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

ECOSMART ECOLOGY
48 Streeton Parade
Everton Park QLD 4053 Australia

Tel: +61 7 3162 1161

INTENDED USE: EcoSmart Ecology has prepared this report at the request of Arrow Energy Pty Ltd. Information and recommendations contain herein are purpose and project specific and EcoSmart Ecology accepts no liability for the use or interpretation of any information contained in this report for any other purposes other than intended.

The report should be read in its entirety. No responsibility is accepted for portions of text taken out of context. This report does not provide legal advice. Legal advice should only be sort from qualified practitioners.

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

1.0 INTRODUCTION 1

2.0 STUDY METHODOLOGY 2

2.1 THE SGP AREA 2
2.2 DATA SOURCES 2
2.3 LIKELIHOOD ASSESSMENT 2
2.4 THREATENED SPECIES HABITAT MAPPING RULES 4
2.5 REGIONAL ECOSYSTEMS SUBJECT TO ASSESSMENT 5
2.6 LIMITATIONS 7

3.0 PROBABILITY OF OCCURRENCE ASSESSMENT 8

3.1 FLORA 8
3.2 TERRESTRIAL FAUNA 9

4.0 POSSIBLE OR KNOWN THREATENED FLORA 1

4.1 TREES AND SHRUBS 1
4.1.1 *Acacia barakulensis* (Waaje Wattle) 1
4.1.2 *Acacia curranii* (Curly-bark Wattle) 4
4.1.3 *Acacia handonis* (Hando's Wattle) 7
4.1.4 *Callitris baileyi* (Bailey's Cypress pine) 10
4.1.5 *Callitrix gurulmundensis* (Gurulmundi Fringe Myrtle) 12
4.1.6 *Eucalyptus curtisii* (Plunkett Mallee) 14
4.1.7 *Micromyrtus carinata* (Gurulmundi Heath-myrtle) 17
4.1.8 *Philotheca sporadica* (Kogan Waxflower) 19
4.2 GRASSES AND SEDGES 22
4.2.1 *Digitaria porrecta* (Finger Panic Grass) 22
4.2.2 Fimbristylis vagans 25
4.2.3 *Homopholis belsonii* (Belson's Panic) 27
4.3 FORBS AND HERBS 30
4.3.1 Cryptandra ciliata 30
4.3.2 Cymbonotus maidenii 32
4.3.3 Picris barbarorum 35
4.3.4 Rutidosis glandulosa 37
4.3.5 Rutidosis lanata 39
4.3.6 Solanum papaverifolium 41
4.3.7 Solanum stenopterum 44
4.3.8 *Thesium australe* (Austral Toadflax) 47
4.3.9 Xerothamnella herbacea 49

5.0 POSSIBLE OR KNOWN THREATENED FAUNA 52
5.1 INVERTEBRATES 52
5.1.1 *Adclarkia cameroni* (Brigalow Woodland Snail) 52
5.1.2 *Adclarkia dulacca* (Dulacca Woodland Snail) 55
5.1.3 *Jalmenus eubulus* (Pale Imperial Hairstreak) 58
5.2 REPTILES 61
5.2.1 *Acanthophis antarcticus* (Common Death Adder) 61
5.2.2 *Glyphodon (Furina) dunmalli* (Dunmall's Snake) 64
5.2.3 *Hemiaspis damelii* (Grey Snake) 68
5.2.4 *Strophurus taenicauda* (Golden-tailed Gecko) 71
5.3 BIRDS 74
5.3.1 *Rostratula australis* (Australian Painted Snipe) 74
5.3.2 *Calyptorhynchus lathami lathami* (Glossy Black Cockatoo) 77
5.3.3 *Hirundapus caudacutus* (White-throated Needletail) 81
5.3.4 *Aphelocephala leucopsis* (Southern Whiteface) 83
5.3.5 *Grantiella picta* (Painted Honeyeater) 86
Vulnerable EPBC Act (effective Jul 2015) Vulnerable NC Act 86
5.3.6 *Stagonopleura guttata* (Diamond Firetail) 89
5.4 MAMMALS 92
5.4.1 *Nyctophilus corbeni* (South-eastern Long-eared Bat) 92
5.4.2 *Petauroides volans sensu lato* (Greater Glider) 96
5.4.3 *Petaurus australis australis* (Yellow-bellied Glider) 101
5.4.4 *Phascolarctos cinereus* (Koala) 105

6.0 REFERENCES 108

FIGURES

Figure 2.1. The SGP Assessment Area, remnant vegetation and protected estate 3
Figure 4.1. Spatial distribution of *Acacia barakulensis* 3
Figure 4.2. Spatial distribution of *Acacia curranii* 6
Figure 4.3. Spatial distribution of *Acacia handonis* 9
Figure 4.4. Spatial distribution of *Callitris baileyi* 11
Figure 4.5. Spatial distribution of *Calytrix gurulmundensis* 13
Figure 4.6. Spatial distribution of *Eucalyptus curtisii* 16
Figure 4.7. Spatial distribution of *Micromyrtus carinata* 18
Figure 4.8. Spatial distribution of *Philotheca sporadica* 21
Figure 4.9. Spatial distribution of *Digitaria porrecta* 24

Figure 4.10. Spatial distribution of *Fimbristylis vigans* 26
Figure 4.11. Spatial distribution of *Homopholis belsonii* 29
Figure 4.12. Spatial distribution of *Cryptandra ciliata* 31
Figure 4.13. Spatial distribution of *Cymbonotus maidenii* 34
Figure 4.14. Spatial distribution of *Picris barbarorum* 36
Figure 4.15. Spatial distribution of *Rutidosis glandulosa* 38
Figure 4.16. Spatial distribution of *Rutidosis lanata* 40
Figure 4.17. Spatial distribution of *Solanum papaverifolium* 43
Figure 4.18. Spatial distribution of *Solanum stenopterum* 46
Figure 4.19. Spatial distribution of *Thesium australe* 48
Figure 4.20. Spatial distribution of *Xerothamnella herbacea* 51
Figure 5.1. Records of the Brigalow Woodland Snail within and surrounding the SGP 54
Figure 5.2. Records of the Dulacca Woodland Snail within and surrounding the SGP 57
Figure 5.3. Records of the Pale Imperial Hairstreak within and surrounding the SGP 60
Figure 5.4. Records of the Common Death Adder within and surrounding the SGP 63
Figure 5.5. Records of the Dunmall's Snake within and surrounding the SGP 67
Figure 5.6. Records of the Grey Snake within and surrounding the SGP 70
Figure 5.7. Records of the Golden-tailed Gecko within and surrounding the SGP 73
Figure 5.8. Records of the Painted Snipe within and surrounding the SGP 76
Figure 5.9. Records of the Glossy Black Cockatoo within and surrounding the SGP 80
Figure 5.10. Records of the White-throated Needletail within and surrounding the SGP 82
Figure 5.11. Records of the Southern Whiteface within 50 km of the SGP 85
Figure 5.12. Records of the Painted Honeyeater within and surrounding the SGP 88
Figure 5.13. Records of the Diamond Firetail within and surrounding the SGP 91
Figure 5.14. Records of the South-eastern Long-eared Bat within and surrounding the SGP .95
Figure 5.15. Records of the Greater Glider within and surrounding the SGP 100
Figure 5.16. Records of the Yellow-bellied Glider within and surrounding the SGP 104
Figure 5.16. Records of the Koala within and surrounding the SGP 107

APPENDICES

Appendix A Likelihood of Occurrence Assessment

Appendix B Consolidated 2023 Species Mapping Rules

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.

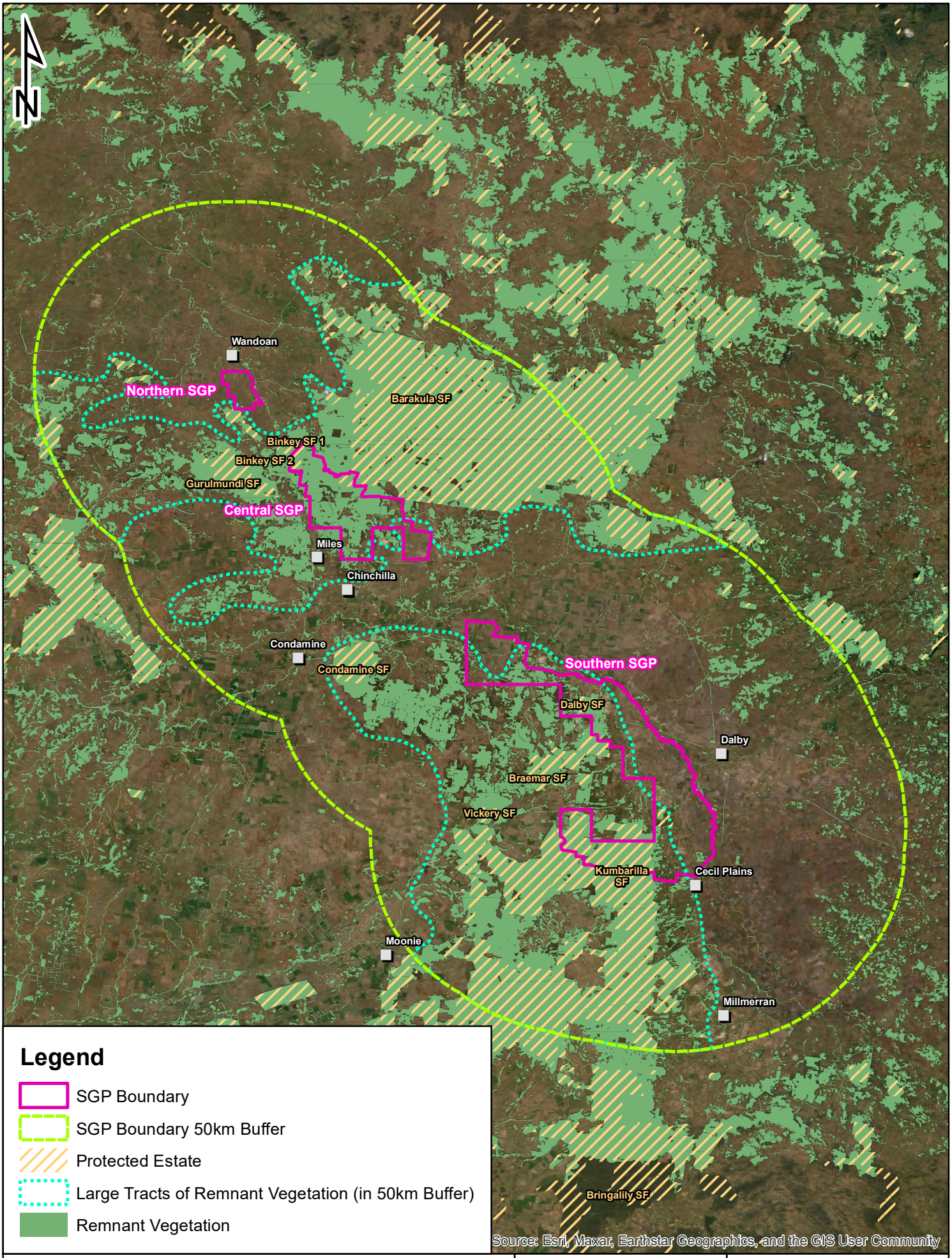


Figure 2.1
The SGP assessment area, remnant vegetation and protected estate

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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

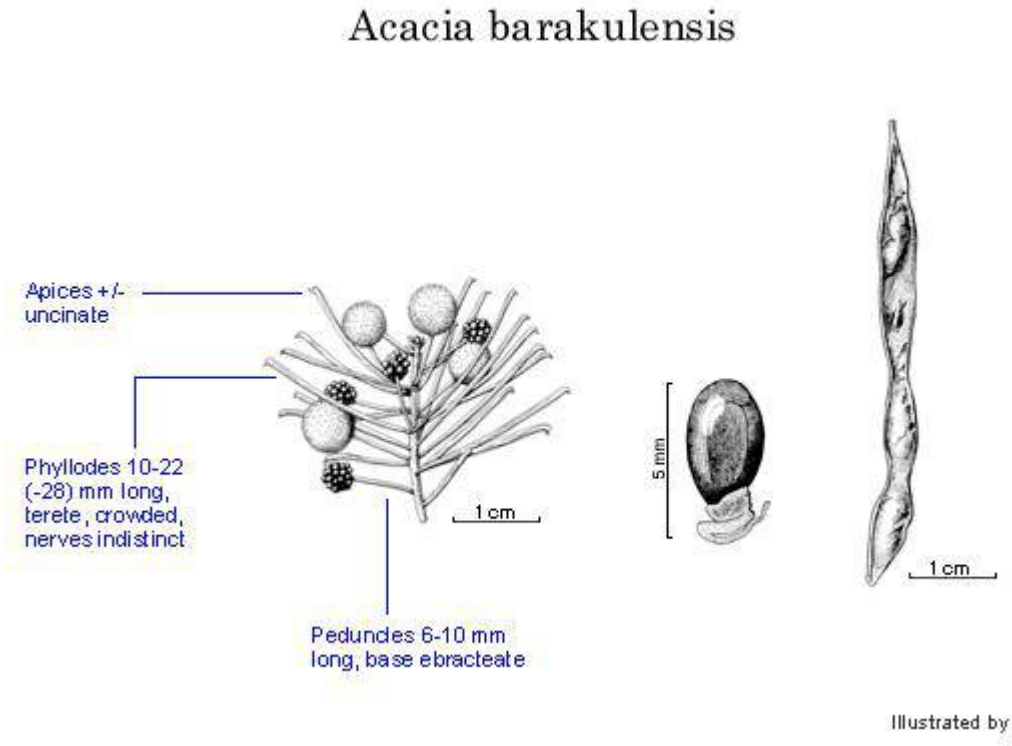
4.1 TREES AND SHRUBS

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

4.1.5 *Callitrix gurulmundensis* (Gurulmundi Fringe Myrtle)

Vulnerable EPBC Act (effective Jul 2000)
Vulnerable NC Act;

Gurulmundi fringe myrtle (*Calytrix gurulmundensis*). Copyright © Boobook

Distribution and Habitat

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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.

Eucalyptus curtisii (Photographs from Euclid)

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).

(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

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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.

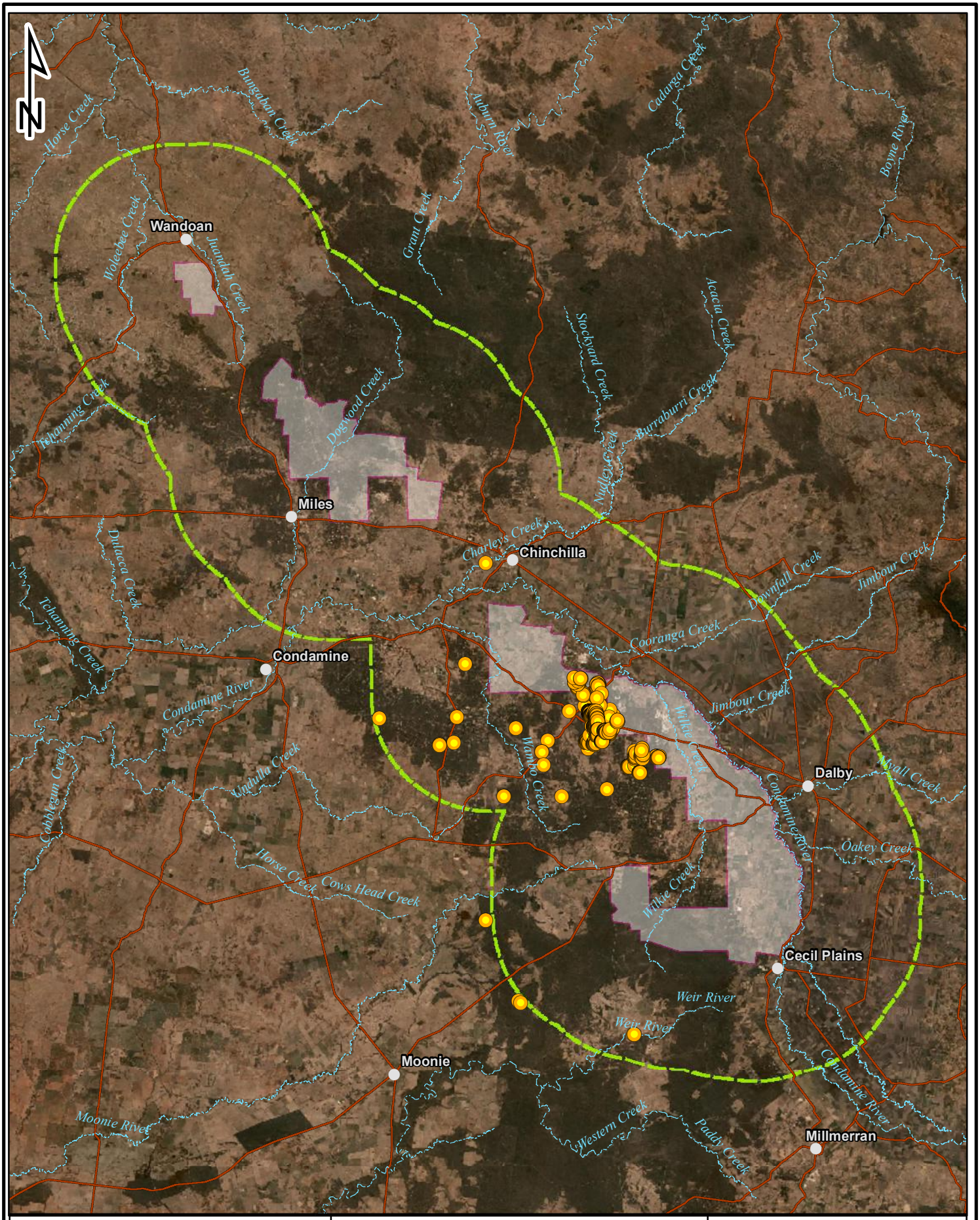
Rule(s) for Habitat Mapping:

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

4.2 GRASSES AND SEDGES

4.2.1 *Digitaria porrecta* (Finger Panic Grass)

Near Threatened NC Act

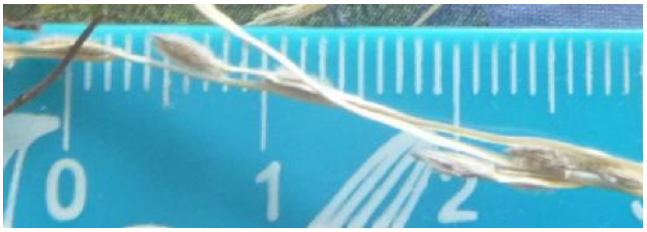
Description

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)

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).



Digitaria porrecta seed (Photograph Paul Williams)

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

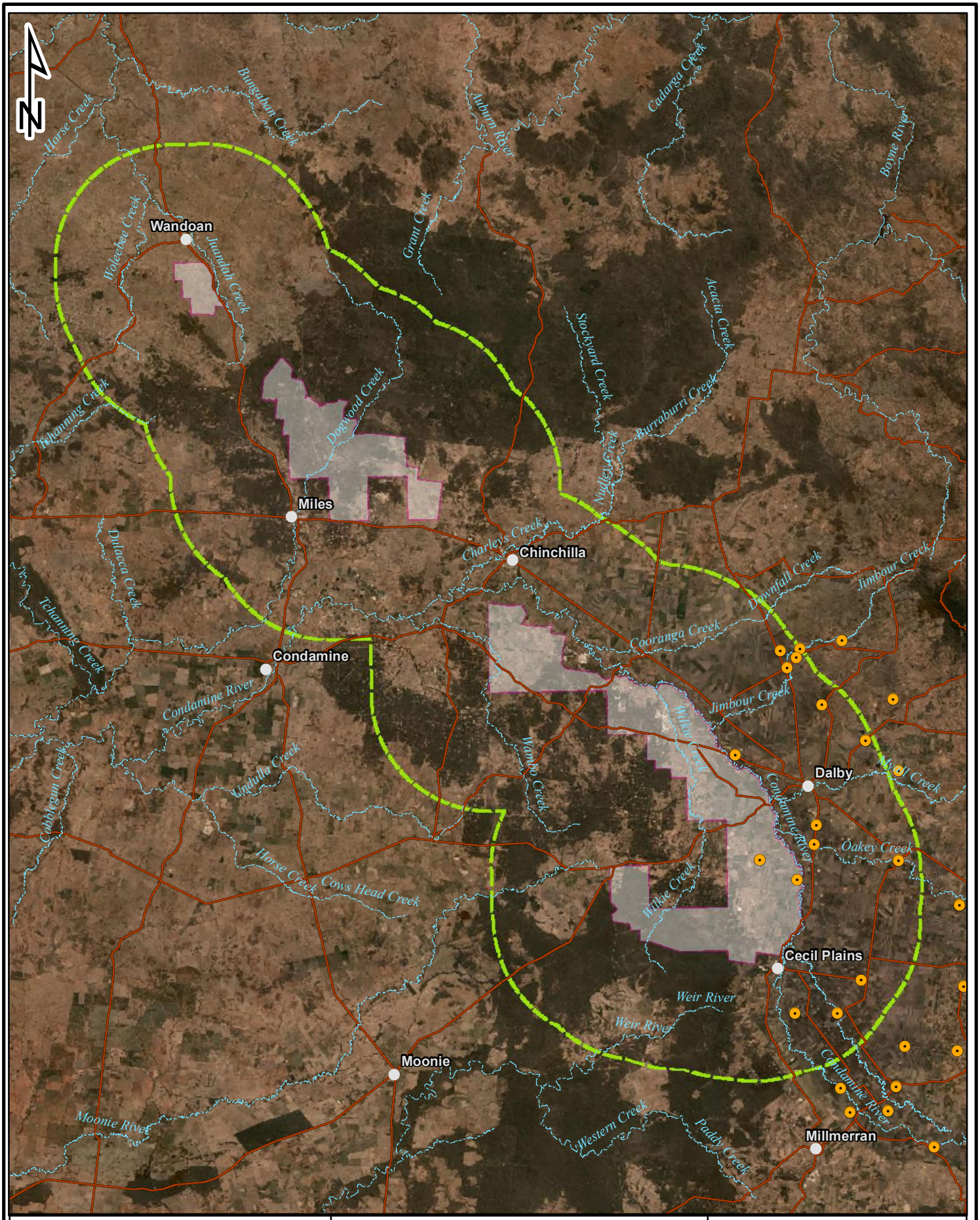
Two records within the SGP, both in non-remnant derived grasslands adjacent to roadside easements between Dalby and Cecil Plains. Both records collected in 1995. A further 15 records located outside the SGP, approximately 25 km to the east (Figure 4.9).

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

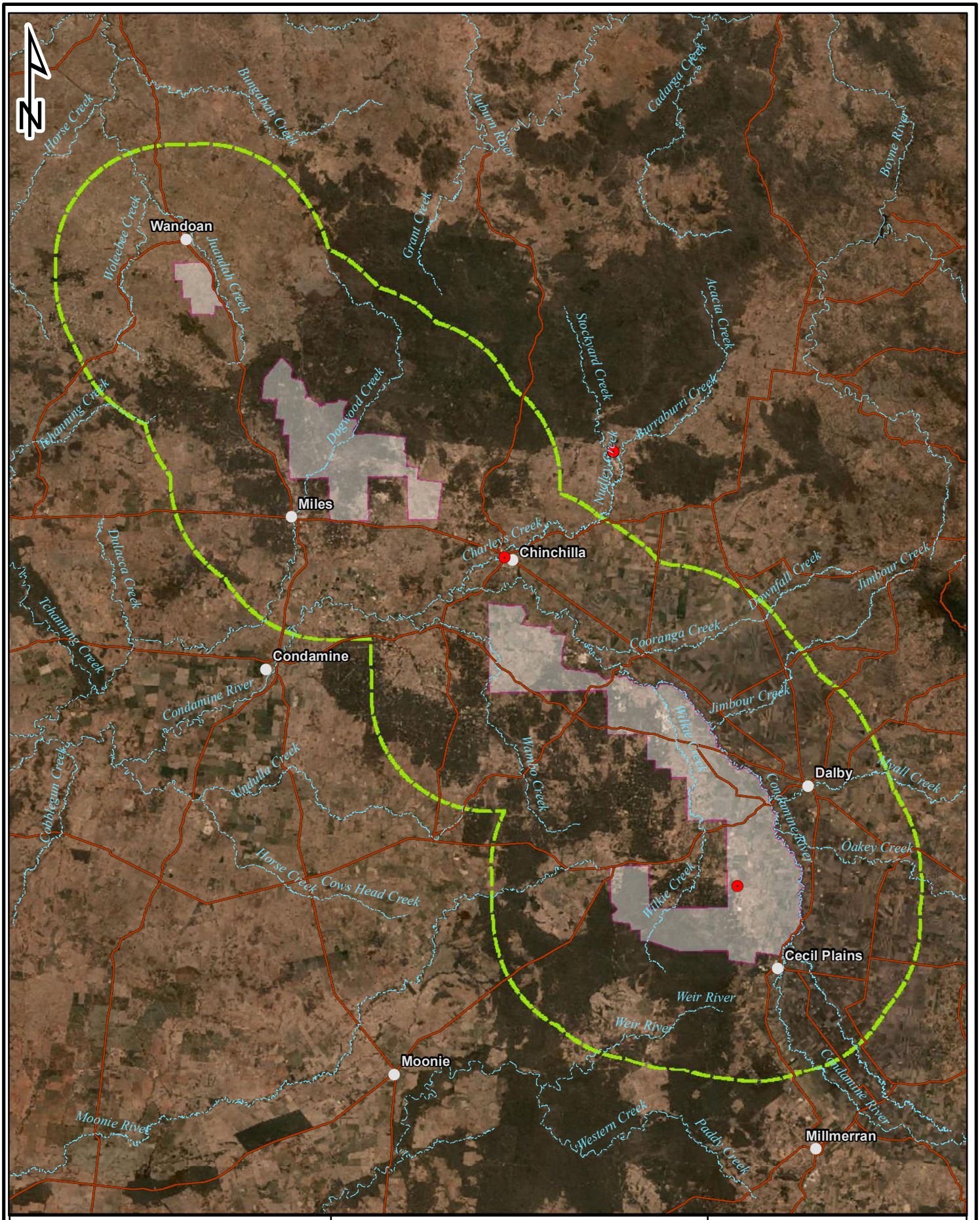
A single herbarium record from the SGP associated with the swampy inlet of Lake Broadwater (Figure 4.10). The species has not been recorded or collected since 1984.

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

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

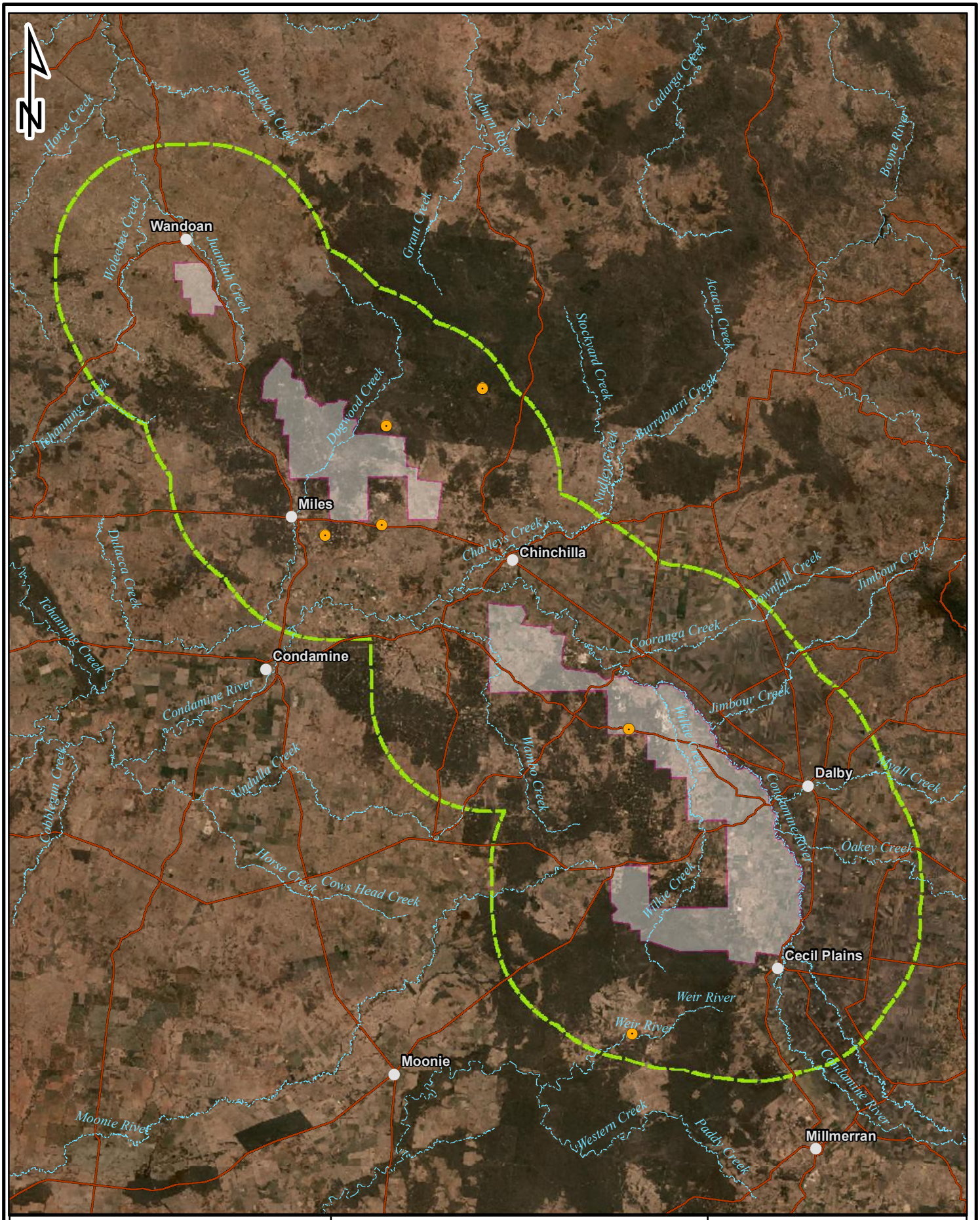
Rutidosis glandulosa grows in eucalypt woodlands, especially near sandstone on sandy or skeletal soils. It recruits in areas of soil disturbance, such as road edges (Barker 1997).

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

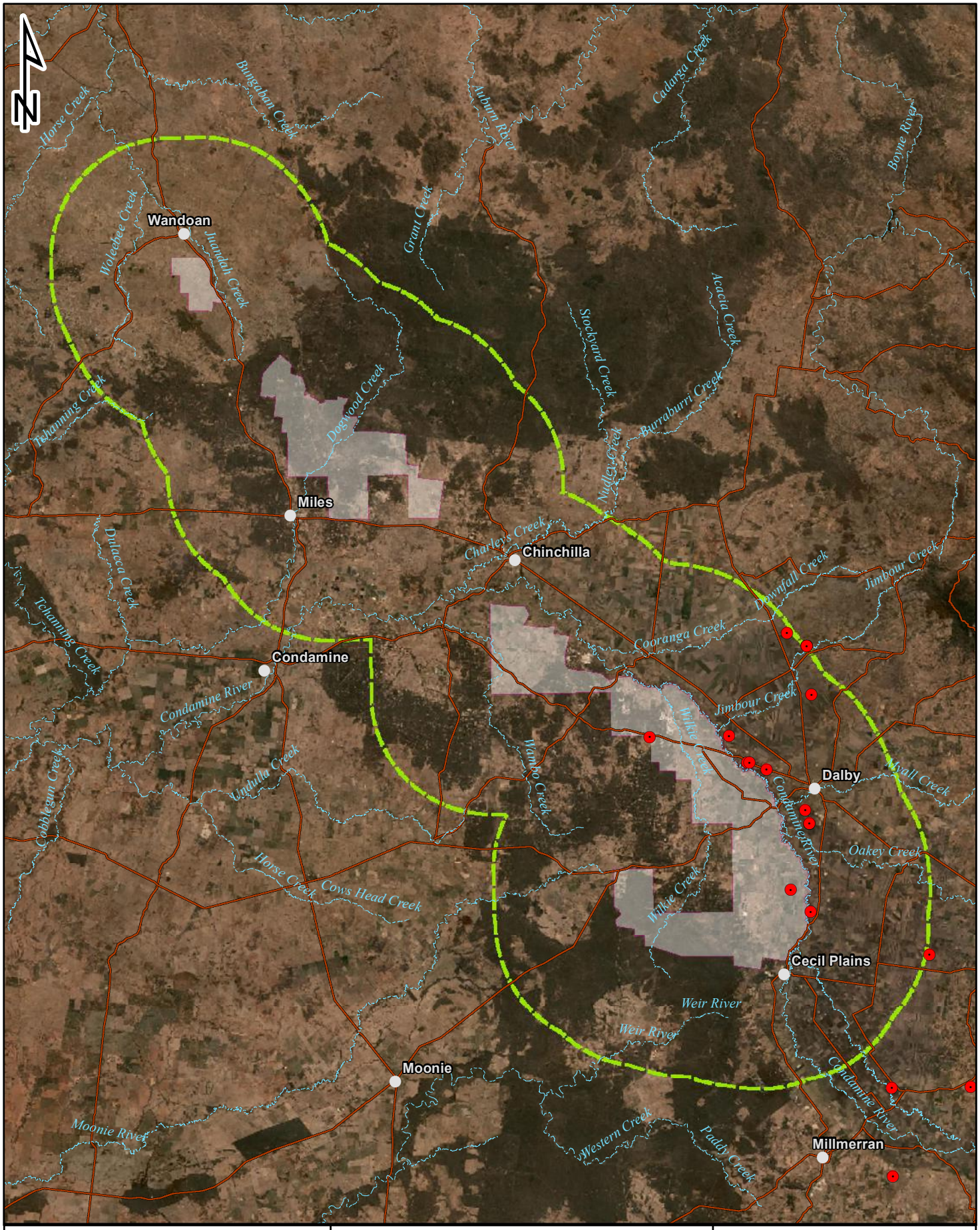
Two records are contained within the SGP assessment area to the south of Dalby with an large number of herbarium records to the east of the SGP assessment area between Chinchilla and Dalby (Figure 4.17).

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

D:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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

3D Environmental
Landscape & Vegetation Science

Kenmore, Qld 4069
Mobile: 0447 8227 119
www.3denvironmental.com.au

F:\Backup C Drive 26519\3D Environmental\Arrow_Aug_2016\Arrow_July23\3d_Arrow_A4P_Veg_July_23.mxd

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.

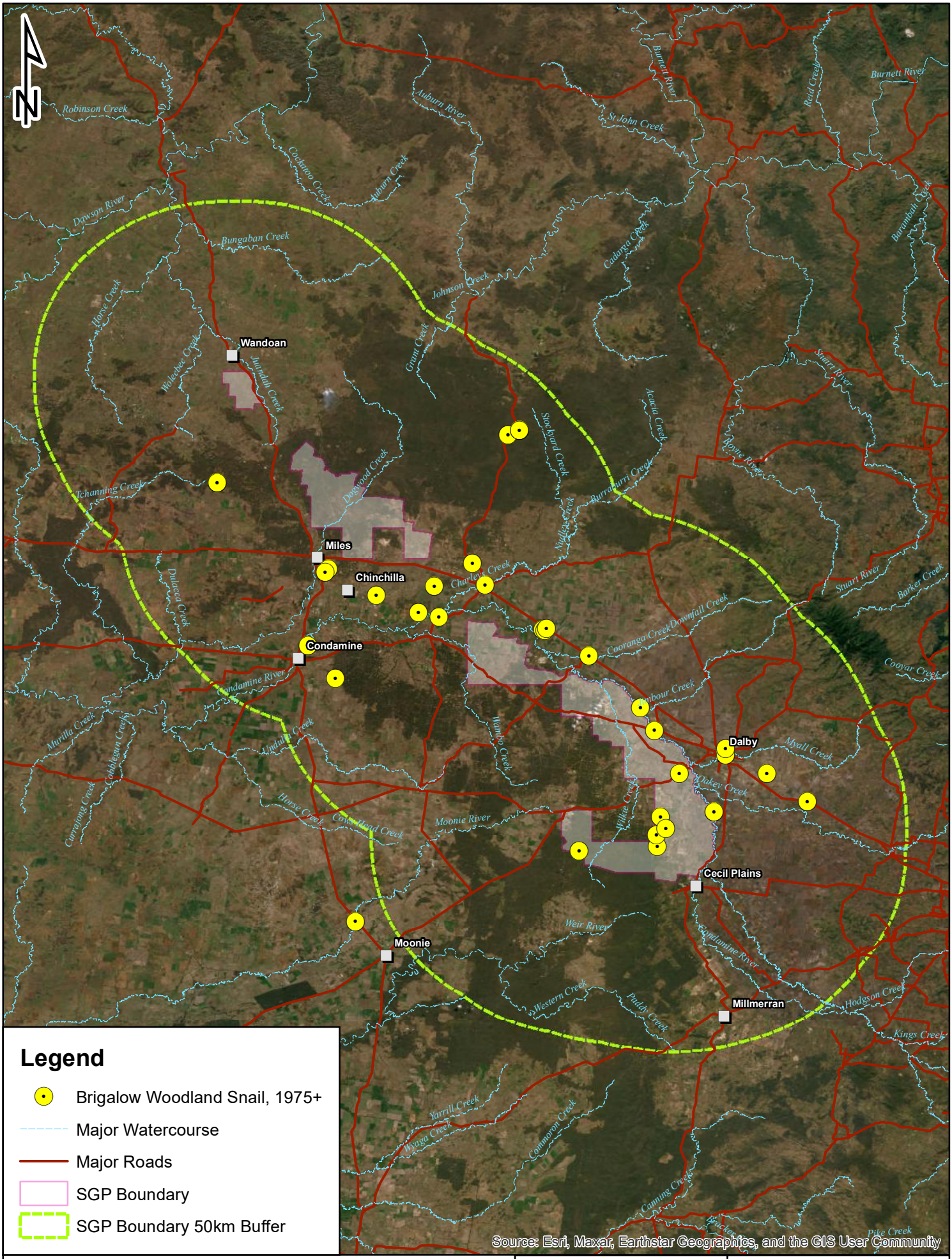


Figure 5.1
Records of the Brigalow Woodland Snail within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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.

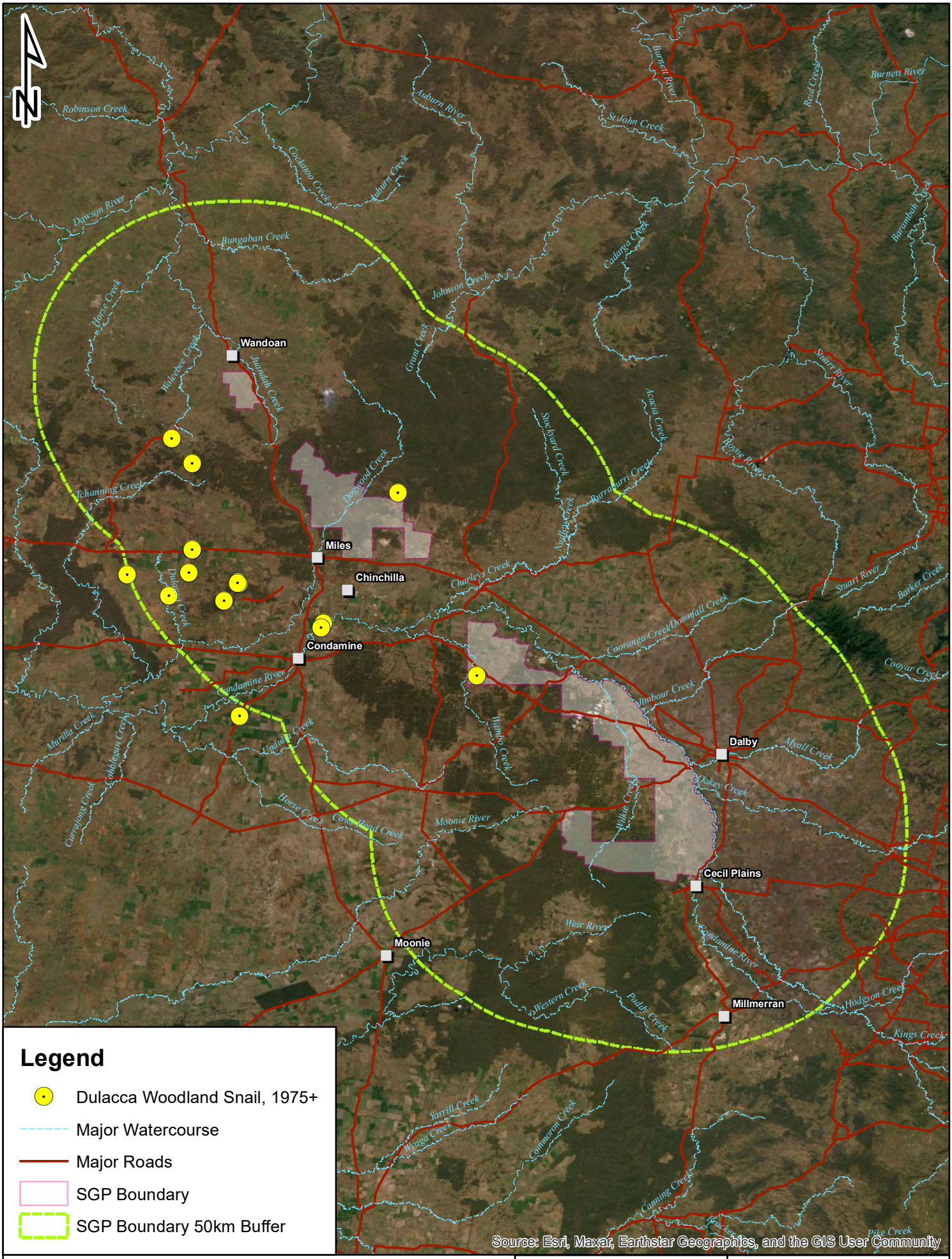


Figure 5.2
Records of the Dulacca Woodland Snail within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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.

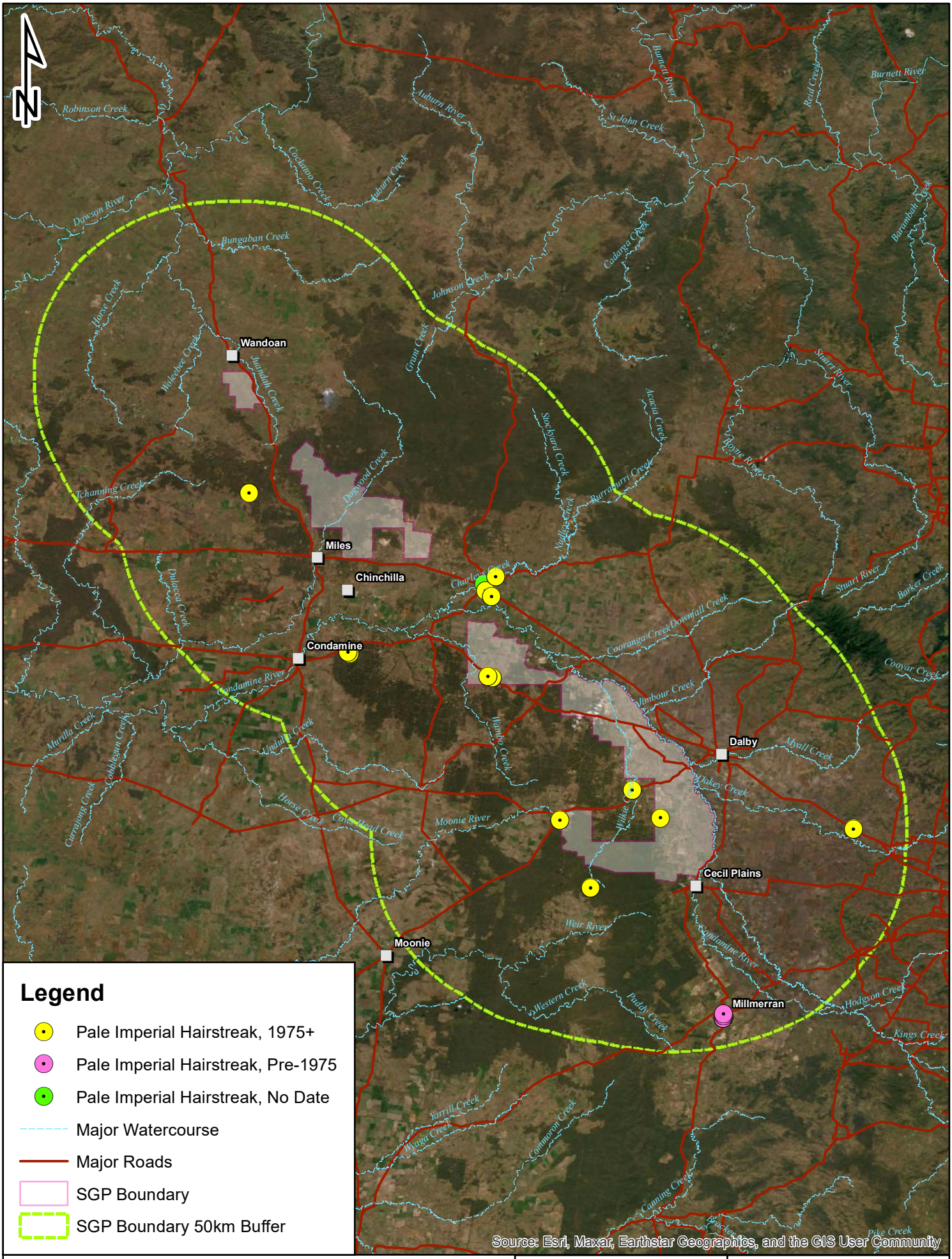


Figure 5.3
Records of the Pale Imperial Hairstreak within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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.

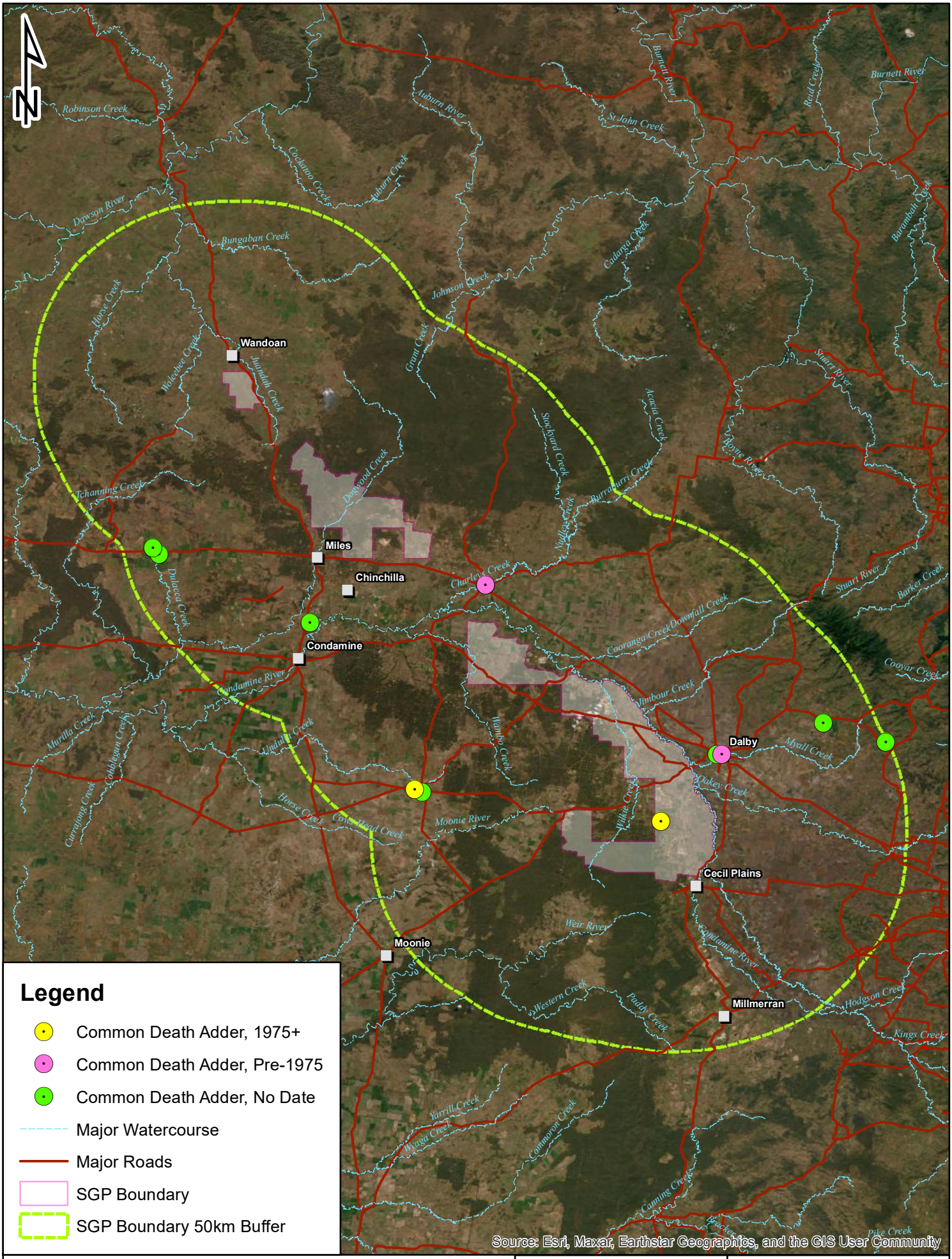
However, within the Brigalow Belt the Common Death Adder is typically associated with large contiguous patches of vegetation. Smaller patches are more likely to suffer degradation and less likely to support the species. As such, suitable habitat is better mapped based on landscape context and patch size 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.



Legend

- Common Death Adder, 1975+
- Common Death Adder, Pre-1975
- Common Death Adder, No Date
- Major Watercourse
- Major Roads
- SGP Boundary
- SGP Boundary 50km Buffer

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

ecosmart ECOLOGY

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

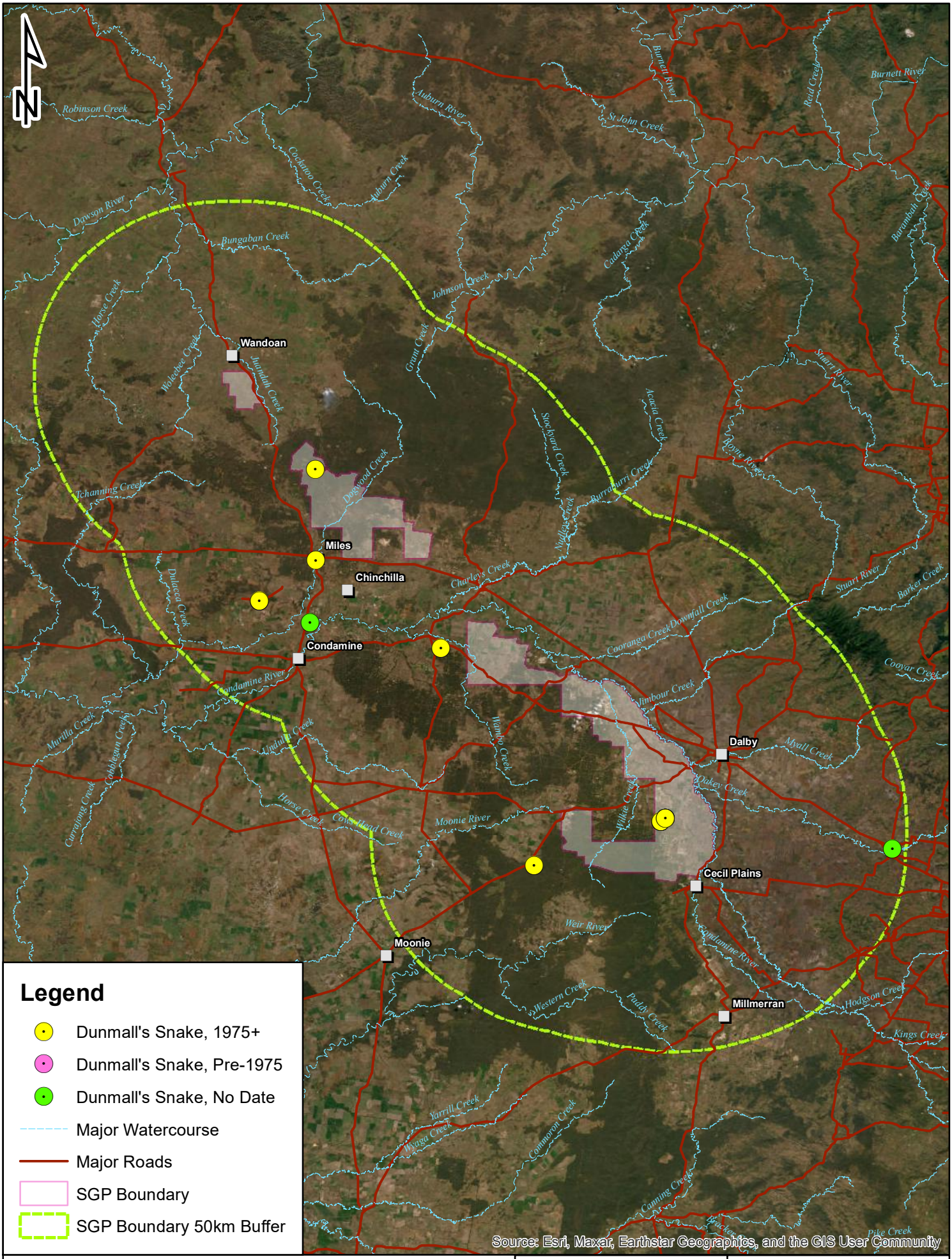
Rule(s) for Habitat Mapping:

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.



Legend

- Dunmall's Snake, 1975+
- Dunmall's Snake, Pre-1975
- Dunmall's Snake, No Date
- Major Watercourse
- Major Roads
- SGP Boundary
- SGP Boundary 50km Buffer

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

ecosmart ECOLOGY

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.

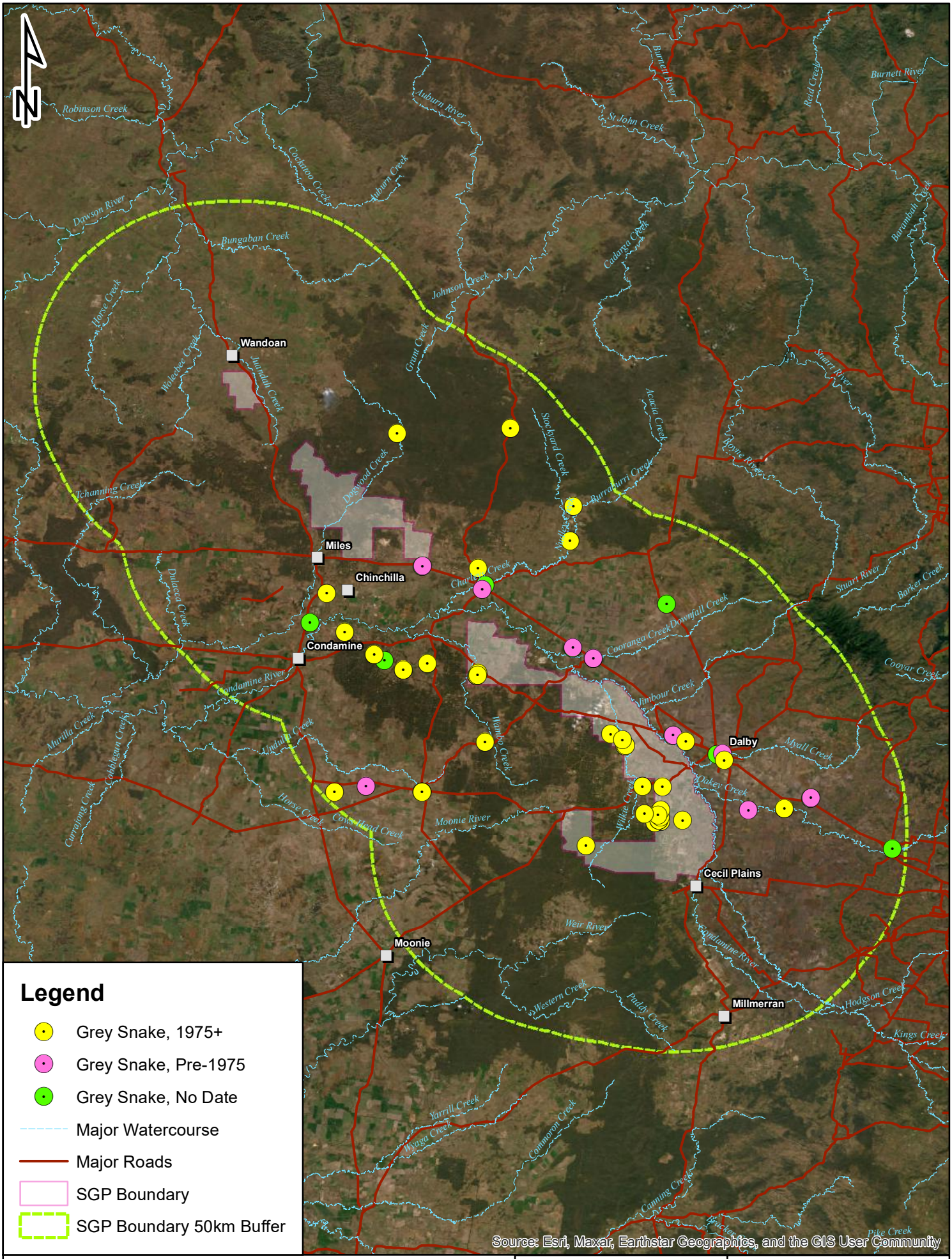


Figure 5.6
Records of the Grey Snake within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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.

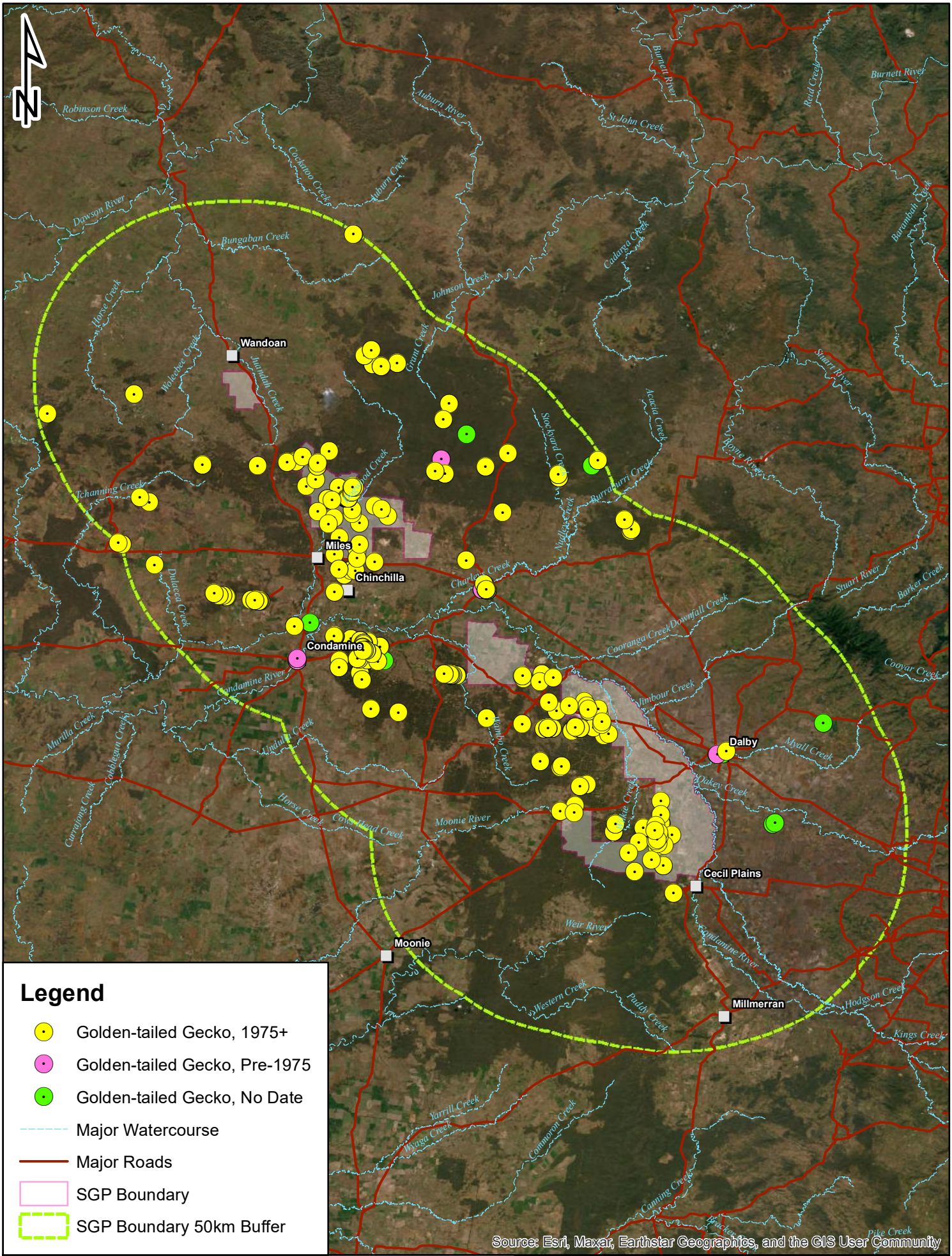


Figure 5.7
Records of the Golden-tailed Gecko within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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

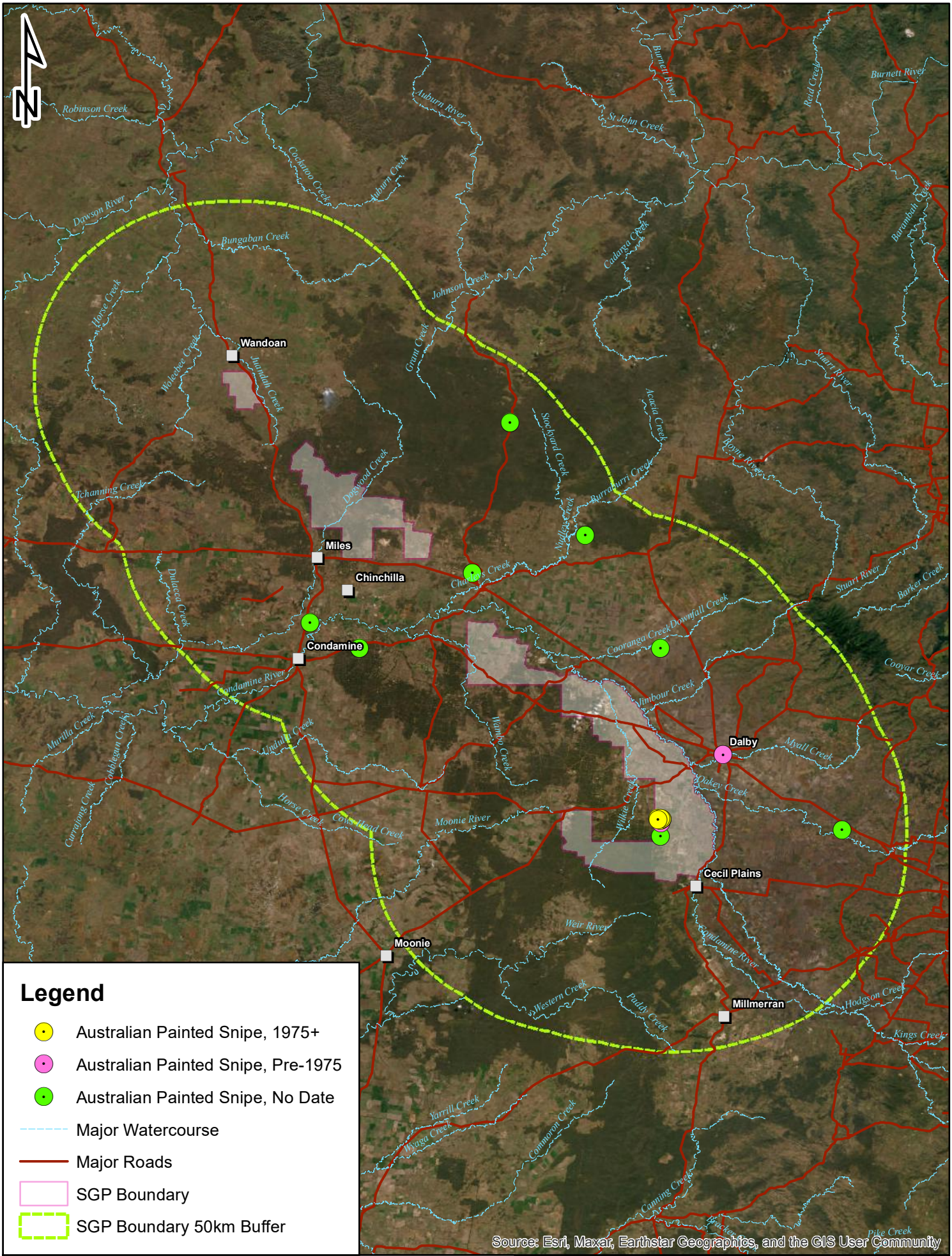
Fourteen records were identified in databases, with all but four post 1975 (Figure 5.8). All recent records are known from within the vicinity of Lake Broadwater. The species is likely to be a vagrant and rare visitor to the SGP, though there is a low possibility the species might occur at Long Swamp. 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.



Legend

- Australian Painted Snipe, 1975+
- Australian Painted Snipe, Pre-1975
- Australian Painted Snipe, No Date
- Major Watercourse
- Major Roads
- SGP Boundary
- SGP Boundary 50km Buffer

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

ecosmart ECOLOGY

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.

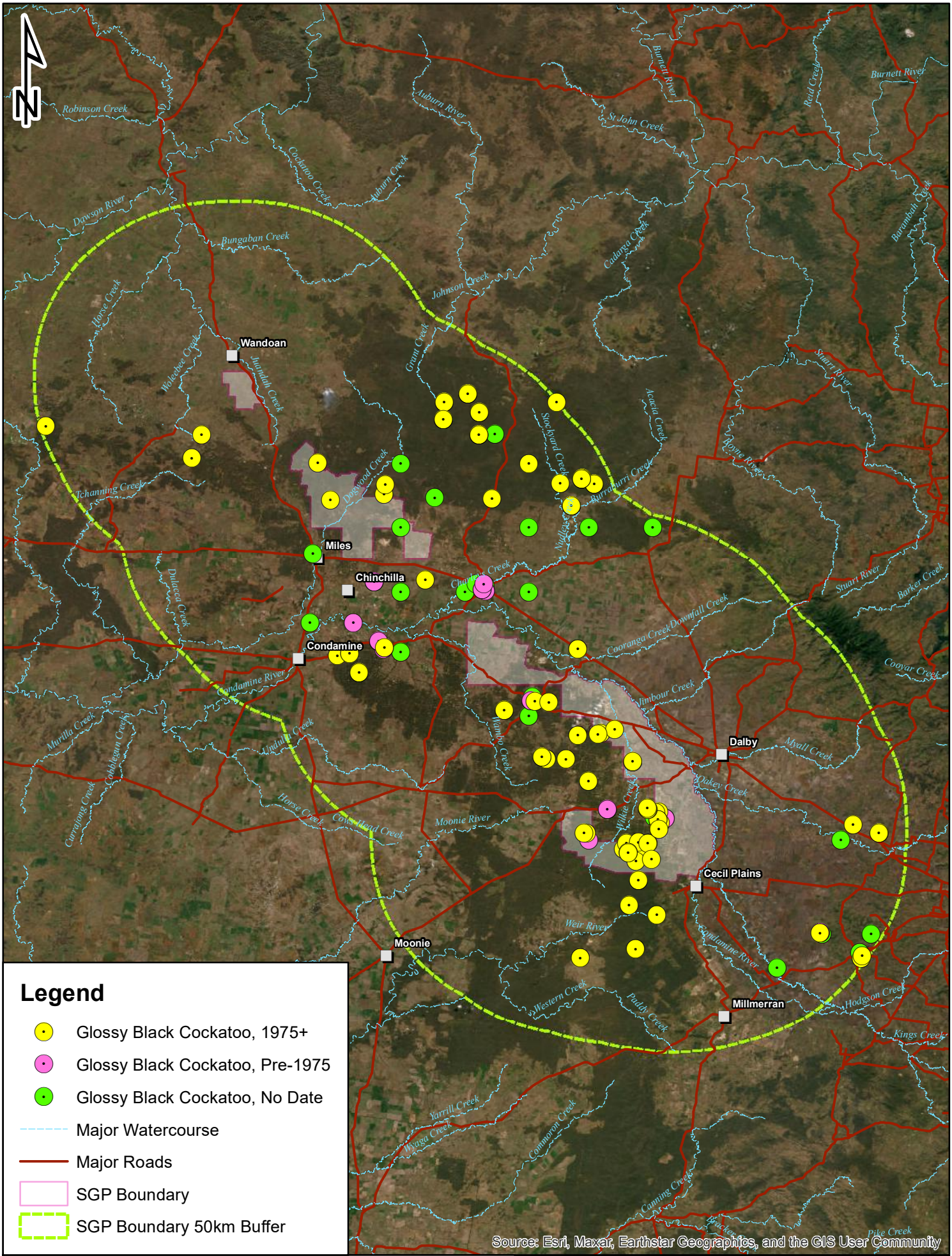


Figure 5.9
Records of the Glossy Black Cockatoo within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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.

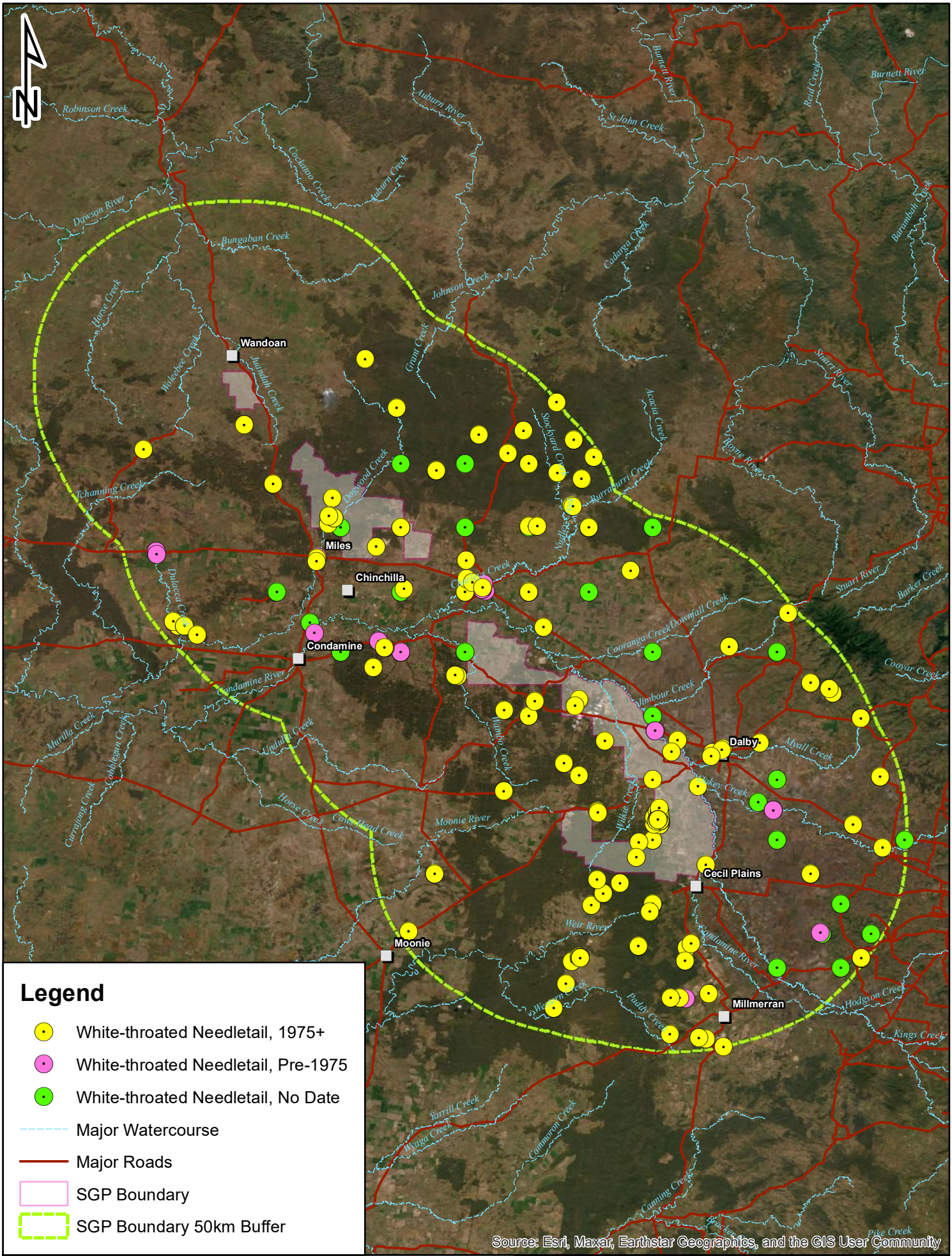


Figure 5.10
Records of the White-throated Needletail within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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.

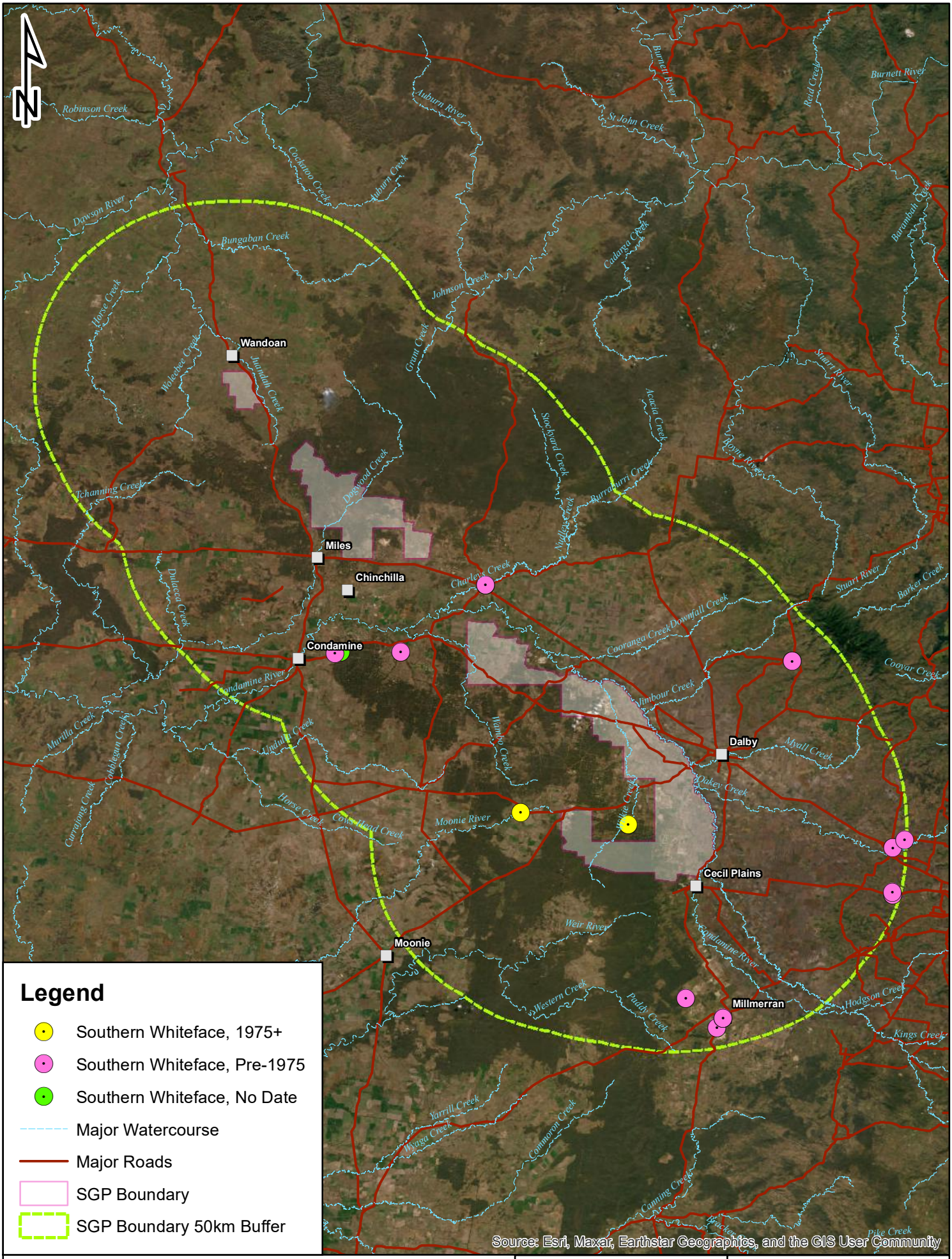


Figure 5.11
Records of the Southern Whiteface within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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.

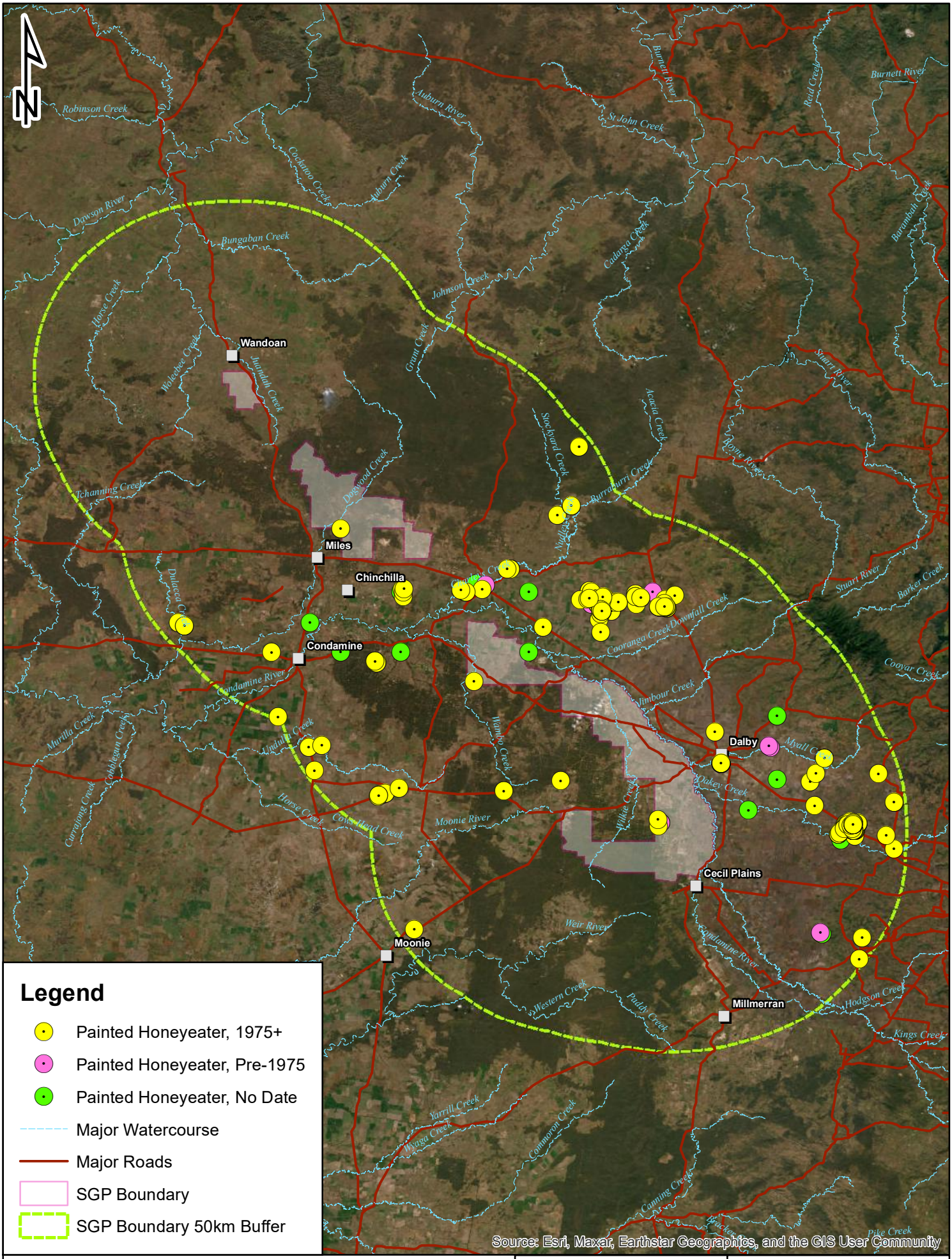


Figure 5.12
Records of the Painted Honeyeater within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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.

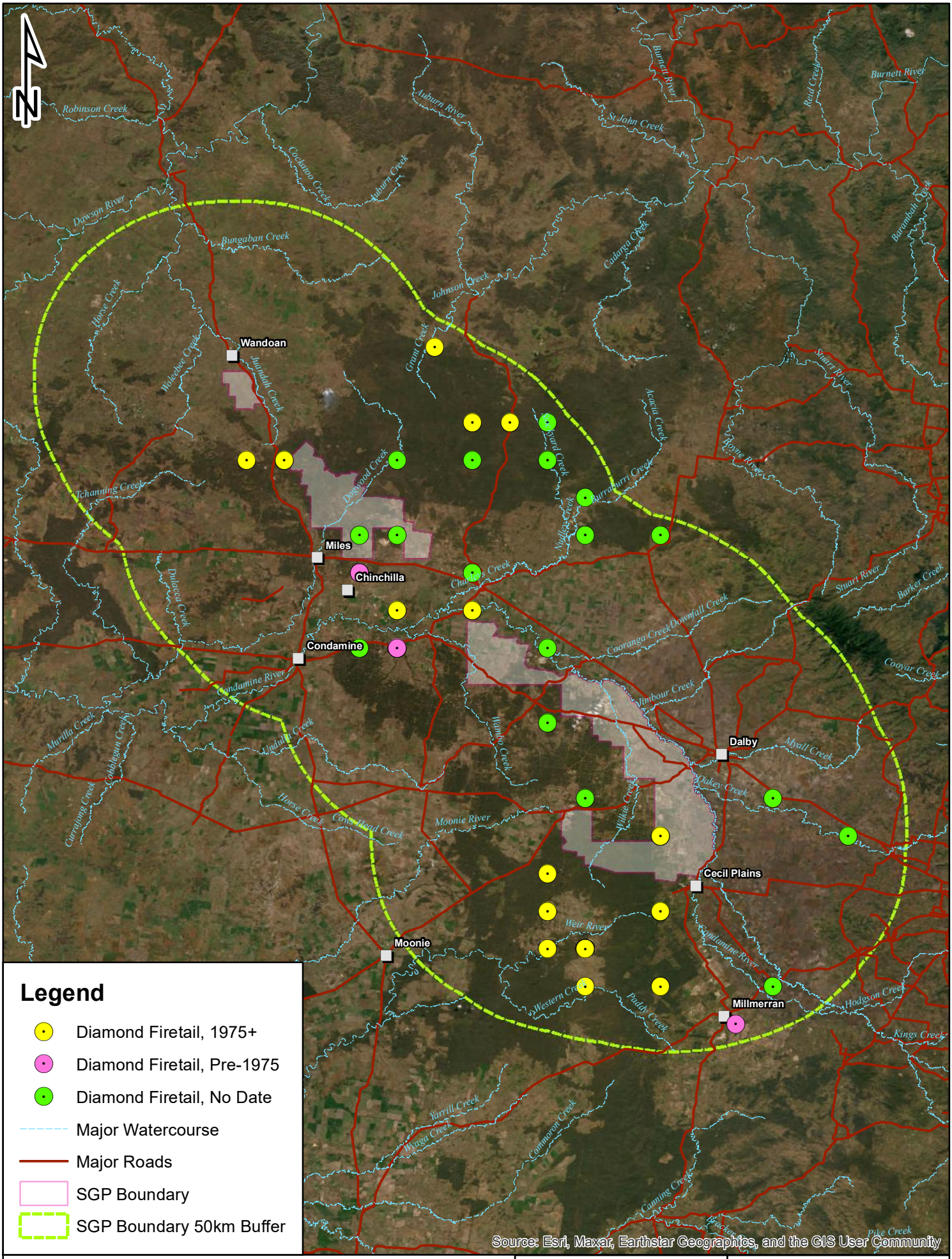


Figure 5.13
Records of the Diamond Firetail within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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:

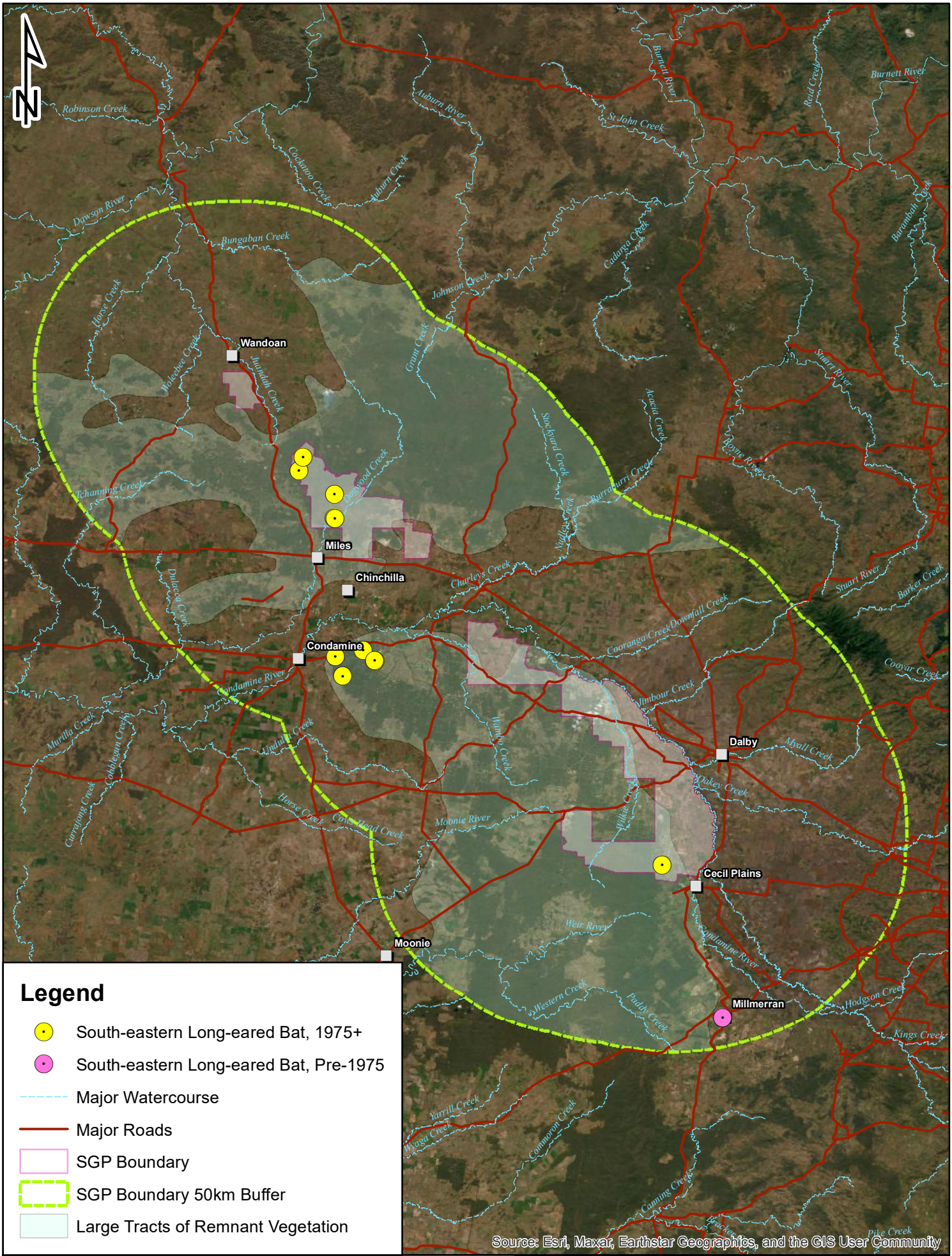
1. Potential South-eastern Long-eared Bat habitat is restricted to contiguous or near-contiguous areas of vegetation (i.e., reduced fragmentation). Within the SGP, potentially important habitat is restricted to vegetation within or abutting the 'large tracts remnant veg.shp'.
2. Within the area defined 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.



Legend

- South-eastern Long-eared Bat, 1975+
- South-eastern Long-eared Bat, Pre-1975
- Major Watercourse
- Major Roads
- SGP Boundary
- SGP Boundary 50km Buffer
- Large Tracts of Remnant Vegetation

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

ecosmart ECOLOGY

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).

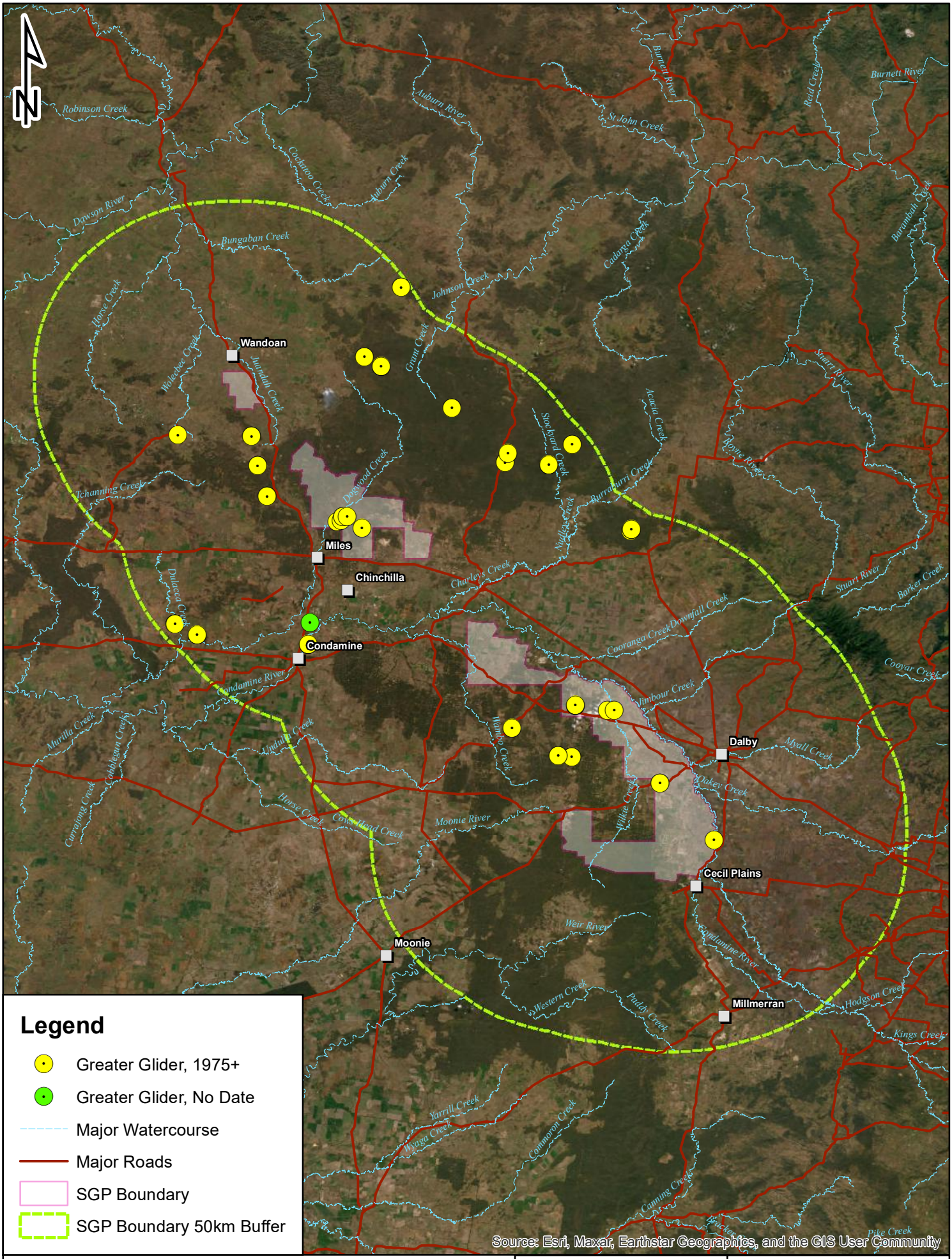


Figure 5.15
Records of the Greater Glider within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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.

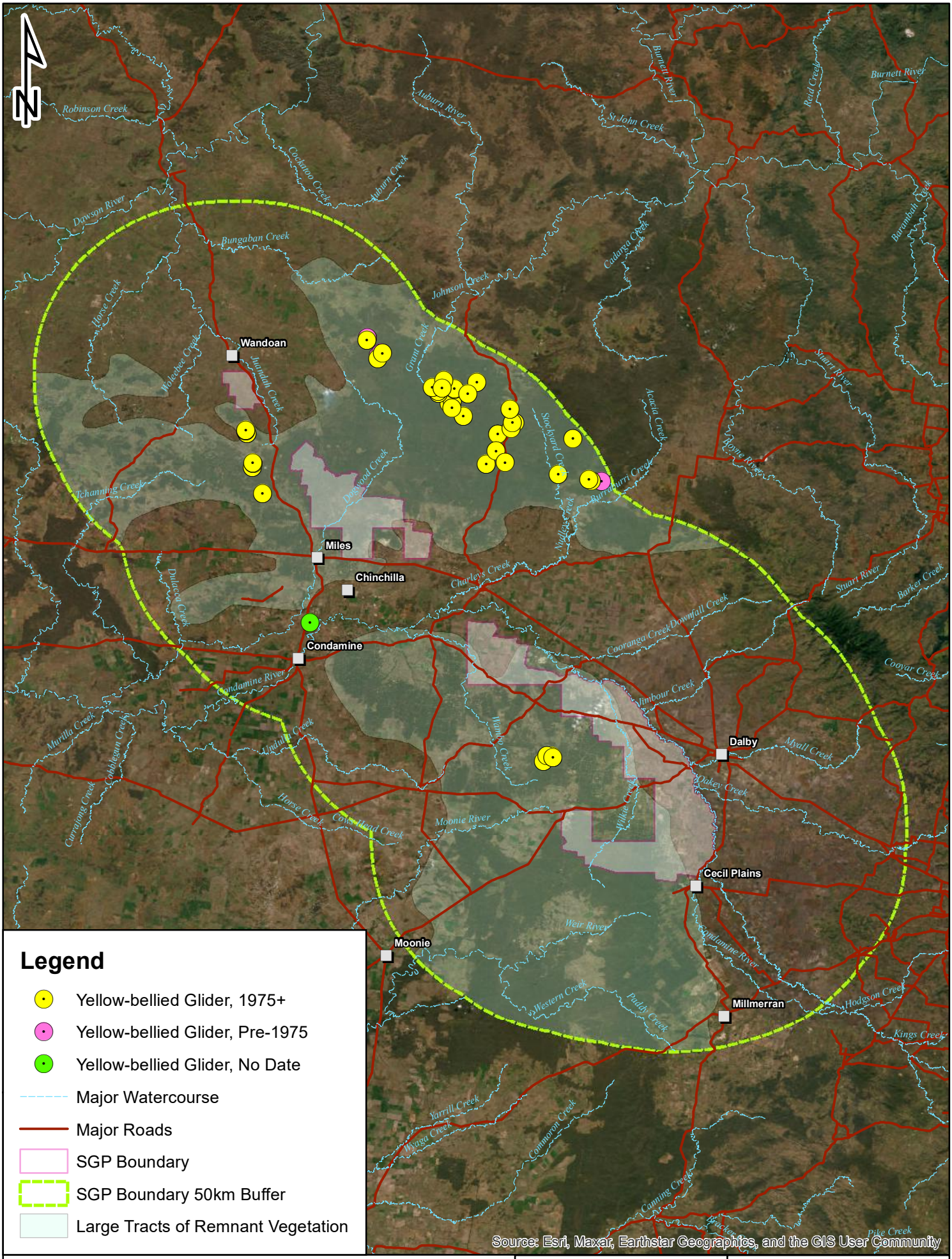


Figure 5.16
Records of the Yellow-bellied Glider within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

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.

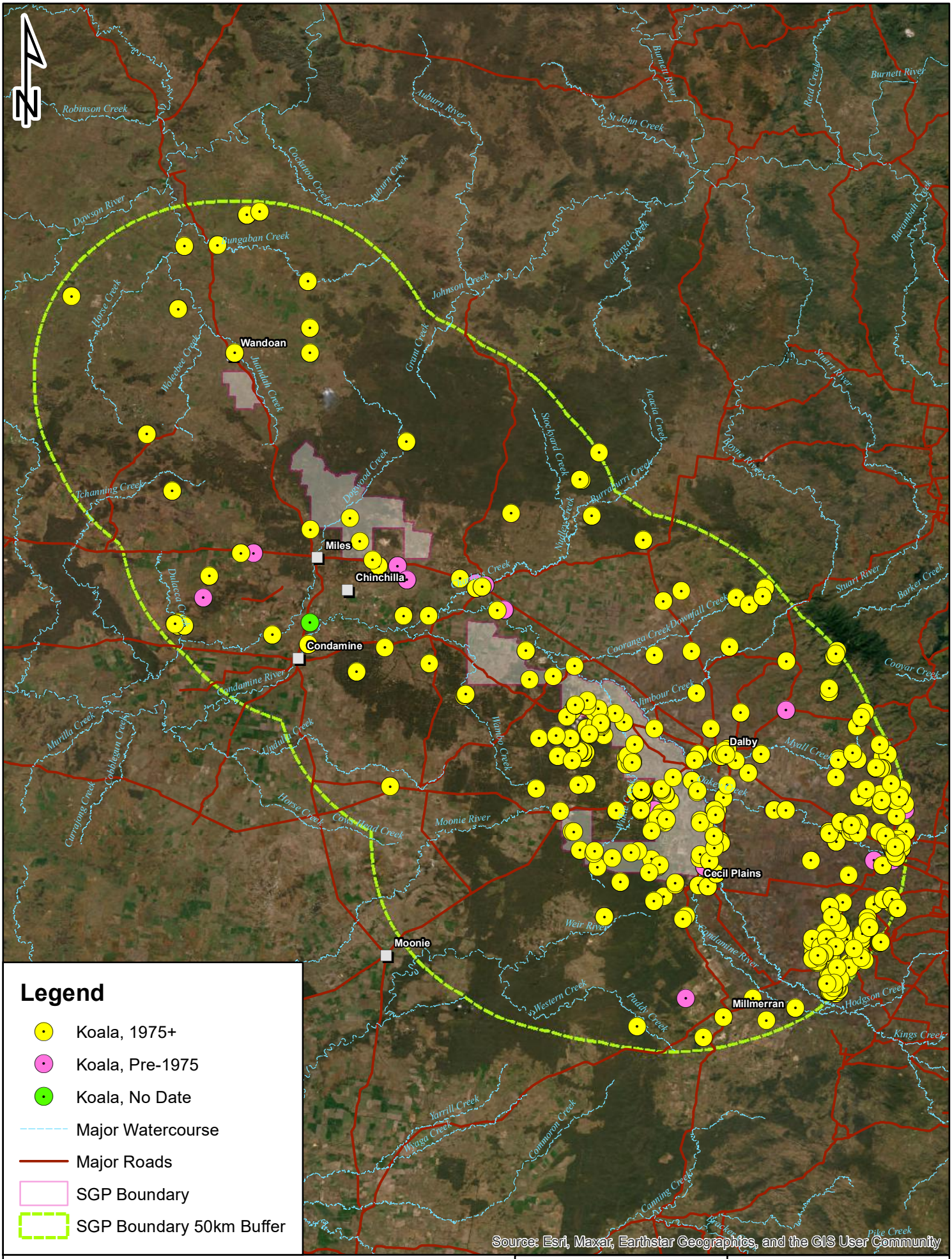


Figure 5.17
Records of the Koala within and surrounding the SGP

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

Client: Arrow Energy

Project: Surat Gas Project

ecosmart ECOLOGY

6.0 REFERENCES

AMTC (2022) The AMTC Australian Mammal Species List. Version 2.0. [online]. Available from: https://australianmammals.org.au/publications/amtc-species-list [Accessed July 14, 2023].

Andrews S., Gration G., Quin D. & Smith A. (1994) *Description and assessment of forestry impacts on fauna of the Urbenville Forestry Management Area. Report for State Forests of New South Wales*. Austeco Environmental Consultants, Armidale.

Antos M. J. & Bennett A. F. (2006) Foraging ecology of ground-feeding woodland birds in temperate woodlands of southern Australia. *Emu - Austral Ornithology* **106** , 29–40.

Antos M. J., Bennett A. F. & White J. G. (2008) Where exactly do ground-foraging woodland birds forage? Foraging sites and microhabitat selection in temperate woodlands of southern Australia. *Emu - Austral Ornithology* **108** , 201–211.

ANU (2021) *A review of koala habitat assessment criteria and methods*. Australian National University, Canberra. [online]. Available from: https://www.awe.gov.au/environment/epbc/publications.

AVH (2023) Australasian Virtual Herbarium. *AVH*. [online]. Available from: https://avh.chah.org.au/https//avh.chah.org.au/ [Accessed July 22, 2023].

Baker A. & Gynther I. eds (2023) *Strahan's Mammals of Australia*. 4th edn. New Holland, Sydney, NSW. [online]. Available from: https://www.thenile.com.au/books/andrew-gynther-ian-baker/strahans-mammals-of-australia/9781925546750 [Accessed June 16, 2023].

Barea L. P. (2008) Nest-site selection by the Painted Honeyeater (*Grantiella picta*) , a mistletoe specialist. *Emu - Austral Ornithology* **108** , 213–220.

Barea L. P. & Watson D. M. (2007) Temporal variation in food resources determines onset of breeding in an Australian mistletoe specialist. *Emu - Austral Ornithology* **107** , 203–209.

Barker M. (1997) *Rutidosis sp.* (Blackdown Tableland) Species Management Profile.

Barrett G. W., Freudenberger D., Drew A., Stol J., Nicholls A. O. & Cawsey E. M. (2008) Colonisation of native tree and shrub plantings by woodland birds in an agricultural landscape. *Wildl. Res.* **35** , 19.

Bean A. R. (1997) A revision of Micromyrtus Benth. (Myrtaceae) in Queensland. *Austrobaileya* **4** , 469–471.

Bean A. R. (2004) The taxonomy and ecology of *Solanum subg. Leptostemonum* (Dunal) Bitter (Solanaceae) in Queensland and far north-eastern New South Wales, Australia. *Austrobaileya* **6** , 639–816.

Beruldsen G. (2004) *Australian Birds, their Nests and Eggs: A guide to the nests and eggs of Australian birds that are known to breed in Australia and on Australian offshore islands*. Woodslane Pty Ltd, Warriewood, NSW.

Bilney R. J., Kambouris P. J., Peterie J. *et al.* (2022) Long-term monitoring of an endangered population of Yellow-bellied Glider *Petaurus australis* on the Bago Plateau, New South Wales,

and its response to wildfires and timber harvesting in a changing climate. *Australian Zoologist* **42** , 592–607.

Black R., Houston W. & Jaensch R. (2010) Evidence of regular seasonal migration by Australian Painted Snipe to the Queensland tropics in autumn and winter. *Stilt*.

Bostock P. D. & Holland A. E. (2016) Census of the Queensland Flora 2016.

Braby M. F. (2000) *The butterflies of Australia: their identification, biology and distribution.* Collingwood.

Breitfuss M. J. & Hill, C. J. (2003) Field observations on the life history and behaviour of *Jalmenus evagoras eubulus* Miskin (Lepidoptera: Lycaenidae) in the southern brigalow belt of Queensland. *Australian Entomologist*.

Brigalow Belt Reptiles Workshop (2010) Proceedings from the workshop for the nine listed reptiles of the Brigalow Belt bioregions.

Brooker M. I. H. & Kleinig D. A. (2004) *Field guide to the eucalypts. Volume 3 Northern Australia*. Bloomings Books, Melbourne. [online]. Available from: https://www.australianplants.com/books.aspx?id=1083 [Accessed July 22, 2023].

Brown D., Wilmer J. W. & Macdonald S. (2012) A revision of Strophurus taenicauda (Squamata; Diplodactylidae) with the description of two new subspecies from central Queensland and a southerly range extension. *Zootaxa* **3243** , 1.

Brown M., Carthew S. M. & Cooper S. J. B. (2007) Monogamy in an Australian arboreal marsupial, the yellow-bellied glider (*Petaurus australis*). *Aust. J. Zool.* **55** , 185.

Burwell C. J. & Pavey C. R. (1992) The insect prey of a white-throated needletail *Hirundapus caudacutus* (Latham) (Aves: Apodidae). *Australian Entomological Magazine* **19** , 37–38.

Cameron A. C. (1968) Feeding Habits of the Spine-tailed Swift. *Emu - Austral Ornithology* **68** , 217–219.

Cameron M. & Cunningham R. B. (2006) Habitat selection at multiple spatial scales by foraging Glossy Black-cockatoos. *Austral Ecol* **31** , 597–607.

Carthew S. M., Goldingay R. L. & Funnell D. L. (1999) Feeding behaviour of the yellow-bellied glider (*Petaurus australis*) at the western edge of its range. *Wildl. Res.* **26** , 199.

Chapman T. (2007) Foods of the glossy Black-Cockatoo Calyptorhynchus lathami.

Chapman T. F. & Paton D. C. (2006) Aspects of Drooping Sheoaks (*Allocasuarina verticillata*) that influence Glossy Black-Cockatoo (*Calyptorhynchus lathami halmaturinus*) foraging on Kangaroo Island. *Emu - Austral Ornithology* **106** , 163–168.

Chapple D. G., Tingley R., Mitchell N. J. *et al.* (2019) *The Action Plan for Australian Lizards and Snakes 2017*. CSIRO Publishing, Clayton South, VIC.

Chinchilla Field Naturalists Club (2017) Charlies Creek Catchment Plant List. Published by the Chinchilla Field Naturalist Club.

Churchill S. (2008) *Australian bats*. 2nd ed. Allen & Unwin, Crows Nest, N.S.W.

Clout M. & Clout M. (1989) Foraging Behavior of Glossy Black-Cockatoos. *Wildl. Res.* **16** , 467.

Comport S., Ward S. & Foley W. (1996) Home ranges, time budgets and food-tree use in a high-density tropical population of greater gliders, *Petauroides volans minor* (Pseudocheiridae : Marsupialia). *Wildl. Res.* **23** , 401.

Cooney S. J. N. & Watson D. M. (2005) Diamond Firetails (*Stagonopleura guttata*) preferentially nest in mistletoe. *Emu - Austral Ornithology* **105** , 317–322.

Covacevich J. A., Couper P. J. & Mcdonald K. (1998) Reptile diversity at risk in the Brigalow Belt, Queensland. *Memoirs of the Queensland Museum*.

Covacevich J. A. & Wilson S. (2020) Land Snakes. In: *Wildlife of Greater Brisbane* (ed M. Ryan) p. 209 Queensland Museum, Brisbane.

Coventry P. (1989) Comments on airborne sightings of White-throated Needletails *Hirundapus caudacutus*. *Australian Bird Watcher*.

Craig S. (1985) Social Organization, Reproduction and Feeding Behaviour of a Population of Yellow-Bellied Gliders, *Petaurus australis* (Marsupialia: Petauridae). *Wildl. Res.* **12** , 1.

Crowley G. M. & Garnett S. T. (2001) Food Value and tree selection by Glossy Black-Cockatoos Calyptorhynchus lathami: TREE SELECTION IN GLOSSY BLACK-COCKATOOS. *Austral Ecology* **26** , 116–126.

Curtis L. K., Dennis A. J., McDonald K. R., Kyne P. M. & Debus S. J. S. eds (2012) *Queensland's threatened animals*. CSIRO Publishing, Collingwood.

Davies N., Gramotnev G., Seabrook L. *et al.* (2013) Movement patterns of an arboreal marsupial at the edge of its range: a case study of the koala. *Mov Ecol* **1** , 8.

Day N. (1993) Tree perching and presumed roosting of White-throated Needletails *Hirundapus caudacutus*. *Australian Bird Watcher* **15** , 43–44.

DCCEEW (2023a) Protected Matters Search Tool. [online]. Available from: https://pmst.awe.gov.au/#/map?lng=131.52832031250003&lat=-28.6905876542507&zoom=5&baseLayers=Imagery,ImageryLabels.

DCCEEW (2023b) Species Profile and Threats Database. *Melanodryas cucullata cucullata* — South-eastern Hooded Robin, Hooded Robin (south-eastern). [online]. Available from: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=470 [Accessed July 14, 2023].

DCCEEW (2023c) Species Profile and Threats Database. *Grantiella picta* — Painted Honeyeater. [online]. Available from: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=470 [Accessed July 14, 2023].

DCCEEW (2023d) Species Profiles and Threat Database: *Phascolarctos cinereus* - Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory). [online]. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85104 [Accessed July 17, 2023].

DEHP (2013) Herbrecs Database extract – January 2013. Queensland Herbarium, Queensland Government, Brisbane.

DES (2020) Method for mapping Matters of state environmental significance. For the State Planning Policy 2017. Version 6.0.

DES (2022a) Species profile - *Acacia barakulensis*. [online]. Available from: https://apps.des.qld.gov.au/species-search/details/?id=2299 [Accessed July 22, 2023].

DES (2022b) Species profile - *Eucalyptus curtisii* (Plunkett mallee). [online]. Available from: https://apps.des.qld.gov.au/species-search/details/?id=17256 [Accessed July 22, 2023].

DES (2022c) Species profile - *Micromyrtus carinata* (Gurulmundi Heath-myrtle). [online]. Available from: https://apps.des.qld.gov.au/species-search/details/?id=17762 [Accessed July 22, 2023].

DES (2022d) Species profile - *Rutidosis lanata*. [online]. Available from: https://apps.des.qld.gov.au/species-search/details/?id=6519 [Accessed July 22, 2023].

Dique D. S., Preece H. J., Thompson J. & Villiers D. L. D. (2004) Determining the distribution and abundance of a regional koala population in south-east Queensland for conservation management. *Wildl. Res.* **31** , 109.

DNR (2000) Species Management Manual.

DSE (2003) Flora and Fauna Guarantee Action Statement – *Austral Toadflax*. [online]. Available from: http://www.dse.vic.gov.au/__data/assets/pdf_file/0011/103241/056_Austral_Toad-flax_1994.pdf.

Eastwood R., Braby M. F., Schmidt D. J. & Hughes J. M. (2008) Taxonomy, ecology, genetics and conservation status of the pale imperial hairstreak (Jalmenus eubulus) (Lepidoptera:Lycaenidae): a threatened butterfly from the Brigalow Belt, Australia. *Invert. Systematics* **22** , 407.

Eddie C. (2023) Craig Eddie (Boobook Ecological Consulting) unpublished data.

Ehmann H. (1992) *Encyclopedia of Australian Animals: Reptiles*. Angus & Robertson, Sydney, NSW.

Ehmke G., Antos M. J., Bennett A. F. *et al.* (2021) South-west Southern Whiteface *Aphelocephala leucopsis castaneiventris* and South-east Southern Whiteface *A. l. leucopsis*. In: *The Action Plan for Australian birds, 2020* CSIRO Publishing, Melbourne.

Ellis W. A. H., Melzer A., Carrick F. N. & Hasegawa M. (2002) Tree use, diet and home range of the koala (Phascolarctos cinereus) at Blair Athol, central Queensland. *Wildl. Res.* **29** , 303.

EPA (2008) BPA BRB South Fauna Expert Panel in Brigalow Belt South Biodiversity Planning Assessment.

Eyre T. (2004) Distribution and conservation status of the possums and gliders of southern Queensland. In: *The Biology of Australian Possums and Gliders* (eds R. L. Goldingay & S. Jackson) pp. 1–25 Surrey Beatty & Sons, Chipping Norton, N.S.W.

Eyre T. J. (2002) *Habitat preferences and management of large gliding possums in southern Queensland*. Ph.D. Southern Cross University, Lismore.

Eyre T. J. (2006) Regional habitat selection of large gliding possums at forest stand and landscape scales in southern Queensland, Australia. *Forest Ecology and Management* **235** , 270–282.

Eyre T. J. (2007) Regional habitat selection of large gliding possums at forest stand and landscape scales in southern Queensland, Australia. *Forest Ecology and Management* **239** , 136–149.

Eyre T. J. & Goldingay R. L. (2005) Characteristics of sap trees used by yellow-bellied gliders in southern Queensland. *Wildl. Res.* **32** , 23.

Eyre T. J., Smith G. C., Venz M. F. *et al.* (2022) Guide to greater glider habitat in Queensland, report prepared for the Department of Agriculture, Water and the Environment, Canberra.

Fensham R. & Fairfax R. (2003) The use of the land survey record to reconstruct pre-European vegetation patterns in the Darling Downs, Queensland, Australia. *Journal of Biogeography* **24** , 827–836.

Fensham R. J. (1998) The grassy vegetation of the Darling Downs, south-eastern Queensland, Australia. Floristics and grazing effects. *Biological Conservation* **84** , 301–310.

Ford H. A., Noske S. & Bridges L. (1986) Foraging of Birds in Eucalypt Woodland in North-Eastern New South Wales. *Emu - Austral Ornithology* **86** , 168–179.

Garnett S. & Baker G. B. eds (2021) *Action Plan for Australian Birds 2020*. CSIRO Publishing. [online]. Available from: https://ebooks.publish.csiro.au/content/ISBN/9781486311910 [Accessed June 15, 2023].

Geering A., Agnew L. & Harding S. (2007) *Shorebirds of Australia.* CSIRO Publishing, Melbourne.

Gibbons P. & Lindenmayer D. (2002) *Tree Hollows and Wildlife Conservation in Australia*. CSIRO Publishing. [online]. Available from: https://ebooks.publish.csiro.au/content/ISBN/9780643090033 [Accessed June 14, 2023].

Goldingay R. (1992) Socioecology of the Yellow-Bellied Glider (*Petaurus australis*) in a Coastal Forest. *Aust. J. Zool.* **40** , 267.

Goldingay R. & Kavanagh R. (1990) Socioecology of the Yellow-Bellied Glider, *Petaurus australis*, at Waratah-Creek, Nsw. *Aust. J. Zool.* **38** , 327.

Goldingay R. L. (1987) Sap feeding by the marsupial *Petaurus australis*: an enigmatic behaviour? *Oecologia* **73** , 154–158.

Goldingay R. L. (1990) The foraging behaviour of a nectar feeding marsupial, *Petaurus australis*. *Oecologia* **85** , 191–199.

Goldingay R. L. (2011) Characteristics of tree hollows used by Australian arboreal and scansorial mammals. *Aust. J. Zool.* **59** , 277.

Goldingay R. L., Carthew S. M. & Daniel M. (2018) Characteristics of the den trees of the yellow-bellied glider in western Victoria. *Aust. J. Zool.* **66** , 179.

Goldingay R. L. & Kavanagh R. P. (1991) The Yellow-bellied Glider: a review of its ecology, and management considerations. In: *Conservation of Australia's Forest Fauna* (ed D. Lunney) pp. 365–375 Royal Zoological Society of NSW, Mosman.

Goldingay R. L. & Quin D. (2004) Components of the habitat of the yellow-bellied glider in north Queensland. In: *The Biology of Australian Possums and Gliders* pp. 369–375 Surey Beatty and Sons, Chipping Norton, N.S.W.

Goldingay R. & Possingham H. (1995) Area requirements for viable populations of the Australian gliding marsupial *Petaurus australis*. *Biological Conservation* **73** , 161–167.

Gonsalves L., Law B., Brassil T., Kerr I. & O'Loughlin C. (2022) Roost Selection in Relation to a Patchy, Mosaic Management Burn by a Threatened Clutter-Adapted Bat. *Forests* **13** , 1327.

Goodland A. (2000) Grassy ecosystem significant sites of the Darling Downs, Queensland. Locations and management recommendations.

Hagman M., Phillips B. L. & Shine R. (2009) Fatal attraction: adaptations to prey on native frogs imperil snakes after invasion of toxic toads. *Proc Biol Sci* **276** , 2813–2818.

Halford D. (1995a) Halford, D (1995b). Acacia handonis Pedley (Mimosaceae) A Conservation Statement.

Halford D. (1995b) Digitaria porrecta S.T.Blake (Poaceae) – Draft Recovery Plan.

Halford D. (1996) Halford D. (1996) Species Profile for Calytrix gurulmundensis.

Hando V. (2007) One of Australia's rarest wattles – *Acacia handonis*. *Acacia Study Group Newsletter, Association of Australian Plant Growers*.

Harris J. M. & Maloney K. S. (2010) *Petauroides volans* (Diprotodontia: Pseudocheiridae). *Mammalian Species* doi: 10.1644/866.1.

Higgins P. J. ed (1999) *Handbook of Australian, New Zealand and Antarctic birds: Volume 4: Parrots to Dollarbird*. Oxford University Press, Melbourne.

Higgins P. J. & Peter J. M. eds (2002) *Handbook of Australian, New Zealand and Antarctic Birds. Volume 6. Pardalotes to Shrike-thrushes*. Oxford University Press, Melbourne.

Higgins P. J., Peter J. M. & Cowling S. J. eds (2006) *Handbook of Australian, New Zealand and Antarctic Birds. Volume 7. Boatbill to Starlings*. Oxford University Press, Melbourne.

Higgins P. J., Peter J. M. & Steele W. K. eds (2001) *Handbook of Australian, New Zealand and Antarctic Birds. Volume 5. Tyrant Flycatchers to Chats*. Oxford University Press, Melbourne.

Hobson R. (2002) Vertebrate Fauna Survey of Remnant Native Grasslands of the Eastern Darling Downs.

Hobson R. (2012) Dunmall's Snake. In: *Queensland's Threatened Animals.* (eds L. K. Curtis & A. J. Dennis) CSIRO Publishing, Melbourne.

Hodder G. V. (2019) *The impact of habitat alteration on the population dynamics of a declining woodland bird in the Mount Lofty Ranges*. PhD Thesis. University of Adelaide.

Holland A. E. (1999) A new species and a new combination in Rutidosis (Gnaphalieae: Angianthinae: Asteraceae). *Austrobaileya*.

Holland A. & Funk V. (2006) A revision of Cymbonotus (Compositae: Arctotidae, Arctotidinae). *Telopea* doi: 10.7751/telopea20065728.

Irish P. & Kavanagh R. (2011) Distribution, habitat preference and conservation status of the Yellow-bellied Glider (*Petaurus australis*) in The Hills Shire, northwestern Sydney. *Australian Zoologist* **35** , 941–952.

Jessup K., Winter J. W. & Franklin D. C. (2020) Size of *Eucalyptus resinifera* tree, and sap trees used by Yellow-bellied Gliders, in the Tumoulin Forest Reserve in north Queensland. *North Queensland Naturalist*.

Johnson R., Eddie C., Pavey C. *et al.* (2017) *Report on a field research project to identify characteristics of habitat influencing the distributions of Yakka Skink and Dumnall's Snake in the Brigalow Belt South bioregion, Queensland.* Boobook Ecological Consulting, Roma Qld.

Johnstone R. E. & Storr G. M. (1998) *Handbook of Western Australian birds. Vol. 1. Non-passerines (emu to dollarbird).* Western Australian Museum, Perth.

Kambouris P. J., Kavanagh R. P. & Rowley K. A. (2013) Distribution, habitat preferences and management of the yellow-bellied glider, *Petaurus australis*, on the Bago Plateau, New South Wales: a reassessment of the population and its status. *Wildl. Res.* **40** , 599.

Kavanagh R. (1987) Forest Phenology and Its Effect on Foraging Behavior and Selection of Habitat by the Yellow-Bellied Glider, *Petaurus australis* Shaw. *Wildl. Res.* **14** , 371.

Kavanagh R. & Lambert M. (1990) Food Selection by the Greater Glider, *Petauroides volans* - Is Foliar Nitrogen a Determinant of Habitat Quality. *Wildl. Res.* **17** , 285.

Kavanagh R. P. (2000) Effects of variable-intensity logging and the influence of habitat variables on the distribution of the Greater Glider *Petauroides volans* in montane forest, southeastern New South Wales. *Pac. Conserv. Biol.* **6** , 18.

Kavanagh R. & Wheeler R. J. (2004) Home range of the greater glider *Petauroides volans* in tall montane forest of southeastern New South Wales, and changes following logging. In: *The Biology of Australian Possums and Gliders* (eds R. L. Goldingay & S. Jackson) pp. 413–425 Surey Beatty and Sons, Chipping Norton, N.S.W.

Keast A. (1968) Competitive interactions and the evolution of ecological niches as illustrated by the australian honeyeater genus *melithreptus* (Meliphagidae). *Evolution* **22** , 762–784.

Kehl J. & Borsboom A. (1984) Home range, den tree use and activity patterns in the greater glider (*Petauroides volans*). In: *Possums and Gliders* (eds A. P. Smith & I. D. Hume) pp. 229–236 Surrey Beatty and Sons, Chipping Norton.

Law B., Gonsalves L., Brassil T. & Hill D. (2018) Does Thinning Homogenous and Dense Regrowth Benefit Bats? Radio-Tracking, Ultrasonic Detection and Trapping. *Diversity* **10** , 45.

Law B., Gonsalves L., Chidel M. & Brassil T. (2016) Subtle use of a disturbance mosaic by the south-eastern long-eared bat (Nyctophilus corbeni): an extinction-prone, narrow-space bat. *Wildl. Res.* **43** , 153.

Lepschi B. J. (1993) Food of Some Birds in Eastern New South Wales: Additions to Barker & Vestjens. *Emu - Austral Ornithology* **93** , 195–199.

Lindenmayer D. (2002) *Gliders of Australia: a natural history*. UNSW Press, Sydney, NSW.

Lindenmayer D. B., Cunningham R. B., Tanton M. T., Smith A. P. & Nix H. A. (1991) Characteristics of hollow-bearing trees occupied by arboreal marsupials in the montane ash forests of the Central Highlands of Victoria, south-east Australia. *Forest Ecology and Management* **40** , 289–308.

Lithgow G. (1997) *60 Wattles of the Chinchilla and Murilla Shires*. Cranbrook Press, Toowoomba.

Marchant S. & Higgins P. J. eds (1993) *Handbook of Australian, New Zealand & Antarctic birds: Volume 2: Raptors to Lapwings*. Oxford University Press, Melbourne.

Martin R., Handasyde K. A. & Lee A. K. (1999) *The koala: natural history, conservation and management*. 2nd ed. UNSW Press, Sydney, Australia.

McCulloch E. M. (1966) Swifts and Bushfires. *Emu - Austral Ornithology* **65** , 290–290.

McGregor D. C., Padovan A., Georges A., Krockenberger A., Yoon H.-J. & Youngentob K. N. (2020) Genetic evidence supports three previously described species of Greater Glider, *Petauroides volans, P. minor,* and *P. armillatus*. *Sci Rep* **10** , 19284.

McGuire A. & Kleindorfer S. (2007) Nesting success and apparent nest-adornment in Diamond Firetails (*Stagonopleura guttata*). *Emu - Austral Ornithology* **107** , 44–51.

McKay G. M. (2008) Greater Glider *Petauroides volans*. In: *The Mammals of Australia* (eds S. van Dyck & R. Strahan) pp. 240–242 Reed New Holland, Sydney.

Melzer A., Carrick F., Menkhorst P., Lunney D. & John B. St. (2000) Overview, Critical Assessment, and Conservation Implications of Koala Distribution and Abundance. *Conservation Biology* **14** , 619–628.

Menkhorst P., Rogers D., Clarke R., Davies J., Marsack P. & Franklin K. (2019) *The Australian Bird Guide*. CSIRO Publishing, Melbourne.

Menkins I. (1998) Draft Report for survey of Homopholis belsonii C.E. Hubb on the Darling Downs.

Munks S., Corkrey R. & Foley W. (1996) Characteristics of Arboreal Marsupial Habitat in the Semi-Arid Woodlands of Northern Queensland. *Wildl. Res.* **23** , 185.

Ngugi M. R., Botkin D. B., Doley D., Cant M. & Kelley J. (2013) Restoration and management of callitris forest ecosystems in Eastern Australia: Simulation of attributes of growth dynamics, growth increment and biomass accumulation. *Ecological Modelling* doi: 10.1016/j.ecolmodel.2013.05.004.

Oliver D. L., Chambers M. A. & Parked D. G. (2003) Habitat and resource selection of the Painted Honeyeater (*Grantiella picta*) on the northern floodplains region of New South Wales. *Emu - Austral Ornithology* **103** , 171–176.

Orchard A. E. & Wilson A. J. G. eds (2001) *Flora of Australia. Volume 11B Mimosaceae, Acacia part 2*. ABRS, Canberra/CSIRO Publishing, Melbourne.

Pavey C. R., Vanderduys E. & Raghu S. (2021) The golden-tailed gecko: a disturbance-tolerant species in a fragmenting environment. *Wildl. Res.* **48** , 643–653.

Pedley L. (1987) *Acacias in Queensland*. Dept. of Primary Industries, Queensland Government, Brisbane.

Pepper J. W., Male T. D. & Roberts G. E. (2000) Foraging ecology of the South Australian glossy black-cockatoo (*Calyptorhynchus lathami halmaturinus*). *Austral Ecology* **25** , 16–24.

Pizzey G., Knight F. & Pizzey S. (2012) *The field guide to the birds of Australia*. 9. ed., revised and updated. Harper Collins Publishers, Sydney.

Pope M. L., Lindenmayer D. B. & Cunningham R. B. (2004) Patch use by the greater glider (*Petauroides volans*) in a fragmented forest ecosystem. I. Home range size and movements. *Wildl. Res.* **31** , 559.

Pringle J. D. (1987) *The shorebirds of Australia: The National Photographic Index of Australian wildlife.* Angus and Robertson, North Ryde.

Queensland Government (2023) Biodiversity status of pre-clearing and 2021 remnant regional ecosystems - Queensland series. [online]. Available from: https://www.data.qld.gov.au/dataset/biodiversity-status-of-pre-clearing-and-2021-remnant-regional-ecosystems-queensland-series.

Queensland Herbarium (2023) Regional Ecosystem Description Database (REDD). Version 13 (May 2023). [online]. Available from: https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/descriptions/download.

Read J. L. (1994) The Diet of Three Species of Firetail Finches in Temperate South Australia. *Emu - Austral Ornithology* **94** , 1–8.

van der Ree R., Ward S. J. & Handasyde K. A. (2004) Distribution and conservation status of possums and gliders in Victoria. In: *The Biology of Australian Possums and Gliders* (eds R. L. Goldingay & S. Jackson) Surey Beatty and Sons, Chipping Norton, N.S.W.

Rees M., Paull D. J. & Carthew S. M. (2007) Factors influencing the distribution of the yellow-bellied glider (*Petaurus australis australis*) in Victoria, Australia. *Wildl. Res.* **34** , 228.

Richardson R. (2006) Queensland Brigalow Belt Reptile Recovery Plan 2008 – 2012.

Rogers D., Hance L., Paton S. *et al.* (2005) The breeding bottleneck: breeding habitat and population decline in the Australian Painted Snipe. In: *Status and Conservation of Seabirds in the East Asian-Australasian Flyway* (ed P. Straw) [online]. Available from: https://awsg.org.au/wp-content/uploads/2021/03/ASC-Canberra-proceedings-2003.pdf.

Rose A. B. (1997) Notes on the diet of Swifts, Kingfishers and Allies in eastern New South Wales. *Australian Bird Watcher* **17** , 203–210.

Rowland J. (2012) Grey snake, Hemiaspis damelii. Targeted species survey guidelines.

Sands D. P. & New T. R. (2002) The action plan for Australian butterflies.

Schodde R. & Mason I. J. (1999) *The Directory of Australian Birds: Passerines*. CSIRO Publishing, Melbourne.

Schulz M. & Kristensen K. (1994) Notes on selected bird species on the South-Western Coast of Tasmania, between Port Davey and Cape Sorell. *Australian Bird Watcher*.

Shapcott A., Lamont R. W., Conroy G., James H. E. & Shimizu-Kimura Y. (2017) A genetic, demographic and habitat evaluation of an endangered ephemeral species Xerothamnella herbacea from Australia's Brigalow belt. *Aust. J. Bot.* **65** , 38.

Sharp D. & Simson B. K. (2002) *AusGrass: Grasses of Australia. CD-ROM, Version 1.0*. Australian Biological Resources Study, Canberra, and Environmental Protection Agency, Queensland.

Shine R. (1980) Ecology of the Australian Death Adder Acanthophis antarcticus (Elapidae): Evidence for Convergence with the Viperidae. *Herpetologica* **36** , 281–289.

Shine R. (1987) Intraspecific Variation in Thermoregulation, Movements and Habitat Use by Australian Blacksnakes, Pseudechis porphyriacus (Elapidae). *Journal of Herpetology* **21** , 165.

Shine R., Spencer C. L. & Keogh J. S. (2014) Morphology, Reproduction and Diet in Australian and Papuan Death Adders (Acanthophis, Elapidae). *PLOS ONE* **9** , e94216.

Smith A. P. & Russell R. (1982) Diet of the Yellow-bellied Glider *Petaurus australis* (Marsupialia: Petauridae) in north Queensland. *Aust. Mammalogy* **5** , 41–45.

Smith G. C., Mathieson M. & Hogan L. (2007) Home range and habitat use of a low-density population of greater gliders, *Petauroides volans* (Pseudocheiridae: Marsupialia), in a hollow-limiting environment. *Wildl. Res.* **34** , 472.

Stanisic J., Shea M., Potter D. & Griffiths O. (2011) *Australian Land Snails Volume 1. A field guide to eastern Australian species*. Bioculture Press, Rivière des Anguilles, Mauritius.

Stanley T. D. & Ross E. M. (1983) *Flora of south-eastern Queensland. Volume One, Two and Three.* Department of Primary Industries, Brisbane.

Stephenson G. & Schmida G. (2007) A second record of the elapid snake Furina dunmalli from New South Wales. *Herpetofauna*.

Sullivan B. J., Baxter G. S., Lisle A. T., Pahl L. & Norris W. M. (2004) Low-density koala (*Phascolarctos cinereus*) populations in the mulgalands of south-west Queensland. IV. Abundance and conservation status. *Wildl. Res.* **31** , 19.

Tarburton M. (2021) Recent increase in knowledge about numbers and flight behaviour in the White-throated Needletail *Hirundapus caudacutus*. *Australian Field Ornithology* doi: 10.20938/afo38124130.

Tarburton M. K. (1993) Radiotracking a White-throated Needletail to Roost. *Emu - Austral Ornithology* **93** , 121–124.

Thompson W. A. & Eldridge D. J. (2005) White cypress pine (*Callitris glaucophylla*): a review of its roles in landscape and ecological processes in eastern Australia. *Aust. J. Bot.* **53** , 555.

TSSC (2008a) Approved Conservation Advice for *Philotheca sporadica*. [online]. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/64944-conservation-advice.pdf.

TSSC (2008b) Approved Conservation Advice for *Homopholis belsonii*. [online]. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/9828-conservation-advice.pdf.

TSSC (2008c) Approved Conservation Advice for *Xerothamnella herbacea*. [online]. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/4146-conservation-advice.pdf.

TSSC (2016a) Conservation Advice for *Adclarkia cameroni* (Brigalow Woodland Snail).

TSSC (2016b) Conservation Advice for *Adclarkia dulacca* (Dulacca Woodland Snail).

TSSC (2022) Conservation Advice for *Petaurus austalis australis* (Yellow-bellied Glider (south-eastern)).

TSSC (2023a) Conservation Advice for *Aphelocephala leucopsis* (Southern Whiteface).

TSSC (2023b) Conservation Advice for *Stagonopleura guttata* (Diamond Firetail).

Turbill C. & Ellis M. (2006) Distribution and abundance of the south-eastern form of the greater long-eared bat Nyctophilus timoriensis. *Aust. Mammalogy* **28** , 1.

Tyndale-Biscoe C. H. & Smith R. F. C. (1969) Studies on the Marsupial Glider, *Schoinobates volans* (Kerr): III. Response to Habitat Destruction. *The Journal of Animal Ecology* **38** , 651.

Vanderduys E. P., Kutt A. S. & Kemp J. E. (2012) Upland savannas: the vertebrate fauna of largely unknown but significant habitat in north-eastern Queensland. *Australian Zoologist* **36** , 59–74.

Watson I. M. (1955) Some Species Seen at the Laverton Saltworks, Victoria, 1950–1953, with Notes on Seasonal Changes. *Emu - Austral Ornithology* **55** , 224–248.

Whitmore M. J. & Eller C. M. (1983) Observations at a Nest of Painted Honeyeaters. *Emu - Austral Ornithology* **83** , 199–202.

Williams K. A. W. (1979) *Native Plants of Queensland. Volume 1*.

Wilson S. (2022) A Field Guide to Reptiles of Queensland. [online]. Available from: https://www.angusrobertson.com.au/books/a-field-guide-to-reptiles-of-queensland-steve-wilson/p/9781925546842 [Accessed July 13, 2023].

Wilson S. & Swan G. (2020) *A Complete Guide to Reptiles of Australia*. New Holland, Sydney.

Winter J. W., Dillewaard H. A., Williams S. E. & Bolitho E. E. (2004) Possums and gliders of north Queensland: distribution and conservation status. In: *The Biology of Australian Possums and Gliders* (eds R. L. Goldingay & S. M. Jackson) pp. 26–50 Surey Beatty and Sons, Sydney.

Woinarski J., Burbidge A. A. & Harrison P. (2014) *The action plan for Australian mammals 2012*. CSIRO Publishing, Collingwood, Vic.

Youngentob K. N., Wood J. T. & Lindenmayer D. B. (2013) The response of arboreal marsupials to landscape context over time: a large-scale fragmentation study revisited (ed R. Whittaker). *J. Biogeogr.* **40** , 2082–2093.

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[#] NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
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# NCA	 EPBC	Typical Habitat	Habitat within the SGP	Local Records	Likelihood Assessment
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'.