i>panicea</i>		Y			1/1
plants	Equisetopsida	Poaceae	<i>Hyparrhenia rufa</i> subsp. <i>rufa</i>		Y			8/8
plants	Equisetopsida	Poaceae	<i>Setaria pumila</i> subsp. <i>pumila</i>		Y			1/1
plants	Equisetopsida	Poaceae	<i>Cynodon dactylon</i> var. <i>dactylon</i>		Y			5/3
plants	Equisetopsida	Poaceae	<i>Megathyrsus maximus</i> var. <i>maximus</i>		Y			4/3
plants	Equisetopsida	Poaceae	<i>Megathyrsus maximus</i> var. <i>coloratus</i>		Y			2/2
plants	Equisetopsida	Poaceae	<i>Setaria pumila</i> subsp. <i>subtesselata</i>		Y			3/3
plants	Equisetopsida	Poaceae	<i>Megathyrsus maximus</i> var. <i>pubiglumis</i>		Y			11/6
plants	Equisetopsida	Poaceae	<i>Urochloa panicoides</i> var. <i>panicoides</i>		Y			5/5
plants	Equisetopsida	Poaceae	<i>Eleusine indica</i>	crowsfoot grass	Y			2/2
plants	Equisetopsida	Poaceae	<i>Chloris virgata</i>	feathertop rhodes grass	Y			4/2
plants	Equisetopsida	Poaceae	<i>Chloris inflata</i>	purpletop chloris	Y			5/1
plants	Equisetopsida	Poaceae	<i>Melinis repens</i>	red natal grass	Y			19/3
plants	Equisetopsida	Poaceae	<i>Lolium perenne</i>	perennial ryegrass	Y			1/1
plants	Equisetopsida	Poaceae	<i>Aira cupaniana</i>		Y			1/1
plants	Equisetopsida	Poaceae	<i>Chloris gayana</i>	rhodes grass	Y			4/3
plants	Equisetopsida	Polygalaceae	<i>Polygala paniculata</i>		Y			1/1
plants	Equisetopsida	Polygonaceae	<i>Rumex hypogaeus</i>		Y			7
plants	Equisetopsida	Pontederiaceae	<i>Eichhornia crassipes</i>	water hyacinth	Y			1/1
plants	Equisetopsida	Portulacaceae	<i>Portulaca pilosa</i>		Y			1
plants	Equisetopsida	Portulacaceae	<i>Portulaca oleracea</i>	pigweed	Y			1
plants	Equisetopsida	Pteridaceae	<i>Pellaea viridis</i> var. <i>viridis</i>		Y			1/1
plants	Equisetopsida	Rubiaceae	<i>Richardia brasiliensis</i>	white eye	Y			4/4

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	Equisetopsida	Scrophulariaceae	<i>Verbascum virgatum</i>	twiggy mullein	Y			2/2
plants	Equisetopsida	Solanaceae	<i>Physalis angulata</i>		Y			1/1
plants	Equisetopsida	Solanaceae	<i>Physalis peruviana</i>		Y			1/1
plants	Equisetopsida	Solanaceae	<i>Physalis pubescens</i>		Y			1/1
plants	Equisetopsida	Solanaceae	<i>Solanum linnaeanum</i>	apple of Sodom	Y			1/1
plants	Equisetopsida	Solanaceae	<i>Solanum nodiflorum</i>		Y			1/1
plants	Equisetopsida	Solanaceae	<i>Datura leichhardtii</i>	native thornapple	Y			1/1
plants	Equisetopsida	Solanaceae	<i>Nicandra physalodes</i>	apple of Peru	Y			2/1
plants	Equisetopsida	Solanaceae	<i>Solanum capsicoides</i>	devil's apple	Y			2/2
plants	Equisetopsida	Solanaceae	<i>Solanum mauritianum</i>	wild tobacco	Y			2/2
plants	Equisetopsida	Solanaceae	<i>Solanum seaforthianum</i>	Brazilian nightshade	Y			1
plants	Equisetopsida	Solanaceae	<i>Solanum nigrum</i>		Y			1/1
plants	Equisetopsida	Solanaceae	<i>Solanum torvum</i>	devil's fig	Y			3/3
plants	Equisetopsida	Sparrmanniaceae	<i>Triumfetta rhomboidea</i>	chinese burr	Y			2/2
plants	Equisetopsida	Sparrmanniaceae	<i>Triumfetta pilosa</i>		Y			2/2
plants	Equisetopsida	Verbenaceae	<i>Lantana camara</i>	lantana	Y			5/3
plants	Equisetopsida	Verbenaceae	<i>Verbena rigida</i>		Y			1/1
plants	Equisetopsida	Verbenaceae	<i>Stachytarpheta jamaicensis</i>	Jamaica snakeweed	Y			1
plants	Equisetopsida	Verbenaceae	<i>Verbena litoralis</i>	verbena	Y			1/1
plants	Equisetopsida	Verbenaceae	<i>Verbena bonariensis</i>	purpletop	Y			1/1
plants	Equisetopsida	Verbenaceae	<i>Verbena incompta</i>		Y			2/2

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

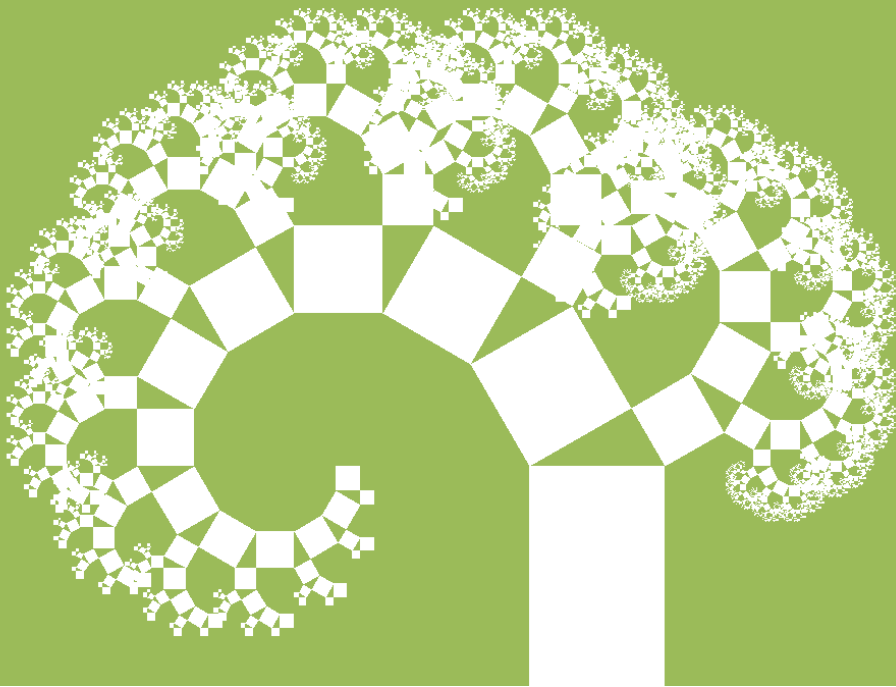
Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ().

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).

This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.

This number is output as 999 if it equals or exceeds this value.



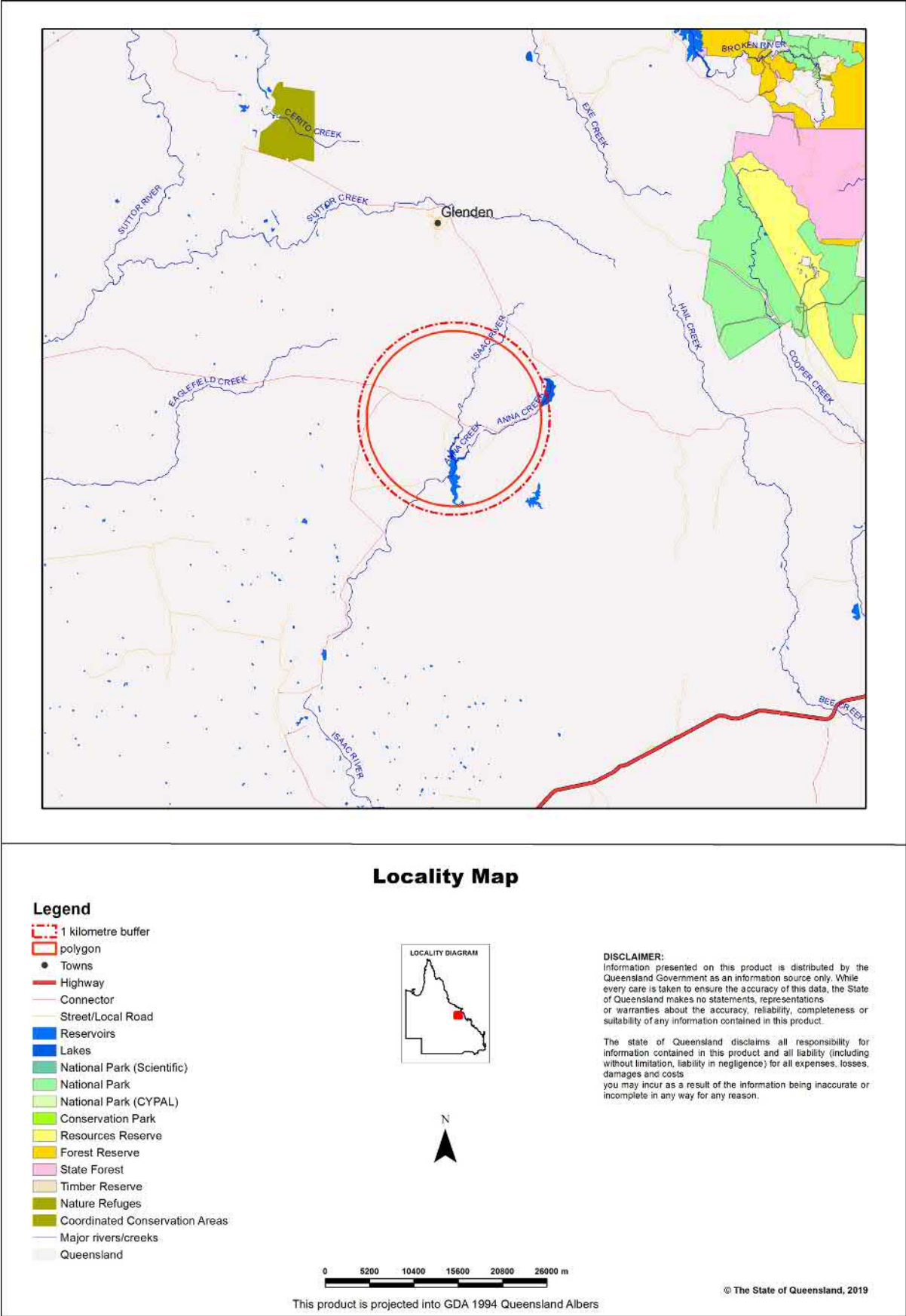
WildNet Records Conservation Significant Species List

For the selected area of interest 33030.12ha

Current as at 13/06/2019

WildNetCSSpecieslist

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)	33,030.12
Local Government(s)	Isaac Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Northern Bowen Basin
Catchment(s)	Fitzroy, Burdekin

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:
 - o Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
 - o China-Australia Migratory Bird Agreement
 - o Japan-Australia Migratory Bird Agreement
 - o 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
1785	Animalia	Aves	Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern subspecies)	V	V	0	1	12/02/2001
1971	Animalia	Aves	Apodidae	<i>Hirundapus caudacutus</i>	white-throated needletail	SL	None	0	1	09/11/2002
1896	Animalia	Aves	Laridae	<i>Hydroprogne caspia</i>	Caspian tern	SL	None	0	2	22/10/2011
1595	Animalia	Aves	Monarchidae	<i>Monarcha melanopsis</i>	black-faced monarch	SL	None	0	1	31/12/1984

Taxon Id	Kingdom	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
2456	Animalia	Mammalia	Pseudocheiridae	<i>Petauroides volans minor</i>	northern greater glider	V	V	0	6	22/03/2017
1825	Animalia	Aves	Threskiornithidae	<i>Plegadis falcinellus</i>	glossy ibis	SL	None	0	1	22/03/2017
1578	Animalia	Aves	Rhipiduridae	<i>Rhipidura rufifrons</i>	rufous fantail	SL	None	0	1	22/03/2017
838	Animalia	Mammalia	Tachyglossidae	<i>Tachyglossus aculeatus</i>	short-beaked echidna	SL	None	0	2	22/03/2017
11323	Plantae	Equisetopsida	Euphorbiaceae	<i>Bertya oppositifolia</i>	None	C	V	1	1	27/10/2013

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
- [Old wildlife data API](#) - access species information approved for publication such as notes, images and records etc.
- [WetlandMaps](#) - view species records, survey locations etc. approved for publication
- [WetlandSummary](#) - view wildlife statistics, species lists for a range of area types, and access species profiles
- [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.

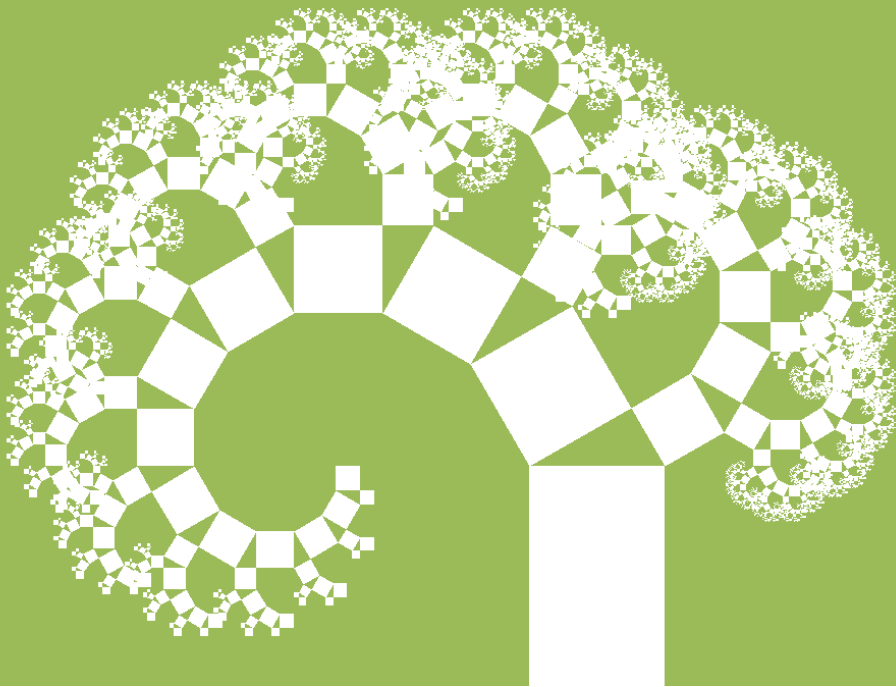
Please direct queries about this report to the [WildNet Team](#).

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](#)

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government, to the maximum extent permitted by law, 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.



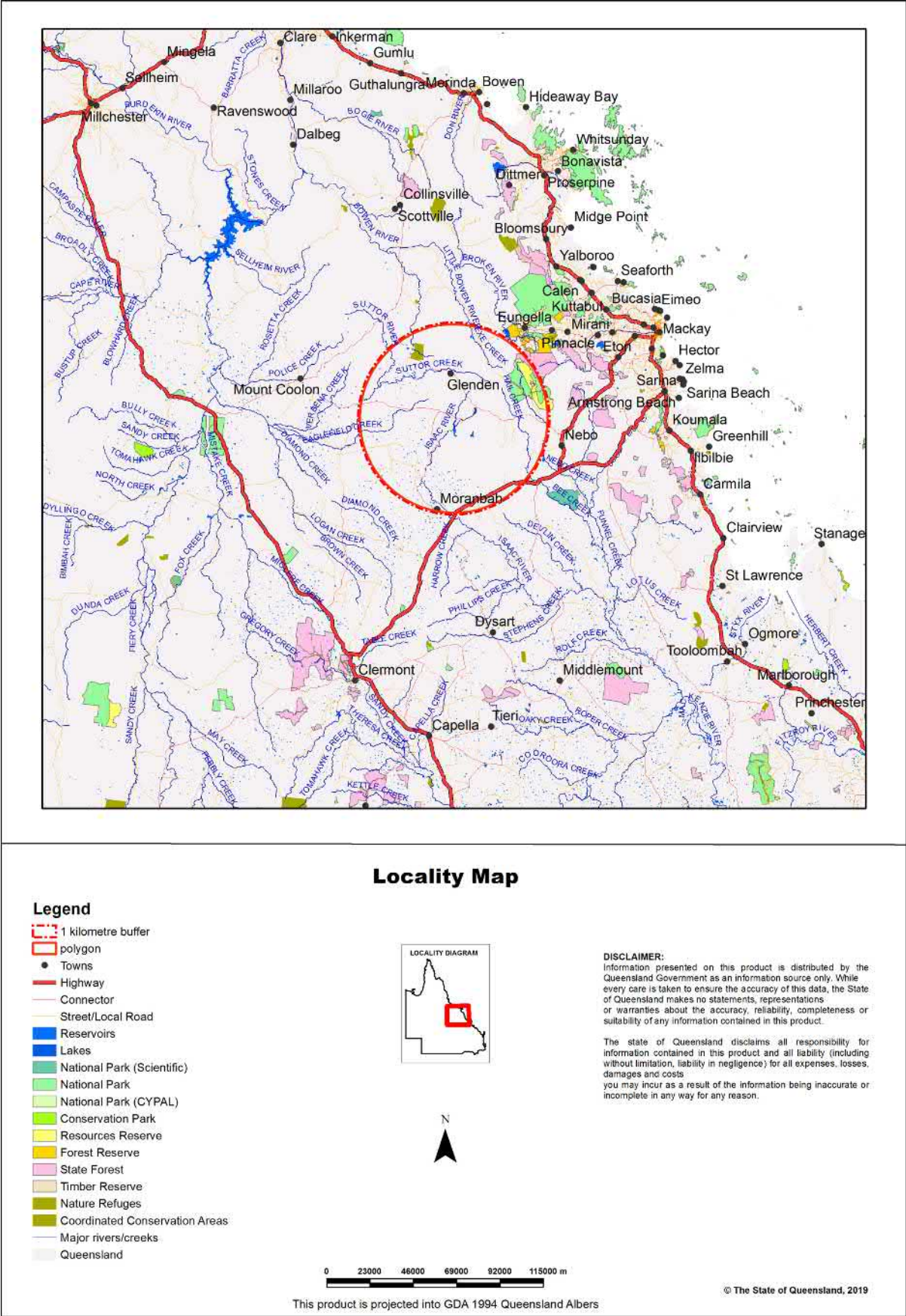
WildNet Records Conservation Significant Species List

For the selected area of interest 782092.35ha

Current as at 13/06/2019

WildNetCSSpecieslist

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)	782,092.35
Local Government(s)	Isaac Regional, Mackay Regional, Whitsunday Regional
Bioregion(s)	Brigalow Belt, Central Queensland Coast
Subregion(s)	Northern Bowen Basin, Bogie River Hills, Belyando Downs, Wyarra Hills, Clarke - Connors Ranges
Catchment(s)	Fitzroy, Burdekin, Pioneer

Protected Area(s)

The following estates and/or reserves are located in the area of interest:

Crediton Forest Reserve
 Crediton State Forest
 Homevale Resources Reserve
 Homevale National Park
 Homevale Conservation Park

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.

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 - o Japan-Australia Migratory Bird Agreement
 - o 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
511	Animalia	Reptilia	Elapidae	<i>Acanthophis antarcticus</i>	common death adder	V	None	0	4	11/06/2013

Taxon Id	Kingdom	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
706	Animalia	Amphibia	Limnodynastidae	<i>Adelotus brevis</i>	tusked frog	V	None	0	1	18/11/2012
1965	Animalia	Aves	Apodidae	<i>Apus pacificus</i>	fork-tailed swift	SL	None	0	1	28/12/2001
1514	Animalia	Aves	Meliphagidae	<i>Bolemoreus hindwoodi</i>	Eungella honeyeater	V	None	0	1	10/04/2008
22493	Animalia	Aves	Cacatuidae	<i>Calyptorhynchus lathami erebus</i>	glossy black-cockatoo (northern)	V	None	0	8	09/08/2011
1939	Animalia	Aves	Charadriidae	<i>Charadrius veredus</i>	oriental plover	SL	None	0	1	31/12/1984
1736	Animalia	Aves	Cuculidae	<i>Cuculus optatus</i>	oriental cuckoo	SL	None	0	4	08/09/2007
800	Animalia	Mammalia	Dasyuridae	<i>Dasyurus hallucatus</i>	northern quoll	C	E	0	21	31/10/2011
483	Animalia	Reptilia	Elapidae	<i>Denisonia maculata</i>	ornamental snake	V	V	1	105	26/11/2015
1728	Animalia	Aves	Accipitridae	<i>Erythrorhynchus radiatus</i>	red goshawk	E	V	0	5	02/07/2013
1857	Animalia	Aves	Scolopacidae	<i>Gallinago hardwickii</i>	Latham's snipe	SL	None	0	3	28/08/2015
1785	Animalia	Aves	Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern subspecies)	V	V	0	103	26/11/2015
1971	Animalia	Aves	Apodidae	<i>Hirundapus caudacutus</i>	white-throated needletail	SL	None	0	2	17/11/2003
1896	Animalia	Aves	Laridae	<i>Hydroprogne caspia</i>	Caspian tern	SL	None	0	6	22/10/2011
994	Animalia	Mammalia	Megadermatidae	<i>Macroderma gigas</i>	ghost bat	E	V	0	2	06/10/2009
1595	Animalia	Aves	Monarchidae	<i>Monarcha melanopsis</i>	black-faced monarch	SL	None	0	12	17/11/2012
1599	Animalia	Aves	Monarchidae	<i>Myiagra cyanoleuca</i>	satin flycatcher	SL	None	0	1	31/03/1976
836	Animalia	Mammalia	Ornithorhynchidae	<i>Ornithorhynchus anatinus</i>	platypus	SL	None	0	5	08/08/2017
848	Animalia	Mammalia	Pseudocheiridae	<i>Petauroides volans</i>	greater glider	V	V	0	1	15/05/2012
2456	Animalia	Mammalia	Pseudocheiridae	<i>Petauroides volans minor</i>	northern greater glider	V	V	0	64	09/09/2017
860	Animalia	Mammalia	Phascolarctidae	<i>Phascolarctos cinereus</i>	koala	V	V	0	21	03/10/2017
1825	Animalia	Aves	Threskiornithidae	<i>Plegadis falcinellus</i>	glossy ibis	SL	None	0	2	22/03/2017
1578	Animalia	Aves	Rhipiduridae	<i>Rhipidura rufifrons</i>	rufous fantail	SL	None	0	14	22/03/2017
1597	Animalia	Aves	Monarchidae	<i>Symposiachrus trivirgatus</i>	spectacled monarch	SL	None	0	4	10/04/2008
838	Animalia	Mammalia	Tachyglossidae	<i>Tachyglossus aculeatus</i>	short-beaked echidna	SL	None	0	31	12/07/2017
1010	Animalia	Mammalia	Emballonuridae	<i>Taphozous australis</i>	coastal sheath-tail bat	NT	None	0	3	31/10/2014

Taxon Id	Kingdom	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
11323	Plantae	Equisetopsida	Euphorbiaceae	<i>Bertya opposens</i>	None	C	V	1	1	27/10/2013
11322	Plantae	Equisetopsida	Euphorbiaceae	<i>Bertya pedicellata</i>	None	NT	None	8	9	07/11/2014
9569	Plantae	Equisetopsida	Euphorbiaceae	<i>Bertya sharpeana</i>	Mt. Coolumbertya	NT	None	2	2	20/05/2003
8936	Plantae	Equisetopsida	Apocynaceae	<i>Cerbera dumicola</i>	None	NT	None	4	7	05/11/2014
11064	Plantae	Equisetopsida	Poaceae	<i>Dichanthium queenslandicum</i>	None	V	E	30	30	12/04/2018
10401	Plantae	Equisetopsida	Poaceae	<i>Dichanthium setosum</i>	None	C	V	1	1	10/05/2006
14599	Plantae	Equisetopsida	Poaceae	<i>Digitaria porrecta</i>	None	NT	None	4	4	14/04/2018
14554	Plantae	Equisetopsida	Myrtaceae	<i>Eucalyptus raveretiana</i>	black ironbox	C	V	9	27	14/03/2012
33414	Plantae	Equisetopsida	Amaranthaceae	<i>Kelita uncinella</i>	None	E	None	14	14	04/07/2012
7667	Plantae	Equisetopsida	Combretaceae	<i>Macropteranthus leiocaulis</i>	None	NT	None	2	2	08/06/1994
6632	Plantae	Equisetopsida	Euphorbiaceae	<i>Omphalea celata</i>	None	V	V	13	13	24/09/2007
8841	Plantae	Equisetopsida	Asteraceae	<i>Ozothamnus eriocephalus</i>	None	V	V	2	3	17/04/2012
30919	Plantae	Equisetopsida	Rhamnaceae	<i>Polianthion minutiflorum</i>	None	V	V	1	1	30/11/2000
31848	Plantae	Equisetopsida	Myrtaceae	<i>Sannantha papillosa</i>	None	E	None	1	1	20/05/2003
16156	Plantae	Equisetopsida	Solanaceae	<i>Solanum adenophorum</i>	None	E	None	2	2	25/04/2017

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
- [Old wildlife data API](#) - access species information approved for publication such as notes, images and records etc.
- [WetlandMaps](#) - view species records, survey locations etc. approved for publication
- [WetlandSummary](#) - view wildlife statistics, species lists for a range of area types, and access species profiles

- [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.

Please direct queries about this report to the [WildNet Team](#).

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](#)

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government, to the maximum extent permitted by law, 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.



Appendix B Fauna Likelihood

Scientific Name Common Name	Status		Habitat Description	Likelihood of Impact
	NC Act	EPBC Act		
Amphibians				
<i>Adelotus brevis</i> Tusked frog	V	-	This species inhabits dams, ditches, flooded grassland and creeks in rainforest, wet sclerophyll forest and woodlands. This species is able to inhabit areas that are natural or artificial and are not concerned whether it is pristine or highly disturbed (ALA 2019).	<u>Potential to occur on New Lenton Mine</u> The only available habitat within the Project is one artificial dam. 1 record within 10 km of the Project. Despite extensive fauna surveys over several years and seasons this species has not been identified within the study area. <u>Unlikely potential for impact</u> The Project contain one small area of potential habitat for the species and the species has not been identified onsite. As per the proposed Project layout, no important habitat for this species will be cleared as a part of Project activities. It is unlikely that the New Lenton Mine will have a significant impact on this species.
<i>Rheobatrachus vitellinus</i> Northern gastric brooding frog	E	Ext	It was found exclusively in undisturbed rainforest in the Clarke Range. This species has not been recorded since 1986 (DES 2013b).	<u>Unlikely to occur on New Lenton Mine</u> This species is classed as extinct in Australia. There is no suitable habitat available onsite. 1 pre-1986 record exists within 50 km of the Project, to the west of Mackay. Despite extensive fauna surveys over several years and seasons this species has not been identified within the study area. <u>Unlikely potential for impact</u> The Project does not contain habitat for the species. As per the proposed Project layout, no important habitat for this species will be cleared as a part of Project activities. It is unlikely that the New Lenton Mine will have a significant impact on this species.

Scientific Name Common Name	Status		Habitat Description	Likelihood of Impact
	NC Act	EPBC Act		
<i>Taudactylus eungellensis</i> Eungella frog	E	E	Inhabits exposed rocky outcrops in association with waterbodies. Prefers natural waterholes, waterfalls and rainforest streams. Bottom dwelling tadpoles inhabit mid-stream pools or partially connected stream-side pools (TSSC 2017).	<u>Unlikely to occur on New Lenton Mine</u> There is no rocky or permanent aquatic habitat available onsite. Confirmed records exist within 50 km of the Project, to the west of Mackay. Despite extensive fauna surveys over several years and seasons this species has not been identified within the study area. <u>Unlikely potential for impact</u> The Project does not contain habitat for the species. As per the proposed Project layout, no important habitat for this species will be cleared as a part of Project activities. It is unlikely that the New Lenton Mine will have a significant impact on this species.
<i>Taudactylus liemi</i> Eungella tinkerfrog	NT	-	This species distribution is restricted to an area to the west of Mackay. The Eungella tinkerfrog occurs amongst moss in moist cracks at the edge of rocky creeks (DES 2013b).	<u>Unlikely to occur on New Lenton Mine</u> There is no rocky aquatic habitat available onsite. Confirmed records exist within 50 km of the Project, to the west of Mackay. Despite extensive fauna surveys over several years and seasons this species has not been identified within the study area. <u>Unlikely potential for impact</u> The Project does not contain habitat for the species. As per the proposed Project layout, no important habitat for this species will be cleared as a part of Project activities. It is unlikely that the New Lenton Mine will have a significant impact on this species.

Scientific Name Common Name	Status		Habitat Description	Likelihood of Impact
	NC Act	EPBC Act		
Fish				
<i>Maccullochella peelii</i> Murray cod	LC	V	This species is able to utilise a diverse range of habitats including clear rocky streams to turbid lowland rivers and billabongs. This species is associated with riparian vegetation communities dominated by <i>Eucalyptus camaldulensis</i> (river red gum). The Murray cod requires several microhabitat features including; large rocks, submerged woody debris, overhanging vegetation, logs, and other woody structures (DoEE 2019).	<u>Unlikely to occur on New Lenton Mine</u> Required large permanent waterbodies do not exist on the Project. The Isaac River has some potential to temporarily support the species during high flow events. No confirmed records within 50 km of the Project. Despite extensive fauna surveys over several years and seasons this species has not been identified within the study area. <u>Unlikely potential for impact</u> The Project does not contain habitat for the species. As per the proposed Project layout, no important habitat for this species will be cleared as a part of Project activities. It is unlikely that the New Lenton Mine will have a significant impact on this species.
Mammals				
<i>Ornithorhynchus anatinus</i> Platypus	SLC	-	Found along the east coast of Australia in freshwater streams, lakes and ponds. Microhabitat features utilised in burrow establishment include; earthen banks, overhanging vegetation, reeds and logs (Van Dyck, Gynther & Baker 2013).	<u>Unlikely to occur on New Lenton Mine</u> Preferred habitat and suitable microhabitat burrow features do not occur within the Project. Five records exist within 50 km of the Project. Despite extensive fauna surveys over several years and seasons this species has not been identified within the study area. <u>Unlikely potential for impact</u> The Project does not contain habitat for the species. As per the proposed Project layout, no important habitat for this species will be cleared as a part of Project activities. It is unlikely that the New Lenton Mine will have a significant impact on this species.

Scientific Name Common Name	Status		Habitat Description	Likelihood of Impact
	NC Act	EPBC Act		
Turtles				
<i>Eseya albagula</i> Southern snapping turtle	E	CE	Found only in the Burness, Fitzroy, Raglan and Mary River drainages of south east Qld. Prefers non-ephemeral, flowing water (DoEE 2019).	<u>Unlikely to occur on New Lenton Mine</u> Preferred habitat does not exist on the Project as the species is predominantly found in permanent flowing water. The Project only contains highly ephemeral waterways only flowing briefly after heavy rainfall. No records within 50 km. Despite extensive fauna surveys over several years and seasons this species has not been identified within the study area. <u>Unlikely potential for impact</u> The Project does not contain habitat for the species. As per the proposed Project layout, no important habitat for this species will be cleared as a part of Project activities. It is unlikely that the New Lenton Mine will have a significant impact on this species.
<i>Rheodytes leukops</i> Fitzroy River turtle	V	V	This species is found only in the Fitzroy River and its tributaries (DoEE 2019).	<u>Unlikely to occur on New Lenton Mine</u> Preferred habitat does not exist on the Project as the species is found in permanent flowing water. The Project is located outside of its known distribution and only contains highly ephemeral waterways only flowing briefly after heavy rainfall. No records within 50 km. Despite extensive fauna surveys over several years and seasons this species has not been identified within the study area. <u>Unlikely potential for impact</u> The Project does not contain habitat for the species. As per the proposed Project layout, no important habitat for this species will be cleared as a part of Project activities. It is unlikely that the New Lenton Mine will have a significant impact on this species.

Notes: LC Least Concern
SLC Special Least Concern
NT Near Threatened
V Vulnerable
E Endangered
CE Critically Endangered
Ext Extinct

Appendix C Site Descriptions and AusRivAS Physical Assessment

Characteristic	LAq01				
Bank Shape	Left Bank		Right Bank		
	Concave		Concave		
Bank Slope	Left Bank		Right Bank		
	Gradual (10°- 30°)		Steep (60°- 80°)		
Factors Affecting Bank Stability	Stock access, Human access, Cleared vegetation				
Artificial Bank Stability Features	None				
Large Woody Debris (%)	None				
Turbidity, Water and Sediment Oils and Odours	Turbidity	Sediment Oils	Water Oils	Sediment Odours	Water Odours
	Opaque	None	None	None	None
Water Level	No flow, standing water				
Bare Ground	Some				
Exposed Tree Roots	None				
Gully Erosion	None				
Bank Slumping	Extensive				
Local Catchment Erosion	Moderate				
Artificial Features at Site	None				
Vegetation and Habitat Description	This site was characterised by RE 11.3.25 which contained a tree layer consisting predominantly of <i>Eucalyptus tereticornis</i> (blue gum) and <i>Casuarina cunninghamiana</i> (river oak). The shrub layer consisted of common riparian species known from the region such as <i>Melaleuca bracteata</i> (river tea-tree), <i>Bauhinia carronii</i> (red bauhinia) and <i>Ficus opposita</i> (sandpaper fig). The ground layer at this aquatic site was dominated by introduced pasture grasses mainly <i>Megathyrsus maximus</i> (green panic) and <i>Bothriochloa pertusa</i> (Indian bluegrass). The riparian width was recorded at approximately 20 m either side of the Isaac River and was connected to surrounding bushland. Moderate disturbance from cattle grazing and major invasive species invasion contributed to the moderate disturbance levels identified in the vegetation communities at this site.				



LAq01



LAq02

Characteristic	LAq02					
Bank Shape	Left Bank			Right Bank		
	Concave			Concave		
Bank Slope	Left Bank			Right Bank		
	Gradual (10°- 30°)			Steep (60°- 80°)		
Factors Affecting Bank Stability	Stock access, Human access, Cleared vegetation					
Artificial Bank Stability Features	None					
Large Woody Debris (%)	None					
Turbidity, Water and Sediment Oils and Odours	Turbidity	Sediment Oils	Water Oils	Sediment Odours	Water Odours	
	Opaque	None	None	None	None	
Water Level	No flow, standing water					
Bare Ground	Some					
Exposed Tree Roots	None					
Gully Erosion	-					
Bank Slumping	Extensive					
Local Catchment Erosion	Moderate					
Artificial Features at Site	None					
Vegetation and Habitat Description	Riparian vegetation at LAq02 was also characterised by RE 11.3.25 and composed of a similar assemblage of species. A slightly different composition of native shrub species was observed with species such as <i>Erythrina variegata</i> (bat wing coral tree) and <i>Acacia salicina</i> (sally wattle) attributing to the mid-story. The ground cover was like that of LAq01 with the addition of the pasture species <i>Cenchrus ciliaris</i> (buffel grass). Although this species is usually recognised as a dominant pasture grass, other grasses such as <i>Megathyrsus maximus</i> (green panic) and <i>Bothriochloa pertusa</i> (Indian bluegrass) were more evident. The riparian width at LAq02 was approximately 20 m on each side of the Isaac River and connected to surrounding woodland. Moderate disturbance from cattle grazing and major exotic species invasion contributed to the moderate disturbance levels identified in the vegetation communities at this site.					

Characteristic	LAq03					
Bank Shape	Left Bank			Right Bank		
	Concave			Concave		
Bank Slope	Left Bank			Right Bank		
	Gradual (10°- 30°)			Steep (60°- 80°)		
Factors Affecting Bank Stability	Stock access, Human access, Cleared vegetation					
Artificial Bank Stability Features	None					
Large Woody Debris (%)	None					
Turbidity, Water and Sediment Oils and Odours	Turbidity	Sediment Oils	Water Oils	Sediment Odours	Water Odours	
	Opaque	None	None	None	None	
Water Level	No flow, standing water					
Bare Ground	Some					
Exposed Tree Roots	None					
Gully Erosion	-					
Bank Slumping	Extensive					
Local Catchment Erosion	Moderate					
Artificial Features at Site	None					
Vegetation and Habitat Description	This site was also characterised by RE 11.3.25 and composed of a very similar assemblage of species as LAq01 and LAq02. The shrub layer consisted of common riparian species known from the region such as <i>Melaleuca bracteata</i> (river tea-tree), <i>Bauhinia carronii</i> (red bauhinia) and <i>Ficus opposita</i> (sandpaper fig). The ground layer at this aquatic site was dominated by introduced pasture grasses mainly <i>Megathyrsus maximus</i> (green panic) and <i>Bothriochloa pertusa</i> (Indian bluegrass). <i>Melinis repens</i> (red natal) was also observed throughout this aquatic site in small, dense patches on the upper banks of the riparian zone. The riparian width was recorded at approximately 20 m either side of the Isaac River and was connected to surrounding bushland. Moderate disturbance from cattle grazing and major weed species invasion contributed to the moderate disturbance levels identified in the vegetation community at this site.					



LAq03



LAq04

Characteristic	LAq04				
Bank Shape	Left Bank		Right Bank		
	Concave		Concave		
Bank Slope	Left Bank		Right Bank		
	Gradual (10°- 30°)		Steep (60°- 80°)		
Factors Affecting Bank Stability	Stock access, Human access, Cleared vegetation				
Artificial Bank Stability Features	None				
Large Woody Debris (%)	None				
Turbidity, Water and Sediment Oils and Odours	Turbidity	Sediment Oils	Water Oils	Sediment Odours	Water Odours
	Opaque	None	None	None	None
Water Level	No flow, standing water				
Bare Ground	Some				
Exposed Tree Roots	None				
Gully Erosion	-				
Bank Slumping	Extensive				
Local Catchment Erosion	Moderate				
Artificial Features at Site	None				
Vegetation and Habitat Description	The vegetation assemblage at LAq04 represented a highly modified pastoral habitat that has been selectively thinned resulting in exotic species invasion and damage to the creek banks by stock access. Dominant tree species included <i>Eucalyptus tereticornis</i> (blue gum) with very few shrub species prevailing in the secondary canopy layer. The ground layer was dominated by invasive pastoral species such as <i>Cenchrus ciliaris</i> (buffel grass), <i>Melinis repens</i> (red natal), <i>Megathyrsus maximus</i> (green panic) and <i>Bothriochloa pertusa</i> (Indian bluegrass).				

Characteristic	LAq05				
Bank Shape	Left Bank		Right Bank		
	Concave		Concave		
Bank Slope	Left Bank		Right Bank		
	Gradual (10°- 30°)		Steep (60°- 80°)		
Factors Affecting Bank Stability	Stock access, Human access, Cleared vegetation				
Artificial Bank Stability Features	None				
Large Woody Debris (%)	None				
Turbidity, Water and Sediment Oils and Odours	Turbidity	Sediment Oils	Water Oils	Sediment Odours	Water Odours
	Opaque	None	None	None	None
Water Level	No flow, standing water				
Bare Ground	Some				
Exposed Tree Roots	None				
Gully Erosion	-				
Bank Slumping	Extensive				
Local Catchment Erosion	Moderate				
Artificial Features at Site	None				



LAq05

Characteristic	LRAq01				
Bank Shape	Left Bank		Right Bank		
	Concave		Concave		
Bank Slope	Left Bank		Right Bank		
	45°		30°		
Factors Affecting Bank Stability	Cattle access, Weed presence, High flow events				
Artificial Bank Stability Features	None present at site				
Large Woody Debris (%)	10%				
Turbidity, Water and Sediment Oils and Odours	Turbidity	Sediment Oils	Water Oils	Sediment Odours	Water Odours
	NA	None	NA	None	NA
Water Level	Dry at time of sampling				
Bare Ground	Low				
Exposed Tree Roots	Low				
Gully Erosion	Some				
Bank Slumping	Low				
Local Catchment Erosion	Some				
Artificial Features at Site	None				
Vegetation and Habitat Description	This site was located along the Isaac River in RE 11.3.25. No water was recorded at the time of sampling, but the vegetation composition represented a healthy riparian woodland. Dominant tree species included <i>Eucalyptus tereticornis</i> (blue gum) and <i>Casuarina cunninghamiana</i> (river oak) while the sparse shrub layer consisted of <i>Ficus opposita</i> (sandpaper fig), <i>Bauhinia hookeri</i> and <i>Lantana camara</i> (lantana). A high diversity of introduced pasture and weed species was recorded within the ground layer with species such as <i>Bothriochloa pertusa</i> (Indian bluegrass) and <i>Cenchrus ciliaris</i> (buffel grass). The surrounding community provides large hollows, exfoliating bark and fallen logs ideal for fauna assemblage.				



LRAq01



LRAq02

Characteristic	LRAq02				
Bank Shape	Left Bank		Right Bank		
	Convex		Concave		
Bank Slope	Left Bank		Right Bank		
	90°		80°		
Factors Affecting Bank Stability	High level of weed presence, High exposure of roots, High flow event, Poor vegetation				
Artificial Bank Stability Features	None present at site				
Large Woody Debris (%)	20%				
Turbidity, Water and Sediment Oils and Odours	Turbidity	Sediment Oils	Water Oils	Sediment Odours	Water Odours
	NA	None	NA	None	NA
Water Level	Dry at time of sampling				
Bare Ground	Extensive				
Exposed Tree Roots	Extensive				
Gully Erosion	Extensive				
Bank Slumping	Moderate				
Local Catchment Erosion	Moderate				
Artificial Features at Site	None present				
Vegetation and Habitat Description	This site exhibited disturbance from cattle grazing and land clearing which resulted in an increase in weed diversity and abundance. Few tree species were recorded and those that were, are generalist species such as <i>Acacia salicina</i> (sally wattle). The ground layer mostly consisted of introduced pasture and weed species with few native grasses. Weed species occurring at this site included, <i>Parthenium hysterophorus</i> (parthenium), <i>Vachellia nilotica</i> (prickly acacia) and <i>Malvastrum americanum</i> (malvastrum).				

Characteristic	LGAq01				
Bank Shape	Left Bank		Right Bank		
	Concave		Concave		
Bank Slope	Left Bank		Right Bank		
	70°		70°		
Factors Affecting Bank Stability	Stock access, Human access, Cleared vegetation				
Artificial Bank Stability Features	None				
Large Woody Debris (%)	None				
Turbidity, Water and Sediment Oils and Odours	Turbidity	Sediment Oils	Water Oils	Sediment Odours	Water Odours
	None	None	None	None	None
Water Level	No flow, dry				
Bare Ground	Extensive				
Exposed Tree Roots	Moderate				
Gully Erosion	Minor				
Bank Slumping	Minor				
Local Catchment Erosion	Moderate				
Artificial Features at Site	None				
Vegetation and Habitat Description	LGAq01 was characterised by non-remnant vegetation on the boundary of RE 11.3.2 and represented a different assemblage of species composition which had been extensively thinned for pastoral habitat. A dominate tree canopy of <i>Eucalyptus populnea</i> , <i>Flindersia dissosperma</i> and <i>Archidendropsis basaltica</i> (dead finish) was observed. A very sparse shrub layer was comprised of <i>Eremophila mitchellii</i> (false sandalwood) occurring moderately set back from the steep slope of riparian edge. The groundcover can be described as almost absent, however of the small patches present, the primary species of <i>Aristida calycina</i> and <i>Bothriochloa pertusa</i> (Indian bluegrass) were present.				



LGAq01



LGAq02

Characteristic	LGAq02				
Bank Shape	Left Bank		Right Bank		
	Concave		Concave		
Bank Slope	Left Bank		Right Bank		
	80°		80°		
Factors Affecting Bank Stability	Stock access, Human access, Cleared vegetation				
Artificial Bank Stability Features	None				
Large Woody Debris (%)	None				
Turbidity, Water and Sediment Oils and Odours	Turbidity	Sediment Oils	Water Oils	Sediment Odours	Water Odours
	NA	None	NA	None	NA
Water Level	No flow, dry				
Bare Ground	Moderate				
Exposed Tree Roots	Extensive				
Gully Erosion	Extensive				
Bank Slumping	Extensive				
Local Catchment Erosion	Moderate				
Artificial Features at Site	None				
Vegetation and Habitat Description	The vegetation assemblage at LGAq02 is reflective of RE 11.9.7 and has been heavily subject to gully erosion along the riparian edge due to historic clearing and damage from stock access. The dominant tree layer is <i>Eucalyptus crebra</i> (narrow-leaved ironbark), <i>Corymbia dallachiana</i> (ghost gum), and <i>Acacia excelsa</i> (ironwood wattle) is present on the eroded riparian edges. These larger trees are providing the main source of stability for the site, whilst a sparse shrub layer of <i>Bauhinia hookeri</i> and <i>Carissa spinarum</i> (conkerberry) provide further support. The groundcover at this site is dominated by introduced species such as <i>Cenchrus ciliaris</i> (buffel grass) and <i>Parthenium hysterophorus</i> (parthenium). Whilst, additional species such as <i>Grewia retusifolia</i> and <i>Megathyrsus maximus</i> (green panic) make up the sparse ground cover.				

Appendix D Flora Species List

Family	Scientific Name	Common Name	NC Act BS Act	EPBC Act	Summer 2018	Autumn 2018	Autumn 2019
Aizoaceae	<i>Tetragonia tetragonoides</i>	New Zealand spinach	LC	NL	x		
Amaranthaceae	<i>Achyranthes aspera</i>	Chaff flower	LC	NL			x
Anacardiaceae	<i>Pleiogynium timorense</i>	Sweet plum	LC	NL	x		
Apocynaceae	<i>Apocynaceae sp.</i>		LC	NL			x
Apocynaceae	<i>Carissa spinarum</i>	Currant bush	LC	NL	x	x	x
Asparagaceae	<i>Eustrephus latifolius</i>	Wombat berry	LC	NL	x	x	x
Asparagaceae	<i>Lomandra longifolia</i>	Spiked mat rush	LC	NL	x		
Asteraceae	<i>Cyanthillium cinereum</i>		LC	NL	x		
Asteraceae	<i>Erigeron bonariensis</i>		Int.	NL	x		
Asteraceae	<i>Parthenium hysterophorus</i>	Parthenium	RIP	WoNS	x	x	x
Asteraceae	<i>Tridax procumbens</i>	Tridax daisy	NL	NL	x		
Asteraceae	<i>Verbesina encelioides</i>	Crownbeard	Int.	NL	x		
Asteraceae	<i>Xanthium occidentale</i>	Noogoora burr	Int.	NL	x		
Cactaceae	<i>Harrisia martinii</i>	Harrisia cactus	RIP	NL	x		
Cactaceae	<i>Opuntia stricta</i>	Prickly pear	RIP	WoNS		x	
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River she-oak	LC	NL	x	x	
Combretaceae	<i>Terminalia oblongata</i>	Yellow wood	LC	NL			x
Commelinaceae	<i>Commelina diffusa</i>	Wandering jew	LC	NL	x		
Cyperaceae	<i>Cyperus gracilis</i>	Dainty sedge	LC	NL	x	x	
Cyperaceae	<i>Cyperus involucratus</i>	Sedge	Int.	NL	x		
Cyperaceae	<i>Cyperus sp.</i>		LC	NL	x		
Erythroxylaceae	<i>Erythroxylum australe</i>	Cocaine bush	LC	NL		x	
Euphorbiaceae	<i>Ricinus communis</i>	Castor oil plant tree	OIP	NL	x	x	
Fabaceae	<i>Acacia excelsa</i>	Ironwood wattle	LC	NL		x	x
Fabaceae	<i>Acacia salicina</i>	Sally wattle	LC	NL	x	x	x
Fabaceae	<i>Archidendropsis basaltica</i>	Dead finish	LC	NL			x
Fabaceae	<i>Bauhinia carronii</i>	Queensland ebony	LC	NL	x	x	
Fabaceae	<i>Bauhinia hookeri</i>	White bauhinia	LC	NL			x
Fabaceae	<i>Cassia brewsteri</i>	Brewster's cassia	LC	NL	x	x	
Fabaceae	<i>Clitoria ternatea</i>	Blue pea	Int.	NL	x		
Fabaceae	<i>Crotalaria alata</i>		Int.	NL	x		
Fabaceae	<i>Crotalaria laburnifolia</i>		Int.	NL	x		
Fabaceae	<i>Crotalaria mitchellii</i>		LC	NL	x	x	
Fabaceae	<i>Erythrina vespertilio</i>	Bat wing coral tree	LC	NL	x		
Fabaceae	<i>Glycine tabacina</i>	Glycine Pea	LC	NL	x		

D

Family	Scientific Name	Common Name	NC Act BS Act	EPBC Act	Summer 2018	Autumn 2018	Autumn 2019
Fabaceae	<i>Macroptilium atropurpureum</i>	Siratro	Int.	NL	x	x	
Fabaceae	<i>Rhynchosia minima</i>	Rhyncho	LC	NL	x	x	
Fabaceae	<i>Senna sp.</i>		LC	NL		x	
Fabaceae	<i>Stylosanthes scabra</i>	Shrubby stylo	Int.	NL		x	
Fabaceae	<i>Vachellia nilotica</i>	Prickly acacia	RIP	WoNS	x	x	
Fabaceae	<i>Vigna lanceolata</i>	Maloga bean	LC	NL		x	
Lamiaceae	<i>Lamiaceae sp.</i>		LC	NL		x	
Malvaceae	<i>Brachychiton australis</i>	Broad leaved bottle tree	LC	NL			x
Malvaceae	<i>Grewia retusifolia</i>	Dog's balls	LC	NL		x	x
Malvaceae	<i>Hibiscus sturtii</i>	Sturt's desert rose	LC	NL		x	
Malvaceae	<i>Malvastrum americanum</i>	Spiked malvastrum	Int.	NL	x	x	
Malvaceae	<i>Sida cordifolia</i>	Flannel sida	Int.	NL	x		
Malvaceae	<i>Sida corrugata</i>	Corrugated sida	LC	NL		x	
Malvaceae	<i>Sida rhombifolia</i>	Arrow-leaf sida	Int.	NL	x		
Malvaceae	<i>Sida rohlenae</i>	Shrub sida	LC	NL	x		
Malvaceae	<i>Sida subspicata</i>	Spiked sida	Int.	NL		x	
Mimosaceae	<i>Mimosa pudica</i>	Common sensitive plant	Int.	NL	x		
Moraceae	<i>Ficus opposita</i>	Sandpaper fig	LC	NL	x	x	
Myrtaceae	<i>Corymbia dallachiana</i>	Ghost gum	LC	NL			x
Myrtaceae	<i>Corymbia tessellaris</i>	Moreton bay ash	LC	NL	x		
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved ironbark	LC	NL			x
Myrtaceae	<i>Eucalyptus populnea</i>	Popular box	LC	NL		x	x
Myrtaceae	<i>Eucalyptus sp.</i>		LC	NL		x	
Myrtaceae	<i>Eucalyptus tereticornis</i>	Blue gum	LC	NL	x		
Myrtaceae	<i>Melaleuca bracteata</i>	Black tea tree	LC	NL	x	x	
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	LC	NL	x		
Oxalidaceae	<i>Oxalis corniculata</i>	Creeping woodsorrel	Int.	NL	x		
Papaveraceae	<i>Argemone ochroluca</i>	Yellow poppy	Int.	NL		x	
Passifloraceae	<i>Passiflora foetida</i>	Stinking passionflower	OIP	NL	x	x	
Phyllanthaceae	<i>Flueggea virosa subsp. melanthesoides</i>		LC	NL	x		
Phyllanthaceae	<i>Phyllanthus virgatus</i>		LC	NL	x		
Picrodendraceae	<i>Petalostigma pubescens</i>	Quinine bush	LC	NL		x	x
Poaceae	<i>Aristida calycina</i>	Dark wire grass	LC	NL		x	x
Poaceae	<i>Aristida latifolia</i>	Feathertop wiregrass	LC	NL		x	
Poaceae	<i>Bothriochloa bladhii</i>		LC	NL		x	

D

Family	Scientific Name	Common Name	NC Act BS Act	EPBC Act	Summer 2018	Autumn 2018	Autumn 2019
Poaceae	<i>Bothriochloa pertusa</i>	Indian bluegrass	Int.	NL	x	x	x
Poaceae	<i>Cenchrus ciliaris</i>	Buffel grass	Int.	NL		x	x
Poaceae	<i>Dactyloctenium radulans</i>	Button grass	LC	NL	x		
Poaceae	<i>Dichanthium sericeum</i>	Queensland bluegrass	LC	NL	x		
Poaceae	<i>Enneapogon sp.</i>		LC	NL		x	
Poaceae	<i>Enteropogon ramosus</i>	Curly windmill grass	LC	NL	x		
Poaceae	<i>Heteropogon contortus</i>	Black spear grass	LC	NL		x	
Poaceae	<i>Megathyrsus maximus</i>	Green panic	Int.	NL	x		x
Poaceae	<i>Melinis repens</i>	Red natal	Int.	NL	x		
Poaceae	<i>Urochloa mosambicensis</i>	Sabi grass	Int.	NL	x	x	
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed	Int.	NL		x	
Proteaceae	<i>Grevillea striata</i>	Beefwood	LC	NL		x	
Pteridaceae	<i>Cheilanthes sieberi</i>	Mulga fern	LC	NL	x		
Rhamnaceae	<i>Alphitonia excelsa</i>	Soap tree	LC	NL	x		
Rubiaceae	<i>Psydrax johnsonii</i>		LC	NL			x
Rutaceae	<i>Flindersia dissosperma</i>		LC	NL			x
Sapindaceae	<i>Atalaya hemiglauca</i>	Whitewood	LC	NL	x	x	x
Scrophulariaceae	<i>Eremophila mitchellii</i>	False sandalwood	LC	NL		x	x
Verbenaceae	<i>Lantana camara</i>	Lantana	RIP	WoNS	x		

Notes:

LC	Least Concern
NL	Not Listed
Int.	Introduced
OIP	Other Invasive Plant
RIP	Restricted Invasive Plant
WoNS	Weed of National Significance

Appendix E Fauna Species List

Family	Scientific Name	Common Name	NC Act BS Act	EPBC Act	Spring (2004)	Summer (2018)	Total
Crustacea							
Palaemonidae	<i>Macrobrachium australiense</i>	Freshwater prawn	-	-		1	1
Parastacidae	<i>Cherax quadricarinatus</i>	Redclaw	-	-		1	1
Gecarcinucidae	<i>Austrothelehusa transversa</i>	Inland freshwater crab	LC	-		1	1
CRUSTACEA					0	3	3
Fishes							
Ambassidae	<i>Ambassis agassizii</i>	Agassiz's glassfish	WIS	-		81	81
Clupeidae	<i>Nematalosa erebi</i>	Bony bream	WIS	-		11	11
Eleotridae	<i>Mogurnda adspersa</i>	Southern purplespotted gudgeon	WIS	-		2	2
Melanotaeniidae	<i>Melanotaenia splendida</i>	Eastern rainbowfish	WIS	-		1	1
Terapontidae	<i>Leiopotherapon unicolor</i>	Spangled perch	WIS	-	4		4
FISHES					4	95	99
Amphibians							
Hylidae	<i>Litoria inermis</i>	Bumpy rocket frog	LC	-	3		3
Hylidae	<i>Litoria latopalmata</i>	Broad-palmed frog	LC	-	50		50
Limnodynastidae	<i>Limnodynastes tasmaniensis</i>	Spotted grass frog	LC	-		116	116
AMPHIBIANS					53	116	169

Notes: LC Least Concern
WIS Wetland Indicator Species

Appendix F Weed Species Fact Sheets

Harrisia cactus

Moonlight cactus

Harrisia martinii, *Harrisia tortuosa* and *Harrisia pomanensis*



Harrisia cactus can form dense infestations that will reduce pastures to a level unsuitable for stock. Harrisia cactus will choke out other pasture species when left unchecked.

The spines are a problem for stock management, interfering with mustering and stock movement.

Harrisia cactus produces large quantities of seed that is highly viable and easily spread by birds and other animals. As well as reproducing from seed, harrisia cactus has long trailing branches that bend and take root wherever they touch the ground. Any broken-off portions of the plant will take root and grow.

Legal requirements

Harrisia cactus (*Harrisia martinii*, *Harrisia tortuosa* and *Harrisia pomanensis*) are restricted invasive plants under the *Biosecurity Act 2014*. It must not be given away, sold, or released into the environment without a permit. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.



At a local level, each local government must have a biosecurity plan that covers invasive plants and animals in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

Harrisia cactus is a perennial. The spiny fleshy stems are jointed and form tangled mats about half a metre high. Many branches often lie flat and take root where they touch the ground. Each section is ribbed lengthwise with six ribs; each rib has low, thick, triangular humps at regular intervals. These humps have cushions of grey felty hairs, three to five short spines lying flat, and one to three erect, stiff, very sharp spines 2.5–3 cm long.

The large flowers open at night. Flowers are pink and funnel-shaped with a tinge of white. These grow singly near the ends of the stems on a scaly but spineless slender grey-green tube 12–15 cm long.

Round, red fruits 4–5 cm across have scattered bumps with hairs and spines. Numerous small black seeds are embedded in the white, juicy pulp of the fruit, which splits open when ripe.

Harrisia cactus roots are of two types. Shallow feeding roots up to 3 cm thick and 30 cm to 2 m long grow mostly horizontally off a crown, up to 15 cm below ground level. Swollen tuberous storage roots descend to a depth of 15–60 cm.

Life cycle

Harrisia cactus bears a bright red fruit containing 400–1000 small black seeds. Plants are easily established from seed and germinate soon after rain.

Seedlings quickly produce a swollen tuberous food storage root that develops as the plant grows. Branches take root where they touch the ground and new plants will grow from broken branches and sections of underground tubers.

Counts of tubers in dense cactus infestations have shown over 125 000 per hectare. Each plant houses many dormant underground buds that are all capable of reshooting when the tip growth dies; any small portion of the tuberous root left in the soil will grow.

Methods of spread

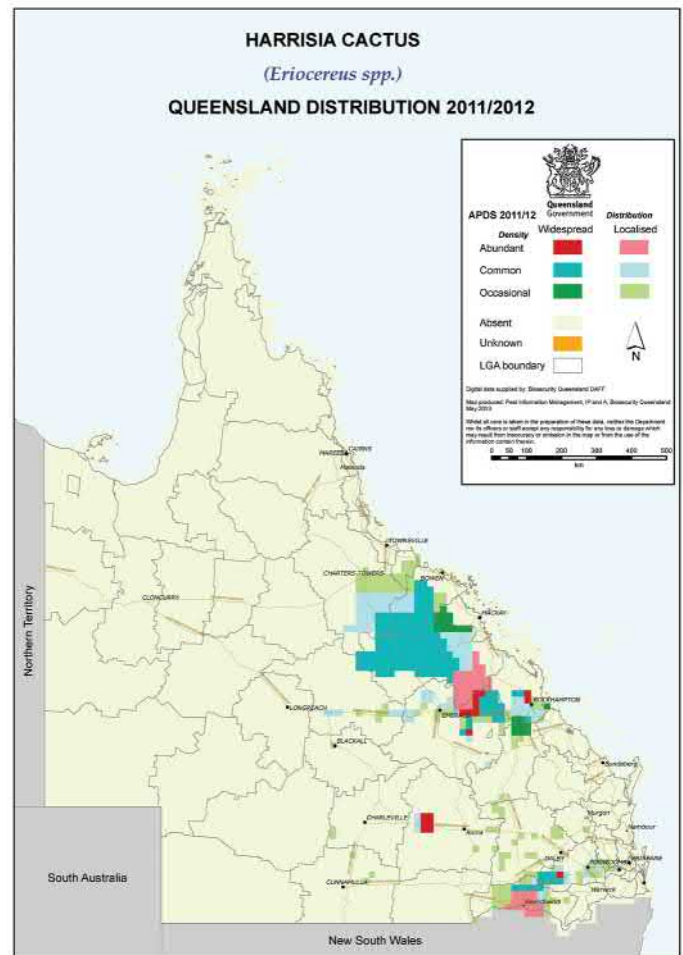
Fruit and seed are readily eaten by birds, mammals and to a lesser extent by feral pigs.

Habitat and distribution

Harrisia cactus is a native of Argentina and Paraguay, South America. It was introduced to Australia as a pot plant in the 1890s. In 1935 it was first recognised as a serious pest in the Collinsville district and by the 1950s was rapidly spreading south.

Harrisia cactus is mainly a pest of brigalow and associated softwood country. However, infestations are now appearing in box and ironbark stands and also in pine forests.

Map 1. Distribution of *Harrisia cactus* in Queensland



The cactus is shade tolerant and reaches its maximum development in the shade and shelter of brigalow scrub, though established infestations can persist once scrub is pulled.

Harrisia cactus is found in the Collinsville, Nebo, Moranbah, Dingo, Blackwater and Goondiwindi districts, with minor infestations occurring at Millmerran, Greenmount, Gatton, Ipswich, Rockhampton, Rannes, Mount Morgan, Alpha and Mitchell.

Control

Managing *Harrisia cactus*

The GBO requires a person to take reasonable and practical steps to minimise the risks posed by *Harrisia cactus*. This fact sheet provides information and some options for controlling *Harrisia cactus*.

Control of this plant is difficult as it has a deep underground tuberous root system and use of a combination of physical, biologic and herbicide controls is recommended.

Physical control

Dig out plants completely and burn. Ensure that all tubers that can grow are removed and destroyed.

Ploughing is not considered an effective means of control unless followed by annual cropping.

Biological control

Two introduced insects have become established in the field:

- a stem-boring longicorn beetle (*Alcidion cereicola*)
- a mealy bug (*Hypogeococcus festerianus*).

The stem-boring beetle only attacks older woody stems. In the Collinsville area, large beetle colonies developed and contributed to the collapse of dense areas of cactus. Populations of *Alcidion cereicola* have declined with the reduction in the cactus in recent years.

The most successful biological control agent is the mealy bug *Hypogeococcus festerianus* which is now present in harrisia cactus in Collinsville, Dingo, Moranbah, Blackwater, Nebo, Charters Towers and Goondiwindi districts, with small colonies established at Alpha, Capella, Rannes, Gatton, Greenmount, Millmerran and Rockhampton.

How mealy bug works

The mealy bug aggregates and feeds in the tips of stems and buds, where it limits growth and causes distortion. This results in the knotting of the stem. The plant's response is to utilise energy reserves within the tuber system to produce new growth. Eventually the plant dies, as it is unable to support the continuous high energy demands.

Dry weather reduces the effectiveness of the mealy bug. When dry, the plant's tuber system becomes dormant. Consequently, mealy bug damage does not result in new growth and the energy reserves within the plant are not affected. Instead the bug may damage all vegetative parts and eventually die out. The tuber will remain dormant until adequate moisture returns, when it will reshoot.

How to spread the bug

Mealy bug disperses naturally via wind, although landholder assistance is necessary for its continuous spread, particularly between patches. The bug is manually spread by cutting infected stems and placing them into healthy plants. The best pieces for starting new colonies are large knobs of twisted and distorted cactus that contain many mealy bugs well protected inside knots. Stem tips covered by white, woolly masses of bug are also good. To collect the bug, cut infected stems approximately 15 cm from the distorted knob and place segments in green, plump sections of the healthy plant. Avoid placing mealy bug in stressed or dried out stems. Small cactus plants require at least one large knot, with larger plants requiring three knots per plant. Where possible, landholders should infest every cactus clump as this ensures a rapid reduction in growth and fruiting potential. When cactus infestations are light, chemical control may be a preferable option.

Cut pieces can be transported in boxes or open vehicles. They are not delicate, but are best kept in the shade. Avoid keeping them in large heaps, in direct sunlight, under tarpaulins or in closed containers for long periods. Such conditions will promote rotting of the stems, leading to poor results or failures. Ideally, stems should be put out within three days and a maximum of five days.

When to infest

Best results come by infesting new areas during spring and early summer, from September to December. Maximum growth and spreading occurs in the summer months of December to February. During the drier and colder months of April to August the mealy bug does not die, but little growth and multiplication occurs. Introduction of mealy bug during autumn and winter will not be lost, but little effect is seen until the following summer.

How soon to expect results

Mealy bugs are generally more active and effective on harrisia cactus growing underneath shrubs and trees, so results will be seen more quickly in these areas than in cactus growing in the open. Best results are obtained when infesting plants that have actively growing new shoots.

During wet summers in northern and central Queensland, the growing points of stems will begin to curl after about six weeks.

By the end of the first summer, damage (severe twisting) will be widespread in infested plants. If the initial infestation was sufficiently heavy, no fruit or growth will occur during the second year, and the cactus will begin to die during the third year. Seedlings and regrowth shoots will continue to be present but by the end of the fourth year there should be very little cactus left.

In the southern portion of the state, where temperatures are lower, the mealy bug still provides control but the process takes longer. However, the mealy bug will do better on cactus in the open, rather than in the shade, as temperatures are higher in the open.

Herbicide control

Foliar application of registered herbicides provides effective control, but can be costly over large areas. Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label (see to Table 1).

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit www.biosecurity.qld.gov.au.



Table 1. Herbicides for the control of harrisia cactus

Situation	Herbicide	Rate	Comments
Non-crop land and rights-of-way	Dichlorprop as K salt (600 g/L)	1 L/60 L water	Good soil moisture essential Spray plant when actively growing to run-off point A follow-up treatment may be necessary
Native pastures, rights-of-way, commercial and industrial areas	Metsulfuron-methyl (600 g/kg) (e.g. Brush-Off®)	20 g/100 L water + surfactant	Spray plant when actively growing to run-off point A follow-up treatment may be necessary
Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way	Triclopyr as butotyl (240 g/L) + Picloram as ioe (120 g/L) (e.g. Access®)	1 L/60 L diesel	Spray plant when actively growing Apply as overall spray, wetting all areas of the plant to ground level
Non-agricultural areas (native pastures), commercial and industrial areas and rights-of-ways	Aminopyralid as K salt 375 g/kg + Metsulfuron methyl 3 g/kg (e.g. Stinger)	40 g/100 L water	Spray to thoroughly wet using 1000 to 1400 L/ha Follow-up treatment may be necessary
Commercial and industrial areas, around buildings and rights-of-way	Triclopyr as butotyl 75 g/L + Metsulfuron-methyl 28 g/L (e.g. Zalam Brush Weed®)	500 mL/100 L	Spray to thoroughly wet using 1000 to 1500 L/ha Follow-up treatment may be necessary
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Triclopyr as tea 200 g/L + Picloram as tipa 100 g/L (e.g. Slasher) or Triclopyr as tea 200 g/L + Picloram as tipa 100 g/L + Aminopyralid 25 g/L (e.g. Tordon RegrowthMaster) (e.g. Tordon DSH®)	2.5 L/100 L water	Spray plant when actively growing (September–March) Treat all stems thoroughly

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.



This fact sheet is developed with funding support from the Land Protection Fund.

Fact sheets are available from Department of Agriculture and Fisheries (DAF) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at www.biosecurity.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DAF does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

Lantana

Lantana camara



Currently, lantana covers more than 5 million ha of subcoastal New South Wales to Far North Queensland. Small infestations of lantana have also been found in central west Queensland, the Northern Territory, Western Australia, South Australia and Victoria. Efforts are under way to control these.

Lantana is mainly spread by fruit-eating birds and mammals. It forms dense thickets that smother and kill native vegetation and are impenetrable to animals, people and vehicles.

Research indicates more than 1400 native species are negatively affected by lantana invasion, including many endangered and threatened species. As lantana is a woody shrub that has thin, combustible canes, its presence can also create hotter bushfires, altering native vegetation communities and pastures.



Legal requirements

All lantana species (*Lantana camara* and *Lantana montevidensis*) are restricted invasive plants under the *Biosecurity Act 2014*. They must not be given away, sold, or released into the environment without a permit. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

At a local level, each local government must have a biosecurity plan that covers invasive plants and animals in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

Lantana camara is a heavily branched shrub that can grow in compact clumps, dense thickets or as a climbing vine.

The stems are square in cross section, with small, recurved prickles. Most leaves are about 6 cm long and are covered in fine hairs. They are bright green above, paler beneath and have round-toothed edges. Leaves grow opposite one another along the stem. When crushed the leaves produce a distinctive odour.

Flowers appear throughout most of the year in clustered, compact heads about 2.5 cm in diameter. Flower colours vary from pale cream to yellow, white, pink, orange and red. Lantana produces round, berry-like fruit that turn from glossy green to purplish-black when ripe.

Life cycle

Flowering and germination occurs all year round but peaks after summer rains. Several thousand seeds can be produced per square metre and these can remain viable for several years.

Research indicates some ornamental lantana varieties have the ability to set seed and can spread vegetatively. They also produce some viable pollen and have the potential to cross-pollinate with wild forms, creating new varieties that could naturalise in the environment.

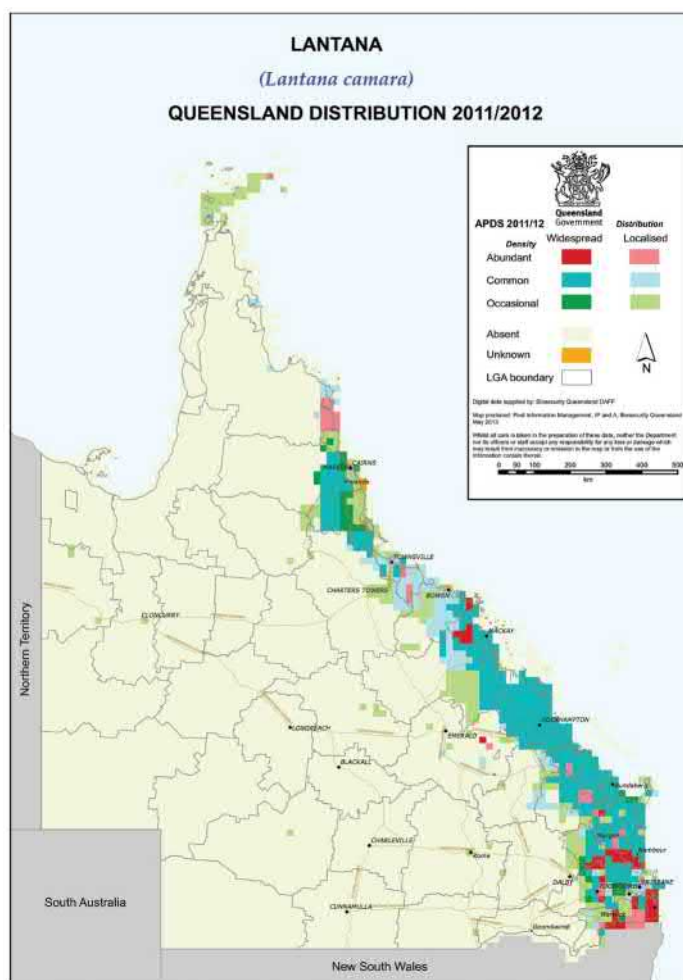
If the number of naturalised varieties increase due to genetic drift from ornamental varieties, it will make finding effective biological control agents even more difficult and potentially extend the climatic tolerances and range of the weed's spread.

Methods of spread

Spread mostly through the garden ornamental trade, by fruit eating birds and mammals.

Lantana camara can also spread via a process known as layering, where horizontal stems take root when they are in contact with moist soil. It will also reshoot from the base of vertical stems.

Map 1. Distribution of *Lantana camara* in Queensland



Habitat and distribution

Lantana camara is native to the tropical and subtropical regions of North, Central and South America.

Lantana camara is found throughout most coastal and subcoastal areas of eastern Australia, from the Torres Strait islands to southern New South Wales. It grows in a wide variety of habitats, from exposed dry hillsides to wet, heavily shaded gullies.

Toxicity

Many lantana varieties are poisonous to stock. It is difficult to tell which varieties are toxic so it is better to treat all forms as potentially poisonous. The toxins in lantana include the triterpene acids, lantadene A (rehmannic acid), lantadene B, and their reduced forms.

Most cases of lantana poisoning occur when new stock are introduced into lantana-infested areas. Stock bred on lantana-infested country avoid lantana unless forced to eat it due to lack of other fodder. Young animals introduced to lantana areas are most at risk.

Symptoms of lantana poisoning depend on the quantity and type of lantana consumed and, under some circumstances, the intensity of light to which the animals are exposed.

Early symptoms of depression are noticeable, with head swaying, loss of appetite, constipation and frequent urination. After a day or two the eyes and the skin of the nose and mouth start yellowing with jaundice, and the muzzle becomes dry and warm. The eyes may become inflamed and have a slight discharge. The animal also becomes increasingly sensitive to light. Finally, the muzzle becomes inflamed, moist and very painful ('pink nose'). Areas of skin may peel and slough off. Death commonly occurs 1–4 weeks after symptoms occur. Death from acute poisoning can occur 3–4 days after eating the plant.

If animals show any of the early symptoms, they should be moved to lantana-free areas, kept in the shade and monitored. Veterinary treatment should be sought immediately. Some remedies may include intravenous fluids, treating skin damage with antibiotics, or drenching with an activated charcoal slurry.

Care should be taken when introducing new or young animals into a paddock if lantana is present. Ensure they have enough fodder to stop them eating lantana in quantities sufficient to result in poisoning. During drought, animals should not be placed in lantana-infested areas without alternative food.

Control

Managing *Lantana camara*

The GBO requires a person to take reasonable and practical steps to minimise the risks posed by *Lantana camara*. This fact sheet provides information and some options for controlling *Lantana camara*.

A general principle is to commence control programs in areas of light infestations and work towards the denser infestations using a mix (integration) of control methods gives the best results. Size, density and geographic location of infestations are important considerations for choosing which mix of control methods to use.

For large lantana infestations, treatment with herbicides by foliar spraying is usually not economically feasible. However, fire, dozing/stick raking, slashing/cutting, aerial helicopter spraying can reduce dense infestations, making follow-up spot treatments with chemicals more economically viable.

Lantana camara seed banks remain viable for at least four years, so follow-up control to kill seedlings before they mature is vital to ensure initial management efforts to control the parent bush are not wasted.

Appropriate fire regimes may become part of a management program to ensure *Lantana camara* invasiveness is reduced and pasture is maintained.

Removal of *Lantana camara* within areas of remnant vegetation may require a permit under the *Vegetation Management Act 1999*. Further information should be sought from the Department of Natural Resources and Mines before works commence.

Mechanical control

Stick raking or ploughing can be effective in removing standing plants. However, regrowth from stumps and/or increased seedling germination in disturbed soil is common and the site will require follow-up treatment.

Grubbing of small infestations—for example, along fence lines—can be a useful and effective method of removing plants, although this is time consuming.

Repeated slashing can also reduce the vigour of lantana, exhausting its stored resources and reducing its likelihood of re-shooting.

Some locations—for example, very steep inclines or gullies—are not suitable for mechanical control options because of the danger of overturning machinery and soil erosion.

Fire

Regular burning will reduce the capacity of plants to survive; however, initial kill rates are variable.

The effectiveness of this method will depend on the suitability of available fuel loads, fire intensity, temperature, relative humidity, soil moisture and season.

Pasture re-establishment can then provide competition to inhibit lantana seed germination. Fire is not recommended in non-fire tolerant vegetated areas such as rainforest, or wooded or plantation areas.

A typical control program for fire may include:

- exclude stock to establish a pasture fuel load
- burning (may require a permit)
- sow improved pastures—consult your local Biosecurity Queensland officer for advice
- continue to exclude stock until pasture has established and seeded
- burn again in summer before rain and spot spray *Lantana camara* regrowth when > 0.5 m high and when it is actively growing (see Table 1).

Biological control

Since 1914, 32 biological control agents have been introduced into Australia in an attempt to control lantana. Eighteen have established, of which several insect species cause seasonal damage, reducing the vigour and competitiveness of lantana in some areas.

Biosecurity Queensland research programs continue to investigate agents suitable for release in Australia, and test the viability of these agents in an effort to identify more effective biological control agents.

It is important to remember that biological control alone should not be relied upon for managing lantana infestations. Consideration should be given to other available control techniques.

The four most important biological control agents are:

- **sap-sucking bug (*Teleonemia scrupulosa*)**
Found in dry areas from Cooktown to Wollongong, this small, mottled, bug feeds on the underside of leaves, growing tips and flower buds, causing the leaves to drop early and stopping the plant from flowering.
- **leaf-mining beetle (*Uroplata girardi*)**
Found in most lantana infestations from Cape Tribulation to Sydney as well as around Darwin, except in very dry or high altitude areas. The adult beetles are dark brown. They shelter in curled leaves and feed on the upper leaf surfaces. Larvae feed in leaves causing blotches to spread across the leaf. This beetle reduces plant vigour and can suppress flowering.
- **leaf-mining beetle (*Octotoma scabripennis*)**
Found in most lantana infestations from Atherton to Wollongong. Adults of this species feed on the upper leaf surface, while larvae feed and mine the centre of the leaf and cause blotches. This activity reduces plant vigour and can suppress flowering.
- **seed-feeding fly (*Ophiomyia lantanae*)**
Found from Cape Tribulation to Eden in New South Wales and also around Darwin and Perth. *Ophiomyia* is a small black fly that feeds on flowers and lays eggs on the green fruits. The maggots of the fly eat the seed and make the fruit unattractive to birds, reducing seed spread.

Other agents such as *Aconophora compressa* (a stem-sucking bug) and *Leptobyrsa decora* (a sap-sucking bug) have caused some damage in specific geographic areas.

Note: Landholders are advised not to consume their time collecting established insects for distribution. Due to their own ability to disperse, these insects will be periodically/seasonally present in areas that are climatically suitable for them.

Herbicide control

Herbicide recommendations for lantana are shown in Table 1. Users of herbicides have a legal obligation to read herbicide labels and use only the registered rates.

Variation in results can be a result of inconsistent application methods, mix rates or seasonal variation. Red-flowered and pink-edged red-flowered lantana are often considered the most difficult to control because their leaves are often smaller and tougher. However, herbicides can kill these varieties if you carefully follow application procedures.

For single-stemmed lantana, basal bark spraying and cut stump methods also give good results at any time of year (but best when the plant is actively growing). On multi-stemmed varieties, you will obtain best results by carefully applying herbicide to each stem.

When treating actively growing plants less than 2 m high, overall spraying of foliage to the point of run-off is recommended. Splatter gun techniques are also effective and particularly useful in hard-to-access areas. This is best done in autumn—when sap flows draw the poison down into the root stock, but before night temperatures get too cold.

Remove grazing animals from spray areas during and soon after treatment. Stress can cause increased sugar levels in the leaves of lantana plants, making them more palatable.

Landholders and contractors should check if the property is situated in a hazardous area. This prevents the use of some herbicides, as defined in the *Agricultural Chemicals Distribution Control Act 1966*.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit www.biosecurity.qld.gov.au.



Table 1. Herbicides for control of *Lantana camara*

Situation	Herbicide	Rate	Optimum time ¹	Comments
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Fluroxypyr 200 g/L (e.g. Flagship 200)	500 mL to 1 L/100 L water	October to April	Thorough wetting of plants is required, higher rate should be used for larger plants
	Fluroxypyr 333 g/L (e.g. Starane Advanced)	300–600 mL/100 L water		
	Fluroxypyr 400 g/L (e.g. Comet 400)	250–500 mL/100 L water		
Domestic areas, commercial, industrial and public service areas, agricultural non-crop areas, forests and rights-of-way	Glyphosate 360 g/L (e.g. Roundup Biactive, Glyphosate 360)	1 L/100 L water	October to April	Wet plant thoroughly Glyphosate affects any green plant it comes into contact with Glyphosate is available in a range of strengths Consult labels for rates for other glyphosate formulations
	Glyphosate 450 g/L (e.g. Glyder 450)	800 mL/100 L		
	Glyphosate 540 g/L (e.g. Roundup PowerMax)	660 mL/100 L		
	Glyphosate 700 g/kg (e.g. Macspred Dri 700)	500 g/100 L		
Agricultural non-crop areas, commercial and industrial areas, pastures and rights-of-way	2,4-D 300 g/L + Picloram 75 g/L (e.g. Tordon 75-D)	0.65 L/100 L water	March to May	Thoroughly wet foliage and soil around base of plant Legumes are affected if sprayed
Non-crop and rights-of-way	Dichlorprop 600 g/L (e.g. Lantana 600)	500 mL/100 L water	December to April	Must thoroughly wet all leaves Please refer to product label for situation details
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Triclopyr 300 g/L + Picloram 100 g/L + aminopyralid 8 g/L (e.g. Grazon Extra®)	350 mL to 500 mL/100 L water	Summer to autumn	Wet plant thoroughly Use the higher rate on plants over 1 m Legumes may be affected if sprayed
	Triclopyr 300 g/L + Picloram 100 g/L (e.g. Conqueror)			
Pastures, rights-of-way and industrial	2,4-D amine 625 g/L (e.g. Ken-Amine 625)	320 mL/100 L water	March to May	Use a coarse spray with sufficient pressure to penetrate canopy and wet stems as well as foliage. Spray at the end of a wet Summer (March to May). Defoliation should occur but respraying of new growth will be necessary in following Autumn. Broadcast grass seed and keep stock off following Summer to allow the pasture to establish. Damage may result to pasture legumes. Red-flowered lantanas are more resistant to 2,4-D
	2,4-D amine 700 g/L (e.g. Amicide Advance 700)	285 mL/100 L water Consult label for other formulations of 2,4-D		
Native pastures, rights-of-way, commercial and industrial areas	Metsulfuron-methyl 600 g/kg (e.g. Associate, Lynx® 600)	10 g/100 L water plus wetter	March to May	Plants up to 2 m tall Thoroughly wet all foliage and stems Spray should penetrate throughout the bush Addition of a wetting agent e.g. Pulse is recommended Results variable Not found effective in tropics Follow-up sprays are necessary
Native pastures, rights-of-way, commercial and industrial areas	Glyphosate 360 g/L (e.g. Weedmaster Duo, Glyphosate 360) plus Metsulfuron-methyl 600 g/L (e.g. Associate, Ken-Met 600) + tank mix	400 mL glyphosate 360 + 3 g metsulfuron/100 L water	March to May	Apply to actively growing bushes up to 2 m tall Spray to thoroughly wet all foliage and stems Spray to penetrate throughout the bush Do not apply during periods of summer drought stress Addition of a wetting agent e.g. Pulse is recommended
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Fluroxypyr 140 g/L + Aminopyralid 10 g/L (e.g. Hotshot)	500–700 mL/100 L water/100 L water	October to April	Apply to actively growing plants. Spray all foliage, including stems, to the point of run-off. Use the lower rate on seedlings and regrowth 0.5–1.2 m tall and the higher rate on plants 1.2–2 m tall
	(i) Basal bark (ii) Cut stump			
	Triclopyr 600 g/L (e.g. Garlon 600)	1 L/60 L diesel	Any time Best results when actively growing	(i) Apply to lower 40 cm of every stem Must ensure complete coverage around stem
	Triclopyr 240 g/L + Picloram 120 g/L (e.g. Access)			(ii) Cut close to ground level Immediately apply herbicide
	Picloram 44.7 g/L + Aminopyralid 4.47 g/L (e.g. Vigilant II® Herbicide Gel)	3–5 mm gel		(ii) If diameter of stump is > 20 mm, use a minimum of 5 mm gel thickness

Table 1. Herbicides for control of *Lantana camara* (continued)

Situation	Herbicide	Rate	Optimum time ¹	Comments
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Glyphosate 360 g/L (e.g. Roundup, Weedmaster Duo)	Undiluted	Any time Best results when actively growing	APVMA permit PER11463 (expires 30/06/2018) Prior to using the herbicides listed under PER11463 you must read or have read to you and understand the conditions of the permit To obtain a copy of this permit visit www.apvma.gov.au
	Splatter gun			
	Glyphosate 360 g/L (e.g. Weedmaster Duo, Glyphosate 360)	1:9 glyphosate + water	October to April	2 x 2 mL dose per 0.5 m height of lantana Addition of Pulse Penetrant may improve control
	Metsulfuron methyl 600 g/L (Associate, Lynx® 600)	2 g/L water	March to May	
	Aerial			Follow label directions for equipment and other requirements for aerial application
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Triclopyr 300 g/L + Picloram 100 g/L (e.g. Conqueror) or Triclopyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L (Grazon Extra)	10 L/ha	When actively growing	Helicopter only Minimum of 200 L water per ha Follow-up re-spray will be required Do not burn within six months of treatment
	Triclopyr 300 g/L + Picloram 100 g/L (e.g. Conqueror) or Triclopyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L (Grazon Extra) + 2,4-D amine 625 g/L (e.g. Ken-Amine 625)	1.5 L + 6 L 2,4-D /ha	When actively growing	Helicopter only Minimum of 200 L water per ha Follow-up re-spray will be required Do not burn within six months of treatment
Non-crop and rights-of-way	Dichlorprop 600 g/L (e.g. Lantana 600)	6–8 L/ha	When plant actively growing	

¹Optimum times are only a guide. *Lantana camara* must be actively growing for the herbicide to work.

Labels often recommend the additional use of a wetting agent or surfactant within the mix. Herbicides types vary in their selectivity against other species and soil residual.

Read the label carefully before use and always use the herbicide in accordance with the directions on the label.



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Fact sheets are available from Department of Agriculture and Fisheries (DAF) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at www.biosecurity.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DAF does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

Opuntoid cacti

Austrocyllindropuntia, *Cylindropuntia* and *Opuntia* species



Three types (genera) of opuntoid cacti have naturalised in Australia and are now considered Weeds of National Significance: *Austrocyllindropuntia*, *Cylindropuntia* and *Opuntia*. They are drought resistant because of their succulent nature, their lack of leaves and their thick, tough skins. These features result in plants that use the majority of their internal tissues for water storage and their outer parts to reduce water loss and damage by grazing and browsing animals. They can remain vigorous in hot, dry conditions that cause most other plants to lose vigour or even die. Some species develop underground bulbs that enable the plant to resist fire and mechanical damage.

Dense infestations compete with native vegetation, limiting the growth of small shrubs and groundcover species. The plant's sharp spines or barbs can cause injury to stock and native animals and contaminate wool and hides, reducing or preventing grazing activities and productivity.

Large stands of cacti provide harbour for pest animals, such as foxes and rabbits and, due to their spiny nature, can limit access for stock mustering and recreational activities. The spines are capable of causing serious injury to animals and humans.



Legal requirements

All Cholla cacti (*Cylindropuntia* spp.) and prickly pear (*Opuntia* spp.) not listed below are prohibited invasive plants and the *Biosecurity Act 2014* requires that all sightings to be reported to Biosecurity Queensland within 24 hours. By law, everyone has a general biosecurity obligation (GBO) to take all reasonable and practical steps to minimise the risk of these cacti spreading until they receive advice from an authorised officer.

The following species are restricted invasive plants under the Act. The Act requires that all sightings of these cacti must be reported to Biosecurity Queensland within 24 hours of the sighting. By law, everyone has a GBO to take all reasonable and practical steps to minimise the risk of spread of these cacti until they receive advice from an authorised officer.

- Hudson pear (*Cylindropuntia rosea* and *C. trunicata*)
- Jumping cholla (*Cylindropuntia prolifera*)
- Bunny ears (*Opuntia microdasys*)
- Riverina pear (*Opuntia elata*)

The following species are restricted invasive plants under the *Biosecurity Act 2014*. They must not be given away, sold, or released into the environment without a permit. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

- Cane cactus (*Austrocyllindropuntia cylindrical*)
- Eve's pin cactus (*Austrocyllindropuntia subulata*)
- Coral cactus (*Cylindropuntia fulgida*)
- Devil's rope pear (*Cylindropuntia imbricata*)
- Snake cactus (*Cylindropuntia spinosior*)
- Common pest pear, spiny pest pear (*Opuntia stricta* Syn. *O. inermis*)
- Drooping tree pear (*Opuntia monacantha* Syn. *O. vulgaris*)
- Tiger pear (*Opuntia aurantiaca*)
- Velvety tree pear (*Opuntia tomentosa*)
- Westwood pear (*Opuntia streptacantha*)

Indian fig (*Opunia ficus-indica*) is not prohibited or restricted invasive plant.

At a local level, each local government must have a biosecurity plan that covers invasive plants and animals in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

Opuntoid cacti vary significantly in their form and habit, ranging from low-growing shrubs under 50 cm to erect trees up to 8 m tall.

Plants are normally leafless succulent shrubs. Stems are divided into segments (pads or joints) that are flat and often incorrectly called leaves.

Young shoots have true leaves resembling small fleshy scales that fall off as the shoot matures.

Flowers are large, normally seen during spring and can be yellow, orange, red, pink, purple or white depending on the species. Fruits vary between species and can be red, purple, orange, yellow or green.

Areoles (spots with clusters of spines) are found on both the pads (joints, segments) and fruit. In addition to spines, areoles often have clusters of sharp bristles (glochids) and tufts of fibre ('wool'). Each areole contains a growing point that can produce roots or shoots.

Hudson pear (*Cylindropuntia rosea* and *C. trunicata*)

Densely branched cactus up to 1.5 m tall and 3 m wide. Spines are extremely sharp, 4.5 cm long, enclosed in whitish papery sheaths. Spines on *C. rosea* are white and *C. trunicata* are brown. Flowers on *C. rosea* are pink-purple, and on *C. trunicata* they are pink-yellow, 5 cm wide. Stem segments are green to grey-green, cylindrical, 90 cm long, 4 cm wide. Fruit is oval-shaped, up to 4.5 cm long, yellow when ripe.

Jumping cholla (*Cylindropuntia prolifera*)

Low shrub 0.4 to 1 m tall. Spines 7–11, 1–2 cm long, light to dark brown, interlacing, white to light tan sheath firmly attached. Flowers are rose to magenta, 25–30 mm wide. Stem segments are dull green to greenish grey, whorled or subwhorled, cylindrical, 4–15 cm long, 4–5 cm wide, waxy flaky surface when dry. Prominent tubercles and segments easily detached. Fruit obovoid to globose, solitary or forming chains, up to 20–50 mm long, green. Seed not seen in Australia.

Bunny ears (*Opuntia microdasys*)

Dense shrub 40–60 cm tall, occasionally more. Stems are pad-like, 6–15 cm long, 4–12 cm wide. No central stem, pads always grow in pairs, giving appearance of bunny ears. Has no spines, but instead has numerous white or yellow glochids (hair-like prickles), 2–3 mm long, in dense clusters. Flowers are yellow, 3 cm wide. Fruits are fleshy, globular, 3 cm long, red-purple.

Riverina pear (*Opuntia elata*)

Branched shrub with erect branches to 2 m tall. Spines absent or 1–3 short spines, whitish yellow present at some areoles. Flowers are orange, 3–4 cm wide. Stem segments are glossy green, sometimes with a purple tinge (especially around the areoles and margins). Often more than 2 cm thick, 5–25 cm long. Fruit club shaped, up to 6 cm long, purplish red.

Cane cactus (*Austrocyllindropuntia cylindrica*)

Dark green shrub, 0.5–1.5 m tall. Branches 35–40 mm diameter. Leaves on new growth, deciduous, 3–5 mm long, but up to 10 mm on regrowth. Spines without papery sheath, 3–6 major ones per areole, 9–25 mm long, and 3–4 minor ones, to 5.5 mm long. Flowers are red to red-orange. Fruit solitary or in small chains of 2–4. 30–60 mm long, dark green to yellow-green.

Eve's pin cactus (*Austrocyllindropuntia subulata*)

Robust shrub to 3 m tall. Branches 40–50 mm diameter. Spines without papery sheath, 1 per areole on new growth, additional smaller ones (up to five) developing in successive years, mostly 35–70 mm long. Flowers are pink. Stem segments are glossy green, sometimes with a purple tinge (especially around the areoles and margins). Often more than 2 cm thick, 5–25 cm long. Fruit large, solitary or in small chains of 2–4, green, 50–135 mm long.

Coral cactus (*Cylindropuntia fulgida*)

Coral cactus grows as a branching shrub 1–1.5 m high. The stems of coral cactus are divided into green cylinder-like pads that are fist-like and obtuse at their apex. Mature coral cactus pads widen, become distorted and wavy, and resemble a piece of coral. Areoles along the pads have a number of short white spines.

Coral cactus produces small (1–2 mm wide) scarlet flowers. The fruit is yellow-green and 2–5 cm wide.

Devil's rope pear (*Cylindropuntia imbricata*)

This open-branching shrub grows 1.5–3 m high. The stems are divided into hairless, dull green, cylindrical pads that vary up to 37 cm in length and are 3.5–5 cm thick. The pads have a series of short raised ridges that give them a twined, rope-like appearance. The areoles are found on these ridges and produce 3–11 pale yellow or white spines, with the longest being 2.5 cm long. Papery sheaths cover these spines.

The flowers are a dull, red-purple colour and found at the ends of pads. The yellow fruit resembles a small, 5 cm wide custard apple and has a spineless areole at the top.

Snake cactus (*Cylindropuntia spinosior*)

This open-branching shrub grows 1–2 m high. The stems are divided into hairless, dull green, cylindrical pads that vary up to 20 cm in length and are 3.5–5 cm thick. The pads have a series of short raised ridges that give them a twined rope-like appearance. The areoles are found on the bottom of these ridges and produce 5–10 pale yellow to brown spines, with the longest being 3 cm long.

The flowers are light red to dark rose and commonly 5–7 cm wide. Snake cactus produces fruit that is yellow and 2–5 cm wide.

Common pest pear, Spiny pest pear (*Opuntia stricta*)

This bushy, spreading plant grows up to 1.5 m high and forms large clumps. The stems are divided into oval, blue-green spineless pads 20 cm long and 10 cm wide. Areoles are in diagonal lines along the pads 2.5 cm to 5 cm apart and have a cushion of brown wool containing bristles but usually no spines. When spines occur they are stout, yellow and up to 4 cm long.

Flowers that are 7.5 cm wide, bright lemon yellow and green at the base. The fruit is oval-shaped, has a deep cavity on one end and tapers at the other. It is purple, 6 cm long and 3 cm wide, with carmine-coloured (dark red) seeds and a fleshy pulp.

Drooping tree pear (*Opuntia monacanta*)

This erect succulent shrub with fibrous roots grows up to 5 m high but is usually 2–3 m high. The branches are divided into glossy light green pads up to 45 cm long, 15 cm wide and 1.5 cm thick. The dark grey trunk grows up to 25 cm in diameter. Drooping tree pear gets its name because the upper segments tend to droop. The areoles on the older pads have 1–5 sharp spines about 5 cm long.

Small, scale-like leaves are found on areoles of very young pads and are quickly shed as the pad grows. Drooping tree pear produces yellow flowers that are 6 cm wide and have red markings on the back. The fruit is pear-shaped and 4–7 cm long with a green skin. The flesh of the fruit is red and pulpy and contains round seeds that are yellow or pale brown. The fruits have areoles with tufts of fine, barbed bristles.

Tiger pear (*Opuntia aurantiaca*)

This succulent low shrub with underground tubers usually grows 30–60 cm high. The stems are divided into very spiny, slightly flattened pads that are 1–30 cm long and 1–5 cm wide. The stems are dark green to purple and red in colour. The areoles have 3–7 brown barbed spines up to 4 cm long surrounded by tufts of short, fine bristles. The pads detach easily and are transported on the skins of animals. Small and scale-like leaves are found on areoles of immature pads.

Tiger pear produces 6 cm wide yellow flowers. The rarely formed fruits are pear-shaped and about 2.5 cm long. When ripe, they are red with purple markings.

Velvety tree pear (*Opuntia tomentosa*)

This tree-like plant forms a central woody trunk over 40 cm wide and grows up to 5 m high. The stems are divided into oblong pads that are dull green and velvety to touch due to the dense covering of short fine hairs. The pads are 15–35 cm long, 8–12 cm wide and 1.5–2 cm thick.

Young plants have 2–4 white or pale yellow spines located in the areoles with one spine reaching a length of 2.5 cm. The areoles usually become spineless as the plant matures. A more spiny variety does exist and has more than 50 spines in each areole on the trunk.

The flowers are a deep orange. The fruit is egg-shaped, about 5 cm long and 3 cm wide, and dull red. The top of the fruit is saucer-shaped with circular lines that meet in the centre and give the fruit a shrivelled appearance. The fruit produces many seeds within a reddish pulp.

Westwood pear or Cardona pear (*Opuntia streptacantha*)

Westwood pear is a shrub-like or tree-like plant that forms clumps by branching from the base and is usually 2–4 m high. The stems are divided into almost circular dull green pads, 25–30 cm long and 15–20 cm wide. The areoles have white spines that vary in number and size when the plant matures.

Young pads have 2–5 white spines 1–2 cm long, accompanied by two hair-like spines 0.5 cm long in the lower part of the areole. Spines increase in number (up to 20) and size (5 cm long) in areoles along the trunk of the plant.

The flowers are yellow and fruits are barrel-shaped, 6 cm long and 5 cm wide with a flat top. The fruit has a purple skin and a rind that is 1 cm thick. Fruits contain red seeds buried in a dark red (carmine) pulp.

Habitat and distribution

Native to the Americas, Opuntoid species are found throughout most Australian states and territories and there is potential for further spread.

In Queensland Opuntoid species are mainly found in low rainfall areas but can be found in gardens, along beaches and on off shore island.

Life cycle

Opuntoids reproduce both sexually and asexually. Birds and other animals readily eat the many seeded fruits and deposit seeds in their droppings. The seeds have hard seed coats that allow them to survive heat and lack of water. Asexual reproduction (cloning) of cacti occurs when pads (joints, segments) or fruits located on the ground take root and produce shoots.

Methods of spread

Animals and floods move broken pads long distances. These pads can survive long periods of drought before weather conditions allow them to set roots. People can spread cacti for ornamental plantings.

Control

Managing opuntoid cacti

The GBO requires a person to take reasonable and practical steps to minimise the risks posed by opuntoid cacti. This fact sheet provides information and some options for controlling opuntoid cacti.

Mechanical and fire control

Mechanical control using machinery is difficult because prickly pear pads can easily re-establish. A hot fire is an effective control method for dense prickly pear infestations. Before burning, consult Biosecurity Queensland to see if this practice is suitable for your pasture and land management practices.

Biological control

Investigations into biological control agents against prickly pear began in 1912. Over 150 insect species were studied throughout the world, with 52 species selected for transport to Queensland. Following intensive host specificity testing, 18 insects and one mite were released in Queensland. Nine insects and the mite remain established in Queensland. These species are:

Cactoblastis cactorum, a stem-boring moth

- *Dactylopius ceylonicus*, a cochineal mealy bug
- *Dactylopius opuntiae*, a cochineal mealy bug
- *Dactylopius confusus*, a cochineal mealy bug
- *Dactylopius tomentosus*, a cochineal mealy bug
- *Dactylopius austrinus*, a cochineal mealy bug
- *Chelinidea tabulata*, a cell-sucking bug
- *Tucumania tapiacola*, a stem-boring moth
- *Archlagocheirus funestus*, a stem-boring beetle
- *Tetranychus opuntiae*, prickly pear red spider mite.

These biological control agents continue to keep several prickly pear species under control. It is important to remember not all the agents attack all species.

The most successful of these agents were the moth *Cactoblastis cactorum* and five cochineal mealy bugs—*Dactylopius ceylonicus*, *D. opuntiae*, *D. confusus*, *D. tomentosus* and *D. austrinus*. The other agents are still around but not in sufficient numbers to provide control.

Cactoblastis cactorum (cactoblastis moth)

Larvae of this moth were introduced from Argentina in 1925. *Cactoblastis* proved to be the most effective agent against the common and spiny pest pears, destroying massive infestations in Australia. Larvae keeps these two pest pears controlled to an acceptable level most of the time, although it is less effective in some coastal and far western areas.

The larvae collectively eat out the contents of the pads, leaving empty pad skins and piles of mushy droppings. The orange and black larvae are occasionally observed on the outsides of pads. *Cactoblastis* also attacks most types of prickly pear but is not effective against them.

Dactylopius spp. (cochineal insects)

All female cochineal insects are small, sessile mealy bugs that spend their adult lives permanently attached to their host plants sucking plant juices. They are covered by a fine, white, waxy secretion and when crushed yield a carmine colouring. The adult males are small, free-flying insects that do not feed.

Dactylopius ceylonicus (monacantha cochineal, Argentine cochineal)

This South American mealy bug was released in 1914 and 1915 to control drooping tree pear. It destroyed the dense infestations existing at that time. It is specific to drooping tree pear and today remains the only effective biological control agent for drooping tree pear. This insect needs to be distributed manually.

Dactylopius opuntiae (prickly pear cochineal)

This mealy bug was introduced from Mexico and southern United States between 1920 and 1922. It is effective against common pest pear, spiny pest pear, velvety tree pear and Westwood pear and remains the main biological control agent against velvety tree pear and Westwood pear. This insect spreads slowly in nature and can be assisted manually.

***Dactylopius confusus* (prickly pear cochineal)**

This mealy bug was introduced from Florida and released in 1933 against spiny pest pear. It remains effective against spiny pest pear in central Queensland but spreads slowly. This insect can be spread manually.

***Dactylopius tomentosus* (devil's rope pear cochineal)**

This mealy bug was introduced from southern United States in 1925 and 1926. It is effective against devil's rope pear but works slowly.

***Dactylopius austrinus* (tiger pear cochineal)**

This mealy bug was introduced from Argentina in 1932. It is specific to and effective against tiger pear. It rapidly reduces tiger pear populations but dies out in a paddock after the destruction of tiger pear. It needs to be reintroduced after tiger pear regrows.

***Chelinidea tabulata* (prickly pear bug)**

This plant-sucking bug was introduced from Texas in 1921. It was effective against dense common pest pear before *Cactoblastis cactorum* was but is now relatively ineffective. This insect also attacks most other prickly pears. The adult is a pale brown bug up to 20 mm long that leaves characteristic round bleached spots on the surface of the cactus.

***Tucumania tapiacola* (prickly pear moth-borer)**

This moth was introduced from Argentina in 1934 against tiger pear. Its solitary larvae feed internally and eat out tiger pear pads with limited effect. It has been observed attacking common pest pear and harrisia cactus.

***Archlagocheirus funestus* (tree pear beetle)**

This stem-boring beetle was introduced from Mexico in 1935. It was effective against velvety tree pear and Westwood pear but has become rare since the dense stands of these prickly pears have gone.

***Tetranychus opuntiae* (prickly pear spider mite)**

This mite was introduced from southern United States and Mexico in 1922. It was effective against common pest pear but is now rare and difficult to find. It causes distinctive scar tissue formation around areoles.

Distributing biological control agents

Cactoblastis

Cactoblastis can be spread manually by distributing eggs or larvae. *Cactoblastis* moths lay chains of eggs (eggsticks) on prickly pear pads from January to February and from September to November. The eggsticks are distinguished from spines by their curved appearance.

1. Collect the fragile eggsticks carefully.
2. Glue single eggsticks to small pieces of paper using a starch-based adhesive.
3. Pin the egg papers to prickly pear pads. (Eggs take up to one month to hatch.)
4. Collect pads or plants in which larvae are obviously still active.

5. At a release site place all the collected plant material in a small part of the infestation.
6. Subsequent generations of moths will disperse through the infestation.
7. Follow up the biological control with either herbicide or mechanical treatment.

Cochineals

Because several cochineal insects affect some prickly pears and not others, it is essential to know what prickly pear you wish to control.

1. Identify your prickly pear type.
2. Find the same prickly pear type which is being attacked by a cochineal.
3. Collect pads of the prickly pear with the insects.
4. Place affected pads against unaffected prickly pears at the release site.
5. Follow up the biological control with either herbicide or mechanical treatment.

Tiger pear cochineal

Tiger pear cochineal is easy to multiply quickly after collection.

1. Carefully collect a reasonable quantity of unaffected tiger pear in a container (box or bucket).
2. Place a few pieces of cochineal-affected tiger pear into the same container.
3. Cover the container with a cloth and store under cover for a few weeks.
4. Check the cactus occasionally.
5. When most of the tiger pear in the container has cochineal, it is ready to distribute.
6. At the release site place affected pads against unaffected prickly pears.
7. Follow up the biological control with either herbicide or mechanical treatment.

Note: It is best to multiply tiger pear cochineal before release.

Herbicide control

Herbicide options available for the control of opuntoid cacti in Queensland are shown in Table 1.

Landholders and contractors should check if the property is in a hazardous area as defined in the *Agricultural Chemicals Distribution Control Act 1966* prior to spraying.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit www.biosecurity.qld.gov.au.

Table 1. Herbicides for the control of opuntoid cacti

Pest name	Situation	Herbicide	Rate	Method
Common prickly pear	Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way	Triclopyr 240 g/L + picloram 120 g/L (e.g. Access)	1 L/60 L diesel	Basal bark/cut stump Apply as an overall spray, wetting all areas of plant to ground level
	Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Triclopyr 300 g/L + picloram 100 g/L (e.g. Conqueror) or Triclopyr 300 g/L + picloram 100 g/L + aminopyralid 8g/L (Grazon Extra)	500 mL/100 L	Apply as a thorough foliage spray
		Triclopyr 600 g/L) e.g. Garlon 600)	3 L/100 L or 0.8 L/60 L diesel	
Coral cactus	Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way	Triclopyr 240 g/L + picloram 120 g/L (e.g. Access)	1 L/60 L diesel	Basal bark/cut stump Apply as an overall spray, wetting all areas of the plant to ground level
	Pastures, rights-of-way, commercial/industrial areas	Triclopyr 240 g/L + picloram 120 g/L (e.g. Access)	1 L/60 L diesel See permit PER13812 (expires 30/11/2017)	Paint stump immediately after cutting or spray basal bark
Tiger pear	Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way	Triclopyr 240 g/L + picloram 120 g/L (e.g. Access)	1 L/60 L diesel	Basal bark/cut stump Apply as an overall spray, wetting all areas of plant to ground level
	Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Triclopyr 600 g/L (e.g. Garlon 600)	3 L/100 L water or 0.8 L/60 L diesel	Apply as a thorough foliage spray
Drooping tree pear	Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way	Triclopyr 300 g/L + picloram 100 g/L (e.g. Conqueror) or Triclopyr 300 g/L + picloram 100 g/L + aminopyralid 8g/L (Grazon Extra)	500 mL/100L water	
	Non-crop areas around buildings, commercial and industrial areas, domestic and public service areas, rights-of-way	Amitrole 250 g/L + ammonium thiocyanate 220 g/L (e.g. Amitrole T)	1 mL/3 cm (inject) or 1 L/25 L (small plants/regrowth)	Tree pears may take up to 12 months to die Respraying may be needed in some cases Consult label
Velvety tree pear	Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way	Triclopyr 240 g/L + picloram 120 g/L (e.g. Access)	1 L/60 L diesel	Basal bark/cut stump Apply as an overall spray, wetting all areas of plant to ground level
	Non-crop areas around buildings, commercial and industrial areas, domestic and public service areas, rights-of-way	Amitrole 250 g/L + ammonium thiocyanate 220 g/L (e.g. Amitrole T)	1 mL/3 cm (inject) or 1 L/25 L (small plants/regrowth)	Tree pears may take up to 12 months to die Respraying may be needed in some cases Consult label
Spiny pest pear Westwood pear Devil's rope pear Snake cactus	Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way	Triclopyr 240 g/L + picloram 120 g/L (e.g. Access)	1 L/60 L diesel	Basal bark/cut stump Apply as an overall spray, wetting all areas of plant to ground level



Snake cactus (*Cylindropuntia spinosior*)



Coral cactus (*Cylindropuntia fulgida*)



Hudson pear (*Cylindropuntia rosea*)



Jumping cholla (*Cylindropuntia prolifera*)



Prickly pear (*Opuntia stricta*)



Bunny ears (*Opuntia microdasys*)



Tiger pear (*Opuntia aurantiaca*)



Riveria pear (*Opuntia elata*)



Drooping tree pear (*Opuntia monacanta*)



Devil's rope pear (*Cylindropuntia imbricata*)



This fact sheet is developed with funding support from the Land Protection Fund.

Fact sheets are available from Department of Agriculture and Fisheries (DAF) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at www.biosecurity.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DAF does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

Parthenium

Parthenium hysterophorus



Parthenium is a vigorous species that colonises weak pastures with sparse ground cover. It will readily colonise disturbed, bare areas along roadsides and heavily stocked areas around yards and watering points. Parthenium can also colonise brigalow, gidgee and softwood scrub soils. Its presence reduces the reliability of improved pasture establishment and reduces pasture production potential.

Parthenium is also a health problem as contact with the plant or the pollen can cause serious allergic reactions such as dermatitis and hay fever.

Parthenium is listed as a Weed of National Significance.

Legal requirements

Parthenium is a restricted invasive plant under the *Biosecurity Act 2014*. It must not be given away, sold, or released into the environment without a permit. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

At a local level, each local government must have a biosecurity plan that covers invasive plants and animals in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.



Description

Parthenium is an annual herb with a deep tap root and an erect stem that becomes woody with age. As it matures, the plant develops many branches in its top half and may eventually reach a height of 2 m.

Its leaves are pale green, deeply lobed and covered with fine soft hairs.

Small creamy white flowers occur on the tips of the numerous stems. Each flower contains four to five black seeds that are wedge-shaped, two millimetres long with two thin, white scales.

Life cycle

Parthenium normally germinates in spring and early summer, produces flowers and seed throughout its life and dies around late autumn. However, with suitable conditions (rain, available moisture, mild temperatures), parthenium can grow and produce flowers at any time of the year. In summer, plants can flower and set seed within four weeks of germination, particularly if stressed.

Methods of spread

Parthenium seeds can spread via water, vehicles, machinery, stock, feral and native animals and in feed and seed. Drought conditions aid the spread of seed with increased movements of stock fodder and transports.

Habitat and distribution

Parthenium is capable of growing in most soil types but becomes most dominant in alkaline, clay loam soils.

The plant is well established in Central Queensland and present in isolated infestations west to Longreach and in northern and southern Queensland.

Infestations have also been found in northern and central parts of New South Wales and it is capable of growing in most states of Australia.

Control

Managing parthenium

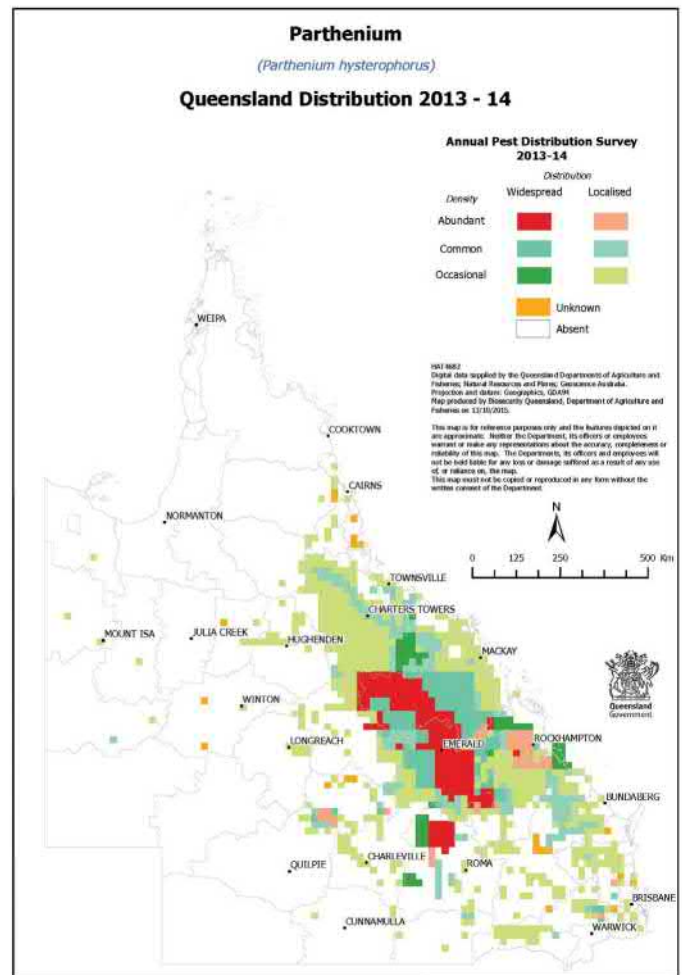
The GBO requires a person to take reasonable and practical steps to minimise the risks posed by parthenium. This fact sheet provides information and some options for controlling parthenium.

Prevention and weed seed spread

Pastures maintained in good condition, with high levels of grass crown cover, will limit parthenium colonisation. Drought, and the subsequent reduced pasture cover, creates the ideal window of opportunity for parthenium colonisation when good conditions return.

Vehicles and implements passing through parthenium infested areas should be washed down with water. Particular care should be taken with earthmoving machinery and harvesting equipment. The wash down procedure should be confined to one area, so that plants that establish from dislodged seed can be destroyed before they set seed.

Map 1. Distribution of parthenium in Queensland



Extreme caution should be taken when moving cattle from infested to clean areas. Avoid movement during wet periods as cattle readily transport seed in muddy soil. On arrival, cattle should be held in yards or small paddocks until seed has dropped from their coats and tails prior to their release into large paddocks. Infestations around yards can be easily spotted and controlled whereas infestations can develop unnoticed in large paddocks.

Particular care should be taken when purchasing seed, hay and other fodder materials. Always keep a close watch for the emergence of parthenium or other weeds on areas where hay has been fed out.

Property hygiene is important. Owners of clean properties should ensure that visitors from infested areas do not drive through their properties. If your property has parthenium on it, ensure that it is not spread beyond the boundary or further within the property.

Manual control

Hand pulling of small areas is not recommended. There is a health hazard from allergic reactions and a danger that mature seeds will drop off and increase the area of infestation.

Pasture management

Grazing management is the most useful method of controlling large-scale parthenium infestations. Maintain pastures in good condition with high levels of ground and grass crown cover. This may require rehabilitation of poor pastures, followed by a sound grazing maintenance program.

Sown pasture establishment—Poor establishment of sown pastures can allow parthenium colonisation.

Pasture agronomy—Aerial seeding prior to scrub pulling is normally beneficial.

Overgrazing—High grazing pressure caused by drought or high stock numbers decreases the vigour and competitiveness of pastures and allows the entry and spread of parthenium. Maintenance of correct stock numbers is most important in controlling parthenium.

Pastures spelling—In situations of serious infestation, pasture spelling is essential for rehabilitation. Total spelling is much more effective than simply reducing the stocking rate. However, overgrazing of the remainder of the property must be avoided.

The most appropriate time for pasture spelling is the spring–summer growing period, with the first 6–8 weeks being particularly important. If the condition of perennial grasses (native or sown) is low, spelling for the entire growing season may be required or introduced grasses may need to be re-sown. Herbicide treatment can hasten the rehabilitation process by removing a generation of parthenium seedlings and allowing grass seedlings to establish without competition. In the presence of parthenium, grass establishment is poor.

Grazing during winter should not increase the parthenium risk. Most tropical grasses are dormant and can tolerate moderate grazing during this period. However, parthenium may germinate and grow at this time.

Fencing—One of the main problems in controlling parthenium is the large paddock size and the variability of country within paddocks. The resulting uneven grazing pressures encourage parthenium to colonise the heavily grazed country. Ideally, similar land types should be fenced as single units. Fencing can be used to great effect to break up large paddocks, allowing more flexible management such as pasture spelling or herbicide application, options not available previously.

Burning—Burning is not promoted as a control strategy for parthenium. However, research suggests that burning for pasture management (e.g. woody weed control) should not result in an increased infestation if the pasture is allowed to recover prior to the resumption of grazing. Stocking of recently burnt areas known or suspected to contain parthenium decreases pasture competition and favours parthenium, ultimately creating a more serious infestation.

Biological control

The combined effects of biological control agents reduced the density and vigour of parthenium and increased grass production.

There are currently a number of insect species and two rust pathogens that have been introduced to control parthenium—a selection of these are outlined below. *Epiblema strenuana* is a moth introduced from Mexico established in all parthenium areas. The moth's larvae feed inside the stem, forming galls that stunt the plant's growth, reduce competitiveness and seed production.

Listronotus setosipennis is a stem-boring weevil from Argentina but is of limited success in reducing parthenium infestations.

Zygogramma bicolorata is a defoliating beetle from Mexico which is highly effective where present. It emerges in late spring and is active until autumn.

Smicronyx lutulentus (Mexico) lays eggs in the flower buds where the larvae feed on the seed heads. *Conotrachelus albocinereus* (stem-galling weevil from Argentina) produces small galls and is still becoming established in Queensland.

Bucculatrix parthenica (leaf mining moth from Mexico) larvae feed on leaves, leaving clear windows in the leaf. *Carmentia ithacae* is a stem boring moth from Mexico which is becoming established at favourable sites in the northern Central Highlands.

Puccinia abrupta is a winter rust from Mexico that infects and damages leaves and stems. It is currently established over a wide area from Clermont south. It requires a night temperature of less than 16 degrees and 5–6 hours of leaf wetness (dew). Sporadic outbreaks occur where weather conditions are suitable.

Puccinia melampodii is a summer rust from Mexico that weakens the plant by damaging the leaves over the summer growing season. It is currently established and spreading at a number of sites from north of Charters Towers to Injune in the south.

Herbicide control

Non-crop areas

Parthenium should be sprayed early before it can set seed. A close watch should be kept on treated areas for at least two years.

Small and/or isolated infestations should be treated immediately. Herbicide control will involve a knockdown herbicide to kill plants that are present and a residual herbicide to control future germinations. Repeated spraying may be required even within the one growing season to prevent further seed production.



Extensive infestations will require herbicide treatment in conjunction with pasture management. Timing of spraying is critical so that parthenium is removed when plants are small and before seeding has occurred. Grasses should be actively growing and seeding so that they can recolonise the infested area.

Table 1. shows the herbicides registered for parthenium control and application rates. All herbicides must be applied strictly in accordance with the directions on the label.

Cropping areas

Controlling parthenium in cropland requires selective herbicide use and/or crop rotations. For further information on parthenium control in crops consult your local biosecurity officer.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit www.biosecurity.qld.gov.au.

Table 1. Herbicides for the control of parthenium

Situation	Herbicide	Rate	Comments
Pastures, rights-of-way and industrial land	2,4-D as amine 625 g/L (e.g. Ken-Amine 625)	320 mL/100 L water	Spot spray Apply to young actively growing plants, ensuring thorough coverage
	2,4-D as amine 700 g/L (e.g. Amicide Advance 700)	285 mL/100L water	
Non agricultural areas (native pastures), commercial and industrial areas, rights-of-way	Aminopyralid 375 g/kg plus metsulfuron-methyl 300 g/kg (Stinger)	10 g/100 L water plus wetting agent Consult label	Spray to thoroughly wet all foliage but not to cause run-off
Fields and fallow, various crops (see label)	Atrazine 500 g/L (e.g. Kenso Atrazine 500)	3.6–6 L/ha Rate varies with situation Consult label	Boom spray. Pre and post emergent application Restrictions apply. Consult label for details of specific conditions. Max 3 kg a.i./ha/yr
Roadside and rights-of-way		6 L/ha	Boom spray. Pre and post emergent application Restrictions apply. Consult label for details of specific conditions. Max 3 kg a.i./ha/yr
Fields and fallow, various crops (see label)	Atrazine 900 g/kg (e.g. Atradex WG)	2–3.3 kg/ha Rate varies with situation Consult label	Boom spray. Pre and post emergent application Restrictions apply. Consult label for details of specific conditions. Max 3 kg a.i./ha/yr
Roadside and rights-of-way		3.3 kg/ha	Boom spray. Pre and post emergent application. Restrictions apply. Consult label for details of specific conditions. Max 3 kg a.i./ha/yr
Non-crop areas, commercial and industrial areas, pastures and rights-of-way	2,4-D 300 g/L + picloram 75 g/L (e.g. Tordon 75-D)	125 mL/100 L	Spot spray during rosette stage Use at least 3000 L/ha in dense infestations Consult label
		3 L/ha	Boom spray during rosette stage Consult label
Native pastures, rights-of-way, commercial and industrial land	metsulfuron methyl 600g/L (e.g. Associate)	5 g/100 L water + wetter	Hand gun. Spray to thoroughly wet all foliage but not to cause runoff
		7 g/ha + wetter	Boom spray. For pastures only. Treat in rosette stage. Consult label for details
Wheat, barley, triticale and cereal rye		5–7 g/h	Boom spray. Lower rate up to 4-leaf stage, higher rate 4-leaf stage to rosette
Native pastures, rights-of-way, commercial and industrial land	Triclopyr 75 g/L + metsulfuron-methyl 28 g/L (e.g. Zelam Brush Weed)	125 mL/100 L water	Spot spray plants from rosette to flowering Consult label for critical comments
Commercial and industrial areas, rights-of-way, around agricultural buildings	Hexazinone 750 g/kg (e.g. Velpar DF)	1 kg/ha 2 g/10 L/20 m ²	Boom spray or spot spray
Around agricultural buildings	Hexazinone 250 g/L (e.g. Velpar L)	3.5 L/ha or 7 L/10 L/20 m ²	
Grass pastures, fallows, various crop and non-crop situations (consult label for details)	Dicamba 500 g/L (e.g. Kamba 500) Dicamba 700 g/kg	Rates vary with situation Consult label	Boom spray or spot spray Consult label for details and critical comments

A number of the listed herbicides are available as different formulations, but some may not be registered for parthenium. Check the label for registration, rate and critical comments. Only use products that list parthenium on the label. The registered rates are for non-crop uses. Consult label for in-crop recommendations. For power hand spray or knapsack use, spray plants to the point of runoff.

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

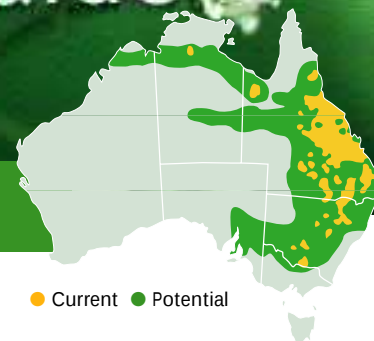
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Weed Management Guide

Parthenium weed –
Parthenium hysterophorus



Parthenium weed (*Parthenium hysterophorus*)

The problem

Parthenium weed is a *Weed of National Significance*. It is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts.

Parthenium weed is a major problem in rangelands and summer cropping areas of Queensland. It has a serious impact on the pastoral industry, costing farmers and graziers in Queensland over \$22 million a year in reduced production and increased management costs. Some people suffer severe allergic reactions

to the plant or its pollen; it can cause dermatitis, hay fever and asthma.

Parthenium weed is toxic to cattle, and meat from livestock that eat the weed can be tainted. It also threatens biodiversity in the Einasleigh Uplands bioregion and native grasslands in the central highlands of Queensland.

The weed

Parthenium weed is native to the subtropics of North and South America. It is a fast-maturing annual (or, under certain conditions, a short-lived perennial)

with a deep tap root and an erect stem that becomes woody with age. It may eventually reach a height of 2 m. Its leaves are pale green, branched and covered with soft fine hairs. The small white flowers (4 mm across) have five distinct corners and grow on the stem tips. Each flower produces four or five black wedge-shaped seeds that are 2 mm long with thin white scales.

Its large and persistent soil seedbank, fast germination rate and ability to undergo dormancy make it well adapted to semi-arid environments. It also releases chemicals that inhibit the germination and growth of pasture grasses and other plants.



Parthenium weed matures quickly and produces large quantities of seed (up to 100,000 seeds per plant).
Photo: Larry K. Allain

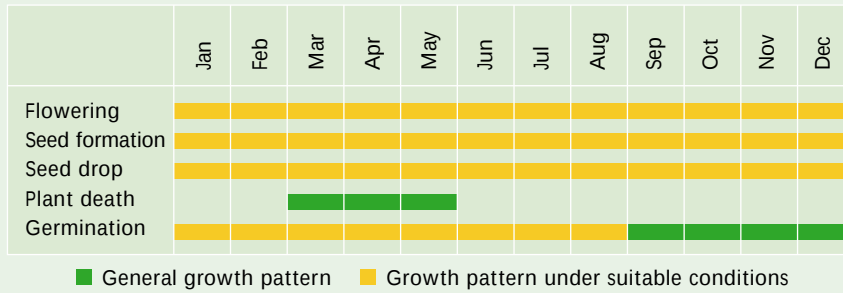
Key points

- Parthenium weed can germinate, grow, mature and set seed in four weeks.
- Parthenium weed is toxic to stock and contact with parthenium weed, particularly its pollen, can cause allergic reactions such as dermatitis, hay fever and asthma in people.
- The best way to prevent an allergic reaction to parthenium weed is to avoid contact with it, especially breathing pollen from flowering plants.
- Pay close attention to property hygiene. Weed seeds are spread very easily by vehicles, machinery, stock, grain and fodder.
- Use mechanical, chemical and biological control and grazing to manage parthenium weed.



Natural Heritage Trust
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Growth calendar



Parthenium weed normally germinates in spring and early summer, produces flowers and seed throughout its short life and dies in late autumn. However, with the right conditions (rain, available moisture, mild soil and air temperatures), parthenium weed can grow and produce flowers at any time of the year. In a good season, four or five generations may emerge. In summer, if plants are stressed (eg due to lack of water), parthenium weed can complete its life cycle in four weeks. Buried seeds have been found to last much longer than seed on the soil surface, and a significant proportion can still germinate after eight to ten years.



Parthenium weed can flower year round.
Photo: Colin G. Wilson

Potential distribution

Parthenium weed is best suited to areas with an annual summer rainfall greater than 500 mm. Based on climate suitability, it could potentially grow in all mainland states and territories.

What to do about it

Preventing spread into new areas

Preventing the spread of parthenium weed is the most cost-effective management strategy.

There is a high risk of spreading parthenium weed by the movement of vehicles, machinery, livestock, grain and other produce. Queensland has a number of washdown facilities and contractors are required to clean harvesters and other equipment before leaving the state. All harvesters are inspected as they cross the Queensland – New South Wales border.

How it spreads

Parthenium weed can produce large quantities of seed, up to 100,000 per plant. More than 340 million parthenium weed seeds per hectare can be present in the surface soil, compared to 120,000 native grass seeds.

The seed is easily spread by vehicles, machinery and animals, and in pasture seed, stock feed and water. Most long distance spread is in produce, vehicles and farm machinery. It can also be spread by flooding and by animals.

Parthenium weed was first discovered in Queensland in 1955. In a short time it spread from isolated outbreaks to establish core infestations across the Central Highlands of Queensland and into New South Wales and the Northern Territory.

In Queensland it grows best on alkaline, clay-loam to heavy black clay soils but tolerates a wide variety of soil types. It aggressively colonises areas with poor groundcover and exposed soil such as wastelands, roadsides and overgrazed pastures. It does not usually become established in undisturbed vegetation or vigorous pastures. Drought, and subsequent reduced pasture cover, create the ideal opportunity for parthenium weed to establish. Flooded country is also very prone to parthenium weed distribution and flooded pastures may need to be spelled from grazing to gain their competitive edge.



Parthenium weed can germinate, grow, mature and set seed in four weeks.
Photo: Sheldon Navie

Where it grows

Parthenium weed infests more than eight million hectares of central Queensland with serious outbreaks in the south and north of the state. Outbreaks, many of which have been controlled, have been found throughout New South Wales as far south as the Victorian border.

Property hygiene is also important. Double-check machinery (including the interior of the vehicle) moving onto your property and drive visitors around in your own vehicle. Always wash down vehicles and machinery in the same area to allow easy follow-up control of any seeds that may germinate. Ensure that service provider vehicles (eg telephone, electricity, gas) are free of parthenium weed seed.

Avoid moving cattle in wet weather as they readily transport seed in muddy soil. When new stock arrive on a property, hold them in yards or small paddocks to let seed drop from their coats and tails before releasing them into large paddocks. Always feed stock in the same area to contain weeds imported in contaminated fodder.

When you are buying hay or seed, be aware of what you are buying. In Queensland landowners are required to supply a vendor declaration to state whether their produce is free of parthenium.

Recent experience with parthenium weed

The Queensland Department of Natural Resources and Mines and the Parthenium Action Group have developed management and control techniques for parthenium weed, which include a combination of biological control agents, pasture management, cultivation and herbicides. Small infestations can be eradicated by early detection and monitoring. An ongoing commitment is needed to remove any seedlings and ensure new infestations do not establish. The extent of parthenium weed in New South Wales has been significantly reduced in recent years; all known roadside infestations have been suppressed and all known infestations on private land are under active control. In the Northern Territory, parthenium weed has been eradicated from previous infestations on the Roper River, at Katherine and in the Gulf of Carpentaria. However, although the area infested with parthenium weed is being reduced, the number of new infestations is increasing.



Large parthenium weed infestation in central Qld.
Photo: Qld DNRM

Control of new outbreaks

Once parthenium weed has been positively identified, treat isolated patches immediately with herbicides recommended by the local council weeds officer. Watch the area closely for at least seven years as repeated spraying may be necessary to kill new germinations. Don't pull up plants by hand, particularly if they have already set seed. There is a danger that mature seeds will drop off the plant and increase the area of infestation.

Control in pasture...

Control in pasture requires timely herbicide application and pasture management. Conservative stocking to keep a good pasture cover is the best way of controlling large-scale parthenium weed infestations and preventing new infestations in clean areas. Areas where stock congregate, such as watering points, often have low groundcover and are highly susceptible to parthenium infestation. To overcome this problem, establish several stock water points per paddock and rotate stock between them.

Breaking up large paddocks by fencing into single units of similar land type can even out grazing and thus avoid bare patches where weeds can invade. It also allows more flexible management



Parthenium weed's large and persistent soil seedbank and fast germination rate make it well adapted to semi-arid environments.
Photo: Colin G. Wilson

strategies, such as spelling pasture and applying herbicide.

...and control in crops

Parthenium weed is becoming a significant problem in crops due to the threat to exports from contaminated grain or other produce. Once in a crop it is very difficult to eradicate, so try to keep crops clean by spraying selective, pre-emergent herbicides where possible and cleaning equipment and machinery such as harvesters. Do not purchase seed that does not comply with the relevant seed Acts. For further information on parthenium weed control in crops, consult your local crop agronomist.

Herbicides

Timing of chemical control is critical. Parthenium weed should be treated when plants are small and have not produced seed, and when grasses are actively growing to recolonise the infested area (eg early summer). Maintaining competition is important for control of parthenium weed, so spraying with a selective herbicide that will not kill other species is recommended. Keep a close watch on treated areas for at least seven years and spot spray isolated outbreaks. A number of herbicides are recommended for parthenium weed control. Contact your local authority for details.

Weed control contacts

State / Territory	Department	Phone	Email	Website
ACT	Environment ACT	(02) 6207 9777	EnvironmentACT@act.gov.au	www.environment.act.gov.au
NSW	NSW Agriculture	1800 680 244	weeds@agric.nsw.gov.au	www.agric.nsw.gov.au
NT	Dept of Infrastructure, Planning and Environment	(08) 8999 5511	weedinfo.ipe@nt.gov.au	www.nt.gov.au
Qld	Dept of Natural Resources and Mines	(07) 3896 3111	enquiries@nrm.qld.gov.au	www.nrm.qld.gov.au
SA	Dept of Water, Land and Biodiversity Conservation	(08) 8303 9500	apc@saugov.sa.gov.au	www.dwlbc.sa.gov.au
Vic	Dept of Primary Industries/Dept of Sustainability and Environment	136 186	customer.service@dpi.vic.gov.au	www.dpi.vic.gov.au www.dse.vic.gov.au
WA	Dept of Agriculture	(08) 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au
Australia wide	Australian Pesticides and Veterinary Medicines Authority	(02) 6272 5852	contact@apvma.gov.au	www.apvma.gov.au

For up-to-date information on which herbicides are registered to control parthenium weed and the best application methods and dosages, contact your state or territory weed management agency or local council. This information varies from state to state and from time to time. Contact details are listed above, including contacts for the Australian Pesticides and Veterinary Medicines Authority, which hosts the PUBCRIS database. This database contains information on all herbicides that are registered for use on weeds in each Australian state and territory.

When using herbicides always read the label and follow instructions carefully. Particular care should be taken when using herbicides near waterways because rainfall running off the land into waterways can carry herbicides with it. Permits from state or territory Environment Protection Authorities may be required if herbicides are to be sprayed on riverbanks.

Mechanical removal

Ploughing the weed in before plants reach flowering stage and then establishing pasture may be effective. Before crops are planted, parthenium weed is normally ploughed in, or pre-emergent herbicides can be used.

Biological control

Biological control of parthenium weed has been investigated in Australia for more than 20 years. Nine insect species and two rusts have been released. Most insects and both rusts have established.

Biological control is one tool that forms part of an integrated management program for large-scale scattered and dense infestations. However, biological control on its own will not eradicate parthenium weed infestations.

The leaf beetle *Zygogramma bicolorata* and the stem moth *Epiblema strenuana* cause the most damage. The beetle emerges in late spring and is active until autumn. The moth is established in all parthenium weed areas. Its larvae (grubs) feed inside the stem, stunting the plant's growth and reducing its competitiveness and seed production. Other species are: a stem boring weevil from Argentina,

Listronotus setosipennis, which is having limited success; a seed-feeding weevil, *Smicronyx lutulentus*, which lays eggs in the flower buds, leaving the newly hatched grubs to feed on the seed heads; a leaf mining moth, *Bucculatrix parthenica*, from Mexico, whose grubs feed on the leaves of parthenium weed; a stem-galling weevil, *Conotrachelus albocinereus*, from Argentina, which is still becoming established; and *Carmentia ithacae*, a stem boring moth from Mexico released from quarantine in 1999 and still becoming established in the Central Highlands.

Seasonal conditions and the need for green plants for insect survival play a major role in the effectiveness and abundance of biological control agents. This is highlighted during long dry periods



The leaf beetle *Zygogramma bicolorata* emerges in late spring and is active until autumn.
Photo: Rachel McFadyen

when insect populations are reduced and need time to recover.

Puccinia abrupta, a winter rust from Mexico, infects and damages leaves and stems. It is established over a wide area in Queensland, south from Clermont. The release program for a second rust, *Puccinia melampodii*, a summer rust, began in 1999 and is continuing. Its establishment has been hindered by drought but further releases have been made in some areas following better rainfall. Its impact is expected to improve if rainfall increases



The leaf beetle *Zygogramma bicolorata* can remove virtually all of parthenium weed's foliage.
Photo: Rachel McFadyen

in the areas infested with parthenium weed. The rust weakens the plant by damaging the leaves over the summer growing season.

Field collection and distribution of biological control agents will help reduce local parthenium weed infestations. For best results a nursery site to raise biological control agents should be developed. Good nursery sites can be as simple as a leaking pipe or tank. Other ideal sites are infested black soil creek flats, gullies or swampy areas. At the same time, ensure that your nursery site does not become a source for further parthenium



The distinctive branched leaves are covered with soft, fine hairs.
Photo: Sheldon Navie

weed infestations. Contact your state/territory weed management agency or local council for assistance in collecting and rearing biological control agents for parthenium weed.

Burning

Burning is not a useful control strategy for parthenium. However, research suggests that burning for other purposes (eg woody weed control) will not result in an increased infestation of parthenium so long as the pasture is allowed to recover before stock are introduced. Stocking of recently burnt areas known or suspected to contain parthenium weed decreases competition, ultimately creating a more serious infestation. Permits may be required to burn, so check with your state/territory weed management agency or local council.

Legislation

Parthenium weed is declared a noxious weed in all mainland states and territories, and landowners are required to control it.

Its introduction into Australia is prohibited. Legislation introduced into Queensland recently makes it a legal requirement for suppliers of stock, machinery, soil, water or other products likely to transport weed seeds to complete a declaration stating whether or not the material is clean of parthenium weed. In New South Wales landowners must report the presence of parthenium weed to the local control authority within three days. This agency will then advise the necessary action to be taken to eradicate the infestation.

Acknowledgments

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Maps: Australian Weeds Committee.

...case study

Management of parthenium weed at Mt Panorama

While parthenium weed is certainly something landholders should try and prevent invading their properties, it can be managed. This is the message from Gail Godwin Smith, project officer with the Parthenium Action Group. Gail and her husband Howard Smith are farmers and graziers at Rolleston in central Queensland.

In 1988, when Howard and his family bought 'Mt Panorama', it was infested with parthenium weed. Today, they regard the weed as an indicator species which appears if pasture is being overgrazed.

'Mt Panorama' has been a trial property for the release of biological control agents, two of which (the *Zygogramma* beetle and summer rust) have had a big impact on the weed.

However, changing management practices has been the major factor in controlling parthenium, says Gail. The main infestations on the property now occur along waterways. Many of these waterways have been fenced off to allow native vegetation to compete with parthenium and they are grazed seasonally to reduce any fire risk.

Favourable seasonal conditions allow spelling of paddocks and rotation of cattle so that healthy pasture is maintained and no one paddock gets eaten out.

Parthenium weed is no longer a problem on the cultivated country either, where minimum tillage is used and pre-emergent herbicide sprayed for other weeds.

The Smith family recognise that they are unlikely to totally eradicate parthenium

weed, and so they must live with it and manage it appropriately.



Changing management practices has been the major factor in controlling parthenium weed on 'Mt Panorama'.
Photo: Qld DNR

How to control parthenium weed

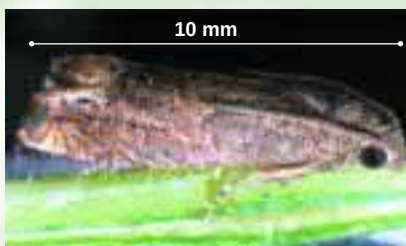
Quick reference guide

Prevention

Maintaining good hygiene on your property can prevent the spread of parthenium weed seed – check vehicles and machinery moving onto the property, drive visitors around in your own vehicle and always wash down vehicles and machinery in the same place. Always feed stock in the same area to contain weeds carried in contaminated fodder and place new stock into a small holding paddock until seed has dropped from their coats and tails.

New outbreaks

Treat immediately with a herbicide recommended by the local council weeds officer. Apply herbicides when plants are actively growing and before they set seed; keep a close watch on treated areas for at least seven years. Spot spray one to two weeks after



The stem moth, *Epiblema strenuana*, is established in all parthenium weed areas.
Photo: Rachel McFadyen

rain, when plants are large enough to see but before they produce seed.

In pasture

Stock conservatively to keep a good pasture cover, which will help prevent invasions of parthenium weed. Some strategies to improve pasture competition are to: spell pastures in the growing season, use rotational grazing, and spray herbicide to encourage grass seed production and reseeding.

To overcome high grazing pressure points, establish several stock water points per paddock and rotate stock between them.

Fencing different land types enables better grazing management.

In crops

Keep crops free of parthenium weed by spraying selective, pre-emergent herbicides where possible and cleaning equipment and machinery such as harvesters.

Biological control

Researchers in Queensland have located and tested a number of biological control agents against parthenium weed. Landowners can collect and distribute biological control agents to help reduce local infestations.

Control options

Type of infestation	Chemical	Biological	Physical	Pasture management	Mechanical
Light – few plants, over a small area	Spot spray before seeds set.	Not suitable.	Hand pulling is not recommended because of the health risks associated with parthenium weed. Use strategic fencing to separate different land types and improve grazing management.	Maintain good pasture cover by not overgrazing.	Some landholders have achieved success by ploughing in parthenium weed in the rosette stage before it seeds, but this must be followed up by sowing a crop or direct seeding perennial pasture.
Medium – plants over a medium area	Spray before seeds set.	Release biological control agents.			
Heavy – large number of plants	Spray before seeds set.	Establish a nursery site for biological control agents if possible.			

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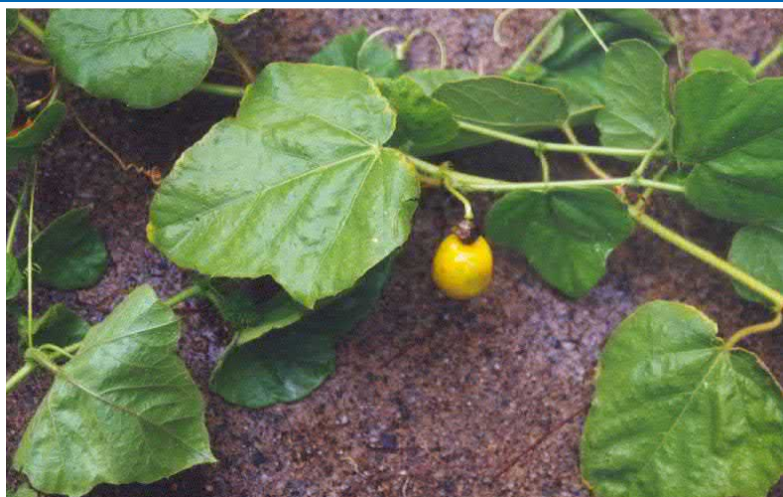
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Stinking passion flower

Passiflora foetida



Stinking passion flower is a native of South America. Though less common in south-east Queensland than the other weedy passionfruit species (corky passion and white passion), stinking passion flower is an invasive environmental weed which can be found invading forest edges, coastal vegetation, roadsides and disturbed areas.

In northern Queensland, stinking passion flower is more widespread, and is commonly found invading disturbed areas along river and creek banks. If left unchecked, this environmental weed has the ability to increase its current distribution, spreading into other natural areas and becoming more invasive. Stinking passion flower is also considered a weed of crops and pastures. It contains cyanic acid and is suspected to be poisonous to people and livestock.

Legal requirements

Stinking passion flower is not a prohibited or restricted invasive plant under the *Biosecurity Act 2014*. However, by law, everyone has a general biosecurity obligation (GBO) to take reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control.

Local governments must have a biosecurity plan that covers invasive plants and animals in their area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.



Description

Stinking passion flower is a climbing vine, densely covered in soft, sometimes sticky hairs. Leaves can have 3–5 pointed lobes, and are between 3–10 cm long. The typical passionfruit-like flowers have cream petals, white, pink or purple centres, and are from 3–5 cm across. Unlike commercial passionfruits, the fruits on this species are dry orange berries, 1–3 cm across, and enclosed in prickly outer leaves (bracts). As its name suggests, the whole plant has an unpleasant smell.

Management strategies

Hand pulling vines when the soil is moist is the most reliable form of control.

Herbicide control

There is no herbicide currently registered for control of stinking passion flower in Queensland; however, an off-label use permit allows the use of various herbicides for the control of environmental weeds in non-agricultural areas, bushland and forests.

See Table 1 for treatment options allowed by the permit.

Prior to using the herbicides listed under PER11463 you must read or have read to you and understand the conditions of the permit. To obtain a copy of this permit visit www.apvma.gov.au

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit www.biosecurity.qld.gov.au.

Table 1. Herbicides for the control of stinking passion flower

Method	Herbicide	Rate	Registration details	Comments
Cut stump	glyphosate 360 g/L	1 part product to 2 parts water	APVMA permit PER11463 Permit expires 30/06/2018	
Basal bark spray	triclopyr 240 g/L + picloram 120 g/L	1 L per 60 L diesel		
Spot spray	triclopyr 200 g/L + picloram 100 g/L	500 mL per 100 L water		
Cut stump	triclopyr 200 g/L + picloram 100 g/L	50 mL per 1 L		Cut stumps to less than 10 cm above the ground.

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

This fact sheet is developed with funding support from the Land Protection Fund.

Fact sheets are available from Department of Agriculture and Fisheries (DAF) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at www.biosecurity.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DAF does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.



Castor oil plant

Ricinus communis



Castor oil plant spreads over sandy soil areas, creek banks and gullies. This can lead to a significant loss of prime grazing land.

The seeds of castor oil contain ricin, a poison that is extremely toxic to livestock and humans. Leaves have a lesser amount of toxin. Symptoms of poisoning in animals usually do not appear for a few hours or several days.

Seeds cause gastrointestinal disorders and leaves tend to cause neuromuscular disorders. Poisoning in livestock is rarely reported though, as castor oil plant is seldom grazed by stock when other pasture plants are available.

Also, small amounts of the plant will induce an immunity to poisoning.

Legal requirements

Castor oil is not a prohibited or restricted invasive plant under the *Biosecurity Act 2014*. However, by law, everyone has a general biosecurity obligation (GBO) to take reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control.



Queensland
Government

Local governments must have a biosecurity plan that covers invasive plants and animals in their area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

Castor oil plant is a tall, branching perennial shrub that grows to 3 m high and occasionally higher. It has stout, hollow branches that are a dull pale green or red. Older branches and trunks turn greyish.

Large leaves (10–60 cm across) are widely spaced on the branches and grow on long, stout, hollow stalks attached off-centre to the bottom of the leaf. Each leaf is divided into 7–9 pointed triangular segments with toothed edges and conspicuous veins. Leaves are glossy, dark reddish-green when young and glossy green when mature.

The flowers are crowded in stout, erect spikes in the forks of the upper branches. Female flowers are in the upper part of the spikes and male flowers at the base.

Female flowers develop into fruit about 2.5 cm across that are covered with soft green or red spines. The fruit have three segments, each segment containing one large, mottled, smooth seed. When ripe, the fruit explode violently and throw the seeds a distance of several metres.

The name castor oil plant is sometimes mis-applied to bellyache bush (*Jatropha gossypifolia*). Bellyache bush can be found in similar habitats but is usually smaller than castor oil plant; has leaves with only three smooth, rounded

lobes; and has small, smooth fruits found in clusters in the upper parts of the plant.

Habitat and distribution

Castor oil plant is native to Africa and Asia, and is now naturalised throughout Australia. It is often abundant along watercourses and floodplains, disturbed or waste land, and roadsides. It may be common locally after heavy rains or floods.

Control

Individual plants or small infestations may be removed by cultivation or hand-pulling. Broadscale infestations may require spraying with herbicides to control the plant.

Herbicides registered for the control of castor oil plant are provided in Table 1. Note that a number of 2,4-D formulations are available, but some do not include registration for castor bean plant. Check label carefully for correct rates.

In addition Fluroxypyr has been found to be very effective and some formulations are permitted in certain situations under PER11463.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit www.biosecurity.qld.gov.au.

Table 1. Herbicides for the control of castor oil plant

Situation	Herbicide	Rate	Registration details	Comments
Pastures, rights-of-way and industrial	2,4-D amine 625 g/L (e.g. Ken-Amine 625)	3.4 L/ha Check label for other formulations		Foliar (overall spray) Add wetting agent Spray plant to point of run-off
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Garlon 600/Triclopyr	1.7 L per 100 L diesel		Basal spray around entire base of plant to a height of 40 cm when plant is actively growing Cut stump at any time of year, but treat stump immediately after cutting
Non-agricultural areas, domestic and public service areas, commercial and industrial areas, bushland/native forests, roadsides, rights of way, vacant lots, wastelands, dunal and coastal areas	Fluroxypyr 200 g/L (e.g. Fluroxypyr 200)	50 mL/10 L water	APVMA permit PER11463 Permit expires 30/06/2023	Foliar spray (backpack) Read permit and label carefully
	Fluroxypyr 333 g/L (e.g. Starane Advanced)	30 mL/10 L water		

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

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Fact sheets are available from Department of Agriculture and Fisheries (DAF) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at www.biosecurity.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DAF does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.



Prickly acacia

Vachellia nilotica subsp. *indica* (Benth) Kyal and Boatwr



Prickly acacia was introduced into Queensland for shade and fodder. Prickly acacia infestations favour bore drains and water courses where trees spread out onto adjacent grassland. Trees along bore drains use valuable water, make maintenance of bore drains more costly, and provide seed to further increase the spread of prickly acacia. As a tree increases in size it outcompetes pasture for water.

Thorny thickets interfere with mustering, movement of stock and access to water.

Prickly acacia is a threat to biodiversity through the transformation of natural grasslands into thorny scrub and woodlands. Prickly acacia also causes soil degradation by facilitating erosion.

Prickly acacia has been recognised in Australia as a Weed of National Significance.



Prickly acacia is a restricted invasive plant under the *Biosecurity Act 2014*. It must not be given away, sold, or released into the environment without a permit. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

Description

The young shrubs form dense thorny thickets, while mature trees are usually single stemmed, with spreading branches that have lost most of their thorns.

Leaves are finely divided and fern-like, with four to ten pairs of leaf branches and ten to twenty pairs of small, narrow, green leaves on each branch. Pairs of stout thorns, usually 1–5 cm long, grow at the base of the leaves.

Flowers are golden-yellow, ball-shaped, about 1 cm across, grow on stems from leaf joints with two to six flowers per group. Pods are 10–15 cm or longer, flat, with narrow constrictions between the seeds, grey when ripe.

Flowering generally occurs late February and continues through to June. Pods ripen and fall from late October through to January. Seeds germinate after significant rainfall in late spring and summer. Seedling growth can be rapid and trees flower and set seed with two to three years after germination under ideal conditions.

Stock, particularly cattle, are the main agents for dispersing seed. The seed takes six days to travel through the gut so stock moved by road transportation can disperse seed over large distances. Water can also disperse pods during floods.

There are widespread infestations of prickly acacia in areas of north-west and central-west Queensland. The variety of *Vachellia nilotica* has been cultivated in many parts of tropical Queensland for its shade and the fodder value of leaves and pods, and is now naturalised in many areas.

Prickly acacia

(*Acacia nilotica*)

Queensland Distribution 2013 - 14

Annual Pest Distribution Survey 2013-14

Distribution

Durability	Widespread	Localised
Abundant		
Common		
Occasional		

Unknown
Absent

1074687
Digital data supplied by the Queensland Departments of Agriculture and Fisheries, Natural Resources and Water, Queensland Australia. Projection and datum: GDA94, UTM, Zone 55S. Map produced by Biosecurity Queensland, Department of Agriculture and Fisheries on 13/10/2015.

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QUEENSLAND GOVERNMENT

Several million hectares of the Mitchell grass plains are infested with prickly acacia. Major areas of infestation occur from Barcaldine north to Hughenden and west to Longreach, Winton and Julia Creek.

Prickly acacia is also found in the lower Gulf of Carpentaria region between Burketown and Normanton, at coastal locations including Bowen, Ayr and Rockhampton, in the Central Highlands and isolated occurrences elsewhere.

Prickly acacia has the potential to grow in most areas of Queensland, and about one-third of the state is well-adapted for prickly acacia growth.

Managing prickly acacia

The GBO requires a person to take reasonable and practical steps to minimise the risks posed by prickly acacia. This fact sheet provides information and some options for controlling prickly acacia.

The following strategies are recommended for landholders to limit the spread of prickly acacia.

Map prickly acacia areas on your property before commencing control:

- a coordinated management strategy can then be devised.

1. **Try to eliminate all prickly acacia along bore drains, creeks and dams:**
 - these trees will produce seeds in most years
 - one medium-sized tree can produce 175 000 viable seeds per year
 - seeds can remain viable in the soil for at least seven years.
2. **Consider replacing open bore drains with piped water:**
 - trees along bore drains are the main seed producers
 - additional advantages of controlled waters are that supplements can be administered to animals via water.
3. **Clean up either least infested paddocks or seeding trees first:**
 - preventing the problem is easier than curing it
 - good management involves keeping some paddocks clean.
4. **Do not let cattle or sheep graze where mature pods are available (pods ripen from October onwards):**
 - insects can destroy much of the seed on the ground
 - cattle relish pods and spread the seed throughout paddocks and properties.
 - sheep and goats also spread prickly acacia by regurgitating seed.
5. **Incorporate strategic fencing to contain prickly acacia:**
 - seeds are primarily spread by stock.
6. **Run sheep instead of cattle in prickly acacia-infested paddocks, wherever possible:**
 - sheep graze seedlings more heavily than cattle.
7. **Quarantine cattle and sheep when moving them from infested paddocks to clean areas:**
 - prickly acacia seed can take up to six days or more to pass through an animal
 - seed also travels in mud packs on animals' feet.
8. **Do not let trees become thick:**
 - trees reduce grass production
 - as many as six plants per m² may be lying dormant in the soil underneath prickly acacia stand.
9. **Do not overgraze:**
 - conserve perennial grasses
 - a good stand of grass should reduce establishment of prickly acacia seedlings by competing for soil moisture and nutrients.
10. **Supplement animals with nitrogen at critical stages (e.g. lambing, weaning or in drought)**
 - dry Mitchell grass pastures usually have inadequate levels of protein for optimum production, especially in the case of pregnant and lactating animals. When prickly acacia is removed, consider providing supplements of non-protein nitrogen such as urea.

Mechanical control

Grubbing

Grubbing is ideal for large areas of scattered to medium density infestations. Wheeled tractors are usually used with a scoop or grubbing attachment. This method requires a tractor of around 80 hp. Trees greater than 15 cm in diameter can be difficult to grub out. Grubbing is best undertaken from May to September or before pod drop.

Pushing

Pushing with dozers or loaders is useful for large areas of medium density infestation. Timing of this method should be restricted to May-September to lessen the establishment of seedling regrowth or during drought conditions. Massive seedling emergence may occur in areas around permanent waters and drainage lines.

Stickraking

This technique utilises a stickrake with cutter bars attached to the bottom of the tines. Timing should be restricted to May-September or during drought conditions. Costs vary depending on the density of plants, terrain, operator skills and machinery used. This method gives immediate results and clean country.

Double chain pulling

This method is adopted by those with high density prickly acacia. It is effective against established stands but not plants below 40 mm in basal diameter.

Timing is important and the technique is best applied in the second year of drought, or before the first pod drop coming out of drought. Chaining along drainage lines and waterways is not recommended due to the high seed loads and the high probability of re-establishment.

Biological control

Six insects have been introduced into Australia as biological control agents against prickly acacia with two of these establishing and providing some benefit. The beetle *Bruchidius sahlbergi* established successfully and is now widespread. Seed predation is generally low but may reach up to 80% where mature pods are available. The leaf-feeding caterpillar *Chiasmia assimilis* has not established in western Queensland but is exerting pressure on prickly acacia in coastal locations. Recent surveys in India have identified potential new agents which will be subject to host-testing studies prior to release.

Native insect attack and dieback

Prickly acacia is attacked by native insects associated with Australian native acacias and other native plants. Generally, leaf-feeding, sap-sucking, root, pod and seed feeding insects attack actively growing prickly acacia. Bark and wood-feeding insects (including borers and twig-girdlers) prefer stressed and dying plants. Native insects can weaken prickly acacia and can contribute to the death of plants when other stresses are involved.

Since the 1970s, dieback of large areas of prickly acacia has occurred throughout western Queensland infestations. The causal factors remain unclear but may involve: water stress during dry seasons and drought, high salt concentrations in soils, root predation by cicada nymphs, and attack by insects and fungal diseases on stressed plants. The University of Queensland is currently undertaking dieback trials using fungal pathogens.

Herbicide control

Basal bark spray

For stems up to 10 cm diameter, carefully spray around the base of the plant to a height of about 30 cm above ground level. Thoroughly spray into all crevices. Large trees may be controlled by spraying to a height of up to 100 cm above ground level. The best time for treatment is autumn.

Cut stump treatment

At any time of the year, cut stems off horizontally as close to the ground as possible and immediately swab or spray the cut surface and stem with the herbicide mixture.

Soil-applied treatments

Soil-applied herbicides are taken up by the roots of plants after rainfall. The major benefit of this method is the speed and ease of application and suppression of new seedlings in treated area. Prickly acacia is a deep rooted plant with the canopy acting as a funnel for rainfall. It is best to apply these herbicides as close to the trunk as possible, preferably when rainfall is likely to occur within a few months. October to January is the best application period.

Foliar (overall) spraying

Foliar spraying of seedlings and young plants to 2 m high may be undertaken with Starane Advanced® mixed with water and a wetting agent. This method is a useful and relatively cheap follow-up control option.

Bore drains (Desert channels)

A bore drain is generally a man-made open earth channel that carries water from a bore to a particular point such as a stock trough or turkey's nest dam. Heaviest infestations of prickly acacia plants normally occur along bore drains tending to produce a large number of pods annually. When treating a bore drain the water needs to be temporarily diverted away from the channels or dam for 24 hours prior to herbicide application. Diuron is then sprayed along a 1-m strip of mud along the sides of the bore drains. The artesian water source is to be returned slowly to the drain 72 hours after initial diuron application. Water flowing past treated drains must also bypass house rainwater tanks and desirable trees for seven days after reopening the drain. To allow maximum uptake of the diuron by prickly acacia roots the drains should not be delved for a minimum of two weeks after treatment.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit www.biosecurity.qld.gov.au.



Table 1. Herbicides for the control of prickly acacia

Situation	Herbicide	Rate	Comments
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Fluroxypyr 200 g/L (e.g. FMC Starane 200)	Refer to product label for rate for specific formulation	Basal bark/cut stump Basal bark only when plant is actively growing and up to 10 cm basal diameter; or cut stump at any time of year and all plant sizes (swab or spray stump within 15 seconds of cutting)
	Fluroxypyr 333 g/L (e.g. Starane Advanced®)		
	Fluroxypyr 400 g/L (e.g. Comet® 400)		
	Triclopyr 600 g/L (e.g. Garlon 600®)	500 mL/60L diesel	
	Triclopyr 240 g/L+ picloram 120 g/L (e.g. Access®)	1 L/60L diesel	Any time of year Basal bark plants up to 10cm basal diameter; or cut stump and all plant sizes (swab or spray stump within 15 seconds of cutting)
Around agricultural buildings and in pasture situations	Hexazinone 250 g/L (e.g. Velpar L®, Bobcat SL®)	4 mL/spot, 1 spot for each metre of height	Soil applied (hand application) Apply October-March for best results For seedlings/bushes/trees up to 5 m tall Avoid damage to off target species – refer to product label for product restraints and critical comments
Grazing land	Tebuthiuron (e.g. Clearview 200GR®, Tebulan 200GR®)	1.5 g/m ²	Avoid damage to off target species – refer to product label for product restraints and critical comments
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Fluroxypyr 200 g/L (e.g. FMC Starane 200) Fluroxypyr 333 g/L (e.g. Starane Advanced®) Fluroxypyr 400 g/L (e.g. Comet® 400)	Refer to product label for rate for specific formulation	Foliar (overall) spraying For seedlings and young plants up to 2 m high Add uptake spraying oil
Grazing land	Tebuthiuron 200 g/kg registered for aerial application (e.g. Clearview)	10–15 kg/ha	Aerial application Use the high rate on dense growth or heavy clay soils Refer to product label for product restraints and critical comments
	Diuron 500 g/L (e.g. Diuron 500SC®) Diuron 900 g/kg (e.g. Diuron 900WG)	64 L/ha 36.5 kg/ha Consult label for details	Bore drains (Desert Channels) DO NOT apply between 1 December and 30 March each year DO NOT apply more than once per calendar year DO NOT open drains for 72 hours following treatment DO NOT apply if heavy rains are predicted within three days of application Application should be limited to 1 m strips along the sides of bore drains Withholding period – do not allow animals to drink water from treated bore drains for three days, before slaughter for human consumption

Landholders and contractors should check if the property is situated in a hazardous area. This prevents the use of some herbicides, as defined in the *Agricultural Chemicals Distribution Control Act 1966*.

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.



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