Biodiversity Impact Assessment for Environmental Authority (EA0001399) Amendment

Surat Gas Project (SGP) North Girrawheen Development Stage 1

Prepared for:
Arrow Energy Pty Ltd

Document Information

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Contents

Appendices

Figures

Tables

1.0 Introduction

Attexo Pty Ltd (Attexo) has been engaged by Arrow Energy Pty Ltd (Arrow Energy) to undertake an assessment of biodiversity impacts associated with the development of the Surat Gas Project (SGP) North to inform an application to amend the approved Environmental Authority (EA0001399) under the *Environmental Protection Act 1994* (EP Act). Specifically, amendments are being sought to authorise impacts associated with the Girrawheen Development Stage 1 (the Project) of the SGP North gasfield which involves the construction of 214 wells and associated supporting activities and additional infrastructure on the following tenements:

- PL305;
- PL491; and
- PL492.

The SGP North EA also covers PL304, PL494 and PL1044 however, no works are proposed on these tenements at this time.

Attexo has been engaged to undertake the following to inform an amendment application under the EP Act:

- assess the ecological values of the EA amendment area;
- calculate anticipated impacts on these values associated with the updated Project design;
- confirm the extent to which these impacts are already approved or trigger an amendment to the current EA; and
- where the impacts are not already approved under the current EA, assess and report on the likely significance of those impacts.

This report has been prepared specifically to support the amendment application documentation for the SGP North EA.

1.1 Project description

The SGP North Project will deliver natural gas to the QGC Bellevue Delivery Point and comprises a number of petroleum leases located to the north-east of the township of Miles, Queensland. The proposed EA amendment seeks to authorise impacts associated with the following infrastructure:

- 214 wells, comprising primarily vertical wells with deviated wells being implemented where required to manage surface constraints;
- 12 water monitoring bores;
- Right of Ways (ROWs) for the construction of gathering lines, access tracks and a water transfer export pipeline (water trunkline);
- the Girrawheen field compression station (FCS) and gas engines to power the facility;
- a hybrid gas/solar power station;
- a temporary accommodation camp;

- a water transfer station;
- communication towers;
- minor road and intersection upgrades;
- access tracks;
- a warehouse, offices and laydown yards;
- gravel pits; and
- stygofauna investigation monitoring bores.

The area in which this infrastructure is proposed is referred to as the SGP North EA amendment area throughout this report. For the purposes of this assessment, values and impacts have been reported over a defined 'Area of Interest' (AOI) around the development footprint (refer **Figure 1.1**) which is based on a 2 km buffer of proposed infrastructure clipped to the relevant tenements of the EA.

1.2 Scope of this report

The scope of this report includes the following matters relevant to the EA amendment:

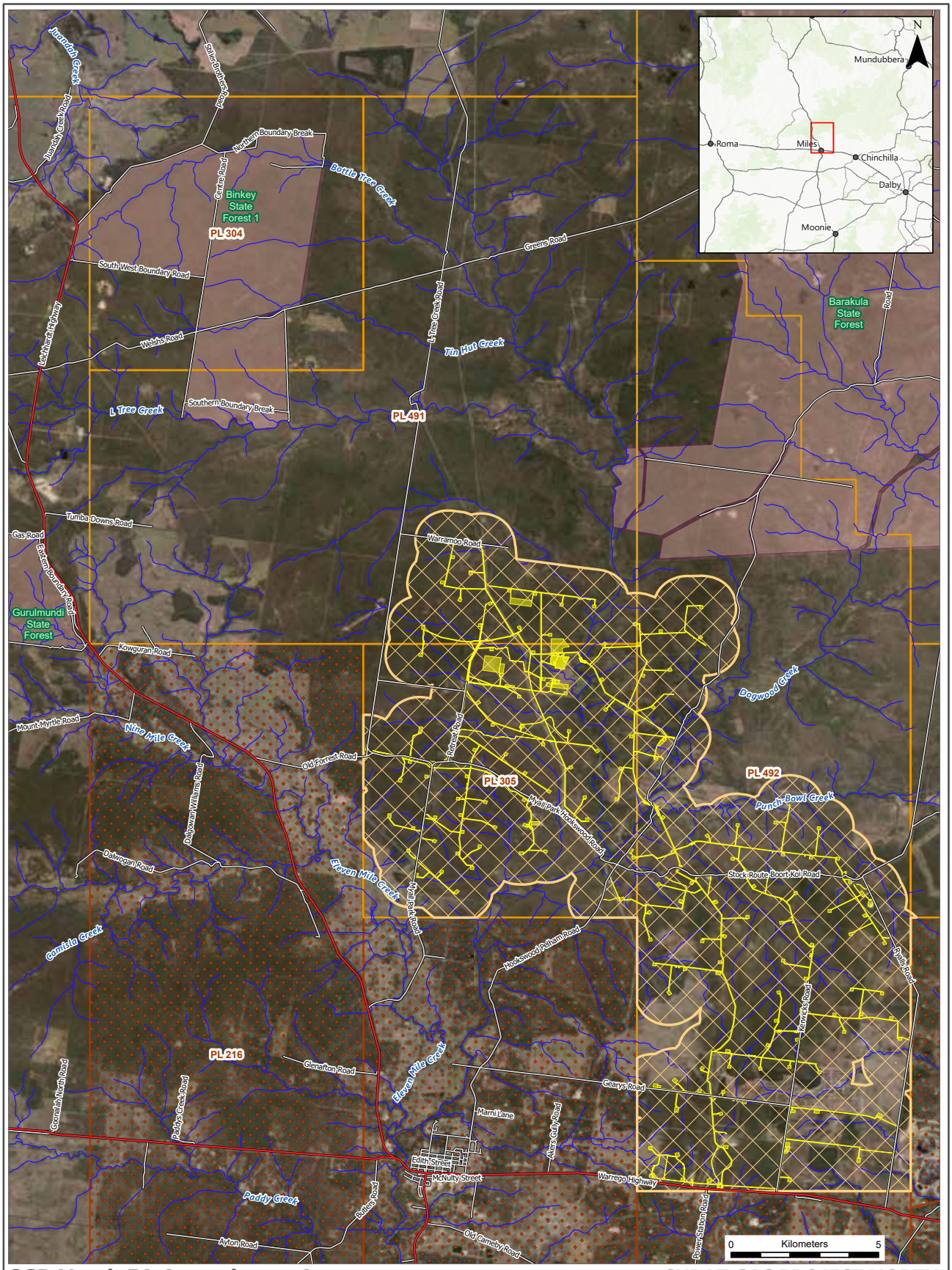
- a review of desktop biodiversity information and ecological field surveys of the EA amendment area to identify any new (i.e. previously unassessed) values relevant to the amendment application (e.g. records and habitat values for species such as Koala, Greater Glider and Painted Honeyeater that were unlisted at the time of the original EA application and approval);
- the calculation of predicted impacts on Environmentally Sensitive Areas (ESAs) protected under the EP Act;
- the calculation of predicted impacts on Prescribed Environmental Matters (PEMs) protected under the *Environmental Offsets Act 2014* (Qld)(EO Act);
- an analysis of the extent to which these predicted impacts are already approved under the existing SGP North EA and identification of any further impacts that would trigger the requirement to amend it; and
- an impact assessment for all trigger values, including previously unassessed biodiversity values identified through the desktop assessment.

1.2.1 Limitations

In undertaking the analysis, Attexo has relied on spatial data and data extracts provided by Arrow Energy between 13 March and 27 March 2024 (Stage 1 Rev C). Any subsequent amendments have not been incorporated into the assessment. For the purposes of this report, Attexo notes the following limitations:

- by agreement with Arrow Energy, all well pads are assumed to constitute 'essential petroleum activities' as defined in the SGP North EA. It is Attexo's understanding that there are some well pads that exceed the size limits imposed by the definition however, Arrow Energy is proposing to authorise these by amending the definition rather than authorise each individually through the inclusion of a despite clause.
- it is understood that all gathering ROWs and other linear corridors have a width of less than 40 m and are compliant with Condition (Biodiversity 5).

- Attexo understands that Arrow Energy is seeking to have impact locations removed from *Schedule F, Table 3 – Significant residual impacts to prescribed environmental matters*. As such, no reference to specific PLs has been incorporated into this table; impact values pertain to the SGP North Stage 1 Project only.



SGP North EA Amendment Area

SURAT GAS PROJECT NORTH

- Highway
- Local Road
- Watercourse
- Area of Interest
- Indicative infrastructure layout (Rev C)
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)
- State forest

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REVIEWED: KR **DRAWN:** JT **SCALE (A3):** 1:120,000 **DATE:** 4/04/2024 **DWG No:** ARR-002_024 **FIGURE 1.1**

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Data Source:Department of Resources, Dept.of Environment and Science, Esri, TomTom, Garmin, FAO, NOAA, USGS, Earthstar Geographics, Esri, USGS

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1.3 Regulatory Framework

1.3.1 *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)

The Environmental Impact Statement (EIS) for the broader SGP was assessed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in 2013. Maximum disturbance limits to core habitat for Matters of National Environmental Significance (MNES) listed under the EPBC Act at the time of the approval are conditioned in Table 1 of the EPBC approval (EPBC 2010/5344) (included as **Appendix A**).

Disturbance to the habitat of MNES species and communities already approved under EPBC 2010/5344 has not been considered further in the current assessment. However, impacts on MNES are included in the assessment where a species that has been historically recorded in the EA amendment area has been listed as conservation-significant under both the EPBC Act and Queensland *Nature Conservation Act 1992* subsequent to the original approval in 2013.

Specifically, the following MNES species have been included in the assessment:

- *Homoranthus decumbens* – listed as 'endangered' in February 2013;
- Koala, *Phascolarctos cinereus* – first listed in April 2012; upgraded to 'endangered' in February 2022;
- Greater Glider, *Petauroides volans volans* – listed as 'endangered' in July 2022;
- Glossy Black Cockatoo (south-eastern), *Calyptorhynchus lathami lathami* – listed as 'vulnerable' in August 2022;
- Painted Honeyeater, *Grantiella picta* – listed as 'vulnerable' in July 2015;
- Diamond Firetail, *Stagonopleura guttata* – listed as 'vulnerable' in March 2023;
- Brigalow Woodland Snail, *Adclarkia cameroni* – listed as 'endangered' in December 2016; and
- Dulacca Woodland Snail, *Adclarkia dulacca* – listed as 'endangered' in December 2016.

1.3.2 *Environmental Protection Act 1994* (Queensland)

The primary approval governing the operation of the SGP North Project at the State level is the Environmental Authority (EA0001399) issued under Queensland's *Environmental Protection Act 1994* (see **Appendix B**). The EA as currently in force was issued on the 1 October 2021 and authorises up to 588 gas production wells and up 650 km of gathering pipelines across PL304, PL305, PL491, PL492, PL494 and PL1044.

The existing EA was approved on the basis of a concept or 'reference' design, which has now been subject to further engineering design and the application of the avoidance principle in the mitigation hierarchy with additional ecology survey data. Arrow Energy is seeking to amend the SGP North EA to reflect impacts associated with the current design.

The primary conditions protecting the biodiversity values of the SGP North area are contained in Schedule F of the SGP North EA. A number of amendments are being sought to these conditions to authorise impacts associated with the development of the SGP North gasfields and associated infrastructure. Details of the proposed amendments are provided in **Section 5.0**.

1.3.2.1 Petroleum activities

The SGP North EA defines three categories of petroleum activities which are used to restrict the kinds of activities that can be undertaken in ESAs and their protection zones. These are 'low impact petroleum activities' that involve limited ground disturbance, 'essential petroleum activities' and 'petroleum activities'.

A summary of the types of activities proposed for the development of the Project and their corresponding definitions is provided in **Table 1.1**.

Table 1.1 Petroleum activities proposed for Girrawheen Development Stage 1

Infrastructure type	Essential petroleum activity	Petroleum activity
Well pads	✓	-
ROW (Gathering)	✓	-
Supporting Access Tracks	✓	-
Field Compressor Station (FCS)	-	✓
Water transfer station	-	✓
Proposed quarries and borrow pit	-	✓
Extra work area (pad)	-	✓
Extra work area (pipeline infrastructure)	-	✓
Extra work area	-	✓
Laydowns	-	✓
Communication Tower	-	✓
Warehouse, facility, camp	-	✓
Camp	-	✓

1.3.2.2 Conservation status of Regional Ecosystems

The Regional Ecosystem Description Database (REDD) lists Regional Ecosystem (RE) types by their biodiversity status (BD status) and the vegetation management class (VM class) of each. The BD status is based on an assessment of the condition of remnant vegetation in addition to the criteria used to determine the class under the *Vegetation Management Act 1999* (VM Act). It is used for a range of planning and management applications including the determination of Environmentally Sensitive Areas (ESAs) that are used for the regulation of the mining and petroleum industry through provisions in the EP Act. For the purposes of the current assessment:

- ESAs are based on the BD status of a given RE type, with 'endangered' REs mapped as Category B ESAs and 'of concern' by BD status mapped as Category C ESAs; and

- Prescribed environmental matters (PEMs) are based on VM class.

1.3.2.3 Essential Habitat

Under the definitions in the SGP North EA, 'essential habitat' is a Category C ESA only where it is for an endangered or vulnerable species of wildlife, and only to the extent that it has been validated as 'essential habitat' by ground-truthing surveys in accordance with the *Vegetation Management Act 1999* (VM Act). For the purposes of this report, Queensland Government 'essential habitat' mapping has been adopted as the basis for the assessment of impacts to essential habitat.

Similarly, essential habitat only constitutes a PEM where it is for an animal or plant that is listed as critically endangered, endangered, or vulnerable under the NC Act (see Schedule 2 of the EO Regulation). An area of essential habitat for a near threatened species only constitutes a PEM for the EO Act where it is being impacted by a development being assessed under the *Planning Act 2016* that triggers consideration of State Code 16 (Clearing of native vegetation) as set out in Schedule 2 of the EO Regulation.

Schedule F, Table 1 contains references to 'essential regrowth habitat' however, there is no definition of this included in the SGP North EA.

Essential Habitat impacts in relation to this EA amendment are discussed further in **Section 5.1**.

1.3.3 Environmental Offsets Act 2014

Under the Queensland Environmental Offsets Framework implemented by the *Environmental Offsets Act 2014* (EO Act) and associated legislation, an environmental offset is required where a significant residual impact occurs to a Matter of State Environmental Significance (MSES). MSES are prescribed in Schedule 2 of the EO Regulation and include:

- an area of habitat for an animal that is endangered, vulnerable or special least concern ('protected wildlife habitat');
- vegetation communities listed as 'endangered' or 'of concern' Regional Ecosystem types under the VM Act;
- essential habitat (as mapped by the Department of Environment, Science and Innovation (DESI));
- an area that is or is not shown as a high risk area on the flora survey trigger map that contains plants that are endangered or vulnerable wildlife;
- regulated vegetation that intersects with wetlands and watercourses;
- connectivity values;
- wetlands of high ecological significance;
- protected areas (including nature refuges);
- declared fish habitat areas and waterways providing for fish passage; and
- legally secured offset areas.

Within the EA process under the EP Act, significant residual impacts on these MSES are authorised via their inclusion in *Schedule F, Table 3 – Significant residual impacts to prescribed environmental matters* (PEMs) (refer **Section 5.2**).

1.3.4 Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act) provides for the gazettal of protected areas including nature refuges, prescribes classes of wildlife and sets out restrictions on the taking or harm to native wildlife without a valid permit. Threatened flora and fauna species have been assessed in terms of those with potential to occur in the SGP North EA amendment area. Classes of wildlife recognised under the NC Act include:

- Extinct in the Wild;
- Critically endangered;
- Endangered;
- Vulnerable;
- Near Threatened;
- Special Least Concern.

It is noted that habitat for a near threatened species does not constitute an ESA, nor is it a PEM under the EO Act. The presence or potential presence of a near threatened species triggers requirements under the NC Act that are approved and managed separately to the EA. Therefore, the occurrence or potential occurrence of near threatened species or their habitat does not trigger any requirement to amend the SGP North EA.

Similarly, habitat for a plant classed as Special Least Concern does not constitute a PEM or ESA however, habitat for a Special Least Concern animal is a PEM for the purposes of the EO Act. As such, the presence of Special Least Concern plants has been noted however, only Special Least Concern fauna species have been included in the PEMs table.

1.3.4.1 Protected Plants Framework

Under the Queensland Government's Protected Plants Framework, where non-exempt clearing of protected plants in the wild is proposed within a high risk area, a proponent is required to complete a flora survey prior to any clearing. The main objective of the flora survey is to locate any extinct, extinct in the wild, critically endangered, endangered, vulnerable or near threatened plants within a clearing impact area. Pre-clearance surveys are typically undertaken within 12 months prior to construction to support an application for a clearing permit under the NC Act where required.

1.3.5 Vegetation Management Act 1999

Petroleum activities do not require permits under the VM Act as clearing is regulated through the EA process under the EP Act. Where appropriate, the VM Class of REs is referred to in the assessment. The VM Class is used to define PEMs for the purposes of the EO Act.

2.0 Methodology

The description of ecological values in the EA amendment area is based on a combination of desktop assessment (historical and more recent), field assessments and Project-specific predictive habitat modelling (habitat mapping rules). Details of these assessments have been provided below.

A recent desktop assessment was undertaken in March 2024 to identify ecological values potentially relevant to the SGP North EA amendment area. The intent of the desktop assessment was to identify ESAs and PEMs relevant to the SGP North EA amendment area, including threatened and migratory species of conservation significance that have been listed since the current SGP North EA was approved (1 October 2021).

2.1 Description of general ecological values

Desktop assessments for the current assessment involved a review of Queensland Government mapping to identify the presence of landscape ecological values and Matters of State Environmental Significance (MSES) in the SGP North EA amendment area. This included reviews of:

- the protected area estate;
- connectivity values (Queensland Statewide Corridors mapping);
- catchment and waterway values (Queensland major watercourse lines mapping, watercourse identification map, MSES – high ecological value waters);
- wetland values (MSES – high ecological significance wetlands mapping, wetland protection areas);
- waterways providing fish passage;
- legally secured offset areas;
- designated precincts in strategic environmental areas;
- fish habitat areas;
- marine plants; and
- highly protected zones of State marine parks.

2.2 Description of terrestrial flora values

Terrestrial vegetation and flora values described in this report have been derived from both desktop assessments and field surveys undertaken since the original Environmental Impact Statement (EIS) for the SGP was submitted in 2013. A summary of these assessments is provided below.

2.2.1 Desktop assessment

Desktop assessments for the current assessment involved a review of:

- project-specific ground-truthed RE (GTRE) mapping undertaken by suitably qualified ecologists for Arrow Energy and threatened flora records maintained in Arrow Energy's GIS;

- The Department of Climate Change, the Environment, Energy and Water's (DCCEEW) Protected Matters Search Tool (PMST) (based around four point searches in the northern, central (2 points) and southern portions of the SGP North EA amendment area (results included in **Appendix C**);
- DESI WildNet database to identify previously recorded flora species within the SGP North area plus a 50 km buffer. Search results from March 2024 (based around four point searches in the northern, central (2 points) and southern portions of the SGP North EA amendment area) are included in **Appendix C**; and
- Queensland Government mapping products, including certified Regional Ecosystem Mapping (Version 13) and Protected Plants Trigger Mapping.

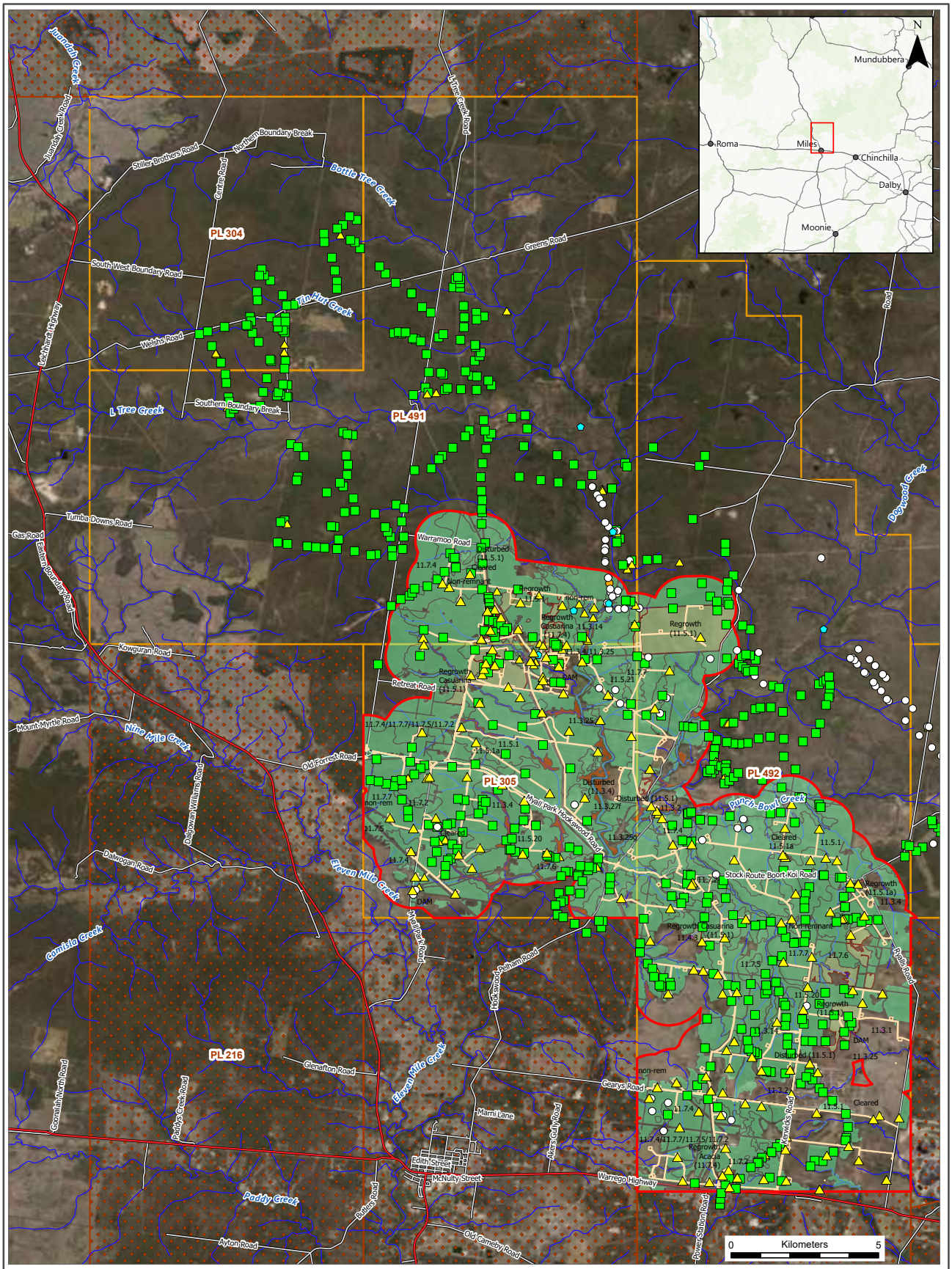
Threatened flora species previously recorded within 50 km of the SGP North EA amendment area were compiled into a Likelihood of Occurrence table (refer to **Appendix D**). Flora species considered known or likely to occur within the amendment have been included in this assessment.

2.2.2 Field-based assessments

Project-specific RE mapping and the assessment of terrestrial flora values is based on numerous field surveys undertaken across the broader SGP North area since the original Environmental Impact Assessment (EIS) in 2013. Vegetation and flora assessments relevant to the SGP North EA amendment area are summarised in **Table 2.1** with the survey effort shown in **Figure 2.1**. GTRE mapping across the wider SGP North gasfields builds on mapping prepared for the EIS and refined by EcoSmart Ecology in 2017. Since then, this GTRE mapping has been systematically verified and updated based on field survey efforts that are part of Arrow Energy's scouting and pre-clearance surveys to assist in the implementation of the mitigation hierarchy for the field development layout. In total, 568 vegetation assessments have been undertaken within the EA amendment area including; 521 quaternary assessments, 31 secondary assessments, 13 observation sites and 3 linear observation sites (**Figure 2.1**). Copies of the Ecological Field Survey (EFS) sheets from the surveys are also included in **Appendix E**.

Table 2.1 Summary of terrestrial flora surveys undertaken for the SGP North EA amendment area

Survey	Survey type	Timing	Undertaken by
Attexo	Vegetation survey	2023	Darren Maxwell
Attexo	Vegetation survey	2023	Richard Floyd
Field Verification Surveys	Vegetation survey	2021-2023	Arrow Energy's Ecology Team
EcoSmart	Vegetation survey, flora survey	2017	David Stanton (3D Environmental)
Arrow Surat Pipeline Survey	Vegetation survey	Various (2009-2013)	Arrow Energy's Ecology Team
Surat Ecological Studies	Vegetation survey	2016-2017	P. Williams, E. Collins
Supplementary EIS Surveys	Vegetation survey	2013	David Stanton (3D Environmental)
EIS Surveys	Vegetation survey	2009-2010	David Stanton (3D Environmental)



Flora Survey Effort

SURAT GAS PROJECT NORTH

- Area of Interest
- Observation Site
- Quaternary Site
- Secondary Site
- Linear Site
- Tertiary Site
- Indicative infrastructure layout
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)

GTRE

- Category A or B: Endangered
- Category A or B: Of Concern
- Category A or B: Least Concern
- Category C or R: Least Concern

- Highway
- Local Road
- Watercourse

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FIGURE 2.1

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2.3 Description of terrestrial fauna values

Terrestrial habitat and fauna values described in this report have been derived from desktop assessments and field surveys undertaken since the original EIS for the SGP was submitted in 2013. A summary of these assessments is provided below.

2.3.1 Desktop assessments

Desktop assessments for the current assessment involved a review of:

- Recent work undertaken by EcoSmart (2023) to update and consolidate ecological data collected across the broader SGP, which included recent database searches within 50 km of the entire SGP area.
- DESI WildNet database to identify previously recorded fauna species within the SGP North area plus a 50 km buffer. Search results from March 2024 (based around four point searches in the northern, central (2 points) and southern portions of the SGP North EA amendment area) are included in **Appendix C**; and
- Project-specific survey reports, data and habitat mapping rules developed using results from terrestrial fauna surveys relevant to the SGP North EA amendment area (see **Table 2.2** and **Figure 2.2**).

Threatened fauna species previously recorded within 50 km of the SGP North EA amendment area were compiled into a Likelihood of Occurrence table (refer to **Appendix D**). Fauna species identified as known to occur or likely to occur within the amendment have been included in this assessment.

2.3.2 Field-based assessments

Project-specific GTRE mapping and the assessment of potential fauna habitat values has been based on numerous field surveys undertaken across the broader SGP North area since the original EIS was submitted in 2013. Targeted fauna surveys and formal habitat assessments relevant to the SGP North EA amendment area are summarised in **Table 2.2** with the survey effort shown in **Figure 2.2**.

A broad range of fauna survey techniques have been undertaken across the SGP North EA amendment area including; 58 habitat assessments, 13 observation sites, 28 diurnal fauna searches, 28 bird surveys, 27 detailed trapping sites (including a mixture of pitfall, funnel and Elliot traps), 30 camera trapping sites, 37 spotlighting sites, 23 harp trapping sites, 28 anabat deployment sites and 25 dedicated koala surveys using the SPOT assessment technique (Phillips & Callaghan, 2011) (**Figure 2.2**).

Copies of the EFS sheets from surveys with habitat assessments are also included in **Appendix E**.

Table 2.2 Summary of terrestrial fauna surveys undertaken for the SGP North EA amendment area

Survey	Survey type	Timing	Undertaken by
Attexo	Habitat assessments & koala surveys	2023	Richard Floyd, Kate Rigg
Field verification surveys	Habitat assessments		Arrow Energy's Ecology Team
Eco Smart	Terrestrial fauna surveys	2016-2017	EcoSmart

Survey	Survey type	Timing	Undertaken by
Supplementary EIS Trapping Surveys	Terrestrial fauna survey	2013	EcoSmart
EIS Surveys	Terrestrial fauna survey	2011	EcoSmart

2.3.3 Threatened species habitat

As part of comprehensive ecological assessments for the broader SGP, EcoSmart and 3D Environmental (2017) developed habitat mapping rules that have been adopted by Arrow Energy to map the distribution of threatened species habitat through the SGP Project area. EcoSmart and 3D Environmental have recently undertaken a review of the original mapping rules and revised them based on new species listings and updated ecological information for the SGP North area.

The extent of threatened species habitat in the SGP North EA amendment area has been calculated using the revised mapping rules which are included in **Appendix F**.

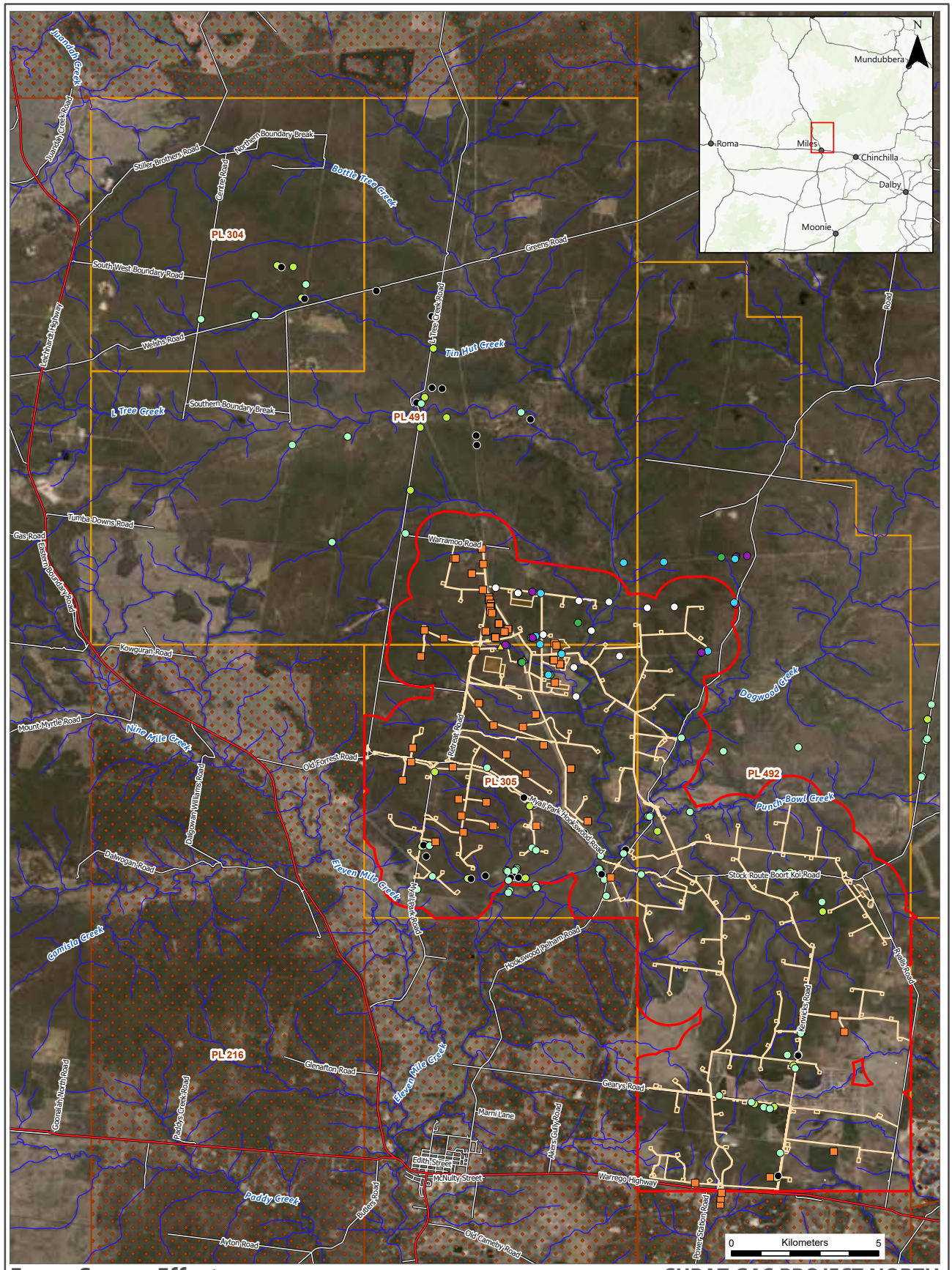
2.4 Impact analysis

The Project footprint and impact calculations provided by Arrow Energy have been compared against SGP North EA conditions and data in Schedule F, Condition (Biodiversity 5) and Table 2, and against Schedule F, Table 3 to identify:

- any departures from Condition (Biodiversity 5) which limits the width of linear infrastructure to 40 m wide in ESAs or their associated protection zones;
- interactions with Category A, B or C ESAs and the extent to which these are authorised by Schedule F, Table 1 which restricts the kinds of activities that can be undertaken in ESAs and their protection zones; and
- interactions with values that are 'Prescribed Environmental Matters' under the EO Act and the extent to which these are authorised by Schedule F, Table 3.

Impacts on ESAs or PEMs in the SGP North EA amendment area that are within existing approved limits under the current SGP North EA are taken to be approved, and *no further consideration has been given to these impacts or values*. Impacts on ESAs or PEMs that exceed existing approved limits or are not mentioned in the current EA are considered in **Section 4.0**.

All impact calculations are based on ground-truthed RE mapping for the SGP North EA amendment area in accordance with Condition (Biodiversity 3) of the SGP North EA, which states that "where mapped biodiversity values differ from [on-the-ground biodiversity values], petroleum activities may proceed…based on the confirmed on-the-ground biodiversity value".



Fauna Survey Effort

SURAT GAS PROJECT NORTH

- Area of Interest
- Anabat Trap Site
- Camera Trap Site
- Habitat Assessment Site
- Harp Trap Site
- Observational Site
- Spotlighting Site
- Trap Site
- Koala Spot Assessment
- Detailed trap sites (Elliot, Pitfall, Funnel + other methods)
- Harp trap sites (plus other methods
- Other fauna detection methods
- Indicative infrastructure layout
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)
- Highway
- Local Road
- Watercourse

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REVIEWED: KR **DRAWN:** JT **SCALE (A3):** 1:120,000 **DATE:** 4/04/2024 **DWG No:** ARR-002_025 **FIGURE 2.2**

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3.0 Description of ecological values

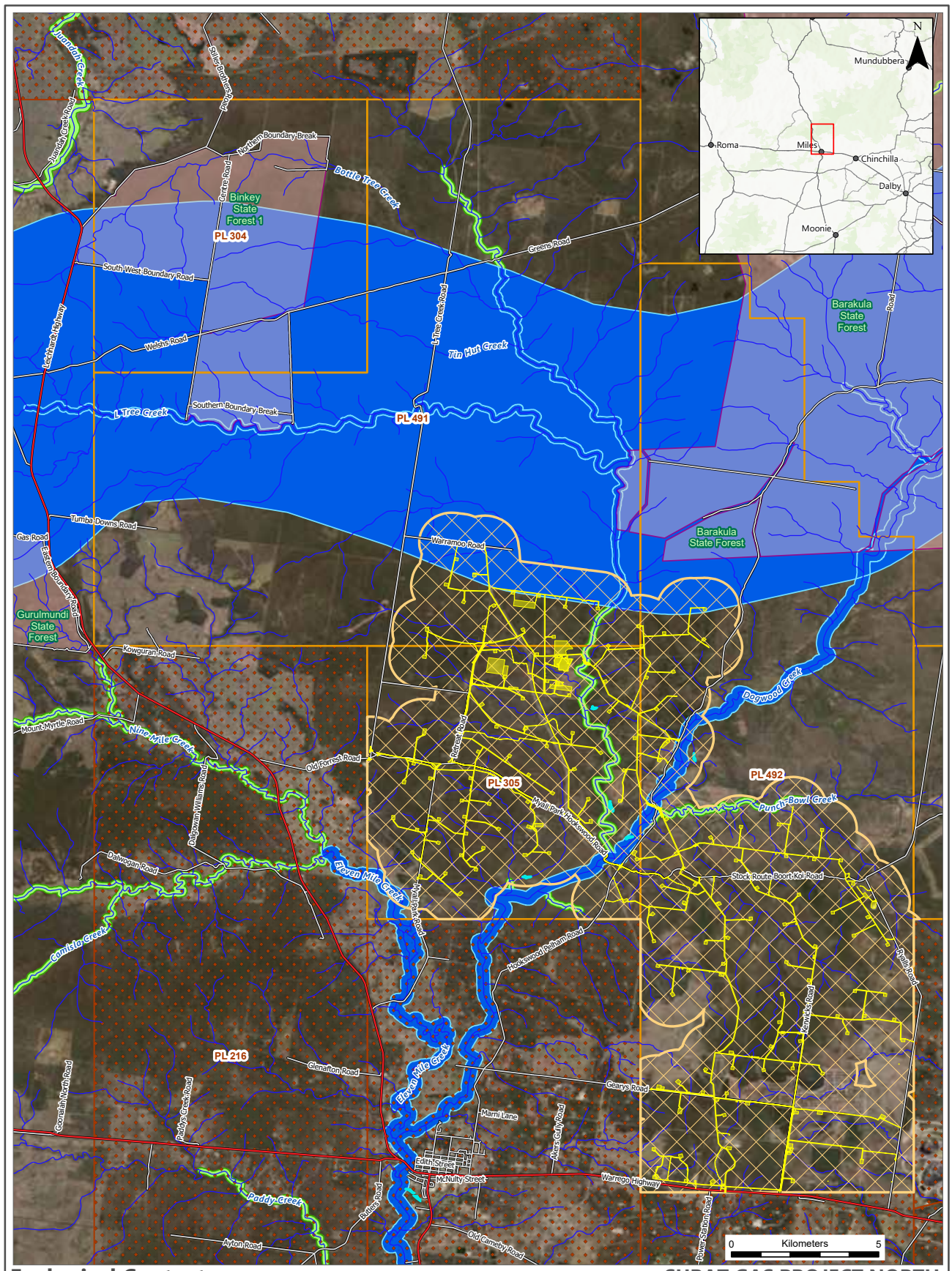
The SGP North EA amendment area is located to the north-east of Miles in the Barakula subregion of the Brigalow Belt bioregion. It can generally be described as grazing lands dominated by dry eucalypt woodlands to open woodlands interspersed with small areas of open forest to woodland dominated by Poplar Box (*E. populnea*) or Silver-leaved Ironbark (*E. melanophloia*) and Spotted Gum (*Corymbia citriodora*). These dominant vegetation types are dissected by riparian open forests to woodlands associated with Dogwood Creek and Bottle Tree Creek. There are also small areas of riverine and off-channel palustrine wetlands associated with these creek systems, though these are not mapped as HES wetlands (refer **Figure 3.1**).

The Barakula to St George Terrestrial Biodiversity Corridor just intersects the northern part of the SGP North EA amendment area, linking Barakula State Forest in the east with Binkey State Forest in the west, both of which contain intact areas of remnant vegetation and habitat. Straddling the Great Dividing Range, Barakula State Forest is the largest state forest in Queensland and contains a rich mosaic of vegetation communities, including eucalypt forests, cypress pine woodlands, heath-lands and spinifex. The riparian biodiversity corridors of Dogwood Creek, Bottle Tree Creek and Punch Bowl Creek traverse the EA amendment area.

Environmentally Sensitive Areas (ESAs) in the SGP North EA amendment area as defined by the Environmental Protection Regulation 2019 (EP Reg) and SGP North EA (for Category C ESAs) are summarised in **Table 3.1** and shown in **Figure 3.3**.

Table 3.1 SGP North Environmentally Sensitive Areas

ESA Category	ESA Type	Occurrence in SGP North EA amendment area
Category A	All	None.
Category B	'Endangered' RE (by Biodiversity Status)	None.
	Other than 'endangered' RE	None.
Category C	Nature refuge	None.
	Koala habitat	None.
	Essential habitat	Mapped essential habitat for Koala and the South-eastern Long-eared Bat; essential habitat noted but not assessed for Near Threatened species (Golden-tailed Gecko).
	'Of concern' RE (by Biodiversity Status)	Occurs in the SGP North EA amendment area as watercourse associated REs 11.3.2, 11.3.4 and 11.3.25.
	Regional Parks, previously known as 'Resources Reserves'	None.
	State Forest or Timber Reserve	None.
	Areas of vegetation that are 'critically limited'	None.



Ecological Context

SURAT GAS PROJECT NORTH

- Area of Interest
- Indicative infrastructure layout
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)
- Vegetation Management Wetlands Mapping
- State forest
- State Biodiversity Corridor
- Regional Biodiversity Corridor
- Highway
- Local Road
- Watercourse

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Data Source:Department of Resources, Dept.of Environment and Science, Esri, TomTom, Garmin, FAO, NOAA, USGS, Earthstar Geographics, Esri, USGS

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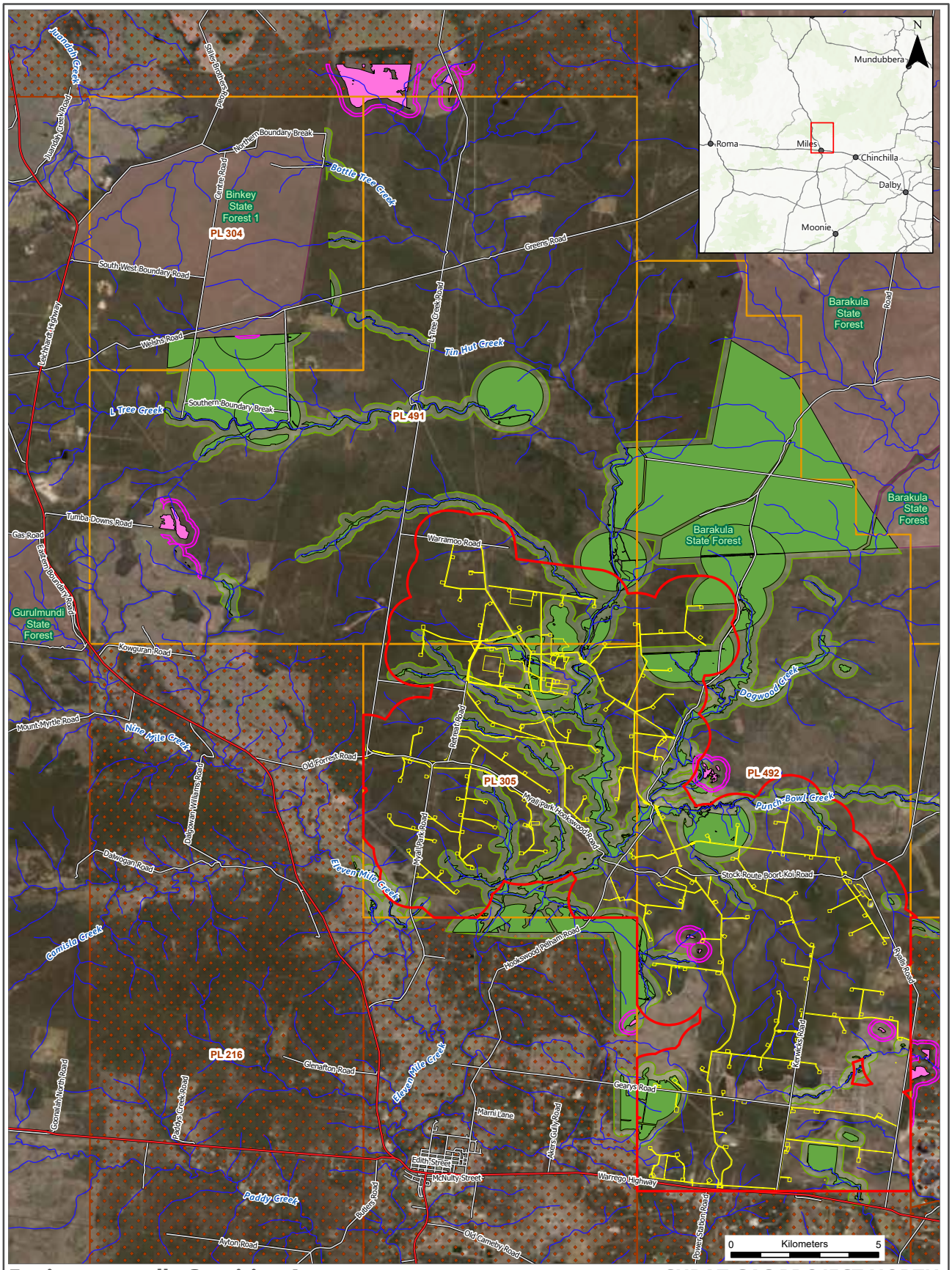


Environmentally Sensitive Areas

SURAT GAS PROJECT NORTH

- Area of Interest
- Indicative infrastructure layout
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)

Environmentally Sensitive Areas (ESA)

- Category B
- Category B - 300m Buffer
- Category C
- Category C - 200m Buffer

- Highway
- Local Road
- Watercourse
- State forest

Attexo

REVIEWED: KR **DRAWN:** JT **SCALE (A3):** 1:120,000 **DATE:** 4/04/2024 **DWG No:** ARR-002_029 **FIGURE 3.3**

GDA2020

3.1 Description of environmental values – terrestrial flora

3.1.1 Vegetation communities

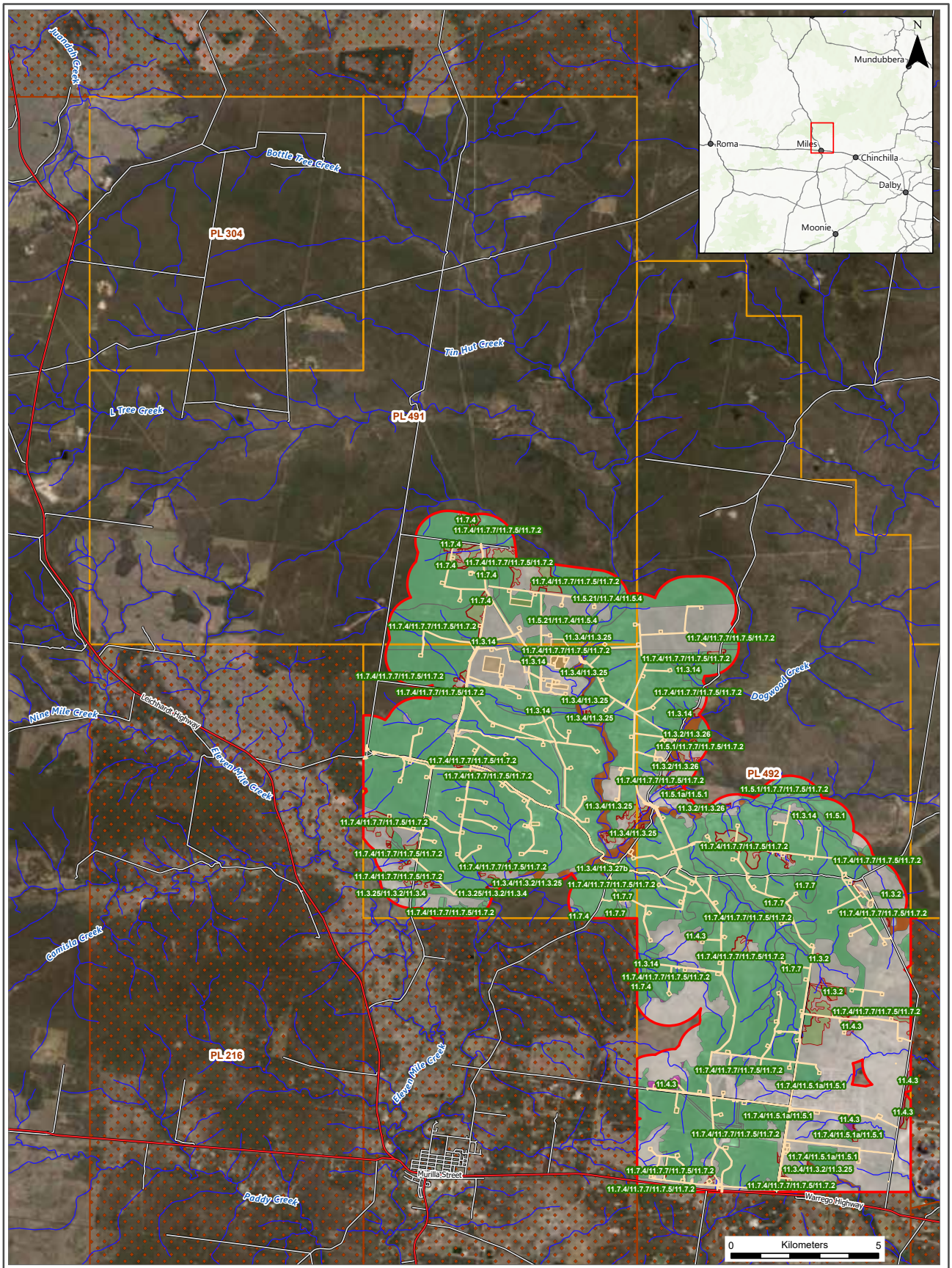
Certified Regional Ecosystem (RE) mapping prepared by the Queensland Herbarium identifies 14 REs within the SGP North EA amendment area (refer **Figure 3.4**). Descriptions for mapped REs are provided in **Table 3.2** and include:

- 1 classified as 'Endangered';
- 4 classified as 'Of concern'; and
- 10 classified as 'Least concern'.

Table 3.2 State Regional Ecosystem mapping by Biodiversity Status (Source: DoR, 2023)

Land zone	RE type	Description	Occurrence in 'Area of Interest' (ha)
Least concern			
3 – Quaternary alluvial plains	11.3.14	*Angophora floribunda*, *A. leiocarpa*, *Eucalyptus tereticornis* and *E. chloroclada* woodland with a secondary tree layer dominated by *Callitris glaucophylla* or *Allocasuarina leuhmanii*. Occurs on Cainozoic alluvial soils.	647.8
	11.3.26	*Eucalyptus moluccana* or *E. microcarpa* woodland to open forest on margins of alluvial plains± *Allocasuarina luehmannii* low tree layer and a grassy ground layer.	18.9
5 – Tertiary-early Quaternary loamy and sandy plains and plateaus	11.5.1	*Eucalyptus crebra* and/or *E. populnea*, *Callitris glaucophylla*, *Angophora leiocarpa*, *Allocasuarina luehmannii* woodland on Cainozoic sand plains and/or remnant surfaces.	233.5
	11.5.1a	*Eucalyptus populnea* woodland with *Allocasuarina luehmannii* low tree layer. Occurs on flat to gently undulating plains formed from weathered sandstones. Duplex soils with sandy surfaces.	32.6
	11.5.4	*Eucalyptus chloroclada*, *Callitris glaucophylla*, *C. endlicheri*, *Angophora leiocarpa* woodland on Cainozoic sand plains and/or remnant surfaces.	34.7
	11.5.21	*Corymbia bloxsomei* +/- *Callitris glaucophylla* +/- *Eucalyptus crebra* +/- *Angophora leiocarpa* woodland on Cainozoic sand plains	69.4
7 – Cainozoic duricrusts	11.7.2	*Acacia* spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone.	592.6
	11.7.4	*Eucalyptus decorticans* and/or *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp., *Lysicarpus angustifolius* woodland on Cainozoic lateritic duricrust.	10,397.8

Land zone	RE type	Description	Occurrence in 'Area of Interest' (ha)
	11.7.5	Shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks. Characteristic genera include *Calytrix* spp., *Hakea* spp., *Kunzea* spp. *Micromyrtus* spp., *Acacia* spp., *Melaleuca* spp. and (in the ground layer) *Triodia* spp.	592.6
	11.7.7	*Eucalyptus fibrosa* subsp. *nubilis* +/- *Corymbia* spp. +/- *Eucalyptus* spp. woodland on Cainozoic lateritic duricrust.	1,205.4
Of concern			
3 – Quaternary alluvial plains	11.3.2	*Eucalyptus populnea* woodland to open woodland. Occasionally *E. melanophloia* or *E. crebra* may be present. The ground layer is dominated by a range of tussock grasses, including *Chloris* spp., *Enteropogon* spp. and *Aristida* spp. Occurs on Cainozoic alluvial plains with variable soil types.	174.1
	11.3.4	*Eucalyptus tereticornis* woodland to open forest on Cainozoic alluvial plains. Other tree species that may be present include *E. camaldulensis*, *Corymbia tessellaris*, *C. clarksoniana*, *E. melanophloia*, *E. platyphylla* or *Angophora floribunda*. A shrub layer is usually absent and a grassy ground layer is prominent.	191.4
	11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland to open forest on fringing levees and banks of major rivers and drainage lines of alluvial plains. Other tree species, including *Casuarina cunninghamiana*, *E. coolabah*, *Melaleuca bracteata*, *M. viminalis*, *Livistona* spp. (in the north), *Melaleuca* spp. and *Angophora floribunda* may occur.	114.3
	11.3.27b	*Acacia harpophylla* and/or Casuarina cristata open forest on alluvial plains, with or without scattered emergent *Eucalyptus* spp. such as *E. coolabah*, *E. largiflorens*, *E. populnea*, *E. orgadophila* and *E. woollsiana*.	4.4
Endangered			
4 – Tertiary-early Quaternary clay plains	11.4.3	*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains	47.6
		Total remnant	**14,356.9**



State Regional Ecosystem Mapping

SURAT GAS PROJECT NORTH

- Area of Interest
- Indicative infrastructure layout (Rev C)
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)
- Category A or B: Endangered
- Category A or B: Of Concern
- Category A or B: Least Concern
- Category C or R: Endangered
- Category C or R: Of Concern
- Category C or R: Least Concern
- Non-remnant
- Watercourse
- Highway
- Local Road

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REVIEWED: KR **DRAWN:** JT **SCALE (A3):** 1:120,000 **DATE:** 4/04/2024 **DWG No:** ARR-002_030

FIGURE 3.4

GDA2020

3.1.1.1 Field-verified Regional Ecosystems

The SGP North EA amendment area retains significant native vegetation cover compared with other parts of the Brigalow Belt bioregion, with approximately 74% of the total land area (21,549 ha) supporting remnant native vegetation and a further 5% supporting regrowth and non-remnant vegetation. Ground-truthed RE mapping prepared for the SGP North EA amendment area is based on Project-specific vegetation community surveys as described in **Section 2.2.2**, with the mapping shown in **Figure 3.5** (shown by Biodiversity Status).

Of the 14 REs originally mapped by the Department of Resources (DOR) for the Project area, three were not recorded during the field survey (refer to **Table 3.3**), including REs 11.3.26, 11.5.4 and 11.3.27b. Of the 17 GTREs recorded during the field survey, six were not mapped by DOR (RE 11.3.1, 11.3.25g, 11.3.27f, 11.4.3, 11.7.6 and 11.5.20).

Table 3.3 Ground-truthed Regional Ecosystems by Biodiversity Status (source: Arrow Energy 2024)

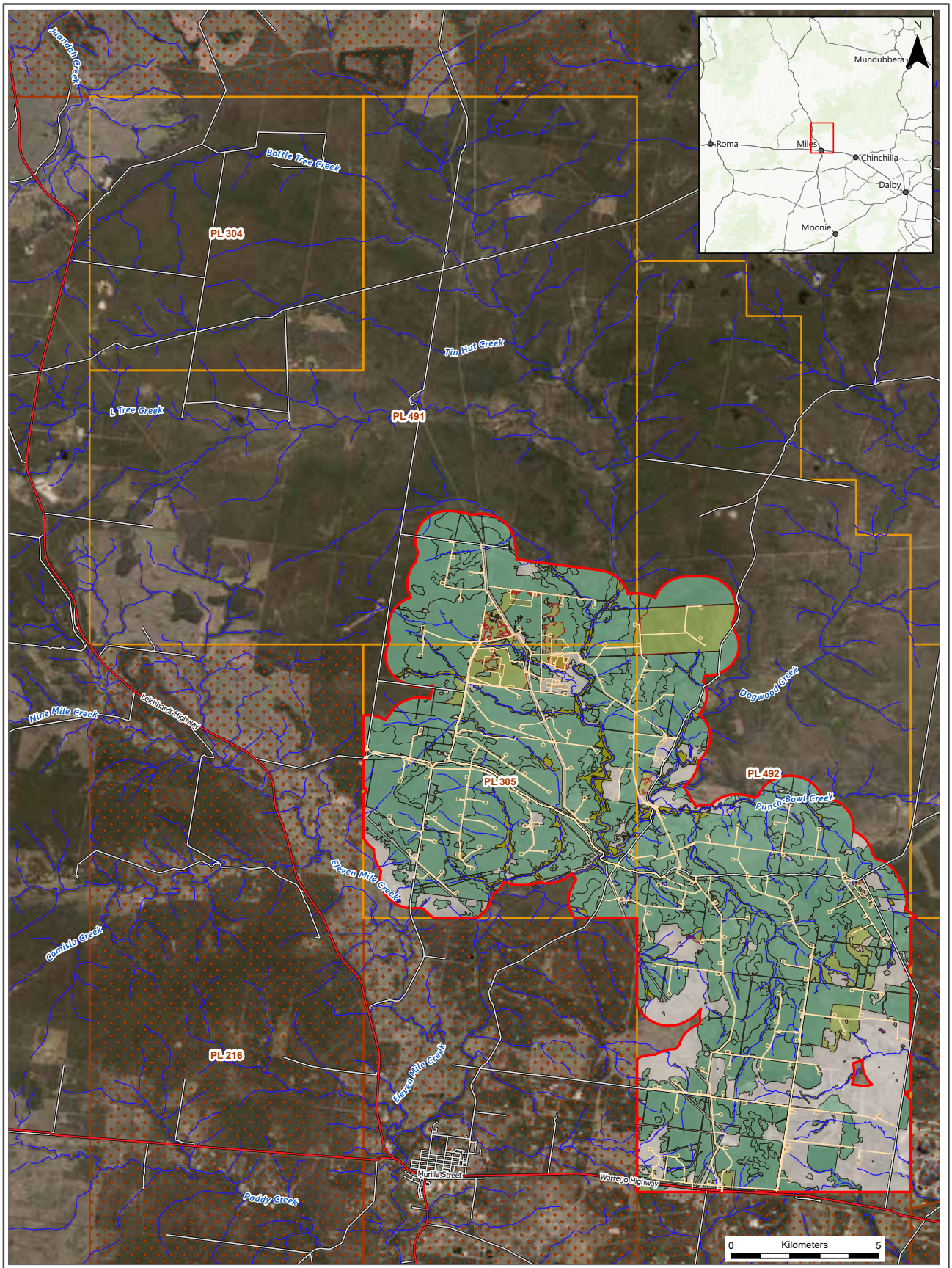
Land zone	RE type	Description	Occurrence in 'Area of Interest' (ha)
Least concern			
3 – Quaternary alluvial plains	11.3.14	*Angophora floribunda*, *A. leiocarpa*, *Eucalyptus tereticornis* and *E. chloroclada* woodland with a secondary tree layer dominated by *Callitris glaucophylla* or *Allocasuarina leuhmanii*. Occurs on Cainozoic alluvial soils.	136.1
5 – Tertiary-early Quaternary loamy and sandy plains and plateaus	11.5.1	*Eucalyptus crebra* and/or *E. populnea*, *Callitris glaucophylla*, *Angophora leiocarpa*, *Allocasuarina luehmannii* woodland on Cainozoic sand plains and/or remnant surfaces.	7167.0
	11.5.1a	*Eucalyptus populnea* woodland with *Allocasuarina luehmannii* low tree layer. Occurs on flat to gently undulating plains formed from weathered sandstones. Duplex soils with sandy surfaces.	19.5
	11.5.20	*Eucalyptus moluccana* and/or *E. microcarpa* and/or E. woollsiana ± *E. crebra* woodland on Cainozoic sand plains.	16.9
	11.5.21	*Corymbia bloxsomei* +/- *Callitris glaucophylla* +/- *Eucalyptus crebra* +/- *Angophora leiocarpa* woodland on Cainozoic sand plains	313.6
7 – Cainozoic duricrusts	11.7.2	*Acacia* spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone.	178.4
	11.7.4	*Eucalyptus decorticans* and/or *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp., *Lysicarpus angustifolius* woodland on Cainozoic lateritic duricrust.	2962.4
	11.7.5	Shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks. Characteristic genera include *Calytrix* spp., *Hakea* spp., *Kunzea* spp. *Micromyrtus* spp., *Acacia* spp., *Melaleuca* spp. and (in the ground layer) *Triodia* spp.	227.4

Land zone	RE type	Description	Occurrence in 'Area of Interest' (ha)
	11.7.6	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust.	247.0
	11.7.7	*Eucalyptus fibrosa* subsp. *nubilis* +/- *Corymbia* spp. +/- *Eucalyptus* spp. woodland on Cainozoic lateritic duricrust.	4031.1
Of concern			
3 – Quaternary alluvial plains	11.3.2	*Eucalyptus populnea* woodland to open woodland. Occasionally *E. melanophloia* or *E. crebra* may be present. The ground layer is dominated by a range of tussock grasses, including *Chloris* spp., *Enteropogon* spp. and *Aristida* spp. Occurs on Cainozoic alluvial plains with variable soil types.	5.1
	11.3.4	*Eucalyptus tereticornis* woodland to open forest on Cainozoic alluvial plains. Other tree species that may be present include *E. camaldulensis*, *Corymbia tessellaris*, *C. clarksoniana*, *E. melanophloia*, *E. platyphylla* or *Angophora floribunda*. A shrub layer is usually absent and a grassy ground layer is prominent.	311.1
	11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland to open forest on fringing levees and banks of major rivers and drainage lines of alluvial plains. Other tree species, including *Casuarina cunninghamiana*, *E. coolabah*, *Melaleuca bracteata*, *M. viminalis*, *Livistona* spp. (in the north), *Melaleuca* spp. and *Angophora floribunda* may occur..	363.3
	11.3.25g	*Eucalyptus populnea* woodland to open woodland on Cainozoic alluvial plains. Occasionally *E. melanophloia* or *E. crebra* may be present. The ground layer is dominated by a range of tussock grasses, including *Chloris* spp., *Enteropogon* spp. and *Aristida* spp.	3.5
	11.3.27f	*Acacia harpophylla* and/or Casuarina cristata open forest on alluvial plains, with or without scattered emergent *Eucalyptus* spp. such as *E. coolabah*, *E. largiflorens*, *E. populnea*, *E. orgadophila* and *E. woollsiana*.	20.4
Endangered			
3 – Quaternary alluvial plains	11.3.1	*Acacia harpophylla* and/or Casuarina cristata open forest on alluvial plains, with or without scattered emergent *Eucalyptus* spp. such as *E. coolabah*, *E. largiflorens*, *E. populnea*, *E. orgadophila* and *E. woollsiana*.	1.7

Land zone	RE type	Description	Occurrence in 'Area of Interest' (ha)
4 – Tertiary-early Quaternary clay plains	11.4.3	*Acacia harpophylla* and/or *Casuarina cristata* open forest on Cainozoic clay plains. *A. harpophylla* forms a continuous canopy with varying densities of *C. cristata*, forming part of the canopy or emerging above it. *C. cristata* may be dominant or form pure stands particularly in the south of the bioregion.	3.2
		Total (remnant)	**16,007.7**
Regrowth			
5 – Tertiary-early Quaternary loamy and sandy plains and plateaus	11.5.1	*Eucalyptus crebra* and/or *E. populnea*, *Callitris glaucophylla*, *Angophora leiocarpa*, *Allocasuarina luehmannii* woodland on Cainozoic sand plains and/or remnant surfaces.	992.9
	11.5.1a	*Eucalyptus populnea* woodland with *Allocasuarina luehmannii* low tree layer. Occurs on flat to gently undulating plains formed from weathered sandstones.	1.2
7 – Cainozoic duricrusts	11.7.4	*Eucalyptus decorticans* and/or *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp., *Lysicarpus angustifolius* woodland on Cainozoic lateritic duricrust.	87.8
	11.7.6	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust.	21.1
		Total (regrowth)	**1,081.9**

3.1.1.2 Threatened ecological communities

Of the 17 REs ground-truthed for the SGP North EA amendment area, two correspond to the Brigalow threatened ecological community (TEC) as listed under the EPBC Act. Impacts on this TEC are authorised under the SGP EPBC approval (refer **Section 1.3.1**).



Ground-Truthed Regional Ecosystem

SURAT GAS PROJECT NORTH

- Area of Interest
- Indicative infrastructure layout (Rev C)
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)

Biodiversity Status:

- Endangered
- Of Concern
- No Concern At Present
- No Concern At Present - Regrowth
- Non-remnant vegetation, cultivated or built environment
- Watercourse
- Highway
- Local Road

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REVIEWED: KR **DRAWN:** JT **SCALE (A3):** 1:120,000 **DATE:** 4/04/2024 **DWG No:** ARR-002_030

FIGURE 3.4

GDA2020

3.1.2 Conservation-significant flora

The desktop assessment identified twenty-eight (28) threatened and nine (9) near-threatened flora species within 50 km of the SGP North EA amendment areas. Of these:

- Two (2) species are listed as MNES but are not listed under the NC Act and are excluded from further assessment, namely Bluegrass (*Dichanthium setosum*) and Winged Pepper-cress (*Lepidium monoplocoides*).
- Sixteen (16) species are also listed as MNES and were considered as part of the original EIS (where relevant, approved maximum disturbance limits under the EPBC approval 2010/5344 are provided in **Appendix A**). These have been excluded from further assessment:
  - Austral Toadflax (*Thesium australe*)
  - Belson's Panic (*Homopholis belsonii*)
  - Curly-bark wattle (*Acacia curranii*)
  - Hando's wattle (*Acacia handonis*)
  - King blue-grass (*Dichanthium queenslandicum*)
  - Ooline (*Cadellia pentastylis*)
  - Queensland western white gum (*Eucalyptus argophloia*)
  - Small-leaved Denhamia (*Denhamia parvifolia*)
  - Tara wattle (*Acacia lauta)*)
  - *Calytrix gurulmundensis*
  - *Eucalyptus virens*
  - *Homoranthus decumbens*
  - *Polianthion minutiflorum*
  - *Vincetoxicum forsteri*
  - *Westringia parvifolia*
  - *Xerothamnella herbacea*.
- A further eight (8) species are considered unlikely to occur based on known habitat preferences and the availability of that habitat within the SGP North EA amendment area.

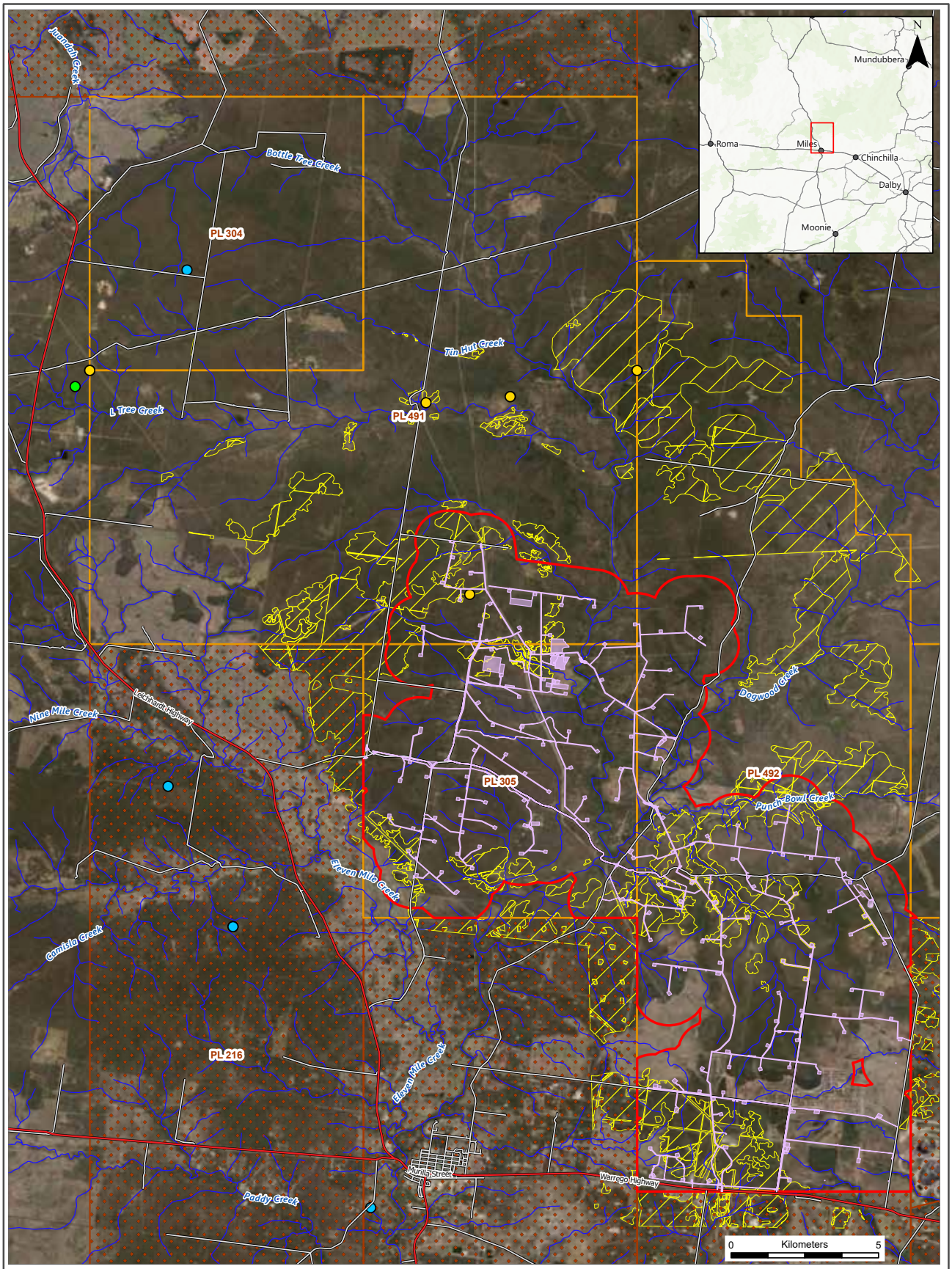
The Likelihood of Occurrence assessment (**Appendix D**) identified one (1) threatened plant species considered likely to occur in the SGP North EA amendment area.

3.1.2.1 *Micromyrtus carinata*, Gurulmundi Heath Myrtle

This species is only known from Gurulmundi State Forest, with a subpopulation located on the Wyona Property 10 km to the north of Miles (within PL304). The Wyona property is approximately 4 km from the SGP North EA amendment

area and more than 5 km from any proposed disturbance areas. Herbarium records indicate that *Micromyrtus carinata* is associated with landscapes formed on laterised sediments with an upper soil layer of red to yellow sand (EcoSmart, 2023). Associated habitats include heath and shrubland (RE 11.7.5) and low woodland dominated by *Eucalyptus exserta*, *Corymbia trachyphloia* and *Callitris glaucophylla* (RE 11.7.4) which occur throughout the SGP North EA amendment area.

Areas of general habitat for this species are shown in **Figure 3.6**.



Conservation-Significant Flora Habitat

SURAT GAS PROJECT NORTH

- Area of Interest
- Indicative infrastructure layout
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)
- *Cryptandra ciliata*
- *Eucalyptus curtisii*
- *Micromyrtus carinata*
- Micromyrtus carinata Habitat
- Highway
- Local Road
- Watercourse

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FIGURE 3.6

GDA2020

3.1.2.2 Near Threatened Flora Species

Two (2) flora species listed as near threatened under the NC Act are known or considered likely to occur in the SGP North EA amendment area, namely:

- *Cryptandra ciliata*; and
- *Rutidosis lanata*, Red-soil Woolly Wrinklewort.

Habitat for a near threatened species does not constitute an ESA, nor is it a PEM under the EO Act. The presence or potential presence of a near threatened species triggers requirements under the NC Act that are approved and managed separately to the EA. Therefore, the occurrence or potential occurrence of near threatened species or their habitat does not trigger any requirement to amend the SGP North EA however, the presence of these species is noted.

3.1.3 Protected plants trigger mapping

There are no 'high risk' areas shown on the Protected Plants Flora Survey Trigger Map in the SGP North EA amendment area.

3.2 Description of environmental values- terrestrial fauna

3.2.1 Habitat types and condition

The SGP North EA amendment area is dominated by eucalypt woodland to open forest habitats on depositional plains, low ridges and floodplains. Ecosystem types on soils of low fertility, typically those REs associated with land zones 5 and 7, form the largest and most continuous tracts of vegetation, these have been heavily used for their timber resources with varying degrees of impact. In particular, habitats dominated by Narrow-leaved Ironbark species (*Eucalyptus crebra*), *E. elegans* and *E. woollsiana* have been logged to a such a degree that all mature canopy trees have been removed. The remaining vegetation comprises secondary growth with a thickened shrub layer forming the canopy.

The impact of logging is also evident in the majority of remnant vegetation on freehold land. The future of these areas may be affected by changes to fire regime.

A number of ecosystems appear more resilient to landscape-wide processes of degradation. In particular, *Eucalyptus fibrosa* subsp. *nubila* forest communities (RE 11.7.7) generally have a better-preserved canopy structure, a greater number of mature canopy trees and fewer large canopy gaps. This preservation is likely to be due to the quality and usefulness of the timber resource rather than an inherent ability to recover from disturbance.

The following broad habitat types are present within the SGP North EA amendment area based on ground-truth RE mapping (refer **Figure 3.5**):

- Eucalypt woodlands to open forests;
- Riparian woodlands to open forests;
- *Acacia* dominated open forest and woodlands;
- Heaths;
- Regrowth and non-remnant woody vegetation (cleared, fragmented or disturbed); and
- Cleared areas.

3.2.2 Conservation-significant fauna

The desktop assessment identified records for fifty-one (51) threatened and two (2) near threatened NC Act listed fauna species within 50 km of the SGP North EA amendment area. Of these:

- Fifteen (15) species are listed as MNES but are not listed under the NC Act and are excluded from further assessment, namely:
  - Black-faced Monarch (*Monarcha melanopsis*)
  - Common Greenshank (*Tringa nebularia*)
  - Common Sandpiper (*Actitis hypoleucos*)
  - Fork-tailed Swift (*Apus pacificus*)
  - Latham's Snipe (*Gallinago hardwickii*)

- Oriental Cuckoo (*Cuculus optatus*)
- Pectoral Sandpiper (*Calidris melanotos*)
- Rufous Fantail (*Rhipidura rufifrons*)
- Satin Flycatcher (*Myiagra cyanoleuca*)
- Sharp-tailed Sandpiper (*Calidris acuminata)*
- Yellow Wagtail (*Motacilla flava*)
- Silver Perch (*Bidyanus bidyanus*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Northern Quoll (*Dasyurus hallucatus*)
- Condamine Earless Dragon (*Tympanocryptis condaminensis*)

- Sixteen (16) are also listed as MNES and were considered as part of the original EIS (approved maximum disturbance limits under the EPBC approval 2010/5344 are provided in **Appendix A**). Sixteen (16) are also listed as MNES and were considered as part of the original EIS (where relevant, approved maximum disturbance limits under the EPBC approval 2010/5344 are provided in **Appendix A**). These have been excluded from further assessment;
  - Australasian Bittern (*Botaurus poiciloptilus*)
  - Australian Painted Snipe (*Rostratula australis*)
  - Black-breasted Button-quail (*Turnix melanogaster*)
  - Squatter Pigeon (southern) (*Geophaps scripta scripta*)
  - Red Goshawk (*Erythrotriochis radiatus*)
  - Star Finch (southern) (*Neochmia ruficauda ruficauda*)
  - White-throated Needletail (*Hirundapus caudacutus*)
  - Regent Honeyeater (*Anthochaera phrygia*)
  - Murray Cod (*Maccullochella peelii*)
  - South-eastern Long-eared Bat (*Nyctophilus corbeni*)
  - Spot-tailed quoll (*Dasyurus maculatus maculatus*)
  - Collared Delma (*Delma torgquata*)
  - Five-clawed worm-skink (*Anomalopus mackayi*)
  - Yakka Skink (*Egernia rugosa*)
  - Dunmall's Snake (*Furina dunmalli*)

- Fitzroy River Turtle (*Rheodytes leukops*).

- The ten (10) fauna species known or considered likely to occur in the SGP North EA amendment area are addressed below, with records shown in **Figure 3.6** to **Figure 3.9**.

3.2.2.1 Diamond Firetail, *Stagonopleura guttata*

Diamond Firetails occur on the south-east mainland of Australia from south-east QLD to Eyre Peninsula, SA and about 300 km inland from the sea. This species occurs in eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats, including farmland and grassland with scattered trees. They tend to prefer areas with relatively low tree density, few large logs, and little litter cover but high grass cover (Higgins et al 2007, Antos et al 2008). Suitable habitat is widespread across the SGP North EA amendment area and there are undated records from within the amendment area, as shown in **Figure 3.6**. There are also records from 2019 within 5 km of the Project area.

3.2.2.2 Glossy Black Cockatoo, *Calyptorhynchus lathami lathami* (south-eastern)

Glossy Black Cockatoos are well represented in the broader SGP area, though records in the SGP North EA amendment area are less frequent than in the south with most records from Lake Broadwater and Kumbarilla State Forest. Typically encountered in small family parties, Glossy Black Cockatoos are dietary specialists feeding exclusively on the seeds of *Allocasuarina* and less frequently *Casuarina* spp. Favoured species include *A. torulosa*, *A. littoralis*, *A. distyla*, *A. diminuta*, *A. gymnanthera* and *A. verticillata*.

Birds inhabit woodlands and forests that contain abundant *Allocasuarina* spp. and large hollows suitable for nesting. Many populations are restricted to remnant vegetation within hills and gullies surrounded by agricultural land though some populations move through artificial landscapes to access favoured food resources (EcoSmart, 2023). Groups are never far from waterbodies, which are visited daily. Being highly mobile, birds may travel considerable distances to isolated fragments in search of food. Advanced regrowth may also provide some foraging opportunities.

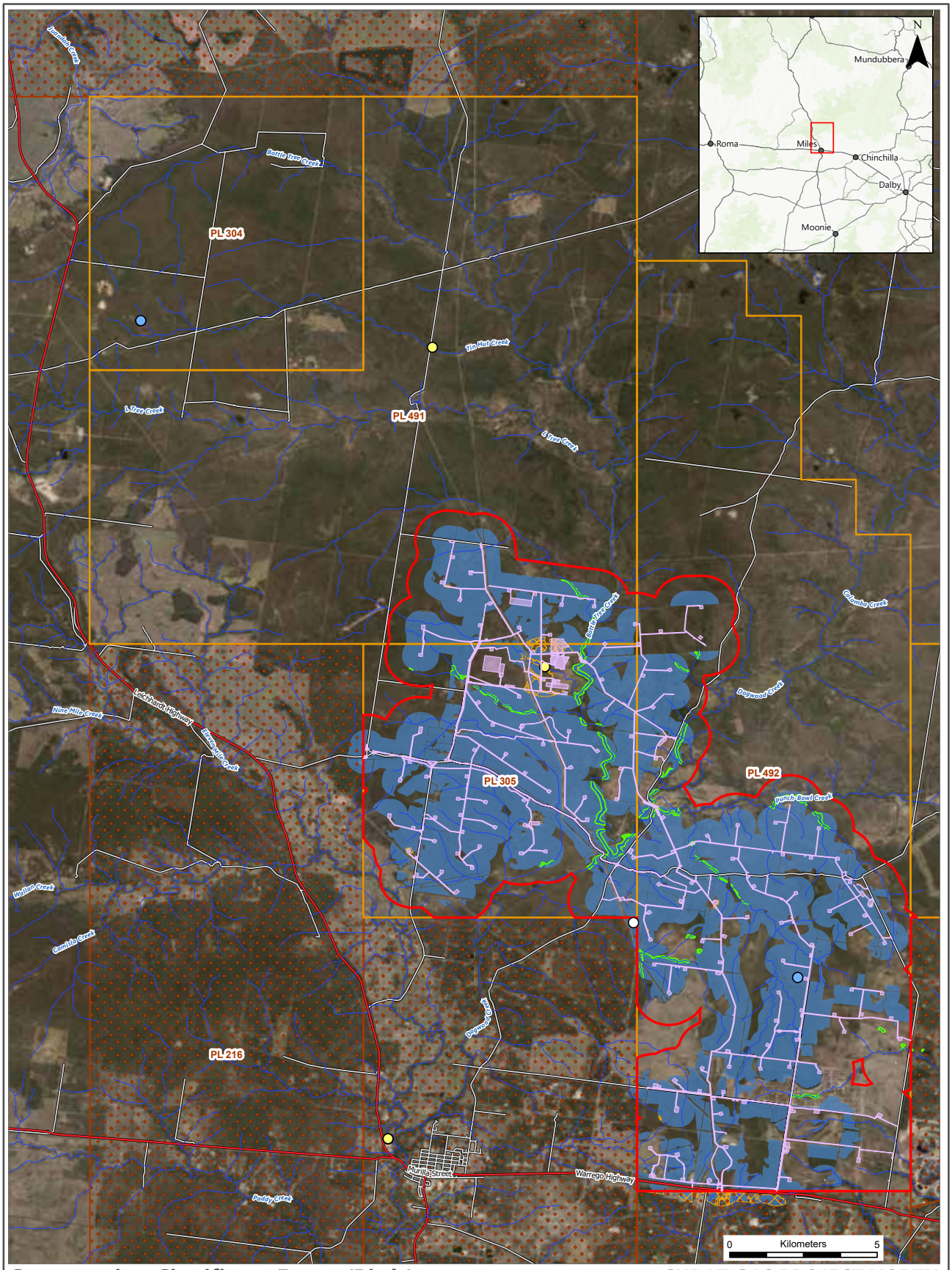
Birds show a preference for productive trees (e.g. higher seed/cone weight ratio), notwithstanding the influence of other factors such as distance from water or breeding hollows. Stands of *Allocasuarina* are not, therefore, of uniform value and the loss of individual stands or trees can have disproportionate impacts. Although an *Allocasuarina* species, *A. luehmannii* has small seeds and is infrequently used.

Habitat mapping rules prepared by EcoSmart (2023) for Glossy Black Cockatoo are included in **Appendix F** .. Suitable habitat within the SGP North EA amendment area is shown in **Figure 3.6**.

3.2.2.3 Painted Honeyeater, *Grantiella picta*

The SGP North EA amendment area is entirely within the distribution of the Painted Honeyeater and the species has been frequently recorded within 50 km. Despite the abundance of local records, evidence of the species within the SGP North EA amendment area is scattered. This likely reflects habitat availability – suitable habitat is generally uncommon. Painted Honeyeaters inhabit open, dry woodlands and forests. They prefer extensive stands of remnant woodlands with mature trees but will use narrow strips and small blocks if sufficient mistletoe fruit is available. A key component of this habitat is mistletoe, the fruit of which forms the basis of their diet, but they may also collect nectar and invertebrates. Most foraging is undertaken within the canopy (EcoSmart, 2023).

Habitat mapping rules prepared by EcoSmart (2023) for Painted Honeyeater are included in **Appendix F** . Suitable habitat within the SGP North EA amendment area is shown in **Figure 3.6.**



Conservation-Significant Fauna (Birds)

SURAT GAS PROJECT NORTH

Area of Interest

Indicative infrastructure layout

Records

- Glossy Black Cockatoo (Calyptorhynchus lathami)
- Painted Honeyeater (Grantiella picta)
- Diamond Firetail (Stagonopleura guttata)

Habitat

- Painted Honey-Eater (Grantiella picta) Habitat
- Glossy Black Cockatoo (Calyptorhynchus lathami) Habitat
- Diamond Firetail (Stagonopleura guttata) Habitat
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)
- Highway
- Local Road
- Watercourse

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REVIEWED: KR **DRAWN:** JT **SCALE (A3):** 1:120,000 **DATE:** 4/04/2024 **DWG No:** ARR-002_035 **FIGURE 3.6**

GDA2020

3.2.2.4 Koala, *Phascolarctos cinereus*

Koalas are well represented in the broader SGP area, within over 700 records within 50 km including numerous records within the SGP North EA amendment area and in all surrounding directions. Closer to the western extent of their distribution, Koalas are often associated with watercourses though they are not restricted to them (Davies et. al., 2013). They are not strongly territorial and home ranges will overlap. Home ranges vary in size from 1-2 hectares in optimum habitat up to 135 ha in semi-arid regions (Baker and Gynther, 2023). Koalas are surprisingly mobile and able to move large distances across artificial (cleared) land. There are no limitations on patch size and they are also often seen in regrowth vegetation. The abundance of records in non-remnant habitats likely reflect these behaviours with individuals able to utilise isolated trees in an otherwise unsuitable landscape.

Koalas feed on eucalypt trees but show dietary preference based on geographical region and the types of tree species present. In the Brigalow Belt, Koalas have at least 24 species of *Eucalyptus* on which they preferentially forage (Australian National University, 2021). Of these tree species, the following have been recorded in the broader SGP: *Corymbia tessellaris*, *C. citriodora*, *Eucalyptus camaldulensis*, *E. chloroclada*, *E. coolabah*, *E. crebra*, *E. exserta*, *E. fibrosa*, *E. melanophloia*, *E. moluccana*, *E. ochrophloia*, *E. populnea* and *E. tereticornis*.

Habitat mapping rules prepared by EcoSmart (2023) for Koala are included in Error! Reference source not found.. Suitable habitat within the SGP North EA amendment area is shown in **Figure 3.7**.

3.2.2.5 Greater Glider, *Petauroides volans volans*

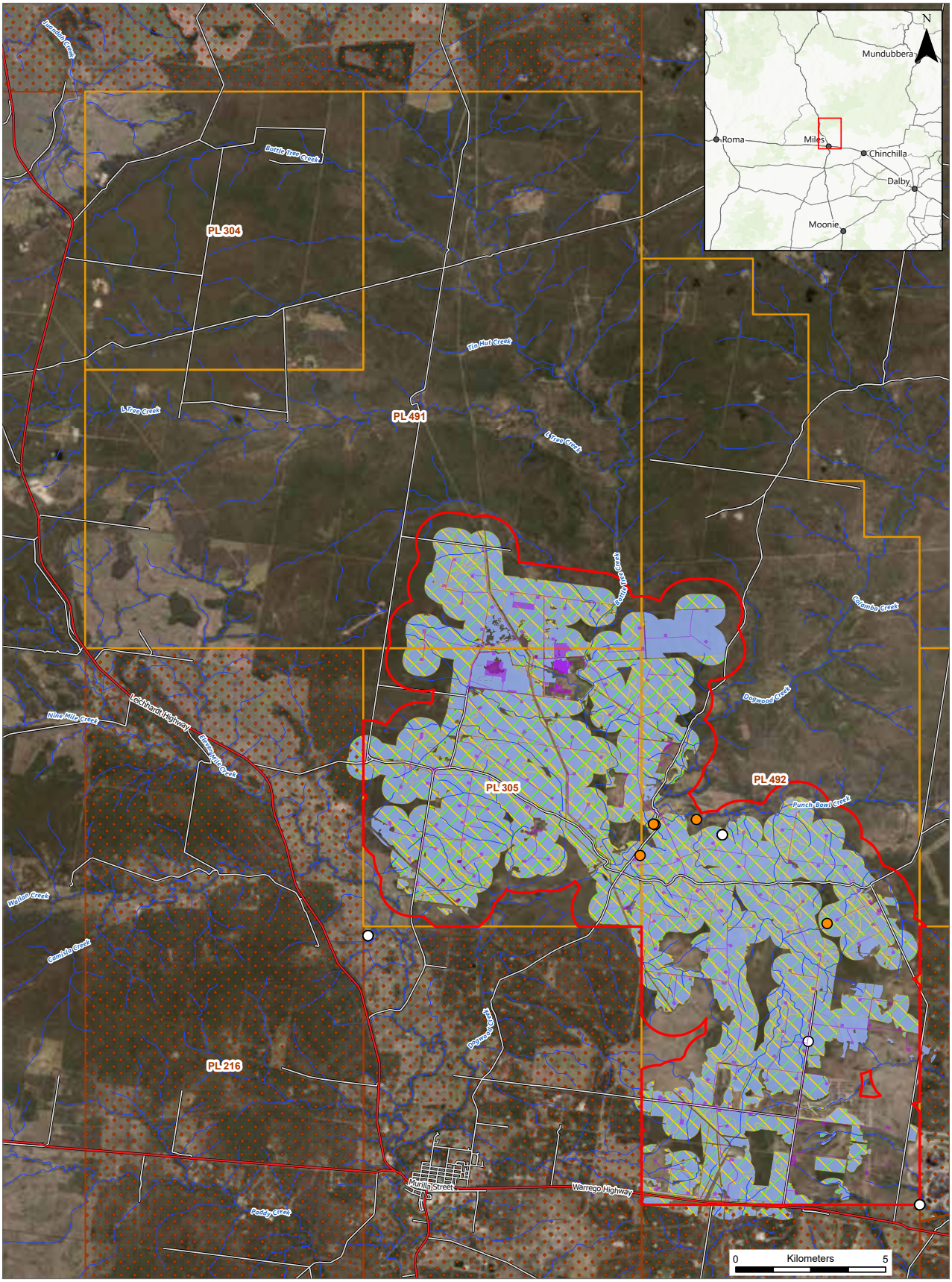
The Greater Glider has been recorded at 23 discrete locations within and surrounding the broader SGP area. Most of these records are associated with larger areas of remnant vegetation, in particular vegetation spanning between Barakula, Binkey and Gurulmundi State Forests in the SGP North EA amendment area. This species is predominantly restricted to eucalypt forests and woodlands. They are most common in taller, moist, montane eucalypt forests with larger, relatively old trees and abundant hollows though in areas west of the Great Dividing Range, they are found in low woodlands (Mackay, 2008).

Greater Gliders are described as having a strictly 'eucalyptus' diet but will also occasionally take flowers and rarely Acacia phyllodes or mistletoe leaves. Dietary selection in the southern Brigalow Belt is poorly understood, with a single study finding foraging animals most often in *E. moluccana*, *E. fibrosa* and *Corymbia citriodora* (Eyre et. al., 2022). Greater Gliders require large, old growth trees with abundant large hollows for denning and its abundance is often linked to hollow density. In southern Queensland, the Greater Glider requires at least 2-4 live den trees for every 2 ha of suitable forest habitat (Eyre T. J., 2007). Males have larger home range sizes than females and sexes usually share a den when the breeding season commences (Mackay, 2008).

Habitat mapping rules prepared by EcoSmart (2023) for Greater Glider are included in Error! Reference source not found.. Suitable habitat within the SGP North EA amendment area is shown in **Figure 3.7**.

1.1.1.1 Yellow-bellied Glider, *Petaurus australis australis*

There are records for Yellow-bellied Glider to the north, east and west of the broader SGP area and this species is well represented in the Barakula and Gurulmundi State Forests, with remnant vegetation within the SGP connecting these areas to form a contiguous forested area. Based on this information and the presence of suitable habitat, the species is considered likely to occur in the SGP North area but is yet to be detected.



Conservation-Significant Fauna (Mammals)

SURAT GAS PROJECT NORTH

- Area of Interest
- Indicative infrastructure layout

Records

- Greater Glider (Petauroides volans)
- Koala (Phascolarctos cinereus)

Habitat

- Yellow-Bellied Glider (Petaurus australis) Habitat Mapping
- Greater Glider (Petauroides volans) Habitat Mapping
- Koala (Phascolarctos cinereus) Habitat Mapping
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)
- Watercourse
- Highway
- Local Road

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GDA2020

The Yellow-bellied Glider is known to be particularly susceptible to the impacts of clearing (Youngentob et al, 2013), and is typically associated with intact forest remnants. This species is well represented in the Barakula and Gurulmundi State Forests with remnant vegetation in the northern half of the SGP North EA amendment area which connects these areas representing potential habitat despite the fact that it has yet to be detected. While linear corridors and other disturbance may ultimately be navigable by individual gliders, the loss of such a large area of habitat does have the potential to be significant for this species.

Impact areas for this species have been included in **Table 5.3**. Suitable habitat within the SGP North EA amendment area is shown in **Figure 3.7**.

3.2.2.6 Common Death Adder, *Acanthophis antarcticus*

The Common Death Adder is a slow-moving, sedentary snake that lies motionless while partially buried in leaf litter, vegetation or soil. They are found in a wide variety of habitats including rainforest, open woodland, shrubland and heath (Ehmann, 1992). Once abundant in the Brigalow Belt, this species is now rarely observed and, when located, is often associated with large contiguous tracts of vegetation such as those present within the SGP North EA amendment area. The Common Death Adder has been recorded from 11 unique locations within 50 km of the broader SGP area though the only recent record is from near Tara in 2021.

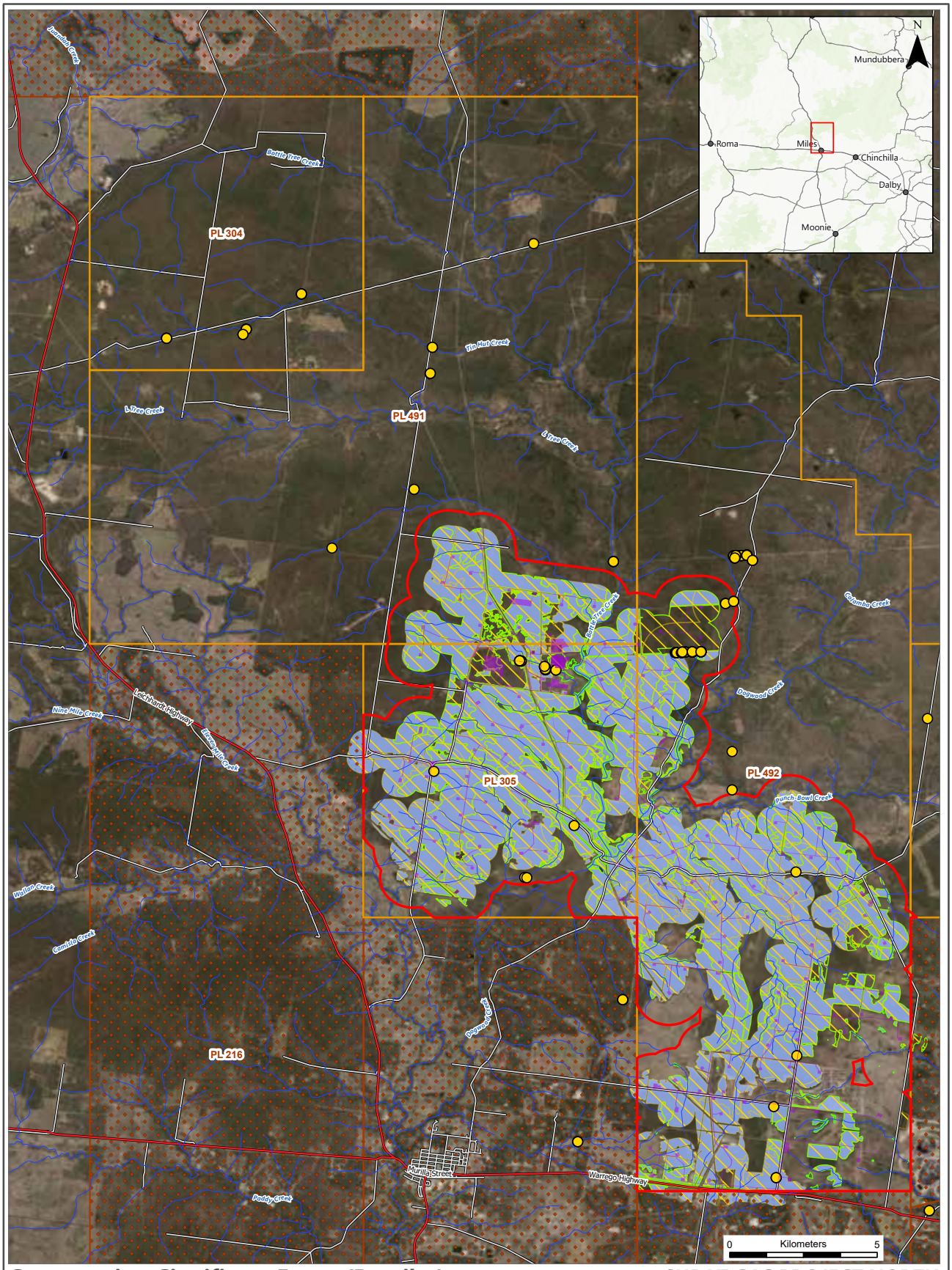
Habitat mapping rules prepared by EcoSmart (2023) for the Common Death Adder are included in Error! Reference source not found.. Suitable habitat within the SGP North EA amendment area is shown in **Figure 3.8**. It is noted that the presence of Death Adders is typically difficult to predict; they may occur in any remnant habitat yet are absent from seemingly good habitat within the Brigalow Belt. This may reflect historic land use, or events that affect ground structure such as fire history. While mapped areas are likely to represent suitable habitat, occupied habitat within the SGP North EA amendment area is likely to be overestimated (EcoSmart, 2023).

3.2.2.7 Grey Snake, *Hemiaspis damellii*

Grey Snakes occur throughout the Brigalow Belt, from coastal districts near Rockhampton, south-east to the Lockyer Valley in south-east Queensland. This species is a weakly venomous nocturnal frog specialist, sheltering during the day under fallen logs, within soil cracks and down animal burrows. They inhabit dry eucalypt forest and occasionally pasture, favouring cracking, flood-prone soils along floodplains and near watercourses (Wilson, 2022).

The broader SGP area is entirely within their distribution and the species has often been recorded within 50 km. There area eight (8) records within the broader SGP area since 1975, five (5) associated with Lake Broadwater and all in the south. Important remnant vegetation for this species includes Brigalow (*A. harpophylla*) ± Belah (*Casuarina cristata*) and grasslands on dark cracking clays. These areas form gilgais, a microrelief which readily collects water attracting large numbers of frogs after rain. Accurate recent records have also been located in RE 11.3.27f and 11.5.20. The latter record occurred in an isolated low-lying area of pooling water within 300 m of a minor creek line mapped as RE 11.3.25 (EcoSmart, 2023).

Habitat mapping rules prepared by EcoSmart (2023) for Grey Snake are included in Error! Reference source not found.. Suitable habitat within the SGP North EA amendment area is shown in **Figure 3.8**.



Conservation-Significant Fauna (Reptiles)

SURAT GAS PROJECT NORTH

- Area of Interest
- Indicative infrastructure layout

Records

- Golden-Tailed Gecko (Strophurus taenicauda)

Habitat

- Golden-Tailed Gecko (Strophurus taenicauda) Habitat
- Grey Snake (Hemiaspis damelii) Habitat
- Common Death Adder (Acanthophis antarcticus) Habitat
- Petroleum Lease (Granted)
- SGP North (Petroleum Lease - Granted)
- Watercourse
- Highway
- Local Road

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GDA2020

3.2.2.8 Brigalow Woodland Snail, *Adclarkia cameroni*

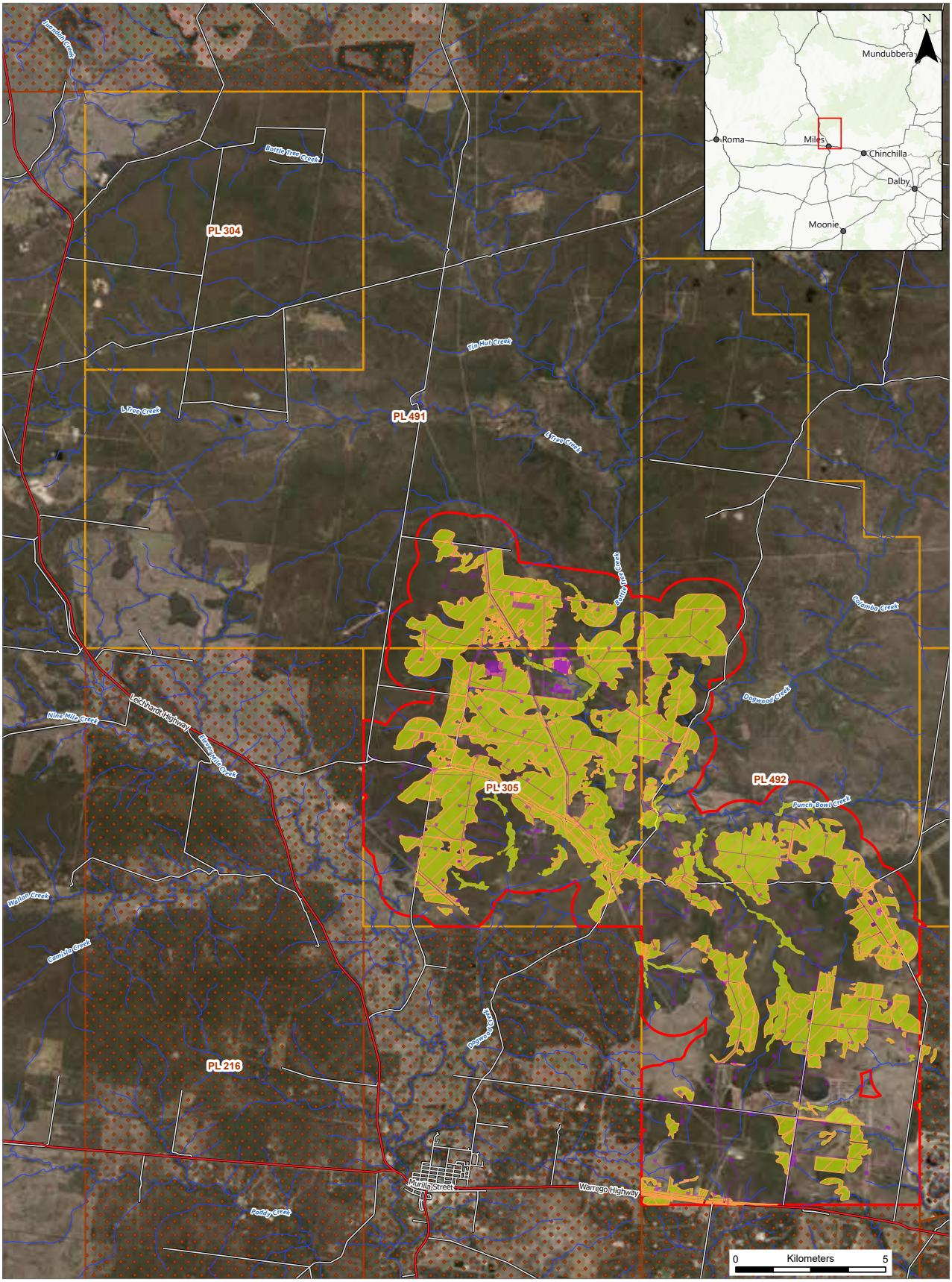
Brigalow Woodland Snail is found in Brigalow and alluvial eucalypt woodlands which have dense cover and scattered debris, especially logs, dense leaf litter, piles of fallen bark and flood debris. This species has been recorded at 27 discrete locations within 50 km of the broader SGP area. While the species is described as occurring within the Condamine floodplain, several records are located a considerable distance from this waterway, including two from within Barakula State Forest and one to the west of the SGP North EA amendment area. The species has also been recorded from highly disturbed and cleared habitats if there is suitable shelter on the ground (e.g. logs).

Habitat mapping rules prepared by EcoSmart (2023) for the Brigalow Woodland Snail are included in **Appendix F** . Suitable habitat within the SGP North EA amendment area is shown in **Figure 3.9**.

3.2.2.9 Dulacca Woodland Snail, *Adclarkia dulacca*

Publicly available records suggest the Dulacca Woodland Snail is restricted to the southern Brigalow Belt between Miles, Dulacca, Wandoan and Meandarra, though recent work has located the species west to the Yuleba area and east to Chinchilla. It has been recorded in available databases at 13 discrete locations within 50 km of the broader SGP area, including nearby areas within Gurulmundi State Forest and Barakula State Forest (just outside the SGP North EA amendment area). This species has been located in a variety of habitats including vine thicket and Brigalow woodland with rock outcrops and Lancewood (*Acacia shirleyi*), Ironbark and *E. woollsiana* woodlands on ridges with and without rock (EcoSmart, 2023). It shelters in moist microhabitats under wood, rocks and other debris as well as under bark at the base of trees. This species has also been recorded from highly disturbed and cleared habitats if there is suitable shelter on the ground (e.g. logs).

Habitat mapping rules prepared by EcoSmart (2023) for the Dulacca Woodland Snail are included in **Appendix F** . Suitable habitat within the SGP North EA amendment area is shown in **Figure 3.9**.



Conservation-Significant Fauna (Invertebrates)

SURAT GAS PROJECT NORTH

- Area of Interest
- Indicative infrastructure layout

Habitat

- Brigalow Woodland Snail (Adclarkia cameroni) Habitat
- Dulacca Woodland Snail (Adclarkia dulacca) Habitat
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)
- Highway
- Local Road
- Watercourse

Attexo

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GDA2020

3.2.3 Near Threatened fauna species

Two (2) fauna species listed as near threatened under the NC Act are known to occur or possibly occurring in the SGP North EA amendment area, namely:

- Golden-tailed Gecko (*Strophurus taenicauda*); and
- Woma Python (*Aspidites ramsayi*).

Habitat for a near threatened species does not constitute an ESA, nor is it a PEM under the EO Act. The presence or potential presence of a near threatened species triggers requirements under the NC Act that are approved and managed separately to the EA. Therefore, the occurrence or potential occurrence of near threatened species or their habitat does not trigger any requirement to amend the SGP North EA however, the presence of these species is noted.

3.2.4 Special Least Concern species

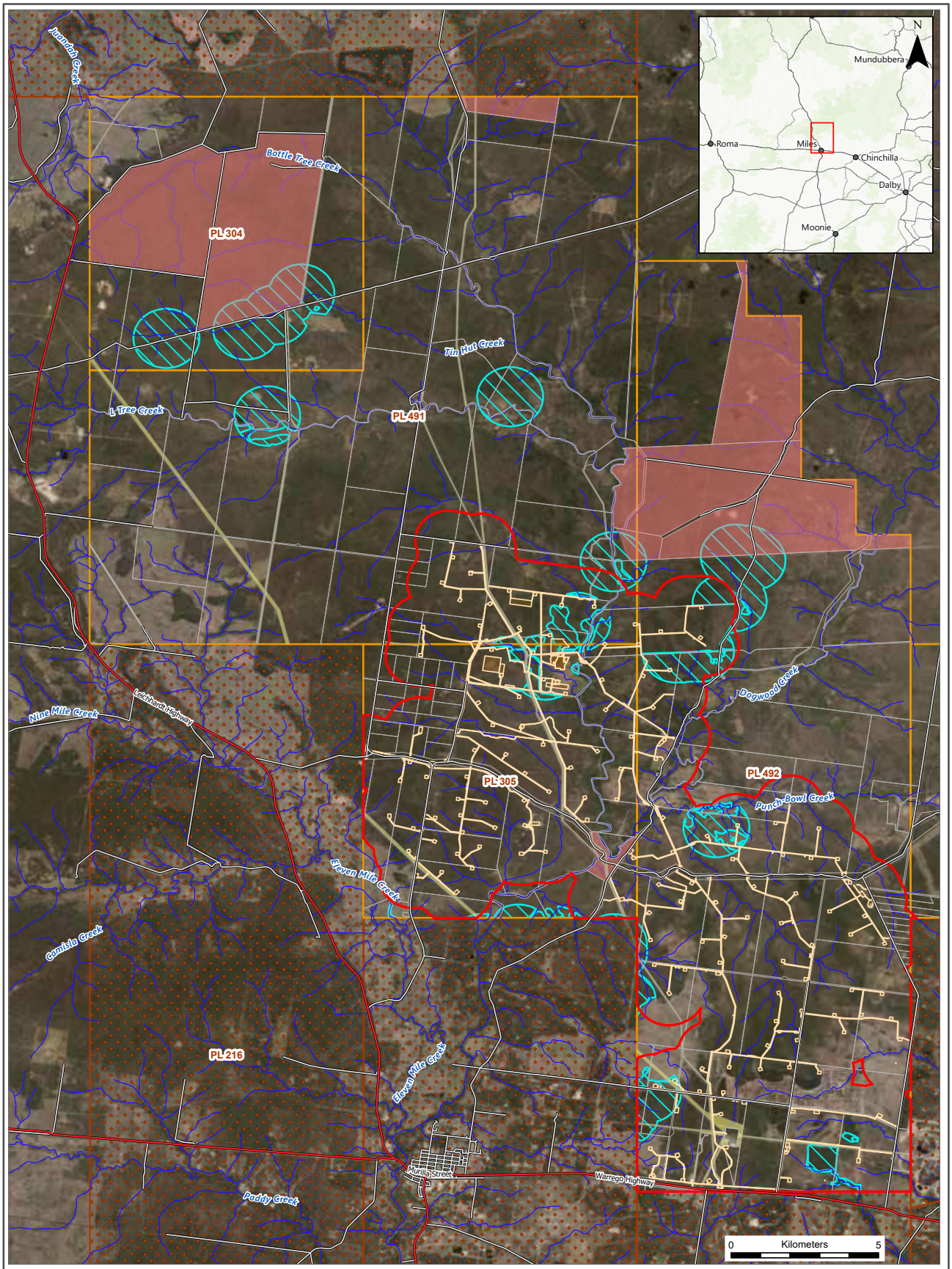
The Short-beaked Echidna (*Tachyglossus aculeatus*) is known to occur in the Project area. This species occupies a broad range of habitat types and could occur anywhere in the Project area.

3.2.5 Essential habitat mapping

The majority of the mapped essential habitat in the SGP North EA amendment area is associated with records for the Golden-tailed Gecko. This species is listed as Near Threatened under the NC Act; as such, mapped essential habitat for this species does not constitute an ESA or a PEM for the purposes of the EA.

Areas of essential habitat for endangered or vulnerable fauna species include:

- Mapped essential habitat for Koala on Lot 27AU49; and
- Mapped essential habitat for the South-eastern Long-eared bat on Girrawheen Station (Lot 15AU38, Lot 16AU38, Lot 17AU199).



Essential Habitat Map

SURAT GAS PROJECT NORTH

- Area of Interest
- Watercourse
- Indicative infrastructure layout
- Essential habitat map
- SGP North (Petroleum Lease - Granted)
- Petroleum Lease (Granted)
- Highway
- Local Road
- Base Parcel
- Easement Parcel
- Strata (Lot) Parcel

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GDA2020

4.0 Impact assessment

4.1 Planning and design

Coal seam gas developments apply an iterative process in terms of locating wells and gathering lines to manage competing constraints associated with the location of surface infrastructure, including ecological values, landholder preferences, geological features, existing infrastructure, and access tracks. Planning and management of surface activities and ground disturbance is undertaken utilising a set of hierarchical management principles to avoid, minimise and mitigate impacts to environmental values. These principles are:

- Avoid: Arrow Energy's first preference is to avoid PEMs, threatened ecological communities and threatened species habitat.
- Minimise: where other competing constraints or the scale / location of PEMs communities or species habitat dictate that avoidance is not possible (e.g. where there is riparian vegetation that need to be crossed or large areas of suitable habitat for wide ranging species such as the Koala, Greater Glider or Painted Honeyeater), Arrow Energy will preferentially locate infrastructure in a manner that minimises the impact to these values (e.g. cross the riparian vegetation at the narrowest or most degraded part or where practicable on the edge of suitable habitat for listed species so as not to bisect good quality habitat).
- Mitigate: implement mitigation measures to further minimise the direct and indirect impacts on ecological values.
- Remediate and rehabilitate: actively remediate and rehabilitate impacted areas to promote and maintain long term recovery.
- Offset: Arrow Energy will offset unavoidable significant residual impacts to PEMs.

The SGP North EA amendment area retains significant native vegetation cover compared with other parts of the Brigalow Belt bioregion, with approximately 74 % of the total land area (21,549 ha) supporting remnant native vegetation and a further 5 % supporting regrowth and other non-remnant vegetation. As such, it is not possible to access the gas resource for SGP North without clearing remnant vegetation, with 122 of the 160 proposed well pads impacting an area of remnant vegetation.

Where possible, facilities requiring larger areas of clearing have been located in cleared areas or lesser quality (non-remnant or regrowth) vegetation. This includes the siting of key facilities for the SGP North development on land purchased by Arrow Energy in 2012 (Girrawheen Station), including the FCS, a warehouse, office facility, camp, laydowns, pipe yards, quarries and laydowns on land. This property includes large areas mapped as Category X (non-remnant) which have been ground-truthed as containing a mix of cleared, non-remnant, regrowth and some remnant vegetation. All facilities on Girrawheen Station have been sited to take advantage of existing cleared areas, with minor clearing in adjoining regrowth or remnant areas required for establishment.

For facilities beyond Girrawheen Station, there is a requirement to clear remnant vegetation given the highly vegetated nature of the amendment area. This includes clearing for camps, laydown areas, communications towers and a borrow pit.

Due to the highly vegetated nature of the gasfield the use of deviated wells (instead of traditional vertical wells) has been identified as a key method of reducing the disturbance area and managing surface constraints to avoid high value ecological areas. There are planned to be 95 deviated wells on 29 well pads. There are often 3 or 4 deviated wells per well pad with 1 well pad containing 8 deviated wells. Three of these deviated wells will consist of a single well pad located to avoid surface constraints.

There are a number of significant planning and access constraint areas that have also influenced the proposed field layout and limited the choice of infrastructure locations. In the south of the EA amendment area in PL 492 there is a large solar farm which is a major constraint in accessing areas in a north-south orientation.

4.2 Overview of impacts

4.2.1 Vegetation clearing

The most significant impact associated with the development of SGP North is the direct loss of the following resulting from the establishment of well pads, gathering and associated infrastructure:

- Approximately 470.8 ha of remnant vegetation (representing approximately 2.9 % of the total remnant vegetation within the amendment area); and
- Approximately 54.2 ha of native regrowth vegetation (representing approximately 5.0% of the total regrowth vegetation in the amendment area).

Given the highly vegetated nature of the SGP North EA amendment area, clearing of remnant vegetation and associated habitat is an unavoidable aspect of the Project development however, the majority of the clearing proposed is in widespread, least concern vegetation types (predominantly RE 11.5.1, 11.7.4 and 11.7.7). **Table 4.1** summarises the total area of remnant and regrowth vegetation in the areas to be disturbed by the Project.

Table 4.1 Vegetation clearing for SGP North by RE type

RE Type	VM Act Status	Biodiversity Status	Impact area (ha)
Remnant			
11.3.2	Of concern	Of concern	0.6
11.3.4	Of concern	Of concern	0.7
11.3.14	Least concern	No concern at present	0.2
11.3.25	Least concern	Of concern	1.8
11.5.1	Least concern	No concern at present	216.7
11.5.1a	Least concern	No concern at present	1.6
11.5.21	Least concern	No concern at present	8.1
11.7.2	Least concern	No concern at present	9.8
11.7.4	Least concern	No concern at present	89.2
11.7.5	Least concern	No concern at present	17.8
11.7.6	Least concern	No concern at present	2.3
11.7.7	Least concern	No concern at present	121.9

RE Type	VM Act Status	Biodiversity Status	Impact area (ha)
		Subtotal (remnant)	**470.8**
Regrowth			
11.5.1	Least concern	No concern at present	47.1
11.7.4	Least concern	No concern at present	7.1
		Subtotal (regrowth)	**54.2**
Cleared and non-remnant			
Non-remnant	-	-	23.8
Cleared land	-	-	179.4
		Total clearing	**728.3**

4.2.2 Habitat fragmentation and landscape connectivity

Habitat fragmentation occurs when continuous areas of habitat are subdivided into a number of smaller, separate components. This term encompasses two interrelated components; habitat loss (i.e. a reduction in the amount of habitat) and fragmentation (i.e. the breaking apart of habitat which increases 'edge effects')(Bennett, 2006). The impacts of habitat fragmentation are scale-dependent and may differ depending on the species or community under consideration. For example, loss of small areas of habitat that do not present a significant barrier to movement by highly mobile species (e.g. birds of prey) may represent a much greater barrier to dispersal of less mobile or far-ranging species (e.g. amphibians or small reptiles).

While the overall clearing areas are large, clearing within remnant vegetation for gasfield development is undertaken in 'chunks', with disturbance areas of 1-2 ha for individual well pads or linear corridors of 20-27 m width with surrounding vegetation left intact. The Landscape Fragmentation and Connectivity (LFC) Tool has determined the impacts on connectivity areas within the SGP North EA amendment area to be significant based on Arrow's GTRE mapping, but not significant using DESI RE mapping. Impact values generated by the LFC Tool have been included in the PEMs table (refer **Table 5.3**). The outputs from the LFC Tool analysis are attached in **Appendix G**.

Loss of connectivity at the patch scale largely depends on the species under consideration; impacts associated with linear infrastructure corridors and waterway crossings are considered in further detail for individual threatened species (refer **Section 4.5**).

4.2.3 Indirect impacts

Indirect impacts on ecological values that may arise as a result of the SGP North development include:

- edge effects resulting from the creation of smaller patches of vegetation with a greater edge to surface ratio, including increased exposure to weed invasion, light and wind penetration (which can alter microclimate features) potentially resulting in changes in community structure and composition over time;
- dust generation during construction, which has the potential to smother plants, reducing photosynthesis and resulting in decreased vegetation health and condition;

- increased noise from the vegetation clearing operations, the operation of machinery and vehicle traffic which may affect the behaviour of wildlife (typically limited to the construction period);
- increased lighting during construction and operation, with the potential to disrupt the behaviour of nocturnal species; and
- mortality resulting from vehicle collision.

Indirect impacts on the ecological values of the SGP North EA amendment area will be managed in accordance with Arrow Energy's existing Environmental Management Framework.

4.3 Impacts on State Forests

There will be no impacts to State Forests.

4.4 Impacts on terrestrial flora values

4.4.1 Endangered REs by VM Class

Within the SGP North EA amendment area, all Endangered REs have been avoided and there are no impacts to the 4.9 ha in the AOI.

4.4.2 Of concern' REs by VM Class

Within the SGP North EA amendment area, 'of concern' REs are restricted to alluvial systems, typically occurring as linear remnants or small patches along waterways and drainage features. No well pads or infrastructure have been located in these areas however, there are some limited impacts associated with linear infrastructure crossings including:

- ROWs for gathering infrastructure and access tracks through narrow linear remnants of 'Of concern' RE 11.3.4 associated with un-named tributaries of Bottle Tree Creek; and
- ROWs, access tracks and extra work areas through a patch of 'Of concern' RE 11.3.2 on Punch Bowl Creek and an unnamed tributary of Columboola Creek in the south of the SGP North EA amendment area.

Impacts on 'Of concern' REs by VM Act class are limited to RE 11.3.4 (0.7 ha) and RE 11.3.2 (0.6 ha); these impacts are within the existing approved limits in Schedule F, Table 3 (PEMs table) and do not trigger a requirement to amend the EA.

4.4.3 Impacts on watercourse vegetation

Impacts on regulated vegetation within a defined distance from the defining banks of watercourses are within the existing approved limits specified in the EA.

4.4.4 Impacts on habitat for endangered and vulnerable flora species

The SGP North development will impact on general habitat for *Acacia barakulensis* and *Micromyrtus carinata* however, neither of these plant species have been located in the amendment area. Pre-clearance surveys will be undertaken within the development areas prior to construction. No allowance has been included in the PEMs table for impacts on habitat for these species.

4.5 Impacts on terrestrial fauna values

4.5.1 Impacts on mapped essential habitat

Pursuant to Schedule F, Table 1 of the SGP North EA, activities in Category C ESAs that are 'essential habitat' are limited to low impact petroleum activities only (i.e. no ground disturbance). The following impacts on essential habitat trigger a requirement to amend the EA as currently formulated:

- 6.1 ha of disturbance of mapped essential habitat for Koala (endangered) comprising two well pads, gathering ROW and extra work areas; and
- 16.2 ha of disturbance of mapped essential habitat for the South-eastern long-eared Bat (vulnerable) comprising pipeline ROW, a quarry, access tracks and extra work areas.

4.5.2 Impacts on habitat for endangered fauna species

4.5.2.1 Greater Glider, *Petauroides volans volans*

Development of the SGP North will result in the direct loss of 437.7 ha of potentially suitable habitat for Greater Glider based on RE associations, with clearing occurring as small patches (1-2 ha in size) for well pads and linear corridors up to 27 m in width. Clearing for the SGP North will reduce the number of forage and denning trees, and result in further fragmentation of remnant vegetation in the amendment area.

Greater Gliders are generally considered to be sensitive to fragmentation, with larger patches of suitable habitat having a higher probability of occupancy and persistence of Greater Glider populations (Possingham et. al., 1994). However, small patches should not be dismissed as important habitat, particularly if connected to other patches. Most studies suggest small home ranges (<3 ha) though outliers recorded by some studies suggest that Greater Gliders are capable of longer distance movements, particularly where there are resource shortages and/or fragmented habitats. While linear corridors may be navigable by individual gliders, the loss of such a large cumulative area of habitat does have the potential to be significant for this species.

Impact areas for this species have been included in **Table 5.3**.

4.5.2.2 Koala, *Phascolarctos cinereus*

Development of the SGP North will result in the direct loss of approximately 536.6 ha of potentially suitable habitat for Koala and would be expected to result in the loss of food trees wherever clearing occurs.

Koalas required large, connected patches of eucalypt woodland to maintain a viable population, although determining the maximum spatial extent to support Koalas either at the individual scale or the population level is complicated by the fact that Koalas can persist in highly fragmented landscapes and the area needed differs widely across their range (Youngentob et al, 2021). West of the Great Dividing Range, eucalypt woodland habitat will generally have less dense food trees than eastern habitats. There is no agreement in the literature about how many

preferred food trees are needed in the landscape to support a Koala population; as such, it is difficult to assess the significance of this impact though the loss of such a large cumulative area of habitat does have the potential to be significant for this species.

Impact areas for this species have been included in **Table 5.3**.

4.5.3 Impacts on habitat for vulnerable fauna species

4.5.3.1 Common Death Adder, *Acanthophis antarcticus*

Development of the SGP North will result in the direct loss of 454.1 ha of potential habitat for Common Death Adder however, the actual area of occupancy for this species within the amendment area is likely to be very small. Clearing will not occur in a single location rather, it will increase the number and extent of linear clearing areas and potentially reduce patch size for this species. Alteration to microhabitats may also detrimentally affect this species as they require groundcover to ambush their prey. Wildfires are also a potential threat to habitat for this species however, the frequency and intensity of wildfires is unlikely to change as a result of the SGP North development.

Impact areas for this species have been included in **Table 5.3**.

4.5.3.2 Brigalow Woodland Snail, *Adclarkia cameroni*

Development of the SGP North will result in the direct loss of 3.2 ha of potentially suitable habitat associated with the major creek systems through the central part of the EA amendment area, although the presence of this species has not been confirmed within the footprint.

Given the limited dispersal capability of these species, any snails in these drainage lines would be assumed to constitute a population. If present, clearing for waterway crossings would have the potential to eliminate local populations of this species however, the area of impact is unlikely to have a significant impact on regional populations. This species is also subject to desiccation and may be impacted by edge effects associated with linear infrastructure.

Impact areas for this species have been included in **Table 5.3**.

4.5.3.3 Glossy Black Cockatoo (south-eastern), *Calyptorhynchus lathami lathami*

Development of the SGP North will result in the direct loss of 25.2 ha of clearing within habitat containing potential shelter and foraging resources for the Glossy Black Cockatoo.

Although the cumulative clearing area is large, this will be undertaken in a number of small 'chunks' and linear corridors. Being highly mobile, this species may travel considerable distances to isolated fragments in search of food and, given the highly vegetated nature of the amendment area and adjoining State Forests, it is unlikely that the loss of small isolated chunks would result in a significant impact on resources for these species. Locally, fragmentation and the removal of hollow-bearing trees may increase predation of nestlings or alternatively result in higher competition for hollows by 'edge' species such as the Common Brushtail Possum, Little Corella, Galah and Sulphur-crested Cockatoo.

Impact areas for this species have been included in **Table 5.3**.

4.5.3.4 Grey Snake, *Hemiaspis damelii*

Development of the SGP North will result in the direct loss of 3.4 ha of suitable habitat for Grey Snake, predominantly associated with clearing in riparian areas. While the cumulative area is moderate, this clearing comprises a number of smaller areas primarily associated with linear infrastructure corridors and is unlikely to have a significant impact on Grey Snake populations in any given location.

Impact areas for this species have been included in **Table 5.3**.

4.5.3.5 Yellow-bellied Glider, *Petaurus australis australis*

Development of the SGP North will result in the direct loss of 437.0 ha of potentially suitable habitat for the Yellow-bellied Glider based on RE associations, with clearing occurring as small patches (1-2 ha in size) for well pads and linear corridors up to 27 m in width. Clearing for the SGP North has the potential to reduce the number of forage and denning trees, and result in further fragmentation of remnant vegetation in the amendment area.

The Yellow-bellied Glider is known to be particularly susceptible to the impacts of clearing (Youngentob et al, 2013), and is typically associated with intact forest remnants. The SGP North EA amendment area supports large contiguous areas of remnant vegetation which provide potential habitat for the Yellow-bellied Glider although it has not been detected in field surveys. While linear corridors and other disturbance may ultimately be navigable by individual gliders, the loss of such a large area of habitat does have the potential to be significant for this species.

Impact areas for this species have been included in **Table 5.3**.

4.5.3.6 Diamond Firetail, *Stagonopleura guttata*

Development of the SGP North will result in the direct loss of 437.9 ha of potentially suitable habitat for the Diamond Firetail based on RE associations, with clearing occurring as small patches (1-2 ha in size) for well pads and linear corridors up to 27 m in width. Historical and ongoing clearing is the main reason for the decline in this species with the population declining 30-50 % over the last ten years (DCCEEW, 2023). While the presence of this species is likely to be sporadic, the loss of such a large area of habitat does have the potential to be significant for this species.

Impact areas for this species have been included in **Table 5.3**.

4.5.4 Impacts on habitat for Special Least Concern species

Development will result in the direct loss of 8.9 ha of habitat for the Short-beaked Echidna. This species could theoretically occur within any habitat in the SGP North amendment area however, impact calculations are derived based on Queensland Government MSES mapping for Special Least Concern animals and by buffering records for this species by 1 km. Approximately 8.9 ha of this habitat will be lost as a result of vegetation clearing for the Project. However, this species occupies a broad range of habitats and no population is likely to be significantly impacted as a result.

Impact areas for this species have been included in **Table 5.3**.

5.0 Summary of proposed amendments

Impacts associated with the development of the SGP North require amendments to the SGP North EA, specifically:

- the inclusion of or authorisations through 'despite clauses' to authorise impacts to ESAs where the petroleum activities proposed are inconsistent with *Schedule F, Table 1 – Authorised petroleum activities in Environmentally Sensitive Areas and their protection zones*; and
- amendments to *Schedule F, Table 3 – Significant residual impacts to prescribed environmental matters* where the impact areas proposed exceed the authorised limits in the SGP North EA.

Details of the proposed amendments are set out below, with the proposed conditions set out in the proposed SGP North EA amendments of the EA amendment supporting information report.

5.1 Environmentally Sensitive Areas

There are no proposed impacts in Category B ESAs. The assessment of impacts on Category C ESAs is provided in **Table 5.1**

It is proposed to authorise impacts to ESAs via *Schedule F, Table 2 – Maximum significant disturbance in ESAs*. This provides flexibility to comply with the maximum footprint within ESAs as not all infrastructure locations or CCAs have been finalised. However, an overview of the proposed intersection of infrastructure within ESAs is provided in **Table 5.1** to assist with identifying where specific authorisation is required to undertake particular types of activities in ESAs despite the restrictions imposed by *Schedule F, Table 1-Authorised petroleum activities in environmentally sensitive areas and their protection zones* ('despite clauses').

Despite clauses are required for any works involving ground disturbance in areas where only low impact petroleum activities are permitted; and non-essential petroleum activities in areas where only essential petroleum activities are permitted. Non-essential petroleum activities proposed within ESAs for the SGP North include:

- extra work areas, such as those required to accommodate well pads on sloping topography;
- communication tower;
- proposed quarry;
- FCS;
- WTS;
- pipe yard and laydown areas; and
- a construction camp.

The proposed conditions to authorise impacts is provided in the supporting information documents 'Proposed SGP North EA amendments'.

Table 5.1 Proposed Activities Affecting Category B and Category C ESAs

ESA Type	Detail	Allowable activities	Proposed activities
Category C			
Of concern RE	RE 11.3.2	Low impact petroleum activities only	ROW – 0.2 ha Access tracks – 0.2 ha Extra work areas – 0.2 ha **Total disturbance requiring authorisation – 0.6 ha**
	RE 11.3.4	Low impact petroleum activities only	ROW – 0.6 ha Access tracks – 0.1 ha Extra work areas – <0.1 ha **Total disturbance requiring authorisation – 0.7 ha**
	RE 11.3.25	Low impact petroleum activities only	ROW – 1.2 ha Access tracks – 0.1 ha Extra work areas – 0.5 ha **Total disturbance requiring authorisation – 1.8 ha**
Essential habitat for endangered wildlife	Koala	Low impact petroleum activities only	**Total disturbance requiring authorisation – 6.1 ha**
Essential habitat for vulnerable wildlife	South-eastern Long-eared Bat	Low impact petroleum activities only	**Total disturbance requiring authorisation – 16.2 ha**
		Cumulative unauthorised disturbance in Category C ESA	**Despite - 23.2 ha**
Category B PPZ			
Endangered RE	PPZ (within 200 m)	Essential petroleum activities only	Well pad - <0.1 ha No amendment required
Category B SPZ			
Endangered RE	PPZ (within 200 m)	Essential petroleum activities only	Well pad – 1.0 ha ROW – 0.5 ha No amendment required
Category C PPZ			
Essential habitat for endangered or vulnerable wildlife and Of concern REs	PPZ (within 200 m)	Essential petroleum activities only	ROW – 48.3 ha Track – 15.6 ha FCS – 0.9 ha WTS – 1.8 ha Quarry – 8.0 ha

ESA Type	Detail	Allowable activities	Proposed activities
			Laydown – 0.4 ha Pipe yard – 1.7 ha Extra work area – 1.6 ha Camp – 0.5 ha Communication tower - <0.1 ha **Total disturbance – 98.6 ha** **Despite – 15.0 ha**

5.1.1 Maximum disturbance limits for ESAs

It is proposed that *Schedule F, Table 2 – Maximum significant disturbance* is updated to reflect the limits shown in **Table 5.2** based on the proposed infrastructure layout. At the time of the application, the inclusion of Protected Wildlife Habitat (as defined under the EO Act, refer **Section 1.3.3**) as a Category C ESA is the subject of discussion between the CSG industry and the DESI. As such, **Table 5.1** includes areas of mapped essential habitat shown on the published essential habitat map only.

By contrast, the values given in **Table 5.2** incorporate impacts to Protected Wildlife Habitat that is a Category A, B or C area shown on the Regulated Vegetation Management Map (RVMM) for a species of wildlife listed as critically endangered, endangered, vulnerable under the *Nature Conservation Act 1992* (thereby reflecting DESI's position with regard to 'essential habitat' constituting an area that contains both wildlife habitat and Category A, B or C RVM mapped areas).

Table 5.2 – Revised *Schedule F, Table 2 – Maximum significant disturbance*

Activity(ies)	Maximum footprint
Ground disturbance for petroleum activities	4090.0 ha (Actual Stage 1 impact = 728.2 ha)
Ground disturbance within a Category B Environmentally Sensitive Area	9.1 ha (Actual Stage 1 impact=0 ha)
Ground disturbance within a Category C Environmentally Sensitive Area	423.5 ha

It is acknowledged that the impacts on Category C ESAs (423.5 ha) reported in **Table 5.2** are inconsistent with the PEMs values reported in **Table 5.3** (536.6 ha). This is because the impacts identified in **Table 5.3** utilise validated and ground-truthed vegetation mapping rather than mapped regulated vegetation that is Category A, B or C RVM as noted by the department's expectations regarding impacts on Category C ESA – Essential Habitat.

5.2 Prescribed Environmental Matters

It is proposed to authorise impacts to the identified PEMs values via amendments to *Schedule F, Table 3 – Significant residual impacts to prescribed environmental matters* as set out in **Table 5.3**.

Table 5.3 Proposed amendments to *Schedule F, Table 3 – Significant residual impacts to prescribed environmental matters*

Prescribed Environmental Matter	Proposed impact (SGP North Stage 1)	Existing approved 'Maximum extent of impact'	Amendment required
Endangered regional ecosystem			
11.4.3	No impact	MNES[1]	Not required
11.9.5	No impact	MNES[1]	Not required
11.9.10	No impact	-	Not required
Of concern regional ecosystem			
11.3.2	0.6 ha	5 ha	Not required
11.3.4	0.7 ha	20 ha	Not required
Regional ecosystems (not within an urban area) within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map			
RE 11.3.2 (17a)	0.3 ha	1 ha	Not required
RE 11.3.4 (16c)	0.3 ha	7 ha	Not required
RE 11.3.14 (18a)	0.2 ha	6 ha	Not required
RE 11.3.25 (16a)	1.6 ha	12 ha	Not required
RE 11.5.1 (18b)	4.0 ha	20 ha	Not required
RE 11.5.4 (18b)	No impact	3 ha	Not required
RE 11.5.20 (13d)	No impact	1 ha	Not required
RE 11.5.21 (18a)	No impact	12 ha	Not required
RE 11.7.4 (12a)	1.6 ha	8 ha	Not required
RE 11.7.5 (29b)	0.1 ha	1 ha	Not required
RE 11.7.6 (10a)	0.3 ha	5 ha	Not required
RE 11.7.7 (12a)	2.1 ha	10 ha	Not required

Prescribed Environmental Matter	Proposed impact (SGP North Stage 1)	Existing approved 'Maximum extent of impact'	Amendment required
Essential habitat (not in an urban area) for vulnerable wildlife			
Nyctophilus corbeni (South-eastern Long-eared Bat)	16.2 ha	MNES[1]	16.2 ha
Essential habitat (not in an urban area) for endangered wildlife			
Phascolarctos cinereus (Koala)	6.1 ha	NA	6.1 ha
Connectivity areas			
Connectivity areas	470 ha	5.8 ha	470 ha
Wetlands and watercourses			
A wetland in a wetland protection area shown on the map of referable wetlands	NA	0 ha	NA
A wetland of high ecological significance shown on the Map of referable wetlands	NA	0 ha-	NA
Designated precincts in a strategic environmental area			
Designated precinct in a strategic environmental area	NA	0 ha	NA
Protected wildlife habitat			
An area shown as a high risk area on the flora survey trigger map that contains plants that are endangered or vulnerable wildlife.	No impact	0 ha	No impact
An area not shown as a high risk area on the flora survey trigger map that contains plants that are endangered or vulnerable wildlife.	NA	0 ha	NA
A non-juvenile koala habitat tree located in an area of bushland habitat, high value rehabilitation or medium value rehabilitation habitat in the 'Map of Assessable Development Area Koala Habitat Values'	NA	MNES[1]	NA
Habitat for an animal that is endangered wildlife			
Petauroides volans volans, Greater Glider	437.7 ha	-	437.7 ha

Prescribed Environmental Matter	Proposed impact (SGP North Stage 1)	Existing approved 'Maximum extent of impact'	Amendment required
Phascolarctos cinereus, Koala	536.6 ha	-	536.6 ha
Habitat for an animal that is vulnerable wildlife			
Acanthophis antarcticus, Common Death Adder	454.1 ha	-	454.1 ha
Adclarkia cameroni, Brigalow Woodland Snail	3.2 ha	-	3.2 ha
Calyptorhynchus lathami lathami, Glossy Black Cockatoo	25.2 ha	-	25.2 ha
Furina dunmalli, Dunmall's Snake	426.4 ha	MNES[1]	Not required
Hemiaspis damelii, Grey Snake	3.4 ha	-	3.4 ha
Stagonopleura guttata, Diamond Firetail	437.9 ha	-	437.9 ha
Nyctophilus corbeni, South-eastern Long-eared Bat	432.7 ha	MNES[1]	Not required
Petaurus australis australis, Yellow-bellied Glider	437.0 ha	-	437.0 ha
Habitat for an animal that is special least concern wildlife			
Tachyglossus aculeatus, Short-beaked Echidna	8.9 ha	35.4 ha	Not required
Protected areas			
National park	NA	0 ha	NA
Regional park	NA	0 ha	NA
Nature refuge	NA	0 ha	NA
Highly protected zones of State marine parks			
Conservation park zone	NA	0 ha	NA
Marine national park zone	NA	0 ha	NA
Preservation zone	NA	0 ha	NA

Prescribed Environmental Matter	Proposed impact (SGP North Stage 1)	Existing approved 'Maximum extent of impact'	Amendment required
Other zones	NA	0 ha	NA
Fish habitat areas			
A declared fish habitat area	NA	0 ha	NA
Waterway providing for fish passage			
Fish passage (not in an urban area)	0.1 ha	18.5 ha	Not required
Marine plants			
Marine plant (not in an urban area)	NA	0 ha	NA
Legally secured offset area			
Legally secured offset area	NA	0 ha	NA

[1] Impact managed under EPBC approval 2010/5344

6.0 References

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Appendix A

EPBC Approval 2010/5344

Approval

Surat Gas Expansion Project (EPBC 2010/5344)

This decision is made under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

person to whom the approval is granted	Arrow Energy Pty Ltd
proponent's ABN	ABN: 73 078 521 936
proposed action	To expand coal seam gas operations in the Surat Basin, Queensland, as described in the referral received under the EPBC Act on 2 February 2010; and as described in the Surat Gas Project Environmental Impact Statement (March 2012) and Supplementary Report to the Environmental Impact Statement (June 2013).
decision	To approve the proposed action for each of the following controlling provisions: • Listed threatened species and communities (sections 18 and 18A) • Listed migratory species (sections 20 and 20A) • A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E)
Conditions of approval	This approval is subject to the conditions specified below.
expiry date of approval	This approval has effect until **31 December 2080**.

Decision-maker	Greg Hunt
name and position	The Hon Greg Hunt MP Minister for the Environment
signature	
date of decision	19:12:2013

Conditions of approval

1. The **Minister** may determine that a plan, strategy or program approved by the Queensland Government satisfies a plan required under these conditions.

Disturbance Limits

2. For the purpose of the action, the **approval holder** must not take any action outside the **project area**.
3. The action is limited to a maximum of 6,500 coal seam gas production wells and associated infrastructure.
4. The **approval holder** must not undertake hydraulic fracturing.
5. To protect **EPBC listed species** and **EPBC communities** within the **project area** the maximum disturbance limits in Table 1 apply to the project. The **approval holder** must not exceed these disturbance limits.

Table 1: Whole of project maximum disturbance limits

Terrestrial species	**Maximum disturbance (hectares) to core habitat**
Curly-bark Wattle, *Acacia curranii*	1210
Hando's Wattle, *Acacia handonis*	1210
Belson's Panic, *Homopholis belsonii*	140
Lobed Blue Grass, *Bothriochloa biloba*	305
Kogan Waxflower, *Philotheca sporadica*	480
Prostanthera sp Dunmore	380
Small-leaved Denhamia, *Denhamia parvifolia*	50
Calytrix gurulmundensis	1210
Ooline, *Cadellia pentastylis*	No disturbance
Finger Panic Grass, *Digitaria porrecta*	174
Austral Toadflax, *Thesium australe*	160
Acacia lauta	990
Cobar Greenhood Orchid, *Pterostylis cobarensis*	2 170
Xerothamnella herbacea	110
Hawkweed, *Picris evae*	120
Austral Cornflower, *Rhaponticum australe*	160
Eucalyptus virens	170
King Blue-grass, *Dichanthium queenslandicum*	160
Queensland White-gum, *Eucalyptus argophloia*	10
Macrozamia machinii	No disturbance
South-eastern Long-eared Bat, *Nyctophilus corbeni*	4 080
Dunmall's Snake, *Furina dunmalli*	4 400
Five-clawed Worm-skink, *Anomalopus mackayi*	560
Squatter Pigeon (Southern), *Geophaps scripta scripta*	3261

Regent Honeyeater, *Anthochaera phrygia*	20
Collared Delma, *Delma torquata*	90
Yakka Skink, *Egernia rugosa*	310
Australian Painted Snipe, *Rostratula australis*	5
EPBC Communities	**Maximum disturbance (hectares)**
Brigalow (*Acacia harpophylla* dominant and co-dominant)	106
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	8
Weeping Myall Woodlands	1
Natural Grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	No disturbance
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	No disturbance
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	No disturbance

6. To protect **EPBC listed species and communities** within the **project area** the maximum disturbance limits in Table 2 apply to **Stage 1**. The **approval holder** must not exceed these disturbance limits.

Table 2: Maximum disturbance limits for Stage 1

Terrestrial species	**Maximum disturbance (hectares) to core habitat**
South-eastern Long-eared Bat, *Nyctophilus corbeni*	167
Dunmall's Snake, *Furina dunmalli*	66
Five-clawed Worm-skink, *Anomalopus mackayi*	2
Squatter Pigeon (Southern), *Geophaps scripta scripta*	203
Regent Honeyeater, *Anthochaera phrygia*	1
Collared Delma, *Delma torquata*	11
Yakka Skink, *Egernia rugosa*	19
EPBC Communities	**Maximum disturbance (hectares)**
Brigalow (*Acacia harpophylla* dominant and co-dominant)	39
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	8

EPBC Species Impact Management and Offset Plan

EPBC Species Impact Management and Offset Plan – Stage 1

7. An EPBC Species Impact Management and Offset Plan for **Stage 1** must be submitted for approval of the **Minister** at least 3 months prior to **commencement**, and must include:

    (a) measures to report the methodology and results of **pre-clearance surveys**, and quantification of actual impacts, in the annual reporting required by condition 28. **Pre-clearance surveys** must be undertaken in accordance with the **Department's survey guidelines** in effect at the time of the survey or other survey methodology approved by the **Department** in writing;

(b) a map of the location of each **EPBC listed threatened species** and its habitat or **EPBC community** in relation to infrastructure and proposed disturbance for **Stage 1**;

(c) potential threats and **impacts** to **EPBC listed species** and **EPBC communities** from **Stage 1**;

(d) a description of the measures that will be taken to avoid, mitigate and manage **impacts** to the **EPBC listed species** and its habitat, including to the **Murray Cod** and **Fitzroy River Turtle,** or an **EPBC community**;

(e) measures to report to the **Department** on the occurrence and circumstances of **EPBC listed species** deaths as a result of the action and actions taken to reduce the likelihood of any such circumstance reoccurring;

(f) a monitoring program to determine the success of mitigation and management measures and inform the next Stage of the EPBC Species Impact Management and Offset Plan to ensure adaptive management for the duration of the project approval;

(g) a discussion of relevant **conservation advice**, **recovery plans** and **threat abatement plans** and how the EPBC Species Impact Management and Offset Plan - **Stage 1** is consistent with these documents;

(h) details of the following minimum offset areas for **Stage 1** including, for each area, the location, tenure, site description and map of environmental values:

i. 112 hectares for Brigalow (*Acacia harpophylla* dominant and co-dominant);

ii. 30 hectares Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions;

iii. 80 hectares for Yakka Skink, *Egernia rugosa*;

iv. 42 hectares for Collared Delma, *Delma torquata*;

v. 230 hectares for Dunmall's Snake, *Furina dunmalli*;

vi. 545 hectares for Squatter Pigeon (Southern), *Geophaps scripta scripta*;

vii. 6.5 hectares for Five-clawed Worm-skink, *Anomalopus mackayi*;

viii. 4 hectares for Regent Honeyeater, *Anthochaera phrygia*; and

ix. 765 hectares for South-eastern Long-eared Bat, *Nyctophilus corbeni*.

(i) a process for any significant **impact** to an **EPBC listed species** or **EPBC community** for **Stage 1**, where the species or community is not identified in Table 2, to be offset in accordance with the **EPBC Act Offsets Policy**;

(j) an offset area management plan for each offset area, which sets out management measures that will be implemented to improve the offset site for the respective **EPBC species** and/or **EPBC community**; and

(k) a timeline for when actions identified in the EPBC Species Impact Management and Offset Plan will be implemented and for legally securing offsets including, for each area, the proposed legal mechanism for securing the offset. Offsets for **Stage 1** must be legally secured prior to **commencement** of **Stage 2**.

8. The EPBC Species Impact Management and Offset Plan for **Stage 1** must be peer reviewed by a **suitably qualified ecologist** approved by the **Minister** in writing. The peer review must be submitted to the **Minister** together with the EPBC Species Impact Management and Offset Plan for **Stage 1** and a statement from the **suitably qualified ecologist** stating that they carried out the peer review and endorse the findings of the peer review.

9. The **approval holder** must not **commence** the action until the EPBC Species Impact Management and Offset Plan for **Stage 1** has been approved by the **Minister** in writing.

EPBC Species Impact Management and Offset Plan – Stages 2 to 4

10. The **approval holder** must update the EPBC Species Impact Management and Offset Plan for the next **development stage** (i.e. **Stage 2, Stage 3** and **Stage 4**) and submit for approval of the **Minister** at least 3 months prior to **commencement** of each **development stage**. Each updated plan must include:

    (a) the information required for the EPBC Species Impact Management and Offset Plan in conditions 7 (a) to (g) and conditions 7 (j) and 7 (k) for the respective **development stage**;

    (b) where **impacts** are unavoidable, an offset strategy to compensate for residual **impacts** to each **EPBC species** or **EPBC community** for that **development stage** in accordance with the **EPBC Act Offsets Policy**. The offset strategy must:

        i. demonstrate how the offset builds on offsets secured as part of the EPBC Species Impact Management and Offset Plan – **Stage 1** and any other **development stage** and, where possible, will contribute to a larger strategic offset for whole of project **impacts**;

        ii. identify land (including a map, site description and shapefile) that has or will be acquired and how it has been or will be legally secured;

        iii. include a detailed discussion of the quality, condition, site context and environmental values of the impact and offset site relevant to the **EPBC species** or **EPBC community** being offset;

        iv. include a description of potential risks to successful implementation of the offset, including a description of contingency measures that would be implemented to mitigate against these risks; and

        v. discuss connectivity of the offset area with other habitats and biodiversity corridors.

    (c) a reconciliation of **impacts** against whole of project disturbance limits. To incentivise avoidance, the **approval holder** is only required to offset realised **impacts**. Where the full **impact** from **Stage 1, Stage 2** or **Stage 3** that has been offset is not realised, the balance of the offset can be transferred to a future offset liability for a future **development stage** for this project.

11. The updated EPBC Species Impact Management and Offset Plan for each **development stage** must be peer reviewed by a **suitably qualified ecologist** approved by the **Minister** in writing. The peer review must be submitted to the **Minister** together with the EPBC Species Impact Management and Offset Plan for each **development stage** and a statement from the **suitably qualified ecologist** stating that they carried out the peer review and endorse the findings of the peer review.

12. The **approval holder** must not **commence Stage 2, Stage 3** or **Stage 4** until the EPBC Species Impact Management and Offset Plan for that **development stage** has been approved by the **Minister** in **writing**. The approved EPBC Species Impact Management and Offset Plan for each **development stage** must be implemented.

Note 1: The Minister may determine that a plan, strategy or program approved by the Queensland Government satisfies the requirements for the EPBC Species Impact Management and Offset Plan under these conditions.

Note 2: Offsets for some species may be accommodated within ecological communities or overlap State approval requirements or other species habitat requirements, as long as they meet the requirements of these conditions of approval in respect of each individual species being offset.

Coal Seam Gas Water Monitoring and Management Plan

Stage 1 CSG Water Monitoring and Management Plan

13. Prior to **commencement**, the proponent must submit a Stage 1 Coal Seam Gas Water Monitoring and Management Plan (Stage 1 CSG WMMP) for the approval of the **Minister,** who may seek the advice of an **expert panel**. The Stage 1 CSG WMMP must include:

    (a) an analysis of the results of the most recent **OGIA model** (built or endorsed by **OGIA**), relevant to all of the project's tenement areas;

    (b) a fit for purpose numerical simulation to assess potential impacts on water resources arising from the action in the project area, subsequent surface water-groundwater interactions in the Condamine Alluvium and impacts to dependent ecosystems;

    (c) an assessment of potential **impacts** from the action on non-spring based groundwater dependent ecosystems through potential changes to surface-groundwater connectivity and interactions with the sub-surface expression of groundwater;

    (d) an assessment of predicted project wide groundwater drawdown levels and pressures from the action, together with confidence levels;

    (e) parameters and a sampling regime to establish baseline data for surface and groundwater resources that may be impacted by the action, including: surface water quality and quantity in the **project area**, and upstream and downstream of potential impact areas; groundwater quality, levels and pressures for areas that may be **impacted** by the project; and for determining connectivity between surface water and groundwater that may be **impacted** by the project;

    (f) a best practice baseline monitoring network that will enable the identification of spatial and temporal changes to surface water and groundwater. This must include a proposal for aquifer connectivity studies and monitoring of relevant aquifers to determine hydraulic connectivity (including potential groundwater dependence of Long Swamp and Lake Broadwater) and must also enable monitoring of all aquatic ecosystems that may be **impacted** by the action;

    (g) a program to monitor subsidence **impacts** from the action, including trigger thresholds and reporting of monitoring results in annual reporting required by condition 28. If trigger thresholds are exceeded, the **approval holder** must develop and implement an action plan to address impacts within 90 calendar days of a trigger threshold being exceeded;

    (h) provisions to make monitoring results publicly available on the **approval holder's** website to facilitate a greater understanding of cumulative **impacts**;

    (i) a discussion on how the **approval holder** is contributing to the **Joint Industry Plan,** including its periodic review. The **approval holder** must contribute to the **Joint Industry Plan** and comply with any part of the **Joint Industry Plan**, or future iterations of the **Joint Industry Plan**, that applies to the **approval holder**;

    (j) a groundwater early warning monitoring system, including:

        i. groundwater drawdown limits for all consolidated aquifers potentially impacted by the action, excluding the Walloon Coal Measures;

        ii. for the Condamine Alluvium, appropriate triggers and groundwater limits and a rationale for their selection;

        iii. early warning indicators and trigger thresholds, including for Lake Broadwater, Long Swamp and other groundwater dependent ecosystems that may potentially be impacted by the action, including

those that may occur outside the **project area** and may be impacted by the action; and

iv. investigation, management and mitigation actions, including substitution and/or groundwater repressurisation, for both early warning indicators and trigger thresholds to address flux impacts on the Condamine Alluvium.

(k) early warning indicators and trigger thresholds, including corrective actions for both early warning indicators and trigger thresholds, for aquatic ecology and aquatic ecosystems;

(l) a CSG water management strategy for produced salt/brine, which discusses how co-produced water and brine will be managed for the action, including in the context of other coal seam gas activities in the Surat Basin;

(m) an analysis of how the **approval holder** will utilise beneficial use and/or groundwater repressurisation techniques to manage produced CSG water from the action, and how any potential adverse **impacts** associated with groundwater repressurisation will be managed;

(n) a discharge strategy, consistent with the recommendations and requirements of the Department of the Environment and Heritage Protection in its **Assessment Report** (pages 94 to 95 and pages 254 to 255) and that includes scenarios where discharge may be required, the quality of discharge water (including water treated by reverse osmosis), the number and location of monitoring sites (including upstream and downstream sites), frequency of monitoring and how the data from monitoring will be analysed and reported, including recommendations on any changes or remedial actions that would be required;

(o) a flood risk assessment for processing facilities and any raw co-produced water and brine dams, which addresses flood risks to the environment from the action in the case of a 1:1000 ARI event. The risk assessment should estimate the consequences if major project infrastructure was subject to such an event, including release of brine and chemicals into the environment;

(p) a cumulative **impact** assessment based on the outputs of the **OGIA model** which integrates groundwater model outputs with known and potential groundwater dependent ecosystems and presents the outputs in map form. Contribute to investigations coordinated through the OGIA to assess hydrological and ecological characteristics of **impacted** groundwater dependent ecosystems;

(q) details of performance measures; annual reporting to the **Department**; and publication of reports on the internet; and

(r) an explanation of how the Stage 1 CSG WMMP will contribute to work undertaken by other CSG proponents in the Surat Basin to understand cumulative **impacts**, including at the local and regional scale, and maximise environmental benefit.

14. The Stage 1 CSG WMMP must be peer reviewed by a **suitably qualified water resources expert/s** approved by the **Minister** in writing. The peer review must be submitted to the **Minister** together with the Stage 1 CSG WMMP and a statement from the **suitably qualified water resources expert/s** stating that they carried out the peer review and endorse the findings of the Stage 1 CSG WMMP.

15. The **approval holder** must not exceed the groundwater drawdown or groundwater limits for each aquifer specified in the Stage 1 CSG WMMP.

16. Unless otherwise agreed in writing by the **Minister**, the **approval holder** must not **commence** the action until the Stage 1 CSG WMMP is approved in writing by the **Minister**. The approved Stage 1 CSG WMMP must be implemented.

Note 3: to ensure efficiency the approval holder may prepare and align the Stage 1 WMMP with the requirements of the Queensland Government, as long as the relevant matters under the conditions of this approval are clearly and adequately addressed.

Stage 2 CSG Water Monitoring and Management Plan

17. Prior to **Stage 2** the **approval holder** must submit a Stage 2 Coal Seam Gas Water Monitoring and Management Plan (Stage 2 CSG WMMP) to the **Minister** for approval, who may seek the advice of an **expert panel**. The Stage 2 CSG WMMP must:

    (a) include all matters in the Stage 1 CSG WMMP, and discuss how the Stage 1 CSG WMMP is informing adaptive management for the Stage 2 CSG WMMP;

    (b) include any updated modelling for the project, including in respect of the **OGIA model** or any updates to the **OGIA model** by **OGIA**;

    (c) include an explanation of how the **approval holder** will contribute to the **Condamine Interconnectivity Research Project**. The Stage 2 CSG WMMP must present the findings of the Condamine Interconnectivity Research project and any modelling done by the **OGIA** to validate predicted drawdown and a review of trigger thresholds and corrective actions for the action;

    (d) report on the potential for flow reversal from the Condamine Alluvium to underlying aquifers, based on data obtained during the Stage 1 CSG WMMP;

    (e) review and update the monitoring network in Stage 1 WMMP to reflect changes in understanding of **impacts** to water resources, including from baseline monitoring and relevant research;

    (f) identify any predicted changes in stream connectivity due to groundwater drawdown from the action and assess potential impacts to groundwater dependent ecosystems due to any predicted changes in stream connectivity, including to water quality, quantity and ecology;

    (g) address any uncertainty in the groundwater-dependency of ecosystems and springs with supporting evidence from field-based investigations for any groundwater-dependent ecosystems and springs confirmed in the **OGIA model**;

    (h) provide details of an ongoing monitoring plan that:

        i. sets out the frequency of monitoring and rationale for the frequency;

        ii. includes continued collection of baseline data for each monitoring site over the life of the project;

        iii. outlines the approach to be taken to analyse the results including the methods to determine trends to indicate potential **impacts**; and

        iv. builds on the groundwater early warning system required at condition 13 (j) and sets out early warning indicators and trigger thresholds and limits for groundwater and surface water.

    (i) include a risk based exceedance response plan that details the actions the **approval holder** will take and the timeframes in which those actions will be undertaken if: early warning indicators and trigger threshold values contained in the Stage 2 CSG WMMP are exceeded, or there are any emergency discharges.

18. The Stage 2 CSG WMMP must be peer reviewed by a **suitably qualified water resources expert/s** approved by the **Minister** in writing. The peer review must be submitted to the **Minister** together with the Stage 2 CSG WMMP and a statement from the **suitably qualified water resources expert/s** stating that they carried out the peer review and endorse the findings of the Stage 2 CSG WMMP.

19. The **approval holder** must not exceed the groundwater drawdown or groundwater limits specified in the Stage 2 CSG WMMP.

20. The **Minister** may direct in writing that the **approval holder** cease water/gas extraction and/or water discharge or use if an early warning indicator, trigger threshold or limit is exceeded, and if the **Minister** is not satisfied that the action proposed or taken by the proponent will remedy the situation. The **Minister** may direct the proponent to implement alternative action at the expense of the proponent.

Note 4: The proponent will be provided with a reasonable opportunity to comment on any such direction before it is required to be implemented.

21. Unless otherwise agreed by the **Minister** in writing, the Stage 2 CSG WMMP must be approved in writing by the **Minister** prior to first extraction of gas. The approved Stage 2 CSG WMMP must be implemented. The Stage 1 CSG WMMP will apply until the commencement of the approved Stage 2 CSG WMMP.

Note 5: to ensure efficiency the approval holder may prepare and align the Stage 2 WMMP with the requirements of the Queensland Government, as long as the relevant matters under the conditions of this approval are clearly and adequately addressed.

Revision of the Stage 2 CSG WMMP

22. To ensure an adaptive management approach, the proponent must submit periodic revisions of the Stage 2 CSG WMMP for approval by the **Minister** in writing, who may seek the advice of an **expert panel**. Revisions must be submitted at least 3 months prior to planned **commencement** of each new **development stage** for the project. The revised CSG WMMP must take into account outcomes of the ongoing monitoring program in the Stage 2 CSG WMMP, groundwater model updates and any bioregional assessments.

23. If the **OGIA model** ceases to exist, then the **approval holder** must submit an alternate model to be used for the purpose of these conditions that replaces the **OGIA model** as referred to in these conditions. The alternate model must be approved by the **Minister** in writing before the next relevant stage of the CSG WMMP is submitted to the **Minister** for approval.

24. The **approval holder** must not **commence Stage 3** or **Stage 4** until a revised Stage 2 CSG WMMP is approved in writing by the **Minister** for that **development stage**. The approved revised Stage 2 CSG WMMP must be implemented.

25. The **Minister** may, by written request to the **approval holder**, require the Stage 1 or Stage 2 CSG WMMP to be revised, including to address expert advice. Any request must be acted on by the **approval holder** within the timeframe specified in the request.

Note 6: The Minister may throughout the life of the project life seek advice from experts, or an expert panel. As a consequence specific matters identified through such advice may need to be addressed in the CSG WMMP Plan. Where such advice is sought the approval holder would be provided with opportunity to submit information and respond to the specific matters identified, in order to ensure the CSG WMMP Plan is based on the best available information. Review requirements will facilitate adaptive management, align with Queensland Government approval requirements, and account for potential cumulative impacts as new scientific information becomes available over the life of the project.

General

26. Within 20 business days after the **commencement** of the action, the **approval holder** must advise the **Department** in writing of the actual date of **commencement.**

27. The **approval holder** must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the management plans, reports or strategies required by this approval, and make them available upon request to the **Department**. The annual report (condition 28) must state all confirmed cases of non-compliance along with details of any remedial actions. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the **EPBC Act,** or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the **Department's** website. The results of audits may also be publicised through the general media.

28. Within three months of every 12 month anniversary of the **commencement** of the action, the **approval holder** must publish a report on its website for the life of the approval outlining how they have been compliant with the conditions of this approval over the previous 12 months, including implementation of any management plans as specified in the conditions. The **approval holder** must also report against disturbance limits. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the **Department** at the same time as the compliance report is published.

29. The **approval holder** must notify the **Department** in writing of potential non-compliance with any condition of this approval as soon as practical and within no later than ten business days of becoming aware of the potential non-compliance. The notice provided to the **Department** under this condition must specify:

    a) the condition which the **approval holder** has potentially breached;

    b) the nature of the potential non-compliance;

    c) when and how the **approval holder** became aware of the non-compliance;

    d) how the non-compliance will affect the approved action;

    e) how the non-compliance will affect the anticipated **impacts** of the approved action, in particular how the non-compliance will affect the **impacts** on the matters of national environmental significance;

    f) the measures the approval holder will take to address the **impacts** of the non-compliance on the matters of national environmental significance and rectify the non-compliance; and

    g) the time by when the approval holder will rectify the non-compliance.

30. Upon the direction of the **Minister**, the **approval holder** must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the **Minister**. The independent auditor must be approved by the **Minister** prior to the commencement of the audit. Audit criteria must be agreed to by the **Minister** and the audit report must address the criteria to the satisfaction of the **Minister.**

31. If the **approval holder** wishes to carry out any activity other than in accordance with the management plans as specified in the conditions, the **approval holder** must submit to the **Department** for the **Minister's** written approval a revised version of that management plan. The approval holder must not **commence** the varied activity until the **Minister** has approved the varied management plan. The **Minister** will not approve a varied management plan unless the revised management plan would result in an equivalent or improved environmental outcome over time. If the **Minister** approves the revised management plan, that management plan must be implemented in place of the management plan originally approved.

32. If the **Minister** believes that it is necessary or convenient for the better protection of listed threatened species, listed migratory species or water resources to do so, the **Minister**

may request that the **approval holder** make specified revisions to the management plans specified in the conditions and submit the revised management plan for the **Minister's** written approval. The **approval holder** must comply with any such request within the timeframe specified by the **Minister**. The revised approved management plan must be implemented. Unless the **Minister** has approved the revised management plan, then the person taking the action must continue to implement the management plan originally approved, as specified in the conditions.

33. If, at any time after five years from the date of this approval, the **approval holder** has not **commenced** the action, then the **approval holder** must not **commence** the action without the written agreement of the **Minister.**

34. Unless otherwise agreed to in writing by the **Minister**, the **approval holder** must publish all management plans referred to in these conditions of approval on their website. Each management plan must be published on the website within 1 month of being approved and remain available on that website for the life of the approval.

Definitions

Approval holder: means the person to whom the approval is granted.

Assessment Report: means the Queensland Department of Environment and Heritage Protection's report under the *Environmental Protection and Biodiversity Conservation Act 1994* for the action.

Commenced/commencement: means any physical disturbance, including clearance of native vegetation, new road work and the establishment of well sites to develop the gas field project area. Commencement does not include:

a) minor physical disturbance necessary to undertake pre-clearance surveys or establish monitoring programs or geotechnical investigations; or

b) activities that are critical to commencement that are associated with mobilisation of plant and equipment, materials, machinery and personnel prior to the start of development only if such activities will have no adverse impact on matters of national environmental significance, and only if the proponent has notified the Department in writing before an activity is undertaken.

Core habitat: means core habitat known and core habitat possible as defined in the rules for habitat mapping for each individual species in the *Supplementary Report to the Surat Gas Project EIS (March 2012), Attachment 1 – Matters of National Environmental Significance*.

Conservation advice: means an approved conservation advice under the EPBC Act for an EPBC Act listed species or community.

Core habitat known: means habitat where a spatially accurate confirmed record of a particular species exists (e.g. Herbrecs or survey record). Core habitat known is attributed to the particular habitat polygon in which it occurs, based on either regional ecosystem (RE) mapping provided by the Queensland Department of Environment and Heritage Protection (or successor agency) or high resolution habitat mapping developed for a specific purpose. Core habitat known also means a 1 km buffer around all spatially accurate (< 400 metres accuracy) species records.

Condamine Interconnectivity Research Project: means the Condamine Interconnectivity Research Project being undertaken by the Queensland Office of Groundwater Impact Assessment as part of the implementation of the Surat Underground Water Impact Report (UWIR), which was prepared by the Queensland Water Commission (QWC) in 2012.

Core habitat possible: means an area where previous records of a particular species are not known to occur within a given area or habitat, although specific habitat features are present which are known to be favoured by the species and the habitat occurs within the species known geographic range.

Department: means the Australian Government Department administering the *Environment Protection and Biodiversity Conservation Act 1999*.

Department's survey guidelines: means:
Matters of National Environmental Significance, Significant Impact Guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999 - http://www.environment.gov.au/epbc/publications/nes-guidelines.html.

Survey Guidelines for Australia's Threatened Frogs, Threatened Birds, Threatened Fish, Threatened Mammals, Threatened Reptiles and Threatened Bats: http://www.environment.gov.au/epbc/guidelines-policies.html.

Development stage: means Stage 1, Stage 2, Stage 3 or Stage 4 of project development, as defined in these definitions.

EPBC/ EPBC Act: means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

EPBC Act Offsets Policy: means the *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy (October 2012) including the Offsets Assessment Guide.

EPBC community: means an endangered ecological community listed under the EPBC Act.

EPBC listed threatened species: means a threatened flora or fauna species listed under the EPBC Act.

Expert panel: means an expert panel appointed by the Minister.

Fitzroy River Turtle: means the Fitzroy River Turtle, *Rheodytes leukops*, listed as vulnerable under the EPBC Act.

General habitat: means where a species has not been recorded in a given location and habitat accounts for some of the features favoured by a particular species. The habitat occurs on the margins of a species known geographic range. Otherwise. the habitat is suitable for the species

Impact: has the definition assigned to it in section 527E of the EPBC Act.

Joint Industry Plan: means the *Joint Industry Plan for an Early Warning System for the Monitoring and Protection of EPBC Springs* established with other coal seam gas proponents operating within the Surat Cumulative Management Area.

Minister: means the Minister administering the *Environment Protection and Biodiversity Conservation Act 1999* and includes a delegate of the Minister.

Murray Cod: means the Murray Cod, *Maccullochella peelii*, listed as vulnerable under the EPBC Act.

OGIA: means the Office of Groundwater Impact Assessment or its successor body,

OGIA model: means the groundwater model developed by the Office of Groundwater Impact Assessment, or its successor body, for the Surat Cumulative Management Area.

Pre-clearance surveys: means surveys that are undertaken for EPBC species and EPBC communities for all areas of the project area that may be disturbed by project activities.

Project area: means the area identified as the project area in Attachment A.

Recovery plan: means an approved recovery plan under the EPBC Act for an EPBC listed species or EPBC community.

Stage 1: means year 1 to 3 (inclusive) of the action, starting at the date of commencement.

Stage 2: means year 4 to 11 (inclusive) of the action.

Stage 3: means year 12 to 20 (inclusive) of the action

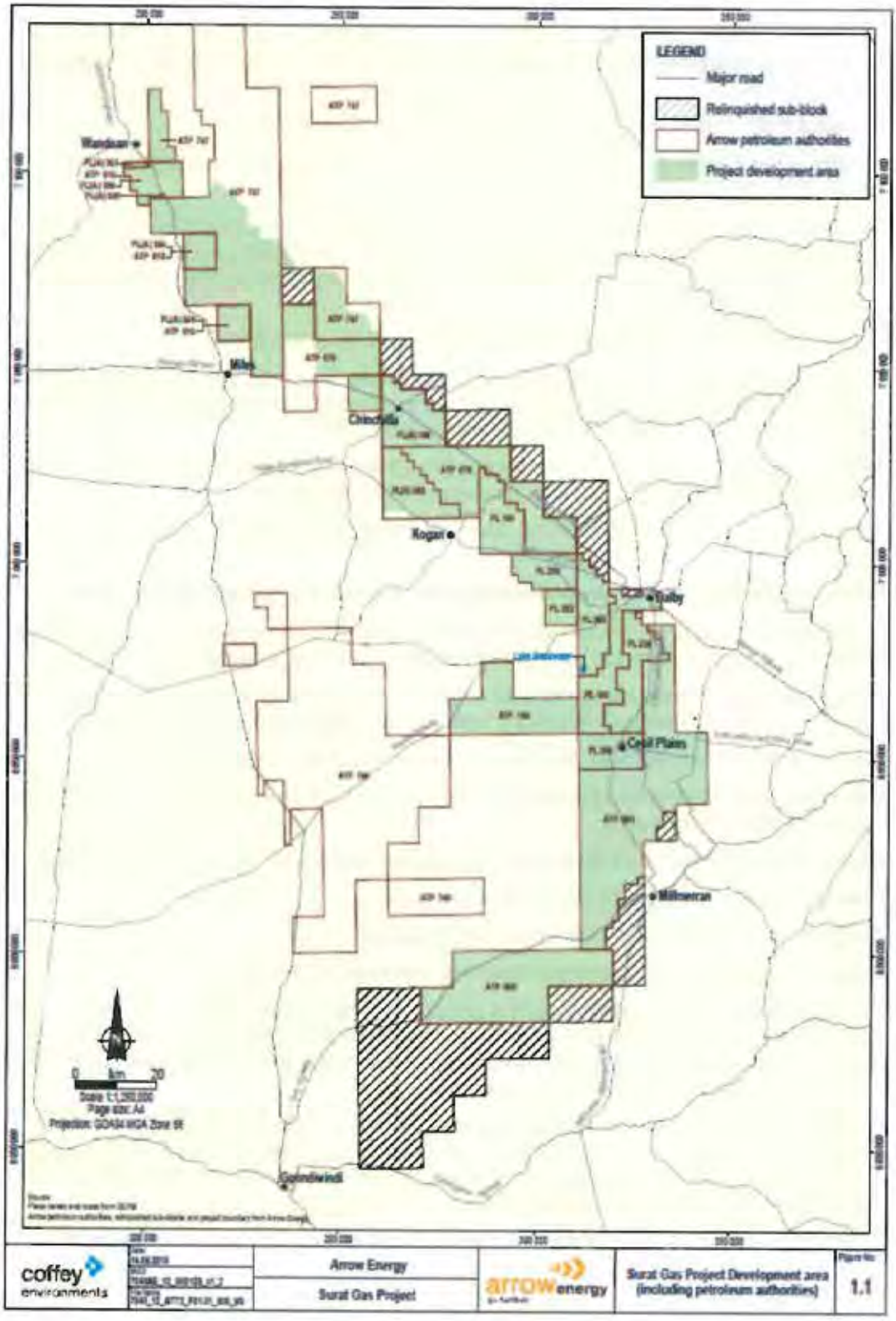
Stage 4: means year 21 to decommissioning (inclusive) of the action.

Suitably qualified ecologist: means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis to performance relative to the subject matter using relevant protocols, standards, methods and literature.

Suitably qualified water resources expert/s: means a natural person with at least a postgraduate degree (or equivalent) in a suitable area (such as hydrology or hydrogeology) and a minimum of 10 years relevant experience in water resources assessment, including at least one year of experience in Australia.

Threat abatement plan: means an approved threat abatement plan under the EPBC Act.

ATTACHMENT A



Appendix B

SGP North Environmental Authority (EA0001399)

Permit

Environmental Protection Act 1994

Environmental authority EA0001399

This environmental authority is issued by the administering authority under Chapter 5 of the Environmental Protection Act 1994.

Environmental authority number: EA0001399

Environmental authority takes effect on 1 October 2021. This is the take effect date.

Environmental authority holder(s)

Name(s)	Registered address
ARROW CSG (AUSTRALIA) PTY LTD	Level 39 111 Eagle Street BRISBANE CITY QLD 4000

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
Ancillary 62 - Resource recovery and transfer facility operation - 1(c) - Operating a facility for receiving and sorting, dismantling, baling or temporarily storing category 2 regulated waste	PL1044
Schedule 3 - 03 - A petroleum activity that is likely to have a significant impact on a category A or B Environmentally Sensitive Area	PL1044
Schedule 3 - 06 - A petroleum activity carried out on a site containing a high hazard dam or a significant hazard dam	PL1044
Schedule 3 - 08 - A petroleum or GHG storage activity, other than items 1 to 7, that includes an activity from Schedule 2 with an AES	PL1044
Schedule 3 - 03 - A petroleum activity that is likely to have a significant impact on a category A or B Environmentally Sensitive Area	PL304

ABN 46 640 294 485

Environmentally relevant activity/activities	Location(s)
Schedule 3 - 06 - A petroleum activity carried out on a site containing a high hazard dam or a significant hazard dam	PL304
Schedule 3 - 08 - A petroleum or GHG storage activity, other than items 1 to 7, that includes an activity from Schedule 2 with an AES	PL304
Ancillary 62 - Resource recovery and transfer facility operation - 1(c) - Operating a facility for receiving and sorting, dismantling, baling or temporarily storing category 2 regulated waste	PL304
Ancillary 62 - Resource recovery and transfer facility operation - 1(c) - Operating a facility for receiving and sorting, dismantling, baling or temporarily storing category 2 regulated waste	PL305
Schedule 3 - 06 - A petroleum activity carried out on a site containing a high hazard dam or a significant hazard dam	PL305
Schedule 3 - 08 - A petroleum or GHG storage activity, other than items 1 to 7, that includes an activity from Schedule 2 with an AES	PL305
Schedule 3 - 03 - A petroleum activity that is likely to have a significant impact on a category A or B Environmentally Sensitive Area	PL305
Schedule 3 - 03 - A petroleum activity that is likely to have a significant impact on a category A or B Environmentally Sensitive Area	PL491
Ancillary 62 - Resource recovery and transfer facility operation - 1(c) - Operating a facility for receiving and sorting, dismantling, baling or temporarily storing category 2 regulated waste	PL491
Schedule 3 - 06 - A petroleum activity carried out on a site containing a high hazard dam or a significant hazard dam	PL491

Environmentally relevant activity/activities	Location(s)
Schedule 3 - 08 - A petroleum or GHG storage activity, other than items 1 to 7, that includes an activity from Schedule 2 with an AES	PL491
Schedule 3 - 06 - A petroleum activity carried out on a site containing a high hazard dam or a significant hazard dam	PL492
Schedule 3 - 08 - A petroleum or GHG storage activity, other than items 1 to 7, that includes an activity from Schedule 2 with an AES	PL492
Schedule 3 - 03 - A petroleum activity that is likely to have a significant impact on a category A or B Environmentally Sensitive Area	PL492
Ancillary 62 - Resource recovery and transfer facility operation - 1(c) - Operating a facility for receiving and sorting, dismantling, baling or temporarily storing category 2 regulated waste	PL492
Schedule 3 - 06 - A petroleum activity carried out on a site containing a high hazard dam or a significant hazard dam	PL494
Schedule 3 - 08 - A petroleum or GHG storage activity, other than items 1 to 7, that includes an activity from Schedule 2 with an AES	PL494
Schedule 3 - 03 - A petroleum activity that is likely to have a significant impact on a category A or B Environmentally Sensitive Area	PL494
Ancillary 62 - Resource recovery and transfer facility operation - 1(c) - Operating a facility for receiving and sorting, dismantling, baling or temporarily storing category 2 regulated waste	PL494

Additional information for applicants

Environmentally relevant activities

The description of any environmentally relevant activity (ERA) for which an environmental authority (EA) is issued is a restatement of the ERA as defined by legislation at the time the EA is issued. Where there is any inconsistency between that description of an ERA and the conditions stated by an EA as to the scale, intensity or manner of carrying out an ERA, the conditions prevail to the extent of the inconsistency.

An EA authorises the carrying out of an ERA and does not authorise any environmental harm unless a condition stated by the EA specifically authorises environmental harm.

A person carrying out an ERA must also be a registered suitable operator under the *Environmental Protection Act 1994* (EP Act).

Contaminated land

It is a requirement of the EP Act that an owner or occupier of contaminated land give written notice to the administering authority if they become aware of the following:

- the happening of an event involving a hazardous contaminant on the contaminated land (notice must be given within 24 hours); or
- a change in the condition of the contaminated land (notice must be given within 24 hours); or
- a notifiable activity (as defined in Schedule 3) having been carried out, or is being carried out, on the contaminated land (notice must be given within 20 business days)

that is causing, or is reasonably likely to cause, serious or material environmental harm.

For further information, including the form for giving written notice, refer to the Queensland Government website www.qld.gov.au, using the search term 'duty to notify'.

Take effect

Please note that, in accordance with section 200 of the EP Act, an EA has effect:

a) if the authority is for a prescribed ERA and it states that it takes effect on the day nominated by the holder of the authority in a written notice given to the administering authority - on the nominated day; or
b) if the authority states a day or an event for it to take effect-on the stated day or when the stated event happens; or
c) otherwise on the day the authority is issued.

However, if the EA is authorising an activity that requires an additional authorisation (a relevant tenure for a resource activity, a development permit under the *Planning Act 2016* or an SDA Approval under the *State Development and Public Works Organisation Act 1971*), this EA will not take effect until the additional authorisation has taken effect.

If this EA takes effect when the additional authorisation takes effect, you must provide the administering authority written notice within 5 business days of receiving notification of the related additional authorisation taking effect.

The anniversary day of this environmental authority is the same day each year as the original take effect date unless you apply to change the anniversary day. The payment of the annual fee will be due each year on this day.

If you have incorrectly claimed that an additional authorisation is not required, carrying out the ERA without the additional authorisation is not legal and could result in your prosecution for providing false or misleading information or operating without a valid environmental authority.

	1 October 2021
Signature	Date

Clancy Mackaway
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Energy and Extracitve Resources
GPO Box 2454, BRISBANE QLD 4001
Phone: (07) 3330 5715
Email: EnergyandExtractive@des.qld.gov.au

Privacy statement

Pursuant to section 540 of the EP Act, the Department is required to maintain a register of certain documents and information authorised under the EP Act. A copy of this document will be kept on the public register. The register is available for inspection by members of the public who are able take extracts, or copies of the documents from the register. Documents that are required to be kept on the register are published in their entirety, unless alteration is required by the EP Act. There is no general discretion allowing the Department to withhold documents or information required to be kept on the public register. For more information on the Department's public register, search 'public register' at www.qld.gov.au. For queries about privacy matters please email privacy@des.qld.gov.au or telephone 13 74 68.

Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:

- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where environmental harm or nuisance may be caused (section 443)

Other permits required

This permit only provides an approval under the *Environmental Protection Act 1994*. In order to lawfully operate you may also require permits / approvals from your local government authority, other business units within the department and other State Government agencies prior to commencing any activity at the site. For example, this may include permits / approvals with your local Council (for planning approval), the Department of Transport and Main Roads (to access state controlled roads), the Department of Resources (to clear vegetation), and the Department of Agriculture and Fisheries (to clear marine plants or to obtain a quarry material allocation).

SCHEDULES

Schedule A – General

(A1) This environmental authority authorises the carrying out of the following resource activity(ies):

a) The petroleum activities[1] listed in **Schedule A, Table 1 – Authorised petroleum activities** to the extent they are carried out in accordance with the activity's corresponding scale and intensity (or both, where applicable); and

b) Incidental activities that are not otherwise specified relevant activities.

Schedule A, Table 1 – Authorised petroleum activities

Activity(ies)	Total scale of petroleum activities / infrastructure	Intensity / maximum size
Coal seam gas production	588 gas production wells: PL304 – 95 wells PL305 – 86 wells PL491 – 192 wells PL492 – 151 wells PL494 – 27 wells PL1044 - 37 wells	1.1 ha per well
Petroleum pipeline	PL304 – 90 km PL305 – 90 km PL491 – 200 km PL492 – 190 km PL494 – 30 km PL1044 – 50 km	650 km of pipeline
Petroleum activities carried out on a site containing a regulated structure[2] (high or significant consequence category dam)	PL304 – Kedron Dam PL305 – Castledean Dam PL1044 – Punchbowl Dam	Kedron Dam – 20 ha Castledean Dam – 14 ha Punchbowl Dam – 35 ha

[1] The petroleum activities are authorised petroleum activities for the purposes of the *Petroleum and Gas (production and Safety) Act 2004* and *the Petroleum Act 1923*.

[2] Words underlined are currently defined in **Schedule K – Definitions** or the *Environmental Protection Act 1994* and/or its subordinate legislation.

(A2) This environmental authority does not authorise environmental harm unless a condition contained in this environmental authority explicitly authorises that harm. Where there is no condition, the lack of a condition shall not be construed as authorising harm.

(General 7 PESCD3[3]) All monitoring must be undertaken by a suitably qualified person.

(General 8) If requested by the administering authority in relation to investigating a complaint, monitoring must be commenced within 10 business days.

(General 9) All laboratory analyses and tests must be undertaken by a laboratory that has NATA accreditation for such analyses and tests.

(General 10) Notwithstanding condition (General 9), where there are no NATA accredited laboratories for a specific analyte or substance, then duplicate samples must be sent to at least two separate laboratories for independent testing or evaluation.

(General 11) Monitoring and sampling[4] must be carried out in accordance with the requirements of the following documents (as relevant to the sampling being undertaken), as amended from time to time:

(a) for waters and aquatic environments, the Queensland Government's Monitoring and Sampling Manual 2009 – *Environmental Protection (Water) Policy 2009*
(b) for groundwater, *Groundwater Sampling and Analysis – A Field Guide* (2009:27 GeoCat #6890.1)
(c) for noise, the Environmental Protection Regulation 2008
(d) for air, the *Queensland Air Quality Sampling Manual* and/or Australian Standards under 3580 *Methods for sampling and analysis of ambient air*, as appropriate for the relevant measurement
(e) for soil, the *Guidelines for Surveying Soil and Land Resources, 2nd edition* (McKenzie *et al.* 2008), and/or the *Australian Soil and Land Survey Handbook, 3rd edition* (National Committee on Soil and Terrain, 2009)
(f) for dust, Australian Standard AS3580.

[3] Conditions that include 'SC' are an existing approved and published standard condition.

[4] Where monitoring and/or sampling cannot safely be undertaken due to an exceptional circumstance (such as a flood event) preventing a timeframe being met, safe access shall be re-established as soon as practicable and the monitoring and/or sampling shall be subsequently undertaken as soon as possible.

Notification

(General 12) In addition to the requirements under Chapter 7, Part 1, Division 2 of the *Environmental Protection Act 1994*, the administering authority must be notified through the Pollution Hotline and in writing, as soon as possible, but within 48 hours of becoming aware of any of the following events:

(a) any unauthorised significant disturbance to land
(b) potential or actual loss of structural or hydraulic integrity of a dam
(c) when the level of the contents of any regulated dam reaches the mandatory reporting level
(d) when a regulated dam will not have available storage to meet the design storage allowance on 1 November of any year
(e) likely or actual loss of well integrity
(f) when the seepage trigger action response procedure required under condition (Water 14(g)) is or should be implemented
(g) unauthorised releases of any volume of prescribed contaminants to waters
(h) unauthorised releases of volumes of contaminants, in any mixture, to land greater than:
    i. 200 L of hydrocarbons; or

ii. 200 L of stimulation additives; or
iii. 500 L of stimulation fluids; or
iv. 1 000 L of brine; or
v. 5 000 L of untreated coal seam gas water; or
vi. 5 000 L of raw sewage; or
vii. 10 000 L of treated sewage effluent.

(i) the use of restricted stimulation fluids

(j) groundwater monitoring results from a landholder's active groundwater bore monitored under the stimulation impact monitoring program which is a 10% or greater increase from a previous baseline value for that bore and which renders the water unfit for its intended use

(k) monitoring results where two out of any five consecutive samples do not comply with the relevant limits in the environmental authority.

Financial Assurance

(General 13 Petroleum activities that cause significant disturbance to land must not be carried out until financial assurance has been given to the administering authority as security for compliance with the environmental authority and any costs or expenses, or likely costs or expenses, mentioned in section 298 of the *Environmental Protection Act 1994*.

(General 14) Prior to any changes in petroleum activities which would result in an increase to the maximum significant disturbance since financial assurance was last given to the administering authority, the holder of the environmental authority must amend the financial assurance and give the administering authority the increased amount of financial assurance.

(General 15) If the amount of financial assurance held by the administering authority has been discounted and either the nominated period of financial assurance has ended, or an event or change in circumstance has resulted in the holder of the environmental authority no longer being able to meet one or more of the mandatory pre-requisites or applicable discount criteria, the holder of the environmental authority must amend the financial assurance and give the administering authority the increased amount of financial assurance as soon as practicable.

Contingency procedures for emergency environmental incidents

(General 16) Petroleum activities involving significant disturbance to land cannot commence until the development of written contingency procedures for emergency environmental incidents which include, but are not necessarily limited to:

a) a clear definition of what constitutes an environmental emergency incident or near miss for the petroleum activity.
b) consideration of the risks caused by the petroleum activity including the impact of flooding and other natural events on the petroleum activity.
c) response procedures to be implemented to prevent or minimise the risks of environmental harm occurring.
d) the practices and procedures to be employed to restore the environment or mitigate any environmental harm caused.
e) procedures to investigate causes and impacts including impact monitoring programs for releases to waters and/or land.
f) training of staff to enable them to effectively respond.
g) procedures to notify the administering authority, local government and any potentially impacted landholder.

(General 17 PESCC 4) All plant and equipment must be maintained and operated in their proper and effective condition.

(General 18) The following infrastructure must be signed with a unique reference name or number in such a way that it is clearly observable:

a) regulated dams and low consequence dams
b) exploration, appraisal and development wells
c) water treatment facilities
d) brine encapsulation facilities
e) landfill cells
f) sewage treatment facilities
g) specifically authorised discharge points to air and waters
h) any chemical storage facility associated with the environmentally relevant activity of chemical storage
i) field compressor stations
j) central compressor stations
k) gas processing facilities; and
l) pipeline compressor stations.

(General 19) Measures to prevent fauna being harmed from entrapment must be implemented during the construction and operation of well infrastructure, dams and pipeline trenches.

Erosion and sediment control

(General 20) For activities involving significant disturbance to land, control measures that are commensurate to the site specific risk of erosion, and risk of sediment release to waters must be implemented to:

a) allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities
b) minimise soil erosion resulting from wind, rain, and flowing water
c) minimise the duration that disturbed soils are exposed to the erosive forces of wind, rain, and flowing water
d) minimise work-related soil erosion and sediment runoff; and
e) minimise negative impacts to land or properties adjacent to the activities (including roads).

Complaints

(General 21) Petroleum activities must not cause environmental nuisance at a sensitive place, other than where an alternative arrangement is in place.

Documentation

(General 22) A certification must be prepared by a suitably qualified person within 30 business days of completing every plan, procedure, program and report required to be developed under this environmental authority, which demonstrates that:

a) relevant material, including current published guidelines (where available) have been considered in the written document

b) the content of the written document is accurate and true; and

c) the document meets the requirements of the relevant conditions of the environmental authority.

(General 23) All plans, procedures, programs, reports and methodologies required under this environmental authority must be written and implemented.

(General 24) All documents required to be developed under this environmental authority must be kept for five years.

(General 25) All documents required to be prepared, held or kept under this environmental authority must be provided to the administering authority upon written request within the requested timeframe.

(General 26) A record of all complaints must be kept including the date, complainant's details, source, reason for the complaint, description of investigations and actions undertaken in resolving the complaint.

Schedule B – Waste Management

General Waste Management

(Waste 1 PESCC 24) Measures must be implemented so that waste is managed in accordance with the waste and resource management hierarchy and the waste and resource management principles.

(Waste 2) Waste, including waste fluids, but excluding waste used in closed-loop systems, must be transported off-site for lawful re-use, remediation, recycling or disposal, unless the waste is specifically authorised to be disposed of or used on site under this environmental authority.

(Waste 3) Waste fluids, other than flare precipitant stored in flare pits, or residual drilling material or drilling fluids stored in sumps, must be contained in either:
a) an above ground container; or
b) a structure which contains the wetting front.

(Waste 4) Green waste may be used on-site for either rehabilitation or sediment and erosion control, or both.

(Waste 5) Vegetation waste may be burned if it relates to a state forest, timber reserve or forest entitlement area administered by the *Forestry Act 1959* and a permit has been obtained under the *Fire and Rescue Service Act 1990*.

Pipeline wastewater

(Waste 6) Pipeline waste water, may be released to land provided that it:
a) can be demonstrated it meets the acceptable standards for release to land; and
b) is released in a way that does not result in visible scouring or erosion or pooling or run-off or vegetation die-off.

Authorised uses of produced water for petroleum activities

(Waste 7) Produced water may be re-used in:
a) drilling and well hole activities; or
b) stimulation activities.

(Waste 8) Produced water may be used for dust suppression provided the following criteria are met:
a) the amount applied does not exceed the amount required to effectively suppress dust; and
b) the application:
   i. does not cause on-site ponding or runoff
   ii. is directly applied to the area being dust suppressed
   iii. does not harm vegetation surrounding the area being dust suppressed; and
   iv. does not cause visible salting.

(Waste 9) Produced water may be used for construction purposes provided the use:
(a) does not result in negative impacts on the composition and structure of soil or subsoils
(b) is not directly or indirectly released to waters
(c) does not result in runoff from the construction site; and
(d) does not harm vegetation surrounding the construction site.

(Waste 10) If there is any indication that any of the circumstances in condition (Waste 8)(b)(i) to (Waste 8(b)(iv)) or (Waste 9)(a) to (Waste 9(d)) is occurring the use must cease immediately and the affected area must be remediated without delay.

Use of produced water for irrigation activities

(Waste C1) Irrigation of produced water is authorised providing it ensures:
- (a) that soil structure, stability and productive capacity can be maintained or improved
- (b) toxic effects to crops do not result; and
- (c) yields and produce quality are maintained or improved.

(Waste C2) Irrigation of produced water is authorised providing a written report is provided to the chief executive which:
- (a) certifies that the outcomes in condition (Waste C1) will be achieved
- (b) states water quality criteria, which has been determined in accordance with the assessment procedures outlined in **Schedule B, Table 1 — Assessment procedures for water quality criteria**
- (c) includes a water monitoring program to monitor that the outcomes listed in condition (Waste C1) are being achieved.

Schedule B, Table 1 — Assessment procedures for water quality criteria

Water quality criteria	Assessment procedure
electrical conductivity sodium adsorption ratio pH	Salinity Management Handbook, with reference to Chapter 11; and/or Australian and New Zealand Guidelines for Fresh and Marine Water Quality, with reference to Volume 1 Chapter 4 and Volume 3 Chapter 9. The assessment should consider: • soil properties within the root zone to be irrigated (e.g. clay content, cation exchange capacity, exchangeable sodium percentage) • water quality of the proposed resource (e.g. salinity, sodicity) • climate conditions (e.g. rainfall) • leaching fractions • average root zone salinity (calculated) • crop salt tolerance (e.g. impact threshold and yield decline) • management practices and objectives (e.g. irrigation application rate, amelioration techniques) • broader landscape issues (e.g. land use, depth to groundwater) • any additional modelling and tests undertaken to support the varied water quality parameters.
heavy metals	Australian and New Zealand Guidelines for Fresh and Marine Water Quality, with reference to Volume 1 Chapters 3 and 4 and Volume 3 Chapter 9.

Water quality criteria	Assessment procedure
	The assessment should aim to derive site specific trigger values (e.g. cumulative contaminant loading limit) based on the methodology provided in the above mentioned procedure.

(Waste 11) Treated sewage effluent or greywater can be released to land provided it:

(a) meets or exceeds secondary treated class B standards for a treatment system with a daily peak design capacity of between 150 EP and 1500 EP; or
(b) meets or exceeds secondary treated class C standards for a treatment system with a daily peak design capacity of less than 150 EP.

(Waste 12) The release of treated sewage effluent or greywater authorised in condition (Waste 11) must:

(a) be to a fenced and signed contaminant release area(s)
(b) not result in pooling or run-off or aerosols or spray drift or vegetation die-off
(c) be to a contaminant release area(s) that is kept vegetated with groundcover, that is:
    i. not a pest species
    ii. kept in a viable state for transpiration and nutrient uptake; and
    iii. grazed or harvested and removed from the contaminant release area as needed, but not less than every three months.

Residual drilling material

(Waste 15) If sumps are used to store residual drilling material or drilling fluids, they must only be used for the duration of drilling activities.

(Waste 16) Residual drilling material can only be disposed of on-site:

(a) by mix-bury-cover method if the residual drilling material meets the approved quality criteria; or
(b) if it is certified by a suitably qualified third party as being of acceptable quality for disposal to land by the proposed method and that environmental harm will not result from the proposed disposal.

(Waste 17) Records must be kept to demonstrate compliance with condition (Waste 15) and (Waste 16).

Schedule C – Protecting Acoustic Values

(Noise 1) Notwithstanding condition (General 21), emission of noise from the petroleum activity(ies) at levels less than those specified in **Schedule C, Table 1 — Noise nuisance limits** are not considered to be environmental nuisance.

Schedule C, Table 1 — Noise nuisance limits

Time period	Time of Day	Metric	Short term noise event[1] (dBA)	Medium term noise event[1] (dBA)	Long term noise event[1] (dBA)
6:00am — 7:00am	Morning	$L_{Aeq,adj,15\ min}$	40	38	35
7:00am — 6:00pm	Day	$L_{Aeq,adj,15\ min}$	45	43	40
6:00pm — 10:00pm	Evening	$L_{Aeq,adj,15\ min}$	40	38	35
10:00pm — 6:00am	Night	$L_{Aeq,adj,15\ min}$	28	28	28
		Max $L_{pA,\ 15\ mins}$	55	55	55
Drilling activities undertaken from 10:00 pm – 7:00 am[2]		$L_{Aeq,\ adj,\ 15\ min}$	28 (measured indoors) 33 (measured outdoors)		

[1] The noise limits in Table 1 have been set based on the following deemed background noise levels (L_{ABG}):

6:00am—7:00 am: 30 dBA
7:00am—6:00 pm: 35 dBA
6:00pm—10:00 pm: 30 dBA
10:00pm—6:00 am: 25 dBA

[2] *Drilling activities undertaken from 10:00 pm – 7:00 am* must be temporary and mobile in nature, and must not contribute to long-term background noise creep.

(Noise 2) If the noise subject to a valid complaint is tonal or impulsive, the adjustments detailed in **Schedule C, Table 2 — Adjustments to be added to noise levels at sensitive receptors** are to be added to the measured noise level(s) to derive $L_{Aeq,\ adj,\ 15\ min}$.

Schedule C, Table 2 — Adjustments to be added to noise levels at sensitive receptors

Noise characteristic	Adjustment to noise
Tonal characteristic is just audible	+ 2 dBA
Tonal characteristic is clearly audible	+ 5 dBA
Impulsive characteristic is just audible	+ 2 dBA
Impulsive characteristic is clearly audible	+ 5 dBA

(Noise 3) Notwithstanding condition (Noise 1), emission of any low frequency noise must not exceed either (Noise 3(a)) and (Noise 3(b)), or (Noise 3(c)) and (Noise 3(d)) in the event of a valid complaint about low frequency noise being made to the administering authority:

(a) 60 dB(C) measured outside the sensitive receptor; and
(b) the difference between the external A-weighted and C-weighted noise levels is no greater than 20 dB; or
(c) 50 dB(Z) measured inside the sensitive receptor; and

(d) the difference between the internal A-weighted and Z-weighted (Max $L_{pZ,\ 15\ min}$) noise levels is no greater than 15 dB.

Schedule D – Protecting Air Values

Venting and Flaring

(Air 1) Unless venting is authorised under the *Petroleum and Gas (Production and Safety) Act 2004* or the *Petroleum Act 1923*, waste gas must be flared in a manner that complies with all of (Air 1(a)) and (Air 1(b)) and (Air 1(c)), or with (Air 1(d)):

(a) an automatic ignition system is used, and
(b) a flame is visible at all times while the waste gas is being flared, and
(c) there are no visible smoke emissions other than for a total period of no more than 5 minutes in any 2 hours, or
(d) it uses an enclosed flare.

Schedule E – Protecting Land Values

General

(Land 1) Contaminants must not be directly or indirectly released to land except as permitted under this environmental authority.

Top soil management

(Land 2) Top soil must be managed in a manner that preserves its biological and chemical properties.

Land management

(Land 3) Land that has been significantly disturbed by the petroleum activities must be managed to ensure that mass movement, gully erosion, rill erosion, sheet erosion and tunnel erosion do not occur on that land.

Acid sulfate soils

(Land 4) Acid sulfate soils must be treated and managed in accordance with the latest edition of the *Queensland Acid Sulfate Soil Technical Manual*.

Chemical storage

(Land 5) Chemicals and fuels stored, must be effectively contained and where relevant, meet Australian Standards, where such a standard is applicable.

Pipeline operation and maintenance

(Land 6) Pipeline operation and maintenance must be in accordance, to the greatest practicable extent, with the relevant section of the APIA Code of Environmental Practice: Onshore Pipelines (2013 or more recent editions).

Pipeline reinstatement and revegetation

(Land 7 PPSCE 17) Pipeline trenches must be backfilled and topsoils reinstated within three months after pipe laying.

(Land 8) Reinstatement and revegetation of the pipeline right of way must commence within 6 months after cessation of petroleum activities for the purpose of pipeline construction.

(Land 9) Backfilled, reinstated and revegetated pipeline trenches and right of ways must be:

(a) a stable landform
(b) re-profiled to a level consistent with surrounding soils
(c) re-profiled to original contours and established drainage lines; and
(d) vegetated with groundcover which includes suitable native species of vegetation for the location and not a pest species, and which is established and growing.

Schedule F – Protecting Biodiversity Values

Confirming biodiversity values

(Biodiversity 1) Prior to undertaking activities that result in significant disturbance to land in areas of native vegetation, confirmation of on-the-ground biodiversity values of the native vegetation communities at that location must be undertaken by a suitably qualified person.

(Biodiversity 2) A suitably qualified person must develop and certify a methodology so that condition (Biodiversity 1) can be complied with and which is appropriate to confirm on-the-ground biodiversity values.

(Biodiversity 3) For conditions (Biodiversity 4) to (Biodiversity 9), where mapped biodiversity values differ from those confirmed under conditions (Biodiversity 1) and (Biodiversity 2), petroleum activities may proceed in accordance with the conditions of the environmental authority based on the confirmed on-the-ground biodiversity value.

Planning for land disturbance

(Biodiversity 4) The location of the petroleum activity(ies) must be selected in accordance with the following site planning principles:

(a) maximise the use of areas of pre-existing disturbance
(b) in order of preference, avoid, minimise or mitigate any impacts, including cumulative impacts, on areas of native vegetation or other areas of ecological value
(c) minimise disturbance to land that may result in land degradation
(d) in order of preference, avoid then minimise isolation, fragmentation, edge effects or dissection of tracts of native vegetation; and
(e) in order of preference, avoid then minimise clearing of native mature trees.

Planning for land disturbance – linear infrastructure

(Biodiversity 5) Linear infrastructure construction corridors must:

(a) maximise co-location

(b) be minimised in width to the greatest practicable extent; and

(c) for linear infrastructure that is an essential petroleum activity authorised in an environmentally sensitive area or its protection zone, be no greater than 40m in total width.

(Biodiversity 8) Where petroleum activities are to be carried out in environmentally sensitive areas or their protection zones, the petroleum activities must be carried out in accordance with **Schedule F, Table 1 — Authorised petroleum activities in environmentally sensitive areas and their protection zones**.

Schedule F, Table 1 — Authorised petroleum activities in environmentally sensitive areas and their protection zones

Environmentally Sensitive Area (ESA)	Within the ESA	Primary protection zone of the ESA	Secondary protection zone of the ESA
Category A ESAs	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B ESAs that are other than 'endangered' regional ecosystems	Only low impact petroleum activities permitted.		Only essential petroleum activities permitted.
Category B ESAs that are 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.
Category C ESAs that are 'nature refuges' or 'koala habitat'	Only low impact petroleum activities permitted.		-
Category C ESAs that are 'essential habitat', 'essential regrowth habitat', or 'of concern' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	-
Category C ESAs that are 'regional parks' (previously known as 'resources reserves')	Only essential petroleum activities permitted.		-
Category C ESAs that are 'state forests' or 'timber reserves'	Only essential petroleum activities permitted.	Petroleum activities permitted.	-
Areas of vegetation that are 'critically limited'	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	-

(Biodiversity 8a) Despite condition (Biodiversity 8), the total scale and maximum footprint of significant disturbance specified in **Schedule F, Table 2 – Maximum significant disturbance** are authorised to be undertaken at the location and within the footprint prescribed in **Schedule F, Table 2 – Maximum significant disturbance.**

Schedule F, Table 2 – Maximum significant disturbance

Activity(ies)	Total scale	Maximum footprint
Ground disturbance for petroleum activities	PL304 – 530 ha PL305 – 600 ha PL491 – 1,240 ha PL492 – 1,250 ha PL494 – 150 ha PL1044 – 320 ha	4,090.0 ha
Ground disturbance within a Category B Environmentally Sensitive Area	PL491 – 2 ha PL492 – 2 ha PL494 – 5 ha PL1044 – 0.1 ha	9.1 ha
Ground disturbance within a Category C Environmentally Sensitive Area	PL304 – 250 ha PL305 – 5 ha PL491 – 65 ha PL492 – 55 ha PL494 – 1 ha PL1044 – 0.1 ha	376.1 ha

(Biodiversity 9) A report must be prepared for each annual return period for all petroleum activities that involved clearing of any environmentally sensitive area or protection zone which includes:

(a) records able to demonstrate compliance with conditions (Biodiversity 4), (Biodiversity 5) and (Biodiversity 8)

(b) a description of the works

(c) a description of the area and its pre-disturbance values (which may include maps or photographs, but must include GPS coordinates for the works); and

(d) based on the extent of environmentally sensitive areas and primary protection zones on the relevant resource authority(ies), the proportion of native vegetation cleared per environmentally sensitive area and primary protection zone, including regional ecosystem type, over the annual return period.

Planning for land disturbance – linear infrastructure

(Biodiversity 10) Significant residual impacts to prescribed environmental matters are not authorised under this environmental authority or the *Environmental Offsets Act 2014* unless the impact(s) is specified in **Schedule F, Table 3 —Significant residual impacts to prescribed environmental matters**

Schedule F, Table 3 — Significant residual impacts to prescribed environmental matters

Prescribed environmental matter	**Location of impact**	**Maximum extent of impact**	**Maximum extent of impact – Stage 1** (Years 1 – 5 inclusive)	**Maximum extent of impact – Stage 2** (Years 6 – 10 inclusive)	**Maximum extent of impact – Stage 3** (Years 11 – 15 inclusive)	**Maximum extent of impact – Stage 4** (Years 16 – 20 inclusive)
Regulated vegetation						
Endangered regional ecosystem						
RE 11.4.3	PLA492	MNES[1, 2]	MNES[1, 2]	TBC[3]	TBC[3]	TBC[3]
RE 11.9.5	PLA494	MNES[1, 2]	MNES[1, 2]	TBC[3]	TBC[3]	TBC[3]
Of concern regional ecosystem (not within an urban area)						
RE 11.3.2	PLA305	5 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
RE 11.3.4	PLA304, PLA491, PLA492	20 ha	7 ha	TBC[3]	TBC[3]	TBC[3]
Regional ecosystems (not within an urban area) that intersect a wetland on the vegetation management wetlands map	N/A	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Regional ecosystems (not within an urban area) within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map						
RE 11.3.2 (17a)	PLA305	1 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
RE 11.3.4 (16c)	PLA305	7 ha	3 ha	TBC[3]	TBC[3]	TBC[3]
RE 11.3.14 (18a)	PLA304, PLA491, PLA492	6 ha	0.5 ha	TBC[3]	TBC[3]	TBC[3]
RE 11.3.25 (16a)	PLA305, PLA491, PLA492, PLA1044	12 ha	1.5 ha	TBC[3]	TBC[3]	TBC[3]
RE 11.5.1 (18b)	PLA305, PLA491, PLA492, PLA1044	20 ha	6 ha	TBC[3]	TBC[3]	TBC[3]
RE 11.5.4 (18b)	PLA304	3 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
RE 11.5.20 (13d)	PLA492	1 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
RE 11.5.21 (18a)	PLA304, PLA305, PLA491, PLA492	12 ha	0 ha	TBC[3]	TBC[3]	TBC[3]

Prescribed environmental matter	**Location of impact**	**Maximum extent of impact**	**Maximum extent of impact – Stage 1** (Years 1 – 5 inclusive)	**Maximum extent of impact – Stage 2** (Years 6 – 10 inclusive)	**Maximum extent of impact – Stage 3** (Years 11 – 15 inclusive)	**Maximum extent of impact – Stage 4** (Years 16 – 20 inclusive)
RE 11.7.4 (12a)	PLA304, PLA305, PLA491, PLA492	8 ha	1.5 ha	TBC[3]	TBC[3]	TBC[3]
RE 11.7.5 (29b)	PLA492	1 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
RE 11.7.6 (10a)	PLA304, PLA305, PLA491, PLA492	5 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
RE 11.7.7 (12a)	PLA305, PLA491, PLA492	10 ha	2 ha	TBC[3]	TBC[3]	TBC[3]
Essential habitat (not in an urban area) for endangered wildlife	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Essential habitat (not in an urban area) for vulnerable wildlife						
Phascolarctos cinereus (Koala)	PLA492	MNES[1, 2]	MNES[1, 2]	TBC[3]	TBC[3]	TBC[3]
Nyctophilus corbeni (South-eastern Long-eared Bat)	PLA491	MNES[1, 2]	MNES[1, 2]	TBC[3]	TBC[3]	TBC[3]
Connectivity areas						
Connectivity area that is a regional ecosystem (not in urban area)						
PLA 494	PLA494	2.2 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
PLA1044	PLA1044	3.6 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Wetlands and watercourses						
A wetland in a wetland protection area shown on the Map of referable wetlands (HES wetlands in GBR)	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
A wetland of high ecological significance shown on the Map	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]

Prescribed environmental matter	**Location of impact**	**Maximum extent of impact**	**Maximum extent of impact – Stage 1** (Years 1 – 5 inclusive)	**Maximum extent of impact – Stage 2** (Years 6 – 10 inclusive)	**Maximum extent of impact – Stage 3** (Years 11 – 15 inclusive)	**Maximum extent of impact – Stage 4** (Years 16 – 20 inclusive)
of referable wetlands						
Designated precincts in strategic environmental areas						
Designated precinct in a strategic environmental areas – *insert reference*	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Protected wildlife habitat						
An area shown as a high risk area on the flora survey trigger map that contains plants that are endangered or vulnerable wildlife	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
An area not shown as a high risk area on the flora survey trigger map that contains plants that are endangered or vulnerable wildlife	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
A non-juvenile koala habitat tree located in an area shown as a bushland habitat, high value rehabilitation habitat or medium value rehabilitation habitat in the 'Map of Assessable Development	NA	MNES[1, 2]	MNES[1, 2]	TBC[3]	TBC[3]	TBC[3]

Prescribed environmental matter	**Location of impact**	**Maximum extent of impact**	**Maximum extent of impact – Stage 1** (Years 1 – 5 inclusive)	**Maximum extent of impact – Stage 2** (Years 6 – 10 inclusive)	**Maximum extent of impact – Stage 3** (Years 11 – 15 inclusive)	**Maximum extent of impact – Stage 4** (Years 16 – 20 inclusive)
Area Koala Habitat Values'						
Habitat for an animal that is endangered wildlife	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Habitat for an animal that is vulnerable wildlife	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Habitat for an animal that is special least concern wildlife						
Tachyglossus aculeatus (Short-beaked Echidna)	PLA304, PLA492	35.4 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Protected areas						
National park	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Regional park	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Nature refuge	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Highly protected zones of State marine parks						
Conservation park zone	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Marine national park zone	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Preservation zone	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Other zones	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Fish habitat areas						
A declared fish habitat area	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Waterway providing for fish passage						
Fish passage (not in an urban area)	PLA304, PLA305, PLA1044	18.5 ha	2.5 ha	TBC[2]	TBC[2]	TBC[2]
Marine plants						
Marine plant (not in an urban area)	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]
Legally secured offset area						
Legally secured offset area	NA	0 ha	0 ha	TBC[3]	TBC[3]	TBC[3]

[1] Matter(s) of National Environmental Significance (MNES) have been prescribed and will be offset in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Species

Impact Management and Offset Plans, specifically the EPBC approval for the Surat Gas Project Environment Impact Statement (EPBC Approval 2010/5344, Tables 1 and 2).

[2] No significant residual impacts to prescribed environmental matters are authorised under this environmental authority unless they are covered within EPBC Approval 2010/5344.

[3] Stages 2 through 4 are to be confirmed in accordance with condition (Biodiversity 16).

(Biodiversity 11) Records demonstrating that each impact to a prescribed environmental matter not listed in **Schedule F, Table 3 —Significant residual impacts to prescribed environmental matters** did not, or is not likely to, result in a significant residual impact to that matter must be:

(a) completed by an appropriately qualified person; and
(b) kept for the life of the environmental authority.

(Biodiversity 12) An environmental offset made in accordance with the *Environmental Offsets Act 2014* and Queensland Environmental Offsets Policy, as amended from time to time, must be undertaken for the maximum extent of impact to each prescribed environmental matter authorised in **Schedule F, Table 3 — Significant residual impacts to prescribed environmental matters**, unless a lesser extent of the impact has been approved in accordance with condition (Biodiversity 15).

(Biodiversity 13) The significant residual impacts to a prescribed environmental matter authorised in condition (Biodiversity 10) for which an environmental offset is required by condition (Biodiversity 12) may be carried out in stages. An environmental offset can be delivered for each stage of the impacts to prescribed environmental matters.

(Biodiversity 14) Prior to the commencement of each stage, a report completed by an appropriately qualified person, that includes an analysis of the following must be provided to the administering authority:

(a) for the forthcoming stage—the estimated significant residual impacts to each prescribed environmental matter; and
(b) for the previous stage, if applicable—the actual significant residual impacts to each prescribed environmental matter, to date.

(Biodiversity 15) The report required by condition (Biodiversity 14) must be approved by the administering authority before a notice of election for the forthcoming stage, if applicable, is given to the administering authority.

(Biodiversity 16) A notice of election for the staged environmental offset referred to in condition (Biodiversity 15), if applicable, must be provided to the administering authority no less than three months before the proposed commencement of that stage, unless a lesser timeframe has been agreed to by the administering authority.

(Biodiversity 17) Within six months from the completion of the final stage of the project, a report completed by an appropriately qualified person, that includes the following matters must be provided to the administering authority:

(a) an analysis of the actual impacts on prescribed environmental matters resulting from the final stage; and
(b) if applicable, a notice of election to address any outstanding offset debits for the authorised impacts.

Schedule G – Protecting Water Values

Contaminant Release

(Water 1) Contaminants must not be directly or indirectly released to any waters.

Authorised impacts to wetlands

(Water 2) The extraction of groundwater as part of the petroleum activity(ies) from underground aquifers must not directly or indirectly cause environmental harm to a wetland.

Authorised activities in waters

(Water 3) Petroleum activities must not occur in or within 200m of a:

(a) wetland of high ecological significance
(b) Great Artesian Basin Spring
(c) subterranean cave GDE.

(Water 4) Only construction or maintenance of linear infrastructure is permitted in or within any wetland of other environmental value or in a watercourse.

(Water 5a) The construction or maintenance of linear infrastructure in a wetland of other environmental value must not result in the:

(a) clearing of riparian vegetation outside of the minimum area practicable to carry out the works; or
(b) ingress of saline water into freshwater aquifers; or
(c) draining or filling of the wetland beyond the minimum area practicable to carry out the works.

(Water 5b) After the construction or maintenance works for linear infrastructure in a wetland of other environmental value are completed, the linear infrastructure must not:

(a) drain or fill the wetland
(b) prohibit the flow of surface water in or out of the wetland
(c) lower or raise the water table and hydrostatic pressure outside the bounds of natural variability that existed before the activities commenced
(d) result in ongoing negative impacts to water quality
(e) result in bank instability; or
(f) result in fauna ceasing to use adjacent areas for habitat, feeding, roosting or nesting.

(Water 6) The construction or maintenance of linear infrastructure activities in a watercourse must be conducted in the following preferential order:

(a) firstly, in times where there is no water present
(b) secondly, in times of no flow
(c) thirdly, in times of flow, providing a bankfull situation is not expected and that flow is maintained.

(Water 7) The construction or maintenance of linear infrastructure authorised under condition (Water 4) must comply with the water quality limits as specified in **Schedule G, Table 1 — Release limits for construction or maintenance of linear infrastructure**.

Schedule G, Table 1 — Release limits for construction or maintenance of linear infrastructure

Water quality parameters	Units	Water quality limits
Turbidity	Nephelometric Turbidity Units (NTU)	For a wetland of other environmental value, if background water turbidity is above 45 NTU, no greater than 25% above background water turbidity measured within a 50m radius of the construction or maintenance activity. For a watercourse, if background water turbidity is above 45 NTU, no greater than 25% above background water turbidity measured within 50m downstream of the construction or maintenance activity.
		For a wetland of other environmental value, if background water turbidity is equal to, or below 45 NTU, a turbidity limit of no greater than 55 NTU applies, measured within a 50m radius of the construction or maintenance activity. For a watercourse, if background water turbidity is equal to, or below 45 NTU, a turbidity limit of no greater than 55 NTU applies, measured within 50m downstream of the construction or maintenance activity.
Hydrocarbons	-	For a wetland of other environmental value, or watercourse, no visible sheen or slick

(Water 8) Monitoring must be undertaken at a frequency that is appropriate to demonstrate compliance with condition (Water 7).

Register of activities in wetlands and watercourses

(Water 9) A register must be kept of all linear infrastructure construction and maintenance activities in a wetland of other environmental value and watercourses, which must include:

(a) location of the activity (e.g. GPS coordinates (GDA94) and watercourse name)
(b) estimated flow rate of surface water at the time of the activity
(c) duration of works, and
(d) results of impact monitoring carried out under condition (Water 8).

Activities in river improvement areas

(Water 10) Measures must be taken to minimise negative impacts to, or reversal of, any river improvement works carried out in River Improvement Areas by Queensland's River Improvement Trusts.

Activities in floodplains

(Water 11) Petroleum activity(ies) on floodplains must be carried out in a way that does not:

(a) concentrate flood flows in a way that will or may cause or threaten a negative environmental impact; or
(b) divert flood flows from natural drainage paths and alter flow distribution; or
(c) increase the local duration of floods; or
(d) increase the risk of detaining flood flows.

Seepage monitoring program

(Water 12) A seepage monitoring program must be developed by a suitably qualified person which is commensurate with the site-specific risks of contaminant seepage from containment facilities, and which requires and plans for detection of any seepage of contaminants to groundwater as a result of storing contaminants by 15 November 2018.

(Water 13) The seepage monitoring program required by condition (Water 12) must include but not necessarily be limited to:

(a) identification of the containment facilities for which seepage will be monitored
(b) identification of trigger parameters that are associated with the potential or actual contaminants held in the containment facilities
(c) identification of trigger concentration levels that are suitable for early detection of contaminant releases at the containment facilities
(d) installation of background seepage monitoring bores where groundwater quality will not have been affected by the petroleum activities authorised under this environmental authority to use as reference sites for determining impacts
(e) installation of seepage monitoring bores that:
    i. are within formations potentially affected by the containment facilities authorised under this environmental authority (i.e. within the potential area of impact)
    ii. provide for the early detection of negative impacts prior to reaching groundwater dependent ecosystems, landholder's active groundwater bores, or water supply bores
    iii. provide for the early detection of negative impacts prior to reaching migration pathways to other formations (i.e. faults, areas of unconformities known to connect two or more formations)
(f) monitoring of groundwater at each background and seepage monitoring bores for the trigger parameters identified in condition (Water 13(b)) at a frequency determined by a suitably qualified person and:
    i. at least once every two years where baseline data has been established; or
    ii. at least every six months for two years to establish baseline data for any impact to groundwaters, after which time monitoring may continue at the frequency according to condition (Water 13(f)(i).
(g) seepage trigger action response procedures for when trigger parameters and trigger levels identified in conditions (Water 13(b)) and (Water 13(c)) trigger the early detection of seepage, or upon becoming aware of any monitoring results that indicate potential groundwater contamination
(h) a rationale detailing the program conceptualisation including assumptions, determinations, monitoring equipment, sampling methods and data analysis; and
(i) provides for annual updates to the program for new containment facilities constructed in each annual return period.

Seepage monitoring bore drill logs

(Water 14) A bore drill log must be completed for each seepage monitoring bore in condition (Water 13) which must include:

(a) bore identification reference and geographical coordinate location
(b) specific construction information including but not limited to depth of bore, depth and length of casing, depth and length of screening and bore sealing details
(c) standing groundwater level and water quality parameters including physical parameter and results of laboratory analysis for the possible trigger parameters
(d) lithological data, preferably a stratigraphic interpretation to identify the important features including the identification of any aquifers; and

(e) target formation of the bore.

Schedule H – Rehabilitation

Rehabilitation planning

(Rehabilitation 1) A Rehabilitation Plan must be developed by a suitably qualified person and must include the:

(a) rehabilitation goals; and

(b) procedures to be undertaken for rehabilitation that will:

i. achieve the requirements of conditions (Rehabilitation 2) to (Rehabilitation 8), inclusive; and

ii. provide for appropriate monitoring and maintenance.

(Rehabilitation 2) Significantly disturbed areas that are no longer required for the on-going petroleum activities must be rehabilitated within 12 months (unless an exceptional circumstance in the area to be rehabilitated (e.g. a flood event) prevents this timeframe being met) and be maintained to meet the following acceptance criteria:

(a) contaminated land resulting from petroleum activities is remediated and rehabilitated

(b) the areas are:

i. non-polluting

ii. a stable landform

iii. re-profiled to contours consistent with the surrounding landform

(c) surface drainage lines are re-established, consistent with natural flow patterns and self-sustaining;

(d) top soil is reinstated; and

(e) either:

i. groundcover, that includes suitable native species of vegetation for the location and not pest species, is growing; or

ii. an alternative soil stabilisation methodology that achieves effective stabilisation is implemented and maintained.

Final rehabilitation acceptance criteria

(Rehabilitation 3) All significantly disturbed areas caused by petroleum activities which are not being or intended to be utilised by the landholder or overlapping tenure holder, must be rehabilitated to meet the following final acceptance criteria measured either against the highest ecological value adjacent land use or the pre-disturbed land use:

(a) greater than or equal to 70% of native ground cover species richness

(b) greater than or equal to the total per cent of ground cover

(c) less than or equal to the per cent species richness of declared plant pest species; and

(d) where the adjacent land use contains, or the pre-clearing land use contained, one or more regional ecosystem(s), then at least one regional ecosystem(s) from the same broad vegetation group, and with the equivalent biodiversity status or a biodiversity status with a higher conservation value as any of the regional ecosystem(s) in either the adjacent land or pre-disturbed land, must be present.

Final rehabilitation acceptance criteria in environmentally sensitive areas

(Rehabilitation 4) Where significant disturbance to land has occurred in an environmentally sensitive area, the following final rehabilitation criteria as measured against the pre-disturbance biodiversity values assessment (required by conditions (Biodiversity 1) and (Biodiversity 2)) must be met:

(a) greater than or equal to 70% of native ground cover species richness
(b) greater than or equal to the total per cent ground cover
(c) less than or equal to the per cent species richness of declared plant pest species
(d) greater than or equal to 50% of organic litter cover
(e) greater than or equal to 50% of total density of coarse woody material; and
(f) all predominant species in the ecologically dominant layer, that define the pre-disturbance regional ecosystem(s) are present.

Continuing conditions

(Rehabilitation 5) Conditions (Rehabilitation 2), (Rehabilitation 3) and (Rehabilitation 4) continue to apply after this environmental authority has ended or ceased to have effect.

Rehabilitation reporting for relinquishment of part of an authority to prospect area under the *Petroleum and Gas (Production and Safety) Act 2004*

Remaining dams

(Rehabilitation 8) Where there is a dam (including a low consequence dam) that is being or intended to be utilised by the landholder or overlapping tenure holder, the dam must be decommissioned to no longer accept inflow from the petroleum activity(ies) and the contained water must be of a quality suitable for the intended on-going uses(s) by the landholder or overlapping tenure holder.

Schedule I – Well construction, maintenance and stimulation activities

Drilling activities

(Well activities 1) Oil based or synthetic based drilling muds must not be used in the carrying out of the petroleum activity(ies).

(Well activities 2) Drilling activities must not result in the connection of the target gas producing formation and another aquifer.

(Well activities 3) Practices and procedures must be in place to detect, as soon as practicable, any fractures that:

a) have or may result in the connection of a target formation and another aquifer as a result of drilling activities; or

b) cause the connection of a target gas producing formation and another aquifer.

Schedule J – Structures

(J1) The consequence category of any structure must be assessed by a suitably qualified and experienced person in accordance with the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)* at the following times:

(a) prior to the design and construction of the structure, if it is not an existing structure; or
(b) prior to any change in its purpose or the nature of its stored contents.

(J2) A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.

(J3) Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)*.

Notification of affected persons

(J4) All affected persons must be provided with a copy of the emergency action plan in place for each regulated structure

(a) for existing structures that are regulated structures, within 10 business days of this condition taking effect;
(b) prior to the operation of the new regulated structure; and
(c) if the emergency action plan is amended, within 5 business days of it being amended.

Operation of a regulated structure

(J5) For existing structures that are regulated structures:

(a) where the existing structure that is a regulated structure is to be managed as part of an integrated containment system for the purpose of sharing the DSA volume across the system, the holder must submit to the administering authority within 12 months of the commencement of this condition a copy of the certified system design plan including that structure; and
(b) there must be a current operational plan for the existing structures.

(J6) Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitated, in compliance with the current operational plan and, if applicable, the current design plan and associated certified 'as constructed' drawings.

Design storage allowance

(J7) The holder must assess the performance of each regulated dam or linked containment system over the preceding November to May period based on actual observations of the available storage in each regulated dam or linked containment system taken prior to 1 July of each year.

(J8) By 1 November of each year, storage capacity must be available in each regulated dam (or network of linked containment systems with a shared DSA volume), to meet the Design Storage Allowance (DSA) volume for the dam (or network of linked containment systems).

(J9) The holder must, as soon as practicable but within forty-eight (48) hours of becoming aware that the regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, notify the administering authority.

(J10) The holder must, immediately on becoming aware that a regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment systems.

Annual inspection report

(J11) Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person.

(J12) At each annual inspection, the condition and adequacy of all components of the regulated structure must be assessed and a suitably qualified and experienced person must prepare an annual inspection report containing details of the assessment and include a recommendations section, with any recommended actions to ensure the integrity of the regulated structure or a positive statement that no recommendations are required.

(J13) The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933*).

(J14) The holder must within 20 business days of receipt of the annual inspection report, provide to the administering authority:

(a) The recommendations section of the annual inspection report; and
(b) If applicable, any actions being taken in response to those recommendations; and
(c) If, following receipt of the recommendations and (if applicable) recommended actions, the administering authority requests a copy of the annual inspection report from the holder, provide this to the administering authority within 10 business days of receipt of the request.

Transfer arrangements

(J15) The holder must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this authority.

Register of Regulated Structures

(J16) A Register of Regulated Structures must be established and maintained by the holder for each regulated structure.

(J17) The holder must ensure that the information contained in the Register of Regulated Structures is current and complete on any given day.

(J18) All entries in the Register of Regulated Structures must be approved by the chief executive officer for the holder of this authority, or their delegate, as being accurate and correct.

(J19) The holder must, at the same time as providing the annual return, supply to the administering authority a copy of the records contained in the Register of Regulated Structures, in the electronic format required by the administering authority.

Schedule K – Definitions

Word or term	Definition
acceptable standards for release to land	means wastewater of the following quality as determined by monitoring results or by characterisation: (a) electrical conductivity (EC) not exceeding 3000µS/cm (b) sodium adsorption ratio (SAR) not exceeding 8 (c) pH between 6.0 and 9.0 (d) heavy metals (measured as total) meets the respective short term trigger value in section 4.2.6, Table 4.2.10—Heavy metals and metalloids in Australian and New Zealand Guidelines for Fresh and Marine Water Quality (e) does not contain biocides.
acid sulfate soil(s)	means a soil or soil horizon which contains sulfides or an acid soil horizon affected by oxidation of sulfides.
adjacent land use(s)	means the ecosystem function adjacent to an area of significant disturbance, or where there is no ecosystem function, the use of the land. An adjacent land use does not include an adjacent area that shows evidence of edge effect.
administering authority	means: (a) for a matter, the administration and enforcement of which has been devolved to a local government under section 514 of the *Environmental Protection Act 1994*—the local government; or (b) for all other matters—the Chief Executive of the Department of Environment and Heritage Protection; or (c) another State Government Department, Authority, Storage Operator, Board or Trust, whose role is to administer provisions under other enacted legislation.
Affected person	is someone whose drinking water can potentially be impacted as a result of discharges from a dam or their life or property can be put at risk due to dwellings or workplaces being in the path of a dam break flood.
alternative arrangement	means a written agreement about the way in which a particular environmental nuisance impact will be dealt with at a sensitive place, and may include an agreed period of time for which the arrangement is in place. An alternative arrangement may include, but is not limited to, a range of nuisance abatement measures to be installed at the sensitive place, or provision of alternative accommodation for the duration of the relevant nuisance impact.
analogue site(s)	means an area of land which contains values and characteristics representative of an area to be rehabilitated prior to disturbance. Such values must encompass land use, topographic, soil, vegetation, vegetation community attributes and other ecological characteristics. Analogue sites can be the pre-disturbed site of interest where significant surveying effort has been undertaken to establish benchmark parameters.
Annual exceedance probability or AEP	the probability that at least one event in excess of a particular magnitude will occur in any given year.
Annual inspection report	means an assessment prepared by a suitably qualified and experienced person containing details of the assessment against the most recent consequence assessment report and design plan (or system design plan); a) against recommendations contained in previous annual inspections reports; b) against recognised dam safety deficiency indicators;

<table>
<tr><th>Word or term</th><th>Definition</th></tr>
<tr><td></td><td>c) for changes in circumstances potentially leading to a change in consequence category;
d) for conformance with the conditions of this authority;
e) for conformance with the ‘as constructed’ drawings;
f) for the adequacy of the available storage in each regulated dam, based on an actual observation or observations taken after 31 May each year but prior to 1 November of that year, of accumulated sediment, state of the containment barrier and the level of liquids in the dam (or network of linked containment systems);
g) for evidence of conformance with the current operational plan.</td></tr>
<tr><td>annual return period</td><td>means the most current 12-month period between two anniversary dates.</td></tr>
<tr><td>appraisal well</td><td>means a petroleum well to test the potential of one (1) or more natural underground reservoirs for producing or storing petroleum. For clarity, an appraisal well does not include an exploration well.</td></tr>
<tr><td>appropriately qualified person / suitably qualified person</td><td>means a person who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature.</td></tr>
<tr><td>approved quality criteria</td><td>for the purposes of residual drilling materials, means the residual drilling material meet the following quality standards:

Part A In all cases:

<table>
<tr><th>Parameter</th><th>Maximum concentration</th></tr>
<tr><td>pH</td><td>6 – 10.5 (range)</td></tr>
<tr><td>Electrical Conductivity</td><td>20 dS/m (20,000 µS/cm)</td></tr>
<tr><td>Chloride*</td><td>8000 mg/L</td></tr>
</table>
*Chloride analysis is only required if an additive containing chloride was used in the drilling process
The limits in Part A must be measured in the clarified filtrate of oversaturated solids prior to mixing.

Part B If any of the following metals are a component of the drilling fluids, then for that metal:

<table>
<tr><th>Parameter</th><th>Maximum concentration</th></tr>
<tr><td>Arsenic</td><td>20 mg/kg</td></tr>
<tr><td>Selenium</td><td>5 mg/kg</td></tr>
<tr><td>Boron</td><td>100 mg/kg</td></tr>
<tr><td>Cadmium</td><td>3 mg/kg</td></tr>
<tr><td>Chromium (total)</td><td>400 mg/kg</td></tr>
<tr><td>Copper</td><td>100 mg/kg</td></tr>
<tr><td>Lead</td><td>600 mg/kg</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Word or term</th><th>Definition</th></tr>
<tr><td></td><td>The limits in Part B and Part C refer to the post soil/by-product mix.

Part C If a hydrocarbon sheen is visible, the following hydrocarbon fractions:
<table>
<tr><th>TPH</th><th>Maximum concentration</th></tr>
<tr><td>C6-C10</td><td>170 mg/kg</td></tr>
<tr><td>C10-C16</td><td>150 mg/kg</td></tr>
<tr><td>C16-C34</td><td>1300 mg/kg</td></tr>
<tr><td>C34-C40</td><td>5600 mg/kg</td></tr>
<tr><td>Total Polycyclic Aromatic Hydrocarbons (PAHs)</td><td>20 mg/kg</td></tr>
<tr><td>Phenols (halogenated)</td><td>1 mg/kg</td></tr>
<tr><td>Phenols (non-halogenated)</td><td>60 mg/kg</td></tr>
<tr><td>Monocyclic aromatic hydrocarbons
(Total sum of benzene, toluene, ethyl benzene, xylenes (includes ortho, para and meta xylenes) and styrene)</td><td>7 mg/kg</td></tr>
<tr><td>Benzene</td><td>1 mg/kg</td></tr>
</table></td></tr>
<tr><td>areas of pre-existing disturbance</td><td>means areas where environmental values have been negatively impacted as a result of anthropogenic activity and these impacts are still evident. Areas of pre-disturbance may include areas where legal clearing, logging, timber harvesting, or grazing activities have previously occurred, where high densities of weed or pest species are present which have inhibited re-colonisation of native regrowth, or where there is existing infrastructure (regardless of whether the infrastructure is associated with the authorised petroleum activities). The term ‘areas of pre-disturbance’ does not include areas that have been impacted by wildfire/s, controlled burning, flood or natural vegetation die-back.</td></tr>
<tr><td>Assessed or assessment</td><td>by a suitably qualified and experienced person in relation to a consequence assessment of a dam, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit of the assessment:

a) exactly what has been assessed and the precise nature of that determination;
b) the relevant legislative, regulatory and technical criteria on which the assessment has been based;
c) the relevant data and facts on which the assessment has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and
d) the reasoning on which the assessment has been based using the relevant data and facts, and the relevant criteria.</td></tr>
<tr><td>associated water</td><td>means underground water taken or interfered with, if the taking or interference happens during the course of, or results from, the carrying out of another authorised activity under a petroleum authority, such as a petroleum well, and includes waters also known as produced formation water. The term includes all contaminants suspended or dissolved within the water.</td></tr>
<tr><td>associated works</td><td>in relation to a dam, means:

(a) operations of any kind and all things constructed, erected or installed for that dam; and
(b) any land used for those operations.</td></tr>
<tr><td>Australian Standard 3580</td><td>means any of the following publications:</td></tr>
</table>

Word or term	Definition
	• AS3580.10.1 Methods for sampling and analysis of ambient air—Determination of particulate matter—Deposited matter—Gravimetric method. • AS3580.9.6 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—PM10 high volume sampler with size-selective inlet—Gravimetric method • AS3580.9.9 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter— PM10 low volume sampler—Gravimetric sampler.
Authority	means an environmental authority or a development approval.
background noise level	means the sound pressure level, measured in the absence of the noise under investigation, as the $L_{A90,T}$ being the A-weighted sound pressure level exceeded for 90% of the measurement time period T of not less than 15 minutes (or $L_{A\ 90,\ adj,\ 15\ mins}$), using Fast response.
bankfull	means the channel flow rate that exists when the water is at the elevation of the channel bank above which water begins to spill out onto the floodplain. The term describes the condition of the channel relative to its banks (e.g. overbank, in-bank, bankfull, low banks, high bank).
bed	of any waters, has the meaning in Schedule 12 of the Environmental Protection Regulation 2008 and— (a) includes an area covered, permanently or intermittently, by tidal or non-tidal waters; but (b) does not include land adjoining or adjacent to the bed that is from time to time covered by floodwater.
being or intended to be utilised by the landholder or overlapping tenure holder	for significantly disturbed land, means there is a written agreement (e.g. land and compensation agreement) between the landholder or the overlapping tenure holder and the holder of the environmental authority identifying that the landholder or the overlapping tenure holder has a preferred use of the land such that rehabilitation standards for revegetation by the holder of the environmental authority are not required. For dams, means there is a written agreement (e.g. land and compensation agreement) between the landholder or the overlapping tenure holder and the holder of the environmental authority identifying that the landholder or the overlapping tenure holder has a preferred use for the dam such that rehabilitation standards for revegetation by the holder of the environmental authority are not required.
biodiversity values	for the purposes of this environmental authority, means environmentally sensitive areas, prescribed environmental matters and wetlands.
BTEX	means benzene, toluene, ethylbenzene, ortho-xylene, para-xylene, meta-xylene and total xylene.
Category A Environmentally Sensitive Area	means any area listed in Schedule 12, Section 1 of the Environmental Protection Regulation 2008.
Category B Environmentally Sensitive Area	means any area listed in Schedule 12, Section 2 of the Environmental Protection Regulation 2008.
Category C Environmentally Sensitive Area	means any of the following areas: • nature refuges as defined in the conservation agreement for that refuge under the Nature Conservation Act 1992 • koala habitat areas as defined under the Nature Conservation (Koala) Conservation Plan 2006

Word or term	Definition
	• state forests or timber reserves as defined under the *Forestry Act 1959* • regional parks (previously known as resource reserves) under the *Nature Conservation Act 1992* • an area validated as 'essential habitat' from ground-truthing surveys in accordance with the *Vegetation Management Act 1999* for a species of wildlife listed as endangered or vulnerable under the *Nature Conservation Act 1992* • *'*of concern regional ecosystems' that are remnant vegetation and identified in the database called 'RE description database' containing regional ecosystem numbers and descriptions.
Certify, certified, certifying or certification	in relation to any matter other than a design plan, 'as constructed' drawings or an annual report regarding dams means, a Statutory Declaration by a suitably qualified person or suitably qualified third party accompanying the written document stating: • the person's qualifications and experience relevant to the function • that the person has not knowingly included false, misleading or incomplete information in the document • that the person has not knowingly failed to reveal any relevant information or document to the administering authority • that the document addresses the relevant matters for the function and is factually correct; and • that the opinions expressed in the document are honestly and reasonably held. In the guideline 'Structures which are dams or levees constructed as part of environmentally relevant activities' (ESR/2016/1937) – means assessment and approval must be undertaken by a suitably qualified and experienced person in relation to any assessment or documentation required by this Manual, including design plans, 'as constructed' drawings and specifications, construction, operation or an annual report regarding regulated structures, undertaken in accordance with the Board of Professional Engineers of Queensland Policy Certification by RPEQs (ID: 1.4 (2A)).
clearing	has the meaning in the dictionary of the Vegetation Management Act 2000 and for vegetation— (a) means remove, cut down, ringbark, push over, poison or destroy in any way including by burning, flooding or draining; but (b) does not include destroying standing vegetation by stock, or lopping a tree.
closed-loop systems	means using waste on site in a way that does not release waste or contaminants in the waste to the environment.
Construction or constructed	in relation to a dam includes building a new dam and modifying or lifting an existing dam, but does not include investigations and testing necessary for the purpose of preparing a design plan.

Word or term	Definition
Consequence	in relation to a structure as defined, means the potential for environmental harm resulting from the collapse or failure of the structure to perform its primary purpose of containing, diverting or controlling flowable substances.
Consequence category	means a category, either low, significant or high, into which a dam is assessed as a result of the application of tables and other criteria in the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).
control measure	has the meaning in section 47 of the *Environmental Protection Regulation 2008* and means a device, equipment, structure, or management strategy used to prevent or control the release of a contaminant or waste to the environment.
critically limited regional ecosystem	means the regional ecosystems defined and listed in Appendix 5 of the Queensland Biodiversity Offset Policy.
coal seam gas water	means underground water brought to the surface of the earth, or moved underground in connection with exploring for, or producing coal seam gas.
daily peak design capacity	for sewage treatment works, has the meaning in Schedule 2, section 63(4) of the *Environmental Protection Regulation 2008* as the higher equivalent person (EP) for the works calculated using each of the formulae found in the definition for EP.
dam(s)	means a land-based structure or a void that contains, diverts or controls flowable substances, and includes any substances that are thereby contained, diverted or controlled by that land-based structure or void and associated works.
Dam crest volume	means the volume of material (liquids and/or solids) that could be within the walls of a dam at any time when the upper level of that material is at the crest level of that dam. That is, the instantaneous maximum volume within the walls, without regard to flows entering or leaving (for example, via spillway).
Design plan	is a document setting out how all identified consequence scenarios are addressed in the planned design and operation of a regulated structure.
designated precinct	has the meaning in Part 5 section 15(3) of the Regional Planning Interests Regulation 2014 and means: • for a strategic environmental area mentioned in section 4(1) – the area identified as a designated precinct on the strategic environmental area map for the strategic environmental are; or • if a strategic environmental area is shown on a map in a regional plan – the area identified on the map as a designated precinct for the strategic environmental area.
design storage allowance or DSA	means an available volume, estimated in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*, published by the administering authority, as amended from time to time, that must be provided in a dam to an annual exceedance probability specified in that Manual.
Designer	for the purposes of a regulated dam, means the certifier of the design plan for the regulated dam.
Development approval	means a development approval under the *Planning Act 2016* (or under the repealed *Sustainable Planning Act 2009 or Integrated Planning Act 1997*) in relation to a matter that involves an environmentally relevant activity under the *Environmental Protection Act 1994*.
development wells	means a petroleum well which produces or stores petroleum. For clarity, a development well does not include an appraisal well.
document	has the meaning in the *Acts Interpretation Act 1954* and means: • any paper or other material on which there is writing; and

Word or term	Definition
	• any paper or other material on which there are marks; and • figures, symbols or perforations having a meaning for a person qualified to interpret them; and • any disc, tape or other article or any material from which sounds, images, writings or messages are capable of being produced or reproduced (with or without the aid of another article or device).
Ecologically dominant layer	has the meaning in the Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.2 August 2012) and means the layer making the greatest contribution to the overall biomass of the site and the vegetation community (NLWRA 2001). This is also referred to as the ecologically dominant stratum or the predominant canopy in woody ecosystems.
ecosystem function	means the interactions between and within living and nonliving components of an ecosystem and generally correlates with the size, shape and location of the vegetation community.
Emergency action plan	means documentation forming part of the operational plan held by the holder or a nominated responsible officer, that identifies emergency conditions that sets out procedures and actions that will be followed and taken by the dam owner and operating personnel in the event of an emergency. The actions are to minimise the risk and consequences of failure, and ensure timely warning to affected persons and the implementation of protection measures. The plan must require dam owners to annually review and update contact information where required.
enclosed flare	means a device where the residual gas is burned in a cylindrical or rectilinear enclosure that includes a burning system and a damper where air for the combustion reaction is admitted.
environmental harm	has the meaning in section 14 of the *Environmental Protection Act 1994* and means any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance. Environmental harm may be caused by an activity— (a) whether the harm is a direct or indirect result of the activity; or (b) whether the harm results from the activity alone or from the combined effects of the activity and other activities or factors.
Environmental nuisance	has the meaning in section 15 of the *Environmental Protection Act 1994* and means unreasonable interference or likely interference with an environmental value caused by — (a) aerosols, fumes, light, noise, odour, particles or smoke; or (b) an unhealthy, offensive or unsightly condition because of contamination; or (c) another way prescribed by regulation.
Environmental offset	has the meaning in section 7 of the *Environmental Offsets Act 2014.*
Environmentally sensitive area	means Category A, B or C environmentally sensitive areas (ESAs)
equivalent person or EP	has the meaning under section 3 of the Planning Guidelines For Water Supply and Sewerage, 2005, published by the Queensland Government. It is calculated in accordance with Schedule 2, Section 63(4) of the *Environmental Protection Regulation 2008* where: • EP = V/200 where V is the volume, in litres, of the average dry weather flow of sewage that can be treated at the works in a day; or • EP = M/2.5 where M is the mass, in grams, of phosphorus in the influent that the works are designed to treat as the inlet load in a day.

Word or term	Definition

essential petroleum activities	means activities that are essential to bringing the resource to the surface and are only the following:
	• low impact petroleum activities
	• geophysical, geotechnical, geological, topographic and cadastral surveys (including seismic, sample /test / geotechnical pits, core holes)
	• single well sites not exceeding 1.1 hectare disturbance and multi-well sites not exceeding 1.5 hectare disturbance
	• well sites with monitoring equipment (including monitoring bores):
	  o for single well sites, not exceeding 1.25 hectares disturbance
	  o for multi-well sites, not exceeding 1.75 hectares disturbance
	• well sites with monitoring equipment (including monitoring bores) and tanks (minimum 1 ML) for above ground fluid storage:
	  o for single well sites, not exceeding 1.5 hectares disturbance
	  o for multi-well sites, not exceeding 2.0 hectares disturbance
	• associated infrastructure located on a well site necessary for the construction and operations of wells:
	  o water pumps and generators
	  o flare pits
	  o chemical / fuel storages
	  o sumps for residual drilling material and drilling fluids
	  o tanks, or dams which are not significant or high consequence dams to contain wastewater (e.g. stimulation flow back waters, produced water)
	  o pipe laydown areas
	  o soil and vegetation stockpile areas
	  o a temporary camp associated with a drilling rig that may involve sewage treatment works that are no release works
	  o temporary administration sites and warehouses
	  o dust suppression activities using water that meets the quality and operational standards approved under the environmental authority
	• communication and power lines that are necessary for the undertaking of petroleum activities and that are located within well sites, well pads and pipeline right of ways without increasing the disturbance area of petroleum activities
	• On-site disposal of Residual Drilling Material
	• supporting access tracks
	• gathering / flow pipelines from a well head to the initial compression facility
	• activities necessary to achieve compliance with the conditions of the environmental authority in relation to another essential petroleum activity (e.g. sediment and erosion control measures, rehabilitation).

existing authority	has the meaning in section 94 of the *Environmental Offsets Act 2014*.

Word or term	Definition
Existing structure	means a structure that prior to 26 July 2018 meets any or both of the following, a structure: a) with a design that is in accordance with the ESR/2016/1933 version 5.00 *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* and that is considerably in progress; b) that is under considerable construction or that is constructed.
exploration well	means a petroleum well that is drilled to: • explore for the presence of petroleum or natural underground reservoirs suitable for storing petroleum; or • obtain stratigraphic information for the purpose of exploring for petroleum. For clarity, an exploration well does not include an appraisal or development well.
Extreme Storm Storage	means a storm storage allowance determined in accordance with the criteria in the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)* published by the administering authority.
flare pit	has the meaning in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*, and means containment area where any hydrocarbon that is discovered in an over-pressured reservoir during a drilling operation is diverted to, and combusted, The flare pit is only used during the drilling and work over process on a petroleum well.
flare precipitant	means waste fluids which result from the operation of a flare.
floodplains	has the meaning in the Water Act 2000 and means an area of reasonably flat land adjacent to a watercourse that— • is covered from time to time by floodwater overflowing from the watercourse; and • does not, other than in an upper valley reach, confine floodwater to generally follow the path of the watercourse; and • has finer sediment deposits than the sediment deposits of any bench, bar or in-stream island of the watercourse.
flowable substance	means matter or a mixture of materials which can flow under any conditions potentially affecting that substance. Constituents of a flowable substance can include water, other liquids fluids or solids, or a mixture that includes water and any other liquids fluids or solids either in solution or suspension.
fuel burning or combustion facility	means a permanent fuel burning or combustion equipment which in isolation, or combined in operation, or which are interconnected, is, or are capable of burning more than 500 kg of fuel in an hour.
GDA	means Geocentric Datum of Australia.
Great Artesian Basin (GAB) spring	means an area protected under the Environment Protection and Biodiversity Conservation Act 1999 because it is considered to be a Matter of National Environmental Significance and identified as a: • community of native species dependent on natural discharge of groundwater from the Great Artesian Basin; or • Great Artesian Basin spring; or • Great Artesian Basin discharge spring wetland. A GAB spring includes a spring vent, spring complex or watercourse spring and includes the land to which water rises naturally from below the ground and the land over which the water then flows. *Note: The Australian Government's Protected Matters Search Tool should be used to get an indication of whether the area of interest may contain an MNES spring.*

Word or term	Definition
	Note: The GAB springs dataset can be requested from the Queensland Government Herbarium
green waste	means waste that is grass cuttings, trees, bushes, shrubs, material lopped from trees, untreated timber or other waste that is similar in nature but does not include pest species.
greywater	means wastewater generated from domestic activities such as laundry, dishwashing, and bathing. Greywater does not include sewage.
Groundwater dependent ecosystem (GDE)	means ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services. For the purposes of the environmental authority, groundwater dependent ecosystems do not include those mapped as "unknown".
growing	means to increase by natural development, as any living organism or part thereof by assimilation of nutriment; increase in size or substance.
Holder	means: a) where this document is an environmental authority, any person who is the holder of, or is acting under, that environmental authority; or b) where this document is a development approval, any person who is the registered operator for that development approval.
hydraulic integrity	refers to the capacity of a dam to contain or safely pass flowable substances based on its design.
Hydraulic performance	means the capacity of a regulated dam to contain or safely pass flowable substances based on the design criteria specified for the relevant consequence category in the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)*.
impulsive (for noise)	means sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the background sound pressure. The duration of a single impulsive sound is usually less than one second.
$L_{A\ 90,\ adj,\ 15\ mins}$	means the A-weighted sound pressure level, adjusted for tonal character that is equal to or exceeded for 90% of any 15 minutes sample period equal, using Fast response.
$L_{Aeq,\ adj,\ 15\ mins}$	means the A-weighted sound pressure level of a continuous steady sound, adjusted for tonal character, that within any 15 minute period has the same square sound pressure as a sound level that varies with time.
land degradation	has the meaning in the *Vegetation Management Act 1999* and means the following: • soil erosion • rising water tables • the expression of salinity • mass movement by gravity of soil or rock • ream bank instability • a process that results in declining water quality.
landholder's active groundwater bore	means bores that are able to continue to provide a reasonable yield of water in terms of quantity for the bores authorised purpose or use. This term does not include monitoring bores owned by the administering authority of the *Water Act 2000*.
Levee	means an embankment that only provides for the containment and diversion of stormwater or flood flows from a contributing catchment, or containment and diversion of flowable materials resulting from releases from other works, during the progress of those stormwater or flood flows or those releases; and does not store any significant volume of water or flowable substances at any other times.

Word or term	Definition
linear infrastructure	means powerlines, pipelines, flowlines, roads and access tracks.
liquid	means a substance which is flowing and offers no permanent resistance to changes of shape.
long term noise event	means a noise exposure, when perceived at a sensitive receptor, persists for a period of greater than five (5) days, even when there are respite periods when the noise is inaudible within those five (5) days.
low consequence dam	means any dam that is not classified as high or significant as assessed using the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures*, published by the administering authority, as amended from time to time.
low impact petroleum activities	means petroleum activities which do not result in the clearing of native vegetation, cause disruption to soil profiles through earthworks or excavation or result in significant disturbance to land which cannot be rehabilitated immediately using hand tools after the activity is completed. Examples of such activities include but are not necessarily limited to soil surveys (excluding test pits), topographic surveys, cadastral surveys and ecological surveys, may include installation of monitoring equipment provided that it is within the meaning of low impact and traversing land by car or foot via existing access tracks or routes or in such a way that does not result in permanent damage to vegetation.
Mandatory reporting level or MRL	means a warning and reporting level determined in accordance with the criteria in the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)* published by the administering authority.
Manual	means the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)* published by the administering authority, as amended from time to time.
Map of referable wetlands	has the meaning in Schedule 12 of the *Environmental Protection Regulation 2008* and means the 'Map of referable wetlands', a document approved by the chief executive on 4 November 2011 and published by the department, as amended from time to time by the chief executive under section 144D.
Max $L_{pA, 15\ min}$	means the absolute maximum instantaneous A-weighted sound pressure level, measured over 15 minutes.
Max $L_{pZ, 15\ min}$	means the maximum value of the Z-weighted sound pressure level measured over 15 minutes.
maximum extent of impact	means the total, cumulative, residual extent and duration of impact to a prescribed environmental matter that will occur over a project's life after all reasonable avoidance and reasonable on-site mitigation measures have been, or will be, undertaken.
medium term noise event	is a noise exposure, when perceived at a sensitive receptor, persists for an aggregate period not greater than five (5) days and does not re-occur for a period of at least four (4) weeks. Re-occurrence is deemed to apply where a noise of comparable level is observed at the same receptor location for a period of one hour or more, even if it originates from a difference source or source location.
methodology	means the science of method, especially dealing with the logical principles underlying the organisation of the various special sciences, and the conduct of scientific inquiry.

Word or term	Definition
mix-bury-cover method	means the stabilisation of residual drilling solids in the bottom of a sump by mixing with subsoil and which occurs in accordance with the following methodology: • the base of the subsoil and residual solid mixture must be separated from the groundwater table by at least one metre of a continuous layer of impermeable subsoil material (kw=10–8m/s) or subsoil with a clay content of greater than 20%; and • the residual solids is mixed with subsoil in the sump and cover; and • the subsoil and residual solids is mixed at least three parts subsoil to one part waste (v/v); and • a minimum of one metre of clean subsoil must be placed over the subsoil and residual solids mixture; and • topsoil is replaced.
Modification or modifying	see definition of 'construction'
month	has the meaning in the Acts Interpretation Act 1954 and means a calendar month and is a period starting at the beginning of any day of one (1) of the 12 named months and ending— • immediately before the beginning of the corresponding day of the next named month; or • if there is no such corresponding day—at the end of the next named month.
NATA accreditation	means accreditation by the National Association of Testing Authorities Australia.
notice of election	has the meaning in section 18(2) *Environmental Offsets Act 2014*.
Operational plan	includes: a) normal operating procedures and rules (including clear documentation and definition of process inputs in the DSA); b) (b) contingency and emergency action plans including operating procedures designed to avoid and/or minimise environmental impacts including threats to human life resulting from any overtopping or loss of structural integrity of the regulated structure.
pipeline waste water	means hydrostatic testing water, flush water or water from low point drains.
pre-disturbed land use	means the function or use of the land as documented prior to significant disturbance occurring at that location.
Predominant species	has the meaning in the Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.2 August 2012) and means a species that contributes most to the overall above-ground biomass of a particular stratum.
Prescribed contaminants	has the meaning in section 440ZD of the *Environmental Protection Act 1994*.
Prescribed environmental matters	has the meaning in section 10 of the *Environmental Offsets Act 2014*, limited to the matters of State environmental significant listed in schedule 2 of the *Environmental Offsets Regulation 2014*.
primary protection zone	means an area within 200m from the boundary of any Category A, B or C ESA.
produced water	has the meaning in Section 15A of the *Petroleum and Gas (Production and Safety) Act 2004* and means CSG water or associated water for a petroleum tenure.
protection zone	means the primary protection zone of any Category A, B or C ESA or the secondary protection zone of any Category A or B ESA.
regional ecosystem	has the meaning in the Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.2 August 2012) and means a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil. Regional ecosystems of Queensland were originally described in Sattler and

Word or term	Definition
	Williams (1999). The Regional Ecosystem Description Database (Queensland Herbarium 2013) is maintained by Queensland Herbarium and contains the current descriptions of regional ecosystems.
Register of Regulated Structures	includes**:** a) Date of entry in the register; b) Name of the structure, its purpose and intended/actual contents; c) The consequence category of the dam as assessed using the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)*; d) Dates, names, and reference for the design plan plus dates, names, and reference numbers of all document(s) lodged as part of a design plan for the dam; e) Name and qualifications of the suitably qualified and experienced person who certified the design plan and 'as constructed' drawings; f) For the regulated dam, other than in relation to any levees – i. The dimensions (metres) and surface area (hectares) of the dam measured at the footprint of the dam; ii. Coordinates (latitude and longitude in GDA94) within five metres at any point from the outside of the dam including its storage area iii. Dam crest volume (megalitres); iv. Spillway crest level (metres AHD). v. Maximum operating level (metres AHD); vi. Storage rating table of stored volume versus level (metres AHD); vii. Design storage allowance (megalitres) and associated level of the dam (metres AHD); viii. Mandatory reporting level (metres AHD); g) The design plan title and reference relevant to the dam; h) The date construction was certified as compliant with the design plan; i) The name and details of the suitably qualified and experienced person who certified that the constructed dam was compliant with the design plan; j) Details of the composition and construction of any liner; k) The system for the detection of any leakage through the floor and sides of the dam; l) Dates when the regulated dam underwent an annual inspection for structural and operational adequacy, and to ascertain the available storage volume for 1 November of any year; m) Dates when recommendations and actions arising from the annual inspection were provided to the administering authority; n) Dam water quality as obtained from any monitoring required under this authority as at 1 November of each year.
regulated dam	means any dam in the significant or high consequence category as assessed using the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*, published by the administering authority, as amended from time to time.
Regulated structure	means any structure in the significant or high consequence category as assessed using the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)* published by the administering authority. A regulated structure does not include: • a fabricated or manufactured tank or container, designed and constructed to an Australian Standard that deals with strength and structural integrity of that tank or container; • a sump or earthen pit used to store residual drilling material and drilling fluid only for the duration of drilling and well completion activities; • a flare pit.
rehabilitation or rehabilitated	means the process of reshaping and revegetating land to restore it to a stable landform and in accordance with acceptance criteria and, where relevant, includes remediation of contaminated land. For the purposes of pipeline rehabilitation, rehabilitation includes reinstatement, revegetation and restoration.

Word or term	Definition
reinstate or reinstatement	for pipelines, means the process of bulk earth works and structural replacement of pre-existing conditions of a site (i.e. soil surface typography, watercourses, culverts, fences and gates and other landscape(d) features) and is detailed in the Australian Pipeline Industry Association (APIA) Code of Environmental Practice: Onshore Pipelines (2013).
reporting limit	means the lowest concentration that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions. For many analytes, the reporting limit is selected as the lowest non-zero standard in the calibration curve. Results that fall below the reporting limit will be reported as "less than" the value of the reporting limit. The reporting limit is also referred to as the practical quantitation limit or the limit of quantitation. For polycyclic aromatic hydrocarbons, the reporting limit must be based on super-ultra trace methods and, depending on the specific polycyclic aromatic hydrocarbon, will range between 0.005 ug/L–0.02 ug/L.
residual drilling material	means waste drilling materials including muds and cuttings or cement returns from well holes and which have been left behind after the drilling fluids are pumped out.
restoration	means the replacement of structural habitat complexity, ecosystem processes, services and function from a disturbed or degraded site to that of a pre-determined or analogue site. For the purposes of pipelines, restoration applies to final rehabilitation after pipeline decommissioning.
Restricted stimulation fluids	has the meaning in section 206 of the *Environmental Protection Act 1994* and means fluids used for the purpose of stimulation, including fracturing, that contain the following chemicals in more than the maximum amount prescribed under a regulation— (a) petroleum hydrocarbons containing benzene, ethylbenzene, toluene or xylene (b) chemicals that produce, or are likely to produce, benzene, ethylbenzene, toluene or xylene as the chemical breaks down in the environment.
revegetation or revegetating or revegetate	means to actively re-establish vegetation through seeding or planting techniques in accordance with site specific management plans.
Secondary protection zone	in relation to a Category A or Category B ESA means an area within 100 metres from the boundary of the primary protection zone.
secondary treated class A standards	means treated sewage effluent or greywater which meets the following standards: • total phosphorous as P, maximum 20mg/L • total nitrogen as N, maximum 30mg/L • 5-day biochemical oxygen demand (inhibited) (e.g. release pipe from sewage treatment plant), maximum 20mg/L • suspended solids, maximum 30mg/L • pH, range 6.0 to 8.5 • e-coli, 80th percentile based on at least 5 samples with not less than 30 minutes between samples, 100cfu per 100mL, maximum 1000cfu per 100mL.
secondary treated class B standards	means treated sewage effluent or greywater which meets the following standards: • total phosphorous as P, maximum 20mg/L • total nitrogen as N, maximum 30mg/L • 5-day biochemical oxygen demand (inhibited) (e.g. release pipe from sewage treatment plant), maximum 20mg/L • suspended solids, maximum 30mg/L • pH, range 6.0 to 8.5 • e-coli, 80th percentile based on at least 5 samples with not less than 30 minutes between samples, 1000cfu per 100mL, maximum 10 000cfu per 100mL.
secondary treated class C standards	means treated sewage effluent or greywater which meets the following standards: • total phosphorous as P, maximum 20mg/L • total nitrogen as N, maximum 30mg/L

Word or term	Definition
	• 5-day biochemical oxygen demand (inhibited) (e.g. Release pipe from sewage treatment plant), maximum 20mg/L • suspended solids, maximum 30mg/L • pH, range 6.0 to 8.5 • e-Coli, 80th percentile based on at least 5 samples with not less than 30 minutes between samples, 10 000cfu per 100mL, maximum 100 000cfu per 100mL.
sensitive place	means: • a dwelling (including residential allotment, mobile home or caravan park, residential marina or other residential premises, motel, hotel or hostel) • a library, childcare centre, kindergarten, school, university or other educational institution • a medical centre, surgery or hospital • a protected area • a public park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment • a work place used as an office or for business or commercial purposes, which is not part of the petroleum activity(ies) and does not include employees accommodation or public roads • for noise, a place defined as a sensitive receptor for the purposes of *the Environmental Protection (Noise) Policy 2008*.
sensitive receptor	is defined in Schedule 2 of the Environmental Protection (Noise) Policy 2008, and means an area or place where noise is measured.
short term noise event	is a noise exposure, when perceived at a sensitive receptor, persists for an aggregate period not greater than eight hours and does not re-occur for a period of at least seven (7) days. Re-occurrence is deemed to apply where a noise of comparable level is observed at the same receptor location for a period of one hour or more, even if it originates from a different source or source location.
significant residual impact	has the meaning in section 8 *Environmental Offsets Act 2014*.
Significantly disturbed or significant disturbance or significant disturbance to land or areas	has the meaning in Schedule 12, section 4 of the Environmental Protection Regulation 2008. Land is significantly disturbed if— (i) to a condition required under the relevant environmental authority; or (ii) if the environmental authority does not require the land to be rehabilitated to a particular condition—to the condition it was in immediately before the disturbance.
species richness	means the number of different species in a given area.
Spillway	means a weir, channel, conduit, tunnel, gate or other structure designed to permit discharges form the dam, normally under flood conditions or in anticipation of flood conditions.
stable	has the meaning in Schedule 5 of the *Environmental Protection Regulation 2008* and, for a site, means the rehabilitation and restoration of the site is enduring or permanent so that the site is unlikely to collapse, erode or subside.
statement of compliance	for a condition in an environmental authority has the meaning in section 208 of the Environmental Protection Act 1994 and is a condition that requires the holder to give the administering authority a statement of compliance about a document or work relating to a relevant activity. The condition must also state— a) the criteria (the compliance criteria) the document or work must comply with; and b) that the statement of compliance must state whether the document or work complies with the compliance criteria; and

Word or term	Definition
	c) the information (the supporting information) that must be provided to the administering authority to demonstrate compliance with the compliance criteria; and d) when the statement of compliance and supporting information must be given to the administering authority.
stimulation	means a technique used to increase the permeability of natural underground reservoir that is undertaken above the formation pressure and involves the addition of chemicals. It includes hydraulic fracturing / hydrofraccing, fracture acidizing and the use of proppant treatments. Explanatory note: This definition is restricted from that in *the Petroleum and Gas (Production and Safety) Act 2004* in order to only capture the types of stimulation activities that pose a risk to environmental values of water quality in aquifers.
stimulation fluid	means the fluid injected underground to increase permeability. For clarity, the term stimulation fluid only applies to fluid injected down well post-perforation.
stimulation impact zone	means a 100m maximum radial distance from the stimulation target location within a gas producing formation.
Strategic environmental area	has the meaning in section 11(1) of the *Regional Planning Interest Act 2014*.
structure	means a dam or levee.
subterranean cave GDE	• means an area identified as a subterranean cave in the mapping produced by the Queensland Government and identified in the Queensland Government Information System, as amended from time to time; and • means a cave ecosystem which requires access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain its communities of plants and animals, ecological processes and ecosystem services. Subterranean cave GDEs are caves dependent on the subterranean presence of groundwater. Subterranean cave GDEs have some degree of groundwater connectivity and are indicated by either high moisture levels or the presence of stygofauna, or both, referred to in the Queensland Government Wetlands Info mapping program, as amended from time to time. *Note: the Subterranean GDE (caves) dataset can be displayed through the Queensland Government Wetland Info mapping program.* *Note: the Subterranean GDE (caves) dataset can be obtained from the Queensland Government Information System.*
Suitably qualified and experienced person	in relation to regulated structures means a person who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the *Professional Engineers Act 2002*, and has demonstrated competency and relevant experience: • for regulated dams, an RPEQ who is a civil engineer with the required qualifications in dam safety and dam design • for regulated levees, an RPEQ who is a civil engineer with the required qualifications in the design of flood protection embankments. Note: It is permissible that a suitably qualified and experienced person obtain subsidiary certification from an RPEQ who has demonstrated competence and relevant experience in either geomechanics, hydraulic design or engineering hydrology.
suitably qualified person	means a person who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about

Word or term	Definition
	performance relevant to the subject matters using relevant protocols, standards, methods or literature.
suitably qualified third party	means a person who: a) has qualifications and experience relevant to performing the function including but not limited to: i. a bachelor's degree in science or engineering; and ii. 3 years' experience in undertaking soil contamination assessments; and b) is a member of at least one organisation prescribed in Schedule 8 of the Environmental Protection Regulation 2008; and c) not be an employee of, nor have a financial interest or any involvement which would lead to a conflict of interest with the holder(s) of the environmental authority.
sump	means a pit in which waste residual drilling material or drilling fluids are stored only for the duration of drilling activities.
synthetic based drilling mud	means a mud where the base fluid is a synthetic oil, consisting of chemical compounds which are artificially made or synthesised by chemically modifying petroleum components or other raw materials rather than the whole crude oil.
System design plan	means a plan that manages an integrated containment system that shares the required DSA and/or ESS volume across the integrated containment system.
top soil	means the surface (top) layer of a soil profile, which is more fertile, darker in colour, better structured and supports greater biological activity than underlying layers. The surface layer may vary in depth depending on soil forming factors, including parent material, location and slope, but generally is not greater than about 300mm in depth from the natural surface.
total density of coarse woody material	means the total length of logs on the ground greater than or equal to 10cm diameter per hectare and number of logs on the ground greater than or equal to 10cm diameter per hectare.
transmissivity	means the rate of flow of water through a vertical strip of aquifer which is one unit wide and which extends the full saturated depth of the aquifer.
valid complaint	means all complaints unless considered by the administering authority to be frivolous, vexatious or based on mistaken belief.
void	means any constructed, open excavation in the ground.
waste and resource management hierarchy	has the meaning provided in section 9 of the *Waste Reduction and Recycling Act 2011* and is the following precepts, listed in the preferred order in which waste and resource management options should be considered— a) AVOID unnecessary resource consumption b) REDUCE waste generation and disposal c) RE-USE waste resources without further manufacturing d) RECYCLE waste resources to make the same or different products e) RECOVER waste resources, including the recovery of energy f) TREAT waste before disposal, including reducing the hazardous nature of waste g) DISPOSE of waste only if there is no viable alternative.
waste and resource management principles	has the meaning provided in section 4(2)(b) of the *Waste Reduction and Recycling Act 2011* and means the: a) polluter pays principle b) user pays principle c) proximity principle d) product stewardship principle.

Word or term	Definition
waste fluids	has the meaning in section 13 of the *Environmental Protection Act 1994* in conjunction with the common meaning of "fluid" which is "a substance which is capable of flowing and offers no permanent resistance to changes of shape". Accordingly, to be a waste fluid, the waste must be a substance which is capable of flowing and offers no permanent resistance to changes of shape.
watercourse	has the meaning in Schedule 4 of the *Environmental Protection Act 1994* and means: 1) a river, creek or stream in which water flows permanently or intermittently— a) in a natural channel, whether artificially improved or not; or b) in an artificial channel that has changed the course of the watercourse. 2) Watercourse includes the bed and banks and any other element of a river, creek or stream confining or containing water.
waters	includes all or any part of a creek, river, stream, lake, lagoon, swamp, wetland, spring, unconfined surface water, unconfined water in natural or artificial watercourses, bed and bank of any waters, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and underground water.
Water year	means the 12-month period from 1 July to 30 June.
well integrity	the ability of a well to contain the substances flowing through it.
Wet season	means the time of year, covering one or more months, when most of the average annual rainfall in a region occurs. For the purposes of DSA determination this time of year is deemed to extend from 1 November in one year to 31 May in the following year inclusive.
wetland	for the purpose of this environmental authority, wetland means: • areas shown on the Map of referable wetlands which is a document approved by the chief executive on 4 November 2011 and published by the department, as amended from time to time by the chief executive under section 144D of the *Environmental Protection Regulation 2008*; and • areas defined under the Queensland Wetlands Program as permanent or periodic / intermittent inundation, with water that is static or flowing fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six (6) metres, and possess one or more of the following attributes: o at least periodically, the land supports plants or animals that are adapted to and dependent on living in wet conditions for at least part of their life cycle, or o the substratum is predominantly undrained soils that are saturated, flooded or ponded long enough to develop anaerobic conditions in the upper layers, or o the substratum is not soil and is saturated with water, or covered by water at some time. The term wetland includes riverine, lacustrine, estuarine, marine and palustrine wetlands; and it does not include a Great Artesian Basin Spring or a subterranean wetland that is a cave or aquifer.
wetland of high ecological significance	means a wetland that meets the definition of a wetland and that is shown as a wetland of 'high ecological significance' or wetland of 'high ecological value' on the Map of referable wetlands.

Word or term	Definition
wetland of other environmental value	means a wetland that meets the definition of a wetland and that is shown as a wetland of 'general environmental significance' or wetland of 'other environmental value' on the Map of referable wetlands.

END OF ENVIRONMENTAL AUTHORITY

Appendix C

Desktop searches

Queensland Government

WildNet species list

Search Criteria: Species List for a Specified Point
Species: All
Type: Native
Queensland status: Rare and threatened species
Records: Confirmed
Date: Since 1980
Latitude: -26.5836
Longitude: 150.2904
Distance: 55
Email: matthew.whitehouse@attexo.com.au
Date submitted: Monday 18 Mar 2024 15:35:52
Date extracted: Monday 18 Mar 2024 15:40:03

The number of records retrieved = 45

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail		V	V	13
animals	birds	Cacatuidae	*Calyptorhynchus lathami*	glossy black-cockatoo		V		1
animals	birds	Cacatuidae	*Calyptorhynchus lathami lathami*	glossy black-cockatoo (eastern)		V	V	22
animals	birds	Columbidae	*Geophaps scripta scripta*	squatter pigeon (southern subspecies)		V	V	1
animals	birds	Estrildidae	*Stagonopleura guttata*	diamond firetail		V	V	2
animals	birds	Meliphagidae	*Grantiella picta*	painted honeyeater		V	V	5
animals	birds	Strigidae	*Ninox strenua*	powerful owl		V		1
animals	birds	Turnicidae	*Turnix melanogaster*	black-breasted button-quail		V	V	2
animals	insects	Lycaenidae	*Jalmenus eubulus*	pale imperial hairstreak		V		3
animals	mammals	Petauridae	*Petaurus australis australis*	yellow-bellied glider (southern subspecies)		V	V	31
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		E	E	11
animals	mammals	Pseudocheiridae	*Petauroides volans volans*	southern greater glider		E	E	7
animals	mammals	Vespertilionidae	*Nyctophilus corbeni*	eastern long-eared bat		V	V	10
animals	reptiles	Boidae	*Aspidites ramsayi*	woma		NT		2
animals	reptiles	Diplodactylidae	*Strophurus taenicauda*	golden-tailed gecko		NT		148/3
animals	reptiles	Elapidae	*Furina dunmalli*	Dunmall's snake		V	V	1
animals	reptiles	Elapidae	*Hemiaspis damelii*	grey snake		E	E	7
animals	snails	Camaenidae	*Adclarkia cameroni*			V	E	2
animals	snails	Camaenidae	*Adclarkia dulacca*	Dulacca woodland snail		E	E	4
plants	land plants	Acanthaceae	*Xerothamnella herbacea*			E	E	2/1
plants	land plants	Asteraceae	*Rutidosis glandulosa*			NT		5/5
plants	land plants	Asteraceae	*Rutidosis lanata*			NT		44/42
plants	land plants	Celastraceae	*Apatophyllum teretifolium*			NT		1/1
plants	land plants	Celastraceae	*Denhamia parvifolia*			V	V	4/4
plants	land plants	Cyperaceae	*Fimbristylis vagans*			E		1/1
plants	land plants	Leguminosae	*Acacia barakulensis*			V		11/10
plants	land plants	Leguminosae	*Acacia curranii*	curly-bark wattle		V	V	4/4
plants	land plants	Leguminosae	*Acacia handonis*	Hando's wattle		V	V	16/14
plants	land plants	Leguminosae	*Acacia wardellii*			NT		25/17
plants	land plants	Myrtaceae	*Calytrix gurulmundensis*			V	V	15/12
plants	land plants	Myrtaceae	*Eucalyptus argophloia*	Queensland western white gum		CR	V	9/5
plants	land plants	Myrtaceae	*Eucalyptus curtisii*	Plunkett mallee		NT		6/6
plants	land plants	Myrtaceae	*Eucalyptus pachycalyx subsp. waajensis*			E		10/9
plants	land plants	Myrtaceae	*Eucalyptus sideroxylon subsp. improcera*			V		8/8
plants	land plants	Myrtaceae	*Homoranthus decumbens*			V	E	4/4
plants	land plants	Myrtaceae	*Homoranthus papillatus*	mouse bush		CR		1
plants	land plants	Myrtaceae	*Melaleuca groveana*			NT		3/3
plants	land plants	Myrtaceae	*Micromyrtus carinata*	Gurulmundi heath-myrtle		E		21/17
plants	land plants	Myrtaceae	*Micromyrtus patula*			E		3/3
plants	land plants	Orchidaceae	*Aphyllorchis anomala*			NT		1
plants	land plants	Poaceae	*Homopholis belsonii*	Belson's panic		E	V	10/10
plants	land plants	Rhamnaceae	*Cryptandra ciliata*			NT		4/4
plants	land plants	Rutaceae	*Philotheca sporadica*			NT	V	443/21
plants	land plants	Solanaceae	*Solanum stenopterum*			V		2/2
plants	land plants	Surianaceae	*Cadellia pentastylis*	ooline		V	V	31/4

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 (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

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

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Queensland Government

WildNet species list

Search Criteria:	Species List for a Specified Point
	Species: All
	Type: Native
	Queensland status: Rare and threatened species
	Records: Confirmed
	Date: Since 1980
	Latitude: -26.5434
	Longitude: 150.2191
	Distance: 55
	Email: matthew.whitehouse@attexo.com.au
	Date submitted: Monday 18 Mar 2024 15:35:31
	Date extracted: Monday 18 Mar 2024 15:40:09

The number of records retrieved = 42

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail		V	V	12
animals	birds	Cacatuidae	*Calyptorhynchus lathami*	glossy black-cockatoo		V		1
animals	birds	Cacatuidae	*Calyptorhynchus lathami lathami*	glossy black-cockatoo (eastern)		V	V	22
animals	birds	Columbidae	*Geophaps scripta scripta*	squatter pigeon (southern subspecies)		V	V	1
animals	birds	Estrildidae	*Stagonopleura guttata*	diamond firetail		V	V	2
animals	birds	Meliphagidae	*Grantiella picta*	painted honeyeater		V	V	5
animals	birds	Strigidae	*Ninox strenua*	powerful owl		V		1
animals	insects	Lycaenidae	*Jalmenus eubulus*	pale imperial hairstreak		V		3
animals	mammals	Petauridae	*Petaurus australis australis*	yellow-bellied glider (southern subspecies)		V	V	29
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		E	E	11
animals	mammals	Pseudocheiridae	*Petauroides volans volans*	southern greater glider		E	E	5
animals	mammals	Vespertilionidae	*Nyctophilus corbeni*	eastern long-eared bat		V	V	10
animals	reptiles	Boidae	*Aspidites ramsayi*	woma		NT		2
animals	reptiles	Diplodactylidae	*Strophurus taenicauda*	golden-tailed gecko		NT		145/3
animals	reptiles	Elapidae	*Furina dunmalli*	Dunmall's snake		V	V	1
animals	reptiles	Elapidae	*Hemiaspis damelii*	grey snake		E	E	7
animals	snails	Camaenidae	*Adclarkia cameroni*			V	E	2
animals	snails	Camaenidae	*Adclarkia dulacca*	Dulacca woodland snail		E	E	4
plants	land plants	Asteraceae	*Rutidosis glandulosa*			NT		5/5
plants	land plants	Asteraceae	*Rutidosis lanata*			NT		36/34
plants	land plants	Celastraceae	*Apatophyllum teretifolium*			NT		1/1
plants	land plants	Celastraceae	*Denhamia parvifolia*			V	V	1/1
plants	land plants	Leguminosae	*Acacia barakulensis*			V		11/10
plants	land plants	Leguminosae	*Acacia curranii*	curly-bark wattle		V	V	4/4
plants	land plants	Leguminosae	*Acacia handonis*	Hando's wattle		V	V	16/14
plants	land plants	Leguminosae	*Acacia wardellii*			NT		25/17
plants	land plants	Myrtaceae	*Calytrix gurulmundensis*			V	V	15/12
plants	land plants	Myrtaceae	*Eucalyptus argophloia*	Queensland western white gum		CR	V	7/3
plants	land plants	Myrtaceae	*Eucalyptus curtisii*	Plunkett mallee		NT		2/2
plants	land plants	Myrtaceae	*Eucalyptus pachycalyx subsp. waajensis*			E		10/9
plants	land plants	Myrtaceae	*Eucalyptus sideroxylon subsp. improcera*			V		8/8
plants	land plants	Myrtaceae	*Homoranthus decumbens*			V	E	4/4
plants	land plants	Myrtaceae	*Homoranthus papillatus*	mouse bush		CR		1
plants	land plants	Myrtaceae	*Melaleuca groveana*			NT		3/3
plants	land plants	Myrtaceae	*Micromyrtus carinata*	Gurulmundi heath-myrtle		E		21/17
plants	land plants	Myrtaceae	*Micromyrtus patula*			E		3/3
plants	land plants	Orchidaceae	*Aphyllorchis anomala*			NT		1
plants	land plants	Poaceae	*Homopholis belsonii*	Belson's panic		E	V	10/10
plants	land plants	Rhamnaceae	*Cryptandra ciliata*			NT		4/4
plants	land plants	Rutaceae	*Philotheca sporadica*			NT	V	14/2
plants	land plants	Solanaceae	*Solanum stenopterum*			V		2/2
plants	land plants	Surianaceae	*Cadellia pentastylis*	ooline		V	V	38/11

Queensland Government

WildNet species list

Search Criteria: Species List for a Specified Point
Species: All
Type: Native
Queensland status: Rare and threatened species
Records: Confirmed
Date: Since 1980
Latitude: -26.5042
Longitude: 150.2276
Distance: 55
Email: matthew.whitehouse@attexo.com.au
Date submitted: Monday 18 Mar 2024 15:35:07
Date extracted: Monday 18 Mar 2024 15:40:13

The number of records retrieved = 42

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail		V	V	12
animals	birds	Cacatuidae	*Calyptorhynchus lathami*	glossy black-cockatoo		V		1
animals	birds	Cacatuidae	*Calyptorhynchus lathami lathami*	glossy black-cockatoo (eastern)		V	V	22
animals	birds	Columbidae	*Geophaps scripta scripta*	squatter pigeon (southern subspecies)		V	V	1
animals	birds	Estrildidae	*Stagonopleura guttata*	diamond firetail		V	V	2
animals	birds	Meliphagidae	*Grantiella picta*	painted honeyeater		V	V	5
animals	birds	Strigidae	*Ninox strenua*	powerful owl		V		1
animals	insects	Lycaenidae	*Jalmenus eubulus*	pale imperial hairstreak		V		3
animals	mammals	Petauridae	*Petaurus australis australis*	yellow-bellied glider (southern subspecies)		V	V	31
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		E	E	11
animals	mammals	Pseudocheiridae	*Petauroides volans volans*	southern greater glider		E	E	5
animals	mammals	Vespertilionidae	*Nyctophilus corbeni*	eastern long-eared bat		V	V	10
animals	reptiles	Boidae	*Aspidites ramsayi*	woma		NT		2
animals	reptiles	Diplodactylidae	*Strophurus taenicauda*	golden-tailed gecko		NT		145/3
animals	reptiles	Elapidae	*Furina dunmalli*	Dunmall's snake		V	V	1
animals	reptiles	Elapidae	*Hemiaspis damelii*	grey snake		E	E	7
animals	snails	Camaenidae	*Adclarkia cameroni*			V	E	2
animals	snails	Camaenidae	*Adclarkia dulacca*	Dulacca woodland snail		E	E	4
plants	land plants	Asteraceae	*Rutidosis glandulosa*			NT		5/5
plants	land plants	Asteraceae	*Rutidosis lanata*			NT		31/29
plants	land plants	Celastraceae	*Apatophyllum teretifolium*			NT		1/1
plants	land plants	Celastraceae	*Denhamia parvifolia*			V	V	1/1
plants	land plants	Leguminosae	*Acacia barakulensis*			V		11/10
plants	land plants	Leguminosae	*Acacia curranii*	curly-bark wattle		V	V	4/4
plants	land plants	Leguminosae	*Acacia handonis*	Hando's wattle		V	V	16/14
plants	land plants	Leguminosae	*Acacia wardellii*			NT		19/13
plants	land plants	Myrtaceae	*Calytrix gurulmundensis*			V	V	15/12
plants	land plants	Myrtaceae	*Eucalyptus argophloia*	Queensland western white gum		CR	V	7/3
plants	land plants	Myrtaceae	*Eucalyptus curtisii*	Plunkett mallee		NT		2/2
plants	land plants	Myrtaceae	*Eucalyptus pachycalyx subsp. waajensis*			E		10/9
plants	land plants	Myrtaceae	*Eucalyptus sideroxylon subsp. improcera*			V		8/8
plants	land plants	Myrtaceae	*Homoranthus decumbens*			V	E	4/4
plants	land plants	Myrtaceae	*Homoranthus papillatus*	mouse bush		CR		1
plants	land plants	Myrtaceae	*Melaleuca groveana*			NT		3/3
plants	land plants	Myrtaceae	*Micromyrtus carinata*	Gurulmundi heath-myrtle		E		21/17
plants	land plants	Myrtaceae	*Micromyrtus patula*			E		3/3
plants	land plants	Orchidaceae	*Aphyllorchis anomala*			NT		1
plants	land plants	Poaceae	*Homopholis belsonii*	Belson's panic		E	V	10/10
plants	land plants	Rhamnaceae	*Cryptandra ciliata*			NT		4/4
plants	land plants	Rutaceae	*Philotheca sporadica*			NT	V	4/3
plants	land plants	Solanaceae	*Solanum stenopterum*			V		2/2
plants	land plants	Surianaceae	*Cadellia pentastylis*	ooline		V	V	38/11

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 (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

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

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Queensland Government

WildNet species list

Search Criteria: Species List for a Specified Point
Species: All
Type: Native
Queensland status: Rare and threatened species
Records: Confirmed
Date: Since 1980
Latitude: -26.6332
Longitude: 150.2942
Distance: 55
Email: matthew.whitehouse@attexo.com.au
Date submitted: Monday 18 Mar 2024 15:37:13
Date extracted: Monday 18 Mar 2024 15:40:19

The number of records retrieved = 45

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail		V	V	13
animals	birds	Cacatuidae	*Calyptorhynchus lathami*	glossy black-cockatoo		V		1
animals	birds	Cacatuidae	*Calyptorhynchus lathami lathami*	glossy black-cockatoo (eastern)		V	V	22
animals	birds	Columbidae	*Geophaps scripta scripta*	squatter pigeon (southern subspecies)		V	V	1
animals	birds	Estrildidae	*Stagonopleura guttata*	diamond firetail		V	V	2
animals	birds	Meliphagidae	*Grantiella picta*	painted honeyeater		V	V	5
animals	birds	Strigidae	*Ninox strenua*	powerful owl		V		1
animals	birds	Turnicidae	*Turnix melanogaster*	black-breasted button-quail		V	V	2
animals	insects	Lycaenidae	*Jalmenus eubulus*	pale imperial hairstreak		V		3
animals	mammals	Petauridae	*Petaurus australis australis*	yellow-bellied glider (southern subspecies)		V	V	27
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		E	E	10
animals	mammals	Pseudocheiridae	*Petauroides volans volans*	southern greater glider		E	E	7
animals	mammals	Vespertilionidae	*Nyctophilus corbeni*	eastern long-eared bat		V	V	10
animals	reptiles	Boidae	*Aspidites ramsayi*	woma		NT		2
animals	reptiles	Diplodactylidae	*Strophurus taenicauda*	golden-tailed gecko		NT		148/5
animals	reptiles	Elapidae	*Furina dunmalli*	Dunmall's snake		V	V	1
animals	reptiles	Elapidae	*Hemiaspis damelii*	grey snake		E	E	7
animals	snails	Camaenidae	*Adclarkia cameroni*			V	E	2
animals	snails	Camaenidae	*Adclarkia dulacca*	Dulacca woodland snail		E	E	4
plants	land plants	Acanthaceae	*Xerothamnella herbacea*			E	E	2/1
plants	land plants	Asteraceae	*Rutidosis glandulosa*			NT		6/6
plants	land plants	Asteraceae	*Rutidosis lanata*			NT		44/42
plants	land plants	Celastraceae	*Apatophyllum teretifolium*			NT		1/1
plants	land plants	Celastraceae	*Denhamia parvifolia*			V	V	4/4
plants	land plants	Cyperaceae	*Fimbristylis vagans*			E		1/1
plants	land plants	Leguminosae	*Acacia barakulensis*			V		10/9
plants	land plants	Leguminosae	*Acacia curranii*	curly-bark wattle		V	V	4/4
plants	land plants	Leguminosae	*Acacia handonis*	Hando's wattle		V	V	16/14
plants	land plants	Leguminosae	*Acacia wardellii*			NT		25/17
plants	land plants	Myrtaceae	*Calytrix gurulmundensis*			V	V	14/11
plants	land plants	Myrtaceae	*Eucalyptus argophloia*	Queensland western white gum		CR	V	9/5
plants	land plants	Myrtaceae	*Eucalyptus curtisii*	Plunkett mallee		NT		7/7
plants	land plants	Myrtaceae	*Eucalyptus pachycalyx subsp. waajensis*			E		10/9
plants	land plants	Myrtaceae	*Eucalyptus sideroxylon subsp. improcera*			V		8/8
plants	land plants	Myrtaceae	*Homoranthus decumbens*			V	E	4/4
plants	land plants	Myrtaceae	*Homoranthus papillatus*	mouse bush		CR		1
plants	land plants	Myrtaceae	*Melaleuca groveana*			NT		3/3
plants	land plants	Myrtaceae	*Micromyrtus carinata*	Gurulmundi heath-myrtle		E		21/17
plants	land plants	Myrtaceae	*Micromyrtus patula*			E		3/3
plants	land plants	Orchidaceae	*Aphyllorchis anomala*			NT		1
plants	land plants	Poaceae	*Homopholis belsonii*	Belson's panic		E	V	9/9
plants	land plants	Rhamnaceae	*Cryptandra ciliata*			NT		4/4
plants	land plants	Rutaceae	*Philotheca sporadica*			NT	V	1442/34
plants	land plants	Solanaceae	*Solanum stenopterum*			V		2/2
plants	land plants	Surianaceae	*Cadellia pentastylis*	ooline		V	V	31/4

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 (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

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

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Australian Government

Department of Climate Change, Energy, the Environment and Water

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. Please see the caveat for interpretation of information provided here.

Report created: 18-Mar-2024

Summary

Matters of National Environment 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 (Ramsar	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	60
Listed Migratory Species:	13

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	21
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	57
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity	Buffer Status
Banrock station wetland complex	1200 - 1300km upstream from Ramsar site	In feature area
Narran lake nature reserve	300 - 400km upstream from Ramsar site	In feature area
Riverland	1100 - 1200km upstream from Ramsar site	In feature area
The coorong, and lakes alexandrina and albert wetland	1300 - 1400km upstream from Ramsar site	In feature area

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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area	In feature area
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community likely to occur within area	In feature area
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community likely to occur within area	In feature area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area	In feature area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area	In buffer area only
Weeping Myall Woodlands	Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat may occur within area	In feature area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	In buffer area only
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat known to occur within area	In feature area
Climacteris picumnus victoriae Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In feature area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area	In feature area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat may occur within area	In buffer area only
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area	In feature area
Stagonopleura guttata Diamond Firetail [59398]	Vulnerable	Species or species habitat known to occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat may occur within area	In buffer area only
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat may occur within area	In feature area
FISH			
Bidyanus bidyanus Silver Perch, Bidyan [76155]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat known to occur within area	In feature area
MAMMAL			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Chalinolobus dwyeri			
Large-eared Pied Bat, Large Pied Bat [183]	Endangered	Species or species habitat may occur within area	In feature area
Dasyurus hallucatus			
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area	In feature area
Dasyurus maculatus maculatus (SE mainland population)			
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area	In buffer area only
Macroderma gigas			
Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
Nyctophilus corbeni			
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat known to occur within area	In feature area
Petauroides volans			
Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area	In feature area
Petaurus australis australis			
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat known to occur within area	In feature 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]	Endangered	Species or species habitat known to occur within area	In feature area
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area	In buffer area only
PLANT			
Acacia curranii			
Curly-bark Wattle [3908]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Acacia handonis Hando's Wattle, Percy Grant Wattle [14928]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Acacia lauta Tara Wattle [4165]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Cadellia pentastylis Ooline [9828]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calytrix gurulmundensis [24241]	Vulnerable	Species or species habitat known to occur within area	In feature area
Denhamia parvifolia Small-leaved Denhamia [18106]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Dichanthium queenslandicum King Blue-grass [5481]	Endangered	Species or species habitat may occur within area	In buffer area only
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Eucalyptus argophloia Queensland White Gum, Queensland Western White Gum, Lapunyah, Scrub Gum, White Gum [19748]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Eucalyptus virens [10181]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Homopholis belsonii Belson's Panic [2406]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Homoranthus decumbens a shrub [55186]	Endangered	Species or species habitat known to occur within area	In feature area
Lepidium monoplocoides Winged Pepper-cress [9190]	Endangered	Species or species habitat may occur within area	In feature area
Polianthion minutiflorum [82772]	Vulnerable	Species or species habitat may occur within area	In feature area
Rhaponticum australe Austral Cornflower, Native Thistle [22647]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area	In feature area
Vincetoxicum forsteri listed as Tylophora linearis [92384]	Endangered	Species or species habitat may occur within area	In buffer area only
Westringia parvifolia [4822]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Xerothamnella herbacea [4146]	Endangered	Species or species habitat likely to occur within area	In feature area
REPTILE			
Anomalopus mackayi Five-clawed Worm-skink, Long-legged Worm-skink [25934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area	In feature area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat known to occur within area	In feature area
Hemiaspis damelii Grey Snake [1179]	Endangered	Species or species habitat known to occur within area	In feature area
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Tympanocryptis condaminensis Condamine Earless Dragon [87888]	Endangered	Species or species habitat may occur within area	In buffer area only
SNAIL			
Adclarkia cameroni Brigalow Woodland Snail [83886]	Endangered	Species or species habitat known to occur within area	In feature area
Adclarkia dulacca Dulacca Woodland Snail [83885]	Endangered	Species or species habitat known to occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat may occur within area	In buffer area only
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat may occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area	In feature area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat may occur within area overfly marine area	In buffer area only
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area overfly marine area	In buffer area only
Pterodroma cervicalis White-necked Petrel [59642]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Rhipidura rufifrons			
Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Tringa nebularia			
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Chinchilla Rifle Range	Nature Refuge	QLD	In buffer area only
Stones Country	Resources Reserve	QLD	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Alfredson Block CSG Project, Qld	2017/7902		Post-Approval	In buffer area only
Atlas Stage 3 Gas Project	2022/09410		Assessment	In buffer area only
Atlas to Reedy Creek Pipeline	2023/09585		Assessment	In buffer area only
Brigalow Peaking Power Plant Project	2023/09692		Referral Decision	In buffer area only
Coal Seam Gas Field Development for Natural Gas Liquefaction Park, Curtis Island	2008/4059		Post-Approval	In buffer area only
Construction of the Central Surat Rail Project	2013/6729		Completed	In feature area
Development of Existing Coal Seam Gas Fields	2008/4398		Post-Approval	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Everleigh Solar Park Project	2022/09339		Post-Approval	In buffer area only
Hopeland Solar Farm Project	2023/09684		Assessment	In buffer area only
Surat Basin Coal Project, 25 km south of Wandoan, QLD	2017/8116		Completed	In buffer area only
The Range Project	2011/5860		Completed	In buffer area only
Controlled action				
Cameby Downs Coal Mine Expansion	2009/4966	Controlled Action	Completed	In feature area
Condabri South CSG Extension Development, Qld	2016/7805	Controlled Action	Completed	In buffer area only
Construct and operate 447km high pressure gas transmission pipeline	2009/4976	Controlled Action	Post-Approval	In feature area
Construction and operation of Nathan Dam and associated water delivery infrastructure	2008/4313	Controlled Action	Post-Approval	In feature area
Construction of a high pressure buried gas pipeline, Kogan to Gladstone, QLD	2009/5029	Controlled Action	Post-Approval	In feature area
Dulacca Renewable Energy Project, Dulacca QLD	2018/8368	Controlled Action	Post-Approval	In buffer area only
Expansion of Coal Seam Gas Fields	2009/4974	Controlled Action	Post-Approval	In feature area
Expansion Of Coal Seam Gas Operations	2010/5344	Controlled Action	Post-Approval	In feature area
Future Gas Supply Area Project	2012/6357	Controlled Action	Completed	In buffer area only
Glen Wilga Open-cut Coal Mine	2003/1173	Controlled Action	Completed	In buffer area only
Ironbark Coal Seam Gas Project	2011/6091	Controlled Action	Completed	In buffer area only
North Surat Coal Project- Collingwood	2012/6236	Controlled Action	Completed	In buffer area only
North Surat Coal Project- Taroom	2012/6237	Controlled Action	Completed	In buffer area only
Queensland Curtis LNG Project - Pipeline Network	2008/4399	Controlled Action	Post-Approval	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Reedy Creek to Glebe Weir Pipeline Project	2011/6181	Controlled Action	Post-Approval	In buffer area only
Santos GLNG Gas Field Development Project, QLD	2012/6615	Controlled Action	Post-Approval	In buffer area only
Surat Gas Project off-tenure pipelines, Surat Basin, Qld	2018/8223	Controlled Action	Post-Approval	In buffer area only
Underground Coal Gasification and Liquefaction Project	2007/3541	Controlled Action	Completed	In buffer area only
Wandoan Coal Mine and Infrastructure Project	2008/4284	Controlled Action	Post-Approval	In buffer area only
Wandoan Coal Project - Coal Seam Methane Water Supply South	2008/4287	Controlled Action	Post-Approval	In feature area
Wandoan Coal Project Coal Seam Methane Water Supply West	2008/4283	Controlled Action	Completed	In buffer area only
Wandoan Coal Project Glebe Weir Raising	2008/4285	Controlled Action	Post-Approval	In buffer area only
Widening and overlay of Leichhardt Highway	2002/645	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
Cameby Downs Coal Mine, construction, operation & decommissioning	2007/3465	Not Controlled Action	Completed	In feature area
Cameby Downs Continued Operations Project, Qld	2018/8304	Not Controlled Action	Completed	In feature area
Chances Plain Solar Farm Project	2019/8532	Not Controlled Action	Completed	In buffer area only
Chinchilla Weir Discharge and Pipeline Project	2011/6000	Not Controlled Action	Completed	In buffer area only
Construct and operate 112km long underground gas transmission pipeline	2008/4358	Not Controlled Action	Completed	In buffer area only
Delga Solar Farm, 1039 Gadsbys Road, Woleebee, Qld	2019/8411	Not Controlled Action	Completed	In buffer area only
Dulacca Solar Farm	2019/8607	Not Controlled Action	Completed	In buffer area only
Edenvale Solar Park	2020/8663	Not Controlled Action	Completed	In buffer area only
Elimatta Open Cut Coal Mine and Coal Processing Plant	2008/4130	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
High Voltage Transmission line Development	2007/3230	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Kogan - Braemar Transmission Line	2004/1850	Not Controlled Action	Completed	In buffer area only
Project Atlas CSG Project, between Wollumbilla and Wandoan, Qld	2018/8329	Not Controlled Action	Completed	In buffer area only
Proposed Coal Seam Gas Development & Associated Infrastructure	2008/4456	Not Controlled Action	Completed	In buffer area only
Surat Basin Railway	2008/3944	Not Controlled Action	Completed	In buffer area only
Surat Basin to Tarong Railway project	2003/1264	Not Controlled Action	Completed	In buffer area only
Warhook Solar Farm, near Miles, Qld	2019/8456	Not Controlled Action	Completed	In feature area
Warrego Highway Upgrade Program, Dalby to Miles overtaking lanes, Qld	2016/7802	Not Controlled Action	Completed	In buffer area only
Western Downs Green Power Hub, Hopeland, Qld	2018/8301	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Chinchilla Solar Farm	2017/7942	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Columboola Solar Farm, 9kms north-east of Miles, Queensland	2017/7962	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Construction and operation of gas pipeline	2005/2254	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Referral decision				
Development of an underground longwall coal mine	2011/6129	Referral Decision	Completed	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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.

Appendix D

Likelihood of occurrence assessments

Listed Threatened Species

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Bird Species						
Australasian Bittern	*Botaurus poiciloptilus*	E	E	PMST	Occurs from southern Queensland to Tasmania and south eastern South Australia. In NSW this species has been recorded along the coast as well as inland wetlands and rivers (NPWS, 1999). The Australasian Bittern occurs in estuarine and freshwater wetlands with tall dense vegetation, including sedges, spike rushes, reeds and bulrush (NPWS, 2000; NPWS, 1999). It favours wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water Feeds mostly at night upon frogs, yabbies, spiders, insects, snails, small fish and mice (Schodde and Tidemann, 1993; NPWS, 2000).	**Unlikely to Occur. Not Required (MNES).** Only scattered marginal habitat for this species is present within the Project area.
Australian Painted Snipe	*Rostratula australis*	E, Ma	E	PMST	Inhabits well-vegetated shallows and margins of wetlands, dams, sewage ponds and other water courses; wet pastures, marshy areas, irrigation systems, lignum, tea-tree scrub and open timber (Geering et al., 2007; Pizzey and Knight 1999). Occurs mostly in south-eastern Australia but dispersive in response to rainfall. The species has a broad range of distribution throughout Australia but has a close association with brackish or freshwater terrestrial wetlands, especially temporary ones which have muddy margins. (www.birdlife.org.au)	**Possibly Occurring. Not Required (MNES).** Limited suitable habitat is present within the Project area, and several nearby records have been identified, although no observation dates have been provided. Impacts on habitat for this species are approved under EPBC 2010/5344.
Black-breasted Button-quail	*Turnix melanogaster*	V	V	PMST, WildNet	Inhabits leaf-litter in drier rainforests, vine thickets; scrubby woodlands of eucalypts, she-oaks, bottle-brushes, brush box, Brigalow and other Acacias; thickets of lantana on rainforest fringes, hoop pine plantations; grain stubbles (Pizzey and Knight 1999). Its distribution is patchy in southeast QLD to northern NSW (Pizzey and Knight 1999).	**Unlikely to Occur. Not Required (MNES).** Whilst suitable habitat is present within the Project area, there are no nearby historical records.
Black-faced Monarch	*Monarcha melanopsis*	Mi, Ma	-	PMST	The Black-faced Monarch is found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating (www.birdsinbackyards.net).	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, there are no nearby historical records.
Blue-winged Parrot	*Neophema chrysostoma*	V, Ma	V	PMST	The Blue-winged parrot breeds on mainland Australia south of the Great Dividing Range in southern VIC from Port Albert in Gippsland west to Nelson, and sometimes in the far south-east of SA, and north-western, central and eastern parts of TAS. This species inhabits a range of habitats from coastal, sub-coastal and inland areas, through to semi-arid zones. They tend to favour grasslands and grassy woodlands and	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, there are no nearby historical records.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
					are often found near wetlands both near the coast and in semi-arid zones. This species can also be seen in altered environments such as airfields, gold-courses and paddocks. Pairs of small parties of Blue-winged parrots forage mainly near or on the ground for seeds of a wide range of native and introduced grasses, herbs and shrubs (SPRAT, 2023).	
Brown Treecreeper (south-eastern)	*Climacteris picumnus victoriae*	V	V	PMST	The Brown Treecreeper is endemic to south-eastern Australia from the Grampians in western VIC, through central NSW to the Bunya Mountains in QLD, and from the coast to the inland slopes of the Great Dividing Range. This species occupies dry open eucalypt forests and woodlands. This subspecies mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understory, sometimes with one or more shrub species (SPRAT, 2023).	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, there are no nearby historical records. The SGP is likely within the Brown Treecreeper hybrid zone (Schodde and Mason, 1999) suggesting any Brown Treecreepers that are present cannot be assigned to subspecies.
Common Greenshank	*Tringa nebularia*	E, Mi, Ma	-	PMST	In Queensland, the species is widespread in the Gulf country and eastern Gulf of Carpentaria (SPRAT, 2010). Found in mudflats, estuaries, saltmarshes, margins of lakes, wetlands, claypans, fresh and salines, commercial saltfields, sewage ponds (Pizzey and Knight 1999).	**Unlikely to Occur. Not Required (MNES).** No suitable habitat is present within the Project area and no nearby historical observations have been identified.
Common Sandpiper	*Actitis hypoleucos*	Mi, Ma	-	PMST	Shallow, pebbly, muddy or sandy edges of rivers and streams, coastal to far inland; dams, lakes, sewage ponds; margins of tidal rivers; waterways in mangroves or saltmarsh; mudflats; rocky or sandy beaches; causeways, riverside lawns, drains and street gutters (Pizzey and Knight 1999).	**Unlikely to Occur. Not Required (MNES).** No suitable habitat is present within the Project area and no nearby historical observations have been identified.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Curlew Sandpiper	*Calidris ferruginea*	CE, Mi, Ma	CR	PMST	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms (Pizzey and Knight 1999). They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They generally roost on bare dry shingle, shell or sand beaches, sandpits and islets in or around coastal or near-coastal lagoons and other wetlands (SPRAT 2015).	**Unlikely to Occur.** No suitable habitat is present within the Project area and no nearby historical observations have been identified.
Diamond Firetail	*Stagonopleura guttata*	V	V	PMST, WildNet	Diamond Firetails occur on the south-east mainland of Australia from south-east QLD to Eyre Peninsula, SA and about 300 km inland from the sea. This species occurs in eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats, including farmland and grassland with scattered trees. They tend to prefer areas with relatively low tree density, few large logs, and little litter cover but high grass cover (SPRAT, 2023).	**Known to Occur. MNES but listed after EPBC 2010/5344 approved** Suitable habitat is present within the Project and historical records from 2019 have been identified nearby. Other historical records have been recorded within the Project area but no dates were provided.
Fork-tailed Swift	*Apus pacificus*	Mi, Ma	-	PMST	Almost exclusively aerial species, flying from less than 1m to at least 300m above the ground. In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh (SPRAT 2010).	**Likely to Occur. Not Required (MNES).** Species was recorded during surveys for the broader SGP. Suitable habitat is abundant across the Project area.
Grey Falcon	*Falco hypoleucos*	V	V	PMST	They Grey Falcon's habitat includes lightly treed inland plains; gibber deserts, sandridges, pastoral lands, timbered watercourses; seldom in driest deserts. Resident or nomadic visitor to inland parts of all mainland states (Pizzey and Knight 1999).	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, there are no nearby historical records.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Latham's Snipe	*Gallinago hardwickii*	V, Mi, Ma	-	PMST	Latham's Snipe is a non-breeding visitor to south-eastern Australia, and is a passage migrant through northern Australia. This species has been recorded along the east coast of Australia from Cape York Peninsula through to south-eastern SA. It occurs in permanent and ephemeral wetlands up to 2000m ASL, where they usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). They can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity (SPRAT, 2023).	**Possibly Occurring. Not Required (MNES).** Limited suitable habitat is present within the Project area, and an older historical record is located within 4 km of the Project.
Oriental Cuckoo	*Cuculus optatus*	Mi	-	PMST	Within Australia, this species uses a range of vegetated habitats such as monsoon rainforests, wet sclerophyll forest, open woodlands and appears quite often along edges of forests, or ecotones between forest types (DoE, 2015; Menkhorst et al,. 2017). This cuckoo species feeds arboreal, foraging for invertebrates on loose bark on the trunks and branches of trees, and among the foliage, including in mistletoes. It will forage from the ground, but requires shrubs or trees from which it sallies and returns to consume prey items. Caterpillars have been noted as a preferred food source. Oriental Cuckoos tend to forage individually and have only been recorded foraging in pairs when infestations of caterpillars occur (DoE, 2015).	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, there are no nearby historical records.
Painted Honeyeater	*Grantiella picta*	V	V	PMST, WildNet	Habitat includes mistletoes in eucalypt forests, box-ironbark-yellow gum woodlands, paperbarks, casuarinas, mulgas/acacias (Birds Australia, 2010; Pizzey and Knight 1999). Rare migrant/nomad with range extending across eastern Australia (Pizzey and Knight 1999). This species diet consists of mistletoe fruits, but also includes nectar and arthropods, especially in the non-breeding season (SPRAT, 2023).	**Likely to occur. MNES but listed after EPBC 2010/5344 approved.** Suitable habitat is present within the Project area and historical records have been identified within 5km of the EA amendment area.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Pectoral Sandpiper	*Calidris melanotos*	Mi, Ma	-	PMST	This species if found in shallow fresh waters, often with low grass and other herbage; swamp margins, flooded pastures, sewage ponds; occasionally tidal areas and saltmarshes (Pizzey and Knight 1999).	**Unlikely to Occur.** No suitable habitat is present within the Project area and no nearby historical observations have been identified.
Powerful Owl	*Ninox strenua*	-	V	WildNet	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the eastern side of the Great Dividing Range, from south-east QLD to SA. They are found in open forests and woodlands, as well as along sheltered gullies in wet forests with dense understories, especially along watercourses. They will sometimes be found in open areas near forests such as farmland, parks, and suburban areas (www.birdsinbackyards.net).	**Possibly Occurring**. Suitable habitat is present within the Project area and historical records have been identified within the vicinity.
Red Goshawk	*Erythrotriorchis radiatus*	E	E	PMST	The Red Goshawk is endemic to Australia where it is very sparsely dispersed across approximately 15% of coastal and sub-coastal Australia from western Kimberly to north-eastern NSW, and occasionally on continental islands. It has probably always occurred in central Australia, where three widely-spaced, recent confirmed sightings corroborate earlier, previously doubted records, however no breeding has been recorded in central Australia. This species occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia. Riverine forests are also used frequently. Such habitats typically support high bird numbers and biodiversity, especially medium to large species which the red goshawk requires for prey (SPRAT, 2023).	**Possibly Occurring.** Not Required (MNES). Suitable habitat is present within the Project area, and historical records have been identified within the vicinity.
Rufous Fantail	*Rhipidura rufifrons*	Mi, Ma	-	PMST	The Rufous Fantail occurs in coastal and near coastal districts of northern and eastern Australia. In eastern Australia they inhabit wet sclerophyll forests often in gullies dominated by eucalyptus species, usually with a dense shrubby understory often including ferns. They also occur in subtropical and temperate rainforests (SPRAT 2017).	**Likely to Occur. Not Required (MNES).** Species was recorded during surveys for the broader SGP. Suitable habitat is abundant across the Project area.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Satin Flycatcher	*Myiagra cyanoleuca*	Mi, Ma	-	PMST	Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests (SPRAT, 2010).	**Possibly Occurring. Not Required (MNES).** Species was recorded during surveys for the broader SGP. Suitable habitat is present within the Project area, but nearby observations are 10 km away.
Sharp-tailed Sandpiper	*Calidris acuminata*	V, Mi, Ma	-	PMST	The sharp-tailed sandpiper breeds in northern Siberia but migrates south to winter in Australia and New Zealand. In the non-breeding season they can be found in tidal mudflats, saltmarshes, mangroves; shallow fresh, brackish or saline inland wetlands; floodwaters, irrigated pastures and crops; sewage ponds and saltfields (Pizzey and Knight 1999).	**Unlikely to Occur. Not Required (MNES).** No suitable habitat is present within the Project area and no nearby historical observations have been identified.
South-eastern Glossy Black-Cockatoo	*Calyptorhynchus lathami lathami*	V	V	PMST, WildNet	The southern Glossy Black Cockatoo has a widespread distribution, ranging from Gympie to the south-east QLD border, inland to Augathella and Tambo. The distribution of this species continues south into NSW spreading inland to the central western plains and also occurs in the eastern coastal Gippsland region of VIC. This species prefers woodland areas dominated by she-oak (Allocasuarina) or open sclerophyll forests and woodland with a stratum of Allocasuarina beneath Eucalyptus, Corymbia or Angophora. Glossy black-cockatoos have also been observed in mixed Allocasaurina, Casuarina, cypress Callitris and brigalow (Acacia harpophylla) woodland assemblages (Hourigan, 2012).	**Known to Occur. MNES but listed after EPBC 2010/5344 approved.** A single record from 2013 was identified within the Project area. This subspecies was not considered during assessments across the SGP, but the parent species was. Suitable habitat present within the Project area.
Southern Whiteface	*Aphelocephala leucopsis*	V	V	PMST	The southern whiteface occurs across most of mainland Australia south of the tropics, from the north-eastern edge of the Western Australian wheatbelt, east to the Great Dividing Range. There is a broad hybrid zone between the two subspecies extending north from the western edge of the Nullarbor Plain. This species lives in a wide range of open woodlands and shrublands where there is an understory of grasses or shrubs, or both. These areas are usually in habitats dominated by	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, no nearby historical observations have been identified.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
					acacias or eucalypts on ranges, foothills and lowlands, and plains. This species is considered to be sedentary, however, atlas records indicate that individuals may more into wetter areas outside of their normal range during drought years (SPRAT, 2023).	
Squatter Pigeon (southern)	*Geophaps scripta scripta*	V	V	PMST, WildNet	The known distribution of the Squatter Pigeon extends south from the Burdekin-Lynd divide in the southern region of Cape York Peninsula to the border Rivers region of northern NSW, and from the east coast to Hughenden, Longreach and Charleville. Their habitat is generally defined as open-forests to sparse, open woodlands and scrub that are mostly dominated by Eucalypts, Corymbia, Acacia or Callitris species. The habitat is generally remnant, regrowth or partly modified vegetation communities and within 3 km of water bodies or courses. Foraging occurs on well-drained, gravelly or loamy soils which support the open-forest to woodland communities with patchy, tussock-grassy understories (SPRAT, 2015).	**Possibly Occurring. Not Required (MNES).** Suitable habitat is present within the Project area, and historical records have been identified within the vicinity. Impacts on habitat for this species are approved under EPBC 2010/5344.
Star Finch (eastern)	*Neochmia ruficauda ruficauda*	E	E	PMST	Distribution is poorly known but it only occurs in central Queensland. It resides mainly in grasslands and grassy woodlands that are located close to body of fresh water. It also occurs in cleared or suburban areas such as along rode sides in towns (SPRAT 2017).	**Unlikely to Occur.** No suitable habitat is present within the Project area and no nearby historical observations have been identified.
Swift Parrot	*Lathamus discolor*	CE, Ma	E	PMST	The Swift Parrot is endemic to south-eastern Australia, breeding in Tasmania and migrating to the Australian mainland. It inhabits eucalypt forests and woodlands, plantations and banksias; street trees, parks and gardens (Pizzey and Knight 1999).	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
White-throated Needletail	*Hirundapus caudacutus*	V, Mi, Ma	V	PMST, WildNet	Almost exclusively aerial from heights of less than 1m up to more than 1000m above the ground. Most often recorded above wooded areas, including open forest and rainforest and also are commonly recorded over heathland and coastal cliffs (SPRAT, 2010).	**Known to Occur. Not required (MNES).** Two records of this species have been confirmed within the Project area (most recently 2013) and suitable habitat is also abundant.
Yellow Wagtail	*Motacilla flava*	Mi, Ma	-	PMST	Regular summer migrant to coastal Australia, especially Darwin to Broome, but also north-eastern Queensland from November to April. Found in short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lands (Pizzey and Knight 1999).	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, no nearby historical observations have been identified.
Fish Species						
Murray Cod	*Maccullochella peelii*	V	V	PMST	The Murray Cod was historically distributed throughout the Murray-Darling Basin, which extends from southern QLD, through NSW, the ACT and VIC to SA, with the exception of the upper reaches of some tributaries. This species still occurs in most parts of this natural distribution but to approximately 1000 m above sea level. The species' estimated extent of occurrence, based on areas with an average river width of 50 m, is 660 km2. This species utilises a diverse range of habitats from clear rocky streams, such as those found in the upper western slopes of NSW, to slow-flowing, turbid lowland rivers and billabongs (SPRAT, 2023).	**Possibly Occurring.** Limited suitable habitat is present within the Project area and nearby historical records have been identified.
Silver Perch	*Bidyanus bidyanus*	CE	-	PMST	The Silver perch are endemic to the Murray-Darling system (including all states and sub-basins). This species formerly utilised a diversity of habitats within the Murray-Darling system and are commonly described as a lowland species that are not found in the cooler upper reaches of rivers. However, numerous reliable accounts exist of Silver Perth penetrating to Cooma (~800 m ASL) on the Murrumbidgee River in large-scale upstream migrants in summer in the early and mid 1900s. This species is consistently reported by anglers and researches to show	**Possibly Occurring.** Limited suitable habitat is present within the Project area and nearby historical records have been identified.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
					a general preference for fast-flowing water, including rapids and races, and more open sections of river, throughout the Murray-Darling Basin (SPRAT, 2023).	
Invertebrate Species						
Brigalow Woodland Snail	*Adclarkia cameroni*	E	V	PMST, WildNet	The Brigalow woodland snail is endemic to south-east QLD, where is occurs in a small number of remnant and scattered Acacia harpophylla (brigalow) and eucalypt woodland patches (such as road verges and riparian corridors) on the Condamine River floodplain, especially in the area around Dalby and Chinchilla (Conservation Advice, 2020).	**Likely to Occur. MNES but listed after 2010/5344 approved.** Records have been recorded within the broader SGP. Suitable habitat and associated Regional Ecosystems are present within the Project area.
Dulacca Woodland Snail	*Adclarkia dulacca*	E	E	PMST, WildNet	The Dulacca woodland snail is endemic to south-east QLD, where it occurs as a small number of isolated and fragmented populations in the area between Miles and Dulacca, and south to Meandarra. This species inhabits a variety of remnant and scattered habitats, such as vine thicket and Acacia harpophylla woodland patches on rocky outcrops with clay to loam soils, Eucalyptus species and Acacia shirleyi woodlands on ridges, and Eucalyptus woollsiana woodlands. These locations are separated by tracks of unsuitable habitat, affecting both dispersal and colonisation events, restricting genetic exchange within the species. This species is also able to exist in areas of brigalow regrowth and even in cleared paddocks but only where logs, woody debris and other suitable microhabitats remain. This species can also shelter under loose bark at the base of trees (SPRAT, 2023).	**Likely to Occur. MNES but listed after 2010/5344 approved.** Records have been recorded within the broader SGP. Suitable habitat and associated Regional Ecosystems are present within the Project area.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Pale Imperial Hairstreak	*Jalmenus eubulus*	-	V	WildNet	Jalmenus eubulus is associated with Brigalow (Acacia harpophylla) dominated forests and woodland stands from central QLD to northern NSW. The larvae are monophagous, feeding on Brigalow leaves and are attended by small black ants (Taylor 2014).	**Possibly Occurring.** Species has been recorded within the broader SGP. Suitable habitat is present within the Project area and historical records have been identified with 16km of the EA amendment area.
Mammal Species						
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V	PMST, WildNet	In QLD and NSW the South-eastern Long-eared Bat inhabits a variety of vegetation types but it is distinctly more common in Box / ironbark / cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern QLD. This species is more abundant in extensive stands of vegetation in comparison to smaller woodland patches, suggesting its home range is probably large. It appears that old-growth vegetation is a critical habitat component in the VIC distribution. This species has also been found to be much more abundant in habitats that have a distinct tree canopy and a dense, cluttered understory layer (SPRAT).	**Known to Occur. Not Required (MNES).** Species has been recorded within the Project area (in 2013). Suitable habitat is also present. Impacts on habitat for this species are approved under EPBC 2010/5344.
Ghost Bat	*Macroderma gigas*	V	E	PMST	Ghost bats occur in a wide range of habitats from rainforest, monsoon and vine scrub, to open woodlands in arid areas. These habitats are used for foraging, while root habitat is more specific. Favoured roosting sites of the ghost bat are undisturbed caves or mineshafts which have several openings. Ghost bats occur in tropical regions in Queensland, and along the ventral and northern coast, from Rockhampton north to Cape York (DEHP 2017).	**Unlikely to Occur. Not Required (MNES).** No suitable habitat is present within the Project area and no nearby historical observations have been identified.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Greater Glider (southern and central)	*Petauroides volans volans*	E	E	PMST, WildNet	The southern and central Greater Glider occurs in eastern Australia, where it has a broad distribution from around Proserpine in QLD, south through NSW and the ACT, to Wombat State Forest in central VIC. This species is largely restricted to eucalypt forests and woodlands of eastern Australia. It is typically found in highest abundance in taller, montane, moist eucalypt forests on fertile soils, with relatively old trees and abundance hollows. It is likely that only a proportion of forest in potential habitat areas is suitable for the species, as the structural attributes of the forest overstorey and forage quality it relies on vary considerably across the landscape (TSSC Conservation Advice, 2022).	**Known to Occur.** Recorded at 23 discrete locations within and surrounding the broader SGP area, including records within the SGP North EA amendment area. Most of these records are associated with larger areas of remnant vegetation spanning between Barakula, Binkey and Gurulmundi State Forests (EcoSmart, 2023)
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	-	PMST	The Grey-headed Flying-fox occurs in a range of habitats including subtropical and temperate rainforests, dry and wet sclerophyll forests, Banksia woodland, heaths and Melaleuca swamps (Duncan et al, 1999; NPWS, 2001).	**Unlikely to Occur. Not Required (MNES).** Whilst limited suitable habitat is present within the Project area, no nearby camps containing this species have been identified.
Koala	*Phascolarctos cinereus*	E	E	PMST, WildNet	The Koala is endemic to Australia. The biological species range extends from north-eastern QLD to the south-east corner of SA. Koalas naturally inhabit a range of temperate, subtropical and tropical forests, woodland and semi-arid community's dominated by Eucalyptus species. Their habitat can broadly be defined as any forest or woodland containing species that are a known Koala food tree, or shrubland with emergent food trees (SPRAT 2017).	**Known to Occur.** Species has been recorded throughout the broader SGP and current Project area. An abundance of suitable habitat is present.
Large-eared Pied Bat	*Chalinolobus dwyeri*	E	E	PMST	It is found in a variety of dryer habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range. Daytime roosts include caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins. In caves it often selects positions close to the cave entrance where individuals huddle together. It is believed to forage for small flying insects below the forest canopy. Its distribution of mostly limited to NSW with a few records in SE Queensland (Strahan, 2002).	**Unlikely to Occur. Not Required (MNES).** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Northern Quoll	*Dasyurus hallucatus*	E	-	PMST	The northern quoll occurs across much of northern Australia, from south-eastern Queensland to the south-west Kimberley, with a disjunct population in the Pilbara. In the Northern Territory it is restricted to the Top End. The species occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforest, sandy lowlands and beaches, shrubland, grasslands and desert. The habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal (SPRAT 2012).	**Unlikely to Occur. Not Required (MNES).** No suitable habitat is present within the Project area and no nearby historical observations have been identified.
Short-Beaked Echidna	*Tachyglossus aculeatus*	-	SLC	WildNet	The Short-beaked Echidna lives in forest and woodlands, heath, grasslands and arid environments. It is found throughout Australia, including Tasmania. Although it is found all over Australia, it is not as common in Sydney as it once was (www.australianmuseum.net.au).	**Known to Occur.** Species has been recorded within the Project area (from 2009) and within the broader SGP. Suitable habitat is abundant.
Spot-tailed Quoll	*Dasyurus maculatus maculatus*	E	E	PMST	The Spotted-tailed Quoll occurs along the east coast of Australia from south east Queensland to South Australia and Tasmania. The Spotted-tailed Quoll has been recorded in a wide range of habitat types including dry and moist sclerophyll forests and woodlands, rainforest, coastal heathland, and riparian forest. This species been occasionally sighted in treeless areas, rocky outcrops and grazing lands (NPWS, 1999; NPWS, 2000; Strahan, 2008). The Spotted-tailed Quoll shelters and dens in small caves, fallen logs with large hollows and tree hollows and may utilise numerous dens within its home range which has been estimated to be between 800 ha to 20 km2 (NPWS, 2000; NPWS in prep, 1999). The Spotted-tailed Quoll is partly arboreal and feeds upon a variety of prey species including birds, rodents, lizards, small wallabies, and even insects. The Spotted-tailed Quoll is also known to scavenge and feed upon carrion, road kills including wild dogs, and litter (Strahan 1998; NPWS 2000).	**Unlikely to Occur. Not Required (MNES).** No suitable habitat is present within the Project area and no nearby historical observations have been identified.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Yellow-bellied Glider (south-eastern)	*Petaurus australis australis*	V	V	PMST, WildNet	The Yellow-bellied Glider is found in tall mature Eucalypt Forest and they feed on a range of sources including winter-flowering Eucalypts which provide nectar and pollen. They also feed upon the sap of Eucalypts in which they chew V-shaped incisions to collect the sap. Yellow-bellied Gliders den in large tree hollows (NPWS, 2000).	**Likely to Occur. MNES but listed after EPBC 2010/5344 was approved.** The species is well represented in Barakula and Gurulmundi State Forests and there are large contiguous areas of forest throughout the SGP North EA amendment area. It is yet to be detected in the broader SGP area but is considered likely to occur.
Reptile Species						
Adorned Delma, Collared Delma	*Delma torquata*	V	V	PMST	Under rocks and in soil cracks on heavy, stony and lightly timbered soils near Kenmore, Brookfield and Mt Crosby. Endemic to South-east Queensland. Also found in numerous disturbed habitats throughout Southeast Queensland (Cogger 2000).	**Unlikely to Occur. Not Required (MNES).** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity. Impacts on habitat for this species are approved under EPBC 2010/5344.
Condamine Earless Dragon	*Tympanocryptis condaminensis*	E	-	PMST	The Condamine Earless Dragon occurs in the eastern Darling Downs region of south-east QLD, in the Brigalow Belt Sough IBRA bioregion. It occurs on the Condamine River floodplain in an area bounded by the Pirrinuan/Jimbour area in the northwest, Millmerran in the southwest, Clifton in the southeast and Toowoomba in the northeast. This species occurs in an area on black-cracking clays that is intensively cropped. Almost all records of this species have been made on one private property, along narrow road reserves or in headlands (thin, less than 10m wide strips of grassland on paddock verges). Vegetation where this species has been observed is cropped (on private property), and remnant native grassland and exotic grassland. The species has been found in cotton, sorghum, maize and sunflower crops. it is known to	**Unlikely to Occur.** No suitable habitat is present within the Project area and no nearby historical observations have been identified.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
					forage in stubble field and may benefit in areas where no-till farming is employed (SPRAT Profile).	
Dunmall's Snake	*Furina dunmalli*	V	V	PMST, WildNet	The distribution of the Dunmall's Snake extends from near the QLD border through the Brigalow Belt South and Nandewar bioregions, as far south as Ashford in NSW. In QLD this species occurs primarily in the Brigalow Belt region in the south-eastern interior of QLD. Records indicate sites at elevations between 200-500 m above sea level. The snake is very rare of secretive with limited records existing. It has been recorded at Archokoora, Oakey, Miles, Glenmorgan, Wallaville, Gladstone, Lake Broadwater, Mount Archer, Exhibition Range National Park, roadside reserves between Inglewood and Texas, Rosedale, Yeppoon and Lake Broadwater Conservation Park. It has been found in a broad range of habitats including forests and woodlands on black alluvial cracking clay and clay loams dominated by Brigalow; and other various Blue Spotted Gum, Ironbark, White Cypress and Bulloak open forests and woodland associations on sandstone derived soils (SPRAT).	**Possibly Occurring. Not Required (MNES).** Suitable habitat is present within the Project area and scattered records have been identified in the areas surrounding the broader SGP. Impacts on habitat for this species are approved under EPBC 2010/5344.
Fitzroy River Turtle	*Rheodytes leukops*	V	V	PMST	The Fitzroy River Turtle is found in rivers with large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles. Preferred areas have high water clarity, and are often associated with Ribbonweed (Vallisneria sp.) beds. Also has an affinity for well-oxygenated riffle zones, moving into deeper pools as the riffle zones cease to flow (SPRAT 2009).	**Unlikely to Occur. Not Required (MNES).** Whilst limited suitable habitat is present within the Project area, there are no recent historical records in the vicinity.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Five-clawed Worm-skink	*Anomalopus mackayi*	V	E	PMST	The distribution of the Five-clawed Worm Skink is patchy in north-eastern NSE and south-eastern QLD. In south-eastern QLD the species is known from the upper Condamine River Floodplain from Warwick in the south to the Jimbour region in the north and bordered by the western edge of the Granite Belt. This species occurs in Bluegrass and/or Mitchell Grass dominated grasslands or mixed grasslands dominated by other grass species, but still categorised as Re 11.3.21. In south-east QLD, the species may also occur in River Red Gum/Queensland Blue Gum/Coolibah/Poplar Box grassy woodland/open forest communities. The species is not likely to be found in soils in which deep cracks do not form, such as hard-setting brown clays or sandy soils (SPRAT, 2022).	**Unlikely to Occur. Not Required (MNES).** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity. Impacts on habitat for this species are approved under EPBC 2010/5344.
Golden-tailed Gecko	*Strophurus taenicauda*	-	NT	WildNet	The Golden-tailed Gecko is only found in the Brigalow Belt North and Brigalow Belt South bioregions of QLD and NSW. This is a mostly arboreal nocturnal species that feeds on a variety of insects and other invertebrates. It occupies a range of vegetation types, particularly where Acacia harpophylla, Casuarina cristata, Allocasuarina luehmannii, Eucalyptus crebra and callitris glaucophylla are growing (Pavey et al. 2021).	**Known to Occur.** Species has been recorded within the Project area at numerous locations. An abundance of suitable habitat is present.
Grey Snake	*Hemiaspis damelii*	E	E	PMST, WildNet	Queensland, records are known from near Goondiwindi and the adjacent Darling-Riverine Plain, from the Darling Downs and from the Lockyer Valley. Several isolated records also occur in the Rockhampton area. It favours woodlands, usually on heavier, cracking clay soils, particularly in association with water bodies. They shelter under rocks, logs and other debris as well as in soil cracks (SPRAT 2011).	**Likely to Occur. MNES but listed after approval of EPBC 2010/5344.** Suitable habitat is present within the Project area and numerous records have been identified within the broader SGP.
Southern Snapping Turtle	*Elseya albagula*	CE	CR	PMST	The Southern Snapping Turtle is only found in the Burnett, Fitzroy, Raglan and Mary River drainages of south-east QLD. It prefers permanent flowing water habitats where there are suitable shelters and refuges like fallen trees. (www.environment.des.qld.gov.au).	**Unlikely to Occur. Not Required (MNES).** Whilst limited suitable habitat is present within the Project area, there are no recent historical records in the vicinity.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Woma Python	*Aspidites ramsayi*		NT	WildNet	The Woma python can be found in the west and centre of Australia from WA through southern NW and northern SA to southern QLD and northwestern NSW. Its range may be discontinuous. This species was previously common on sandplains with other populations in the south and east found amongst wheatbelt and goldfield areas (www.ala.org.au).	**Possibly Occurring. Not Required (MNES).** Limited suitable habitat is present within the Project area and nearby historical records have been identified.
Yakka Skink	*Egernia rugosa*	V	V	PMST	Endemic to Queensland where its distribution is highly fragmented. Often associated with partly-buried rocks, logs or tree stumps, root cavities and abandoned animal burrows. It is also known to excavate deep burrow systems. The Yakka Skink can persist in cleared habitats if shelter sites such as raked log piles, deep gullies, tunnel erosion/sinkholes and rabbit warrens are available (DEHP 2017).	**Unlikely to Occur. Not Required (MNES).** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity. Impacts on habitat for this species are approved under EPBC 2010/5344.
Plant Species						
Austral Cornflower	*Rhaponticum australe*	V	V	PMST	The Austral Cornflower is currently confined to Queensland. The species was known to previously occur in NSW and VIC, but is now presumed extinct in those locations (2008). The current distribution of the Austral Cornflower extends from Allora (north of Warwick) to Callide (north-west of Biloela), QLD. This species usually grows on heavy black or red-brown clay, or clay loams derived from basalt. Populations are often confined to roadsides and cultivation headlands. Locations where the species occurs range in altitude up to 480 m above sea level. The species is often found in woodland and grassland and in association with Eucalyptus crebra, E. Orgadophila, E. populnea, E. tereticornis, E. melanophloia, Angophora subcelutina, A. floribunda, Dichanthium sericeum and Themeda triandra (SPRAT, 2019).	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity. Impacts on habitat for this species are approved under EPBC 2010/5344.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Austral Toadflax	*Thesium australe*	V	V	PMST	Austral Toadflax occurs in NSW, ACT, QLD and CIV. Its current distribution is sporadic but widespread, occurring between the Bunya Mountains in SE QLD to NE VIC, and as far inland as the southern, central and northern tablelands in NSW and the Toowoomba region. It is a semi-parasitic species found on roots of a range of grass species, notably Kangaroo Grass. It occurs in subtropical, temperate and subalpine climates over a wide range of altitudes. It occurs on soils derived from sedimentary, igneous and metamorphic geology on a range of soils including black clay loams to yellow podzolics and peaty loams. It occurs in shrubland, grassland or woodland, often in damp sites (SPRAT 2018).	**Unlikely to Occur. Not Required (MNES).** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity. Impacts on habitat for this species are approved under EPBC 2010/5344.
Belson's Panic	*Homopholis belsonii*	V	E	PMST, WildNet	*Homopholis belsonii*'s distributional range lies within the Brigalow belt QLD, namely the Darling Downs area west of Toowoomba, near Oakey, Jondaryan, Bowenville, etc. The species is also found on the northwest slopes and plains of NSW, north of Warialdra. This grass species is found on poor soils in dry woodlands and at elevations of 200-520 m in NSW and 342-500 in QLD. There are three general types of habitat which support this species a) Rocky, basaltic hills; b) flat to gently undulating alluvial areas; and c) drainage lines. This species is commonly found amongst fallen timber, at the base of trees and shrubs, among branches and leaves of trees hanging low and around fence lines. It is believed to be shade dependent as it almost always occurs in these types of areas (SPRAT Profile).	**Possibly Occurring. Not Required (MNES).** Suitable habitat is present within the Project area and nearby historical records have been identified. Impacts on habitat for this species are approved under EPBC 2010/5344.
Bluegrass	*Dichanthium setosum*	V	-	PMST	Dichanthium setosum has been reported from inland NSW to QLD. There are also reports from WA and TAS. The species is associated with heavy basaltic black soils and red-brown loams with clay subsoils (predominantly cracking clays or alluvium, often in gilgai). It is often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. The species may tolerate or benefit from disturbance, otherwise, disturbance is indicative of threatening processes in its habitat (SPRAT Profile).	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
Curly-bark Wattle	*Acacia curranii*	V	V	PMST, WildNet	Grows in dry sclerophyll forests and semi-arid woodlands across a variety of habitats within western New South Wales and Queensland. It occurs on deeply weathered sandstones forming red sandy soils. The species occurs in widely scattered thickets in patches of diverse heath scrub with emergent trees (WetlandInfo).	**Possibly Occurring. Not Required (MNES).** Suitable habitat is present within the Project area and nearby historical records have been identified. Impacts on habitat for this species are approved under EPBC 2010/5344.
Gurulmundi Heath Myrtle	*Micromyrtus carinata*	-	E	WildNet	*Micromyrtus carinata* is endemic to a small area to the north-west of Gurulmundi, on the crest of the Great Diving Range. The species occurs east of Chinchilla and north-west of Miles (occurs within the Gurulmundi State Forest). This species inhabits the tops of laterised ridges, on shallow to deep, yellow or red sands (QLD - Species Profile).	**Likely to occur.** Suitable habitat is present within the Project area and there is a known population within 5km of the SGP North EA amendment area.
Hairy-joint Grass	*Arthraxon hispidus*	V	V	PMST	In NSW and QLD, this species is found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps, as well as woodland. In the SE QLD Bioregion, A. hispidus has also been recorded growing around freshwater springs on coastal foreshore dunes, in shaded small gullies, on creek banks, and on sandy alluvium in creek beds in open forests, and also with bog mosses in mound springs (QLD - Species Profile)	**Unlikely to Occur.** Whilst limited suitable habitat is present within the Project area, there are no recent historical records in the vicinity.
Hando's Wattle	*Acacia handonis*	V	V	PMST, WildNet	Inhabits gently undulating slopes and stony ridges with laterite soils. Associated vegetation includes open forest or woodland with varying density of understory. Associated species include Eucalyptus fibrosa subsp. nubila, Corymbia watsoniana subsp. watsoniana, Lysicarpus angustifolius, and Allocasuarina inophloia (Halford, 1995a). Other wattles growing in the area include Acacia conferta, A. complanata, A. julifera and A. juncifolia (Hando, 2007). Associated understorey species include Dodonaea falcata, Boronia bipinnata, B. glabra, Cleistochloa subjuncea, Entolasia stricta, Schoenus kennyi, Triodia scariosa subsp. yelarbonensis, and Lomandra multiflora subsp. multiflora (SPRAT Profile).	**Possibly Occurring. Not Required (MNES).** Suitable habitat is present within the Project area and nearby historical records have been identified. Impacts on habitat for this species are approved under EPBC 2010/5344.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
King Blue-grass	*Dichanthium queenslandicum*	E	V	PMST	King Blue-grass is endemic to central and southern QLD where it occurs in three disjunct populations including: Hughenden district; from Nebo to Monto and west to Clermont and Rolleston; and Dalby district. Its extent of occurrence has reduced from 1100 km2 to 245 km2. Its area of occupancy is unknown, but based on the extent of occurrence it is likely to be restricted. This species occurs within the South Eastern QLD, Brigalow Belt South, Brigalow Belt North, Central Mackay Coast, Desert Uplands, Mitchell Grass Downs and Einasleigh Uplands Bioregions. The distribution of this species overlaps with several EPBC listed Threatened Ecological Communities. This species occurs on black cracking clay in tussock grasslands mainly in association with other species of blue grasses but also with other grasses restricted to this soil type. This species is mostly confined to natural grassland on the heavy black clay soils on undulating plains (SPRAT Profile).	**Unlikely to Occur. Not Required (MNES).** No suitable habitat is present within the Project area and no nearby historical observations have been identified. Impacts on habitat for this species are approved under EPBC 2010/5344.
Mouse bush	*Homoranthus papillatus*	-	CR	WildNet	*Homoranthus papillatus* is restricted to Girraween National park, chiefly in the vicinities of Mount Norman and The Pyramids. This species occurs in pockets of decomposed granite with other heathy shrubs, on high exposed rock pavements and in adjoining heathy eucalypt woodlands (QLD - Species Profile)	**Unlikely to Occur.** There is a single (2001) record from Binkey State Forest however Tony Bean (*Homoranthus* expert at the Queensland Herbarium) considers this to most likely be a misidentification as the species is restricted to Girraween National Park.
Ooline	*Cadellia pentastylis*	V	V	PMST, WildNet	Ooline occurs on the north-west slopes of NSW and in central and southern QLD where it is found within the 500 mm and 750 mm rainfall isohyets. This species is of considerable biogeographic interest as it is a relic of an extensive rainforest vegetation that covered much of Australia in the past. This species grows in semi-evergreen vine thickets and sclerophyll vegetation on undulating terrain of various geology, including sandstone, conglomerate and claystone. It forms a closed or open canopy, as a dominant or commonly with White Box and White	**Known to Occur. Not Required (MNES).** Suitable habitat is present within the Project area and a record from 2020 has been identified within the Project area. Impacts on habitat for this species are approved under EPBC 2010/5344.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
					Cypress Pine, with an open understory and leaf litter dominating the forest floor (SPRAT Profile).	
Plunkett Mallee	*Eucalyptus curtisii*	-	NT	WildNet	Eucalyptus curtisii has two growth forms that occur in different habitats. The shorter mallee form is more likely to occur as the only eucalypt species on poorly drained lowland sites in shrubland dominated by banksia, with an understorey of heath plants, and sometimes E. conglomerata may also be present. The larger growth form occurs as scattered individuals on better drained soils in the more open areas of mixed eucalypt forests. Commonly associated species include Corymbia citriodora subsp. variegata, C. trachyphloia and Callitris endlicheri, less commonly associated with E. fibrosa, E. planchoniana and E. acmenoides. E. curtisii occurs on sandy podsoils with impeded drainage, shallow stony soils, clay loams and stony clays with a surface layer of loose stones (www.wetlandinfo.des.qld.gov.au).	**Possibly Occurring.** Suitable habitat is present within the Project area and nearby historical records have been identified.
Queensland Western White Gum	*Eucalyptus argophloia*	V	CR	PMST, WildNet	Eucalyptus argophloia occurs on flat to undulating country at 300 - 340 m above sea level. It prefers deep, dark, heavy clay soils, often with strong gilgai development. It has been recorded growing in brigalow woodland and forest communities associated with Belah, Poplar Box and Inland Grey Box (www.wetlandinfo.des.qld.gov.au)	**Possibly Occurring. Not Required (MNES).** Suitable habitat is present within the Project area and nearby historical records have been identified. Impacts on habitat for this species are approved under EPBC 2010/5344.
Red-soil Woolly Wrinklewort	*Rutidosis lanata*	-	NT	WildNet	Rutidosis lanata is restricted to western Darling Downs from north of Jackson to south of Hannaford, southeast QLD. A recent intensive survey of the area has recorded the species at only two of the five localities, near Meandarra and north of Jackson. This species occurs at altitudes of 280-320 m ASL in open eucalypt forests and woodlands including Eucalyptus populnea-Casuarina cristata forest, ironbark and	**Likely to Occur.** Suitable habitat is present within the Project area and a nearby record from 2016 has been identified.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
					Acacia sparsiflora forest, box ironwood forest, and E. populnea woodland with Eremophile mitchellii. It has been recorded growing on flat land or stony red ridges in red-brown gravelly sands, grey clays, red-brown clay or sandy loams (QLD - Species Profile).	
Small-leaved Denhamia	*Denhamia parvifolia*	V	V	PMST, WildNet	Denhamia parvifolia occurs from Eidsvold to Kingaroy, and near Chinchilla. The species occurs within Allies Creek State Forest and Koko State Forest. This species is found in vine forests and semi-evergreen vine thickets, commonly on basalt-derived, brown or red soils above 300m in altitude. It is also occasionally found in ecotone areas with open forests (QLD - Species Profile).	**Possibly Occurring.** Limited suitable habitat is present within the Project area and nearby historical records have been identified.
Tara Wattle	*Acacia lauta*	V	V	PMST	Localities are characterized by a gently undulating to flat landforms. Soils are moderately deep and hard setting with a weakly acidic to neutral sandy loam surface grading into neutral to alkaline sandy clay subsoil. The vegetation varies from open forest to low woodland with a dense or moderately dense shrub layer. Tree species present at all sites include Callitris glaucophylla (White Cypress Pine) and Allocasuarina luehmannii (Buloke) (SPRAT Profile).	**Unlikely to Occur. Not Required (MNES).** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity. Impacts on habitat for this species are approved under EPBC 2010/5344.
Winged Pepper-cress	*Lepidium monoplocoides*	E	-	PMST	Lepidium monoplocoides is widely distributed on the inland plains of south-eastern Australia, occurring from northern NSW to western Victoria, with an old record from south-eastern SA. The species occurs in the Murray Darling Depression, Diverina, Darling Riverine Plains and Cobar Peneplain Bioregions. This species occurs in open, sparsely vegetated sites in a range of habitats on heavy clay or clay-loam soils, usually on sites that are seasonally flooded or prone to waterlogging, in arid to semi-arid areas with an average rainfall range of 200-450 mm per year. Vegetation communities in which the species occurs include grasslands, wetlands and floodplain woodlands dominated by Eucalyptus coolabah and Eucalyptus largiflorens, and chenopod shrublands dominated by Atriplex, Maireana and/or Nitraria species.	**Unlikely to Occur. Not Required (MNES).** Whilst suitable habitat is present within the Project area, there are no nearby historical records in the vicinity.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
					Locations where this species occurs tend to be ephemeral, and it may be an opportunistic species able to take advantage of seasonally available habitat (National Recovery Plan).	
	Acacia barakulensis	-	V	WildNet	Found on yellowish sandy soils, described as pale loamy-sand over sandstone (Marburg Formation-sandstone). The species grows in similar habitat to the more common A. gittinsii, consisting of tall shrubland with Eucalypt emergents or shrubby woodland with Acacia sp. (e.g. probably A. johnsonii var. althoferi). Associated species include Eucalyptus tenuipes, Corymbia trachyphloia, Calytrix gurulmundensis, and Triodia mitchellii (Queensland Herbarium, 2011).	**Possibly Occurring.** Suitable habitat is present within the Project area and nearby historical records have been identified.
	Acacia wardellii	-	NT	WildNet	*Acacia wardellii* is known from south of Roma, south-west of Chinchilla and the Thomby Range in south-east QLD. In the Thomby Range, the species has been collected near Rocky Glen Homestead, Glenmore in the Silver Springs Gas Field, and in an area ranging from 15 km east-north-east to 15 km east-south-east of Condamine. It has also been collected 16 km west of Inniscraig Homestead south of Roma, near Binjour south-east of Eidsvold and Rockwood Station, 36 km south-east of Chinchilla. This species grows in gravelly soil on shallow weathered sandstone in eucalypt woodland and has been recorded from disturbed and recently burnt areas. The species has been described from tall open forest with Corymbia trachyphloia, C. intermedia, Eucalyptus major, E. cloeziana with a sparse Allocasuarina torulosa shrub layer (QLD - Species Profile).	**Possibly Occurring.** Suitable habitat is present within the Project area and nearby historical records have been identified.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
	Apatophyllum teretifolium	-	NT	WildNet	*Apatophyllum teretifolium* occurs in Expedition Range, just west of Expedition Range State Forest; Expedition National Park north-west of Taroom; Carnarvon National Park north-north-west of Injune; Lonesome National Park north-east of Injune; Barakula State Forest near Chinchilla and Nour Nour National Park north-west of Gayndah. This species is found in: woodland consisting of Eucalyptus decorticans and/or Acacia shirleyi, with Callitris endlicheri and sometimes with E. cloeziana, Corymbia hendersonii and E. exserta; woodland of Corymbia citriodora, C. watsoniana and Eucalyptus mediocris on sandstone; low woodland of Eucalyptus tenuipes, C. trachyphloia on shallow sandy soil; and Corymbia hendersonii, Syncarpia glomulifera, Allocasuarina littoralis woodland with a dense shrubby understorey including Xylomelum cunninghamianum, Banksia collina, Persoonia sp. and Xanthorrhoea sp. Apatophyllum teretifolium occurs on steep rocky slopes around the tops and bases of cliff lines and on the ends of rocky spurs (SPRAT Profile)	**Possibly Occurring.** Suitable habitat is present within the Project area and nearby historical records have been identified.
	Aphyllorchis anomala	-	NT	WildNet	The Pauper Orchid occurs in north-eastern QLD, mainly from Rossville to the Atherton Tableland, in Finch Hatton George and in Conway Range near Airlie Beach. This species grows at lower altitudes in rainforests, where it occurs in moist shady locations adjacent to streams. It is typically found in sandy soils or loams rich in decaying vegetation (Australian Tropical Rainforest Orchids).	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity.
	Calytrix gurulmundensis	V	V	PMST, WildNet	*Calytrix gurulmundensis* is restricted to south-eastern QLD where it is known from Gurulmundi, Guluguba and Barakula areas, north-west of Toowomba. This species has been recorded in open shrubland with sparse, stunted Eucalyptus, *Casuarina* and *Acacia* spp. and in Triodia hummock grassland with scattered shrubs. The habitat at Gurulmundi State Forest is consistent with QLD RE 11.7.5. At this site, grader activity is suggested to have moved the species along tracks so that its distribution covers an area of several square kilometres (SPRAT Profile).	**Likely to Occur. Not Required (MNES).** Suitable habitat is present within the Project area the the Project is adjacent to the only known population. Impacts on habitat for this species are approved under EPBC 2010/5344.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
	Cryptandra ciliata	-	NT	WildNet	*Cryptandra ciliata* grows in woodland on sandstone ridges and slopes from the Barakula State Forest to near Theodore in south-east QLD (Atlas of Living Australia).	**Known to Occur.** Suitable habitat is present within the Project area and records have been identified within the Project area.
	Eucalyptus pachycalyx subsp. waajensis	-	E	WildNet	*Eucalyptus pachycalyx* subsp. *waajensis* is known from three sites between Miles, Taroom, Eidsvoid and west of Springsure in QLD and also in Grafton, NSW. This species grows in woodland communities, on hillsides and ridge tops on shallow, sandy soils derived from sandstone and granite (QLD - Species Profile).	**Possibly Occurring.** Limited suitable habitat is present within the Project area and nearby historical records have been identified in Barakula State Forest.
	Eucalyptus sideroxylon subsp. improcera	-	V	WildNet	*Eucalyptus sideroxylon* subsp. *improcera* is known only from the Waaje area of Barakula State Forest about 70 km north-north-west of Chinchilla. Here it is confined to a sandy lateritised plateau supporting heathland and shrubland with scattered emergent eucalypts. The associated eucalypts are E. panda, E. pachycalyx subsp. waajensis, Corymbia trachyphloia subsp. trachyphloia and C. bloxsomei (Bean, 2010b).	**Possibly Occurring.** Limited suitable habitat is present within the Project area and nearby historical records have been identified in Barakula State Forest.
	Eucalyptus virens	V	V	PMST	Eucalyptus virens has a very limited distribution in southern Queensland and is currently known from 5 locations scatters over a distance of approximately 500km. Locations include near Inglewood, Tara, north-east of Eidsvold and the scarp on approach to the Maranoa River near Mt Moffatt, 10km east-south-east of Brovinia, north of Binjour and north-west of Injune. This species occurs on sandy soils on low rises, hillslopes, sandstone escarpments and scree slopes. This species grows in woodland communities (QLD - Species Profile).	**Unlikely to Occur. Not Required (MNES).** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity. Impacts on habitat for this species are approved under EPBC 2010/5344.
	Fimbristylis vagans	-	E	WildNet	A sedge to 80cm tall that fringes ephemeral watercourses and lagons on alluvium (No Reference).	**Unlikely to Occur.** No suitable habitat is present within the Project area and no nearby historical observations have been identified.

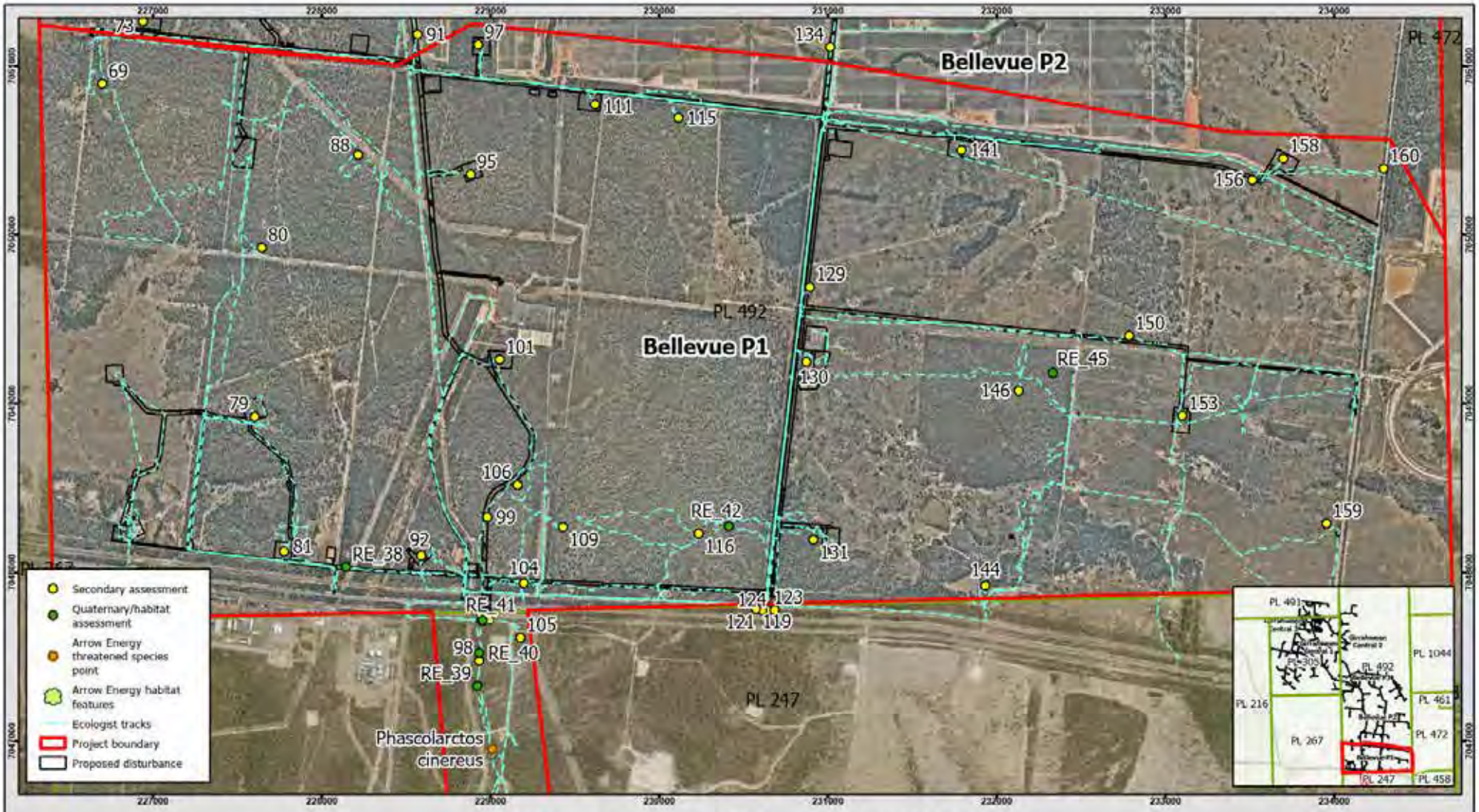
Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
	Homoranthus decumbens	E	V	PMST, WildNet	*Homoranthus decumbens* occurs in QLD where it is restricted to Barakula State Forest near Chinchilla. This population consists of approximately 50 plants. This species occurs on flat country on deep sandy soils with lateritic pebbles, in heath and shrubby woodland. Regional Ecosystems likely to support this species include 11.7.5, 11.7.5a, 11.7.5b and 11.5.21 (SPRAT Profile).	**Possibly Occurring.** Suitable habitat is present within the Project area and nearby historical records have been identified in Barakula State Forest.
	Melaleuca groveana	-	NT	WildNet	Melaleuca groveana has a fragmented distribution from Port Stephens NSW to the Blackdown Tableland in central QLD. This species grows on exposed rocky ridges, high mountain slopes and the summits of mountains, at altitudes between 340-600m ASL. It generally occurs in heaths and eucalypt woodlands and forests with heath understoreys. It is also found in tall open forest with a grassy understory and in microphyll vine forest. It has been recorded growing on red sandy loams, skeletal rocky soils and sandy soils over sandstone rock (QLD - Species Profile).	**Possibly Occurring.** Suitable habitat is present within the Project area and nearby historical records have been identified in Barakula State Forest.
	Micromyrtus patula	-	E	WildNet	Micromyrtus patula is only known from the type locality at Barakula State Forest. This species grows in heathland on an almost flat, rocky platform of laterised sandstone on skeletal soil. It is associated with stunted specimens of Eucalyptus excerta and E. tenuipes, as well as Kardomia jucunda, Acacia julifera subsp. julifera, Seringia cololLata and Melaleuca thymifolia (DES - Species Search, 2020).	**Possibly Occurring.** Suitable habitat is present within the Project area and nearby historical records have been identified in Barakula State Forest.
	Philotheca sporadica	-	NT	PMST, WildNet	Philotheca sporadica is known from the south-east QLD just north of Tara to approximately 12 km east of Kogan in the Darling Downs Pastoral District. In 1995 the QLD herbarium had recorded 11 populations and at least four have subsequently included. Within the Condamine River catchment this species occurs on soils derived from low fertility laterised Cretaceous sandstones in undulating to flat top or rounded hills. It is associated with open shrubland to closed shrubland to closed woodland dominated by Allocasuarina inophloia, Angophora leiocarpa, Callistris endlicheri, Callistris glaucophylla, Eucalyptus crebra,	**Possibly Occurring.** Suitable habitat is present within the Project area and nearby historical records have been identified.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
					Corymbia watsoniana, Eucalyptus exerta, Eucalyptus fibrosa, E. fibrosa subsp. nubillis and Lysicarpus angustifolius (SPRAT, 2022).	
	Polianthion minutiflorum	V	V	PMST	Polianthion minutiflorum is known from Redcliffe vale, about 110 km west of Mackay, south to Kingaroy, covering a distance of approximately 800 km. This species is usually found in forest and woodland on sandstone slopes and gullies with skeletal soil, or sometimes deeper sands adjacent to deeply weathered laterite (www.des.qld.gov.au/species-search).	**Unlikely to Occur.** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity.
	Rutidosis glandulosa	-	NT	WildNet	*Rutidosis glandulosa* is known from approximately 15 populations across 6 distinct localities. This species occurs as far north as the Blackdown Tableland national Park, where 5 populations have been recorded. There is also one population just south on the Planet Downs Pastoral Holding. Other locations include Carnarvon Gorge National Park and just south on the Carnarvon Range, Gwambagwine, Barakula State Forest and Thulimbah. This species generally occurs on sandy or gravelly well drained soil in grassy open eucalypt woodland. Around Blackdown National Park, this species was observed growing in open forest dominated by Eucalyptus interstans, E. sphaerocarpa and Angophora leiocarpa. It has also been recorded in dense woodland, within spinifex heathland and open forests dominated by Corymbia citriodora, Eucalyptus crebra, Allocasuarina luehmannii with herby understories (QLD - Species Profile).	**Possibly Occurring.** Suitable habitat is present within the Project area and nearby historical records have been identified.
	Solanum stenopterum	-	V	WildNet	Solanum stenopterum is patchily distributed across the Darling Downs in QLD from Gayndah south to Goondiwindi, west to Jackson and east to Oakey. It inhabits grassland or woodlands of belah and poplar box on black, brown or red clay loam soils. It also grows on loamy ridges, along roadsides and in paddocks (www.des.qld.gov.au/species-search).	**Possibly Occurring.** Suitable habitat is present within the Project area and nearby historical records have been identified.

Common Name	Scientific Name	EPBC Status	NC Status	Source	Habitat Description	Likelihood of Occurrence
	Vincetoxicum forsteri	E	E	PMST	Vincetoxicum forsteri has rarely been collected and is known from eight localities in the Dubbo area and Mt Crow near Barraba in NSW, and "Myall Park" near Glenmorgan in QLD. This species is also conserved within Goobang National Park, Eura State Forest, Goonoo State Forest, Pilliga West State Forest and Coolbaggie Nature Reserve. This species grows in dry scrub, open forest and woodlands and overlaps with the distribution of the Brigalow and White Box-Yellow Box-Blakely's Red Gum Threatened Ecological Communities (Approved Conservation Advice, 2008).	**Unlikely to Occur. Not Required (MNES).** Whilst suitable habitat is present within the Project area, there are no recent historical records in the vicinity.
	Westringia parvifolia	V	V	PMST	Westringia parvifolia is known from four collections near Yelarbon, Inglewood and Woondiwindi in south-west QLD and from near Yetman in northern NSW. This species grows with Baker's Mallee (Eucalyptus bakeri) and Green Malle (E. viridis) and between clumps of Spinifex on sandy and stony soils (SPRAT, 2022).	**Unlikely to Occur.** No suitable habitat is present within the Project area and no nearby historical observations have been identified.
	Xerothamnella herbacea	E	E	PMST, WildNet	Xerothamnella herbacea is known from two sites north-east of Chinchilla, a single record from near Theodore and a record near Yelarbon east of Goondiwindi, QLD. This species occurs in Brigalow dominated communities in shaded situations, often in leaf litter and is associated with gilgais (SPRAT, 2022).	**Possibly Occurring.** Suitable habitat is present within the Project area and nearby historical records have been identified. Impacts on habitat for this species are approved under EPBC 2010/5344.

Appendix E

Ecological Field Survey (EFS) sheets



Bellevue Part 1 - Ecological Survey Extent

Source:
Arrow Energy Pty Ltd
Geoscience Australia
DNRME

Date:22/03/2024
Issued To: Tom Casey
Author: Holly Morecroft

Kilometers
0 1 2

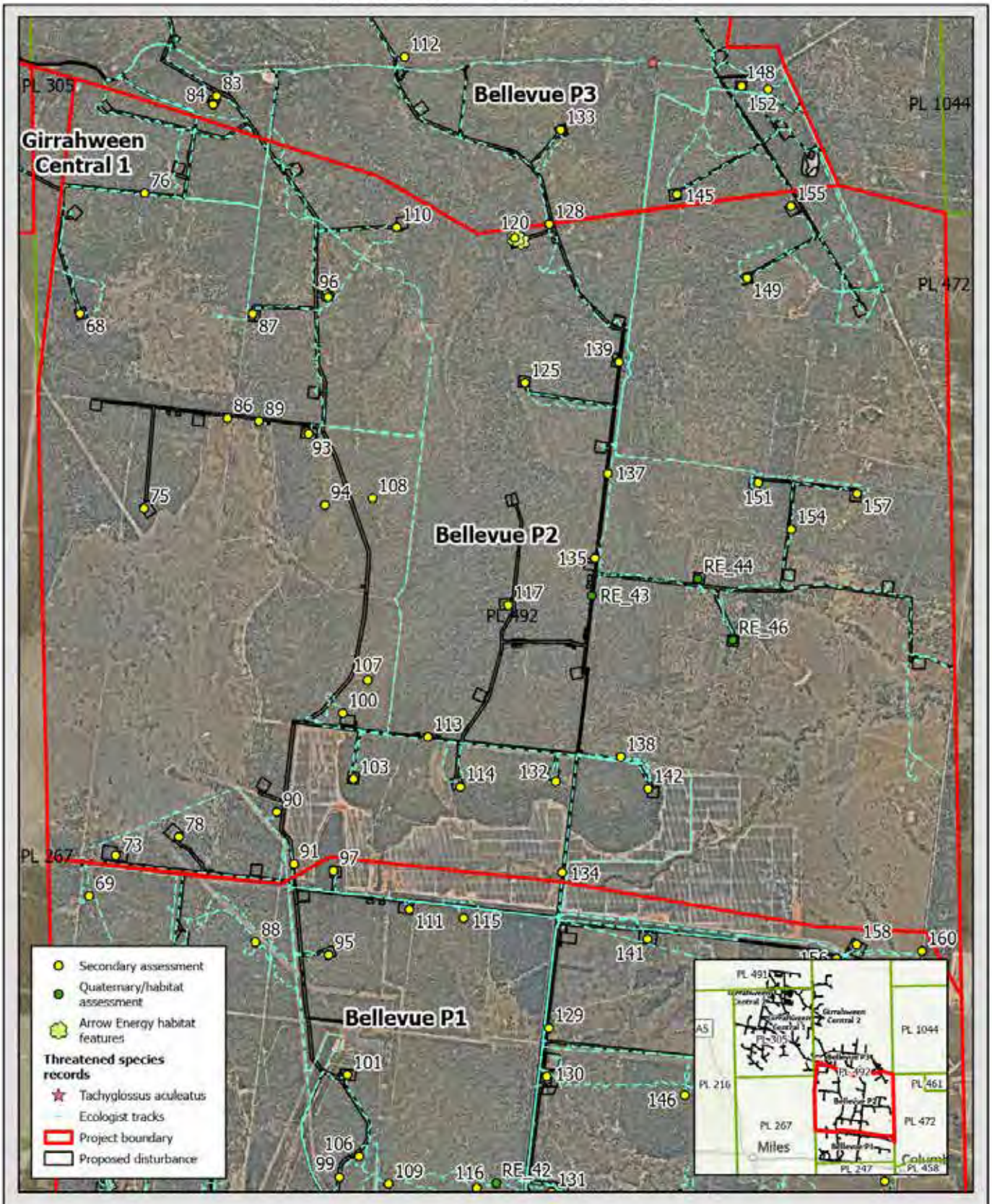
Coordinate System: GDA2020 MGA Zone 56 Scale 1:30,000 @ A4

N

arrow energy
go further

NOT FOR CONSTRUCTION

ARROW ENERGY - SURAT GAS PROJECT



Bellevue Part 2 - Ecological Survey Extent

Source:
Arrow Energy Pty Ltd
Geoscience Australia
DNRME

Date:22/03/2024
Issued To: Arrow Energy
Author: Arrow Energy

Kilometres
Scale 1:45,000 @ A4
Coordinate System: GDA2020 MGA Zone 56

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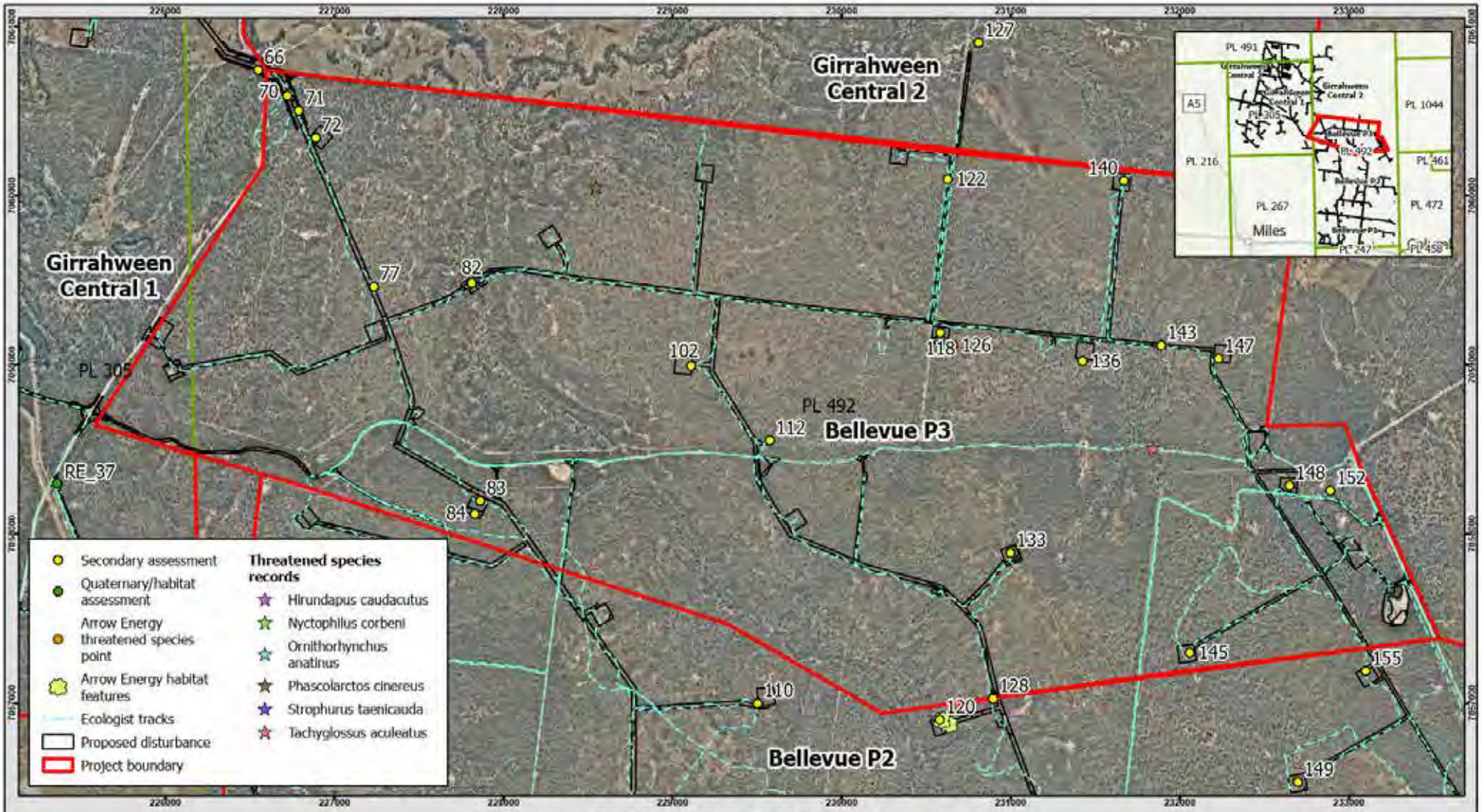
arrow energy go further

NOT FOR CONSTRUCTION



Bellevue Part 3 - Ecological Survey Extent

Source:
Arrow Energy Pty Ltd
Geoscience Australia
DNRME

Date:22/03/2024
Issued To: Tom Casey
Author: Holly Morecroft

Kilometers
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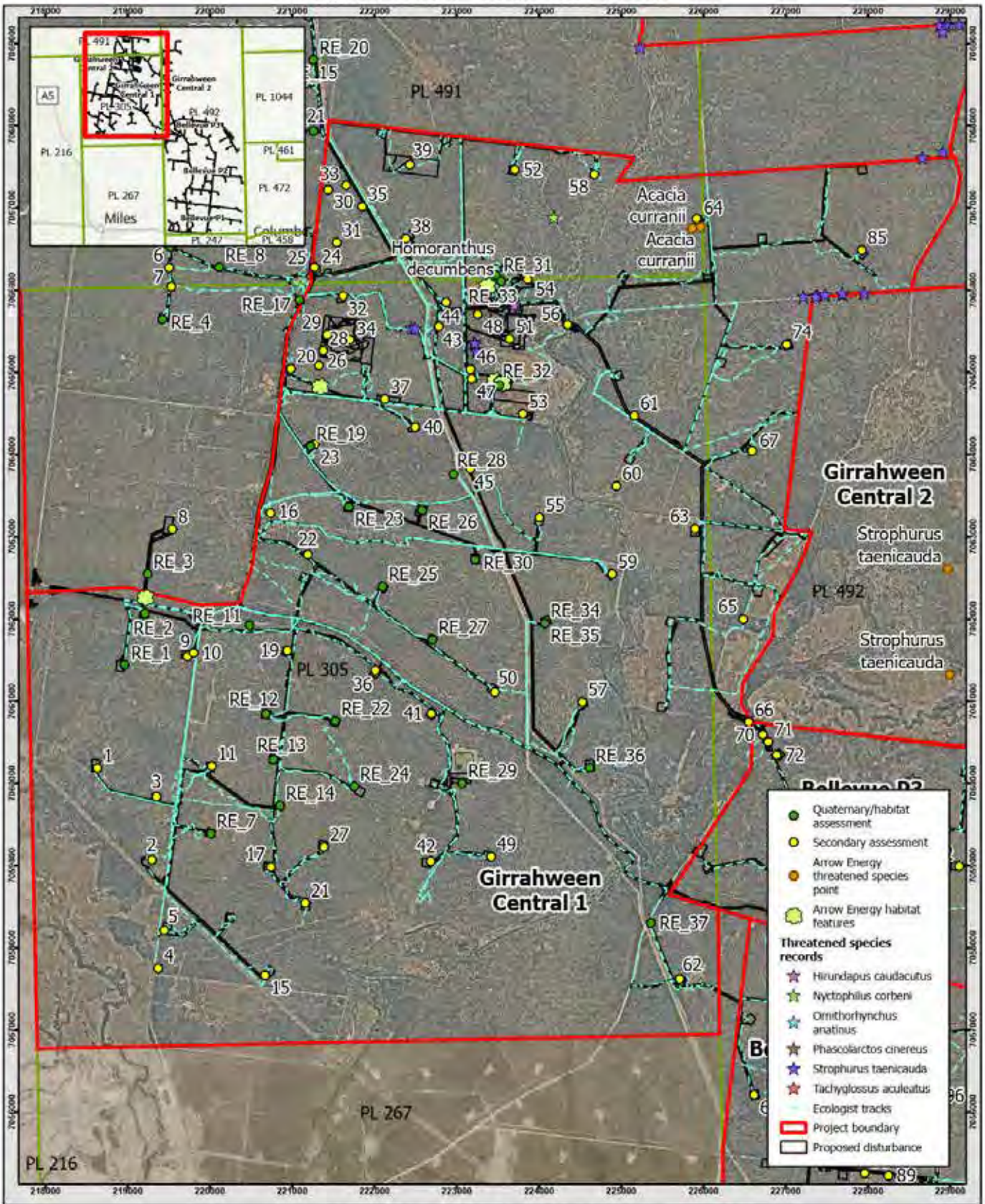
Coordinate System: GDA2020 MGA Zone 56 Scale 1:30,000 @ A4

N

arrow energy
go further

NOT FOR CONSTRUCTION

ARROW ENERGY - SURAT GAS PROJECT



Girrahween Central Part 1 - Ecological Survey Extent

Source:
Arrow Energy Pty Ltd
Geoscience Australia
DNRME

Date:22/03/2024
Issued To: Arrow Energy
Author: Arrow Energy

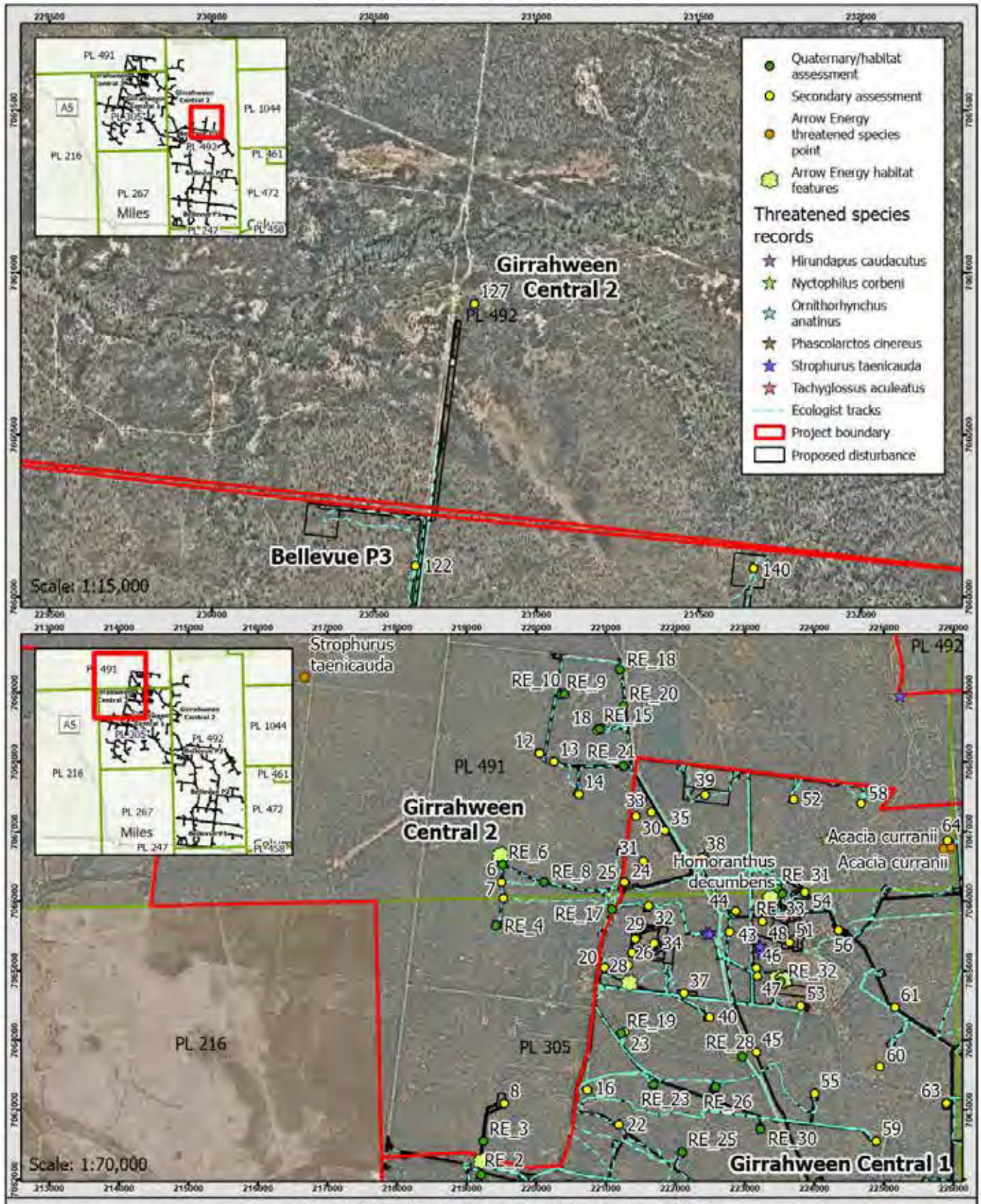
Kilometres
Scale 1:60000 @ A4
Coordinate System: GDA2020 MGA Zone 56

N

arrow energy

NOT FOR CONSTRUCTION

ARROW ENERGY - SURAT GAS PROJECT



Girrahween Central 2 - Ecological Survey Extent

Source:
Arrow Energy Pty Ltd
Geoscience Australia
DNRME

Date:22/03/2024
Issued To: Arrow Energy
Author: Arrow Energy

Coordinate System: GDA2020 MGA Zone 56

NOT FOR CONSTRUCTION

Table of Contents

Secondary Data

Label	Date	File Name
1	2023-05-03	1_Girrahween Central P2
2	2023-05-02	2_Girrahween Central P2
3	2023-05-03	3_Girrahween Central P2
4	2021-10-26	4_Castledean 101 Access
5	2021-10-26	5_Castledean 101
6	2023-08-23	6_GirrahweenP2_OC11.3.4_WP200
7	2023-08-23	7_GirrahweenP2_Gathering_System_WP200
8	2023-08-23	8_GirrahweenP2_WP190
9	2023-05-03	9_Girrahween Central P2
10	2023-08-22	10_GirrahweenP1_Access_track_WP101
11	2023-05-04	11_Girrahween Central P2
12	2023-08-24	12_GirrahweenP2_WP115
13	2023-08-24	13_GirrahweenP2_GatherginSystem_WP115
14	2023-08-24	14_GirrahweenP2_WP240
15	2023-05-09	15_Girrahwenn Central P2
16	2023-04-19	16_Girrahween Central P1
17	2023-05-10	17_Girrahwenn Central P2
18	2023-08-24	18_GirrahweenP2_WP239
19	2023-05-04	19_Girrahween Central P2
20	2023-04-11	20_Girrahween Central P1
21	2023-05-10	21_Girrahwenn Central P2
22	2023-05-31	22_Girrahween Central P-1
23	2023-04-17	23_Girrahween Central P1
24	2022-12-07	24_Girrahween Geotech
25	2021-10-26	25_Yeronga 101 Camp
26	2022-12-07	26_Girrahween Geotech
27	2023-05-10	27_Girrahwenn Central P2
28	2022-12-07	28_Girrahween Geotech
29	2023-05-19	29_Girrahween Central P2

Label	Date	File Name
30	2021-10-26	30_Yeronga 101 Access
31	2023-02-28	31_Girrahween FCS
32	2023-04-11	32_Girrahween Central P1
33	2023-02-28	33_Girrahween FCS
34	2023-05-19	34_Girrahween Central P2
35	2023-02-28	35_Girrahween FCS
36	2023-05-05	36_Girrahween Central P2
37	2023-05-15	37_Girrahween Central P2
38	2023-04-12	38_Girrahween Central P1
39	2023-05-31	39_Girrahween Central P-1
40	2023-04-17	40_Girrahween Central P1
41	2023-05-08	41_Girrahwenn Central P2
42	2023-05-09	42_Girrahwenn Central P2
43	2023-04-12	43_Girrahween Central P1
44	2023-04-12	44_Girrahween Central P1
45	2023-08-24	45_GirrahweenP1_GatheringSystem_Reassessment
46	2023-03-01	46_Girrahween FCS
47	2023-04-12	47_Girrahween Central P1
48	2023-03-01	48_Girrahween FCS
49	2023-05-08	49_Girrahwenn Central P2
50	2023-04-18	50_Girrahween Central P1
51	2022-12-07	51_Girrahween Geotech
52	2023-04-12	52_Girrahween Central P1
53	2023-04-12	53_Girrahween Central P1
54	2023-08-25	54_GirrahweenP1_Quarry
55	2023-04-19	55_Girrahween Central P1
56	2023-03-01	56_Girrahween FCS
57	2023-04-18	57_Girrahween Central P1
58	2023-04-12	58_Girrahween Central P1
59	2023-04-18	59_Girrahween Central P1
60	2023-04-04	60_Girrahween Central P1
61	2023-03-09	61_Bellevue
62	2023-05-09	62_Girrahwenn Central P2
63	2023-04-04	63_Girrahween Central P1
64	2023-04-05	64_Girrahween Central P1
65	2023-04-03	65_Girrahween Central P1
66	2023-03-10	66_Bellevue
67	2023-04-04	67_Girrahween Central P1
68	2022-02-22	68_Alderley 229
69	2020-11-04	69_Alderley 111
70	2022-02-14	70_11.3.25-1
71	2022-02-14	71_11.3.2-1
72	2022-02-14	72_Alderley 248
73	2022-03-15	73_Alderley 123 Option
74	2023-04-04	74_Girrahween Central P1
75	2022-03-14	75_Alderley 201-203
76	2022-04-13	76_ROW Lot848BWR739
77	2022-02-14	77_Disturbed 11.5.1-1
78	2022-03-15	78_Alderley 124
79	2020-11-03	79_Alderley 104
80	2020-11-03	80_Alderley 107

Label	Date	File Name
81	2020-11-03	81_Alderley 102
82	2022-02-15	82_11.3.25-2
83	2022-02-22	83_Alderley 246
84	2023-08-22	84_Bellevue3_WP246_Reassessment
85	2023-04-05	85_Girrahween Central P1
86	2022-03-14	86_Cleared-1
87	2022-02-22	87_Alderley 230
88	2020-11-04	88_Alderley 110
89	2022-03-16	89_Cleared Shrubby-1
90	2023-03-08	90_Bellevue
91	2020-06-23	91_Gathering south of Alderley 181
92	2020-11-05	92_Alderley 101
93	2023-05-29	93_Bellevue Part 2
94	2022-03-16	94_Alderley 197
95	2020-11-05	95_Alderley 148
96	2022-02-22	96_Alderley 214
97	2020-06-23	97_Alderley 149
98	2021-08-19	98_Regrowth 11.7.4-2
99	2021-08-19	99_Regrowth 11.7.4-1
100	2023-05-29	100_Bellevue Part 2
101	2020-11-05	101_Alderley 117 (multi wll pad)
102	2022-02-15	102_Alderley 244
103	2020-06-24	103_Alderley 183
104	2020-11-05	104_HDD Pad Warrego Highway
105	2020-11-09	105_McNulty EWA South of Warrego Hwy
106	2021-08-19	106_RE 11.7.4-1
107	2022-03-16	107_Alderley 192
108	2022-03-16	108_11.3.14-1
109	2020-11-11	109_Alderley 133
110	2022-02-24	110_Alderley 213
111	2021-04-29	111_Well Pad Option
112	2022-02-15	112_11.5.1-1
113	2022-03-17	113_11.7.2-1
114	2020-06-24	114_Alderley 186
115	2020-11-11	115_Alderley 151-154
116	2020-11-11	116_Alderley 134
117	2022-04-12	117_Alderly 223
118	2021-10-26	118_Alderley 251 Camp
119	2023-07-20	119_Warrego HWY-Kerwicks Rd Intersection
120	2023-08-22	120_Bellevue2_WP217_Reassessment
121	2023-07-20	121_Warrego HWY-Kerwicks Rd Intersection
122	2022-02-15	122_11.5.1-2
123	2023-07-20	123_Warrego HWY-Kerwicks Rd Intersection
124	2023-07-20	124_Warrego HWY-Kerwicks Rd Intersection
125	2022-02-24	125_Alderley 219
126	2022-12-08	126_Alderly 242
127	2021-10-26	127_Alderley 251
128	2022-02-23	128_11.7.2-1
129	2021-04-29	129_Gathering North of Alderley 137-139
130	2020-11-03	130_Alderley 138 (multi wll pad)
131	2020-11-02	131_Alderley 135 (re-located).

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132	2020-06-24	132_Alderley 187
133	2022-02-23	133_Alderley 216
134	2022-03-17	134_Kerwick Rd Upgrades
135	2022-04-12	135_Alderly 221
136	2022-12-08	136_Alderly 240
137	2022-04-12	137_ROW Lot748BWR294
138	2023-06-01	138_Bellevue Part 2
139	2022-02-23	139_11.7.6-1
140	2022-02-16	140_11.5.1-3
141	2020-11-03	141_Alderley 161-4 (multi wll pad)
142	2020-06-24	142_Alderley 189
143	2022-02-15	143_11.7.7-1
144	2020-11-02	144_Access track Bellevue Pt1
145	2022-02-17	145_Alderley 236
146	2020-11-03	146_Alderley 142
147	2022-02-16	147_Alderley 238
148	2022-02-17	148_Alderley 237
149	2022-02-17	149_Alderley 234
150	2023-03-07	150_Bellevue
151	2023-05-30	151_Bellevue Part 2
152	2022-02-17	152_Regrowth 11.5.1a
153	2020-11-06	153_Alderley 143
154	2023-05-30	154_Bellevue Part 2
155	2022-02-17	155_Alderley 235
156	2020-11-11	156_Tie-in East of Alderley 161-164
157	2023-05-30	157_Bellevue Part 2
158	2020-06-23	158_Alderley 171-174
159	2020-11-06	159_Alderley 147
160	2020-06-23	160_Turnout east of Alderley 170s

Quaternary Data

Date	Label	File Name
2023-05-03	RE_1	RE_1_Girrahween Central P2
2023-05-03	RE_2	RE_2_Girrahween Central P2
2023-08-23	RE_3	RE_3_GirrahweenP2_WP190_RE
2023-08-23	RE_4	RE_4_GirrahweenP2_WP200
2023-08-23	RE_6	RE_6_Koala Survey_WP330
2023-05-03	RE_7	RE_7_Girrahween Central P2
2023-08-23	RE_8	RE_8_GirrahweenP2_GatheringSystem_WP330_RE
2023-08-24	RE_9	RE_9_GirrahweenP2_WP241_RE
2023-08-24	RE_10	RE_10_Koala_Survey_WP241
2023-05-03	RE_11	RE_11_Girrahween Central P2
2023-05-04	RE_12	RE_12_Girrahween Central P2
2023-05-04	RE_13	RE_13_Girrahween Central P2
2023-04-04	RE_14	RE_14_Girrahween Central P2
2023-08-24	RE_15	RE_15_Koala Survey_WP239

Label	Date	File Name
2023-08-23	RE_17	RE_17_GirrahweenP2_GatheringSystem_WP234_RE
2023-08-24	RE_18	RE_18_Koala Survey _GS_WP239
2023-05-31	RE_19	RE_19_Girrahween Central P-1
2023-08-24	RE_20	RE_20_GirrahweenP2_GatheringSystem_WP239
2023-08-24	RE_21	RE_21_GirrahweenP2_GatheringSystem_WP240
2023-05-04	RE_22	RE_22_Girrahween Central P2
2023-04-19	RE_23	RE_23_Girrahween Central P1
2023-05-04	RE_24	RE_24_Girrahween Central P2
2023-04-18	RE_25	RE_25_Girrahween Central P1
2023-04-19	RE_26	RE_26_Girrahween Central P1
2023-04-18	RE_27	RE_27_Girrahween Central P1
2023-08-24	RE_28	RE_28_GirrahweenP1_OC_Reassessment
2023-05-15	RE_29	RE_29_Girrahween Central P2
2023-04-18	RE_30	RE_30_Girrahween Central P1
2023-05-31	RE_31	RE_31_Girrahween Central P-1
2023-05-15	RE_32	RE_32_Girrahween Central P2
2023-08-25	RE_33	RE_33_GirrahweenP1_Quarry_RE
2023-04-18	RE_34	RE_34_Girrahween Central P1
2023-04-18	RE_35	RE_35_Girrahween Central P1
2023-04-17	RE_36	RE_36_Girrahween Central P1
2023-08-22	RE_37	RE_37_GirrahweenP1_Access_Track
2020-11-05	RE_38	RE_38_Gathering E of Alderley 106
2023-10-25	RE_39	RE_39_McNulty-Pipeline-Koala Survey-02
2023-10-25	RE_40	RE_40_McNulty-Pipeline-RE-01
2023-10-25	RE_41	RE_41_McNulty-Pipeline-Koala Survey-01
2020-11-12	RE_42	RE_42_Alderley 133 and 134 Gathering
2022-04-13	RE_43	RE_43_<Null>
2023-05-30	RE_44	RE_44_Bellevue Part 2
2020-11-03	RE_45	RE_45_Possible multi well pad
2023-05-30	RE_46	RE_46_Bellevue Part 2

Arrow Energy Threatened Species Points

OBJECTID	Date time Submitted	Scientific Name	Common Name	Collector Expertise
1	2012-08-31 14:57	Strophurus taenicauda	Golden-tailed Gecko	Specialist
2	2012-08-31 14:59	Strophurus taenicauda	Golden-tailed Gecko	Specialist
3	2012-08-31 15:01	Strophurus taenicauda	Golden-tailed Gecko	Specialist
4	2013-09-09 15:37	Acacia curranii	Curly-bark Wattle	Ecologist - flora
5	2013-09-09 15:38	Acacia curranii	Curly-bark Wattle	Ecologist - flora
6	2013-09-09 15:40	Homoranthus decumbens		Ecologist - flora
7	2023-11-07 0:11	Phascolarctos cinereus	Koala	Ecologist
8	2023-11-07 0:11	Phascolarctos cinereus	Koala	Ecologist
9	2023-11-07 0:11	Phascolarctos cinereus	Koala	Ecologist

Habitat Features

OBJECTID	Date time Submitted	Habitat Feature Type	Comments Notes
1	2013-09-05 11:52	Hollow-bearing tree	Large mature Eucalyptus populnea with hollows
2	2013-09-05 11:56	Burrow	
3	2016-03-18 10:44	Habitat tree (Alive)	Mature tree - avoid if possible
4	2016-03-18 10:45	Habitat tree (Alive)	Mature tree - avoid if possible
5	2016-03-18 10:45	Habitat tree (Alive)	Mature tree - avoid if possible
6	2016-03-18 10:45	Habitat tree (Alive)	Mature tree - avoid if possible
7	2016-03-18 10:46	Other	Grass tree (type A plant) - avoid if possible
8	2016-03-18 10:47	Other	Grass tree (type A plant) - avoid if possible
9	2016-03-18 10:47	Other	Grass tree (type A plant) - avoid if possible
10	2016-03-18 10:47	Other	Grass tree (type A plant) - avoid if possible
11	2016-03-18 10:47	Other	Grass tree (type A plant) - avoid if possible
12	2016-03-18 10:48	Other	Grass tree (type A plant) - avoid if possible
13	2016-03-18 10:48	Other	Grass tree (type A plant) - avoid if possible
14	2016-03-18 10:48	Other	Grass tree (type A plant) - avoid if possible
15	2016-03-18 10:49	Other	Grass tree (type A plant) - avoid if possible
16	2016-03-18 10:49	Other	Grass tree (type A plant) - avoid if possible
17	2016-03-18 10:49	Other	Grass tree (type A plant) - avoid if possible
18	2016-03-18 10:49	Other	Grass tree (type A plant) - avoid if possible
19	2016-03-18 10:50	Other	Grass tree (type A plant) - avoid if possible
20	2016-03-18 10:50	Other	Grass tree (type A plant) - avoid if possible
21	2016-03-18 10:50	Other	Grass tree (type A plant) - avoid if possible
22	2016-03-18 10:51	Other	Grass tree (type A plant) - avoid if possible
23	2023-09-04 1:27	Log	Approx. 2m log in the ground
24	2023-09-04 1:30	Log	Approx. 3m log in the ground
25	2023-09-04 1:33	Stag	Stag with a hole (>50cm) in middle
26	2023-09-04 1:35	Stag	Stag with a central hollow (<50 cm)
27		Hollow-bearing tree	Eucalyptus crebra
28		Stag	Hollow on stag
29		Hollow-bearing tree	Eucalyptus crebra with a hollow > 50 cm
30		Hollow-bearing tree	Eucalyptus crebra with a hollow > 50 cm
31		Hollow log	
32		Hollow-bearing tree	Eucalyptus crebra with a hollow > 50 cm
33		Hollow log	
34		Hollow log	

Threatened Species Records

OBJECTID	Scientific Name	Data Resource Name	Year
1	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
2	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
3	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
4	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
5	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
6	Tachyglossus aculeatus	WildNet - Queensland Wildlife Data	2009
7	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
8	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
9	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
10	Ornithorhynchus anatinus	WildNet - Queensland Wildlife Data	2010
11	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
12	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
13	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
14	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
15	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
16	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
17	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
18	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
19	Strophurus taenicauda	ALA species sightings and OzAtlas	2011
20	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
21	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
22	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
23	Nyctophilus corbeni	WildNet - Queensland Wildlife Data	2013
24	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
25	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
26	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013

OBJECTID	Scientific Name	Data Resource Name	Year
27	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
28	Hirundapus caudacutus	WildNet - Queensland Wildlife Data	2013
29	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
30	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
31	Strophurus taenicauda	WildNet - Queensland Wildlife Data	2013
32	Phascolarctos cinereus	WildNet - Queensland Wildlife Data	1987

Appendix F

Habitat mapping rules

THREATENED SPECIES MAPPING RULES REVIEW

Surat Gas Project

PREPARED FOR ARROW ENERGY PTY LTD
September 2023

Surat Gas Project

Threatened species mapping rules review

September 2023

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DOCUMENT CONTROL

Name of Project:	Surat Gas Project threatened species mapping rules review
Project Number:	ARW_2202
Project Manager:	Mark Sanders
Document Author(s):	Mark Sanders, Paul Williams, David Stanton
Name of Document:	SGP threatened species mapping rules review report
File Name:	ESE (2023) SGP Threat Spp mapping rules_Sep 23_v1.0.docx
Version:	Version 1.0

CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

In 2011 3D Environmental (3DE) and EcoSmart Ecology (ESE) prepared a terrestrial ecology impact assessment report for the Surat Gas Project (SGP). This work included inspecting relevant data sources to identify threatened species (flora and fauna specially protected under the *Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act] and *Nature Conservation Act 1992* [NC Act]), which are known within and surrounding the SGP.

'Rules' were created to map habitat for these Matters of National and State Environmental Significance (MNES and MSES) based on GIS data, allowing the prediction of high value habitat. Habitats were classed as 'core' habitat or 'general' habitat. Core habitat areas reflect those REs which are likely to be regularly inhabited by, or of 'high importance' to, the species. Such areas include high amenity habitat which could include important resources such as roosting and nesting sites or food resources. General habitats are 'those REs that may be used less regularly by fauna' (3DE and ESE 2011) and has lower amenity habitat. These definitions roughly match the definitions of 'Core Habitat Possible' and 'General Habitat Possible' in DES (2020), which was not available in 2011 The mapping has been used to calculate offset requirements based on the extent of Core Habitat Known and Core Habitat Possible.

Considerable field work has been completed within and surrounding the SGP area since this work was completed and our local knowledge has increased substantially. In a few cases, this has identified ways in which the mapping rules could be modified and improved for greater accuracy. Such changes are scattered across various survey documents, leading to confusion regarding the most relevant mapping rules. Furthermore, additional MNES and MSES species have been listed under legislation since the work was completed. These additional species have not been previously assessed. A revision of this work is now required, to consolidate previous works, assess new taxa, and review and update the mapping information.

2.0 STUDY METHODOLOGY

2.1 THE SGP AREA

The SGP has a combined extent of 206,594 ha and includes a southern (145,945 ha), central (53,048 ha) and northern area (7,601 ha). The Condamine River forms the eastern boundary of the southern area (Figure 2.1).

A large portion of the central area is covered by remnant vegetation while the northern area has the least amount of remnant vegetation. Available RE mapping (Queensland herbarium v13) across the broader area has been used to identify extensive contiguous or near-contiguous vegetation. Large contiguous patches of remnant vegetation are more likely to contain suitable habitat for patch-size dependant species. The layer 'large tracts remnant veg.shp' (Figure 2.1) has been created to assist in mapping these patch-size dependant species.

2.2 DATA SOURCES

Information on the types of MNES and MSES species which might occur in the SGP area, along with coordinate accurate GIS data (where possible) was gathered from the following sources:

- The EPBC Act Protected Matters Search Tool,
- Australia's Virtual Herbarium (AVH 2023) for vouchered specimen records sourced from a number of Australian Herbarium,
- Wildnet database of voucher plant specimens and fauna and flora observation records,
- The Atlas of Living Australia (ALA) online database (https://www.ala.org.au/),
- EcoSmart Ecology's inhouse database, which includes records from the SGP area gathered while working for Arrow since 2011, and
- Records supplied by Arrow arising from other works such as spotter-catcher activities.

All databases were inspected using a 50 km buffer around the SGP, though for plants a 25 km buffer may have been used to aid the assessment of likelihood. The results were collated, sorted, loaded into ArcGIS for analysis. While possible duplicate records were removed from the database it is undoubtable some remain.

Ground-truthed Regional Ecosystem data was used to determine vegetation types within the SGP area, while mapping from the Queensland Government (v13) was used for areas outside the SGP but within the 50 km buffer (Queensland Government 2023). Other data sources, including Essential Habitat, was also inspected as useful.

2.3 LIKELIHOOD ASSESSMENT

Using the above data, a list of threatened species (as protected under the EPBC or NC Acts) was generated for consideration. The potential of populations of these species occurring within the SGP was assessed based on (i) the location of relevant records, (ii) relevance (i.e., date of records) and (iii) suitability of habitat within the SGP, using the criteria in Table 2.1.

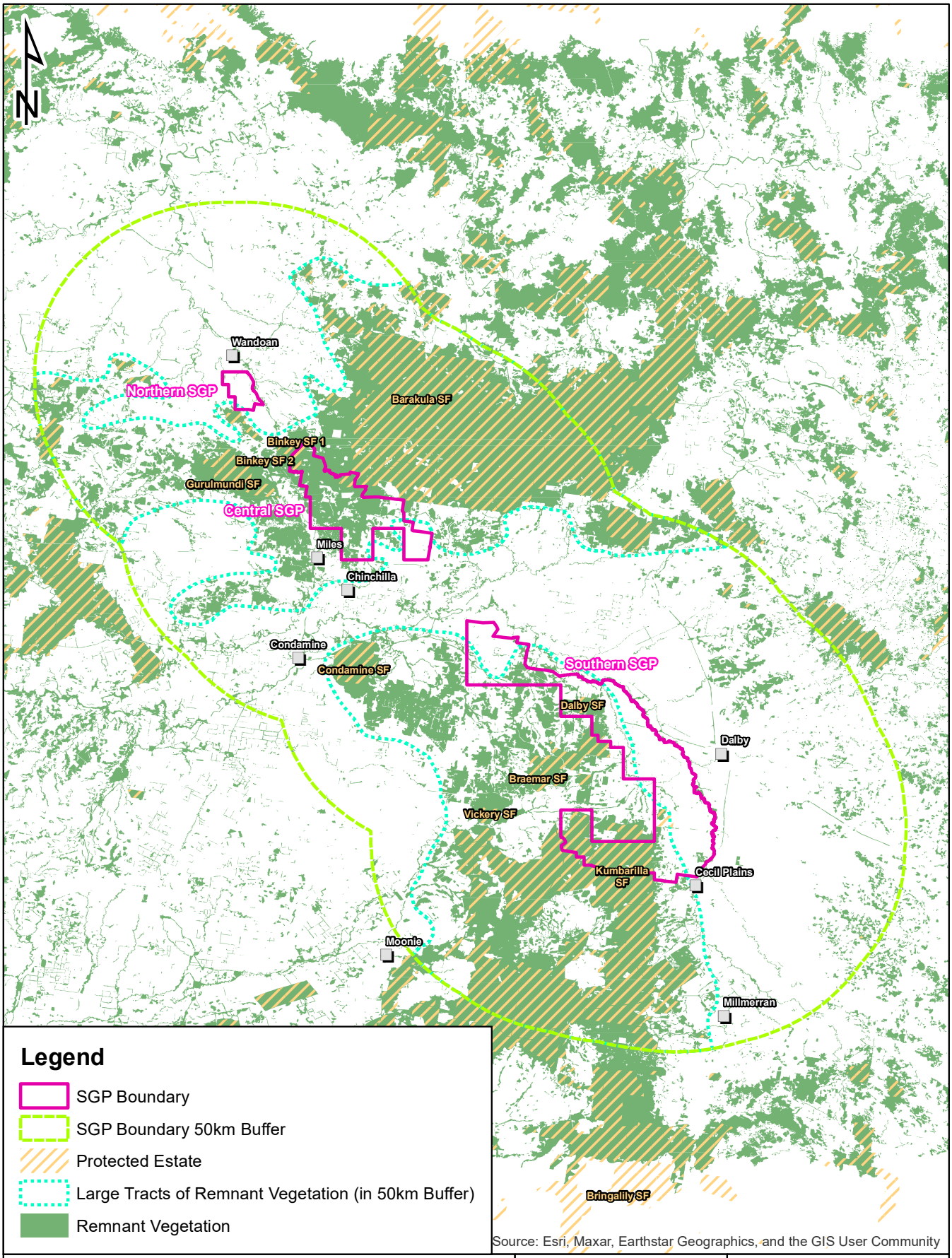


Figure 2.1
The SGP assessment area, remnant vegetation and protected estate

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

A number of species have been recorded from, or could occur at, Lake Broader National Park and will not occur away from this feature. This lake is unique in the local landscape and provides habitat not found elsewhere within the SGP. It is assumed development activities will not affect the lake directly or indirectly and, as such, these species need no further assessment. Special mention is made where a species is restricted to the lake, but they are assessed as 'will not occur' for the broader SGP.

Based on the assessment mapping rules were produced for species known, likely or with the possibility of occurring. Rules for unlikely or transient individuals were not formulated.

Table 2.1. Criteria for assessing the likelihood of populations being present

Likelihood	Criteria	Probability
Known	Recorded within and/or immediately adjacent the SGP area	100%
Likely	Suitable habitat within or immediately adjacent the SGP area; numerous relevant records (< 30 years old and within 20 km)	>80%
Possible	Suitable habitat within or adjacent the SGP; numerous records but records > 20 km away or > 30 years old OR Marginal habitat within the SGP; few, but recent (<30 yrs), records within 20 km of SGP	10-18%
Unlikely	No suitable habitat; few records from desktop assessment and records > 20 km from the SGP	<10%
Will Not Occur (WNO)*	Despite records within 50 km, these species will not occur due to local extinction or the lack of suitable habitat.	0%
Transient	Species highly mobile and known to occasionally appear in areas away from known population centres (usually birds). Species not expected to permanently establish.	N/A

* Some species may occur at Lake Broadwater, which is unique in the landscape and provides habitat not located in the broader SGP.

2.4 THREATENED SPECIES HABITAT MAPPING RULES

An assessment of habitat suitability for individual threatened species (both flora and terrestrial vertebrate fauna) was undertaken to identify areas of 'core' habitat and areas of 'general' habitat. Core habitat areas reflect those REs that are likely to be regularly inhabited by, or of high importance to, the species, while general habitats reflect those REs which may contribute to their broader distribution (DES 2020). Core and general habitat types were determined using the following steps:

1. Refining the threatened species database created in Section 2.1 to include only sightings since 1950 for flora, since 1975 for fauna, and with an accuracy (precision) to within 500 m (DES 2020).
2. Cross-referencing the above sightings against vegetation mapping data (ground-truthed for the SGP and RE mapping v13 for the broader 50 km buffer) to generate a list of REs and Broad Vegetation Groups (BVG) in which each species has been recorded.
3. Extrapolating additional REs based on the types of BVG (1 m) identified in the above step.
4. Cross-referencing the RE list for each species to ensure it includes relevant REs documented as having high value in the Regional Ecosystem Description Database (REDD; Queensland Herbarium 2023).

5. Vetting the resulting RE list generated in the above steps for each species, based on known habitat requirements, to remove erroneous REs.
6. Segregating the REs into core and supplementary categories by comparing the REDD with each species' known habitat requirements.
7. Suggesting any modifications to account for factors that cannot be included in RE descriptions (e.g. species distributions, proximity to highly valuable habitat, patch size etc.).

Consistent with DES (2020), we have designated areas around recent known records (as defined in the first point above) as 'Core Habitat Known'.

Numerous fauna species select habitats based on specific habitat factors which cannot be assigned to individual REs, such as rock outcrops or the presence of water or mistletoe.

2.5 Regional Ecosystems Subject to Assessment

The habitat mapping for this project assessed only REs present within the SGP, as detailed in Table 2.2 below.

Table 2.2. Regional Ecosystems within the SGP and assessed in this work

RE	Description	Extent (ha) in SGP	BVG (1 m)
11.3.1	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	21.51	25a
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	593.55	17a
11.3.3	*Eucalyptus coolabah* woodland on alluvial plains	26.83	16 c
11.3.4	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains	822.90	16 c
11.3.14	*Eucalyptus spp., Angophora spp., Callitris spp.* woodland on alluvial plains	342.31	18a
11.3.17	*Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains	213.49	25a
11.3.18	*Eucalyptus populnea, Callitris glaucophylla, Allocasuarina luehmannii* shrubby woodland on alluvium	418.39	17a
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	1,448.53	16a
11.3.26	*Eucalyptus moluccana* or *E. microcarpa* woodland to open forest on margins of alluvial plains	3.82	13d
11.3.27a	Vegetation ranges from open water +/- aquatics and emergents such as *Chara spp. Nitella spp., Myriophyllum verrucosum, Nymphaea violacea, Pyrgillus javanicus, Potamogeton crispus, P. tricarinatus, Ottelia ovalifolia, Vallisneria caulescens* and *Nymphoides indica*. A narrow fringing woodland commonly dominated by *E. camaldulensis* or *E. coolabah*	25.36	34a
11.3.27d	*Eucalyptus camaldulensis* and/or *E. tereticornis* woodland. A range of sedges and grasses occur in the ground layer including *Fimbristylis vagans, Myriophyllum striatum, Nitella*	203.49	34a

RE	Description	Extent (ha) in SGP	BVG (1 m)
	pseudoflabellata and *Pseudoraphis* sp. Occurs fringing large lakes.		
11.3.27f	*Eucalyptus coolabah* and/or *E. tereticornis* open woodland to woodland fringing swamps. Occurs on closed depressions on floodplains associated with old drainage courses that are intermittently flooded.	207.11	34d
11.3.27i	*E. tereticornis* woodland to open woodland with sedgeland ground layer. Other tree species such as *E. coolabah* and *E. largiflorens* may be present or locally dominant.	52.0	34d
11.4.3	*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains	388.71	25a
11.4.3a	*Melaleuca squamophloia* woodland associated with *Acacia harpophylla* communities on Cainozoic clay plains	56.64	25a
11.5.1	*Eucalyptus crebra* and/or *E. populnea, Callitris glaucophylla, Angophora leiocarpa, Allocasuarina luehmannii* woodland on Cainozoic sand plains and/or remnant surfaces	35,333.91	18b
11.5.1a	*Eucalyptus populnea* woodland with *Allocasuarina luehmannii* low tree layer. Occurs on flat to gently undulating plains formed from weathered sandstones	350.93	17a
11.5.4	*Eucalyptus chloroclada, Callitris glaucophylla, C. endlicheri, Angophora leiocarpa* woodland on Cainozoic sand plains and/or remnant surfaces	3,242.26	18b
11.5.20	*Eucalyptus moluccana* and/or *E. microcarpa* and/or *E. woollsiana +/- E. crebra* woodland on Cainozoic sand plains	5,422.68	13d
11.5.21	*Corymbia bloxsomei +/- Callitris glaucophylla +/- Eucalyptus crebra +/- Angophora leiocarpa* woodland on Cainozoic sand plains and/or remnant surfaces	2,238.88	18a
11.7.2	*Acacia* spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	176.41	24a
11.7.4	*Eucalyptus decorticans* and/or *Eucalyptus spp., Corymbia spp., Acacia spp., Lysicarpus angustifolius* woodland on Cainozoic lateritic duricrust	12,945.05	12a
11.7.5	Shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks	437.07	29b
11.7.6	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust	956.16	10a
11.7.7	*Eucalyptus fibrosa subsp. nubilis +/- Corymbia spp. +/- Eucalyptus spp*. woodland on Cainozoic lateritic duricrust	9,286.21	12a
11.9.2	*Eucalyptus melanophloia +/- E. orgadophila* woodland to open woodland on fine-grained sedimentary rocks	46.04	17b
11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on fine-grained sedimentary rocks	6.50	25a
11.9.7	*Eucalyptus populnea, Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	1.53	17a
11.9.10	*Eucalyptus populnea* open forest with a secondary tree layer of *Acacia harpophylla* and sometimes *Casuarina cristata* on fine-grained sedimentary rocks	14.98	25a

2.6 LIMITATIONS

Habitat mapping for this project has assessed only REs present within the SGP (see above). The rules do not supply an exhaustive list of suitable habitats and should only be used for mapping vegetation within the SGP.

Some threatened species are poorly understood and predicting suitable habitats can be difficult. Others are unexplainably scattered throughout the landscape apparently absent from areas suitable habitat while present in others. Fauna can also be highly cryptic and difficult to detect, they can go un-noticed for decades before appearing. This hinders accurately predicting the presence of some species, and therefore potential impacts. Comments on mapping accuracy for each species has been provided as a guide.

3.0 PROBABILITY OF OCCURRENCE ASSESSMENT

3.1 FLORA

There are 30 threatened and near threatened plant species recorded within a 50 km radius of the SGP which have been assessed for their likely occurrence. Of these, 20 are either known or have the possibility to occur (Table 3.1).

Table 3.1. Threatened flora identified in the database searches within 50 km of the SGP

Species	Status		Likelihood in SGP
	NCA	EPBC	
Trees and Shrubs			
Acacia barakulensis Waaje Wattle	Vul		Possible
Acacia curranii Curly Bark Wattle	Vul	Vul	Possible
Acacia handonis Hando 's Wattle	Vul	Vul	Possible
Acacia lauta Tara Wattle	Vul	Vul	Unlikely
Acacia wardellii Thomby Range wattle	NT		Unlikely
Apatophyllum teretifolium Cliff Apatophyllum	NT		Unlikely
Callitris baileyi Bailey's cypress pine	NT		Possible
Calytrix gurulmundensis Gurulmundi Fringe Myrtle	Vul	Vul	Possible
Cadellia pentastylis Ooline	Vul	Vul	Unlikely
Denhamia parviflora Small-leaved Denhamia	Vul	Vul	Unlikely
Eucalyptus argophloia Chinchilla white gum	Vul	Vul	Unlikely
Eucalyptus curtisii Plunkett Mallee	NT		Possible
Eucalyptus pachycalyx subsp. waajensis Pumpkin gum	End		Unlikely
Eucalyptus sideroxylon subsp. improcera Red ironbark	Vul		Unlikely
Eucalyptus virens Shiny-leaved Ironbark	Vul	Vul	Unlikely
Homoranthus decumbens	Vul	End	Unlikely
Homoranthus papillatus	CrE		Unlikely
Melaleuca groveana	NT		Unlikely
Micromyrtus carinata	End		Possible
Micromyrtus patula	End		Unlikely
Philotheca sporadica Kogan Waxflower	NT	Vul	Known
Pomaderris coomingalensis	End		Unlikely
Sophora fraseri	Vul	Vul	Unlikely
Grasses and Sedges			
Cyperus clarus	Vul	-	Unlikely

Species	Status		Likelihood in SGP
	NCA	EPBC	
Digitaria porrecta Finger Panic Grass	NT		Known
Dicanthium queenslandicum	Vul	End	Unlikely
Fimbristylis vagans	End		Known, at least in the past
Homopholis belsonii	End	Vul	Possible
Forbs and Herbs			
Camptacra perdita	End		Unlikely
Clematis fawcettii	Vul	Vul	Unlikely
Cryptandra ciliata	NT		Possible
Cymbonotus maidenii	End		Possible
Leuzea australis	Vul	Vul	Unlikely
Picris barbarorum	Vul		Possible
Picris evae	Vul	Vul	Unlikely
Prostanthera sp. (Dunmore D.M.Gordon 8A)	Vul	Vul	Unlikely
Rutidosis glandulosa	NT		Known
Rutidosis lanata	NT		Possible
Solanum papaverifolium	End		Known
Solanum stenopterum	Vul		Possible
Thesium australe Austral Toadflax	Vul	Vul	Possible
Vincetoxicum forsteri	End	End	Unlikely
Xerothamnella herbacea	End	End	Possible

CrE = Critically Endangered; End = Endangered; Vul = Vulnerable; NT = Near Threatened

3.2 TERRESTRIAL FAUNA

A total of 47 threatened fauna species were identified as occurring, or having potential to occur, within 50 km of the SGP. This includes two species identified under the EPBC Protected Matters Search Tool (PMST; DCCEEW 2023a) for which no records were found. The PMST is predictive in nature and can return species which have not been recorded within the search extent.

An analysis of likelihood (Appendix A) indicates 12 species have already been detected within the SGP and a further five are possible. No vertebrates are considered likely, which is not unexpected considering survey effort within the SGP - any species likely to occur have been confirmed as present. This suggests the remaining possible species have a much lower probability of occurring, which is consistent with our assessment. Targeted surveys for the three invertebrates have not been undertaken.

Table 3.2. A summary of the likelihood assessment for threatened terrestrial fauna

GROUP	Likelihood Assessment				
	Known	Possible	Unlikely	Transient	WNO
Invertebrate	3	0	0	0	0
Amphibia	0	0	0	0	3
Reptilia	4	0	2	0	2
Aves	3	3	5	3	6
Mammalia	3	1	2	0	6
Total	*13*	*4*	*9*	*3*	*17*

WNO = Will not occur (but may be restricted to Lake Broadwater)

Profiles and mapping rules for the combined 17 species possible or known from the SGP is provided in Section 5.0. In addition to these species, the Yakka Skink (*Egernia rugosa*), Collared Delma (*Delma torquata*) and Squatter Pigeon (*Geophaps scripta scripta*) were included in Arrows original approval (EPBC 2010/5344). Consideration of records and habitats within the SGP suggest two of these species, the Yakka Skink and Collared Delma, are unlikely to occur while the Squatter Pigeon is possible only as a transient. Populations or areas of important habitat for these species is unlikely and they are not considered further.

Searches also highlighted the possible presence of Hooded Robin and Brown Treecreeper, both of which have a subspecies specially protected under legislation (*Melanodryas cucullata cucullata* and *Climacteris picumnus victoriae* respectively). The SGP is likely within the Brown Treecreeper hybrid zone (Schodde and Mason 1999), suggesting Brown Treecreepers present within the SGP cannot be assigned to subspecies. The boundary between subspecies of Hooded Robin is obscure, with some texts suggesting the southern subspecies extends north into Queensland (Schodde and Mason 1999) while others indicating it is largely restricted to NSW (DCCEEW 2023b). Neither have been confirmed within the SGP and based on all available evidence it seems that the protected subspecies do not occur. They are not considered further in this work.

Table 3.3. Threatened terrestrial vertebrates identified in the database searches within 50 km of the SGP.

CLASS ***Scientific Name***	**Common Name**	**EPBC**	**NCA**	**No. Rec**	**Likelihood**
INVERTEBRATES					
Adclarkia cameronii	Brigalow Woodland Snail	End	Vul	27	Known
Adclarkia dulacca	Dulacca Woodland Snail	End	End	12	Known
Jalmenus eubulus	Pale Imperial Hairstreak	-	Vul	18	Known
AMPHIBIA					
Adelotus brevis	Tusked Frog	-	Vul	3	WNO
Litoria cooloolensis	Cooloola Tree Frog	-	NT	2	WNO
Mixophyes iteratus	Giant Barred Frog	End	End	1	WNO
REPTILIA					
Acanthophis antarcticus	Common Death Adder	-	Vul	26	Known
Anomalopus mackayi	Five-clawed Worm-skink	Vul	Vul	32	WNO
Delma torquata	Collared Delma	Vul	Vul	0	Unlikely
Egernia rugosa	Yakka Skink	Vul	Vul	5	Unlikely
Furina dunmalli	Dunmall's Snake	Vul	Vul	20	Known
Hemiaspis damelii	Grey Snake	End	End	118	Known
Strophurus taenicauda	Golden-tailed Gecko	-	NT	492	Known
Tympanocryptis condaminensis	Condamine Earless Dragon	End	End	122	WNO
AVES					
Anthochaera phrygia	Regent Honeyeater	CrE	CrE	5	Unlikely
Aphelocephala leucopsis	Southern Whiteface	Vul	Vul	18	Possible
Botaurus poiciloptilus	Australasian Bittern	End	End	16	Unlikely
Calidris ferruginea	Curlew Sandpiper	CrE	CrE	10	WNO (LB)
Calyptorhynchus lathami lathami	Glossy Black Cockatoo	Vul	Vul	293	Known
Erythrotriorchis radiatus	Red Goshawk	End	End	25	Unlikely
Falco hypoleucos	Grey Falcon	Vul	Vul	5	Transient
Geophaps scripta scripta	Squatter Pigeon	Vul	Vul	71	Transient
Grantiella picta	Painted Honeyeater	Vul	Vul	863	Known

CLASS *Scientific Name*	Common Name	EPBC	NCA	No. Rec	Likelihood
Hirundapus caudacutus	White-throated Needletail	Vul	Vul	273	Known
Lathamus discolor	Swift Parrot	CrE	End	9	Unlikely
Limosa lapponica baueri	Bar-tailed Godwit	Vul	Vul	10	WNO (LB)
Lophochroa leadbeateri leadbeateri	Major Mitchell's Cockatoo	End	End	15	Transient
Ninox strenua	Powerful Owl	-	Vul	5	Unlikely
Pedionomus torquatus	Plains-wanderer	CrE	CrE	9	WNO
Psephotus pulcherrimus	Paradise Parrot	Ex	Ex	13	WNO
Rostratula australis	Australian Painted Snipe	End	End	24	Possible
Poephila cincta	Black-throated Finch	End	End	2	WNO
Stagonopleura guttata	Diamond Firetail	Vul	Vul	110	Possible
Turnix melanogaster	Black-breasted Button-quail	Vul	Vul	3	WNO
MAMMALIA					
Chalinolobus dwyeri	Large-eared Pied Bat	Vul	Vul	1	WNO
Dasyurus hallucatus	Northern Quoll	End	LC	0	WNO
Dasyurus maculatus maculatus	Spotted-tailed Quoll	End	End	19	Unlikely
Onychogalea frenata	Bridled Nailtail Wallaby	End	End	1	WNO
Petrogale penicillata	Brush-tailed Rock-wallaby	Vul	Vul	2	WNO
Pteropus poliocephalus	Grey-headed Flying-fox	Vul	LC	3	Unlikely
Macroderma gigas	Ghost Bat	Vul	Vul	0	WNO
Nyctophilus corbeni	South-eastern Long-eared Bat	Vul	Vul	25	Known
Petauroides volans (sensu lato)	Greater Glider	End	End	83*	Known
Petaurus australis australis	Yellow-bellied Glider	Vul	Vul	94	Possible
Phascolarctos cinereus	Koala	End	End	735	Known
Pseudomys australis	Plains Rat	Vul	LC	1	WNO

CrE = Critically Endangered; End = Endangered; Vul = Vulnerable; LC = Least Concern; WNO = Will not occur; WNO (LB) = Will not occur across the broader SGP but known specially and only from Lake Broadwater

*Likely duplication of records as *P. armillatus* in Wildnet and *P. volans* in ALA

4.0 POSSIBLE OR KNOWN THREATENED FLORA

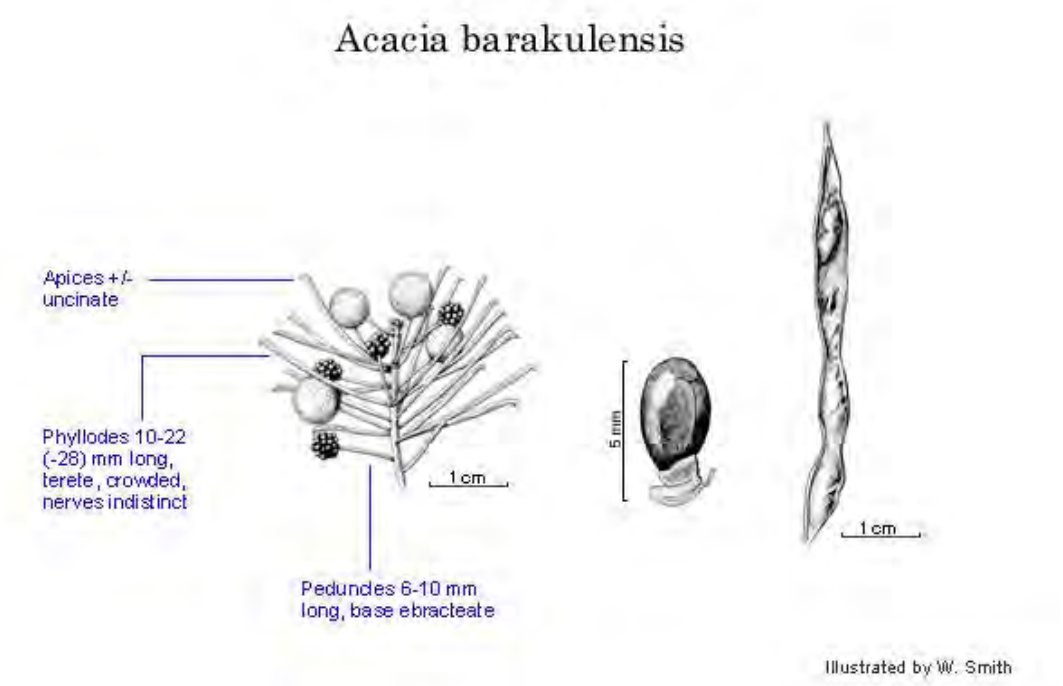
4.1 TREES AND SHRUBS

4.1.1 *Acacia barakulensis* (Waaje Wattle)

Vulnerable (NC Act)

Description

Acacia barakulensis is a small shrub, up to 2 m tall. It is distinguished by its small, terete leaves with an apical hook and round globular flower heads on a long stalk.



Acacia barakulensis diagram from World Wide Wattle

Distribution and Habitat

Waaje Wattle is a local endemic restricted to Barakula State Forest, north of Chinchilla where it grows on sandy soils in eucalypt communities in the Waaje Wildflower Area (Lithgow 1997; Orchard and Wilson 2001; Chinchilla Field Naturalists Club 2017).

HERBRECS specimen records indicate habitat in flat gently undulating plains on the crest of the slope on deep yellow loamy sand soil derived from sandstone or laterite. Vegetation is tall shrubland with *Eucalyptus tenuipes, Corymbia trachyphloia, Calytrix gurulmundensis*, and *Triodia mitchellii* (DES 2022a). Habitat is consistent with RE 11.7.4, 11.7.5, 11.7.6, and 11.7.7. Survey records identified the species in woodland of narrow leaf ironbark (*Eucalyptus crebra*) + smooth barked apple (*Angophora leioclada*) + white cypress pine (*Callitris glaucophylla*) with

a subcanopy of white cypress and bulloak (*Allocasuarina luehmanii*) on old loamy plains (RE 11.5.1, 11.5.4, 11.5.21).

Ecology

Similar to many Acacias, there is a likelihood that *Acacia barakulensis* will respond to disturbance, or populations rejuvenated by fire. Knowledge of the species biology and response to disturbances such as habitat fragmentation, changed fire regimes and edge effects is poorly understood.

Records Relevant to the SGP

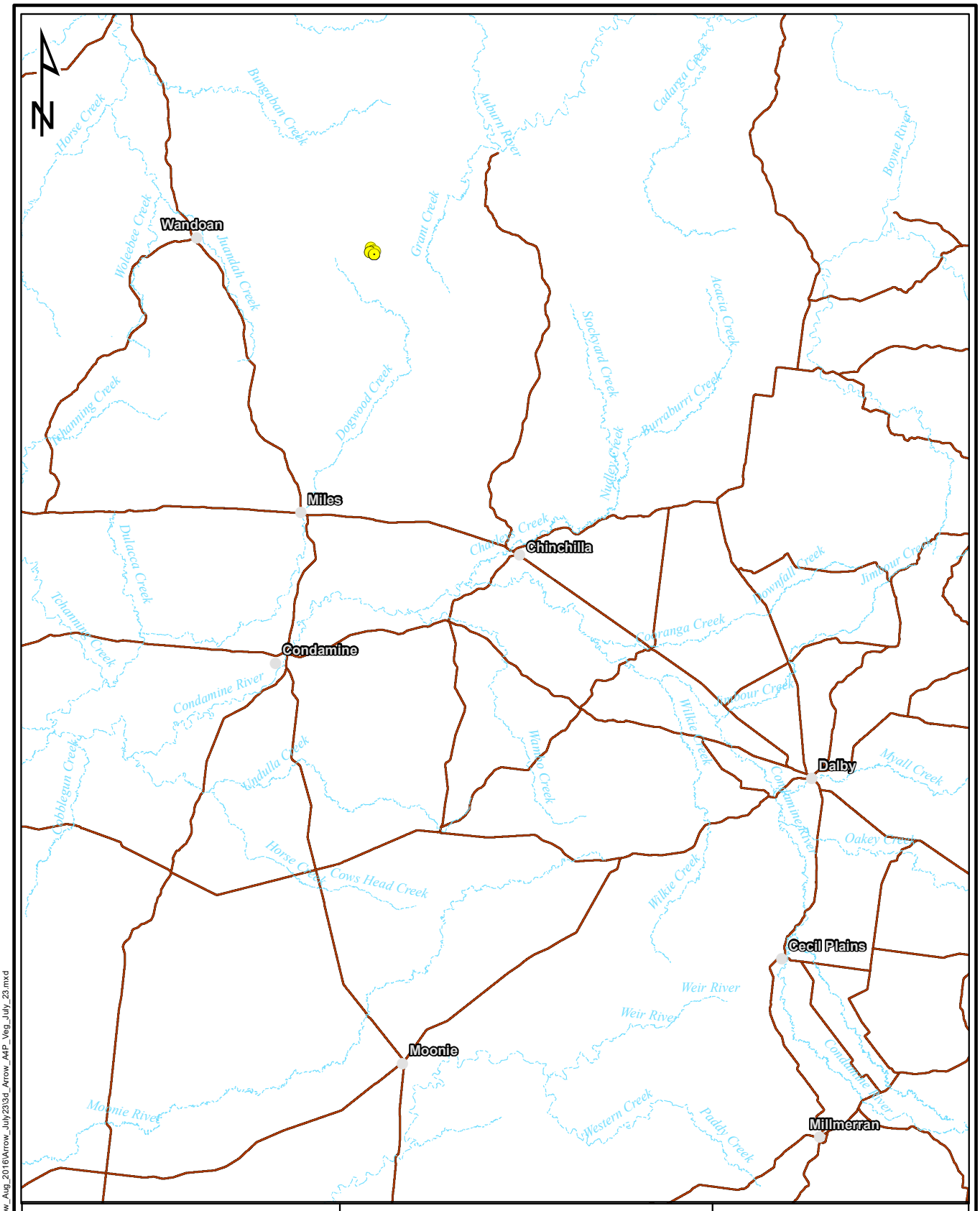
Herbrecs identifies five confirmed populations 28 km to the north-east of the SGP area within Barakula State Forest (Figure 4.1). Due to contiguous habitats between this area and the SGP, the species is considered possible to occur.

Rule(s) for Habitat Mapping:

1. The species will only likely occur in the central SGP area.
2. Within the central area of the SGP, REs 11.5.1, 11.5.14, 11.5.21, 11.7.4, 11.7.5, 11.7.6 and 11.7.7 are mapped as 'General Habitat' due to lack of local records.
3. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
4. Non-remnant and regrowth habitats are mapped as 'Absence Suspected'.

Mapping Confidence

Due to the relatively broad habitat tolerances, mapping of general habitat is considered to be of moderate accuracy.



Legend

Acacia barakulensis

NC Act, EPBC

- Vulnerable, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.1. Spatial distribution of *Acacia barakulensis*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 **Drawn By** DG **Date** 24-Jul-23 A4

[redacted]

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4.1.2 *Acacia curranii* (Curly-bark Wattle)

Vulnerable EPBC Act (effective Jul 2000)
Vulnerable NC Act

Description

Acacia curranii is a shrub with reddish flaky "minni ritchi" bark. It has long needle like leaves with tiny silky hairs, flowers are clustered in leave axils and the narrow pods have matted hairs.

Curly-bark wattle (*Acacia curranii).* Photograph M. Fagg, Australian National Botanical Gardens

Distribution and Habitat

Acacia curranii has disjunct NSW and Queensland populations. The NSW populations grow on the state's southern western downs. The only known Queensland population occurs in and adjacent to the Gurulmundi State Forest area of the Darling Downs, approximately 65 km north-west of Chinchilla (Pedley 1987; Orchard and Wilson 2001). The Gurulmundi population is restricted to an area of less than 20 km diameter and represents a significant northern population, well separated from the NSW populations.

Plants are known to occur in shrubby heaths, dry sclerophyll forests and semi-arid woodlands where they can occur as widely scattered thickets in very species-rich heathy scrub with emergent eucalypts (Pickard 1995 c, Threatened Species Scientific Committee 2008a). The Gurlumundi population has been reported as growing in dense "groves" (Pedley 1987). Queensland collections of curly-bark wattle, recorded in Herbrecs, mostly occur within areas mapped by the Queensland Herbarium as Regional Ecosystem 11.7.5; shrubland with *Calytrix* spp., *Hakea* spp., *Kunzea* spp., *Micromyrtus* spp., *Acacia* spp., *Melaleuca* spp. and a spinifex grass layer, on natural scalds on deeply weathered sedimentary rocks.

Ecology

The typical life span of curly-bark wattle is unknown, but it is probably similar to many other shrubby *Acacia* species in being a moderately long-lived shrub of 10 to 30 years. It has been recorded flowering during August and September, with pods maturing several months later (Pedley 1987). As a hard-seeded legume, the soil-stored seed reserves of *A. curranii* are likely to be long lived (i.e. > 10 years). The observed abundant regeneration via seedlings after fire

suggests *Acacia curranii* will also germinate seedlings following mechanical disturbance of the topsoil, although repeated soil disturbance would kill the seedlings that germinate after any initial disturbance. The impact of stock grazing is unknown, but damage from grazing by feral goats has been observed (Cohn 1995).

Records Relevant to the SGP

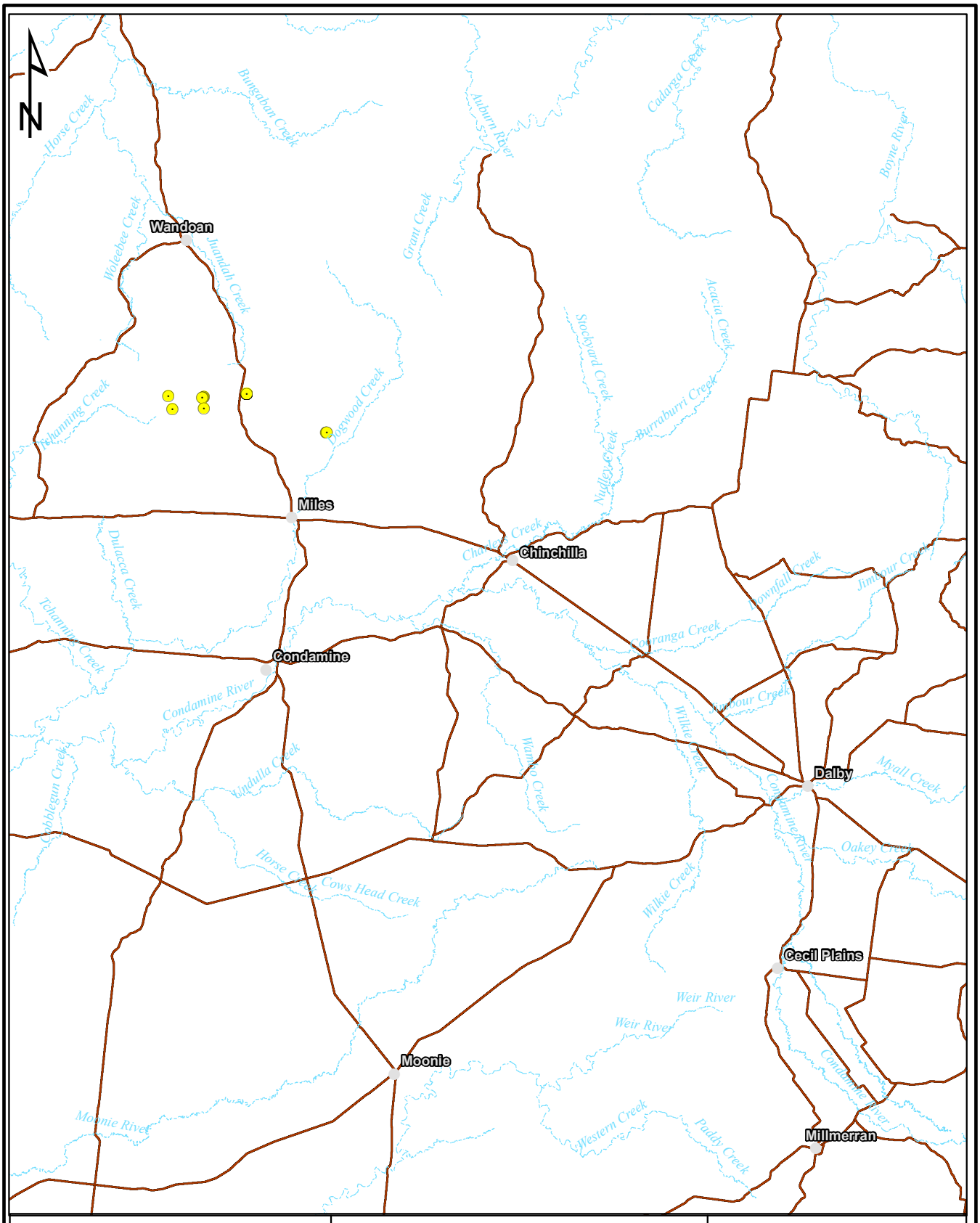
Sixteen records of the species are confirmed in Herbrecs with the nearest population 11 km west of the SGP area with Gurulmundi State Forest (excluding low precision records). An additional two records exist within tenement boundaries 20 km to the north of Miles, from Arrow Energy internal database (Figure 4.2).

Rule(s) for Habitat Mapping:

1. The species will likely only occur in the central SGP area to the north of Miles.
2. In the absence of survey records within the SGP area, RE 11.7.5, 11.7.4, 11.7.7 in the potential area of occurrences have been allocated as 'General Habitat'.
3. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
4. All other regional ecosystems, regrowth and cleared areas are mapped as 'Absence Suspected'.

Mapping Confidence

High mapping confidence is applied to be species based on the revised mapping boundaries and detailed on-ground assessment.



Legend

Acacia curranii

NC Act, EPBC Act

- Vulnerable, Vulnerable
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.2. Spatial distribution of *Acacia curranii*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 **Drawn By** DG **Date** 30-Jul-23 A4

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4.1.3 *Acacia handonis* (Hando's Wattle)

Vulnerable EPBC Act (effective Jul 2000)
Vulnerable NC Act

Description

Acacia handonis is a small, resinous shrub that grows to 2 m tall. Leaves are tiny, terete with glandular hairs and a slightly hook tip point. Flowers are relatively large heads and pods have a rough surface.

Acacia handonis (Photograph M. Fagg, Australian National Botanical Gardens)

Distribution and Habitat

Hando's wattle has an extremely restricted occurrence, being known only from the Barakula State Forest, approximately 40 km north of Chinchilla (Orchard and Wilson 2001). This population of Hando's wattle was considered to occur in three adjacent areas and was estimated in 1994 to contain around 10 080 individuals over approximately 28 ha (Halford 1995a). The extent of population was considered to have broadened within the Barakula State Forest between the initial collections in 1978 and 1997 (Lithgow 1997).

Hando's wattle has only been collected on rocky ridges and slopes on sandstone-derived geology in eucalypt woodland and open forest (Orchard and Wilson 2001). The vegetation it grows within is a shrubby woodland of *Eucalyptus fibrosa* subsp. *nubila*, *Eucalyptus watsoniana* subsp. *watsoniana, Lysicarpus angustifolius,* and *Allocasuarina inophloia* (Halford 1995a). The descriptions of the habitat from which it has been collected are consistent with the regional ecosystem mapping for its locations. This is, primarily RE 11.7.7: *Eucalyptus fibrosa* subsp.

nubila +/- *Corymbia* spp. +/- *Eucalyptus* spp. on lateritic duricrust. One collection is also recorded in RE 11.7.6: *Corymbia citriodora* or *Eucalyptus crebra* woodland on lateritic duricrust.

Ecology

The life span of Hando's wattle plants in the wild is unknown, but they live for about 10 years in cultivation (Hando 2007). Plants have been collected in flower in July, August and September, and with pods in August, September and November. As a hard-seeded legume, the soil-stored seed reserves of Hando's wattle are likely to be long lived (i.e. > 10 years). The response to fire by Hando's wattle has not been well studied. However, it is suggested that it regenerates well from seed following burning (DNR 2000).

Records Relevant to the SGP

Seventeen records in Herbrecs with the nearest population 35 km east of the SGP within Barakula Sate Forest (Figure 4.3).

Rule(s) for Habitat Mapping:

1. Regional Ecosystems 11.7.4, 11.7.5, 11.7.6, 11.7.7 and 11.5.1 in the Central region of the SGP (North of Miles) should be classed as 'General Habitat' on account of the intensive survey undertaken in the SGP.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. Non-remnant and regrowth derived from these habitats are mapped as 'Absence Suspected'.

Mapping Confidence

High mapping confidence is applied to be species based on the revised mapping boundaries and detailed on-ground assessment.

Legend

Acacia handonis

NC Act, EPBC

- Vulnerable, Vulnerable
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.3. Spatial distribution of *Acacia handonis*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 | **Drawn By** DG | **Date** 24-Jul-23 | A4

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4.1.4 *Callitris baileyi* (Bailey's Cypress pine)

Near Threatened NC Act

Description

Callitris baileyi is a small native pine with rough bark. It's branchlets appear grooved due to the ridged leaves, 2 to 5 mm long. The cone has a point on the upper half of the outer surface.

Callitris baileyi (Photograph Paul Williams)

Distribution and Habitat

In Queensland, Baileys Cypress occurs from the state border to Goomeri in the north and west to the Bunya Mountains. The distribution is predominantly within the Southeast Queensland bioregion extending into the Brigalow Belt near the bioregional boundary (EHP 2017b). The species also occurs in the drier ranges of NSW.

Typical habitat is open woodland with *Eucalyptus exserta*, *E. crebra* and *Callitris glaucophylla* with a mid-dense shrubby understorey typical of RE 11.7.4. (Stanley and Ross 1983) describe its habitat as eucalypt woodland, with ironbark, blue gum and spotted gum on rocky slopes, mountainous areas, in shallow and often clay soils. Bailey's cypress can alson grow along riparian edges.

Ecology

Little is known concerning the ecology of this species. Male and female cones occur on the same tree and fruiting has been recorded all year round. This species is threatened by direct loss as a result of clearing as well as inappropriate fire regimes.

Records Relevant to the SGP

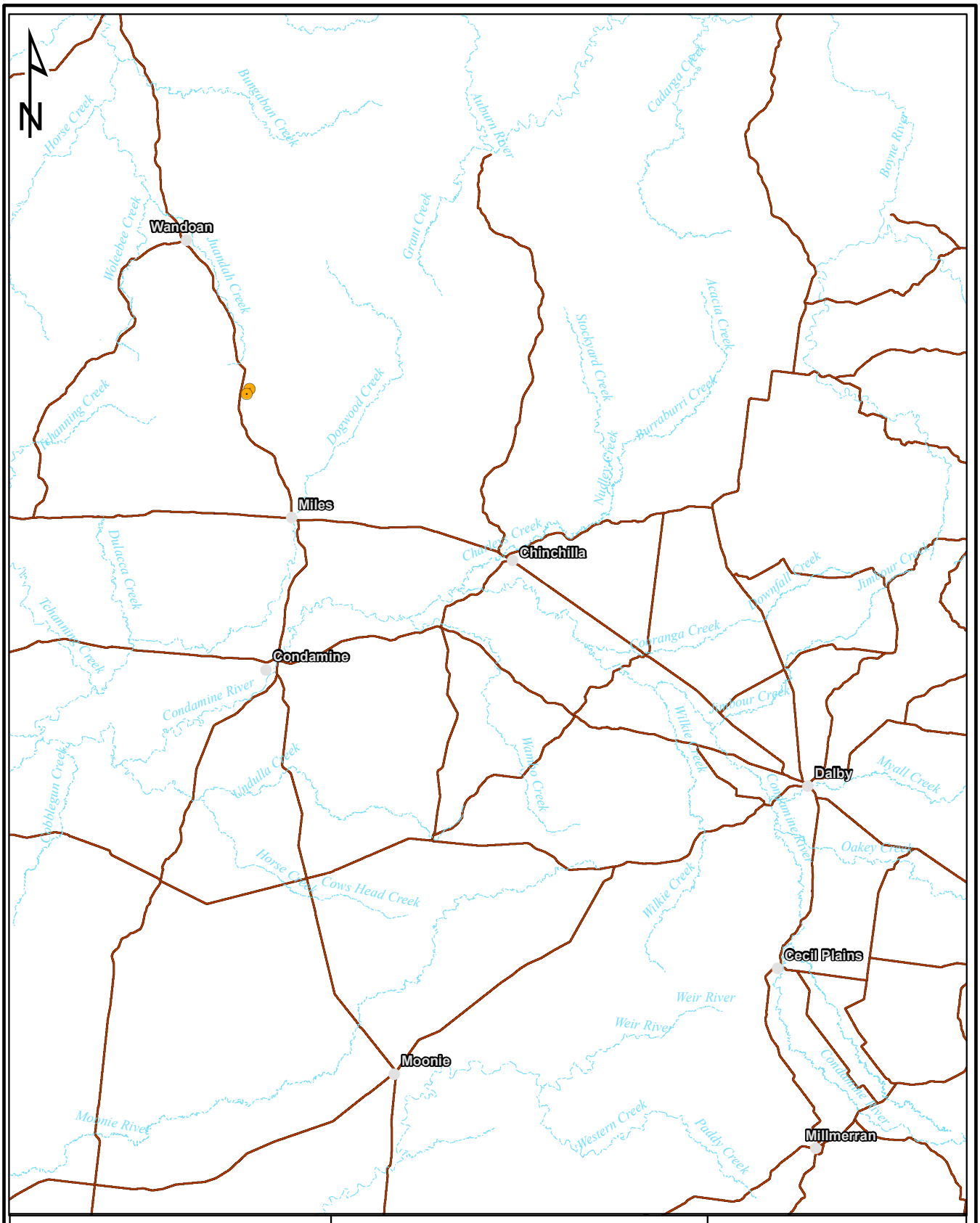
Nearest local record is 2.6 km west of the SGP (40 km north of Miles) in Gurulmundi State Forest (Figure 4.4). The record was collected during SGP EIS studies in 2011.

Rule(s) for Habitat Mapping:

1. Regional Ecosystems 11.7.4, 11.7.5, 11.7.6, 11.7.7 and 11.5.1 in the Central region of the SGP (North of Miles) should be classed as 'General Habitat' on account of the intensive survey undertaken in the SGP.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. Non-remnant and regrowth derived from these habitats are mapped as 'Absence Suspected'.

Mapping Confidence

The general nature of habitat for this species makes preferred habitats relatively easy to predict and habitat mapping for the species is considered to have high to moderate confidence.



Legend

Callitris baileyi

NC Act, EPBC Act

- Near Threatened, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.4. Spatial distribution of *Callitris baileyi*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 **Drawn By** DG **Date** 24-Jul-23 A4

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4.1.5 *Callitrix gurulmundensis* (Gurulmundi Fringe Myrtle)

Vulnerable EPBC Act (effective Jul 2000)
Vulnerable NC Act;

Distribution and Habitat

Gurulmundi fringe myrtle (*Calytrix gurulmundensis*). Copyright © Boobook

The species is endemic to the Gurulmundi and Barakula areas north of Chinchilla (Halford 1996). Gurulmundi fringe myrtle has been recorded growing in patches of shrubland on very shallow soils. Soils are lateritic sandstone ridges, which contain yellow sandy-clay that retains moisture (Williams 1979). Vegetation is predominately eucalypt, acacia, casuarina dense shrublands with spinifex, and spinifex grassland with scattered shrubs. This habitat description is consistent with RE 11.7.5 (shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks). The coordinates of Gurulmundi fringe myrtle collections derived from Herbrecs place them in areas mapped by as RE 11.7.4, 11.7.5, 11.7.6 and 11.7.7.

Ecology

The life span of Gurulmundi fringe myrtle is unknown, but it is likely to live for at least a decade. Flowers have been recorded from June to October (Halford 1996). Plants as small as 15 cm tall have been observed to flower (Williams 1979). Gurulmundi fringe myrtle can be quite common at sites where it grows, being described in several collection labels as abundant or co-dominant at the collection site (AVH 2023).

Records Relevant to the SGP

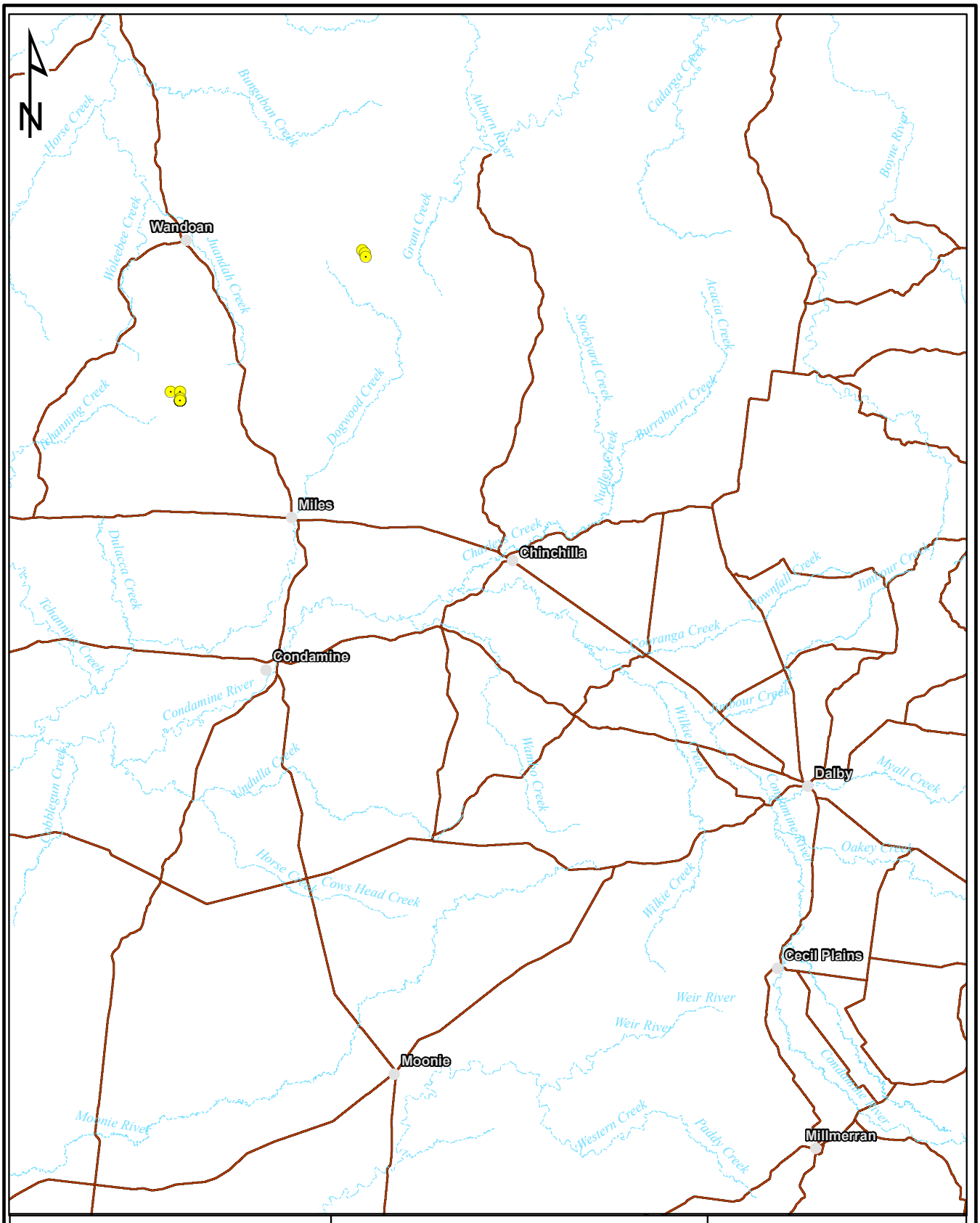
The nearest local record is 12 km west of the SGP (30 km north of Miles) within Gurulmundi State Forest. A population also exists in Waaje Scientific Reserve 36 km east of Wandoan (Figure 4.5).

Rule(s) for Habitat Mapping:

1. REs 11.5.1, 11.7.4, 11.7.5, 11.7.6 and 11.7.7 in the Gurulmundi area to the north of Chinchilla (-27.75) in the central SGP area should be considered 'General Habitat'.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. Other habitats including all regrowth and non-remnant habitats should be assigned to "Absence Suspected

Mapping Confidence

High mapping confidence is applied to be species based on the revised mapping boundaries and detailed on-ground assessment that did not locate any additional populations.



Legend

Calytrix gurulmundensis

NC Act, EPBC

- Vulnerable, Vulnerable
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.5. Spatial distribution of *Calytrix gurulmundensis*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 **Drawn By** DG **Date** 04-Sep-23 A4

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4.1.6 *Eucalyptus curtisii* (Plunkett Mallee)

Near Threatened NC Act

Description

Eucalyptus curtisii is a multi-stemmed "mallee" small eucalypt tree. The trunk is smooth with bark shedding in curled flakes. Leaves are narrow, flower buds contain four sepal teeth.

Distribution and Habitat

The plant is scattered but nowhere common occurring on coastal hinterland to 80 km north and south of Brisbane and inland over 300 km north west to the Dalby and Miles districts (DNR 2000). Occurs in the Burnett, Leichhardt, Moreton and Darling Downs pastoral districts (Bostock and Holland 2016). Conserved in Expedition Range, Robinson Gorge and Isla Gorge National Parks (Brooker and Kleinig 2004).

Eucalyptus curtisii (Photographs from Euclid)

(DES 2022b) suggests *Eucalyptus curtisii* has two growth forms that occur in different habitats with a shorter shorter mallee associated with shrublands dominanted by banksia in poorly drained lowland sites with a larger growth occurring as scattered individuals on better drained soils in the more open areas of mixed eucalypt forests. The species is most typically associated with lateritised landscapes within regional ecosystems 11.7.4 and 11.7.5. Commonly associated species include *C. trachyphloia, Eucalyptus exserta* and *Callitris endlicheri* and less commonly associated with *E. fibrosa*.

Ecology

Flowering of *Eucalyptus curtisii* has been recorded between the months of September and November, and fruiting occurs throughout the year (Queensland Herbarium, 2012 cited in DES 2022). Response to fire is not documented.

Records Relevant to the SGP

Not known from within the SGP but with numerous records to the west, the nearest being approximately 2. km from the SGP boundary and 35 km north of Miles. There are also a number of records in Kumbarilla State Forest to the south, although all records are well outside the SGP (Figure 4.6).

Rule(s) for Habitat Mapping:

1. Eucalyptus curtisii may occur throughout the entire SGP area.
2. Through the SGP, REs 11.7.2, 11.7.4, 11.7.5, 11.7.6 and 11.7.7 should be classified as 'General Habitat' in recognition of the extensive survey effort undertaken.
3. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
4. All other REs including regrowth and non-remnant vegetation should be classified as 'Absence Suspected'.

Mapping Confidence

Due to the extensive survey effort and known habitat preferences, mapping of *Eucalyptus curtisii* is attributed as having a high degree of confidence.

Legend

Eucalyptus curtisii

NC Act, EPBC Act

- Near Threatened, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.6. Spatial distribution of *Eucalyptus curtisii*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

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4.1.7 *Micromyrtus carinata* (Gurulmundi Heath-myrtle)

Endangered NC Act

Description

Micromyrtus carinata is a 2.5 m tall shrub with pendulous branches. Its tiny leaves overlap and small yellow flowers cluster along the ends of branchlets, the back of petals have a ridged keel (Bean 1997).

Micromyrtus carinata specimen (Image from Atlas of Living Australia)

Distribution and Habitat

Micromyrtus carinata is known only from Gurulmundi State Forest 40 km to the north of Miles with a sub-population located on the Wyona Property 10 km to the north of Miles .

Herbarium records indicate *Micromyrtus carinata* is associated with landscapes formed on lateritised sediments with an upper soil layer of red to yellow sand (DES 2022c). Associated regional ecosystems include inhabits the tops of laterised ridges, on shallow to deep, yellow or red sands. Associated habthitats include heath and shrubland (RE 11.7.5) and low woodland dominated by *Eucalyptus exserta, Corymbia trachyphloia* and *Callitris glaucophylla* (RE 11.7.4).

Ecology

Little is known regarding the ecology of this species. (Bean 1997) suggest it likely flowers at any time in response to rain although fruits and flowers have been collected between May and October (DES 2022c).

Records Relevant to the SGP

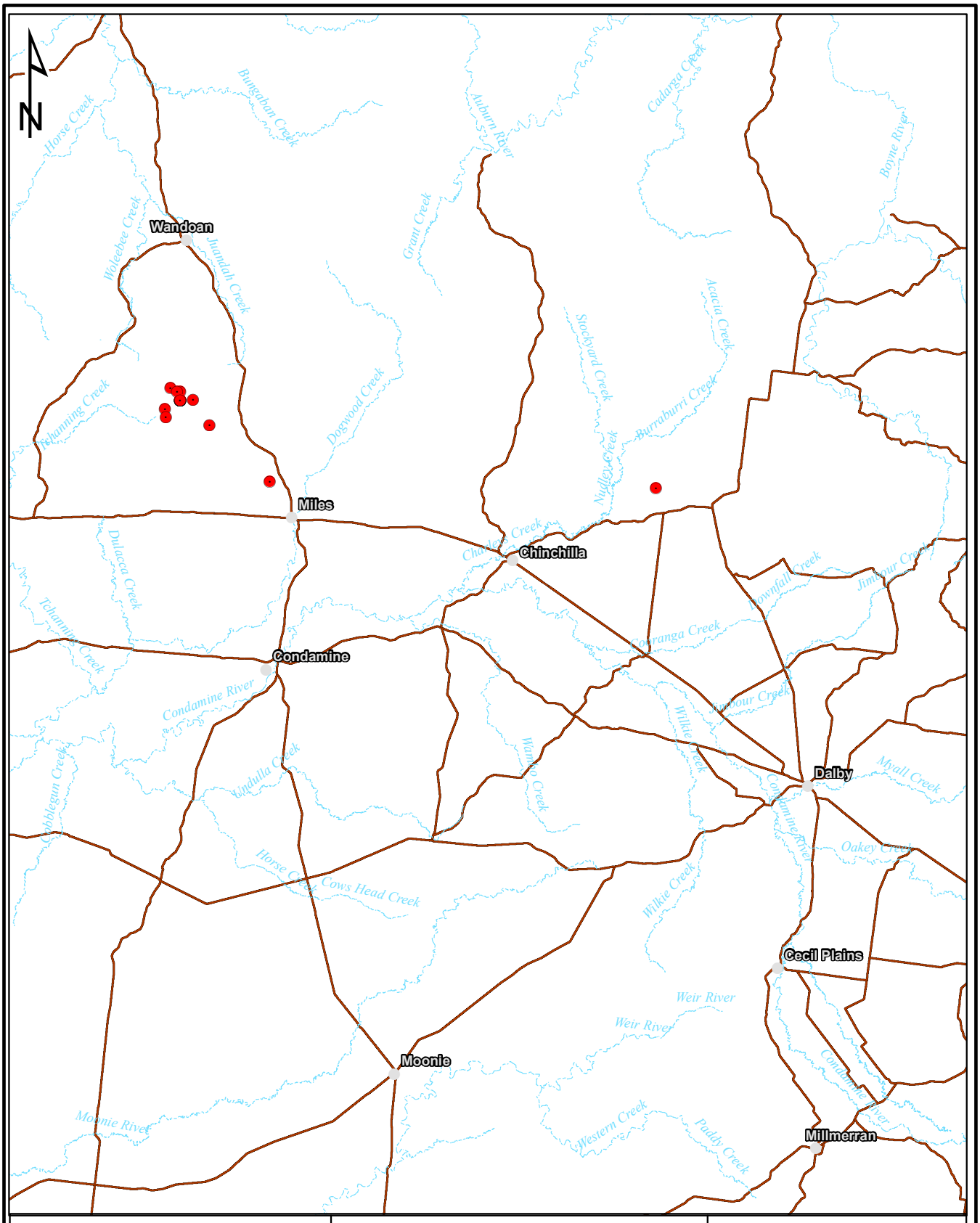
Nearest record is 10 km north-west of Miles and 4 km west of the SGP on the Wyona Property. The major population occurs in Gurulmundi State Forest 12 km west of the SGP (Figure 4.7).

Rule(s) for Habitat Mapping:

1. REs 11.7.4 and 11.7.5 in the Gurulmundi area to the north of Chinchilla (-27.75) in the central SGP area should be considered 'General Habitat'.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. Other habitats should be assigned to "Absence Suspected. Non-remnant and regrowth derived from these habitats are mapped as 'Absence Suspected'.

Mapping Confidence

High mapping confidence is applied to be species based on the revised mapping boundaries and detailed on-ground assessment that did not locate any additional populations.



Legend

Micromyrtus carinata

NC Act, EPBC Act

- Endangered, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.7. Spatial distribution of *Micromyrtus carinata*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 **Drawn By** DG **Date** 24-Jul-23 A4

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4.1.8 *Philotheca sporadica* (Kogan Waxflower)

Near Threatened NC Act

Description

Philotheca sporadica is an attractive small shrub with tiny spherical "club-shaped" leaves and showy white flowers.

Philotheca sporadica (Photograph David Stanton)

Distribution and Habitat

Philotheca sporadica is a local endemic, known only from the Dalby-Kogan district in south-east Queensland. It has been collected over a 25 km distance, from Kumbarilla State Forest south-west of Dalby, to north-west of Kogan (TSSC 2008a; AVH 2023). This species main populations occur within Arrow's lease.

Field surveys indicate Philotheca sporadica occurs almost exclusively within RE 11.7.4 (*Eucalyptus decorticans* and/or *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp., *Lysicarpus angustifolius* on lateritic duricrust) and RE 11.7.5 with a few individual plants overlapping with RE 11.7.7. The species has a tendency to form dense, locally restricted populations, particularly on scalded areas with limited soil on latrite rocks. Typical density is 10 to 20 plants per 10 m by 10 m area.

Ecology

Philotheca sporadica is a woody shrub with a lifespan of at least several years, probably typically over a decade. It prefers skeletal soils, especially associated with lateritic geologies. (Halford 1996) indicated *Philotheca sporadica* plants shrubs survive fire by coppicing regrow from the base of stems. Plants have also been observed regrowing after mechanical disturbance along powerline tracks. Therefore, *Philotheca sporadica* has a capacity for multiyear persistence at a site following moderate disturbance of above ground parts, however will likely be killed by disturbance to roots.

Records Relevant to the SGP

The majority of *Philotheca sporadica* plants grow within the Arrow lease, concentrated within a 10 km radius of Kogan, on its eastern side (Figure 4.8). These plants grow on private land and State Forest. Populations may cover extensive areas although the margins of populations are generally discrete.

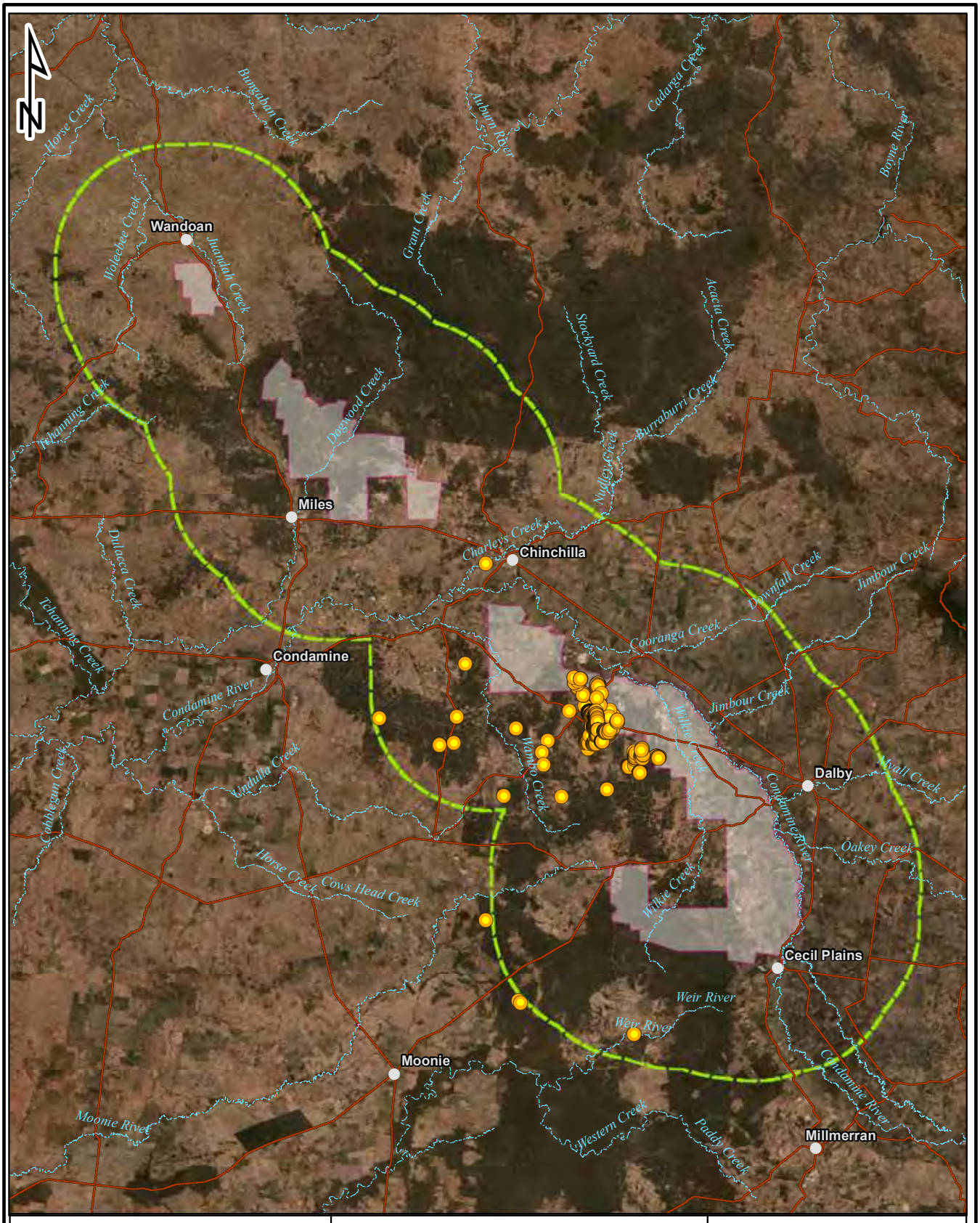
Rule(s) for Habitat Mapping:

1. The species will most likely occur within a 25 km wide buffer surrounding Kogan although cannot be discounted as occurring within suitable habitats throughout the SGP.
2. REs 11.7.4, 11.7.5 and 11.7.7 are classified as "Core habitat Possible" within 25 km from Kogan.

3. Regrowth habits (non-remnant) derived from RE 11.7.4, 11.7.5 and 11.7.7 within 25 km from Kogan are classified as "General Habitat'.
4. All areas of RE 11.5.1 within 25 km from Kogan are classified as 'General Habitat'.
5. All 'Core Habitat Possible' and 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
6. The remaining areas of RE 11.7.4 throughout the SGP are classified as 'General Habitat'
7. All other areas are classified as 'Absence Suspected'.

Mapping Confidence

The detailed ground surveys undertaken throughout habitats for this species in the SGP area and highly localised populations gives habitat mapping a high confidence.



Legend

Philotheca sporadica

NC Act, EPBC

- Near Threatened, Vulnerable
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.8. Spatial distribution of *Philotheca sporadica*

Client ARROW ENERGY

0 15 30 45 60
Kilometers

Scale 1:1,050,026 | **Drawn By** DG | **Date** 30-Jul-23 | A4

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4.2 GRASSES AND SEDGES

4.2.1 *Digitaria porrecta* (Finger Panic Grass)

Near Threatened NC Act

Description

Digitaria porrecta is a perennial grass with a panicle-type seed head. The plant base, nodes along the stem and seeds are hairy. Most lower arms of the seed head are branched, which distinguishes *Digitaria porrecta* from similar species of Digitaria.

Digitaria porrecta seed head – note branching on lower arms (Photograph by David Stanton)

Digitaria porrecta seed (Photograph Paul Williams)

Distribution and Habitat

Finger panic grass is known from four disjunct areas extending over 1000 km across NSW and Queensland. The Queensland distribution includes broad populations in the Nebo district; the Central Highlands between Springsure and Rolleston; and from Jandowae south to Warwick. In NSW, it is known from near Inverell, south to the Liverpool Plains near Coonabarabran and Werris Creek (TSSC 2008a).

Finger panic grass grows in grasslands, woodlands and open forests with a grassy understory, on black soil plains of the Darling Downs, and lighter textured soils to the west (Goodland 2000; Fensham 1998). Fensham (1998) found it is most abundant in grassland, but is "relatively unspecific" in its habitat preference. It is not restricted to high quality native grasslands, but also grows along roadsides and can be found in highly disturbed sites (Goodland 2000). Finger panic grass been recorded inside the project development area, within roadside remnant grasslands on dark cracking clay plains (RE 11.3.21); poplar box (*E. populnea*) open forest and woodland with grassy understorey, on dark cracking clay plain (RE 11.3.2); and along disturbed railway reserves on dark cracking clay soils (DEHP 2013). The primary habitats for this species in the project development area are RE 11.3.2, RE 11.3.21 and non-remnant derived grasslands.

Ecology

Finger panic grass is a spreading perennial that can reproduce vegetatively (Halford 1995b). Older clumps are reported to die in the centre, with the outer edges of the clump becoming separate plants. Seeds drop to the ground when mature, but appear to have a six month to one year dormancy prior to germinating (Halford 1995b). This is similar to some other sub -

tropical grasses, such as black spear grass, and delays germination until the wet season rains. The species produces fertile material from March to April (TSSC 2008f).

Records Relevant to the SGP

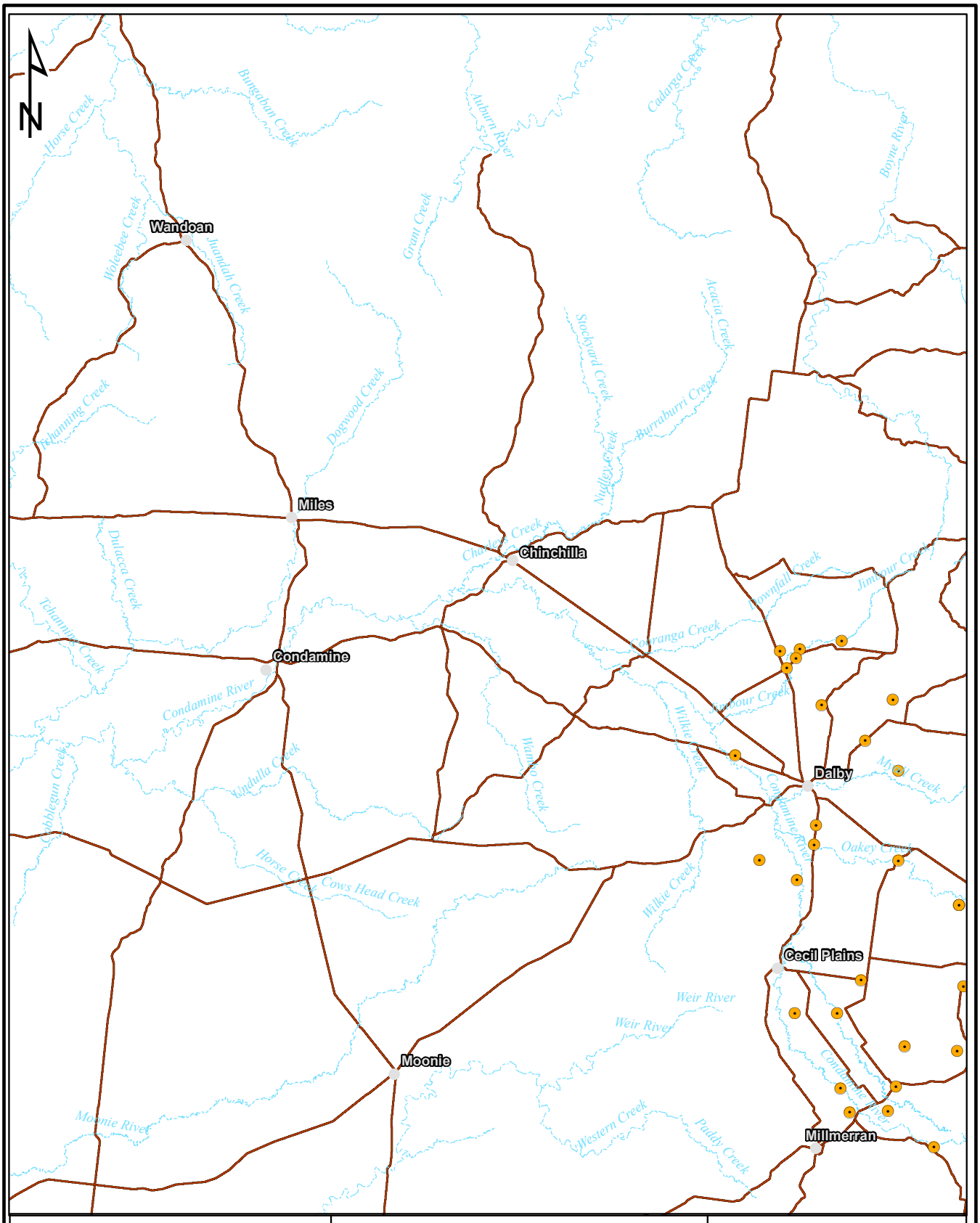
Two records within the SGP, both in non-remnant derived grasslands adjacent to roadside easements between Dalby and Cecil Plains. Both records collected in 1995. A further 15 records located outside the SGP, approximately 25 km to the east (Figure 4.9).

Rule(s) for Habitat Mapping:

1. The species is most likely to occur on heavy clay soils associated with the Condamine Alluvium although may occur throughout the entire SGP.
2. Regional Ecosystem 11.3.2 should be treated as 'General Habitat'.
3. Derived native grassland where it is associated with the Condamine Alluvium or other heavy clay soil should be considered 'General Habitat'.
4. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
5. All other remnant vegetation in the project development area and all cleared agricultural and grazing land should be treated as 'Absence Suspected'.

Mapping Confidence

Digitaria porrecta has relatively predictable habitat preferences and with the availability of project scale mapping (1:50 000), it is considered that the habitat mapping has a high level of confidence. It should be noted that no records of the species have been formally documented since 1995.



Legend

Digitaria porrecta

NC Act, EPBC Act

- Near Threatened, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.9. Spatial distribution of *Digitaria porrecta*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 **Drawn By** DG **Date** 25-Jul-23 A4

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4.2.2 Fimbristylis vagans

Endangered NC Act

Description

Fimbristylis vagans is a small sedge with rhizomes and branching seed heads.

Distribution and Habitat

A little-known Queensland endemic restricted to the Darling Downs between Lake Broadwater and Nudley Creek (30 km NE of Chinchilla) (DEHP 2013). The species occupies habitats fringing ephemeral watercourses and lagoons on alluvium, typically RE 11.3.2, 11.3.4, 11.3.14, 11.3.26 and 11.3.27. The species is not known to be associated with non-remnant habitats.

Ecology

Species ecology is poorly documented although like most species associated with wetland habitats, is likely to be a seasonally dependent species that flowers and reproduces following rainfall.

Fimbristylis vagans specimen (Image by Queensland Herbarium)

Records Relevant to the SGP

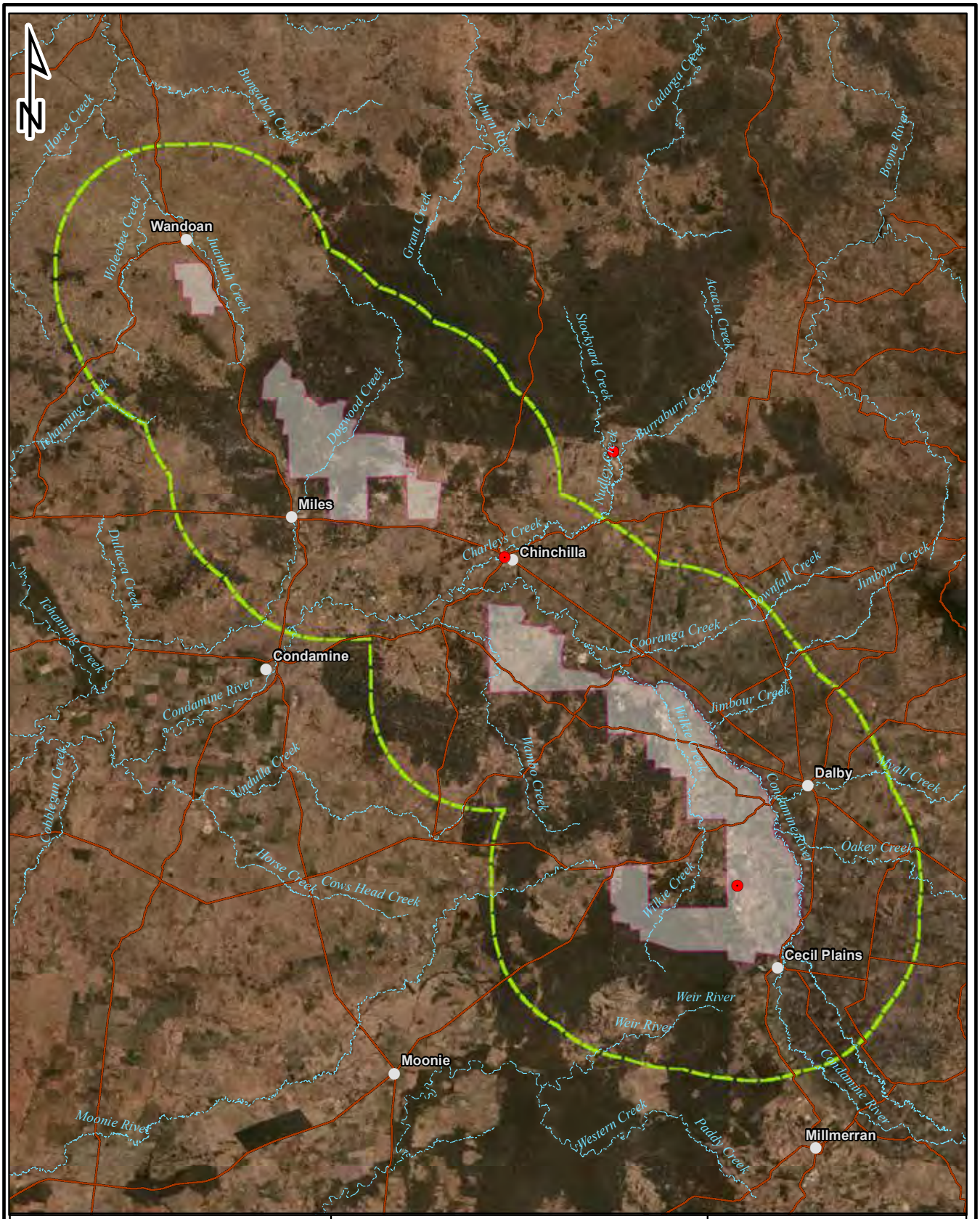
A single herbarium record from the SGP associated with the swampy inlet of Lake Broadwater (Figure 4.10). The species has not been recorded or collected since 1984.

Rule(s) for Habitat Mapping:

1. The species may occur throughout the entire SGP.
2. 'Core Habitat Possible' includes the wetland fringe of Lake Broadwater characterised by RE 11.3.27f and wetland habitats of Long Swamp.
3. REs 11.3.2, 11.3.3, 11.3.4, 11.3.14, 11.3.25 and 11.3.26 throughout the SGP are classified as 'General Habitat'.
4. All Core Habitat Possible and General Habitat within 1 km of a recent (1950+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
5. All remaining remnant and non-remnant vegetation is mapped as 'Absence Suspected'.

Mapping Confidence

Habitat characteristics for this species are well understood and can be matched to regional ecosystem descriptions. The mapping is considered to be highly accurate.



Legend

Fimbristylis vagans

NC Act, EPBC Act

- Endangered, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.10. Spatial distribution of *Fimbristylis vagans*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

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4.2.3 *Homopholis belsonii* (Belson's Panic)

Vulnerable EPBC Act (effective Jul 2000)
Endangered NC Act

Description

Homopholis belsonii is a 0.5 m tall perennial grass that spreads vegetatively via stolons. The ligule, where the base of leaves join the stem, are clear membranes rather than hairs. Its seedheads are a branched panicle, with seeds only at the ends of each arm.

Homopholis belsonii (Belson's panic). Copyright © Boobook

Distribution and Habitat

In Queensland, major populations occur on the Darling Downs near Oakey, Jondaryan, Bowenville, Dalby, Acland, Sabine, Quinalow, Goombungee, Gurulmundi and Millmerran, and further west between Miles and Roma (Goodland 2000). Also known from the north-western slopes and plains of NSW (TSSC 2008b).

Belson's panic prefers moderate to highly fertile soils, especially those derived from basalt and fertile alluvial flats. It is generally associated with poplar box and brigalow woodlands on light red/brown earths (Goodland 2000; Fensham and Fairfax 2003). Based on Herbrecs specimens, the species is most commonly associated with habitats on heavy clay soils, particularly those dominated by Brigalow including REs 11.3.1, 11.3.17, 11.4.3, 11.9.5 ad 11.9.10. Herbarium records also indicate some potential for the species to overlap with RE 11.3.2.

Belson's panic is also capable of growing within disturbed habitats. Of the 22 collections within the study area, 15 (68%) are located in non-remnant areas such as roadside easements. It has been seen growing among fallen timber at the base of trees or shrubs, among branches and the bottom of netting fences (TSSC 2008b).

Ecology

Belson's panic tends to grow in shade under trees but can also grow in cleared regrowth. As a rhizomatous perennial grass, it probably is capable of living for many years, and to have some tolerance to fire and at least low levels of grazing. It is reported to spread out very rapidly (Menkins 1998). Flowers have been recorded between February and May (Sharp and Simson 2002).

Records Relevant to the SGP

A considerable number of records to the east of Dalby with the nearest 12 km from the eastern boundary of the SGP. Two records within 8 km of the boundary of the northern SGP area within 10 km of Wandoan (Figure 5.1). There is a single record of the species in the Arrow threatened species database from near Weroona in the central region of the SGP, plus several recent unvouchered records along the Moonie Highway west of Dalby.

Rule(s) for Habitat Mapping:

1. The species may occur throughout the entire SGP although is most likely to occur in Brigalow associated habitats in the northern SGP area.
2. Regional Ecosystems 11.9.5, 11.9.10 and 11.3.17 including derived non-remnant regrowth is mapped as 'Core Habitat Possible' in the northern SGP area.
3. REs 11.3.1, 11.3.17, 11.4.3 and 11.9.5 including non-remnant derived regrowth in central and southern SGP areas are classified as 'General Habitat'.
4. All Core Habitat Possible and General Habitat within 1 km of a recent (1950+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
5. All remaining remnant and non-remnant vegetation is mapped as 'Absence Suspected'.

Mapping Confidence

Due to the relatively specific habitat requirements, detailed survey throughout the SGP area and resolution of the revised mapping database, mapping is considered to have a high degree of confidence.

Legend

Homopholis belsonii

NC Act, EPBC

- Endangered, Vulnerable
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.11. Spatial distribution of *Homopholis belsonii*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 **Drawn By** DG **Date** 30-Jul-23 A4

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4.3 FORBS AND HERBS

4.3.1 Cryptandra ciliata

Near Threatened NC Act

Description*Cryptandra ciliata* is a woody herb growing to 50 cm in height, with hairy young branchlets. It has tiny (3 mm long) leaves that cluster at the end of branches. Leaf margins are recurved obscuring much of the lower surface. Tiny, hairy white flowers are produced in leaf axils near the ends of branchlets.

Cryptandra ciliata specimen (Image from *Atlas of Living Australia)*

Distribution and Habitat

Restricted to the Gurulmundi, Barakula and Cracow areas of south-eastern Queensland (DNR 2000; Chinchilla Field Naturalists Club 2017). Typical habitat is eucalypt dominant woodland, lancewood (*Acacia shirleyi*) woodland and Triodia grassland on rocky on low lateritic and sandstone ridges. Habitat in the SGP is consistent with RE 11.7.5, 11.7.4, 11.7.6, 11.5.1, 11.5.4, 11.5.21.

Ecology

There is little documented information on the ecology of this species.

Records Relevant to the SGP

Three herbarium records within 5 km of the SGP boundary with a single record within 1 km of the eastern boundary, 30 km to the north of Miles (Figure 4.12).

Rule(s) for Habitat Mapping:

1. The species is only likely to occur in the central SGP area where the following REs should be treated as 'General Habitat'; 11.5.1, 11.5.4, 11.5.21, 11.7.4, 11.7.5, 11.7.6 and 11.7.7.
2. All General Habitat within 1 km of a recent (1950+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
3. All other remnant vegetation in the project development area, regrowth vegetation and cleared agricultural land should be treated as 'Absence Suspected'.

Mapping Confidence

Due to the general habitat requirements, intensity of the field survey and detailed mapping revision available, mapping is considered to have a high degree of confidence.

Legend

Cryptandra ciliata

NC Act, EPBC Act

- Near Threatened, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.12. Spatial distribution of *Cryptandra ciliata*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

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4.3.2 Cymbonotus maidenii

Endangered NC Act

Description

Cymbonotus maidenii is a yellow flowered daisy with deeply toothed leaves forming a rosette at ground level. The underside of the leaves are hairy.

Cymbonotus maidenii (Photo from iNaturalist)

Distribution and Habitat

The species occurs in scattered populations throughout central areas of NSW and in southern inland districts as far west as Mitchell (Holland and Funk 2006).

The species is associated with a range of remnant and non-remnant habits with records occurring on disturbed roadside drains, native and derived grasslands. It is typically associated with heavy brown to grey cracking clay soils (Holland and Funk 2006). Habitats favoured by the species are RE 11.3.21 from which it is known to occur. The woodland RE 11.3.2 and derived native grassland also present potential habitat for the species. It can however occur in a range of highly disturbed locations and hence its occurrence may not be readily predicted.

Ecology

Other than being a perennial, very little is known about this species although, though as a daisy it is probably fairly short-lived (e.g. living < 5 years). The species is known to flower throughout the year but most prominently in spring, possibly in response to rainfall. The seeds are likely to be wind dispersed, which should assist colonisation. It has the ability to survive along disturbed roadsides in in other highly disturbed habitats.

Records Relevant to the SGP

Five Herbrecs specimens recorded within 10 km of the eastern boundary of the SGP area, mostly in the Cecil Plains / Millmerran Area including collections on road reserves on the Cecil Plains - Millmerran Road (Figure 4.13).

Rule(s) for Habitat Mapping:

1. The species is most likely to occur from the Dalby area (-27.00) south to Millmerran (-27.9) generally on the Condamine Alluvium.
2. RE 11.3.2 , derived regrowth of RE 11.3.2, and associated derived grasslands occurring between in this area should be treated as 'General Habitat'.
3. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.

4. All other remnant vegetation and cleared agricultural land in the SGP should be treated as 'Absence Suspected'.

Mapping Confidence

Due to the relatively specific habitat requirements, detailed survey throughout the SGP area and resolution of the revised mapping database, mapping is considered to have a high degree of confidence. There may however be a number of potential habitats adjacent to roadsides that are beyond mapping resolution.

Legend

Cymbonotus maidenii

NC Act, EPBC Act

- Endangered, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.13. Spatial distribution of *Cymbonotus maidenii*

Client ARROW ENERGY

0 15 30 45 60
Kilometers

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4.3.3 Picris barbarorum

Vulnerable NC Act

Description

Picris barbarorum is a yellow flowered daisy with small flower heads. Leaves are rough and hairy.

Distribution and Habitat

Occurs from the Darling Downs and Warrego pastoral districts in southern Queensland (Bostock and Holland 2016), to north of the north-west plains of NSW. In the Darling Downs, it has a restricted distribution but may be locally abundant. Known to occur from the Jandowae, Macalister, Norwin localities and along the Warrego highway west of Dalby.

Herbrecs specimens indicate occurrence in native grassland (RE 11.3.21) of *Dichanthium sericeum* in stock routes, road reserves adjacent to disturbed areas such as cultivated paddocks and road and rail lines on black clay soil (DEHP 2013).

Picris barbarorum specimen (Image from Atlas of Living Australia)

Ecology

Poorly known, though as a daisy probably short-lived (e.g. < 5 years). Flowering phenology not documented though likely to be re-invigorated in response to rainfall, particularly in spring.

Records Relevant to the SGP

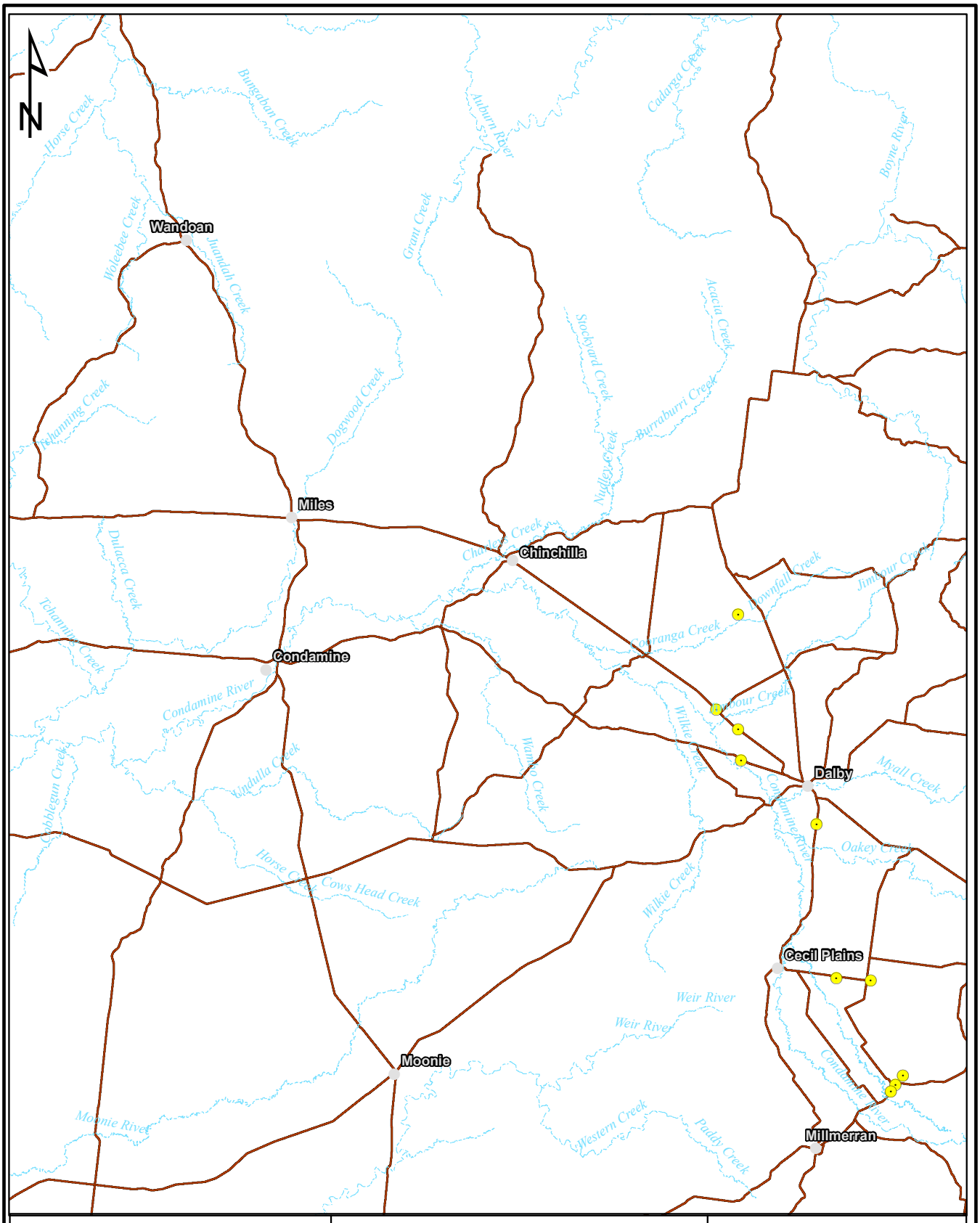
Four herbarium records within 5 km of the SGP with the nearest less than 2 km from the SGP boundary, 14 km north-west of Dalby (Figure 4.14).

Rule(s) for Habitat Mapping:

1. The following REs and habitats should be classified as 'General Habitat' where they are in association with the Condamine Alluvium.
   - RE 11.3.2 and derived regrowth vegetation.
   - Non-remnant derived native grasslands
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. All other remnant and non-remnant vegetation should be treated as 'Absence Suspected'.

Mapping Confidence

Due to the relatively specific habitat requirements, detailed survey throughout the SGP and resolution of the revised mapping database, mapping is considered to have high accuracy. However, there may be a number of potential habitats adjacent to roadsides that are beyond mapping resolution.



Legend

Picris barbarorum

NC Act, EPBC Act

- Vulnerable, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.14. Spatial distribution of *Picris barbarorum*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

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4.3.4 Rutidosis glandulosa

Near Threatened NC Act

Description

Rutidosis glandulosa is a 40 cm tall herb, with glandular hairy (not pale woolly) stems and leaves (Holland 1999). Its leaves are approximately 7 cm long and 0.5 cm wide. It has yellow-orange daisy flowers and has been recorded flowering or seeding in most months of the year. It is distinguished from similar species by the dense glandular hairs and yellow-orange flower head.

Rutidosis glandulosa specimen (Image from Atlas of Living Australia)

Distribution and Habitat

Known locations of *Rutidosis glandulosa* populations are scattered from near Stanthorpe to the Blackdown Tablelands, west of Rockhampton.

Records Relevant to the SGP

The species has recently been recorded (though without a vouchered specimen) near a road edge adjacent to Dalby State Forest, on the Dalby-Kogan Road, about 13 km south-east of Kogan (Figure 4.15). Near the lease, it is also known from Barakula State Forest where is grows in ironbark woodland on plains.

Ecology

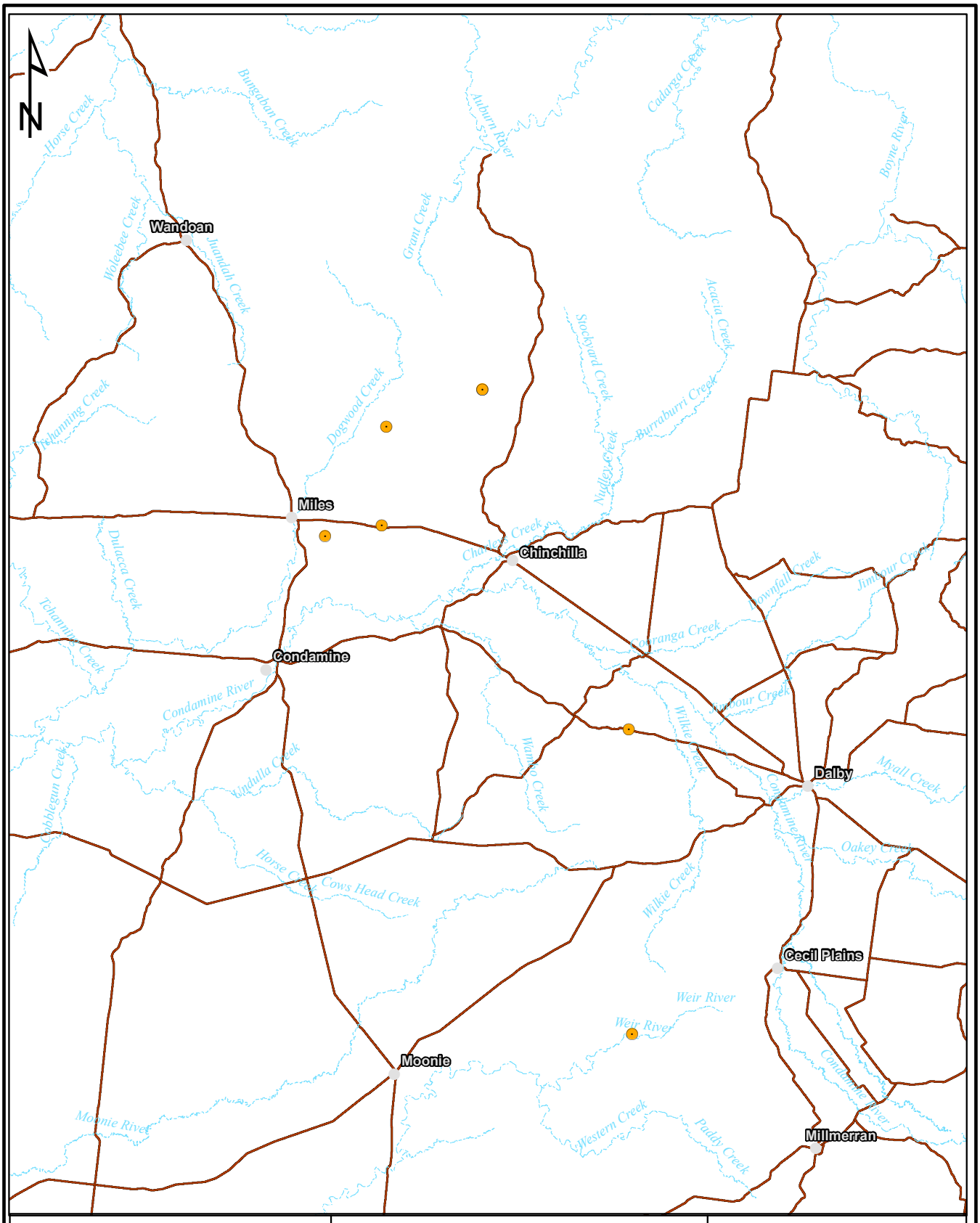
Rutidosis glandulosa grows in eucalypt woodlands, especially near sandstone on sandy or skeletal soils. It recruits in areas of soil disturbance, such as road edges (Barker 1997).

Rule(s) for Habitat Mapping:

1. The following REs and habitats should be classified as 'General Habitat'. REs 11.9.9 (including regrowth derived from this RE) and 11.5.4 (including derived regrowth).
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. All remaining remnant and non-remnant vegetation is mapped as 'Absence suspected'.

Mapping Confidence

The primary feature of vegetation containing *Rutidosis glandulosa* is of sandy or gravelly soil dominated by a mix of eucalypts, and often on road edges. These features are not specific to a small number of REs and therefore it is likely *Rutidosis glanudulosa* may also grow in REs not listed here. Therefore there is a low confidence in correlating this species distribution with specific REs.



Legend

Rutidosis glandulosa

NC Act, EPBC

- Near Threatened, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.15. Spatial distribution of *Rutidosis glandulosa*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 **Drawn By** DG **Date** 25-Jul-23 A4

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4.3.5 Rutidosis lanata

Vulnerable NC Act

Description

Rutidosis lanata is a yellow flowered daisy which grows to about 30 cm tall. The stems and lower leaf surface are pale and woolly. Leaves are 1-4.5 cm long, margins can be wavy but are not recurved (as they are in *Rutidosis galndulosa*).

Rutidosis lanata specimen (Image from Atlas of Living

Distribution and Habitat

Endemic to south central Queensland from near Jackson to Hannaford on the western Darling Downs (DNR 2000). Mainly found in roadside vegetation of Acacia and Eucalypt woodland/open forest on red sandy ridges and clay flats between 280-320 m altitude adjacent to cleared or partly cleared grazing and cropping land (DNR 2000). Based on Herbrecs notes, associated vegetation includes open grassy woodland of *Eucalyptus populnea* with *Eremophila mitchellii; Acacia harpophylla, Casuarina cristata*, and *Eucalyptus woollsiana* woodland on reddish-brown loamy clay; remnant *Acacia harpophylla, Eucalyptus coolabah, Eucalyptus populnea* open forest on alluvium clay loam and gentle sedimentary rises; and in cleared areas along powerlines adjoining *Acacia aprepta* thicket.

Ecology

Rutidosis lanata flowers and fruits from October to March and produces a soil-stored seed bank that lasts for less than one year (DES 2022d).

Records Relevant to the SGP

Eight Herbarium records within 20 km from the SGP, all recorded in the Miles / Chinchilla area (Figure 4.16).

Rule(s) for Habitat Mapping:

1. The species may occur throughout the entire project area although is more likely north from Chinchilla based on vouchered herbarium records. Throughout the SGP, the following REs should be treated as 'General Habitat'; 11.3.4, 11.3.2, 11.3.17, 11.9.5 and 11.9.7.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. All other remnant vegetation in the project development area, regrowth vegetation and cleared agricultural land should be treated as 'Absence Suspected'.

Mapping Confidence

Due to the relatively specific habitat requirements, detailed survey throughout the SGP and resolution of the revised mapping database, mapping is considered to have a high degree of confidence.

Legend

Rutidosis lanata

NC Act, EPBC Act

- Near Threatened, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.16. Spatial distribution of *Rutidosis lanata*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 | **Drawn By** DG | **Date** 25-Jul-23 | A4

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4.3.6 Solanum papaverifolium

Endangered NC Act

Description

Solanum papaverifolium is a prickly herb with deeply lobed leaves 4-7 cm long and 3-5 cm wide. The stems and leaves lack star shaped hairs (present on *Solanum stenopterum*). Flowers are purple, with 12 to 40 prickles on the calyx (i.e. the outer sepals of the flower).

Solanum papaverifolium (Photo D. Stanton)

Distribution and Habitat

Recorded from three locations between Jimbour and Warwick (Bean 2004) as well as a number of old records in the Dalby-Cecil Plains area. Goodland (2000) reports two populations west of Dalby on the Warrego Highway before Kogan Rd, and large populations up to 100 m in extent off Cecil Plains Rd. Also occurs in in NSW (Bean 2004). Occupies wetter areas of grasslands or eucalypt woodland on heavy alluvial soils (Goodland 2000; Bean 2004).

Ecology

Little is documented on the ecology of the species. It has been observed flowering throughout the year and populations are most likely rejuvenated following rainfall. The species occurs on soils utilised by intensive agriculture and remains on roadside reserves and stock routes. Populations remain threatened by habitat destruction, weed invasion, and roadworks (Goodland 2000; Bean 2004).

Records Relevant to the SGP

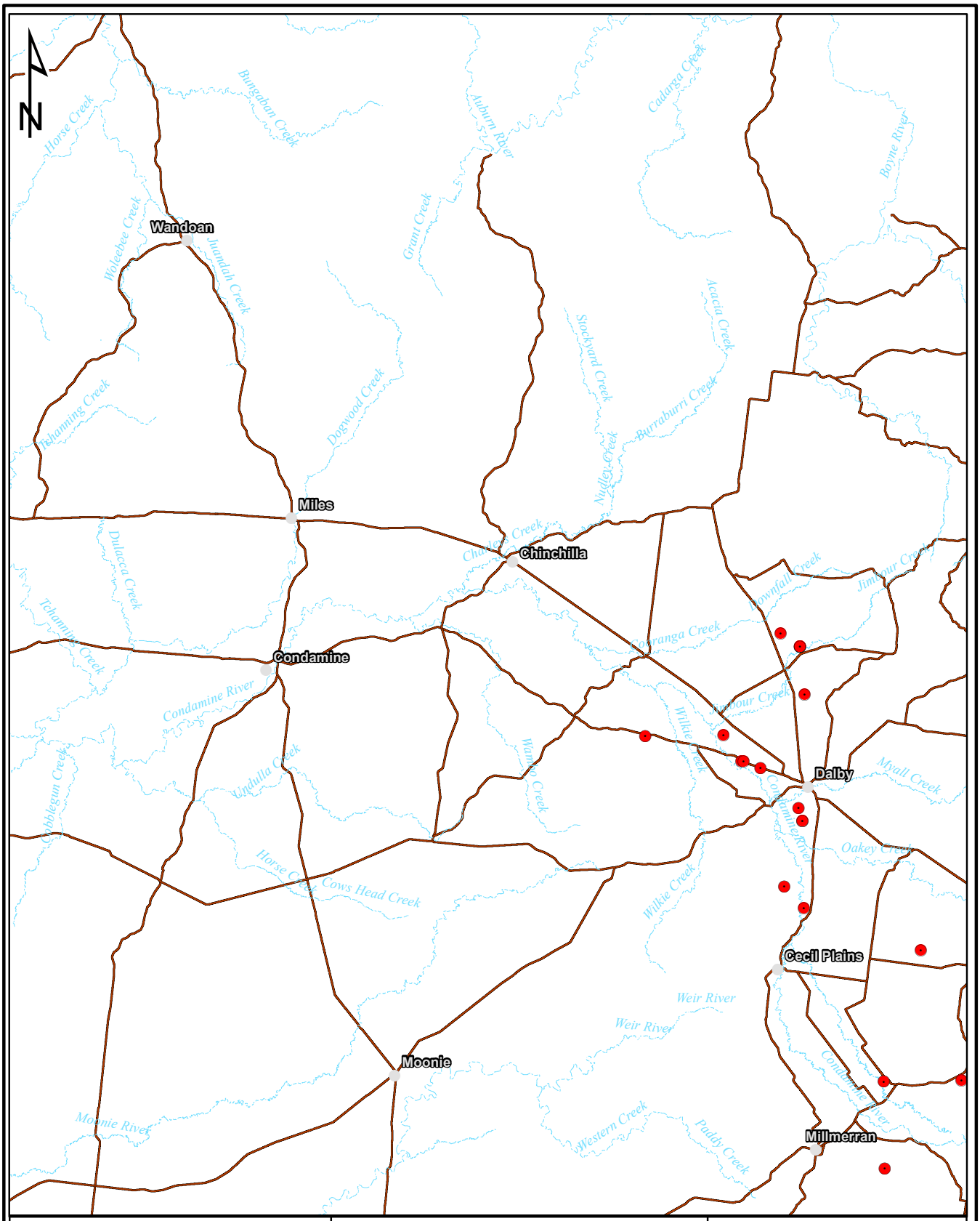
Two records are contained within the SGP assessment area to the south of Dalby with an large number of herbarium records to the east of the SGP assessment area between Chinchilla and Dalby (Figure 4.17).

Rule(s) for Habitat Mapping:

1. The species is most likely to occur on habitat formed by heavy clay soils associated in particular with the Condamine Alluvium.
2. Regional Ecosystems 11.3.2 and Derived Native Grassland (non-remnant) provide the most suitable habitats for the species. Where these habitats occur on the alluvial landforms to the west and south of Dalby, they are mapped as "General Habitat".
3. All General Habitat within 1km of a recent (1980+), accurate (± 500m) record is classed as "Core Habitat Known".
4. All remaining remnant and non-remnant vegetation is mapped as "Absence Suspected".

Mapping Confidence

Due to the relatively specific habitat requirements, detailed survey throughout the assessment area and resolution of the revised mapping database, mapping is considered to have a high degree of confidence.



Legend

Solanumn papaverifolium

NC Act, EPBC Act

- Endangered, Not Listed
- Major Watercourse
- Major Roads
- SGP_Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.17. Spatial distribution of *Solanum papaverifolium*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 | **Drawn By** DG | **Date** 5/09/2023 | A4

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4.3.7 Solanum stenopterum

Vulnerable NC Act

Description

Solanum stenopterum is a prickly herb growing to 40 cm tall. Leaves are lobed, 3 to 7 cm long, with star-shaped hairs on the lower surface. Both the upper and lower leaf surfaces have between 1 and 15 prickles. Flowers are purple.

Solanum stenopterum specimen (Image from Atlas of Living Australia)

Distribution and Habitat

Recorded in Queensland from Gayndah in the Burnett Pastoral district to Moonie and west to Glenmorgan and Yuleba (Bean 2004; Bostock and Holland 2016). Known in NSW from Ashford (Bean 2004). The species is Known to occur in non-remnant grassland approximately 7.5 km south of Dalby; 3.5 km east of Cecil Plains in a roadside gravel pit; and approximately 6 km south east of Cecil Plains in remnant Eucalyptus populnea woodland on alluvium (11.3.2).

Ecology

Little is documented on the ecology of the species although similar to many solanum species in the Brigalow Belt, likely flowers at multiple times throughout the year in response to rainfall events.

Records Relevant to the SGP

Known to occur in non-remnant grassland approximately 7.5 km south of Dalby; 3.5 km east of Cecil Plains in a roadside gravel pit; and approximately 6 km south east of Cecil Plains in remnant *Eucalyptus populnea* woodland on alluvium (RE 11.3.2). All herbarium records are outside SGP (Figure 4.18).

Rule(s) for Habitat Mapping:

1. REs 11.3.2, 11.3.1 and 11.3.17 to the west and south of Dalby should be classed as 'General Habitat' on account of comprehensive surveys.
2. Regrowth vegetation derived from RE 11.3.2, 11.3.1 and 11.3.17 south and west of Dalby are classed as 'General Habitat'.
3. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
4. All other vegetation is mapped as 'Absence Suspected'.

Mapping Confidence

Due to the relatively specific habitat requirements, detailed survey throughout the SGP and resolution of the revised mapping database, mapping is considered to have a high degree of confidence.

Legend

Solanum stenopterum

NC Act, EPBC

- Vulnerable, NA
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.18. Spatial distribution of *Solanum stenopterum*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 | **Drawn By** DG | **Date** 24-Jul-23 | A4

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4.3.8 *Thesium australe* (Austral Toadflax)

Vulnerable EPBC Act (effective Jul 2000)
Vulnerable NC Act

Distribution and Habitat

Historical collections (including the late 1800's) were made from Tasmania, but it is now considered extinct in that state (DSE 2003). Austral Toadflax occurs in eastern Victoria, NSW and southern Queensland. The majority of southern Queensland collections are from the Darling Downs and Moreton districts (Bostock and Holland 2016). The Dalby area represents the species western limits on the Darling Downs.

Austral toadflax has been collected within popular box (*Eucalyptus populnea*) woodland on alluvial flats (RE 11.3.2) north-west of Dalby, within the project development area. Other Herbarium collection records of Austral toadflax are from along roadsides, mountain coolibah (*Eucalyptus orgadophila*) grassy open woodlands with kangaroo grass (*Themeda triandra*) and Queensland blue grass (*Dichanthium sericeum*). RE 11.3.2 in the Dalby region is considered the most likely habitat in the SGP.

Ecology

A root parasite of kangaroo grass (*Themeda triandra*) and other grasses, Austral toadflax lives for at least two years. Flowers have been recorded from spring to autumn with fruit developing in summer. Austral toadflax has been observed to germinate prolifically after fire and also after drought. The species is relatively short lived, persisting up to two years after germination (DSE 2003).

Records Relevant to the SGP

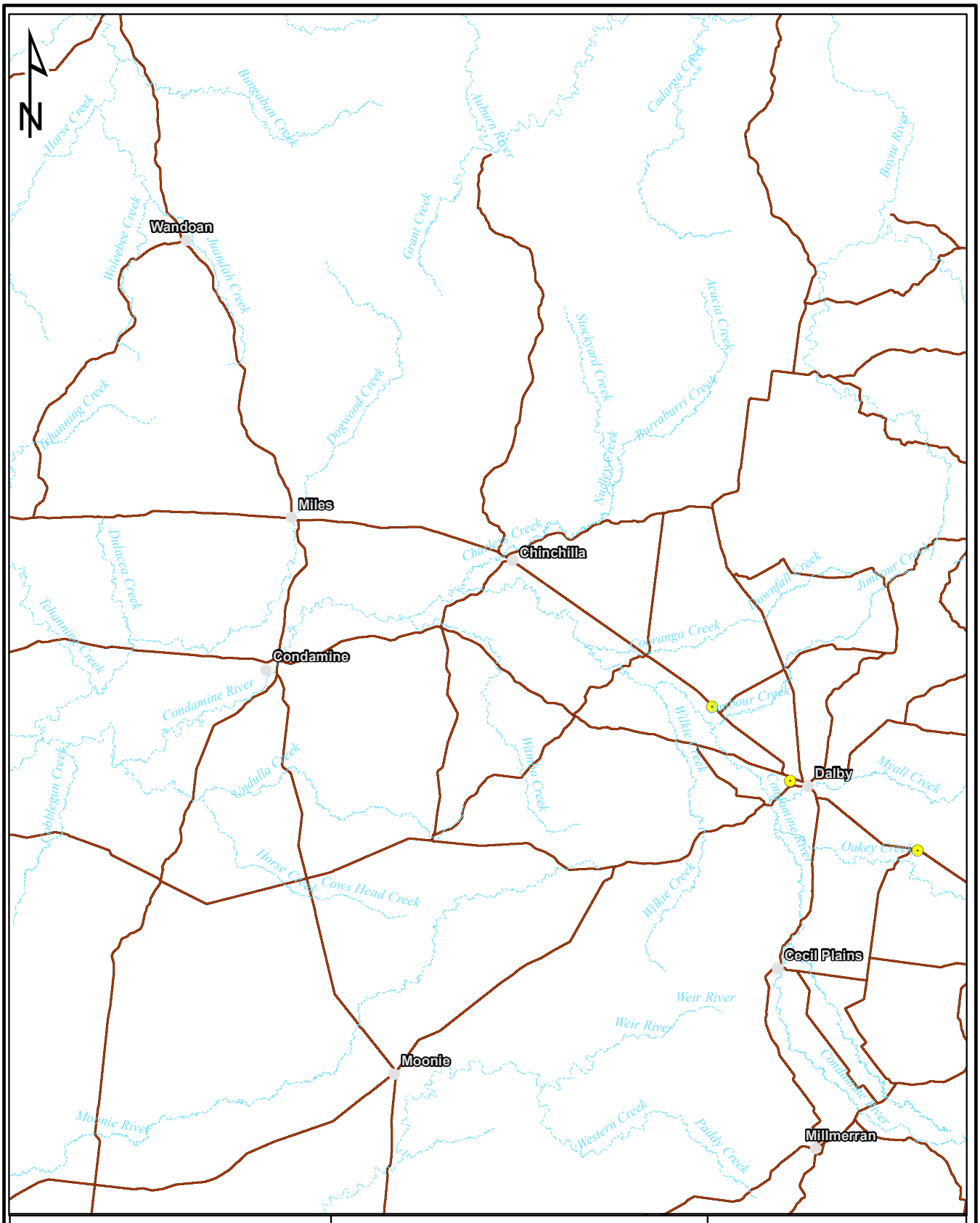
Two herbarium records within 10 km of the SGP with the nearest record 2.7 km east of the SGP boundary, 25 km north west of Dalby (Figure 4.19).

Rule(s) for Habitat Mapping:

1. Intact representation of Poplar Box dominant woodland (RE 11.3.2) associated with the Condamine River Alluvium (Condamine River Floodplain) should be treated as "General Habitat'.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. All other REs and non-remnant vegetation (including regrowth) should be treated as 'Absence Suspected'.

Mapping Confidence

Due to the relatively specific habitat requirements, detailed survey throughout the SGP and resolution of the revised mapping database, mapping is considered to have a high degree of confidence.



Legend

Thesium australe

NC Act, EPBC Act

- Vulnerable, Vulnerable
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.19. Spatial distribution of *Thesium australe*

Client ARROW ENERGY

0 15 30 45 60

Kilometers

Scale 1:1,050,026 **Drawn By** DG **Date** 04-Sep-23 A4

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4.3.9 Xerothamnella herbacea

Endangered EPBC Act (effective Jul 2000)
Endangered NC Act

Description

Xerothamnella herbacea is a 30 cm tall herb. Leaves are soft textured and opposite each other on the stem. Flowers are pink to mauve and lobed.

Xerothamnella herbacea. Photograph Copyright © Boobook

Distribution and Habitat

Xerothamnella herbacea is known from seven locations between Goondiwindi and Theodore. Scattered populations occur to the north-east of Chinchilla (between Chinchilla and Boondooma Lake), within Palmgrove and Expedition National Parks to the southwest of Moura. Two isolated population occur between Goondiwindi and Millmerran.

Occurs in remnant and disturbed Brigalow (*Acacia harpophylla*) and Belah (*Casuarina cristata*) dominated communities in shaded situations, often in leaf litter (TSSC 2008 c). The species is associated with Brigalow dominated communities, preferring shady locations where it grows in leaf litter (TSSC 2008 c). The plant often occurs in gilgais in vertic clay soils (vertosols) and is known to occur in non-remnant and highly disturbed habitats. Regional ecosystems associated with this species are typically dominated by Brigalow or Belah and include REs 11.3.1, 11.4.3 and 11.9.5.

Ecology

Little is known in regard to the ecology of *Xerothamnella herbacea* although it can live for a few years and establish vegetatively by rooting from nodes along stems. It can die back to roots in dry conditions and subsequently resprout (Shapcott *et al.* 2017)

Records Relevant to the SGP

Two herbarium records to within 20 km of the SGP Boundary, 20 km to the east and north of Chinchilla (Figure 4.20).

Rule(s) for Habitat Mapping:

1. The species may occur throughout the entire project area where it may be associated with Brigalow dominant habitats 11.3.1, 11.4.3 and 11.9.5. Throughout the SGP these REs and any derived regrowth Brigalow should be treated as 'General Habitat'.

2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. All other remnant vegetation in the SGP, regrowth vegetation and cleared agricultural land should be treated as 'Absence Suspected'.

Mapping Confidence

Due to the relatively specific habitat requirements, detailed survey throughout the SGP and resolution of the revised mapping database, mapping is considered to have a high degree of confidence.

Legend

Xerothamnella herbacea

NC Act, EPBC

- Endangered, Endangered
- Major Watercourse
- Major Roads
- Arrow Lease Boundary
- Arrow Lease Boundary 25km Buffer

Figure 4.20. Spatial distribution of *Xerothamnella herbacea*

Client ARROW ENERGY

0 15 30 45 60
Kilometers

Scale 1:1,050,026 | **Drawn By** DG | **Date** 24-Jul-23 | A4

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5.0 POSSIBLE OR KNOWN THREATENED FAUNA

5.1 INVERTEBRATES

5.1.1 *Adclarkia cameroni* (Brigalow Woodland Snail)

Endangered EPBC Act (effective Dec 2016)
Vulnerable NC Act

Ecology and occurrence within the SGP

The Brigalow Woodland Snail is located in the southern portion of the Brigalow belt associated with the Condamine catchment, particularly the Condamine floodplain between Dalby and Chinchilla (Stanisic *et al.* 2011), though recent work has found the species from the Balonne River floodplain near Surat to the eastern Darling Downs including Jondaryan, Brookstead, Millmerran and Bringally State Forest (Eddie 2023). The species is recorded in available databases at 27 discrete locations within 50 km of the SGP (Figure 5.1). This includes three records on the eastern boundary of the SGP – near the Condamine River – and six records within the SGP. All records within the database are post 1994.

The species is found in Brigalow and alluvial eucalypt woodlands, which have dense cover and scattered debris, especially logs, dense leaf-litter, piles of fallen bark and flood debris. While egg-laying has not been recorded, it is assumed eggs are deposited in small depressions in the soil under logs and other debris where soil moisture is high. Desiccation to adults and eggs is the greatest threat to the species (TSSC 2016a).

The species has limited mobility and, while they can move between patches of habitat under favourable conditions, fragmentation is likely to lead to isolation (TSSC 2016a).

Habitat Mapping

This species inhabits Brigalow communities on clay soils as well as most eucalypt woodlands on floodplains. Within the SGP these habitats seem most consistent with REs 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.17, 11.3.25, 11.3.27, 11.4.3, 11.4.3a. 11.9.5, 11.9.7 and 11.9.10. The species can also occasionally occur in 11.5.1 when nearby favourable habitat is removed (Eddie 2023). This vegetation type, 11.5.1, is not consistent with the high amenity habitat, though revision of this understanding may be required in the future as additional surveys and information sheds light on the species requirements.

While the species is described as occurring within the Condamine floodplain, several records are located considerable distance from this waterway (e.g., two from within Barakula State Forest, ~50 Km to the north-east). This is sufficient to suggest the species could occur anywhere within the SGP.

Rule(s) for Habitat Mapping:

1. The species could occur anywhere within the SGP.
2. The following regional ecosystems, including derived regrowth, should be mapped as 'Core Habitat Possible': 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.17, 11.3.25, 11.3.27 (all sub-types), 11.4.3, 11.4.3a, 11.9.5, 11.9.7 and 11.9.10.

3. The following regional ecosystems, including derived regrowth, should be mapped as 'General Habitat': 11.3.14, 11.3.18, 11.3.26, 11.5.1, 11.5.1a, and 11.5.20.
4. All 'Core Habitat Possible' and 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
5. All remaining vegetation is mapped as 'Absence suspected'.

Mapping Confidence

Current information suggests most Brigalow Woodland Snail populations will be restricted to Brigalow and/or alluvial/riparian vegetation within floodplains. These can be matched to REs with some confidence. However, records from alternative communities suggests the species sometimes occupy less favourable habitats. Understanding the significance of these additional habitats may be possible in the future as information is accumulated.

This species has been recorded from highly disturbed and cleared habitats if there is suitable shelter on the ground (e.g., logs). These habitats are not captured by the above rules and pre-clearing mitigation measures are likely necessary to minimise impacts.

There are several undescribed species of Camaenidae which occupy the same range and habitats as *A. cameroni*. Identification of these species requires careful examination of shell microsculpture as shell shape, size and thickness are variable. Specimen-backed records identified by experts are therefore required to establish presence/absence of this species.

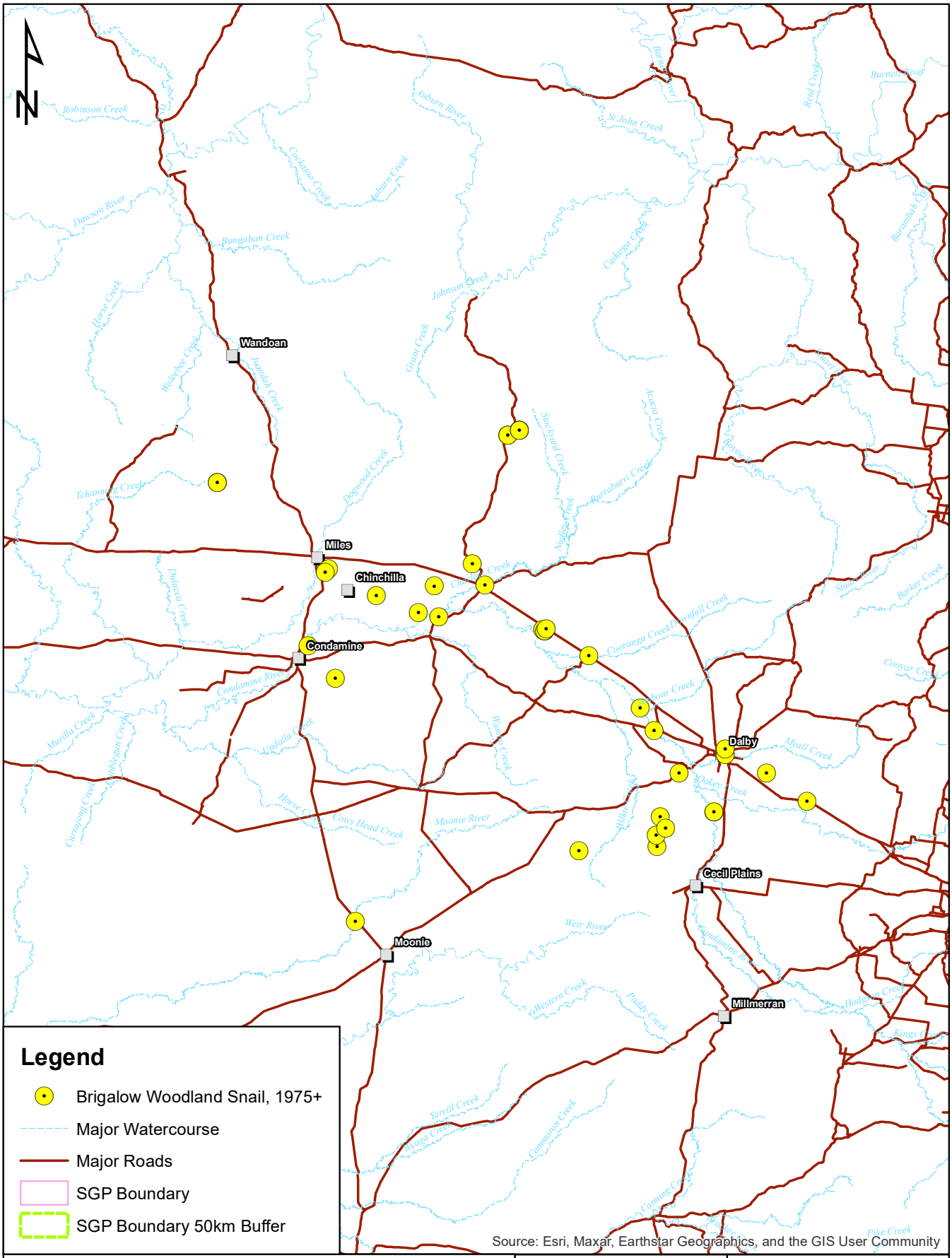

Figure 5.1
Records of the Brigalow Woodland Snail within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.1.2 *Adclarkia dulacca* (Dulacca Woodland Snail)

Endangered EPBC Act (effective Dec 2016)
Endangered NC Act

Ecology and occurrence within the SGP

Publicly available records suggest the Dulacca Woodland Snail is restricted to the southern Brigalow Belt between Miles, Dulacca, Wandoan and Meandarra, though recent work has found the species west to the Yuleba area and east to the Chinchilla area (Eddie 2023). It has been recorded in available databases at 13 discrete locations within 50 km of the SGP including the nearby Gurulmundi State Forest. The species has been recorded once in the SGP and at one location to the east of the SGP near Barakula State Forest. Current record and distributions suggest the species will occur only as far south as Kogan, although no targeted surveys have been undertaken.

The species has been located in a variety of habitats including vine thicket and Brigalow (*A. harpophylla*) woodland with rock outcrops and Lancewood (*A. shirleyi*), Ironbark and *E. woollsiana* woodlands on ridges with and without rock (TSSC 2016b). It shelters in moist microhabitats under wood, rocks and other debris, as well as under bark at the base of trees. It has been found persisting in brigalow regrowth but only where there is abundant suitable microhabitats (e.g., logs, dense leaf litter). Eggs are laid in suitable microhabitat locations during summer rains.

The Dulacca woodland snail has limited mobility. Recruitment is likely to be low, with recruitment events limited to periods of rainfall (TSSC 2016b).

Habitat Mapping

Conservation advice (TSSC 2016b) indicates the species is known from Brigalow and Semi-evergreen vine thickets, which in the SGP includes REs 11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.5 and 11.9.10. Based on expert advice (Eddie 2023) the species has also been recorded from, or core habitats should be expected in, 11.5.20, 11.7.6, 11.7.7 and 11.9.5. General habitats include RE 11.5.1, 11.5.1a, and 11.9.10. It tends to avoid areas susceptible to flooding and so is not prevalent on alluvial systems.

Rule(s) for Habitat Mapping:

1. The species could occur within the northern and central regions of the SGP, but is not expected to the north of Kogan (latitude -27.06) in the southern SGP area.
2. North of -27.06, any areas of the following REs (including derived regrowth) are mapped as 'Core Habitat Possible': 11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.5 and 11.9.10.
3. Within the central and northern SGP, any areas of the following REs (including derived regrowth) are mapped as 'General Habitat': 11.5.1, 11.5.1a and 11.9.10.
4. All 'Core Habitat Possible' and 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
5. All remaining vegetation is mapped as 'Absence suspected'.

Mapping Confidence

While high amenity habitats can be matched with some confidence to RE descriptions, this species remains relatively poorly known. The current mapping has moderate confidence and should be reviewed as more information becomes available.

This species has been recorded from highly disturbed and cleared habitats if there is suitable shelter on the ground (e.g., logs). These habitats are not captured by the above rules and pre-clearing mitigation measures are likely necessary to minimise impacts.

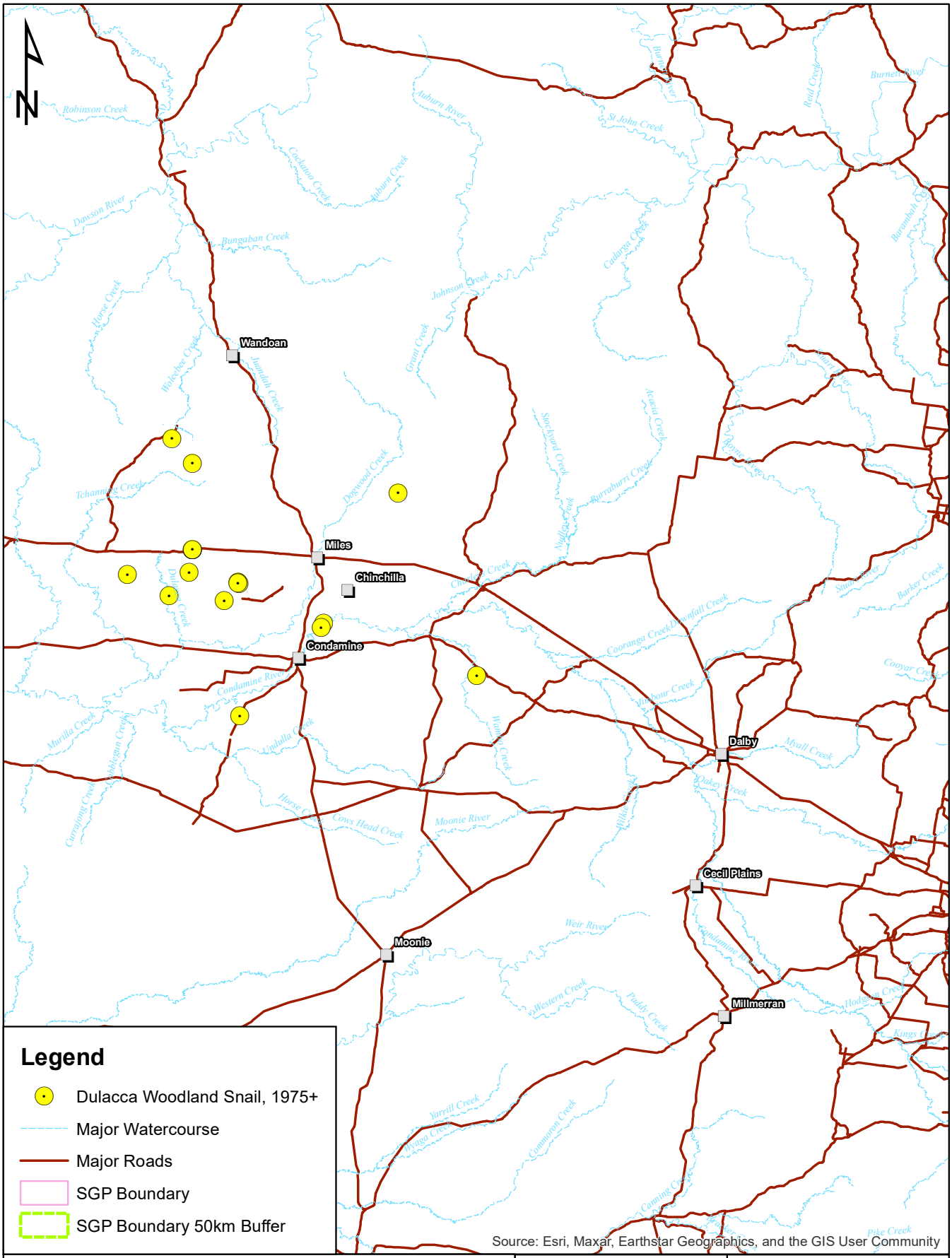

Figure 5.2
Records of the Dulacca Woodland Snail within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.1.3 *Jalmenus eubulus* (Pale Imperial Hairstreak)

Vulnerable NC Act

Ecology and occurrence within the SGP

Jalmenus eubulus is restricted to the eastern Brigalow Belt Bioregion. The northern limit of its distribution appears to be around the latitude of Mackay and ranges south to around Boggabilla in northern NSW. The eastern limit of its distribution is roughly designated by the Great Dividing Range, being found near Kroombit Tops, Binjour Plateau, Bunya Mountains and Jondaryan (Eastwood *et al.* 2008). It may be found as far west as Carnarvon (Sands and New 2002).

The species has been recorded at approximately 18 descrete locations surrounding the SGP, most since 1975 (Figure 5.4). The number of records and locations is likely to underestimate its occurrence due to a lack of systematic survey effort.

The species is restricted to Brigalow (*Acacia harpophylla*)-dominated woodlands and open-forests. Its core habitat is old-growth Brigalow, particularly those areas with Belah (*Casuarina cristata*), emergent eucalypts such as *Eucalyptus populnea* and understorey shrubs and adults are always observed in association with old-growth (remnant) *A. harpophylla* communities (Breitfuss and Hill, C. J. 2003; Eastwood *et al.* 2008). Being highly mobile, isolated patches may also provide suitable habitat.

Jalmenus eubulus feeds exclusively on Brigalow (*A. harpophylla*) shrubs ranging in height from 0.5 to 5 m and (Braby 2000; Breitfuss and Hill, C. J. 2003; Eastwood *et al.* 2008). The species has also been documented as feeding on other *Acacia* species (Sands and New 2002), but this has been discarded as erroneous in recent reviews (Eastwood *et al.* 2008).

It is likely that eggs enter diapause shortly after being laid. Emergence is triggered by summer rainfall, which may fall irregularly throughout the species' range, resulting in apparent different activity patterns between populations and years. Adults have been recorded between October and April, with peak activity in February and March. Peak activity appears to occur approximately two months after the wettest months of the year (December and January) (Eastwood *et al.* 2008).

Larvae feed singly, or occasionally in small groups of up to three individuals (Braby 2000). As in many lycaenid butterflies, the larvae are always attended by ants of the *Iridomyrmex* group, on which they are likely to be reliant for survival (Braby 2000; Sands and New 2002; Eastwood *et al.* 2008).

Habitat Mapping

This species is an old-growth Brigalow specialist and, with the exception of occasional transient individuals, will be largely restricted to Brigalow patches. Suitable REs within the SGP include 11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.5.

Rule(s) for Habitat Mapping:

1. The species may occur throughout the SGP area.
2. Within the SGP all remnant Brigalow (11.3.1, 11.3.17, 11.4.3 11.4.3a, 11.9.5) is classed as 'Core Habitat Possible'.

3. All 'Core Habitat Possible' within 1 km of a recent (1975+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
4. The remaining REs, regrowth and non-remnant areas are classed as 'Absence Suspected'.

Mapping Confidence

The life-cycle and habitat requirements for the Pale Imperial Hairstreak is well documented and understood. Correlation between important habitat characteristics and Regional Ecosystem descriptions is high. The habitat mapping for this species is expected to be highly accurate.

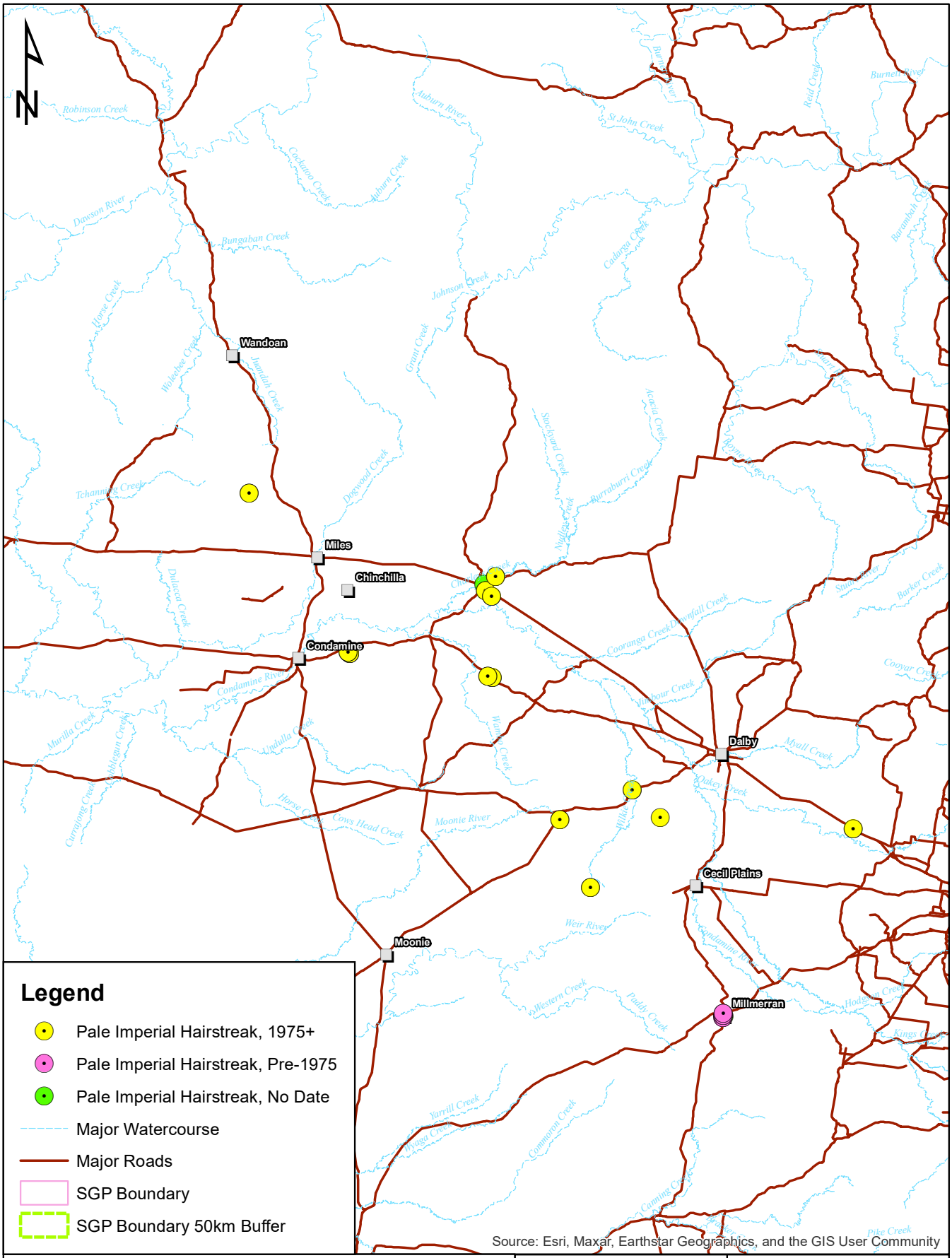

Figure 5.3
Records of the Pale Imperial Hairstreak within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.2 REPTILES

5.2.1 *Acanthophis antarcticus* (Common Death Adder)

Vulnerable NC Act

Ecology and occurrence within the SGP

Common Death Adders can be found throughout most of Queensland (Wilson and Swan 2020). Once abundant in the Brigalow Belt, they are now rarely observed and, when located, often associated with large contiguous tracts of vegetation. For example, records are more abundant with the state forests around Inglewood and Southwood National Park. In addition to their size, these areas have low grazing pressure and retain a complex and healthy ground strata (in particular ground debris). They may represent strongholds for the species in the southern Brigalow Belt (EPA 2008).

Death Adders are found in a wide variety of habitats, including rainforest, open woodland, shrubland and heath (Ehmann 1992; Wilson and Swan 2020). They are typically not associated with grasslands or very open woodlands as these lack complex ground strata layers and abundant debris.

The Common Death Adder is a slow-moving, sedentary snake that lies motionless while partially buried in leaf litter, vegetation or soil. Breeding takes place in spring and autumn (Ehmann 1992). Diet consists of lizards and small mammals, and to a lesser extent frogs (Shine *et al.* 2014). Diet changes with age, young animals consuming more reptiles and frogs, whilst adults feed predominantly on small mammals and birds (Shine 1980). Their hunting style and diet make them particularly susceptible to Cane Toad ingestion (Hagman *et al.* 2009). This threat might explain their low abundance within the SGP where Toads are abundant and widespread.

The Common Death Adder has been recorded from 11 unique locations within 50 km of the SGP (Figure 5.4). Most recently the species was recorded near Tara in 2021, and a second from 1984 near Lake Broadwater (though with low accuracy ±2,500 m), represent all the records since 1975. One record from Dalby is pRE 1975 and all others are undated. The Lake Broadwater record is the only occurrence of the species within the SGP. While of low probability, these records suggest the species might have some potential to occur within the SGP, however, as the species appears to be sparce and quite uncommon, large areas of suitable habitat are likely to be uninhabited.

Habitat Mapping

Only two records within the database were spatially accurate enough to extract habitat data and both occurred in non-remnant habitats. Suitable REs within the SGP must therefore be ascertained by comparing the REs description to the species known ecology. On examination, all remnant vegetation is considered suitable for this species.

However, within the Brigalow Belt the Common Death Adder is typically associated with large contiguous patches of vegetation. Smaller patches are more likely to suffer degradation and less likely to support the species. As such, suitable habitat is better mapped based on landscape context and patch size with patches greater than 1,000 ha of highest value.

Rule(s) for Habitat Mapping:

1. Potential Death Adder habitat is most likely in contiguous and near-contiguous areas of vegetation (i.e., reduced fragmentation). Potentially important habitat is therefore likely restricted to vegetation within or abutting the 'large tracts remnant veg.shp'. Within this area, all remnant vegetation (irrespective of RE designation) should be classed as 'Core Habitat Possible'.
2. Any remnant vegetation (irrespective of RE designation) outside the 'large tracts remnant veg.shp' is mapped as 'General Habitat'.
3. Core Habitat Possible and General Habitat within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
4. All non-remnant habitats, including regrowth, are mapped as 'Absence Suspected'.

Mapping Confidence

The presence of Death Adders is difficult to predict; they may occur in any remnant habitat yet are absent from seemingly good habitat within the Brigalow Belt. This may reflect historic land use, or events that affected ground structure such as fire history. Following fire, recolonisation may only occur if remaining patches are large or well connected to nearby populations. Local abundance of Cane Toads may also affect populations viability. Due to these difficulties, the habitat map for this species is considered to have low accuracy in predicting the species occurrence. While mapped areas are likely to represent suitable habitats, occupied habitat is likely to be overestimated.

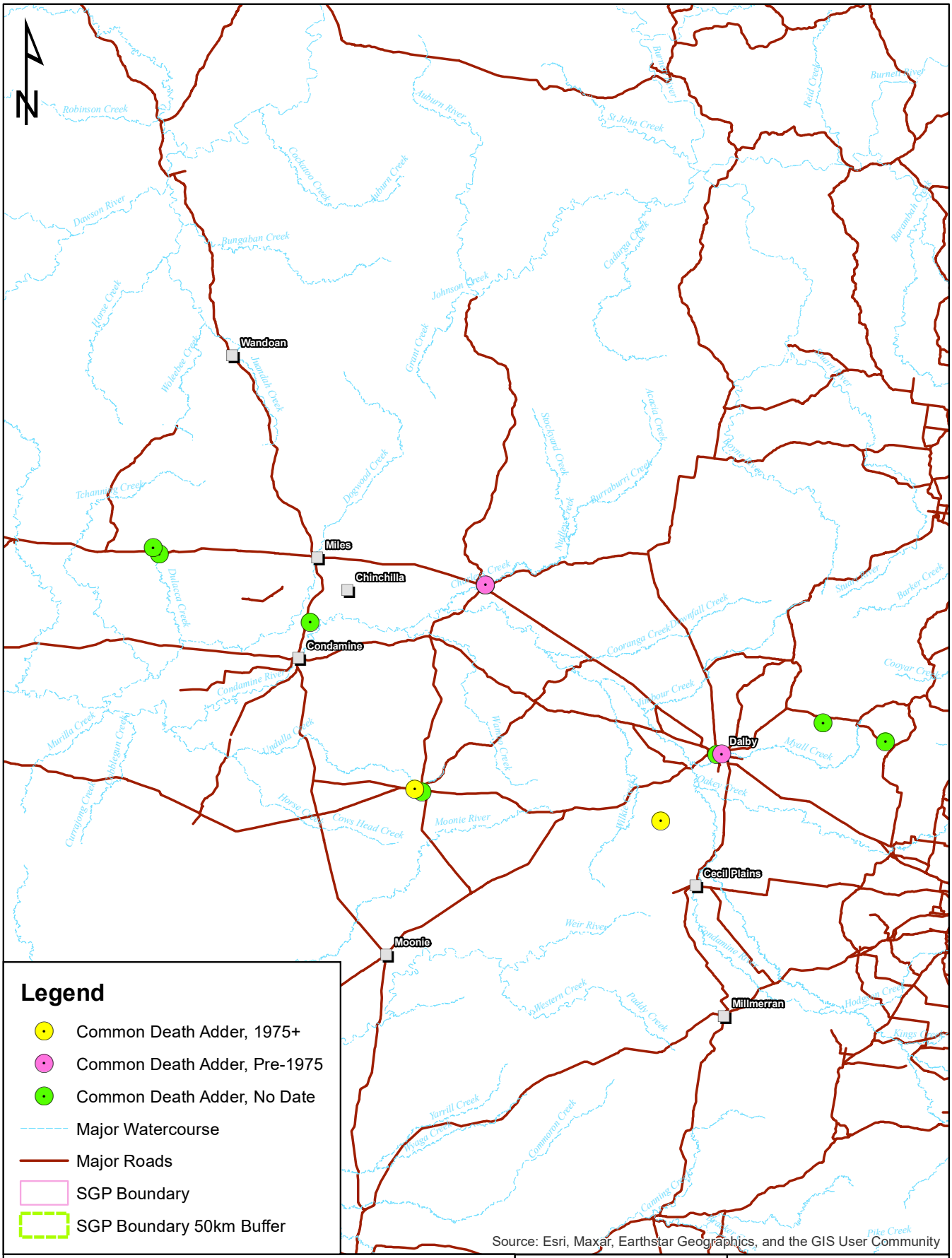

Figure 5.4
Records of the Common Death Adder within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.2.2 *Glyphodon (Furina) dunmalli* (Dunmall's Snake)

Vulnerable EPBC Act (effective Jul 2000)
Vulnerable NC Act

Ecology and occurrence within the SGP

Dunmall's Snake (*Glyphodon dunmalli,* previously *Furina dunmalli*) is confined to the Brigalow Belt bioregion of south-eastern Queensland and north-eastern New South Wales, occurring north to Clermont and near Rockhampton. Most records are from the Dalby-Tara area of the Darling Downs (Hobson 2012). The SGP area is entirely contained within the species distribution. The species is very rarely encountered, even in areas of known habitat, and has been described as 'extremely secretive, rarely encountered, possibly genuinely scarce' (Wilson 2022).

The Dunmall's Snake has been recorded from a number of locations surrounding the SGP including two records approximately 6-7 km to the west. One of these is undated and likely very old while the second is dated as the year 2000. Three records fall within the SGP, two at Lake Broadwater (dated as 1984 and 1993) and a third recent record (2017) in the north (Figure 5.5). These three onsite records have been recorded from RE 11.5.1 and regrowth RE 11.5.20.

Limited information is available on habitat preferences of the Dunmall's Snake. It has been recorded from a wide range of habitats, including forests and woodlands dominated by brigalow (*Acacia harpophylla*) and other acacias (*A. burowii, A. deanii, A. leiocalyx*), cypress (*Callitris* sp.) or Buloke (*Allocasuarina luehmannii*) on black alluvial cracking clay and clay loams (Covacevich *et al.* 1998; Stephenson and Schmida 2007; Brigalow Belt Reptiles Workshop 2010; Hobson 2012). It also occurs in Spotted Gum (*Corymbia citriodora*) and ironbark (*Eucalyptus crebra* and *E. melanophloia*) on sandstone derived soils and there is a record from the edge of dry vine scrub (Stephenson and Schmida 2007; Brigalow Belt Reptiles Workshop 2010). However, preferred habitat appears to be brigalow growing on cracking black clay and clay loams (Chapple *et al.* 2019), with the majority of records from between 200 to 500 m elevation (Hobson 2012). The species can, on rare occasions, inexplicably appear in sub-optimal vegetation. Advanced regrowth habitat should not be discounted, particularly when adjacent or linking areas of suitable habitat.

Habitat Mapping

Modelling completed by Johnson *et al.* (2017) failed to find any reliable attributes for predicting suitable habitat for this species. The study noted the types of BVG's in which Dunmall's Snakes have been recorded, several of which occur within the SGP (Table 5.1).

This list should not be considered exhaustive as the species is poorly known and the number of records low. Additional REs within the SGP which are structurally similar and likely suitable based on the species known habitat use includes RE 11.3.14, 11.5.21 and 11.7.2.

Table 5.1. Association of Dunmall's Snake records with 1:1 m Broad Vegetation Groups (Modified from Johnson *et al* 2017; only BVGs/REs relevant to the SGP listed)

BVG	Description	Representative REs within SGP
10a	Dry woodlands to open woodlands dominated by *Corymbia citriodora* (Spotted Gum). (land zones 10, 7, 12, 11).	11.7.6
12a	Dry woodlands to open woodlands dominated by ironbarks such as *Eucalyptus decorticans* (Gum-topped Ironbark), *E. fibrosa* subsp. *nubila* (Blue-leaved Ironbark), or *E. crebra* (Narrow-leaved Red Ironbark) and/or bloodwoods such as *Corymbia trachyphloia* (Yellow Bloodwood), *C. leichhardtii* (Rustyjacket), *C. watsoniana* (Watson's Yellow Bloodwood), *C. lamprophylla, C. peltata* (Yellowjacket). Occasionally *E. thozetiana* (Mountain Yapunyah), *E. cloeziana* (Gympie Messmate) or *E. mediocris* are dominant. Mostly on sub-coastal/inland hills with shallow soils. (land zones 7, 9, 10).	11.7.4, 11.7.7
13d	Woodlands dominated by *Eucalyptus moluccana* (Gum-topped Box or *E. microcarpa,* Inland Grey Box) on a range of substrates. (land zones 3, 5, 8, 9, 11, 12).	11.3.26, 11.5.20
17a	Woodlands dominated by *Eucalyptus populnea* (Poplar Box) (or *E. brownii*, Reid River Box) on alluvium, sand plains and footslopes of hills and ranges. (land zones 3, 4, 5, 9, 10, 11, 12).	11.3.2, 11.3.18, 11.5.1a, 11.9.7
18b	Woodlands dominated *Eucalyptus crebra* (*sens. lat.*) (Narrow-leaved Red Ironbark) frequently with *Corymbia* spp. or *Callitris* spp. on flat to undulating plains. (land zones 3, 5).	11.5.1, 11.5.4
25a	Open forests to woodlands dominated by *Acacia harpophylla* (Brigalow) sometimes with *Casuarina cristata* (Belah) on heavy clay soils. Includes areas co-dominated with *A. cambagei* (Gidgee) and/or emergent eucalypts. (land zones 3, 4, 7, 9, 11).	11.3.1, 11.3.17, 11.4.3/a, 11.4.10, 11.9.5, 11.9.10

Rule(s) for Habitat Mapping:

1. The species could occur throughout the entire SGP.
2. All areas of remnant vegetation with a combined extent >50 ha consisting of the following REs should be classed as 'Core Habitat Possible': 11.3.1, 11.3.17, 11.3.18, 11.4.3, 11.4.3a, 11.5.1, 11.5.1a, 11.5.4, 11.5.20, 11.7.4, 11.7.6, and 11.7.7.
3. Smaller vegetation patches (<50ha) of the above REs may be mapped as 'General Habitat' if they are in close proximity (≤500 m) to areas of 'Core Habitat Possible'.
4. All areas of remnant vegetation with a combined extent >50 ha consisting of the following REs should be classed as 'General Habitat': 11.3.14, 11.5.21, 11.7.2.
5. Advanced regrowth of all the above REs are mapped as 'General Habitat' if they are adjacent (≤500 m) or connect to large areas of 'Core Habitat Possible' or 'General Habitat'.
6. Core Habitat Possible and General Habitat within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
7. Remaining REs, regrowth and non-remnant areas are mapped as 'Absence Suspected'.

Mapping Confidence

This species is very poorly understood and records are scarce. Predicting its occurrence is extremely difficult and the mapping is likely to have low accuracy. The species is likely absent from large areas of mapped habitat.

After extensive surveys in suitable habitat under favourable conditions failed to locate Dunmall's Snake, Johnson *et al.* (2017) concluded 'As potential habitat is currently so poorly defined, improving knowledge may be a more useful conservation action for this species than would be offsetting land selected on the basis of existing knowledge.' They suggested offsets committing to long-term targeted work (i.e., several years field work at appropriate times, in appropriate habitats) to help refine habitat understanding may be of higher value than land-based offsets.

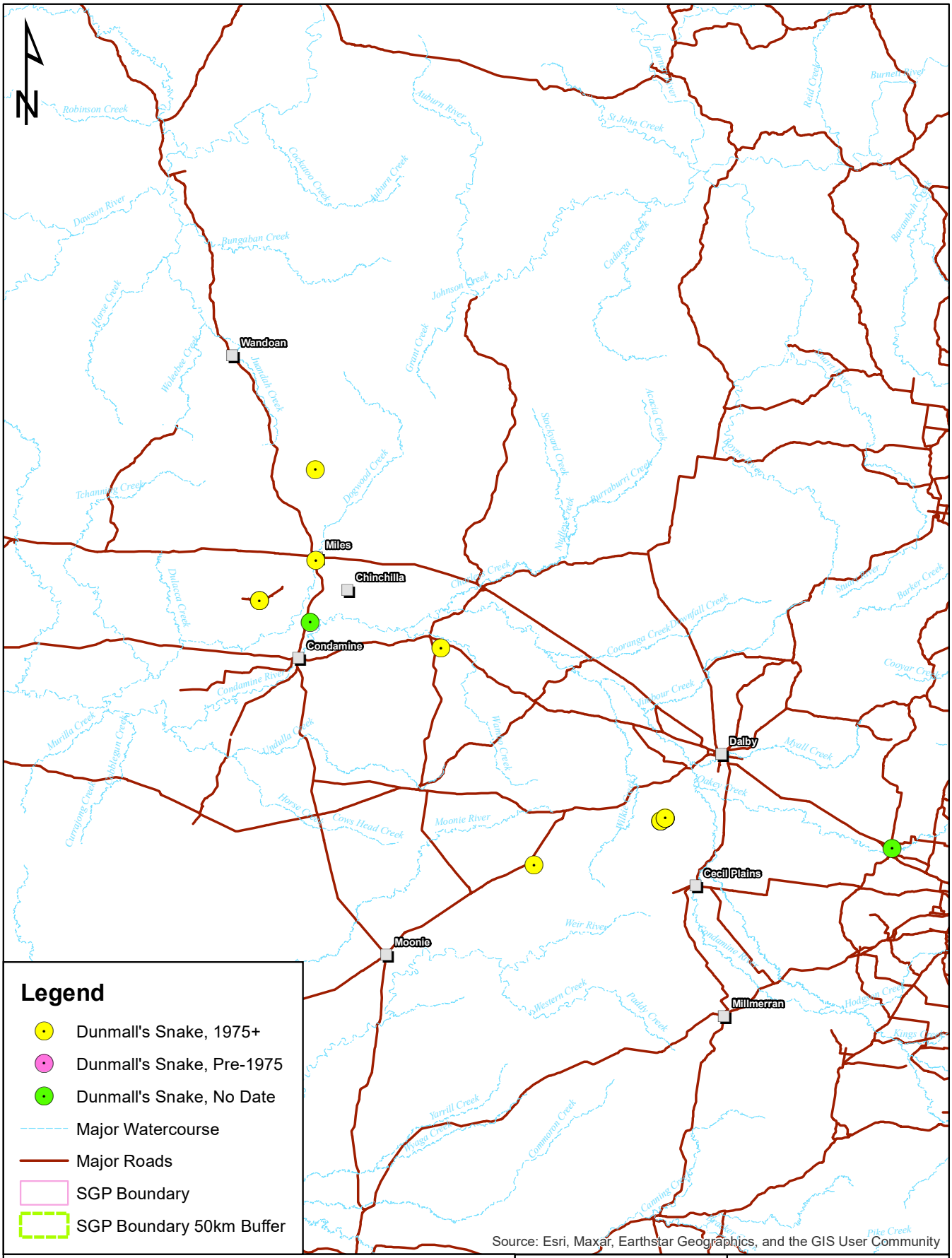

Figure 5.5
Records of the Dunmall's Snake within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.2.3 *Hemiaspis damelii* (Grey Snake)

Endangered EPBC Act (effective Oct 2022)
Endangered NC Act

Ecology and occurrence within the SGP

Grey snakes occur throughout the Brigalow Belt, from coastal districts near Rockhampton, south-east to the Lockyer Valley in South East Queensland (Wilson and Swan 2020; Wilson 2022). The SGP is entirely within their distribution and the species has been often recorded within 50 km. This includes eight records since 1975, all located in the south and five associated with Lake Broadwater.

They inhabit dry eucalypt forest and occasionally pasture favouring cracking, flood-prone soils along floodplains and near watercourses (Hobson 2002; Rowland 2012; Covacevich and Wilson 2020; Wilson 2022). Most records are not associated with large river channels, but rather they typically inhabit the adjacent floodplains with ephemeral ponds or wetlands.

Grey Snakes are weakly venomous nocturnal frog specialists (Shine 1987; Wilson and Swan 2020), sheltering during the day under fallen logs, within soil cracks and down animal burrows. They are known to give birth to up to 10 live young (Covacevich and Wilson 2020), but little else is recorded of their breeding biology.

Habitat Mapping

Important remnant vegetation within the SGP for this species will include Brigalow (*A. harpophylla*) ± Belah (*Casuarina cristata*) and grasslands on dark cracking clays (TSSC 2023a). These areas form gilgais - a microrelief which readily collects water attracting large numbers of frogs following rain. Within the SGP, such habitats are confined to RE 11.4.3, 11.4.3a and 11.9.5. Accurate recent (1975+) records within the SGP have also been located in RE 11.3.27f and 11.5.20. The latter record occurred in an isolated low-lying area of pooling water (M. Sanders *pers obs*) within 300 m of a minor creek line map as RE 11.3.25. Large areas of RE 11.5.20 are unlikely to support resting surface water and, on balance, probably do not warrant mapping as 'core habitat possible'. In contrast, most ecosystems on landzones 3 and 4 are likely to have areas of inundation, gilgais or similar. These features will attract frogs and therefore Grey Snakes.

Within the 50 km of the SGP records are also associated with RE 11.5.20, and 11.7.4/11.7.7. However, most records within 50 km are associated with non-remnant habitats (88%), and this may suggest the species is less influenced by dominant vegetation type than microrelief characteristics.

Rule(s) for Habitat Mapping:

1. The species could occur throughout the entire SGP.
2. All remnant vegetation where surface water could collect provides potential habitat for these species. In particular, vegetation on Landzones 3, and 4 should be classed as 'Core Habitat Possible' (11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.14, 11.3.18, 11.3.25, 11.3.26, 11.3.27, 11.4.3 and 11.4.3a). In addition, the following REs have clay soils, gilgai's or are likely to be subject to temporal ponding and should also be 'Core Habitat Possible'; 11.9.5.

3. Derived Grasslands, which occur in alluvial floodplains in the SGP, are mapped as 'Core Habitat Possible'.
4. Larger contiguous areas of REs 11.5.1, 11.5.1a, 11.5.20, and 11.5.21, or where these are immediately adjacent Core Habitat Possible, are included as 'General Habitat'.
5. Artificial waterbodies are mapped as 'General Habitat'.
6. All remnant vegetation, non-remnant vegetation, regrowth or grazing land (but not tilled land, tracks or cultivated land) within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
7. Regrowth be classed according to its parent regional ecosystem.
8. Tilled crops, tracks and cultivated land (i.e., areas with frequently surface disturbed) are mapped as 'Absence Suspected'.

Mapping Confidence

This species may occur in a number of habitats, including modified grazing land with exotic grasses where suitable microrelief is retained. The mapping rules provided here are based on the Regional Ecosystem model, but increasingly it seems this approach is poor at predicting this species habitat. The mapping is likely to have low confidence in predicting suitable habitat.

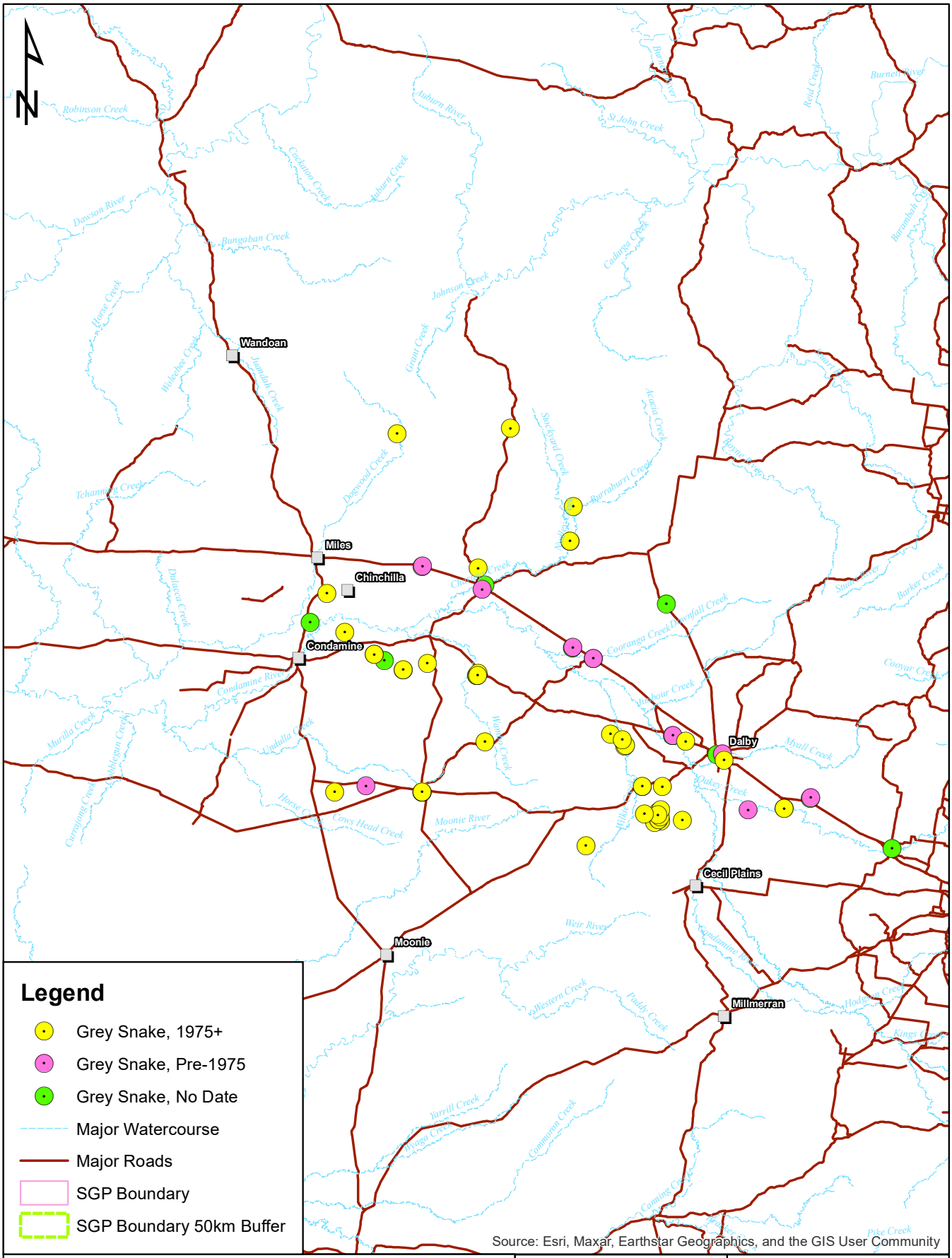

Figure 5.6
Records of the Grey Snake within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.2.4 *Strophurus taenicauda* (Golden-tailed Gecko)

Near Threatened NC Act

Ecology and occurrence within the SGP

Golden-tailed geckos are found from the western slopes of the Great Dividing Range to Carnarvon, and from Emerald in the north to Inglewood/Millmerran in the south. The SGP therefore encompasses a sizable portion of the species' range. The area around Barakula may represent a stronghold for this species (Richardson 2006). It has often been recorded within and surrounding the SGP (Figure 5.7).

Golden-tailed geckos are found mainly in association with Brigalow (*Acacia harpophylla*), Cypress (*Callitris* spp.) and Buloke (*Allocasuarina luehmannii*) ironbark (*Eucalyptus* spp.) (Brown *et al.* 2012). Ground cover, tree hollows and loose or peeling bark on standing trees may be important shelter sites for this species (Richardson 2006). The species appears tolerant to fragmentation, provided the vegetation is largely unaffected by grazing and there is abundance of cypress pine (Thompson and Eldridge 2005; Ngugi *et al.* 2013; Pavey *et al.* 2021). They are also known to utilise regrowth (Pavey *et al.* 2021) and are often at highest densities in vegetation with abundant shrub, especially *Acacia* and *Callitris*.

During the daytime, Golden-tailed Geckos shelter under loose bark and in tree hollows (Wilson 2022). They may also bask during the daytime. In Spring/Summer, females lay a clutch of two eggs. Females may lay more than one clutch in a season.

Movement patterns of the species have not been documented. However, individuals have been recorded crossing dual lane roads during warm summer nights.

Habitat Mapping

An analysis of recent (1975+) records within the SGP and surrounding area (Table 5.2) found Golden-tailed Geckos inhabiting the following BVG groups: 10a, 12a, 13d, 16a, 17a, 18a, 18b, 25a and 29b. This analysis suggests the following REs could contain suitable habitat within the SGP: 11.3.1, 11.3.2, 11.3.14, 11.3.17, 11.3.18, 11.3.26, 11.4.3, 11.4.3a, 11.5.1, 11.5.1a, 11.5.20, 11.5.21, 11.3.26, 11.5.4, 11.7.4, 11.7.6, 11.7.7, 11.9.5, 11.9.7 and 11.9.10.

While there is some evidence the species might occur in one of the following REs, these are generally not considered high amenity due to the lack of a suitable shrub layer: 11.3.2, 11.3.25, 11.7.2 and 11.9.5. Similarly Brown *et al.* (2012) also list RE 11.3.3, 11.3.4 and 11.9.2, though these too seem less than ideal. These REs can be mapped as general habitat.

Table 5.2. Association of Golden-tailed Gecko records with 1:1 m Broad Vegetation Groups within the SGP and surrounding 50 km area

BVG (1 m)	Count of records			Representative REs in the SGP
	SGP	50 km	% of total	
10a	2	9	3.1	11.7.6
12a	24	61	23.7	11.7.4, 11.7.7
13d	5	6	3.1	11.3.26, 11.5.20
16a	3	0	0.8	11.3.25
17a	0	7	2.0	11.3.2, 11.3.18, 11.5.1a, 11.9.7
18a	2	11	3.6	11.3.14, 11.5.21
18b	41	43	23.5	11.5.1, 11.5.4
25a	0	2	0.6	11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.5, 11.9.10
29b	4	6	2.8	11.7.5
Non-remnant	38	94	36.9	
Total	*119*	*239*	*100.0*	

Rule(s) for Habitat Mapping:

1. The species may occur throughout the entire SGP area.
2. Within the SGP, REs 11.3.1, 11.3.14, 11.3.17, 11.3.18, 11.4.3 11.4.3a, 11.5.1, 11.5.1a, 11.5.4, 11.5.20, 11.5.21, 11.3.26, 11.7.4, 11.7.6, 11.7.7, 11.9.5, 11.9.7, 11.9.10 are mapped as 'Core Habitat Possible'.
3. Within the SGP, REs 11.3.2, 11.3.3, 11.3.4, 11.3.25, 11.7.2, 11.7.5 and 11.9.2 are mapped as 'General Habitat'.
4. All areas of advanced regrowth (10+ yrs) should be treated as remnant vegetation and classed accordingly.
5. Core Habitat Possible and General Habitat within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
6. Habitat patches <5ha and greater than 200 m in distance from other remnant vegetation (i.e., isolated) are downgraded to 'Absence Suspected'.
7. 'Core Habitat Possible' (as identified in the steps above) between 5ha and 10ha in size and more than 200 m in distance from other remnant vegetation (i.e., isolated) is downgraded to 'General Habitat'.
8. 'General Habitat' (as identified in the steps above) between 5ha and 10ha in extent and more than 200 m in distance from other remnant vegetation (i.e., isolated) is downgraded to 'Absence suspected'.
9. Remaining regrowth and REs are classed as 'Absence Suspected'.

Mapping Confidence

Golden-tailed Geckos appear to be unevenly distributed throughout suitable habitat. However, they can also inhabit regrowth. As such, the mapped habitat area is likely to have a moderate accuracy.

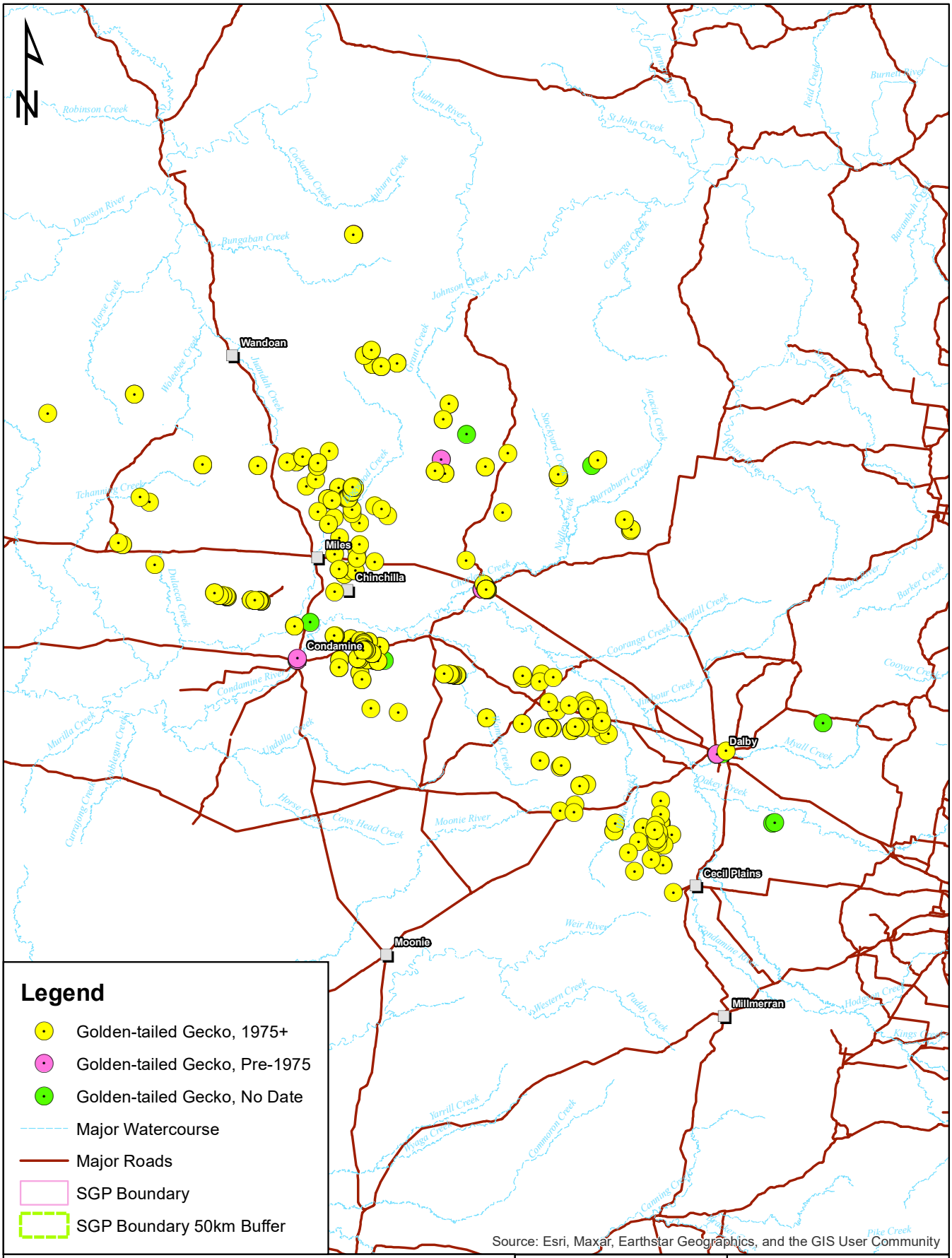

Figure 5.7
Records of the Golden-tailed Gecko within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.3 BIRDS

5.3.1 *Rostratula australis* (Australian Painted Snipe)

Endangered EPBC Act (effective May 2013)
Vulnerable NC Act

Ecology and occurrence within the SGP

Most records of the species occur east of a line between Eyre Peninsula and the Gulf of Carpentaria, excluding Cape York Peninsula where they appear to be absent (Marchant and Higgins 1993). However, scattered individuals occur west as far as Western Australia, where they may have once been common in the Kimberley and Swan Coastal Plain (Johnstone and Storr 1998). Recent records mostly centre on the Murray-Darling basin of eastern Queensland and New South Wales (Marchant and Higgins 1993; Rogers *et al.* 2005). Lake Broadwater is considered to be important habitat for this species within Brigalow Belt South, although there is no known breeding record from this location (EPA 2008).

Birds may be recorded singly or in small groups in freshwater marshes. They are extremely nomadic, coming and going in response to local rainfall and flooding. Although its occurrence in a location is often erratic, with the bird absent some years and common in others (Marchant and Higgins 1993) there is indication of some regular seasonal migration, e.g., to central and north coastal Queensland in autumn and winter (Black *et al.* 2010). Breeding only occurs in swamps with temporary water regimes and complex shorelines forming islands, shallow water, exposed wet mud and dense low fringing vegetation (Rogers *et al.* 2005; Geering *et al.* 2007). During non-breeding periods, they may be found in a wider range of habitats including dams, rice paddocks, waterlogged grasslands, roadside drains and even brackish waterways (Marchant and Higgins 1993).

The Australian painted snipe appears to be crepuscular and nocturnal, feeding on mudflats or in shallow water during the morning and evening and throughout the night (Geering *et al.* 2007). A variety of foods are eaten, including vegetation, seeds, insects, worms, molluscs, crustaceans and other invertebrates including beetles (Marchant and Higgins 1993; Johnstone and Storr 1998).

Nesting occurs in spring and summer in southern Australia and during the wet season in northern Australia (Geering *et al.* 2007). Nests consist of a simple scrap in the ground lined by dry grasses, fine twigs and other vegetation. These nests are located in specific positions such as on a small island surrounded by shallow water, or occasionally on small mounds of purpose-built vegetation surrounded by water (Beruldsen 2004; Rogers *et al.* 2005). Breeding occurs only in suitable temporary wetlands with low relief and complex shorelines after an influx of water (Rogers *et al.* 2005).

Migration patterns are poorly known for the species (Pringle 1987). They are possibly dispersive or migratory. It is possible that such movements are due to local conditions, moving to flooded areas from drying wetlands (Marchant and Higgins 1993).

Habitat Mapping

Fourteen records were identified in databases, with all but four post 1975 (Figure 5.8). All recent records are known from within the vicinity of Lake Broadwater. The species is likely to be a vagrant and rare visitor to the SGP, though there is a low possibility the species might occur at Long Swamp. It is not considered likely elsewhere within the SGP.

Rule(s) for Habitat Mapping:

1. Lake Broadwater (RE 11.3.27c and 11.3.27f) is mapped as 'Core Habitat Known'.
2. Long Swamp (RE 11.3.27d and 11.3.27f) is mapped as "Core Habitat Possible'.
3. Core Habitat Possible within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
4. All remaining REs and non-remnant vegetation (including regrowth) is mapped as 'Absence Suspected'

Mapping Confidence

While the Australian Painted Snipe can occur on a variety of wetlands (including minor waterbodies), it is only known to occur within the immediate area of Lake Broadwater. Habitats outside these are likely to be marginal.

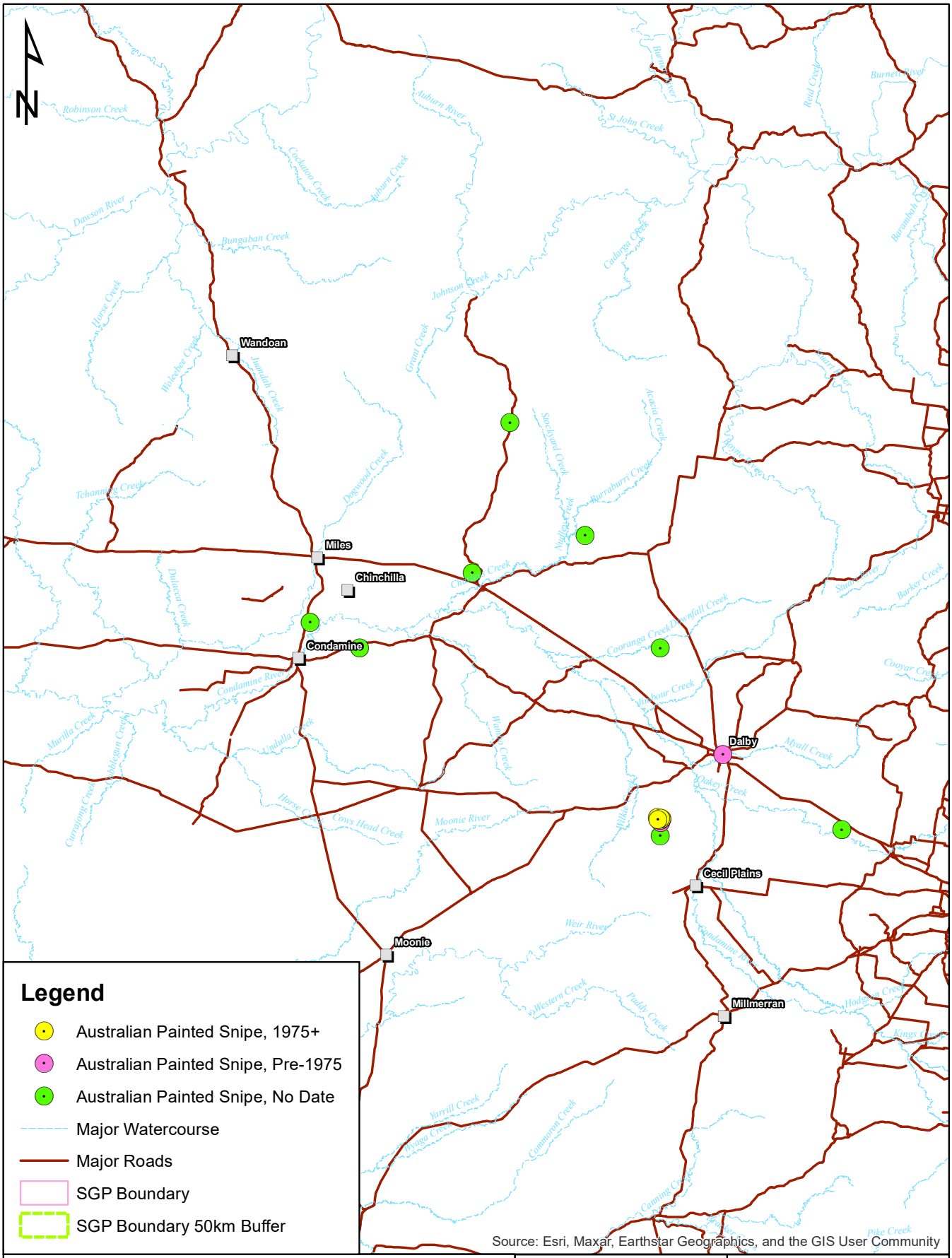

Figure 5.8
Records of the Australian Painted Snipe within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.3.2 *Calyptorhynchus lathami lathami* (Glossy Black Cockatoo)

Vulnerable EPBC Act (effective Aug 2022)
Vulnerable NC Act

Ecology and occurrence within the SGP

Glossy Black-Cockatoos (*Calyptorhynchus lathami*) have a patchy distribution along the east coast and ranges south from near the Paluma Range to Gippsland in Victoria. They are uncommon and declining, especially in the south-western parts of its range, and are now extinct in mainland South Australia (Garnett and Baker 2021). There has been concern for the status of Glossy Black-Cockatoos in the Southern Downs due to the loss of feeding and nesting resources (EPA 2008).

Birds inhabit woodlands and forests that contain abundant *Allocasuarina* spp. and large hollows suitable for nesting. Many populations are restricted to remnant vegetation within hills and gullies surrounded by agricultural land (Higgins 1999); however, some populations move through artificial landscapes such as semi-urban parks, gardens and golf courses to access favoured food resources (Higgins 1999; M. Sanders *pers. obs.*). Groups are never far from waterbodies, which are visited daily. Being highly mobile, birds may travel considerable distances to isolated fragments in search of food. Advanced regrowth may also provide some foraging opportunity.

Typically encountered in small family parties, Glossy Black-Cockatoos are dietary specialists, feeding exclusively on the seeds of *Allocasuarina* and less frequently *Casuarina* spp. Favoured species include *A. torulosa*, *A. littoralis*, *A. distyla*, *A. diminuta*, *A. gymnanthera* and *A. verticillata* (Chapman 2007). While poorly documented Glossy Black-Cockatoos feed on *A. inophloia* in and around the Kumbarilla to Inglewood area (M. Sanders *pers. obs.*). Although a *Allocasuarina* species, *A. luehmannii* has small seeds and is infrequently used.

Observations of the species feeding on other resources (e.g., *Callitris* and *Banksia* spp.) are likely to represent food switching during periods of poor *Allocasuarina* cone production (Chapman 2007). It is unclear if the use of *A. inophloia* by local populations reflect food switching, or if local populations rely on stands of *A. inophloia*. However, given the abundance of orts (feeding signs) in some locations, and their repeated observation over consecutive years, the latter seems plausible.

Birds show a preference for productive trees (e.g., higher seed/cone weight ratio), notwithstanding the influence of other factors such as distance from water or breeding hollows (Clout and Clout 1989; Pepper *et al.* 2000; Crowley and Garnett 2001; Cameron and Cunningham 2006; Chapman and Paton 2006; Chapman 2007). Stands of *Allocasuarina* spp. are not, therefore, of uniform value and the loss of individual stands or trees can have disproportionate impacts.

Pairs breed during winter, mainly from April to July, although breeding has been recorded as late as August or as early as March (Beruldsen 2004). Nests are located in a large vertical hollow extending one or two meters deep. Hollows may be reused over many years (Beruldsen 2004). Females incubate and care for the young alone, but are regularly attended and fed by the male. Only one egg is produced, which hatches in about 30 days. Once hatched the chick

fledges in around 60 days, but remains with its parents and is fed for another three months (Garnett and Baker 2021).

Glossy Black Cockatoos are well represented in the SGP area, though records in the very north are less frequent than in the south. Birds or their signs have been often recorded in and around Lake Broadwater and Kumbarilla State Forest (Figure 5.9).

Habitat Mapping

Accurate, recent records identified five 1 m BVG's and non-remnant vegetation as potential habitat for Glossy Black Cockatoo (Table 5.3). Within the SGP, this corresponds to the following REs: 11.3.1, 11.3.14, 11.3.17, 11.4.3, 11.4.3a, 11.5.1, 11.5.4, 11.5.21, 11.7.4, 11.7.6, 11.7.7, 11.9.5 and 11.9.10. However not all these REs will have *Allocasuarina* or *Casuarina* foraging resources and the list can be narrowed based on RE composition to: 11.3.1, 11.3.17, 11.4.3, 11.4.3a and 11.9.5. The REs 11.5.4 and 11.7.4 can also be included due to the presence of *A. inophloia* and *A. littoralis*, though in the case of 11.7.4 *Allocasuarina* seems to be present only south of the Warrego Highway. In fact, analysis of records in the southern section of the SGP (south of the Warrego Highway) suggests RE 11.7.4 is disproportionately favoured with more records present than expected based on the percentage of RE extent (11 actual records, versus a predicted 3.5 records).

Table 5.3. Association of Glossy Black Cockatoo records with 1:1 m Broad Vegetation Groups within the SGP and surrounding 50 km area

BVG (1 m)	Count of records			Representative REs in the SGP
	SGP	50 km	% of total	
10a	0	7	7.1	11.7.6
12a	13	3	16.2	11.7.4, 11.7.7
18a	3	8	11.1	11.3.14, 11.5.21
18b	3	9	12.1	11.5.1, 11.5.4
25a	7	15	22.2	11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.5, 11.9.10
Non-remnant	5	26	31.3	
Total	31	68	100.0	

Rule(s) for Habitat Mapping:

1. The species could occur throughout the entire SGP.
2. Regional Ecosystems containing *Casuarina cristata* (11.3.1. 11.3.17, 11.4.3, 11.4.3a, 11.9.5) and *Allocasuarina inophloia* (11.5.4) are classed as 'Core Habitat Possible'.
3. South of the Warrego Highway areas of RE 11.7.4 may also have *Allocasuarina littoralis* and should be mapped as 'Core Habitat Possible'.
4. Regrowth of the above REs, which could contain larger trees with suitable foraging resources, are mapped as 'Core Habitat Possible'.
5. Core Habitat Possible within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.

6. All remaining REs and non-remnant vegetation (including regrowth) is mapped as 'Absence Suspected'.

Mapping Confidence

Within the SGP Core Habitat Possible accurately predicts the presence of *Allocasuarina* foraging resources, though it is acknowledged individual trees can be scattered throughout remnant vegetation or modified landscapes. While Core Habitat Possible is abundant in the south region (Dalby region) of the SGP, it is more scattered in the central region, reducing the likelihood Glossy Black-cockatoos will occur. This is generally sported by the distribution of Glossy Black Cockatoo records which become less common the further north.

A hot wildfire severely damaged large areas of Glossy Black-cockatoo habitat in Kumbarilla State forest in late 2016. It may take several decades for foraging and nesting resources to recover in this area.

Nests are located in large tree hollows, usually in proximity to foraging resources. Predicting where suitable nest trees might occur is difficult and no attempt has been made to capture possible nest areas in the mapping product. Nevertheless, most ecosystems included within the mapping rules are likely to have large-hollow bearing trees.

A supply of water is also important for Glossy Black-cockatoo populations, and suitable locations which may attract birds are likely to be scattered throughout areas of vegetation; these are not mapped.

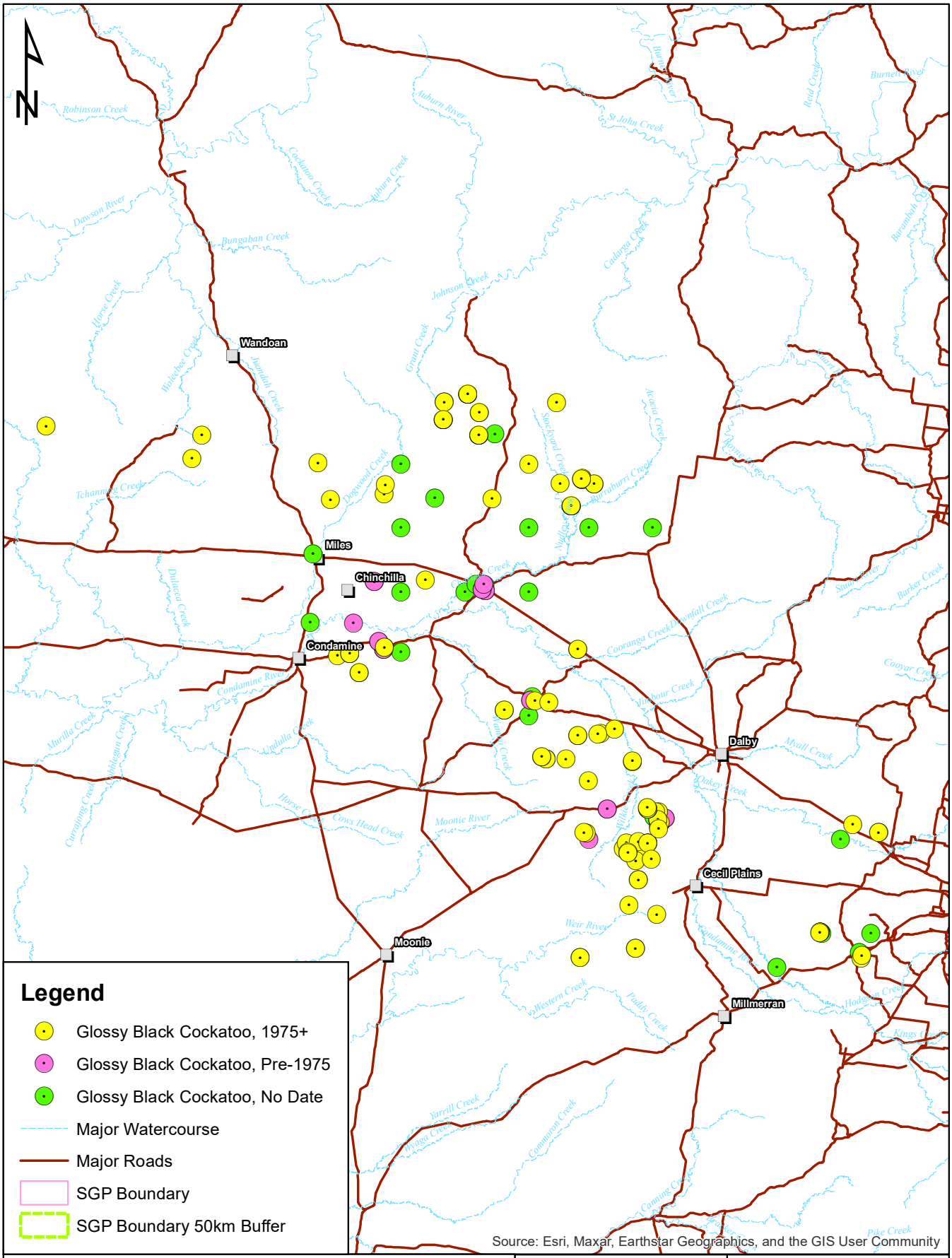

Figure 5.9
Records of the Glossy Black Cockatoo within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.3.3 *Hirundapus caudacutus* (White-throated Needletail)

Vulnerable EPBC Act (effective Jul 2019)
Vulnerable NC Act

Ecology and occurrence within the SGP

The White-throated Needletail is a migrant to Australia between spring and autumn, overwintering from its breeding grounds in eastern Siberia, China and Japan (Higgins 1999). During this time White-throated Needletails occur throughout east and southeast Australia. In Queensland the species is mostly observed to the east of the Great Dividing Range, but has been regularly recorded further inland (Higgins 1999). The species has been seen throughout the SGP and commonly in the surrounding areas (Figure 5.10).

The species is found above a variety of habitat types, most often treed areas such as open forest or rainforest, but also frequently over cleared land and even urban cities (Higgins 1999).

The White-throated Needletail is a predominantly aerial species, flying from almost ground level to altitudes of over 1000 m above ground level (Watson 1955; Coventry 1989). Individuals are rarely observed to alight but have been recorded roosting in trees, and it is thought they may also roost on cliff-faces though there have been no direct observations of this behaviour (Day 1993; Tarburton 1993; Higgins 1999; Tarburton 2021). It is possible that birds also roost aerially, or at least sometimes fly late into the night (Schulz and Kristensen 1994; Higgins 1999; Tarburton 2021).

White-throated Needletails are generalist insectivores, with consumption likely linked to availability of swarming prey rather than a preferential diet (Burwell and Pavey 1992). The species has been recorded feeding on a range of insect taxa including flying ants, beetles, cicadas, and grasshoppers (Cameron 1968; Burwell and Pavey 1992; Tarburton 1993; Rose 1997; Lepschi 1993). They rarely, if ever, alight while feeding (Higgins 1999). White-throated Needletails have been recorded feeding at disturbed sites including bushfires and recently ploughed farmland (Cameron 1968; McCulloch 1966), through which activities large swarms of insects are disrupted and able to be taken on the wing.

Habitat Mapping

This species forages in the airspace over all types of terrestrial land systems including forests, cleared grazing land, tilled and cropped farmland and even urban cities. If 'core' habitat represents areas regularly inhabited or of high importance, then the airspace above the entire SGP, irrespective of landuse, is 'Core Habitat Possible'. The species has little interaction or reliance on terrestrial ecosystems, except perhaps for roosting in large trees (Tarburton 1993).

Considering the above, the definitions of 'Core Habitat Possible' and 'General Habitat' applied elsewhere in this work are not applicable. Mapping for this species is not possible.

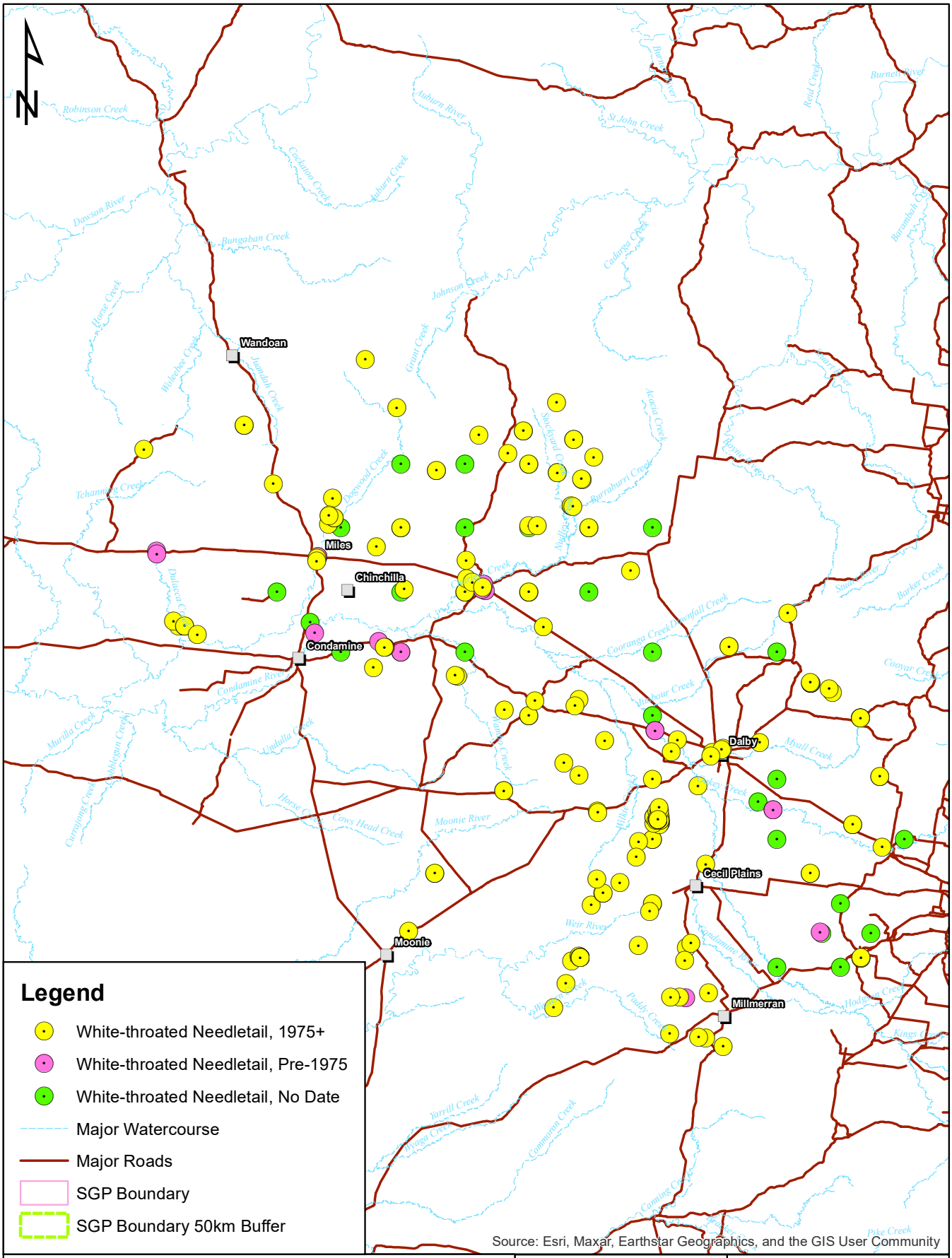

Figure 5.10
Records of the White-throated Needletail within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.3.4 *Aphelocephala leucopsis* (Southern Whiteface)

Vulnerable EPBC Act (effective Mar 2023)
Vulnerable NC Act

Ecology and occurrence within the SGP

The Southern Whiteface (*Aphelocephala leucopsis*) has a widespread but patchy distribution across most of mainland Australia south of the tropics, from the north-eastern edge of the Western Australian wheatbelt, east to the Great Dividing Range (Schodde and Mason 1999). While the SGP falls entirely within the distribution of the species, it is located near its eastern limit. Based on ALA data there are only but a few (~4) records east of the SGP within the Brigalow Belt.

Southern Whiteface are a small stocky thornbill-like bird who can be found in woodlands and tall shrublands with grassy or low shrub understorey or both (Schodde and Mason 1999; Menkhorst *et al.* 2019). They are encountered in small flocks or pairs, often with other species, cleaning food from the ground, leaf litter and/or debris, occasionally foraging on lower tree trunks, branches and stumps, often moving into low foliage or shrubs when resting or disturbed (Antos and Bennett 2006; Menkhorst *et al.* 2019). Habitat critical to the survival of the Southern Whiteface includes areas of relatively undisturbed open woodlands and shrublands with an understorey of grasses or shrubs, or both; habitat with low tree densities and herbaceous understory litter cover which provides essential foraging habitat (Antos *et al.* 2008); and living and dead trees with hollows and crevices which are essential for roosting and nesting (TSSC 2023a).

Based on publicly available data, the species has not been recorded within the SGP and has been recorded infrequently in the surrounding area (Figure 5.11). The species has been recorded only twice since 1975 within 50 km of the SGP, with the remain records are either prior to 1975 (6 records) or without date (6 records). These records, along with the presence of suitable habitat within the SGP (see discussion below), suggests the species has some potential to occur, all be it low.

Southern Whiteface breeding occurs from July to October, however, the timing of breeding can be affected by rainfall in arid regions (Higgins and Peter 2002). Breeding may occur outside the usual season following sufficient rainfall, or may not occur at all during drought. Nest are large bulky domed constructions of grass, bark and roots, usually in a hollow or crevice, although sometimes in low bushes (Higgins and Peter 2002).

Habitat loss and fragmentation are likely to have caused Southern Whiteface declines in recent years, especially in the parts of the species' range where there has been complete removal of habitat for intensive agriculture. The population has declined substantially by an estimated 30 to 50% every ten years since 1999, with no indication that the declines are slowing (Ehmke *et al.* 2021).

Habitat Mapping

Only four Southern Whiteface records within 50 km have sufficiently accurate data to extract Regional Ecosystem information. Two of these records fall within RE 11.9.5 and another two in 11.5.20/11.3.18/11.3.25. In the latter instance, it seems likely the birds were present in

11.5.20 as the other two REs typically have thick ground layers (grasses) preventing birds foraging on the ground. Based on a similar 1 m BVG classification the following REs might be structurally similar: 11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.5.26 and 11.9.10. Areas of 11.3.2, 11.5.1, 11.5.1a and 11.7.7 might also be considered. While these habitats are likely to have the highest amenity for the species within the SGP they remain, on balance, typically too thick to be considered high amenity habitat.

This, however, is not to deny the above REs can have areas of reduced canopy and ground cover. While the Southern Whiteface cannot be discounted from occurring in these types of locations, our impression is these habitats are too infrequent and too isolated to elevate any of the above REs to 'Core Habitat Possible'. All are better considered 'General Habitat'.

One study in NSW found Southern Whiteface were more common in planted (regrowth) habitats than remnant or paddock sites (Barrett *et al.* 2008). Indeed, Southern Whitefaces can be found in areas where thinning or past clearing activities have reduced the canopy density creating conditions simulating open woodland habitats (M. Sanders *pers obs*). Ironically, it may be possible high amenity habitats within the SGP occur in non-remnant habitats. Finding a consistent method to accurately show where non-remnant habitats might be suitable is a problematic, if not a nearly impossible task without exhaustive field survey program. It seems better to also leave these as 'General habitat' and elevate them to a higher rating if the species is recorded in pre-clearing surveys.

A study from northern Victoria (Antos and Bennett 2006) failed to record these birds from riparian 'Black Box' and 'River Red Gum' woodlands, which seems likely due to prolific grass in riparian habitats. Our observations within the SGP also suggest, with the exception of those listed above, the remaining REs on Landzone 3 will have low amenity due to thick grass (e.g., 11.3.25, 11.3.27, 11.3.18 etc) or dense canopy.

Rule(s) for Habitat Mapping:

1. It is assumed the species could occur throughout the entire SGP.
2. All remnant and regrowth vegetation of RE 11.3.1, 11.3.2, 11.3.17, 11.4.3, 11.4.3a, 11.5.20, 11.5.26, 11.9.5, 11.9.10 should be mapped as 'General Habitat'.
3. General Habitat within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known' (as of writing no such areas exist within the SGP).
4. All remaining remnant and non-remnant vegetation (including regrowth) is mapped as 'Absence suspected'.

Mapping Confidence

While Southern Whiteface habitat preference is relatively well understood, mapping habitat amenity based on the available REs within the SGP is difficult. We cannot exclude the possibility the species could occur but, in general, habitats are typically not ideal. More open habitats become increasingly common further west and this is reflected in the species distribution; the SGP is near the eastern limit of the species occurrence in southern Queensland. Should the records of this species within the SGP increase, these rules should be refined based on improved habitat understanding.

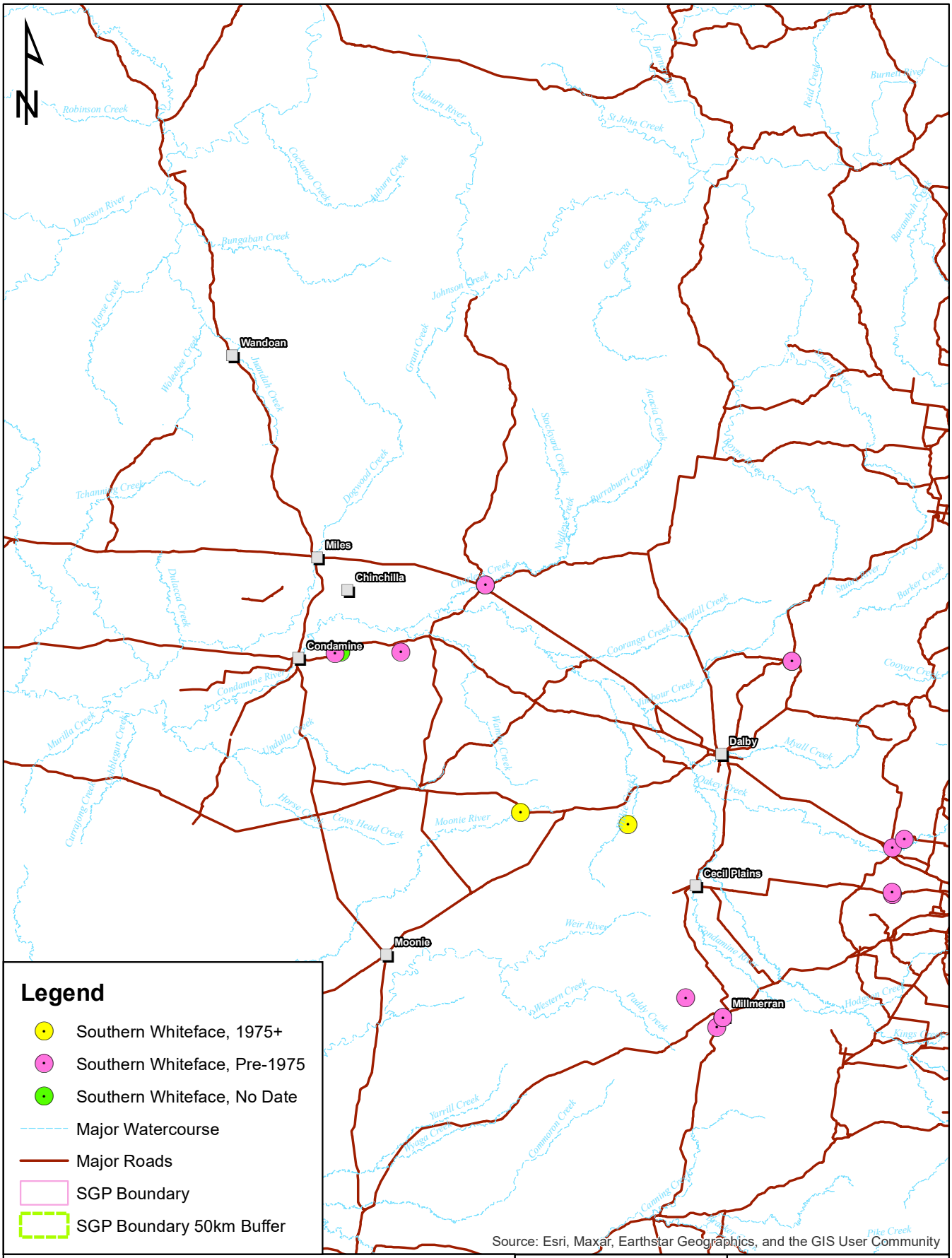

Figure 5.11
Records of the Southern Whiteface within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.3.5 *Grantiella picta* (Painted Honeyeater)

Vulnerable EPBC Act (effective Jul 2015)
Vulnerable NC Act

Ecology and occurrence within the SGP

Endemic to Australia, the Painted Honeyeater may be found from the eastern Northern Territory to Victoria and southern regions of South Australia (Pizzey *et al.* 2012). Rare in the Northern Territory, they are widespread throughout Queensland, absent only from Cape York and high rainfall areas. The SGP area occurs entirely within the distribution of the Painted Honeyeater and the species has been frequently recorded within 50 km. Despite the abundance of local records, evidence of the species within the SGP is scattered. This likely reflects habitat availability - suitable habitat is generally uncommon.

Painted Honeyeaters inhabit open dry woodlands and forests. They prefer extensive stands of remnant woodlands with mature trees, but will use narrow strips and small blocks if sufficient mistletoe fruit is available (Higgins *et al.* 2001; DCCEEW 2023 c). A key component of Painted Honeyeaters habitat is Mistletoe, the fruit of which they feed on almost exclusively, but may also collect nectar and invertebrates (Oliver *et al.* 2003). Most foraging is undertaken within the canopy (Higgins *et al.* 2001).

Nesting occurs during spring-summer (Sept.-Feb.), predominantly in the south-east of its range north to around Brisbane. The breeding season is determined by photoperiod to coincide with warmer summer months, but actual breeding is cued in relation to the progression of mistletoe fruiting. This ensures that breeding is matched by peak resource availability, avoiding temporal variation inherent in unpredictable environments (Barea and Watson 2007).

Small, frail cup-shape nests with narrow sides are constructed in the outer foliage and branchlets of eucalypts, casuarinas and acacias. However, a disproportionately large number of nests are placed in mistletoe clumps in taller trees (Whitmore and Eller 1983; Beruldsen 2004; Barea 2008).

While not well understood, movement patterns are generally described as a north-south migration (Keast 1968). Populations move north during winter and return south of approximately 26° latitude during spring-summer to breed (Higgins et al. 2001). At some locations they can be irruptive in response to abundant mistletoe fruiting (Oliver *et al.* 2003).

Habitat Mapping

Within the southern Brigalow belt vegetation which supports abundant Needle-leaved (*Amyema cambagei*) and Grey Mistletoe (*A. quandang*) are particularly favoured. Needle-leaved Mistletoe is associated with *Casuarina cunninghamiana* and *Casuarina cristata,* while Grey Mistletoe is associated with larger *Acacia* species (especially *A. harpophylla*). Riparian woodlands (e.g., *E. camaldulensis* waterways) can also be utilised if mistletoe is abundant.

Analysis of spatially accurate and recent records identifies five BVG groups as containing Painted Honeyeater Records (Table 5.4). From the data it is immediately obvious the vast majority, 97% of records, fall within BVG 25a and non-remnant habitats. Closer examination shows that, of the records within BVG 25a, all but one occurs in RE 11.3.17. This is appears to be a critical habitat for the species in the SGP region. Spatial inspection also reveals many

records (>250) in non-remnant habitats are associated with (i) patches of regrowth 11.3.17, 11.9.6 and 11.9.10 around Jondaryan and (ii) fragments/regrowth 11.3.1 and 11.9.6 in the Jandowae areas. These habitats are dominated by Brigalow, presenting a clear picture of habitat preference.

Table 5.4. Association of Painted Honeyeater with 1:1 m Broad Vegetation Groups within the SGP and surrounding 50 km area

BVG (1 m)	Count of records			Representative REs in the SGP
	SGP	50 km	% of total	
11a	0	1	0.2	None
12a	0	3	0.6	11.7.4, 11.7.7
16a	0	0	0.0	11.3.25
17a	0	1	0.2	11.3.2, 11.3.18, 11.5.1a, 11.9.7
25a	1	143	26.9	11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.5, 11.9.10
29b	0	4	0.7	11.7.5
Non-remnant	1	381	71.4	
Total	*2*	*533*	*100.0*	

Rule(s) for Habitat Mapping:

1. The species may occur throughout the entire SGP.
2. REs dominated by Brigalow including 11.3.1, 11.3.17, 11.4.3, 11.4.3a and 11.9.5 (including 'disturbed' communities) are mapped as 'Core Habitat Possible'.
3. Regrowth derived from RE 11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.5 (i.e., brigalow regrowth) is mapped as 'Core Habitat Possible'.
4. The above REs and REs 11.5.20 and 11.3. 27a and 11.3.27f are mapped as 'Core Habitat Known' around Lake Broadwater.
5. All remaining areas of RE 11.3.25 and 11.3.27 (including all subtypes) are mapped as 'General Habitat',
6. All 'Core Habitat Possible' or 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
7. All remaining REs and non-remnant (including regrowth) areas are 'Absence Suspected'.

Mapping Confidence

While RE units do not account for this species key resource, mistletoe density, mistletoe is most often associated with the REs identified here as 'Core Habitat Possible'. However, these REs do not always have mistletoe. The mapping product is likely to slightly overestimate habitat availability but, on balance, is considered to have high accuracy.

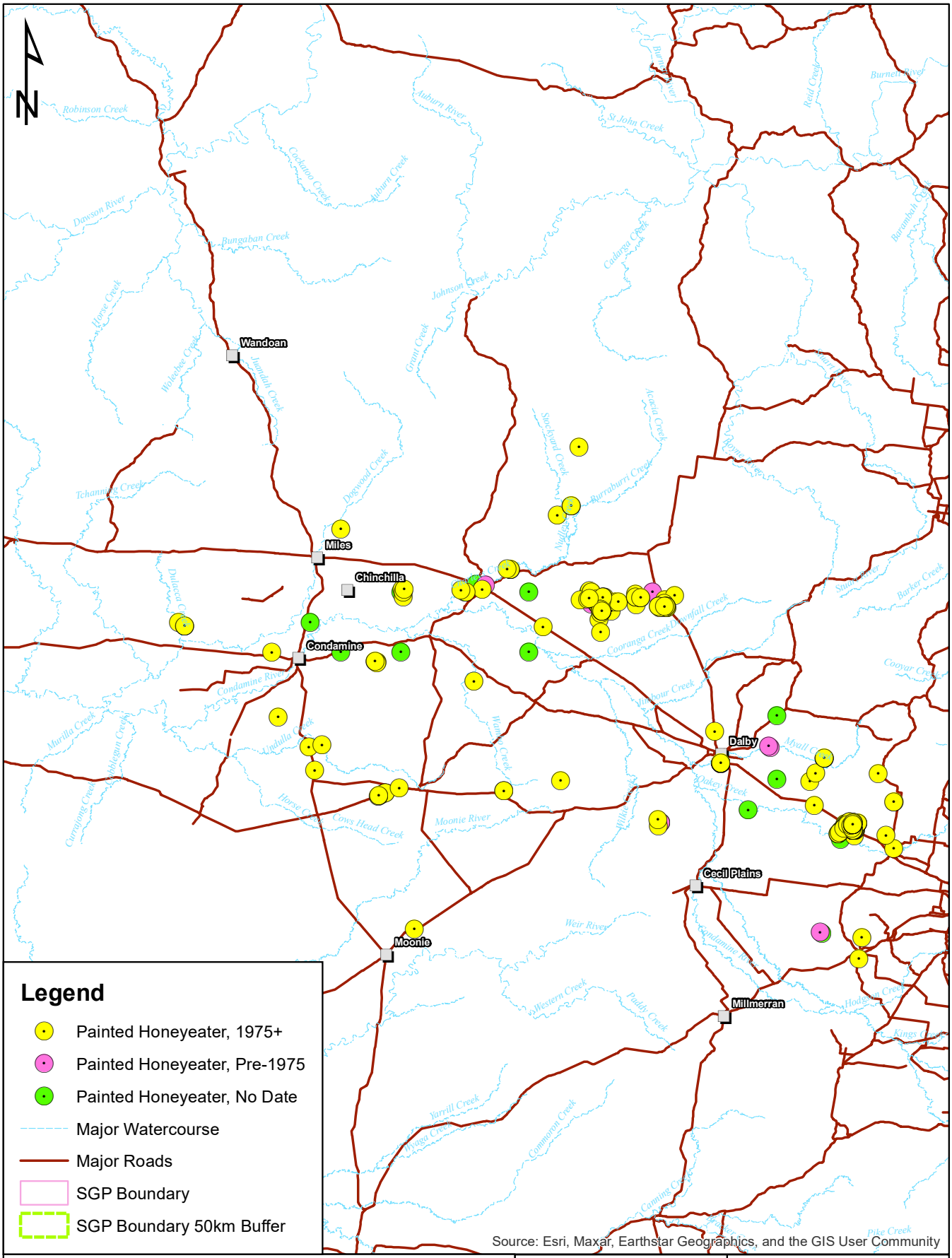

Figure 5.12
Records of the Painted Honeyeater within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.3.6 *Stagonopleura guttata* (Diamond Firetail)

Ecology and occurrence within the SGP

The Diamond Firetail occurs in south-eastern Australia, from south-east Queensland to the Eyre Peninsula in South Australia (TSSC 2023b). Within this distribution, the species occurs across a range of habitat types, including eucalypt woodland, banksia shrubland, and cypress forest (Cooney and Watson 2005; McGuire and Kleindorfer 2007; Antos *et al.* 2008; Hodder 2019). Populations appear unable to persist in fragmented areas which lack remnant patches of vegetation larger than 200 ha (TSSC 2023b).

Records of the species are scattered from around the SGP (Figure 5.13). However, ascertaining occurrence in the SGP has been thwarted by the lack of accurate records within available public databases – no records are available through Wildnet and all records on ALA have been rounded to a 10 km grid. Our work within the SGP, and other works undertaken by Arrow, have failed to locate the species suggesting it at this time is not known.

The Diamond Firetail is granivorous, with a diet consisting predominantly of grass seeds, with the remainder of the diet typically made up of forbs (Read 1994; Hodder 2019). Both native and introduced grasses and forbs are utilised dependent on availability (Read 1994; Hodder 2019). In South Australia, the species is also reported to at least occasionally feed on the seeds of *Allocasuarina* spp., which appears to represent a case of diet switching during a period of grass seed scarcity over winter (Read 1994; Hodder 2019). Foraging occurs almost exclusively on the ground, with only a small number of foraging bouts at 1-2 m above the ground (Ford *et al.* 1986; Antos and Bennett 2006). Ideal foraging habitat for Diamond Firetails is characterised by mostly open areas with low tree density, low percentage cover of fallen logs, and high percentage cover of grass, with patches of bare ground, moss and forbs (Antos *et al.* 2008; Antos and Bennett 2006).

Breeding takes place from August to February. Nests are built up to 4-5 m above the ground in a range of plant species depending on location, including *Eucalyptus* spp., *Banksia* spp., *Allocasuarina* spp. and mistletoe, and are often adorned with flowers around the entrance (Cooney and Watson 2005; McGuire and Kleindorfer 2007). Females lay an average clutch size of 4-5 eggs, although as many as seven may be laid (Higgins *et al.* 2006). Diamond Firetails mature within 10-20 weeks depending on location and climate. Nests may be utilised for more than one season but typically a new nest is built each year (McGuire and Kleindorfer 2007).

Habitat Mapping

No accurate records are available for this species and, in the absence of this data, evaluating important REs can only be achieved though descriptive comparison of each RE to known high amenity habitat features. This suggests all forest and woodlands within the SGP could be potentially inhabited though, on balance, 11.7.5 and 11.7.2 are likely too thick and with reduced grass cover.

Based on DCCEEW (2023h), a patch size threshold of 200 ha has been included in the mapping rules.

Rule(s) for Habitat Mapping:

1. The species may occur throughout the entire SGP, but is considered less likely to persist in combined patches <200ha (where a combined patch includes all remnant vegetation types and ignores non-remnant gaps <200 m wide).
2. All remnant REs within the SGP *except* 11.7.5 and 11.7.2, with a combined remnant patch size (irrespective of RE designation) greater than 200 ha is 'Core Habitat Possible'.
3. All remnant REs within the SGP *except* 11.7.5 and 11.7.2, with a combined remnant patch size (irrespective of RE designation) less than 200 ha but within 500 m of core habitat possible is 'General Habitat'.
4. All regrowth of the above REs with a combined patch size greater than 200 ha is 'General Habitat'.
5. All 'Core Habitat Possible' or 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
6. Remaining isolated areas of remnant and non-remnant vegetation (including regrowth) are mapped as 'Absence Suspected'.

Mapping Confidence

The frequency and location of contemporary records of the Diamond Firetail surrounding the SGP is difficult to ascertain based on currently available data. However, in general, they are scattered suggesting that, while the species could occur, its presence might be sporadic. It is possible large areas of suitable habitat remain uninhabited. Should records of this species within the SGP increase, these rules should be refined based on improved habitat understanding.

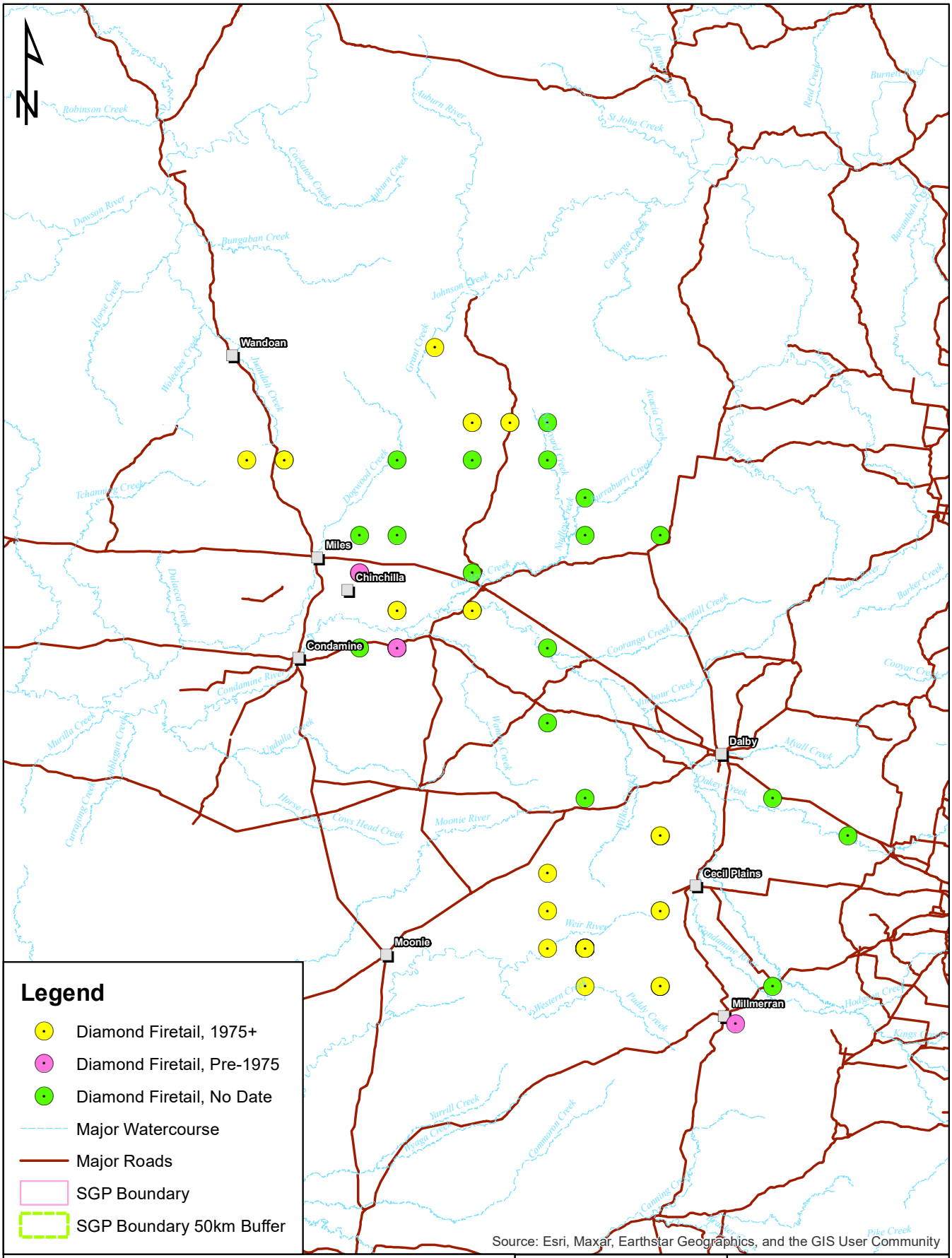

Figure 5.13
Records of the Diamond Firetail within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.4 MAMMALS

5.4.1 *Nyctophilus corbeni* (South-eastern Long-eared Bat)

Vulnerable EPBC Act (effective Apr 2001)
Vulnerable NC Act

Ecology and occurrence within the SGP

The South-eastern Long-eared Bat (*Nyctophilus corbeni*) is largely restricted to the Murray-Darling Basin (Churchill 2008; Baker and Gynther 2023) with its stronghold in the Pilliga forests of New South Wales (Turbill and Ellis 2006). In Queensland, it is mainly recorded in the south of the Brigalow Belt (Curtis *et al.* 2012) and from large tracts of vegetation, approximately 5000+ ha in size (e.g., Southwood National Park), although the species can be recorded from smaller vegetation tracts of 600 ha (e.g., Erringibba National Park) (EPA 2008). A similar association for large continuous vegetation has been noted in NSW (Turbill and Ellis 2006).

Records of the species are scattered around the SGP, though few fall within 50 km. A cluster of records is located in the central block of the SGP, situated roughly between Gurulmundi and Barakula State Forests. Another cluster of records is located in Condamine State Forest to the west of the SGP. Both these areas fall within large relatively contiguous areas of vegetation (Figure 5.14). The species requires targeted survey effort and is likely to be more widely distributed throughout these large forest areas. Law *et al.* (2016, 2018) found wildfires have deleterious impacts and extensive fires in Kumbarilla during late 2016 may have adversely affected populations in these areas (if present).

The species is common in box/ironbark/cypress pine woodland and vegetation dominated by Buloke (*Allocasuarina luehmannii*) on sandy soils, though it can also occur in Brigalow (*Acacia harpophylla*) and Belah (*Casuarina cristata*) communities, dry sclerophyll forests with *Corymbia citriodora*, and semi-evergreen vine thickets (Turbill and Ellis 2006; Churchill 2008; Baker and Gynther 2023). The species prefers areas with a distinct overlapping canopy and a dense understorey (Churchill 2008; Law *et al.* 2016).

Roosting has been recorded in hollows and fissures of trees and occasionally under exfoliating bark and even within foliage (Churchill 2008; Curtis *et al.* 2012; Baker and Gynther 2023). While living and dead Eucalypts are most commonly used, several studies in NSW suggest they disproportionately selecting dead trees and in particular dead Buloke (*Allocasuarina luehmannii*) for roosting. Most roost trees are <40 cm DBH and, despite being common in the landscape, hollows in larger trees (e.g., *Eucalyptus camaldulensis*) are not utilised. Typically, individuals do not use a roost location over sequential nights, preferring to regularly move between roosts (Law *et al.* 2016, 2018; Gonsalves *et al.* 2022).

With broad, short wings, the South-eastern Long-eared Bat is highly manoeuvrable and well-adapted to its cluttered habitat. They fly close to vegetation, often through the canopy and can drop suddenly to almost ground level after prey (Churchill 2008). South-eastern Long-eared Bats typically forage up to about 4 km from their roost, although individuals have been captured up to 7 km from roost. Average forage distance is thought to be ~1-2 km (Law *et al.* 2016).

Available evidence suggests the species is reluctant to move into open habitats including wildfire regrowth (Law *et al.* 2016, 2018). This may, in part, explain why most records are

associated with larger continuous intact vegetation. Further, minor fragments and linear strips of native vegetation are vulnerable to understorey damage and loss of dead trees, especially when combined with grazing.

Mating occurs in autumn and winter. Females are able to store spermatozoa until ovulation and conception in early spring. Two young are usually born in late October to November and lactation continues until January (Baker and Gynther 2023).

Habitat Mapping

Nine accurate records are available to derive habitat information, five fall within RE 11.5.1, one in a heterogeneous area of RE 11.7.4/11.7.7 and three within RE 11.7.5/11.7.7. The RE 11.7.5 refers to low shrubland and is unlikely to be suitable habitat. Extrapolation based on BVG grouping (BVG 12a and 18b) suggests suitable habitat could also include RE 11.5.4.

However, considering the low number of records from which to gain habitat data, other REs should be considered based on habitat description. Studies have found the species preferring areas with abundant shrub layers and Buloke (Law *et al.* 2016). REs within the SGP matching this description include 11.3.1, 11.3.14, 11.3.18, 11.4.3, 11.4.3a, 11.5.1, 11.5.1a, 11.5.4, 11.5.21, 11.7.4, 11.7.7, 11.9.5 and 11.9.10. Other REs that may also be considered, but are less likely to have a dense understorey, include: 11.3.25, 11.3.27, 11.5.20, 11.7.2 and 11.7.6.

Rule(s) for Habitat Mapping:

1. Potential South-eastern Long-eared Bat habitat is restricted to contiguous or near-contiguous areas of vegetation (i.e., reduced fragmentation). Within the SGP, potentially important habitat is restricted to vegetation within or abutting the 'large tracts remnant veg.shp'.
2. Within the area defined in step 1 above, REs 11.3.1, 11.3.14, 11.3.18, 11.4.3, 11.4.3a, 11.5.1, 11.5.1a, 11.5.4, 11.5.21, 11.7.4, 11.7.7, 11.9.5 and 11.9.10 are mapped as 'Core Habitat Possible'.
3. Within the area defined in step 1 above, REs 11.3.25, 11.3.27, 11.5.20, 11.7.2 and 11.7.6 are mapped as 'General Habitat'.
4. Within the designated area in step 1, isolated patches (>500 m from any other remnant vegetation) of the REs listed in step 2 above are reclassed as 'General Habitat'.
5. All 'Core Habitat Possible' or 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
6. All remaining remnant and non-remnant vegetation, including regrowth, is mapped as 'Absence Suspected'.

Mapping Confidence

Identifying suitably large tracts of remnant vegetation within the SGP is relatively easy. Predicting where the species might occur within this vegetation is more complex. While those REs listed as 'Core Habitat Possible' accurately reflect the best areas of habitat, large tracts of 'General Habitat' may have suitable structure and provide good habitat for the species. Should

records of this species within the SGP increase, these rules should be refined based on improved habitat understanding.

While several REs have been excluded as not suitable ('Absence Suspected') in the mapping product, their landscape position often contributes to patch integrity and they may therefore provide an important role in ensuring a populations persistence.

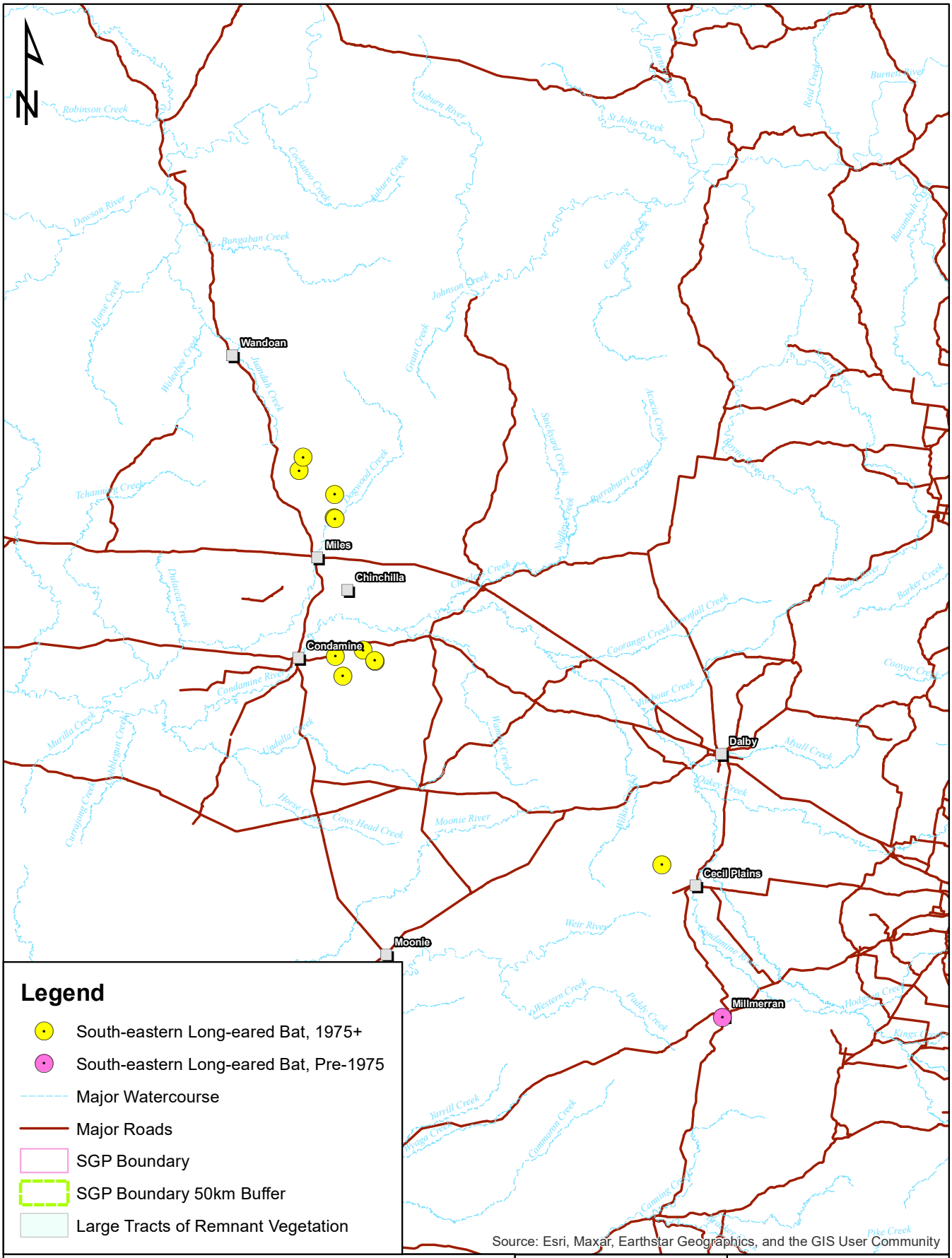

Figure 5.14
Records of the South-eastern Long-eared Bat within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.4.2 *Petauroides volans sensu lato* (Greater Glider)

Endangered EPBC Act (effective Jul 2022)
Endangered NC Act (also as *P. armillatus*)

Recent genetic research (McGregor *et al.* 2020) suggests *P. volans* may be paraphyletic, consisting of three closely related taxa. Some agencies and jurisdictions have accepted this work and recognise *P. armillatus* (Central Greater Glider) as a separate species. However no formal description of the new taxa has been published, their distributions are poorly understood, and taxonomic change has not been formally recognised by the Australian Mammal Taxonomic Consortium (AMTC 2022). Nor has the new taxonomy been recognised in the recently published Mammals of Australia (Baker and Gynther 2023). In the interests of taxonomic stability, we retain *P. volans* (southern and central populations) as a single species here (*sensu lato*), but recognise this may change in the future. Irrespective of the taxonomic uncertainty, both southern and central Greater Glider are currently listed under state and federal legislation as Endangered.

Ecology and occurrence within the SGP

The Greater Glider (*Petauroides volans*) is the largest gliding possum in Australia. Its distribution extends from the Windsor Tableland in north Queensland, south to Wombat State Forest in central Victoria (Woinarski *et al.* 2014). Inland isolated subpopulations are also known from the Gregory Range (west of Townsville) (Winter *et al.* 2004), and another in the Einasleigh Uplands bioregion of Queensland (Vanderduys *et al.* 2012).

The Greater Glider has been recorded at 23 discrete locations within and surrounding the SGP (Figure 5.15). Most of these records are associated with larger areas of remnant vegetation, in particular vegetation spanning between Barakula, Binkey and Gurulmundi State Forests, and vegetation associated with Condamine, Braemar, Vickery and Kumbarilla State Forests. However a number of records fall in fragmented vegetation, usually long narrow linear strips associated with Wilkie and Condamine River.

The species is predominately restricted to eucalypt forests and woodlands, and are most common in taller, montane, moist eucalypt forests with larger, relatively old trees and abundant hollows (Andrews *et al.* 1994; Kavanagh 2000; Eyre 2004; van der Ree *et al.* 2004; Vanderduys *et al.* 2012). In areas west of the Great Dividing Range they are found in low woodlands (McKay 2008).

Greater Gliders are described as having a strictly 'eucalyptus' diet but will also occasionally take flowers and rarely *Acacia* phyllodes or mistletoe leaves (Lindenmayer 2002; Kavanagh and Wheeler 2004; Woinarski *et al.* 2014). Studies have found a preference for young leaves or particular eucalypt species, with selection likely related to leaf nutrient concentration (Kavanagh and Lambert 1990; Lindenmayer 2002; Eyre 2006). Dietary selection in the southern Brigalow Belt is poorly understood with a single study finding foraging animals most often in *E. moluccana, E. fibrosa* and *Corymbia citriodora* (Smith *et al.* 2007; Eyre *et al.* 2022). A study of Greater Gliders across the broader southeast Queensland region (including the Brigalow Belt Bioregion) also identified *E. tereticornis* and *E. citriodora* as predictors of Greater Glider presence in drier forests (Eyre 2006). In contrast (Comport *et al.* 1996) found Greater Gliders

showing a preference for *E. acmenoides* over other eucalypts, which included *E. tereticornis* and *C. citriodora*, despite other eucalypts having higher nutrient content.

Greater Gliders require large old-growth trees with abundant large hollows for denning and its abundance is often linked to hollow density (Kehl and Borsboom 1984; Lindenmayer *et al.* 1991; Andrews *et al.* 1994; Smith *et al.* 2007; Goldingay 2011). Both live and dead trees can be used but most dens are located in living trees (Kavanagh and Wheeler 2004). Preferred hollows are typically higher in the canopy and comparatively deeper, with a large internal cavity preferred over smaller shallower hollows (Lindenmayer 2002). Hollow entrance size is poorly documented but is likely around 18 cm (Goldingay 2011).

In southern Queensland the Greater Glider requires at least 2−4 live den trees for every 2 ha of suitable forest habitat (Eyre 2002). Studies in Barakula State Forest found female Greater Gliders inhabited areas with, on average, 3.8 den trees per hectare while male home ranges had far fewer, on average 0.9 den trees per hectare (Smith *et al.* 2007), though males used slightly more hollow-bearing trees overall (4-20, average 11) than females (6-18, average 10).

Home ranges are usually 1-4 ha in size, however in dry and more open woodland home ranges can be up to 19 ha (Kehl and Borsboom 1984; Comport *et al.* 1996; Gibbons and Lindenmayer 2002; Pope *et al.* 2004; Eyre 2004; Smith *et al.* 2007; Eyre *et al.* 2022). Males have a larger home range size than females and sexes usually share a den when the breeding season commences (Kavanagh and Wheeler 2004; Pope *et al.* 2004; McKay 2008).

Females give birth to only one young from March to June. Juveniles emerge from the pouch when three to four months old and become independent at around nine months. However, Greater Gliders do not reach their sexual maturity and start breeding until their second year (Tyndale-Biscoe and Smith 1969; McKay 2008). It is estimated the species can live up to 15 years (Harris and Maloney 2010).

Habitat Mapping

Based on available research, Greater Gliders in the southern Brigalow Belt are primarily associated with forests dominated by *E. tereticornis*, *E. moluccana, E. fibrosa* and *C. citriodora* (Eyre 2006; Smith *et al.* 2007). *Eucalyptus crebra* and *E. melanophloia* forests are also possibly important based on RE analysis (Eyre *et al.* 2022). These correspond with REs 11.3.4, 11.3.25, 11.3.26, 11.3.27, 11.5.1, 11.5.20, 11.7.6, 11.7.7 and they should be included as core habitat. Five additional REs have been identified using accurate records within 50 km of the SGP (Table 5.5): 11.3.14, 11.5.21, 11.7.4, 11.9.2 and 11.9.7. The description of these REs match the habitat profile for Greater Glider.

Two other REs within the SGP warrant consideration, despite lacking records, 11.3.2 and 11.3.3. Both these contain large eucalypts which readily for hollows but may be too open to be frequently utilised by the species. They can be mapped as General Habitat.

While the species is more likely to occur in contiguus eucalypt forests (Youngentob *et al.* 2013), estimating minimum patch thresholds is difficult. In Queensland, Eyre (2006) suggested Greater Gliders are associated with remnant patches exceeding 160 ha. However, careful inspection of accurate records within and surrounding the SGP show several observations have occurred in highly fragmented landscapes though, in general, these observations are from long

narrow linear strips which connect to larger patches. Other authors have also noted this species persisting in small fragmented patches (Lindenmayer 2002; Pope *et al.* 2004; Eyre *et al.* 2022) and, as a consequence, no patch threshold is applied here. This approach is consistent with Queensland mapping practice (Eyre *et al.* 2022).

Table 5.5. Association of Greater Glider records with 1:1 m Broad Vegetation Groups within the SGP and surrounding 50 km area

BVG (1 m)	Count of records			Representative REs in the SGP
	SGP	50 km	% of total	
10a	1	10	23.4	11.7.6
12a	1	6	14.9	11.7.4, 11.7.7
13d	0	6	12.8	11.3.26, 11.5.20
16a	4	7	23.4	11.3.25
16 c	1	0	2.1	11.3.3, 11.3.4
17b	0	2	4.3	11.9.2, 11.9.7
18a	0	2	4.3	11.3.14, 11.5.21
18b	2	0	4.3	11.5.1, 11.5.4
Non-remnant	2	3	10.6	
Grand Total	*11*	*36*	*100*	

Rule(s) for Habitat Mapping:

1. The species may occur throughout the entire SGP.
2. Mapped habitat (core habitat possible or general habitat) is restricted to remnant vegetation patches with an accumulative size >10 ha (i.e., entire extent, regardless of RE types, and ignoring non-remnant gaps of less than 150 m).
3. Within combined patches > 10 ha, 'Core Habitat Possible' includes REs 11.3.4, 11.3.14, 11.3.21, 11.3.25, 11.3.26, 11.3.27 (including all subtypes), 11.5.1, 11.5.4, 11.5.20, 11.5.21, 11.7.4, 11.7.6, 11.7.7, 11.9.2 and 11.9.7.
4. Within combined patches > 10 ha, Polygons of REs 11.3.2 and 11.3.3, immediately adjacent Core Habitat Possible are mapped as 'General Habitat'.
5. All Core Habitat Possible and General Habitat within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
6. All regrowth and other non-remnant habitats are mapped as 'Absence Suspected'.

Mapping Confidence

Important habitat characteristics for this species are well understood and can be matched to regional ecosystem descriptions. However, areas within the SGP have been subject to historic logging removing larger hollow-bearing trees and reducing denning opportunities for Greater Glider. It is possible the resulting map overestimates potential habitat.

Furthermore, our mapping varies considerably from mapping developed and produced by the Queensland Department of Science (Eyre *et al.* 2022), which factors in Species Distribution Modelling (SDM). SDM evaluates a species climatic envelop based on known records, and its

inclusion appears to have removed most vegetation within the SGP. This is surprising as the map does not seem to account for many records within and surrounding the SGP, including records to the west. While the mapping rules above may overestimate habitat due to anthropogenic impacts (e.g., logging), the DES mapping seems too pessimistic. The REs identified in our analysis, on balance, match those identified as suitable by (Eyre *et al.* 2022).

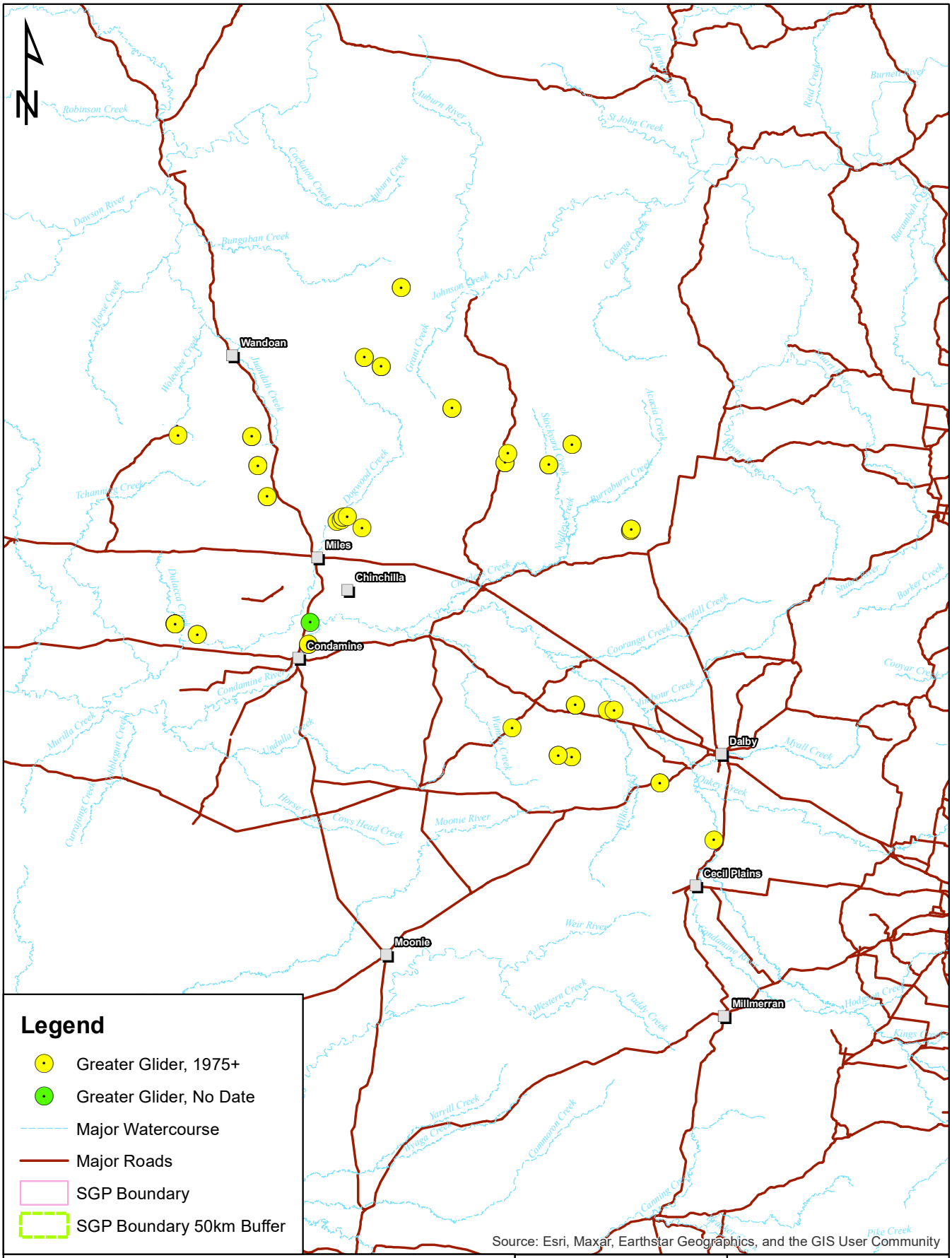

Figure 5.15
Records of the Greater Glider within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.4.3 *Petaurus australis australis* (Yellow-bellied Glider)

Vulnerable EPBC Act (effective Mar 2022)
Vulnerable NC Act

Ecology and occurrence within the SGP

The Yellow-bellied Glider is found in coastal forests and mountain ranges from the Wet Tropics to Victoria, extending inland as far as Blackdown Tablelands and Carnarvon Gorge National Parks (Woinarski *et al.* 2014). The species occurs as two disjunct populations: a small Wet Tropics population, and a more widespread southeastern population (*P. a. australis*) ranging from Mackay, QLD, to Victoria (Brown *et al.* 2007). The species is typically restricted to large contiguous or near contiguous forest patches with areas less than 18,000ha (180 km^2) unlikely to support viable populations (Goldingay and Possingham 1995; TSSC 2022).

While records can be found to the north, east and west of the SGP, there are few records of to the south (Figure 5.16). The species is well represented in the nearby Barakula and Gurulmundi State Forests, and remnant vegetation within the SGP connects these areas to form a considerably large contiguous forested area (Figure 5.16). Records are also present to the west of the southern SGP in Braemar State Forest, which also contributes to a large area of remnant forest vegetation stretching south to Kumbarilla State Forest. Based on this information, and the presence of suitable habitat, the species is likely to occur within the SGP but is yet to be detected. Significant wildfire through much of Kumbarilla State forest in late 2016 may have reduced habitat amenity and affected populations (if present) in the south.

Habitat requirements for the species broadly encompass tall, mature Eucalyptus forest in large contiguous forest reserves of thousands of hectares in area (Goldingay and Possingham 1995; Eyre 2007). In northern and central Australia they are associated with dry Eucalypt-dominated forest (Eyre 2007), while in southern Australia they are more closely associated with cool, moist montane forest with high rainfall (>600 mm; Rees *et al.* 2007). Typically, Yellow-bellied Gliders are associated with smooth- and gum-barked trees (Goldingay 1987; Kavanagh 1987; Kambouris *et al.* 2013; Bilney *et al.* 2022) with deep, narrow and high hollows (Craig 1985; Goldingay *et al.* 2018). Winter-flowering trees are important in some areas (Irish and Kavanagh 2011).

The majority of the species energy requirements are derived from tree sap (exudates) as well as nectar, often supplemented with insects, particularly of the order Coleoptera (Smith and Russell 1982; Craig 1985, 1985; Goldingay 1990). Sap is harvested by making uniquely recognisable notches or gouges in the Eucalypts bark using its sharp front incisors. Larger trees are disproportionately harvested for sap (Eyre and Goldingay 2005).

The frequency of consumption and proportion of sap and nectar in the diet varies by both location and forest phenology i.e. timing of flowering (Kavanagh 1987; Goldingay 1990; Goldingay and Kavanagh 1991; Carthew *et al.* 1999). Within a given home range, Yellow-bellied Gliders only feed on a small subset of species of Eucalyptus, and only a small number of individual trees, with a preference for smooth- and gum-barked trees with a DBH >60 cm (Craig 1985; Goldingay 1987; Kavanagh 1987; Goldingay and Quin 2004; Kambouris *et al.* 2013; Jessup *et al.* 2020).

Breeding is somewhat opportunistic, with a single young born between early winter and early summer, with timing of birth probably dependent on resource availability (Craig 1985; Goldingay and Kavanagh 1991).

Average home range size of the Yellow-bellied Glider varies from 25 ha to 85 ha (Goldingay and Kavanagh 1990; Goldingay and Possingham 1995). Within these home ranges, Yellow-bellied Gliders den in hollow-bearing trees and regularly change dens, as often as nightly in some instances (Craig 1985). They den in stable family groups, consisting of either a monogamous pair with or without a single dependent offspring, or a polygynous group of up to six individuals, consisting of a single male and multiple females with or without dependent offspring (Craig 1985; Goldingay and Kavanagh 1990; Goldingay 1992; Brown *et al.* 2007).

Habitat Mapping

Based on the available location data, the majority of Yellow-bellied Glider records within 50 km of the SGP are located within BVG 10a. Closer examination shows that the dominant RE present where these observations occur are 11.7.6 and 11.10.1, both dominated by *Corymbia citriodora*. These are obviously critical vegetation types for the species in the local area.

Cross-referencing known Yellow-bellied Glider tree associations (TSSC 2022) with tree species identified within the SGP identify the following: *Corymbia trachyphloia*, *Eucalyptus tereticornis, E. crebra, E. fibrosa* and *E. moluccana*. Within the SGP these trees can be found in REs 11.3.4, 11.3.25, 11.3.26, 11.5.1, 11.5.20, 11.5.21, 11.7.4 and 11.7.7 – these match the BVGs listed in Table 5.6 except BVG 25a. Closer examination of Yellow-bellied Glider records within BVG 25a reveal these occur in mixed polygons containing one of the above mentioned REs. The REs associated with BVG 25a are not consistent with good Yellow-bellied Glider habitat.

Table 5.6. Association of Yellow-bellied Glider records with 1:1 m Broad Vegetation Groups within the SGP and surrounding 50 km area

BVG (1 m)	Count of records			Representative REs in the SGP
	SGP	50 km	% of total	
10a	0	52	66.7	11.7.6
12a	0	10	12.8	11.7.4, 11.7.7
13d	0	8	10.3	11.3.26, 11.5.20
16 c	0	2	2.6	11.3.3, 11.3.4
18a	0	2	2.6	11.3.14, 11.5.21
25a	0	4	5.1	11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.10, 11.9.5
Total	*0*	*78*	*100.0*	

Patch size is also an important factor in determining high habitat amenity areas for Yellow-bellied Gliders, with connected patches greater than 18,000ha needed to support viable populations (Goldingay and Possingham 1995; TSSC 2022). Suitable habitat should only fall within the two areas shown in Figure 5.16 above - vegetation connected with Gurulmundi, Binkey and Barakula State Forests, and vegetation connected with Condamine, Braemar, Vickery and Kumbarilla State Forests. These areas are contained within the provided 'large tracts remnant veg.shp' layer.

Rule(s) for Habitat Mapping:

1. Potential Yellow-bellied Glider habitat is restricted to contiguous or near-contiguous areas of vegetation (i.e., reduced fragmentation). Within the SGP, potentially important habitat is restricted to vegetation within or abutting the 'large tracts remnant veg.shp'.
2. Within the above area, REs 11.3.4, 11.3.25, 11.3.26, 11.5.1, 11.5.4, 11.5.20, 11.5.21, 11.7.4, 11.7.6 and 11.7.7 are mapped as 'Core Habitat Possible'.
3. RE 11.5.4 and 11.9.2 can be structurally similar to the above REs (forest) but lack known tree associations; within the area defined in step 1 above these REs are mapped as 'General Habitat'.
4. Within the designated area in step 1, isolated patches (>400 m from *any* other remnant vegetation) of the REs listed in step 2 and 3 above are mapped as 'General Habitat'.
5. All 'Core Habitat Possible' or 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
6. Remaining areas of remnant, non-remnant and regrowth vegetation is 'Absence suspected'.

Mapping Confidence

The habitat requirements for this species are relatively well understood and match well to the Regional Ecosystem classification system. Combining suitable REs with a patch size threshold should produce a map of relatively high accuracy.

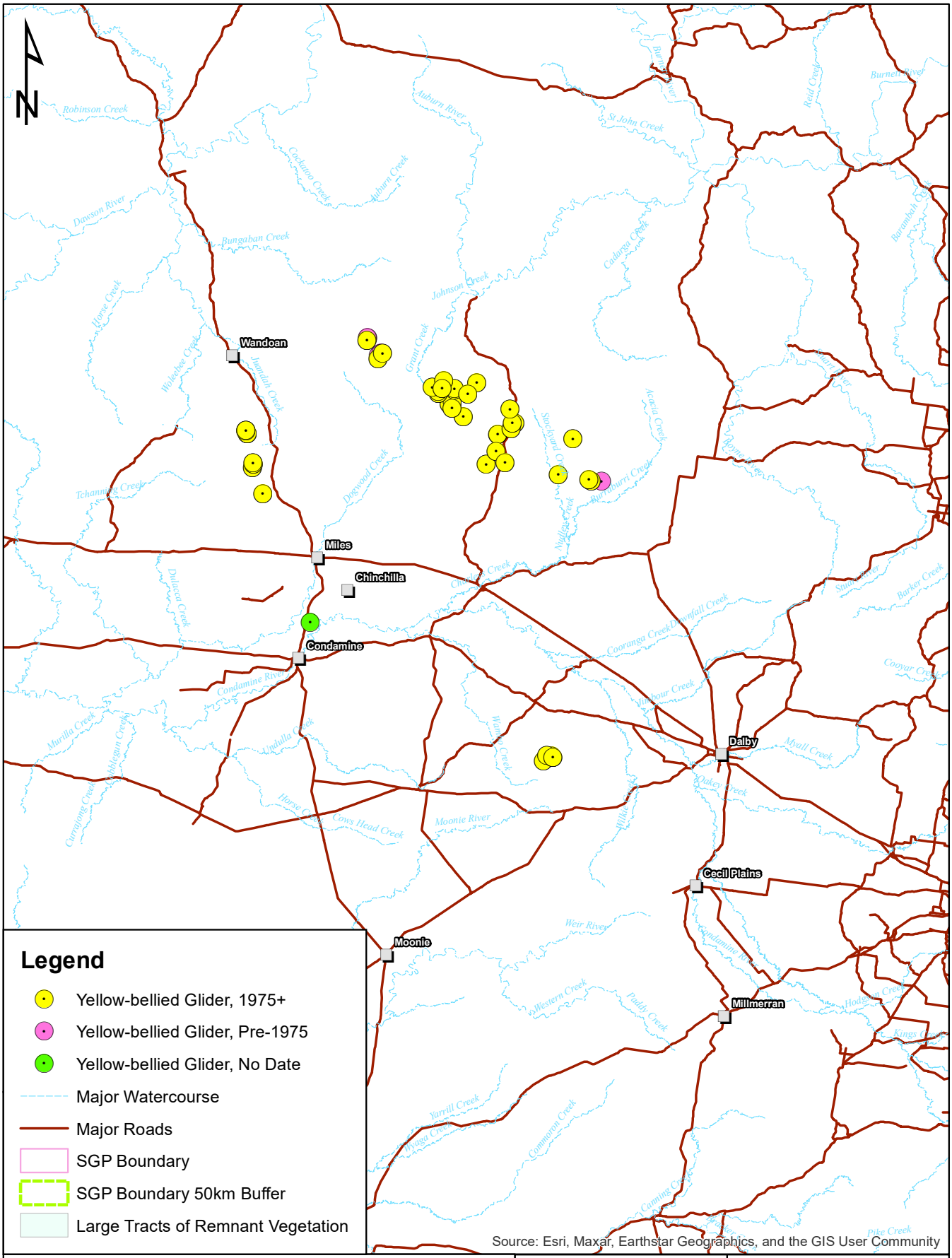

Figure 5.16
Records of the Yellow-bellied Glider within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

5.4.4 *Phascolarctos cinereus* (Koala)

Endangered EPBC Act (effective Feb 2022)
Endangered NC Act

Ecology and occurrence within the SGP

Endemic to eastern Australia, the Koala is a solitary species which is widespread across coastal and inland areas from Cooktown, Queensland to the Mt. Lofty ranges, South Australia (Baker and Gynther 2023). Restricted to altitudes below 800 m ASL (Munks *et al.* 1996), Koalas occur in a diversity of habitats including temperate, sub-tropical and tropical forest, woodland and semi-arid communities, and sclerophyll forest, on foothills, plains and in coastal areas (Martin *et al.* 1999; Baker and Gynther 2023). Closer to the western extent of their distribution they are often associated with water courses though are not restricted to them (Melzer *et al.* 2000; Sullivan *et al.* 2004; Davies *et al.* 2013). The Koala has been located in nine biogeographic regions of Queensland, including the southern Brigalow Belt (DCCEEW 2023d).

Koalas feed on eucalyptus trees but show dietary preference based on geographical region and the types of tree species present. In the Brigalow Belt Koalas have at least 24 species of Eucalyptus upon which they preferentially forage (ANU 2021). Of these tree species the following have been recorded within the SGP: *Corymbia tessellaris, C. citriodora, Eucalyptus camaldulensis, E. chloroclada, E. coolabah, E. crebra, E. exserta, E. fibrosa, E. melanophloia, E. moluccana, E. ochrophloia, E. populnea,* and *E. tereticornis*.

Koalas are not strongly territorial and home ranges will overlap. Home ranges vary in size from 1-2 hectares in optimum habitat up to 135 hectares in semi arid regions (Ellis *et al.* 2002; Baker and Gynther 2023). Movements are often as short as the distance between feed trees; however dispersing individuals will move over larger distances. Established individuals have been known to make exploratory movements over larger distances before returning to home ranges (Dique *et al.* 2004).

The breeding season occurs between October and May with females producing up to one offspring per year (Baker and Gynther 2023). Juveniles become independent from one year of age with males living for over 12 years and females living for over 15 years (Martin *et al.* 1999). Breeding occurs from two years of age, and is often determined by the establishment of a male hierarchy as males become vocal and fiercely fight for females (Baker and Gynther 2023).

Habitat Mapping

Analysis of available spatially accurate recent (1975+) Koala records identifies their presence in a wide range of BVGs which correspond to many of the REs present within the SGP (Table 5.7). While some identified REs (e.g., 11.3.1, 11.3.27a, 11.4.3, 11.3.4a, 11.7.2, 11.7.5) do not initially appear to contain Eucalypts based on their description, closer examination of the REDD reveals emergent Eucalypts are often present. In fact, based on the REDD, potential foraging trees are present in all remnant types *except* 11.9.5.

Koalas are surprisingly mobile and able to move large distances across artificial land. There are no limitations on suitable patch size. They are also often seen in regrowth. The abundance of records in non-remnant habitats likely reflect these behaviours with individuals able to utilise isolated trees in an otherwise unsuitable landscape.

Table 5.7. Association of Koala records with 1:1 m Broad Vegetation Groups within the SGP and surrounding 50 km area

BVG (1 m)*	Count of records			Representative REs in the SGP
	SGP	50 km	% of total	
10a	0	9	1.9	11.7.6
11a	0	18	3.8	None
12a	6	5	2.4	11.7.4, 11.7.7
13d	4	0	0.9	11.3.26, 11.5.20
16a	4	17	4.5	11.3.25
16 c	5	0	1.1	11.3.3, 11.3.4
17a	6	31	7.9	11.3.18, 11.3.2, 11.5.1a, 11.9.7
18a	1	2	0.6	11.3.14, 11.5.21
18b	26	19	9.6	11.5.1, 11.5.4
25a	6	10	3.4	11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.10, 11.9.5
30a	0	4	0.9	None
34a	5	0	1.1	None
Undifferentiated Non-remnant	12	278	62.0	
Total	*75*	*393*	*100*	

* Includes records from differentiated regrowth, records from undifferentiated regrowth added to non-remnant tally

Rule(s) for Habitat Mapping:

1. The species may occur throughout the entire SGP.
2. All remnant and regrowth REs *except* 11.9.5 are mapped as 'Core Habitat Possible'.
3. All Core Habitat Possible within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.

Mapping Confidence

Our understanding of Koala habitat use in the SGP has increased substantially and it is now recognised that the species can use a wider variety of REs than initially recognised. The mapping is now considered to have high accuracy.

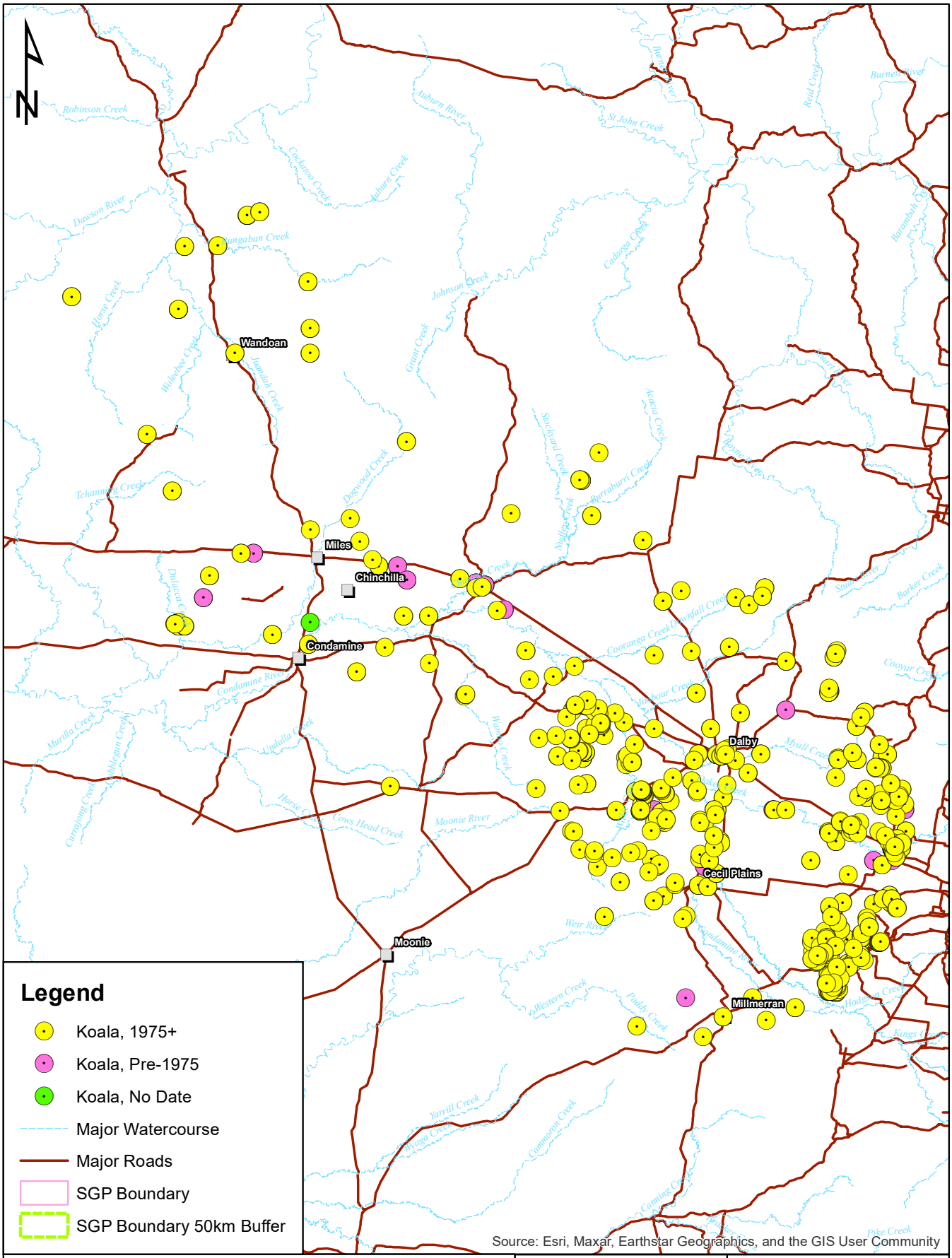

Figure 5.17
Records of the Koala within and surrounding the SGP

Scale
1:1,427,963
0 12.5 25 50 km

Client: Arrow Energy

Project: Surat Gas Project

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Appendix A
Likelihood of Occurrence Assessment

LIKELIHOOD OF ASSESSMENTS

The table below lists flora and fauna species that either known from within 50 km of the SGP or have been identified in the EPBC online Protected Matters search. The Likelihood assessment has been based on the SGP having a Life of Operation of approximately 25 years. Mobile fauna species which could occur within the SGP over this timeframe, but are unlikely to represent a permanent population or a population relying on the SGP for its long-term viability are assessed as 'Transient'.

Scientific Name Common Name	Status#		Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
	NCA	EPBC				
FLORA						
Trees and shrubs						
Acacia barakulensis Waaje Wattle	Vul	-	HERBRECS specimen records indicate species is associated with woodland and shrubland habitats formed by *Eucalyptus tenuipes, Corymbia trachyphloia, Calytrix gurulmundensis, and Triodia mitchellii.* Habitat is consistent with RE 11.7.4, 11.7.5, 11.7.6, and 11.7.7.	The species is considered to possibly occur based on suitability of habitat in the SGP and contiguity of adjacent habitats	Herbrecs identifies 5 confirmed populations 28 km to the north-east of the SGP study area within Barakula State Forest.	Possible
Acacia curranii Curly Bark Wattle	Vul	Vul	Plants are known to occur in shrubby heaths, dry sclerophyll forests and semi-arid woodlands where they can occur as widely scattered thickets in very species-rich heathy scrub with emergent eucalypts (Pickard 1995c, Threatened Species Scientific Committee 2008). Curly-bark wattle grows on sandy clay soils that are poorly drained on weathered sandstone.	The species is considered to possibly occur based on suitability of habitat in the SGP and contiguity of adjacent habitats	Sixteen local populations are recorded in Herbrecs with the nearest population 11 km west of the SGP study area with Gurulmundi State Forest (excluding low precision records).	Possible

Scientific Name Common Name	Status#		Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
	NCA	EPBC				
Acacia handonis Hando 's Wattle	Vul	Vul	Hando's wattle has only been collected on rocky ridges and slopes on sandstone-derived geology in eucalypt woodland and open forest. The vegetation it grows within is a shrubby woodland of *Eucalyptus fibrosa subsp. nubila, Eucalyptus watsoniana subsp. watsoniana, Lysicarpus angustifolius*, and Allocasuarina inophloia (Halford 1995). This is consistent with RE11.7.7	The species is considered to possibly occur based on suitability of habitat in the SGP and contiguity of adjacent habitats	Seventeen local populations are recorded in Herbrecs with the nearest population 35 km east of the SGP study area within Barakula SF (54 km west-north-west of Miles)	Possible
Acacia lauta Tara Wattle	Vul	Vul	Associated with sandy soils hosting ironbark woodland. Known populations have been mapped within REs 11.7.7, 11.7.4 and 11.7.5. These REs provide a representative mix of shrubland and woodland of which ironbark (*Eucalyptus crebra, Eucalyptus sideroxylon or Eucalyptus fibrosa)* forms a dominant to sub-dominant component (TSSC 2008o).	Populations are localised to the area surrounding Tara and Inglewood. Due to a lack of survey record following comprehensive survey, this species is considered unlikely to occur.	Nearest record is 20km west of the Kumbarilla State Forest in the vicinity of Tara (64 km west of Dalby).	Unlikely
Acacia wardellii	NT	-	The species inhabits gravelly soils on shallow weathered sandstone in eucalypt woodland (Pedley, 1978). Herbrecs data (EHP 2013) indicates typical habitats including RE 11.7.4, RE 11.7.7 and RE 11.7.5.	Potential habitats include REs 11.7.4 and 11.7.7 to in the vicinity of Kogan although extensive ground survey in this locality suggest a new population within the SGP is unlikely.	Three populations recorded all approximately 16 km west of the SGP study area and 25 km west of Chinchilla. Greater than 30km west of the nearest suitable habitat near Kogan.	Unlikely

Scientific Name Common Name	Status#		Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
	NCA	EPBC				
Apatophyllum teretifolium Sandstone Pricklebush	NT	-	This small shrub grows in eucalypt forest on rocky surfaces, including cliffs.	The primary habitats that may contain *Apatophyllum teretifolium* are REs 11.7.4 and 11.7.7	One population is known from approximately 28 km to the east of the SGP study area, in Barakula SF, north of Chinchilla.	Unlikely
Callitris bayleyii Bailey's cypress pine	NT	-	A 3D Environmental survey record associated with the Surat EIS (3D Environmental 2011) confirms its presence in low open forest (11-15m) of *Eucalyptus exserta, E. crebra* and *Callitris glaucophylla* with a mid-dense shrubby understorey dominated by *Micromyrtus sessilis with Acacia crassa, Alphitonia excelsa,* and *Petalostigma pubescens*. Habitat typical of RE11.7.4	Extensive tracts of suitable habitat occur in the central portion of the SGP area. The extent of habitat including core habitat possible and general habitat has been provided within the attached GIS package.	Nearest local record is 2.6 km west of the SGP study area (40 km north of Miles) in Gurulmundi State Forest.	Possible
Calytrix gurulmundensis Gurulmundi Fringe Myrtle	Vul	Vul	Grows in patches of shrubland on shallow lateritic soils at sandstone ridges. Vegetation is predominately eucalypt, acacia, casuarina dense shrublands with spinifex, and spinifex grassland with scattered shrubs. This habitat description is consistent with RE 11.7.5 (shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks).	Suitable habitats include patches of RE11.7.5 and RE11.7.4 in to the west and north-west of the central assessment area. The extent of habitat including core habitat possible and general habitat has been provided within the attached GIS package.	Nearest local record is 12 km west of the SGP study area (30 km north of Miles) within Gurulmundi State Forest. A population also exists in Waaje Scientific Reserve 36 km east of Wandoan.	Possible

Scientific Name Common Name	Status#		Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
	NCA	EPBC				
Cadellia pentastylis Ooline	Vul	Vul	Ooline grows in semi-evergreen vine thickets, brigalow and occasionally in adjacent eucalypt woodland, where it maybe locally dominant in the canopy layer or occur as an emergent (TSSC 2008e) and also residual trees in cleared paddocks. Substrates include clay plains, sandstone and residual ridges (Eddie 2007).	Although Ooline occupies a range of substrates, local records are located in sandstone ravines in Gurulmundi State Forest. There are no known similar habitats in the SGP study area.	Nearest local collected sample is 23 km west of the SGP area and 50 km NE of Miles. There are no other local records. A 1963 record at Myall Park is included in AVH, although accompanying notes indicate that this plant is cultivated. An additional low precision (5121 m) observation is also shown in ALA approximately 5 km north of the Myall Park. This is considered most likely to be the same cultivated record. Extensive searches for this large distinctive species throughout the SGP have been unsuccessful and it is considered 'unlikely' to occur.	Unlikely
Denhamia parviflora Small-leaved Denhamia	Vul	Vul	Small-leaved Denhamia grows in semi-evergreen vine thickets, vine scrubs and brigalow (*Acacia harpophylla*) softwood communities on fertile, red brown sandy clay loam hillslopes and crests (DNR 2000).	Suitable habitat and substrate within the assessment area is extremely limited.	2 pre-1985 records located to the east of Chinchilla, approximately 20 km east of the SGP study area.	Unlikely

Scientific Name Common Name	Status#		Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
	NCA	EPBC				
Eucalyptus argophloia Chinchilla white gum	Vul	Vul	Exists largely in disturbed regrowth vegetation with associated tree species of brigalow (*A. harpophylla*), grey box (*E. molluccana/ E. microcarpa*) white cypress pine (*C. glauca*) and poplar box (*E. populnea*). The tree is associated with red loams, grey brown clays and clay loams of moderate to high fertility. According to TSSC, no known populations occur in vegetation classified as remnant under the VM Act.	Suitable red high fertility loamy substrates have not been identified in the SGP.	Nine records located east of the SGP study area with the nearest population 25 km from the SGP boundary and 18 km north-west of Chinchilla	Unlikely
Eucalyptus curtisii Plunkett Mallee	NT	-	Lateritic sandstone and sandstone rises/ridges and slopes often with *Eucalyptus exserta, E. fibrosa* subsp. *nubila, Corymbia trachyphloia,* and *Callitris glaucophylla.* Typical habitats include RE11.7.7, 11.7.5 and 11.7.5.	Has potential to occur throughout the SGP study area in suitable habitats. Estimated extent of suitable habitat within the SGP provided in GIS package.	Numerous local records mostly west of the SGP study area with the nearest record 2.5 km west of the SGP study area and 35km north of Miles	Possible
Eucalyptus pachycalyx subsp. waajensis *Pumpkin gum*	End	-	Grows in an apparently unique small area of sandy plateau, as an emergent tree, with *Eucalyptus sideroxylon subsp improcera* in a shrubland of *Melaleuca uncinata*, RE 11.7.5	Similar habitat present although extensive field survey did not identify any populations of this distinctive tree in the SGP.	Known from 29 km north-east of SGP, in northern Barakula State Forest.	Unlikely
Eucalyptus sideroxylon subsp. improcera *Red ironbark*	Vul	-	Grows in an apparently unique small area of sandy plateau, as an emergent tree in a shrubland of *Melaleuca uncinata*, RE 11.7.5	Similar habitat present although extensive field survey did not identify any populations in the SGP.	Known from northern Barakula State Forest, 29 km to the east of SGP.	Unlikely

Scientific Name Common Name	Status#		Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
	NCA	EPBC				
Eucalyptus virens Shiny-leaved Ironbark	Vul	Vul	The species is known to inhabit plateaus and sandstone escarpments and sandy soils which form low rises. Based on Herbrecs data (EHP 2013), populations are mapped as occurring in association with REs11.7.7, 11.7.4. 11.7.5, 11.7.6 and11.5.1, all associated with residual soils.	Similar habitat present although extensive field survey did not identify any new populations.	Extremely localised population with 2 records from the vicinity of Tara, 9 km west of the SGP study area (64 km west of Dalby).	Unlikely
Homoranthus decumbens	Vul	End	This low shrub grows in a unique sandy lateritic and sandstone outcrop area with *Eucalyptus pachycalyx* subsp *waajensis* and *Eucalypus sideroxylon* subsp *improcera*, RE 11.7.5	Similar habitat present although extensive field survey did not identify any populations of this distinctive tree in the SGP.	Known from 29km north-east of SGP, in northern Barakula State Forest.	Unlikely
Homoranthus papillatus	CE	-	Areas of soil amongst granite outcrop heath.	No suitable habitat present.	This shrub has only been collected at Girraween National Park, near Stanthorpe. Wildnet and Atlas of Living Australia list one 2001 observation (lacking a plant sample specimen) from Binkey State Forest, north of Miles. However, Tony Bean, the Homoranthus expert at the Queensland Herbarium, considers this most likely a mis-identification.	Unlikely
Melaleuca groveana Groves Paperbark	NT	-	A small shrub of rocky outcrop shrubland areas, RE 11.7.5.	Similar habitat present although extensive field survey did not identify any populations of this distinctive tree in the SGP.	Known from 29 km north-east of SGP, in northern Barakula State Forest.	Unlikely

Scientific Name Common Name	Status#		Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
	NCA	EPBC				
Micromyrtus carinata	End	-	Herbrecs records indicate suitable habitat in heathland and low woodland typical of REs 11.7.4 and 11.7.5.	Estimated extent of suitable habitat within the SGP provided in GIS package.	Nearest Herbarium Record is 10km north-west of Miles and 4 km west of the SGP study area on the Wyona Property.	Possible
Micromyrtus patula	End	-	A small shrub of rocky outcrop shrubland areas, RE 11.7.5.	Similar habitat present although extensive field survey did not identify any populations of this distinctive tree in the SGP.	Known from 30 km north-east of SGP, in northern Barakula State Forest.	Unlikely
Philotheca sporadica Kogan Waxflower	NT	Vul	Based on field survey observation, the species is universally restricted to open scalds and low *Eucalyptus exserta* dominant woodlands associated with RE11.7.4,as well as associated non remnant areas such as powerline tracks. .	The extent of habitat including known, core habitat possible and general habitat has been provided within the attached GIS package	There are 11 known populations, seven occur on road verges, seven extend onto freehold land and one population is within Braemar State Forest (Halford 1995c in TSSC 2008j). The extent of known populations and habitat has been expanded considerably as a result of the current assessment.	Known
Pomaderris coomingalensis	End	-	Occurs in Eucalyptus and Callitris woodland in shallow sandy soil or Eucalyptus woodland on hard sandstone jump ups. Herbarium records (DERM 2011) include woodland of narrow leaved ironbark (*Eucalyptus crebra*) and *E. fibrosa subsp nubila*.	Extensive areas of potential habitat in the Kogan / Kumbarilla areas in RE11.5.1, 11.7.4 and 11.7.7.	A single record to then west of Kumbarilla State forest, 10km from the west of the SGP study area. Not recorded in field surveys despite extensive survey effort in suitable habitat	Unlikely
Sophora fraseri Brush Sophora	Vul	Vul	Grows in vine thicket and dry rainforests.	No suitable habitat within SGP	Has been collected in vine thicket near Toowoomba and further east.	Unlikely

Scientific Name Common Name	Status# NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Grasses and Sedges						
FLORA	Vul	-	Known from heavy soils with records from remnant and disturbed *Eucalyptus orgadophila* woodland on basaltic soils and grassland on heavy alluvium.	Limited suitable remnant habitat in the assessment area and the species is not known to be associated with non-remnant habitats.	A single 1995 herbarium record exists in the Jandowae area, 18 km east of the SGP study area and 25 km north of Dalby.	Unlikely
Dichanthium queenslandicum King bluegrass	Vul	End	*Dichanthium queenslandicum* is in mostly confined to natural grassland on the heavy black clay soils (basalt downs, basalt cracking clay, open downs) on undulating plains, typically growing with other bluegrass species including *Dicanthium setosum*	While suitable habitat occurs in native grassland habitats RE 11.3.21 and 11.3.24, the species has never been recorded to the west of Bowenville.	The nearest record occurs 23 km to the east of the SGP near Bowenville, collected in 2011. Additional records occur 25 km to the north near Jandowae, although these are historic (both 1951).	Unlikely
Digitaria porrecta Finger Panic Grass	NT	-	Finger panic grass grows in grasslands, woodlands and open forests with a grassy understory, on black soil plains of the Darling Downs, and lighter textured soils to the west (Goodland 2000; Fensham 1998). Fensham (1998) found it is most abundant in grassland, but is "relatively unspecific" in its habitat preference. It is not restricted to high quality native grasslands, but also grows along roadsides and can be found in highly disturbed sites.	The most suitable habitats are associated with derived grassland habitats, typically associated with roadside easements between Chinchilla and Cecil Plains.	Two records within the SGP study area , both in non-remnant derived grasslands adjacent to roadside easements between Dalby and Cecil Plains. Both records collected in 1995. A further 15 records within 25 km east of the SGP study area boundary.	Known

Scientific Name Common Name	Status[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Fimbristylis vagans	End	-	A sedge to 80cm tall that that fringes ephemeral watercourses and lagoons on alluvium.	A large number of potential habitats associated with swamps and drainage lines.	A single record from the SGP study area associated with the swampy inlet of Lake Broadwater. Has not been recorded or collected since 1984.	Known
Homopholis belsonii	End	Vul	Belson's panic prefers moderate to highly fertile soils, especially those derived from basalt and fertile alluvial flats. It is generally associated with poplar box and brigalow woodlands on light red/brown earths (Fensham and Fairfax 1997, Goodland 2000). It is most likely to be associated with RE11.3.1, 11.3.17, 11.4.3, 11.9.5, 11.9.10.	Regional ecosystems associated with heavy clay, typically brigalow. Scattered remnants of REs 11.3.1, 11.3.17, 11.4.3, 11.9.5, 11.9.10 occur throughout the SGP EIS Area.	A considerable number of records to the east of Dalby with the nearest 12 km from the eastern boundary of the SGP study area. Two records within 8 km of the boundary of the northern study region within 10 km of Wandoan.	Possible
Forbs and herbs						
Cryptandra ciliata	NT	-	Suitable habitat in eucalypt dominated woodland, lancewood (Acacia shirleyi) woodland and Triodia grassland on rocky on low lateritic and sandstone ridges. Habitat in the PDA is consistent with RE 11.7.5, 11.7.4, 11.7.6, 11.5.1, 11.5.4, 11.5.21.	Woodlands in the Chinchilla/Miles region in the Central assessment area provide for potential habitat for the species.	Three herbarium records within 5km of the assessment area boundary with a single record within 1km of the eastern boundary, 30km to the north of Miles.	Possible

Scientific Name Common Name	Status#		Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
	NCA	EPBC				
Cymbonotus maidenii	End	-	The species is associated with a range of remnant and non-remnant habits with records occurring on disturbed roadside drains, native and derived grasslands. It is typically associated with heavy brown to grey cracking clay soils (Holland & Funk 2006).	Suitable habitat occurs within derived grassland habitats to the south of Dalby.	Five Herbrecs specimens recorded within 10 m of the eastern boundary of the SGP study area, mostly in the Cecil Plains / Millmerran Area including collections on road reserves on the Cecil Plains - Millmerran Road.	Possible
Leuzea australis Sunflower	Vul	Vul	Grows in basalt-derived grasslands on cracking clay soils, RE 11.8.11.	Similar habitat occurs in the far south of SGP.	Closest known plants grow 40 km to the south east of Dalby. This is a distinctive looking herb.	Unlikely
Picris barbarorum	Vul	-	Known from native grassland (12.3.21) of *Dichanthium sericeum* in stock routes, road reserves adjacent to disturbed areas such as cultivated paddocks and road and rail lines on black clay soil.	Potential habitat associated with derived grassland in road reserves to the north and south of Dalby.	Four herbarium records within 5km of the SGP study area with the nearest less than 2 km from the assessment area boundary, 14km north-west of Dalby.	Possible
Picris evae Hawk weed	Vul	Vul	Heavy cracking clay soils derived from basalt, e.g. RE 11.8.11.	Similar but not specific habitat within SGP.	Closest known plants grow 26 to 30 km to the south east of Dalby.	Unlikely
Prostanthera sp. (Dunmore D.M.Gordon 8A)	Vul	Vul	Forests and woodlands on rocky outcrops.	Similar habitat occurs in the SGP.	Records from the 1940's and 1950's from the Millmerran area, but no recent records near the SGP	Unlikely
Rutidosis glandulosa	NT	-	Mainly found in roadside vegetation of Acacia and Eucalypt woodland/open forest on red sandy ridges and clay flats between 280-320m altitude adjacent to cleared or partly cleared grazing and cropping land (DNR 2000).	It has been recorded within REs 11.5.4 and 11.9.9 although may occur in various mixed eucalypt woodlands within project area.	Two records within the SGP study area and two Herbarium records within 20 km from the SGP study area.	Known

Scientific Name Common Name	Status#		Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
	NCA	EPBC				
Rutidosis lanata	NT	-	Mainly found in roadside vegetation of Acacia and Eucalypt woodland/open forest on red sandy ridges and clay flats between 280-320m altitude adjacent to cleared or partly cleared grazing and cropping land (DNR 2000).	Most likely to be recorded within REs 11.3.4, 11.3.2 and 11.3.3 in the vicinity of Chinchilla although may occur in these habitats throughout the entire project area.	Eight Herbarium records within 20 km from the SGP study area, all recorded in the Miles / Chinchilla area.	Known
Solanum papaverifolium	End	-	Occurs in wetter (swampy) areas of grasslands or open eucalypt woodland on heavy alluvial soils (Goodland 2000). The species is often recorded in non-remnant habitat.	Suitable habitat occurs within derived grassland and associated woodlands typically associated with roadside reserves.	Two records contained within the SGP study area to the south of Dalby with an large number of herbarium records to the east of the SGP study area between Chinchilla and Dalby.	Known
Solanum stenopterum	Vul	-	Occurs in disturbed grassland, *Casuarina cristata* forest or *Eucalyptus populnea* woodland on clay soils (Bean 2004).	Derived grassland, Brigalow and grassy woodlands of *Eucalyptus populnea* between Dalby and Cecil Plains.	Known to occur in non-remnant grassland approximately 7.5km south of Dalby; 3.5 km east of Cecil Plains in a roadside gravel pit; and approximately 6 km south east of Cecil Plains in remnant Eucalyptus populnea woodland on alluvium (11.3.2). All herbarium records outside SGP study area.	Possible
Thesium australe Austral toadflax	Vul	Vul	Austral toadflax has been collected within popular box (*Eucalyptus populnea*) woodland on alluvial flats (RE 11.3.2) north-west of Dalby, within the project development area.	Most likely to occur on habitats formed on heavy clay associated with the Condamine Alluvium. RE11.3.2 provides the most suitable habitat within the assessment area.	Two herbarium records within 10km of the SGP study area, with the nearest record 2.7k east of the eastern SGP study area boundary, 25km north west of Dalby.	Possible

Scientific Name Common Name	Status[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Vincetoxicum forsteri	End	End	*Vincetoxicum forsteri* (previously called *Tylophora linearis*) is a vine of eucalypt woodland, and associated non remnant areas	Potentially could occur in any eucalypt woodland area.	Has been recorded north of Miles	Possible
Xerothamnella herbacea	End	End	Occurs in remnant and disturbed brigalow (*Acacia harpophylla*) and belah (*Casuarina cristata*) dominated communities in shaded situations, often in leaf litter (TSSC 2008n).	Numerous brigalow habitats (RE11.3.1, 11.4.3, 11.9.5), both remnant and disturbed have potential to host this species.	Two herbarium records to within 20km of the SGP Boundary, 20km to the east and north of Chincilla.	Possible
FAUNA						
Invertebrates						
Adclarkia cameroni Brigalow Woodland Snail	End	Vul	Brigalow and alluvial eucalypt woodlands, which have dense cover and scattered debris, especially logs, dense leaf-litter, piles of fallen bark and flood debris	Within the SGP habitats possibly suitable include: RE 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.17, 11.3.25, 11.3.27, 11.4.3, 11.4.3a. 11.9.5, 11.9.7 and 11.9.10	Known from at least six locations within the SGP and three on the eastern boundary.	Known
Adclarkia dulacca Dulacca Woodland Snail	End	End	A variety of habitats including vine thicket, Brigalow, Lancewood, Ironbark and *E. woollsiana* woodlands	Numerous potentially suitable habitats are present. In particular RE 11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.5 and 11.9.10	Known from one location within the SGP, most other records located further west	Known

Scientific Name Common Name	Status[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Jalmenus eubulus Pale imperial hairstreak	Vul	-	Restricted to Brigalow (*Acacia harpophylla*)-dominated woodlands and open-forests, particularly those areas with Belah (*Casuarina cristata*), emergent eucalypts such as *Eucalyptus populnea* and understorey shrubs (Breitfuss and Hill 2003; Eastwood et al. 2008).	Old-growth remnant brigalow communities occur within the SGP.	Three records are located within the SGP, the most recent of which is 25 years old. Additional records within 50km of the SGP are predominantly >20y old,, with the exception of a single record from 2008 in Gurulmundi SF, and two records from 2012 in Condamine SF The species requires targeted surveys to detect, even during suitable conditions. Current number of records are likely to underestimate abundance and distribution	Known
Amphibians						
Adelotus brevis Tusked Frog	-	Vul	More permanent ponds and streams in rainforest to wet and dry forests including suitable modified and artificial waterbodies (Anstis 2013)	Some low amenity habitat possible around farm dams and within major creeklines. However habitats are typically drier than those where this species is encountered.	No records within the SGP. Three records within 50km, one from Barakula SF from 1996, a second from Kaimkillenbun in 1978. The third, recent record from Miles in 2021, supported by a photograph, is a deceased Cane Toad (*Rhinella marina*).	Will not occur
Litoria cooloolensis Cooloola Tree Frog	-	NT	Permanent wallum wetlands – coastal heaths on sand with tannin stained acidic waters.	None.	A single record from 1972 ~12km SE of Wandoan near the northern SGP is an artefact of rounding. The verbatim locality provided on ALA is from Coolamera Lake, Cooloola	Will not occur

Scientific Name Common Name	Status[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Mixophyes iteratus Giant Barred Frog	End	End	Deep, slow-flowing creeks with steep, undercut banks. May occur in disturbed areas but prefer pristine habitat (Lemckert 1999). Require dense leaf litter and low vegetation for daytime shelter.	None.	A single recent record from 2021 ~25km NE of Dalby, supported by a photograph, shows a tadpole of a species other than *M. iteratus*	Will not occur
Reptiles						
Acanthophis antarcticus Common Death Adder	Vul	-	Found in a wide variety of habitats, including rainforest, open woodland, shrubland and heath (Wilson and Swan 2003).	Suitable vegetation is found in the larger tracks of vegetation associated with Barakula State forest in the north and Kumbarilla SF in the south.	12 records within 50km of the SGP, mostly very old (>90y) or with no date recorded. A single recent record from 2021 is located in Tara. A single record within the SGP, from Lake Broadwater, is 39y old.	Known
Anomalopus mackayi Long-legged worm-skink	Vul	End	Open grasslands with cracking black soil.	No suitable remnant habitats. Derived grasslands may provide some low-amenity habitat.	No records within the SGP; one record within 10km of the SGP. Most recent records (<20 years old) centred around Oakey and Dalby. Never recorded west of the Condamine River.	Will not occur
Delma torquata Collared Delma	Vul	Vul	Rocky outcrops in dry, open eucalypt-acacia woodlands, including Briglaow, with an understorey of grass and shrubs. Can be found in disturbed habitats (Chapple 2017).	Low amenity habitat possible in isolated locations of small jump-ups.	No records within 50km of the SGP boundary.	Unlikely (but considered in detail in Section 5.0)

Scientific Name Common Name	Status[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Egernia rugosa Yakka skink	Vul	Vul	Usually occurs on well-drained, coarse, gritty soils in the vicinity of low ranges, foothills and undulating terrain (Wilson and Swan 2008; Richardson 2006), but can also be found on loam and clay soils (Eddie 2012).	Suitable habitat is present throughout much of the SGP	Two records within 50km of the SGP, one ~2km east of Gurulmundi SF, another ~6km east of Condamine SF. Also anecdotally said to have been recently recorded somewhere in Barakula SF. Rare and scattered in the east of its range.	Unlikely (but considered in detail in Section 5.0)
Furina dunmalli Dunmall's snake	Vul	Vul	Wide range of habitats, including forests and woodlands dominated by brigalow (*Acacia harpophylla*) and other Acacia spp., cypress (*Callitris* spp.) or bulloak (*Allocasuarina luehmannii*) on black alluvial cracking clay and clay loams (Covacevich *et al*. 1988; Stephenson and Schmida 2008).	Suitable habitat is present throughout much of the SGP	Two records, either old (>30y) or undated exist at Lake Broadwater. An additional two records are located within 8km outside the SGP area, with the most recent record from 2000.	Known
Hemiaspis damelii Grey snake	End	-	Inhabits dry eucalypt forest and occasionally pasture, favouring areas of cracking, flood-prone soils along floodplains and near watercourses within the Brigalow Belt (Wilson 2005).	Suitable habitat present across much of the Condamine floodplain on landzone 3 and 4, including non-remnant cleared areas of gilgai black soil in the north-west extent of the southern SGP portion.	61 records within 50km of the SGP, including 15 within the southern SGP, mostly centred around Lake Broadwater and just east of Braemar SF.	Known
Strophurus taenicauda Golden-tailed gecko	NT	-	Found mainly in association with brigalow (*Acacia harpophylla*), cypress (*Callitris* spp.) and ironbark (*Eucalyptus* spp.).	Suitable habitat is present throughout much of the SGP	Regularly recorded within 50km of the SGP (>300 records, including 92 within the SGP). Species recorded during surveys.	Known

Scientific Name Common Name	Status# NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Tympanocryptis condaminensis Condamine Earless Dragon	End	End	Open grasslands and cropland with cracking black soil	No suitable remnant habitats. Derived grasslands may provide some low-amenity habitat.	Closest accurate record from 2023 ~16km from SGP, ~30km SE of Dalby. No records known west of the Condamine River.	Will not occur
Birds						
Anthochaera phrygia Regent Honeyeater	CE	CE	Forests and woodlands of ironbark, box, swamp mahogany and river oak.	Limited low-amenity habitat associated with riparian stretches of *E. tereticornis.*	Only six records within 50km of the SGP, all undated or >20y old, centred around Dalby and Chinchilla. Vagrant within the southern Brigalow Belt.	Unlikely
Aphelocephala leucopsis Southern Whiteface	Vul	Vul	Low-density open woodland and shrublands with grassy and/or shrubby understorey, abundant leaf litter and debris, and hollow- and crevice-bearing trees (DCCEEW 2023)	Some, likely low-amenity, habitat scattered throughout the SGP.	Scattered records within 50km of southern SGP, all undated or at least 15y old. Nearest recent record (2008) from Wilkie Creek in north of Kumbarilla SF, surrounded by southern SGP.	Possible
Botaurus poiciloptilus Australasian Bittern	LC	End	Freshwater wetlands with dense vegetation, particularly reeds and sedges.	Low amenity habitat, only associated with artificial waterbodies, possible. Suitable habitat at Lake Broadwater.	Nine records within 50km of the SGP, all either undated or >50y old. This species is highly vagrant and would be a very rare visitor to the SGP area.	Unlikely (LB)
Calidris ferruginea Curlew Sandpiper	End	CE	Saline and freshwater wetlands, saltmarshes, estuaries, mudflats. Prefers areas with exposed mud for foraging.	Only likely at Lake Broadwater.	Six old (>30y) records from Lake Broadwater in the southern SGP. Most recent record from 2007 on a dam ~7km south of Lake Broadwater. While it is likely to occur at Lake Broadwater, the species has a low probability of occur at other locations within the SGP during Life of Operation.	Will not occur (LB)

Scientific Name Common Name	Status#		Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
	NCA	EPBC				
Calyptorhynchus lathami Glossy Black-cockatoo	Vul	Vul	Inhabits woodlands and forests that have abundant Allocasuarina species and abundant large hollows suitable for nesting. Many populations are restricted to remnant vegetation within hills and gullies surrounded by agricultural land (Higgins 1999).	Habitat throughout the SGP except the very northern portion. Higher amenity habitat more prevalent in the southern SGP area.	Regularly recorded (160 records) in and within 50km of the SGP. Within the SGP most records are associated with Lake Broadwater and Kumbarilla SF. Recorded during surveys.	Known
Erythrotriorchis radiata Red Goshawk	End	End	Open forests, woodlands, wetlands, rainforest fringes	Suitable habitat present throughout the SGP	Two records within the southern SGP in the vicinity of Lake Broadwater, and an additional 9 within 50km of the SGP centred around Chinchilla and Oakey. All records are old (i.e. >40 years) and the species is rarely recorded in the Brigalow Belt. No known likely population.	Unlikely/ Transient
Falco hypoleucos Grey Falcon	Vul	Vul	Lightly treed inland plains, gibber deserts, pastoral lands	Typically occurs in dyer more open habitats than those present in the SGP.	Four undated records within 50km of the SGP and one old (>20y) record from Lake Broadwater likely represent misidentifications or a very occasional vagrant. The species is rarely recorded within the Brigalow Belt.	Unlikely/ Transient

Scientific Name Common Name	Status[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Geophaps scripta scripta Squatter Pigeon	Vul	Vul	Occurs mainly in dry grassy eucalypt woodlands and open forests and also inhabits cypress pine (Callitris spp.) and Acacia dominated woodlands (Frith 1982)	Non-remnant habitats present throughout the SGP. Remnant habitats are, throughout much of the SGP, too heavily wooded to be considered high-amenity.	Periodically recorded in and withing 50km of SGP. most recently from 20222 near Nudley SF ~70km E of central SGP. Three records within the central SGP, the most recent from 2012. Despite suitable habitat being present, this species is likely to vagrant, with individuals not representing a resident or seasonal population. May sporadically occur in the northern and central regions of the SGP during Life of Operation.	Transient
Grantiella picta Painted honeyeater	Vul	Vul	Found mainly in dry open woodlands and forests, particularly box-ironbark woodlands. It may also occur in riparian forest, on plains with scattered eucalypts and in remnant trees on farmland and their occurrence is strongly associated with mistletoe.	Isolated areas of remnant brigalow present high-amenity habitat within the SGP	Within 50km of the SGP, multiple records exist, notably from Jondaryan and Jandowae, with an array of records from Jondaryan and Dalby in the past five years, although these may represent repeat sightings of only a few individuals. Four records within the SGP in the southern portion near Lake Broadwater the most recent from 2016. Likely to occur within the SGP infrequently.	Known
Hirundapus caudacutus White-throated Needletail	Vul	Vul	Possible over all land types due to aerial foraging habit	Entire SGP provides suitable foraging habitat.	Regularly recorded within 50km of the SGP, including during surveys. Multiple occurrences within the central and southern SGP, particularly in the vicinity of Lake Broadwater and	Known

Scientific Name Common Name	Status# NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Lathamus discolour Swift Parrot	End	CE	Flowering trees in forests and woodlands	Low amenity habitat associated with riparian E. tereticornis. Typically in a region too dry for the species which is more coastal	Six records within 50km of the SGP, all undated or >50yr old. Any possible current or future occurrence would be of vagrant individuals.	Unlikely
Limosa lapponica baureri Bar-tailed Godwit	Vul	Vul	Saline and freshwater wetlands, saltmarshes, estuaries, mudflats. Prefers areas with exposed mud for foraging, usually within proximity to the coast.	Only likely at Lake Broadwater.	With the exception of two pre-1900 records, this species has been recorded on only three occasions between 1980 and 1987. All records are from the vicinity of Lake Broadwater	Will not occur (LB)
Lophochroa leadbeateri Pink Cockatoo	Vul	-	Sparsely timbered open grasslands, *Callitris* and *Casuarina* woodlands, mulga woodlands, trees in proximity to watercourses	Habitats within the SGP are, on balance, too closed and more mesic than areas inhabited by this species.	Two records exist within the project site in the Lake Broadwater area, both >30yr old. Several undated or old (>50yr) exist within 50km of the SGP. and the age of these sparse records indicate the species does not occur in the area with any frequency.	Will not occur
Ninox strenua Powerful Owl	Vul	-	Eucalypt forests on ranges with densely vegetated gullies, drier and lower elevation forest with sufficient prey and large hollows	Low-amenity habitat associated with large tracks of forest dissected by riparian corridors with E. tereticornis. Arboreal mammals throughout much of the SGP are not common.	No records within the SGP and all records are old (i.e. >20 years). Rarely recorded within the Brigalow Belt.	Unlikely
Pedionomus torquatus Plains-wanderer	Vul	Vul	Open grasslands with patches of bare ground, low sparse shrublands	None.	Outside of known range and all records are old (ie. >40 years).	Will not occur

Scientific Name Common Name	Status[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Psephotus pulcherrimus Paradise Parrot	Ex	Ex	Eucalypt woodland in lightly timbered river valleys with grassy understorey, often with termite mounds (DCCEEW 2023)	N/A. Species is extinct. Most forested areas too dense.	Historic records from Dalby and Oakey Creek; however, species is extinct and therefore no longer occurs within the SGP.	Will not occur
Rostratula australis Australian Painted Snipe	Vul	End	Found in a wide range of habitats including ephemeral swamps, dams, rice paddocks, waterlogged grasslands, roadside drains and even brackish waterways (Marchant and Higgins 1993).	Most restricted to Lake Broadwater, though some moderate to low-amenity habitat is possible at the adjacent Long-swamp under favourable conditions.	Records within 50km of SGP are sparse and mostly undated. Eight records known from the southern section of the SGP, in the vicinity of Lake Broadwater, the most recent from 2013.The species could occur within the SGP Life of Operation, though most likely restricted to this area.	Possible
Stagonopleura guttata Diamond Firetail	Vul	Vul	A range of habitat types including eucalypt woodland, banksia shrubland and cypress forest, provided a grassy understorey is present for foraging.	Suitable habitat present throughout the SGP	Multiple records exist within 50km of the SGP; however, all records have been subjected to rounding and are therefore inaccurate, so it impossible to determine how many actually fall within 50km of the SGP, or within the SGP itself. The most recent records are from 2021 and are all within the vicinity of the block of SF comprised of Kumbarilla, Dunmore and Western Creek SFs.	Possible
Poephila cincta cincta	End	End	Open Eucalypt woodlands and grasslands	Limited	Two undated (likely very old) records relating to an isolated, but now extinct, population centred on the Tablelands of NSW.	Will not occur

Scientific Name Common Name	Status[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Turnix melanogaster Black-breasted button-quail	Vul	Vul	Leaf litter in drier rainforests, vine thickets, lantana on rainforest edges, hoop pine plantation	None	A single 30y old record from Barakula SF. Also known from state forests north of, but connected to, Barakula SF. No known record from within the SGP.	Will not occur
Mammals						
Chalinolobus dwyeri Large-eared Pied Bat	Vul	Vul	Often observed along ecotones on rainforest edges or in association with sandstone escarpments (DoE 2017).	Largely absent. Only very poor habitat present in minor jump-ups.	A single 30yr old record from Western Creek SF, ~36km S of southern SGP.	Will not occur
Dasyurus hallucatus Northern Quoll	LC	End	Most common in rocky eucalypt woodland and open forest within 200 kilometres of the coast.	Largely absent. Only very poor habitat present in minor jump-ups.	No records within 50km of the SGP.	Will not occur
Dasyurus maculatus maculatus Spotted-tailed quoll	Vul	End	Inhabits a variety of forested habitats including subtropical and temperate rainforests, vine thickets, wet and dry sclerophyll forests, woodland and coastal scrub.	Spot-tailed Quoll populations are typically constrained to contiguous forested areas. Contiguous areas of SF including Barakula SF adjacent the central SGP, and the SF block comprising Kumbarilla, Dunmore and Western Creek SFs adjacent the southern SGP likely provide suitable habitat.	Three records within the SGP and several within 20km of the SGP boundary, however, all records are old (i.e. >40 years), with the exception of a confirmed sighting of an injured animal near Tara within the past 5 years, and a record from 2022 on the Warrego Hwy between Dalby and Oakey. These were likely transient individuals. The current status of this species in the Brigalow Belt is uncertain, and transient individuals may occur throughout the SGP, although this would a rare occasion.	Unlikely

Scientific Name Common Name	Status[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Macroderma gigas Ghost Bat	End	Vul	Habitats used for foraging vary from dry open woodlands to tropical rainforests (Wilmer 2012).	No suitable roosting structures occur.	No records within 50km of the SGP. Presumed locally extinct in the area.	Will not occur
Nyctophilus corbeni South-eastern long-eared bat	Vul	Vul	Found more commonly in box/ironbark/cypress pine woodland on sandy soils. It also occurs in bulloak (*Allocasuarina luehmannii*), brigalow (*Acacia harpophylla*) and belah (*Casuarina cristata*) communities (Turbill and Ellis 2006; Churchill 2008).	Suitable habitat is present within the SGP, particularly in larger contiguus areas associated with Barakula State Forest in the north and Kumbarilla State Forest in the south.	Recorded within the past 10yrs at six locations in central SGP, and a single location in the southern SGP adjacent Kumbarilla SF. Records outside the SGP are >20y old.	Known
Onychogalea frenata Bridled Nailtail Wallaby	End	End	Woodland, especially Brigalow scrub, along with eucalypt woodland and other *Acacia* spp. scrub. Dense shrub, grass and hollow log cover are important for sheltering. Grassland abutting dense woodland and scrub provides important foraging habitat (DCCEEW 2023).	N/A. Species is locally extinct.	Three very old (>80y) records from the Oakey and Milmerran regions. Species now only known from a small number of isolated populations within national parks and nature refuges. Locally extinct.	Will not occur
Petauroides armillatus/volans Greater Glider	End	End	Mainly restricted to eucalypt forests and woodlands where they typically occur in highest abundance in taller, montane, moist eucalypt forests with larger, relatively old trees and abundant hollows (Eyre 2004). In areas west of the Great Dividing Range, they are found in low woodlands (McKay 2008).	Possible habitat present in woodland areas and riparian habitats with *E. tereticornis*	Recorded within central and southern SGP. Scattered records from outside the SGP within the past 30yrs are largely restricted to state forests.	Known

Scientific Name Common Name	Status[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Petaurus australis australis Yellow-bellied Glider	Vul	Vul	Contiguous tracts of thousands of hectares comprising tall, mature eucalypt forest, especially dominated by smooth- and gum-barked species with high, deep hollows (Craig 1985; Goldingay and Possingham 1995; Eyre 2007 Goldingay et al. 2018). In southern QLD *E. tereticornis, C. citriodora* and *E. moluccana* are particularly favoured (Eyre 2007)	Possible habitat present in woodland areas and riparian vegetation in larger tracts of contiguous vegetation, in particular vegetation associated with Barakula State Forest in the north and Kumbarilla State Forest in the south.	Not recorded within the SGP. Multiple records within Barakula SF, although all are >20yr old. Sparse records from Gurulmundi and Braemar SFs are ~15yrs old.	Possible
Petrogale penicillata Brush-tailed Rock-wallaby	Vul	Vul	Inhabits rock piles and cliff lines in vegetation ranging from rainforest to dry sclerophyll forests.	None	Two records from ~10km north of Lake Broadwater are likely erroneous as no suitable habitat exists within the vicinity of the records.	Unlikely

Scientific Name Common Name	Status[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
Phascolarctos cinereus Koala	Vul	Vul	Found in a diversity of habitats including temperate, sub-tropical and tropical forest, woodland and semi-arid communities, and sclerophyll forest, on foothills, plains and in coastal areas (Dyck & Stratham 2008). On the western side of the Great Dividing Range at the western edges of their range, the species is often associated with riparian vegetation although are not restricted to them (Melzer et al. 2000; Sullivan et al. 2003).	Eucalypt forest areas throughout the SGP, less likely in the northern SGP area.	>700 records within 50km of SGP. Recorded during surveys, with most records within the SGP confined to the southern portion in association with the Condamine River, Braemar SF, Dalby SF, Kumbarilla SF and Lake Broadwater	Known
Pseudomys australis Plains Rat	End	Vul	Cracking clay depressions and small drainage lines on arid gibber plains, and vast, cracking clay plains (Van Dyck et al 2013).	None	Two very old records (i.e. >100 years) within 50km of the SGP. Presumed locally extinct in the area.	Will not occur
Pteropus poliocephalus Grey-headed flying-fox	LC	Vul	Foraging habitat includes rainforests, open eucalypt forests, woodlands, Melaleuca swamps and Banksia woodlands. Roosts are commonly within dense vegetation close to water, primarily rainforest patches, stands of Melaleuca, mangroves or riparian vegetation (Nelson 1965).	Limited habitat available in riparian corridors with abundant *E. tereticornis*.	Three locations within 50km of SGP, including records from 2011. Individuals are known to occasionally use a seasonal flying-fox camp along Myall Creek in Dalby. The species is a typically a vagrant west of the Great Dividing Range and would be a rare visitor to the SGP.	Unlikely

[#] LC = Least Concern, NT = Near Threatened, Vul = Vulnerable, End = Endangered, CE = Critically Endangered, EX = Extinct, Mig = Migratory

Appendix B
Consolidated 2023 Species Mapping Rules

Consolidated Mapping Rules (alphabetical)

FLORA

Acacia barakulensis

1. The species will only likely occur in the central SGP area.
2. Within the central area of the SGP, REs 11.5.1, 11.5.14, 11.5.21, 11.7.4, 11.7.5, 11.7.6 and 11.7.7 are mapped as 'General Habitat' due to lack of local records.
3. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
4. Non-remnant and regrowth habitats are mapped as 'Absence Suspected'.

Acacia curranii (Curly-bark Wattle)

1. The species will likely only occur in the central SGP area to the north of Miles.
2. In the absence of survey records within the SGP area, RE 11.7.5, 11.7.4, 11.7.7 in the potential area of occurrences have been allocated as 'General Habitat'.
3. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
4. All other regional ecosystems, regrowth and cleared areas are mapped as 'Absence Suspected'.

Acacia handonis (Hando's Wattle)

1. Regional Ecosystems 11.7.4, 11.7.5, 11.7.6, 11.7.7 and 11.5.1 in the Central region of the SGP (North of Miles) should be classed as 'General Habitat' on account of the intensive survey undertaken in the SGP.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. Non-remnant and regrowth derived from these habitats are mapped as 'Absence Suspected'.

Callitris baileyi (Bailey's Cypress pine)

1. REs 11.5.1, 11.7.4, 11.7.5, 11.7.6 and 11.7.7 in the Gurulmundi area to the north of Chinchilla (-27.75) in the central SGP area should be considered 'General Habitat'.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. Other habitats including all regrowth and non-remnant habitats should be assigned to 'Absence Suspected'.

Callitrix gurulmundensis (Gurulmundi Fringe Myrtle)

1. REs 11.5.1, 11.7.4, 11.7.5, 11.7.6 and 11.7.7 in the Gurulmundi area to the north of Chinchilla (-27.75) in the central SGP area should be considered 'General Habitat'.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. Other habitats including all regrowth and non-remnant habitats should be assigned to "Absence Suspected

Cryptandra ciliata

1. The species is only likely to occur in the central SGP area where the following REs should be treated as 'General Habitat'; 11.5.1, 11.5.4, 11.5.21, 11.7.4, 11.7.5, 11.7.6 and 11.7.7.
2. All General Habitat within 1 km of a recent (1950+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
3. All other remnant vegetation in the project development area, regrowth vegetation and cleared agricultural land should be treated as 'Absence Suspected'.

Cymbonotus maidenii

1. The species is most likely to occur from the Dalby area (-27.00) south to Millmerran (-27.9) generally on the Condamine Alluvium.
2. RE 11.3.2 , derived regrowth of RE 11.3.2, and associated derived grasslands occurring between in this area should be treated as 'General Habitat'.
3. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
4. All other remnant vegetation and cleared agricultural land in the SGP should be treated as 'Absence Suspected'.

Digitaria porrecta (Finger Panic Grass)

1. The species is most likely to occur on heavy clay soils associated with the Condamine Alluvium although may occur throughout the entire SGP.
2. Regional Ecosystem 11.3.2 should be treated as 'General Habitat'.
3. Derived native grassland where it is associated with the Condamine Alluvium or other heavy clay soil should be considered 'General Habitat'.
4. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
5. All other remnant vegetation in the project development area and all cleared agricultural and grazing land should be treated as 'Absence Suspected'.

Eucalyptus curtisii (Plunkett Mallee)

1. Eucalyptus curtisii may occur throughout the entire SGP area.
2. Through the SGP, REs 11.7.2, 11.7.4, 11.7.5, 11.7.6 and 11.7.7 should be classified as 'General Habitat' in recognition of the extensive survey effort undertaken.
3. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
4. All other REs including regrowth and non-remnant vegetation should be classified as 'Absence Suspected'.

Fimbristylis vagans

1. The species may occur throughout the entire SGP.
2. 'Core Habitat Possible' includes the wetland fringe of Lake Broadwater characterised by RE 11.3.27f and wetland habitats of Long Swamp.
3. REs 11.3.2, 11.3.3, 11.3.4, 11.3.14, 11.3.25 and 11.3.26 throughout the SGP are classified as 'General Habitat'.
4. All Core Habitat Possible and General Habitat within 1 km of a recent (1950+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
5. All remaining remnant and non-remnant vegetation is mapped as 'Absence Suspected'.

Homopholis belsonii (Belson's Panic)

1. The species may occur throughout the entire SGP although is most likely to occur in Brigalow associated habitats in the northern SGP area.
2. Regional Ecosystems 11.9.5, 11.9.10 and 11.3.17 including derived non-remnant regrowth is mapped as 'Core Habitat Possible' in the northern SGP area.
3. REs 11.3.1, 11.3.17, 11.4.3 and 11.9.5 including non-remnant derived regrowth in central and southern SGP areas are classified as 'General Habitat'.
4. All Core Habitat Possible and General Habitat within 1 km of a recent (1950+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
5. All remaining remnant and non-remnant vegetation is mapped as 'Absence Suspected'.

Micromyrtus carinata (Gurulmundi Heath-myrtle)

1. REs 11.7.4 and 11.7.5 in the Gurulmundi area to the north of Chinchilla (-27.75) in the central SGP area should be considered 'General Habitat'.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. Other habitats should be assigned to "Absence Suspected. Non-remnant and regrowth derived from these habitats are mapped as 'Absence Suspected'.

Philotheca sporadica (Kogan Waxflower)

1. The species will most likely occur within a 25 km wide buffer surrounding Kogan although cannot be discounted as occurring within suitable habitats throughout the SGP.
2. REs 11.7.4, 11.7.5 and 11.7.7 are classified as "Core habitat Possible" within 25 km from Kogan.
3. Regrowth habits (non-remnant) derived from RE 11.7.4, 11.7.5 and 11.7.7 within 25 km from Kogan are classified as "General Habitat'.
4. All areas of RE 11.5.1 within 25 km from Kogan are classified as 'General Habitat'.
5. All 'Core Habitat Possible' and 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
6. The remaining areas of RE 11.7.4 throughout the SGP are classified as 'General Habitat'
7. All other areas are classified as 'Absence Suspected'.

Picris barbarorum

1. The following REs and habitats should be classified as 'General Habitat' where they are in association with the Condamine Alluvium.
    - RE 11.3.2 and derived regrowth vegetation.
    - Non-remnant derived native grasslands
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. All other remnant and non-remnant vegetation should be treated as 'Absence Suspected'.

Rutidosis glandulosa

1. The following REs and habitats should be classified as 'General Habitat'. REs 11.9.9 (including regrowth derived from this RE) and 11.5.4 (including derived regrowth).
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. All remaining remnant and non-remnant vegetation is mapped as 'Absence suspected'.

Rutidosis lanata

1. The species may occur throughout the entire project area although is more likely north from Chinchilla based on vouchered herbarium records. Throughout the SGP, the following REs should be treated as 'General Habitat'; 11.3.4, 11.3.2, 11.3.17, 11.9.5 and 11.9.7.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. All other remnant vegetation in the project development area, regrowth vegetation and cleared agricultural land should be treated as 'Absence Suspected'.

Solanum papaverifolium

1. The species is most likely to occur on habitat formed by heavy clay soils associated in particular with the Condamine Alluvium.
2. Regional Ecosystems 11.3.2 and Derived Native Grassland (non-remnant) provide the most suitable habitats for the species. Where these habitats occur on the alluvial landforms to the west and south of Dalby, they are mapped as "General Habitat".
3. All General Habitat within 1km of a recent (1980+), accurate (± 500m) record is classed as "Core Habitat Known".
4. All remaining remnant and non-remnant vegetation is mapped as "Absence Suspected".

Solanum stenopterum

1. REs 11.3.2, 11.3.1 and 11.3.17 to the west and south of Dalby should be classed as 'General Habitat' on account of comprehensive surveys.
2. Regrowth vegetation derived from RE 11.3.2, 11.3.1 and 11.3.17 south and west of Dalby are classed as 'General Habitat'.
3. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
4. All other vegetation is mapped as 'Absence Suspected'.

Thesium australe (Austral Toadflax)

1. Intact representation of Poplar Box dominant woodland (RE 11.3.2) associated with the Condamine River Alluvium (Condamine River Floodplain) should be treated as "General Habitat'.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. All other REs and non-remnant vegetation (including regrowth) should be treated as 'Absence Suspected'.

Xerothamnella herbacea

1. The species may occur throughout the entire project area where it may be associated with Brigalow dominant habitats 11.3.1, 11.4.3 and 11.9.5. Throughout the SGP these REs and any derived regrowth Brigalow should be treated as 'General Habitat'.
2. All 'General Habitat' within 1 km of a recent (1950+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
3. All other remnant vegetation in the SGP, regrowth vegetation and cleared agricultural land should be treated as 'Absence Suspected'.

FAUNA

Acanthophis antarcticus (Common Death Adder)

1. Potential Death Adder habitat is most likely in contiguous and near-contiguous areas of vegetation (i.e., reduced fragmentation). Potentially important habitat is therefore likely restricted to vegetation within or abutting the 'large tracts remnant veg.shp'. Within this area, all remnant vegetation (irrespective of RE designation) should be classed as 'Core Habitat Possible'.
2. Any remnant vegetation (irrespective of RE designation) outside the 'large tracts remnant veg.shp' is mapped as 'General Habitat'.
3. Core Habitat Possible and General Habitat within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
4. All non-remnant habitats, including regrowth, are mapped as 'Absence Suspected'.

Adclarkia cameroni (Brigalow Woodland Snail)

1. The species could occur anywhere within the SGP.
2. The following regional ecosystems, including derived regrowth, should be mapped as 'Core Habitat Possible': 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.17, 11.3.25, 11.3.27 (all sub-types), 11.4.3, 11.4.3a, 11.9.5, 11.9.7 and 11.9.10.
3. The following regional ecosystems, including derived regrowth, should be mapped as 'General Habitat': 11.3.14, 11.3.18, 11.3.26, 11.5.1, 11.5.1a, and 11.5.20.
4. All 'Core Habitat Possible' and 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
5. All remaining vegetation is mapped as 'Absence suspected'.

Adclarkia dulacca (Dulacca Woodland Snail)

1. The species could occur within the northern and central regions of the SGP, but is not expected to the north of Kogan (latitude -27.06) in the southern SGP area.
2. North of -27.06, any areas of the following REs (including derived regrowth) are mapped as 'Core Habitat Possible': 11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.5 and 11.9.10.
3. Within the central and northern SGP, any areas of the following REs (including derived regrowth) are mapped as 'General Habitat': 11.5.1, 11.5.1a and 11.9.10.
4. All 'Core Habitat Possible' and 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
5. All remaining vegetation is mapped as 'Absence suspected'.

Aphelocephala leucopsis (Southern Whiteface)

1. It is assumed the species could occur throughout the entire SGP.
2. All remnant and regrowth vegetation of RE 11.3.1, 11.3.2, 11.3.17, 11.4.3, 11.4.3a, 11.5.20, 11.5.26, 11.9.5, 11.9.10 should be mapped as 'General Habitat'.
3. General Habitat within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known' (as of writing no such areas exist within the SGP).
4. All remaining remnant and non-remnant vegetation (including regrowth) is mapped as 'Absence suspected'.

Calyptorhynchus lathami lathami (Glossy Black Cockatoo)

1. The species could occur throughout the entire SGP.
2. Regional Ecosystems containing Casuarina cristata (11.3.1. 11.3.17, 11.4.3, 11.4.3a, 11.9.5) and Allocasuarina inophloia (11.5.4) are classed as 'Core Habitat Possible'.
3. South of the Warrego Highway areas of RE 11.7.4 may also have Allocasuarina littoralis and should be mapped as 'Core Habitat Possible'.
4. Regrowth of the above REs, which could contain larger trees with suitable foraging resources, are mapped as 'Core Habitat Possible'.
5. Core Habitat Possible within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
6. All remaining REs and non-remnant vegetation (including regrowth) is mapped as 'Absence Suspected'.

Glyphodon (Furina) dunmalli (Dunmall's Snake)

1. The species could occur throughout the entire SGP.
2. All areas of remnant vegetation with a combined extent >50 ha consisting of the following REs should be classed as 'Core Habitat Possible': 11.3.1, 11.3.17, 11.3.18, 11.4.3, 11.4.3a, 11.5.1, 11.5.1a, 11.5.4, 11.5.20, 11.7.4, 11.7.6, and 11.7.7.
3. Smaller vegetation patches (<50ha) of the above REs may be mapped as 'General Habitat' if they are in close proximity (≤500 m) to areas of 'Core Habitat Possible'.
4. All areas of remnant vegetation with a combined extent >50 ha consisting of the following REs should be classed as 'General Habitat': 11.3.14, 11.5.21, 11.7.2.
5. Advanced regrowth of all the above REs are mapped as 'General Habitat' if they are adjacent (≤500 m) or connect to large areas of 'Core Habitat Possible' or 'General Habitat'.
6. Core Habitat Possible and General Habitat within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
7. Remaining REs, regrowth and non-remnant areas are mapped as 'Absence Suspected'.

Grantiella picta (Painted Honeyeater)

1. The species may occur throughout the entire SGP.
2. REs dominated by Brigalow including 11.3.1, 11.3.17, 11.4.3, 11.4.3a and 11.9.5 (including 'disturbed' communities) are mapped as 'Core Habitat Possible'.
3. Regrowth derived from RE 11.3.1, 11.3.17, 11.4.3, 11.4.3a, 11.9.5 (i.e., brigalow regrowth) is mapped as 'Core Habitat Possible'.
4. The above REs and REs 11.5.20 and 11.3. 27a and 11.3.27f are mapped as 'Core Habitat Known' around Lake Broadwater.
5. All remaining areas of RE 11.3.25 and 11.3.27 (including all subtypes) are mapped as 'General Habitat',
6. All 'Core Habitat Possible' or 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
7. All remaining REs and non-remnant (including regrowth) areas are 'Absence Suspected'.

Hemiaspis damelii (Grey Snake)

1. The species could occur throughout the entire SGP.
2. All remnant vegetation where surface water could collect provides potential habitat for these species. In particular, vegetation on Landzones 3, and 4 should be classed as 'Core Habitat Possible' (11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.14, 11.3.18, 11.3.25, 11.3.26, 11.3.27, 11.4.3 and 11.4.3a). In addition, the following REs have clay soils, gilgai's or are likely to be subject to temporal ponding and should also be 'Core Habitat Possible'; 11.9.5.
3. Derived Grasslands, which occur in alluvial floodplains in the SGP, are mapped as 'Core Habitat Possible'.
4. Larger contiguous areas of REs 11.5.1, 11.5.1a, 11.5.20, and 11.5.21, or where these are immediately adjacent Core Habitat Possible, are included as 'General Habitat'.
5. Artificial waterbodies are mapped as 'General Habitat'.
6. All remnant vegetation, non-remnant vegetation, regrowth or grazing land (but not tilled land, tracks or cultivated land) within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
7. Regrowth be classed according to its parent regional ecosystem.
8. Tilled crops, tracks and cultivated land (i.e., areas with frequently surface disturbed) are mapped as 'Absence Suspected'.

Hirundapus caudacutus (White-throated Needletail)

No Rules

Jalmenus eubulus (Pale Imperial Hairstreak)

1. The species may occur throughout the SGP area.
2. Within the SGP all remnant Brigalow (11.3.1, 11.3.17, 11.4.3 11.4.3a, 11.9.5) is classed as 'Core Habitat Possible'.
3. All 'Core Habitat Possible' within 1 km of a recent (1975+), accurate (≤500 m) record is reclassified as 'Core Habitat Known'.
4. The remaining REs, regrowth and non-remnant areas are classed as 'Absence Suspected'.

Nyctophilus corbeni (South-eastern Long-eared Bat)

1. Potential South-eastern Long-eared Bat habitat is restricted to contiguous or near-contiguous areas of vegetation (i.e., reduced fragmentation). Within the SGP, potentially important habitat is restricted to vegetation within or abutting the 'large tracts remnant veg.shp'.
2. Within the area defined in step 1 above, REs 11.3.1, 11.3.14, 11.3.18, 11.4.3, 11.4.3a, 11.5.1, 11.5.1a, 11.5.4, 11.5.21, 11.7.4, 11.7.7, 11.9.5 and 11.9.10 are mapped as 'Core Habitat Possible'.
3. Within the area defined in step 1 above, REs 11.3.25, 11.3.27, 11.5.20, 11.7.2 and 11.7.6 are mapped as 'General Habitat'.
4. Within the designated area in step 1, isolated patches (>500 m from any other remnant vegetation) of the REs listed in step 2 above are reclassed as 'General Habitat'.
5. All 'Core Habitat Possible' or 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
6. All remaining remnant and non-remnant vegetation, including regrowth, is mapped as 'Absence Suspected'.

Petauroides volans sensu lato (Greater Glider)

1. The species may occur throughout the entire SGP.
2. Mapped habitat (core habitat possible or general habitat) is restricted to remnant vegetation patches with an accumulative size >10 ha (i.e., entire extent, regardless of RE types, and ignoring non-remnant gaps of less than 150 m).
3. Within combined patches > 10 ha, 'Core Habitat Possible' includes REs 11.3.4, 11.3.14, 11.3.21, 11.3.25, 11.3.26, 11.3.27 (including all subtypes), 11.5.1, 11.5.4, 11.5.20, 11.5.21, 11.7.4, 11.7.6, 11.7.7, 11.9.2 and 11.9.7.
4. Within combined patches > 10 ha, Polygons of REs 11.3.2 and 11.3.3, immediately adjacent Core Habitat Possible are mapped as 'General Habitat'.
5. All Core Habitat Possible and General Habitat within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
6. All regrowth and other non-remnant habitats are mapped as 'Absence Suspected'.

Petaurus australis australis (Yellow-bellied Glider)

1. Potential Yellow-bellied Glider habitat is restricted to contiguous or near-contiguous areas of vegetation (i.e., reduced fragmentation). Within the SGP, potentially important habitat is restricted to vegetation within or abutting the 'large tracts remnant veg.shp'.
2. Within the above area, REs 11.3.4, 11.3.25, 11.3.26, 11.5.1, 11.5.4, 11.5.20, 11.5.21, 11.7.4, 11.7.6 and 11.7.7 are mapped as 'Core Habitat Possible'.
3. RE 11.5.4 and 11.9.2 can be structurally similar to the above REs (forest) but lack known tree associations; within the area defined in step 1 above these REs are mapped as 'General Habitat'.
4. Within the designated area in step 1, isolated patches (>400 m from any other remnant vegetation) of the REs listed in step 2 and 3 above are mapped as 'General Habitat'.
5. All 'Core Habitat Possible' or 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
6. Remaining areas of remnant, non-remnant and regrowth vegetation is 'Absence suspected'.

Phascolarctos cinereus (Koala)

1. The species may occur throughout the entire SGP.
2. All remnant and regrowth REs except 11.9.5 are mapped as 'Core Habitat Possible'.
3. All Core Habitat Possible within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.

Rostratula australis (Australian Painted Snipe)

1. Lake Broadwater (RE 11.3.27c and 11.3.27f) is mapped as 'Core Habitat Known'.
2. Long Swamp (RE 11.3.27d and 11.3.27f) is mapped as "Core Habitat Possible'.
3. Core Habitat Possible within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
4. All remaining REs and non-remnant vegetation (including regrowth) is mapped as 'Absence Suspected'

Stagonopleura guttata (Diamond Firetail)

1. The species may occur throughout the entire SGP, but is considered less likely to persist in combined patches <200ha (where a combined patch includes all remnant vegetation types and ignores non-remnant gaps <200 m wide).
2. All remnant REs within the SGP except 11.7.5 and 11.7.2, with a combined remnant patch size (irrespective of RE designation) greater than 200 ha is 'Core Habitat Possible'.
3. All remnant REs within the SGP except 11.7.5 and 11.7.2, with a combined remnant patch size (irrespective of RE designation) less than 200 ha but within 500 m of core habitat possible is 'General Habitat'.
4. All regrowth of the above REs with a combined patch size greater than 200 ha is 'General Habitat'.
5. All 'Core Habitat Possible' or 'General Habitat' within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
6. Remaining isolated areas of remnant and non-remnant vegetation (including regrowth) are mapped as 'Absence Suspected'.

Strophurus taenicauda (Golden-tailed Gecko)

1. The species may occur throughout the entire SGP area.
2. Within the SGP, REs 11.3.1, 11.3.14, 11.3.17, 11.3.18, 11.4.3 11.4.3a, 11.5.1, 11.5.1a, 11.5.4, 11.5.20, 11.5.21, 11.3.26, 11.7.4, 11.7.6, 11.7.7, 11.9.5, 11.9.7, 11.9.10 are mapped as 'Core Habitat Possible'.
3. Within the SGP, REs 11.3.2, 11.3.3, 11.3.4, 11.3.25, 11.7.2, 11.7.5 and 11.9.2 are mapped as 'General Habitat'.
4. All areas of advanced regrowth (10+ yrs) should be treated as remnant vegetation and classed accordingly.
5. Core Habitat Possible and General Habitat within 1 km of a recent (1975+), accurate (≤500 m) record is classed as 'Core Habitat Known'.
6. Habitat patches <5ha and greater than 200 m in distance from other remnant vegetation (i.e., isolated) are downgraded to 'Absence Suspected'.
7. 'Core Habitat Possible' (as identified in the steps above) between 5ha and 10ha in size and more than 200 m in distance from other remnant vegetation (i.e., isolated) is downgraded to 'General Habitat'.
8. 'General Habitat' (as identified in the steps above) between 5ha and 10ha in extent and more than 200 m in distance from other remnant vegetation (i.e., isolated) is downgraded to 'Absence suspected'.
9. Remaining regrowth and REs are classed as 'Absence Suspected'.

Appendix G

LFC Tool Outputs

Department of Environment and Science (DES)
Landscape Fragmentation and Connectivity (LFC) Tool version 1.7 LOGFILE
Process started at 12-03-2024 08:50:24 PM
Python version: 3.9.11 [MSC v.1931 64 bit (AMD64)]
Arcpy version: 3.0.2
Username: tstringer

INPUT PARAMETERS
Output Workspace: R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Arrow\OutputArrow
Threshold lookup table:
R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Arrow\LFC_data.gdb\tbl_Regional_frag_local_threshold
Remnant cover layer: R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Arrow\LFC_data.gdb\ArrowRegVeg
Cover layer metadata title:Regulated vegetation management map - version 5.0
Remnant cover layer edited: False
Regional buffer extent: 20 kilometres
Local buffer will be: 5 kilometres
Impact layer: R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Disturbance\New File Geodatabase.gdb\Disturbance_
layer projection: GDA2020
Raster cell resolution for analysis: 10 metres
Edge Width: 50 metres
(The distance from non-remnant landscapes through to the core ecosystem - the edge of remnant ecosystems)
Default projection:
\\VDC12EUCFSX01.CH4.COM.AU\Apps\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\GDA 2020 Queensland AlbersOFFSET.prj

20:50:27 Checking out the spatial analyst tool - required for LFC

20:50:27 _____BEGINNING LANDSCAPE FRAGMENTATION AND CONNECTIVITY ANALYSIS_____

20:50:27 This tool will categorise the landscape into:
{0: 'non-rem', 1: 'patch', 2: 'edge', 3: 'perforated', 4: 'core (< 100 hectares)', 5: 'core (100-500 hectares)', 6: 'core (> 500 hectares)', 7: 'water'}

20:50:30 R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Arrow\OutputArrow\lyr_file does not exist, creating it now.
20:50:30 Copying across impact site feature(s) and calculating area in hectares (AreaHA)
20:50:47 Making a local copy of the impact site
20:51:40 Preparing remnant cover layer for analysis
20:52:00 Created regional scale buffer of 20 kilometres
20:52:26 Created local scale buffer of 5 kilometres
20:53:12 Clipped the remnant cover to the regional buffer extent
20:53:35 Unioned the pre impact remnant layer with the impact site
20:54:08 Attributed the impact area as cleared
20:54:10 Area of RVM Cat B clearing is 470.27 hectares
20:54:10 SQL selection used is RVM_CAT = 'B' and Landcover = 0 on shapefile R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Arrow\OutputArrow\LFC_result.gdb\clip_remcover_post

20:54:10 Categorised the cover attributes in clip_remcover_pre ready for raster conversion
20:55:18 Converted clip_remcover_pre to raster

20:55:23 Categorised the cover attributes in clip_remcover_post ready for raster conversion
20:56:27 Converted clip_remcover_post to raster

20:56:27 Run Landscape fragmentation analysis on the pre impact regional landscape

REGULATED VEGETATION TYPES BEING EXTRACTED FROM LAND COVER

IDENTIFYING OF CORE, PATCH, EDGE AND PERFORATIONS

COMBINING FRAGMENTATION CLASSES

CLASSIFYING CORE FOREST PATCHES BY AREA

COMPOSING FINAL FRAGMENTATION MAP

FINISHED: COMPOSING FINAL FRAGMENTATION MAP

(FRAGMENTATION CALCULATION TIME WAS 34.5 MINUTES)

21:32:26 Run Landscape fragmentation analysis on the post impact regional landscape

REGULATED VEGETATION TYPES BEING EXTRACTED FROM LAND COVER

IDENTIFYING OF CORE, PATCH, EDGE AND PERFORATIONS

COMBINING FRAGMENTATION CLASSES

CLASSIFYING CORE FOREST PATCHES BY AREA

COMPOSING FINAL FRAGMENTATION MAP

FINISHED: COMPOSING FINAL FRAGMENTATION MAP

(FRAGMENTATION CALCULATION TIME WAS 35.9 MINUTES)

22:09:49 Extracting a local subset of lfc_regional_pre_impact

22:10:31 Extracting a local subset of lfc_regional_post_impact

22:11:15 Collating pre and post impact statistics and trigger assessment

22:11:15 Summarising area statistics for: lfc_local_pre_impact
22:11:15 Summarising area statistics for: lfc_local_post_impact
22:11:16 Summarising area statistics for: lfc_regional_pre_impact
22:11:19 Summarising patch count for lfc_local_pre_impact
22:12:04 Summarising patch count for lfc_local_post_impact

Analysing impact on Connectivity Areas

SIGNIFICANCE TEST ONE

The regional total area is 269713.61

The regional extent of core remnant is 122999.61
The regional extent of core remnant is 45.60 percent
This level of regional fragmentation sets a local impact threshold of: 10.0 percent

The table below lists the local impact thresholds for categories of regional core remnant extent:

REGIONAL CORE CATEGORY	LOCAL IMPACT THRESHOLD
< 10	2.0
10 - 30	5.0
30 - 50	10.0
50 - 70	20.0
70 - 90	30.0
>90	50.0

Area of core at the local scale (pre impact): 31648.93
Area of core at the local scale (post impact): 30313.989999999998
Percent change of core at the local scale (post impact): 4.22 percent

SIGNIFICANCE TEST TWO

The number of core remnant areas occurring on the site: 47
The number of core remnant areas remaining on the site post impact: 41
(Only core polygons greater than or equal to 1 hectare are included)

RESULT

22:14:17 This analysis has determined a SIGNIFICANT impact on connectivity areas
(A significant reduction in core remnant at the local scale is False OR a change from core to non-core remnant at the site scale is True)
(Total area of RVM Cat B clearing is 470.27 hectares)

The significance table has been written to: ..\main_output\lfc_significance_assessment.csv
The local scale summary table has been written to: ..\main_output\lfc_local_scale_summary.csv
The site scale summary table has been written to: ..\main_output\lfc_site_scale_summary.csv
GIS layer files copied into folder \lyr_file within the project folder.
View layers in ArcPro
using..\R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Arrow\OutputArrow\lyr_file\Connectivity Area Impact Assessment.lyrx

Please scrutinise the output tables and spatial layers to confirm the desktop modelling of connectivity area impact

This analysis used an unedited copy of the Regulated Vegetation layer.

22:21:10 _____COMPLETED LANDSCAPE FRAGMENTATION AND CONNECTIVITY ANALYSIS_____

Department of Environment and Science (DES)
Landscape Fragmentation and Connectivity (LFC) Tool version 1.7 LOGFILE
Process started at 13-03-2024 12:10:15 AM
Python version: 3.9.11 [MSC v.1931 64 bit (AMD64)]
Arcpy version: 3.0.2
Username: tstringer

INPUT PARAMETERS
Output Workspace: R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Gov\OutputGov
Threshold lookup table:
R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Gov\LFC_data.gdb\tbl_Regional_frag_local_threshold
Remnant cover layer: R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Gov\LFC_data.gdb\GovRegVeg
Cover layer metadata title:Regulated vegetation management map - version 7.03
Remnant cover layer edited: False
Regional buffer extent: 20 kilometres
Local buffer will be: 5 kilometres
Impact layer: R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Disturbance\New File Geodatabase.gdb\Disturbance_
layer projection: GDA2020
Raster cell resolution for analysis: 10 metres
Edge Width: 50 metres
(The distance from non-remnant landscapes through to the core ecosystem - the edge of remnant ecosystems)
Default projection:
\\VDC12EUCFSX01.CH4.COM.AU\Apps\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\GDA 2020 Queensland AlbersOFFSET.prj

00:10:17 Checking out the spatial analyst tool - required for LFC

00:10:18 _____BEGINNING LANDSCAPE FRAGMENTATION AND CONNECTIVITY ANALYSIS_____

00:10:18 This tool will categorise the landscape into:
{0: 'non-rem', 1: 'patch', 2: 'edge', 3: 'perforated', 4: 'core (< 100 hectares)', 5: 'core (100-500 hectares)', 6: 'core (> 500 hectares)', 7: 'water'}

00:10:21 R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Gov\OutputGov\lyr_file does not exist, creating it now.
00:10:21 Copying across impact site feature(s) and calculating area in hectares (AreaHA)
00:10:41 Making a local copy of the impact site
00:11:35 Preparing remnant cover layer for analysis
00:11:54 Created regional scale buffer of 20 kilometres
00:12:20 Created local scale buffer of 5 kilometres
00:12:59 Clipped the remnant cover to the regional buffer extent
00:13:21 Unioned the pre impact remnant layer with the impact site
00:13:47 Attributed the impact area as cleared
00:13:48 Area of RVM Cat B clearing is 460.37 hectares
00:13:48 SQL selection used is RVM_CAT = 'B' and Landcover = 0 on shapefile R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Gov\OutputGov\LFC_result.gdb\clip_remcover_post

00:13:48 Categorised the cover attributes in clip_remcover_pre ready for raster conversion
00:14:44 Converted clip_remcover_pre to raster

00:14:52 Categorised the cover attributes in clip_remcover_post ready for raster conversion
00:15:52 Converted clip_remcover_post to raster

00:15:52 Run Landscape fragmentation analysis on the pre impact regional landscape

REGULATED VEGETATION TYPES BEING EXTRACTED FROM LAND COVER

IDENTIFYING OF CORE, PATCH, EDGE AND PERFORATIONS

COMBINING FRAGMENTATION CLASSES

CLASSIFYING CORE FOREST PATCHES BY AREA

COMPOSING FINAL FRAGMENTATION MAP

FINISHED: COMPOSING FINAL FRAGMENTATION MAP

(FRAGMENTATION CALCULATION TIME WAS 32.8 MINUTES)

00:49:52 Run Landscape fragmentation analysis on the post impact regional landscape

REGULATED VEGETATION TYPES BEING EXTRACTED FROM LAND COVER

IDENTIFYING OF CORE, PATCH, EDGE AND PERFORATIONS

COMBINING FRAGMENTATION CLASSES

CLASSIFYING CORE FOREST PATCHES BY AREA

COMPOSING FINAL FRAGMENTATION MAP

FINISHED: COMPOSING FINAL FRAGMENTATION MAP

(FRAGMENTATION CALCULATION TIME WAS 28.9 MINUTES)

01:20:01 Extracting a local subset of lfc_regional_pre_impact

01:20:35 Extracting a local subset of lfc_regional_post_impact

01:21:12 Collating pre and post impact statistics and trigger assessment

01:21:12 Summarising area statistics for: lfc_local_pre_impact
01:21:13 Summarising area statistics for: lfc_local_post_impact
01:21:13 Summarising area statistics for: lfc_regional_pre_impact
01:21:16 Summarising patch count for lfc_local_pre_impact
01:21:48 Summarising patch count for lfc_local_post_impact

Analysing impact on Connectivity Areas

SIGNIFICANCE TEST ONE

The regional total area is 269713.62

The regional extent of core remnant is 124215.77
The regional extent of core remnant is 46.05 percent
This level of regional fragmentation sets a local impact threshold of: 10.0 percent

The table below lists the local impact thresholds for categories of regional core remnant extent:

REGIONAL CORE CATEGORY	LOCAL IMPACT THRESHOLD
< 10	2.0
10 - 30	5.0
30 - 50	10.0
50 - 70	20.0
70 - 90	30.0
>90	50.0

Area of core at the local scale (pre impact): 32562.4
Area of core at the local scale (post impact): 30763.690000000002
Percent change of core at the local scale (post impact): 5.52 percent

SIGNIFICANCE TEST TWO

The number of core remnant areas occurring on the site: 4
The number of core remnant areas remaining on the site post impact: 4
(Only core polygons greater than or equal to 1 hectare are included)

RESULT

01:23:27 This analysis has determined any impact on connectivity areas is NOT significant
(A significant reduction in core remnant at the local scale is False OR a change from core to non-core remnant at the site scale is False)

The significance table has been written to: ..\main_output\lfc_significance_assessment.csv
The local scale summary table has been written to: ..\main_output\lfc_local_scale_summary.csv
The site scale summary table has been written to: ..\main_output\lfc_site_scale_summary.csv
GIS layer files copied into folder \lyr_file within the project folder.
View layers in ArcPro
using..\R:\GIS\Geomatics_Shared\Scripts\MSES_MNES\4_LFC\Gov\OutputGov\lyr_file\Connectivity Area Impact Assessment.lyrx

Please scrutinise the output tables and spatial layers to confirm the desktop modelling of connectivity area impact

This analysis used an unedited copy of the Regulated Vegetation layer.

01:30:18 _____COMPLETED LANDSCAPE FRAGMENTATION AND CONNECTIVITY ANALYSIS_____