Appendix G Hail Creek Transition Project – Terrestrial Ecology Assessment Report (EcoSM, 2015)

Hail Creek Open Cut Eastern Margin Extension

Replacement Ecological Impact Assessment Report

Hail Creek Coal Holdings Pty Limited

SLR Project No.: 626.30128.00000

27 November 2025

ecosm.com.au

HAIL CREEK TRANSITION PROJECT
TERRESTRIAL ECOLOGY ASSESSMENT REPORT

Rio Tinto Coal Australia

PO Box 5385
Brendale Q 4500

P 0448 899 649
F 07 3264 7131
E steve.marston@ecosm.com.au

May 2015

Disclaimer

The preparation of this report has been in accordance with the brief provided by the Client and relies upon data collected under limitations, as specified within the report. All findings, conclusions or recommendations contained within the report are based on the aforementioned circumstances and represent the professional opinions of Ecological Survey & Management. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Ecological Survey & Management.

If a third party relies upon the facts, content, opinions or subject matter contained in this report without the prior consent of Ecological Survey & Management, the third party assumes all risk and releases and indemnifies Ecological Survey & Management from any loss, damage, claim or liability arising directly or indirectly from the use of or reliance upon this report.

Apart from fair dealing for the purpose of private study, research, criticism or review as permitted under the Copyright Act, no part of this report, its attachments or appendices may be reproduced by any process without the prior written consent of Ecological Survey & Management.

Document History and Status

Document version:	13003_Rpt01j
Author(s):	Meredith Watherston
Reviewed by:	Steve Marston
Approved by:	Steve Marston
Signed :	
Date issued:	26 May 2015

Contents

Executive Summary 1
1 Introduction 5
1.1 Overview 5
1.2 Description of the Project 5
1.3 Assessment Objectives 7
1.4 Regional Context 8
1.5 Description of the Study Area 8
1.5.1 Climate 8
1.5.2 Topography 8
1.5.3 Soils 9
1.5.4 Surface Water 9
1.5.5 Current Land Use 9
1.5.6 Protected Areas 10
2 Methodology 11
2.1 Nomenclature and Taxonomy 11
2.1.1 Flora 11
2.1.2 Fauna 11
2.2 Review of Existing Information 11
2.2.1 Database Searches 11
2.2.2 Literature and Reports of Previous Studies 12
2.3 Field Survey 13
2.3.1 Flora Field Survey Methods 14
Survey Timing and Climatic Conditions 14
Secondary Assessment Sites 16
Tertiary Assessment Sites 16
Quaternary Assessment Sites 17
Vegetation Condition Assessment 17
Natural Grassland Assessment Quadrats 18
Brigalow Assessment 18
Semi-evergreen Vine Thicket Assessment 18
Targeted Species Surveys 19
Vegetation Mapping 19
Random Traverses 20
Flora Inventory and Abundance 20
Coordinate System and Map Datum 20

Ancillary Information 21
2.3.2 Fauna Field Survey Techniques 21
Survey Timing and Climatic Conditions 21
Overview of Survey Effort 23
Systematic Trap Sites 24
Supplementary Survey Sites 29
Spotlighting 30
Call Playback 31
Infrared Cameras 31
Bird Surveys 31
Anabat 31
Harp Trap 32
Active Searches 32
Koala Line Transects 32
Opportunistic Observations 33
Habitat Assessment 33
Fauna Field Survey Standards 33
2.3.3 Likelihood of Occurrence 38
Threatened Ecological Community Assessment 38
Conservation Significant Species Assessment 38
Conservation Significant Species Habitat Mapping 38
2.3.4 Assessment of Significance of Impacts 39
2.3.5 Limitations 40
3 Desktop Results 41
3.1 Geology of the Study Area 41
3.2 EPBC Act Listed Threatened Ecological Communities 41
3.3 Queensland Regulated Vegetation Mapping 42
3.4 Conservation Significant Flora 43
3.4.1 EPBC Act Listed Flora 43
3.4.2 NC Act Listed Flora 43
3.4.3 Essential Habitat 44
3.5 Conservation Significant and Migratory Fauna 44
3.5.1 EPBC Act Listed Fauna 44
Migratory Species 45
Register of Critical Habitat 45
3.5.2 NC Act Listed Fauna 45

3.5.3 Essential Habitat 46
3.6 Critical Habitat and Environmentally Sensitive Areas 47
3.7 Watercourses and Wetlands 47
3.7.1 Referable Wetlands 47
3.7.2 Vegetation Management Wetlands 48
3.7.3 Vegetation Management Watercourses 48
3.7.4 Groundwater Dependent Ecosystems 48
Queensland Wetland Data Springs 49
3.8 Biodiversity Planning Assessment Mapping 49
4 Field Flora Results 50
4.1 EPBC Act Listed Threatened Ecological Communities 50
4.1.1 Brigalow TEC 50
4.1.2 Natural Grassland TEC 51
4.1.3 SEVT TEC 51
4.2 Queensland Remnant Vegetation 52
4.2.1 Ecological condition 53
4.2.2 Groundwater Dependent Ecosystems 77
4.3 Floristic Diversity 78
4.4 Conservation Significant Flora Species 78
4.4.1 EPBC Act Listed Flora 78
Black Ironbox 78
Siah's Backbone 79
King Bluegrass (Dichanthium queenslandicum) 80
4.4.2 NC Act Listed Flora 80
4.4.3 Exotic Flora 80
5 Field Fauna Results 82
5.1 Habitat and Landscape Connectivity 82
5.2 Habitat Assessment 82
5.3 Fauna Diversity 84
5.3.1 Birds 84
5.3.2 Amphibians 85
5.3.3 Reptiles 85
5.3.4 Mammals 85
5.4 Important Fauna Sites or Occurrences 86
5.5 Conservation Significant Fauna Species 86
5.5.1 EPBC Act Listed Fauna 86

Squatter Pigeon (Southern) 87
Koala 88
Australian Painted Snipe 90
Ornamental Snake 90
Migratory Species 90
5.5.2 NC Act Listed Fauna 93
Glossy Black-cockatoo 93
Notable Species 93
5.5.3 Feral Animals 94
6 Landscape Values 95
6.1 Protected Areas 95
6.2 Corridors and Connectivity 95
6.3 Wetlands and waterways 95
7 Potential Impacts 97
7.1 Land Clearance 97
7.1.1 Vegetation Clearing 97
7.1.2 Habitat Removal 102
7.2 Indirect Impacts 102
7.2.1 Subsidence 102
7.2.2 Hydrological changes 103
7.2.3 Edge Effects 105
7.2.4 Fragmentation 105
7.2.5 Exotic Flora and Pest Animals 106
7.2.6 Dust 106
7.2.7 Noise and Vibration 107
7.2.8 Lighting 107
7.2.9 Traffic 108
7.2.10 Final Landform 108
7.3 Matters of National Environmental Significance 108
7.3.1 Brigalow TEC 109
7.3.2 Natural Grassland TEC 109
7.3.3 SEVT TEC 110
7.3.4 Black Ironbox 110
7.3.5 Siah's Backbone 111
7.3.6 Squatter Pigeon 111
7.3.7 Koala 112

7.3.8 Australian Painted Snipe 113
7.3.9 Ornamental Snake 113
7.3.10 Migratory Birds 114
7.4 Matters of State Environmental Significance 115
7.4.1 Regulated Vegetation 115
7.4.2 Connectivity Areas 117
7.4.3 Wetlands and Watercourses 117
7.4.4 Protected Wildlife Habitat 118
Squatter Pigeon 118
Koala 119
Australian Painted Snipe 119
Ornamental Snake 119
Glossy-black Cockatoo 119
Short-beaked Echidna 120
7.4.5 Protected Areas - Homevale National Park 121
7.4.6 Legally Secured Offset Areas 122
7.5 Cumulative Impacts 122
8 Impact Avoidance and Mitigation Measures 124
8.1 Refinement of the Mine Design to Avoid Land Clearance 124
8.2 Vegetation Clearance Procedures 124
8.3 Management of Indirect Impacts 125
8.3.1 Subsidence Management 125
8.3.2 Tension Crack Remediation 126
8.3.3 Surface Water Management 126
8.3.4 Pest Animal and Weed Management 127
8.3.5 Dust Management 127
8.3.6 Vehicle Strike 127
8.3.7 Rehabilitation 127
8.4 Management of matters of NES and SES 128
9 Residual Impacts and Offset Liability 131
9.1 Significant Residual Impacts on Matters of NES 132
9.2 Significant Residual Impacts on Matters of SES 135
9.3 Offset Strategy 138
10 References 139

List of Tables

Table 1: Flora and fauna survey program 14
Table 2: Monthly rainfall (mm) for Nebo (approx. 30km south-east of the Study Area)..... 15
Table 3: Indicative weather conditions for the Study Area 21
Table 4: Dry season fauna survey effort for the Study Area 24
Table 5: Description of habitat of systematic fauna trap sites..... 25
Table 6: Description of supplementary survey sites 29
Table 7: Survey effort for each conservation significant species targeted during the field survey..... 35
Table 8: Criteria to assess potential for species to occur in the Study Area.. 38
Table 9: Criteria to determine if assessment of significance of impacts from the Project is required for the species or community..... 40
Table 10: Queensland Regional Ecosystem Mapping for the Study Area..... 42
Table 11: Extract from the essential habitat database version 4.0 46
Table 12: Condition and status of field-validated Brigalow TEC..... 50
Table 13: Regional Ecosystems identified in the Study Area during the field surveys 54
Table 14: Area of field-validated vegetation in the Study Area 76
Table 15: Comparison of Remnant Regional Ecosystems remaining in the Northern Bowen Basin Subregion and Brigalow Belt Bioregion 77
Table 16: Exotic flora in the Study Area..... 81
Table 17: EPBC Act Koala habitat assessment 89
Table 18: Feral Animals in the Study Area..... 94
Table 19: Vegetation Communities proposed to be impacted by the Project .. 99
Table 20: Vegetation Communities proposed to be impacted by Stage 1 of the Project..... 101
Table 21: Approximate surface disturbance extent to matters of NES..... 109
Table 22: Assessment of clearing and subsidence impacts to regulated vegetation against the significant residual impact criteria of the *Queensland Residual Impact Guideline* (VM Act status)..... 116
Table 23: Matters of NES and SES Disturbance limits 128
Table 24: Mitigation measures to minimise impacts to matters of NES and SES. 128
Table 25: Total land area potentially requiring offsetting (all matters of NES and SES combined) 132
Table 26: Matters of NES potentially requiring offsets under the EPBC Act .. 134
Table 27: Matters of SES potentially requiring offsets under the EO Act..... 136

List of Figures

Figure 1: Location of the Study Area 153
Figure 2: Project Layout 154
Figure 3: Stage 1 Project Layout 155
Figure 4: Flora survey site locations 156
Figure 5: Fauna survey site locations 157
Figure 6: Geology mapping for the Study Area 158
Figure 7: NRM Regional Ecosystem mapping for the Study Area 159
Figure 8: Environmentally Sensitive Area and Biodiversity Planning Assessment mapping for the Study Area 160
Figure 9: Field-validated Commonwealth threatened ecological community mapping for the Study Area 161
Figure 10: Field-validated Regional Ecosystem mapping for the Study Area . 162
Figure 11: Conservation significant flora species records and potential habitat mapping for the Study Area 163
Figure 12: Declared exotic flora records for the Study Area 164
Figure 13: Broad habitat types within the Study Area 165
Figure 14: Conservation significant fauna mapping for the Study Area – Koala and Squatter Pigeon 166
Figure 15: Conservation significant fauna mapping for the Study Area – Australian Painted Snipe and Ornamental Snake 167
Figure 16: Conservation significant fauna mapping for the Study Area – Glossy Black-cockatoo and Short-beaked Echidna 168
Figure 17: Field-validated Regional Ecosystems in the Project Area 169
Figure 18: Field-validated Regional Ecosystems in the Stage 1 Project Area 170
Figure 19: Commonwealth threatened ecological communities relative to the Project Area 171
Figure 20: Commonwealth threatened ecological communities relative to the Stage 1 Project Area 172
Figure 21: Conservation significant flora in the Project Area 173
Figure 22: Conservation significant flora in the Stage 1 Project Area 174
Figure 23: Broad habitat types in the Project Area 175
Figure 24: Broad habitat types in the Stage 1 Project Area 176
Figure 25: Conservation significant fauna habitat in the Project Area – Koala and Squatter Pigeon 177
Figure 26: Conservation significant fauna habitat in the Stage 1 Project Area – Koala and Squatter Pigeon 178
Figure 27: Conservation significant fauna habitat in the Project Area – Australian Painted Snipe and Ornamental Snake 179
Figure 28: Conservation significant fauna habitat in the Stage 1 Project Area – Australian Painted Snipe and Ornamental Snake 180
Figure 29: Conservation significant fauna habitat in the Project Area – Glossy Black-cockatoo and Short-beaked Echidna 181
Figure 30: Conservation significant fauna habitat in the Stage 1 Project Area – Glossy Black-cockatoo and Short-beaked Echidna 182

Appendices

Appendix A: Study Team

Appendix B: EPBC Act Protected Matters Search Report for the Search Area

Appendix C: BirdLife Australia Atlas Search Results for the Search Area

Appendix D: Queensland Museum Database Search Results for the Search Area

Appendix E: Protected Plants Flora Survey Trigger Map for the Study Area

Appendix F: Significant Flora Returned from Database Searches for the Search Area

Appendix G: Significant Fauna Returned from Database Searches for the Search Area

Appendix H: National Atlas of Groundwater Dependent Ecosystems (GDEs) Mapping for the Study Area

Appendix I: Flora Field Records for the Study Area

Appendix J: Fauna Field Records for the Study Area

Appendix K: Significance Assessments for Conservation Significant Species

Symbols and Abbreviations

*	(Preceding a plant species name) plant species not native to Australia
±	With or without, more or less
BoM	Bureau of Meteorology
BPA	Biodiversity Planning Assessment
BVG	Broad Vegetation Group
CHPP	Coal Handling Processing Plant
CI	Crown Intercept
DAFF	(Queensland) Department of Agriculture, Fisheries and Forestry
DBH	Diameter at breast height
DEH	(New South Wales) Department of Environment and Heritage
DEWHA	Former (Commonwealth) Department of Environment, Water, Heritage and the Arts
DotE	(Commonwealth) Department of the Environment
DSITIA	(Queensland) Department of Science, Information Technology, Innovation and the Arts
EA	Environmental Authority
EDL	Ecologically Dominant Layer
EEM	Ecological Equivalence Methodology
EHP	(Queensland) Department of Environment and Heritage Protection
EIA	Eastern Infrastructure Area
EMP	Environmental Management Plan
EO Act	(Queensland) *Environmental Offsets Act 2014*
EP Act	(Queensland) *Environmental Protection Act 1994*
EPBC Act	(Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
EWP	Elevated work platform
GDE	Groundwater dependent ecosystem
GPS	Global positioning system
ha	Hectares
IUCN	International Union for Conservation of Nature
km	Kilometres

kV	Kilovolt
LES	Matters of Local Environmental Significance
LP Act	(Queensland) *Land Protection (Pest and Stock Route Management) Act 2002*
MDL	Mineral Development License
MIA	Mine Infrastructure Area
ML	Mining Lease
Mtpa	Million Tonnes per annum
NC Act	(Queensland) *Nature Conservation Act 1992*
NC Regulation	(Queensland) Nature Conservation (Wildlife) Regulation 2006
NES	Matters of National Environmental Significance
NRM	(Queensland) Department of Natural Resources and Mines
PFC	Projective Foliage Cover
QEOP	Queensland Environmental Offsets Policy 2014
RE	Regional Ecosystem as defined under the Queensland Vegetation Management Regulation 2000
ROM	Run of mine
SES	Matters of State Environmental Significance
SEVT	Semi-evergreen vine thicket
SEWPaC	Former (Commonwealth) Department of Sustainability, Environment, Water, Populations and Communities
SMP	Species Management Program
SPRAT	Species Profile and Threats Database
TEC	Threatened Ecological Community
TOR	Terms of Reference
TSSC	Threatened Species Scientific Committee
UIA	Underground Infrastructure Area
VM Act	(Queensland) *Vegetation Management Act 1999*
VM Regulation	(Queensland) Vegetation Management Regulation 2000
WoNS	Weeds of National Significance

Glossary

Term	Definition
Biodiversity Status	This is an EHP classification dependent on condition of remnant vegetation *in addition* to the criteria used to determine class under the Queensland *Vegetation Management Act 1999*. This classification is used for a range of planning and management applications, i.e. to determine environmentally sensitive areas. A regional ecosystem is listed as 'endangered' if: ▪ Less than 10% of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss; or ▪ 10-30 % of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000ha; or ▪ It is a rare regional ecosystem subject to a threatening process. A regional ecosystem is listed as 'of concern' if: ▪ 10-30% of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss. A regional ecosystem is listed as 'no concern at present' if: ▪ The degradation criteria listed above for 'endangered' or 'of concern' regional ecosystems is not met.
Benchmark condition	Benchmark condition describes the standard or typical condition of a particular RE in an undisturbed condition and is determined from an average value from mature and long undisturbed reference of 'Best on Offer' sites (Eyre et al. 2011). Benchmarks are developed by the EHP for various vegetation communities, but not all at this stage.
Bioregion	A geographically distinct biological region, which is a reporting unit for assessing the status of native ecosystems and their level of protection. Australia is divided into 89 bioregions. Bioregions form part of the regional ecosystem classification code system. The Study Area is located largely in the Isaac-Comet Downs sub-region of the Brigalow Belt North Bioregion. However, the north-west edge of the Study Area reaches into the adjacent Northern Bowen Basin sub-region.
Colonial breeder	As defined under Species Management Programs under the Nature Conservation (Wildlife Management) regulation 2006, species that are 'Least Concern' species, but breed in colonies or are migratory and therefore at greater risk as they are found in groups or larger numbers permanently or during specific seasons. Species include: ▪ Microbats ▪ Glider species ▪ Wetland birds ▪ Figbirds ▪ Flock Bronzewings ▪ Metallic Starlings ▪ Rainbow Bee-eater ▪ Swallows, Martins and Wood-swallows.

Term	Definition
Declared pests	Plants and animals listed under the Queensland *Land Protection (Pest and Stock Route Management) Act 2002*.
Endangered	Prescribed to a threatened ecological community, regional ecosystem or species under the Queensland *Vegetation Management Act 1999*, *Nature Conservation Act 1992* or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
Environmentally Sensitive Area (ESA)	Defined under the Environmental Protection Regulation 2008, a Category A Environmentally Sensitive Area is: ▪ a national park, conservation park or forest reserve under the *Nature Conservation Act 1992* ▪ the wet tropics area under the *Wet Tropics World Heritage Protection and Management Act 1992* ▪ the Great Barrier Reef Region under the *Great Barrier Reef Marine Park Act 1975* ▪ a marine park under the *Marine Parks Act 2004*. A Category B Environmentally Sensitive Area is: ▪ a coordinated conservation area, a wilderness area, a World Heritage management area, an international agreement area, an area of critical habitat or major interest identified under a conservation plan or an area subject to an interim conservation order under the *Nature Conservation Act 1992* ▪ an area subject to the Bonn, Ramsar or Paris Conventions ▪ a zone of a marine park under the *Marine Parks Act 2004* ▪ an area to the seaward side of the highest astronomical tide ▪ a place of cultural heritage significance or a registered place under the *Queensland Heritage Act 1992* ▪ an area recorded in the Aboriginal Cultural Heritage Register under the *Aboriginal Cultural Heritage Act 2003* ▪ a feature protection areas, State forest park or scientific area under the *Forestry Act 1959* ▪ a declared fish habitat or place of a marine plant area under the *Fisheries Act 1994* ▪ a regional ecosystem with an Endangered biodiversity status identified in the database known as the 'Regional ecosystem description database'.
EPBC Act conservation status	The *Environment Protection and Biodiversity Conservation Act 1999* lists species and communities: Extinct in the wild: ▪ It is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or ▪ It has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a timeframe appropriate to its life cycle and form. Critically Endangered:

Term	Definition
	▪ It is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria. Endangered: ▪ It is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria. Vulnerable: ▪ It is not critically endangered or endangered; and ▪ It is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria. Migratory: ▪ Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II); ▪ Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the Chine-Australia Migratory Bird Agreement (CAMBA); ▪ Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).
Iconic species	Defined under the Nature Conservation (Wildlife) Regulation 2006 as 'special least concern': ▪ Echidna (*Tachyglossus aculeatus*); and ▪ Koala (*Phascolarctos cinereus*); and ▪ Platypus (*Ornithorhynchus anatinus*); and ▪ Wombat (*Family Vombatidae*). As well as 'least concern': ▪ Raptors ▪ Wetland birds.
Least Concern	Prescribed to regional ecosystems listed under the Queensland *Vegetation Management Act 1999*.
Matter of NES	A matter protected under the EPBC Act, including: ▪ World heritage properties ▪ National heritage places ▪ Wetlands of international importance ▪ Listed threatened species and ecological communities ▪ Migratory species ▪ Commonwealth marine areas ▪ The Great Barrier Reef Marine Park ▪ Nuclear actions ▪ A water resource, in relation to coal seam gas development and large coal mining development.

Term	Definition
Matter of SES	A matter of State Environmental Significance listed in Schedule 2 of the Environmental Offset Regulation 2014 and include: ▪ Regulated vegetation ▪ Connectivity areas ▪ Wetlands and watercourses ▪ High preservation areas of wild river areas ▪ Protected wildlife habitat ▪ Protected areas ▪ Highly protected zones of State marine parks ▪ Fish habitat areas ▪ Waterway providing for fish passage ▪ Marine plants ▪ Legally secured offset areas.
Matter of LES	A matter described in Section 5(3) of the Environmental Offset Regulation 2014 as a matter of local environmental significance for which an environmental offset is required under a local planning instrument.
NC Act conservation status	Under the *Nature Conservation Act 1992*, native wildlife may be prescribed as: Extinct in the wild: ▪ There have been thorough searches conducted for the wildlife; and ▪ The wildlife has not been seen in the wild over a period that is appropriate for the life cycle or form of the wildlife. Endangered: ▪ There have not been thorough searches conducted for the wildlife and the wildlife has not been seen in the wild over a period that is appropriate for the life cycle or form of the wildlife; or ▪ The habitat or distribution of the wildlife has been reduced to an extent that the wildlife may be in danger of extinction; or ▪ The population size of the wildlife has declined, or is likely to decline, to an extent that the wildlife may be in danger of extinction; or ▪ The survival of the wildlife in the wild is unlikely if a threatening process continues. Vulnerable: ▪ The population size or distribution of the wildlife has declined, or is likely to decline, to an extent that the wildlife may become endangered because of a threatened process; or ▪ The population size of the wildlife has been seriously depleted and the protection of the wildlife is not secured; or ▪ The population of the wildlife is low or localised and dependent on habitat that has been, or is likely to be, adversely affected, in terms of quantity or quality, by a threatening process. Near Threatened:

Term	Definition
	▪ The population size or distribution of the wildlife is small and may become smaller; or ▪ The population size of the wildlife has declined, or is likely to decline, at a rate higher than the usual rate for population changes for the wildlife; or ▪ The survival of the wildlife in the wild is affected to an extent that the wildlife is in danger of becoming vulnerable. Special Least Concern: ▪ Defined specifically as: a. The Koala (*Phascolarctos cinereus*); b. The Short-beaked Echidna (*Tachyglossus aculeatus*); c. The Platypus (*Ornithorhynchus anatinus*); d. A least concern bird to which the Japan and Australia Migratory Bird Agreement (JAMBA), China and Australia Migratory Bird Agreement (CAMBA), or the Bonn 1979 Convention apply. Least Concern: ▪ The Wildlife is common or abundant and is likely to survive in the wild.
Near Threatened	Prescribed to species listed under the Queensland *Nature Conservation Act 1992*.
Of Concern	Prescribed to regional ecosystems listed under the Queensland *Vegetation Management Act 1999*.
Region	The local area surrounding the Study Area, including the landscape within 20 km of the Study Area.
Regional ecosystem	A vegetation community within a bioregion that is consistently associated with a particular combination of geology, landform and soils.
Regulated vegetation	Vegetation regulated through the *Sustainable Planning Act 2009*
Remnant vegetation	Defined under the Queensland *Vegetation Management Act 1999* as, woody vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.
Conservation significant species and vegetation	Refers to: ▪ Species listed as Endangered, Vulnerable or Near Threatened under the Queensland Nature Conservation (Wildlife) Regulation 2006 or Critically Endangered, Endangered or Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* ▪ Threatened ecological community listed as Critically Endangered, Endangered or Vulnerable under the

Term	Definition
	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* ▪ Regional ecosystems with an Endangered or Of Concern biodiversity status or *Vegetation Management Act 1999* status.
Study Area	An area defined for the purposes of this baseline study and impact assessment and shown on Figure 1 and which comprises portions of ML 4738.
Threatened ecological community	A community listed under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
Vegetation management Act status	This is a statutory classification under the Queensland *Vegetation Management Act 1999*. A regional ecosystem is listed as 'endangered' if: ▪ Remnant vegetation for the regional ecosystem is less than 10% of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation for the regional ecosystem is less than 10,000ha. A regional ecosystem is listed as 'of concern' if: ▪ Remnant vegetation for the regional ecosystem is 10-30% of its pre-clearing extent across the bioregion; or more than 30% of its pre-clearing extent remains and the remnant vegetation extent for the regional ecosystem is less than 10,000ha. A regional ecosystem is listed 'least concern' if: ▪ Remnant vegetation for the regional ecosystem is over 30% of its pre-clearing extent across the bioregion, and the remnant vegetation area for the regional ecosystem is greater than 10,000ha.
Vulnerable	Prescribed to a threatened ecological community or species under the Queensland *Nature Conservation Act 1992* or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Executive Summary

Ecological Survey & Management were engaged by Rio Tinto Coal Australia (RTCA) to undertake terrestrial flora and fauna surveys and assessment as part of the Hail Creek Transition Project (the Project). The Project would involve the extension of open cut operations at the existing Hail Creek Mine, in central Queensland, and development of an underground mining operation, entirely contained within the existing Surface Rights Area of ML 4738.

The Project was referred under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and was declared to be a 'controlled' action for the purpose of the EPBC Act due to potential impacts on the following controlling provisions under Part 3 of the EPBC Act:

- Sections 18 and 18A of the EPBC Act (listed threatened species and communities); and
- Sections 24D and 24E of the EPBC Act (water resources).

The Study Area (an area encompassing the Project Area and nearby areas within ML 4738) for the Project is located west of the Britton and Denham Ranges, approximately 120km south-west of Mackay. It is situated within the Northern Bowen Basin Sub-region of the Brigalow Belt Bioregion.

Assessment Methodology

The terrestrial flora and fauna assessment involved desktop and field-based surveys to determine the presence and likely presence of matters of national environmental significance (NES) and state environmental significance (SES) under Commonwealth and Queensland legislation respectively.

The validation and mapping of remnant vegetation and collation of a flora species list was undertaken at a total of 432 vegetation assessment sites. These sites included; 50 ecological equivalence monitoring (EEM) sites, 22 detailed secondary sites, 169 tertiary sites, 156 modified quaternary sites, and 35 bio-condition monitoring sites.

A total of 11 systematic trap sites, 29 supplementary sites, 10 harp trap sites and 18 Anabat sites were employed across the Study Area during post wet season and dry season fauna surveys. Fauna surveys have been carried out for 27 days and flora surveys for 33 days as summarised in Table ES1.

Table ES1: Field survey effort for the terrestrial flora and fauna assessment

	Wet Season (Autumn)	Dry Season (Spring)	Total Survey Period
Fauna	▪ 4 to 18 March 2013	▪ 10 to 21 November 2013	27 days
Flora	▪ 9 to 14 February 2012 (bio-condition sites) ▪ 26 February to 8 March 2013 ▪ 18 to 21 March 2013 ▪ 28 March 2013 ▪ 31 January to 1 February 2015 ▪ 16 to 20 February 2015	▪ 9 to 12 November 2013	33 days

Survey Results and Impacts to Protected Matters

The assessment found the Study Area including and surrounding the Project to support 15 remnant sparse or mid-dense Regional Ecosystems (RE) accounting for 6,608.5ha. Of this area, 93.5ha contains Endangered REs, 3,641.0ha Of Concern REs and 2,874.0ha of Least Concern REs (Figure 17). Three Endangered ecological communities listed under the EPBC Act were identified in the Study Area but fall outside the Project Area, including:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) (Brigalow)
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (Natural Grasslands)
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT).

The assessment also found that the Project Area supported habitat for six EPBC Act listed species and an additional two *Nature Conservation Act 1992* (NC Act) listed species of conservation significance that were identified or considered likely to occur, as follows:

- Black Ironbox (*Eucalyptus raveretiana*) – Vulnerable (EPBC Act), Least Concern (NC Act)
- Squatter Pigeon (southern) (*Geophaps scripta scripta*) – Vulnerable (EPBC Act and NC Act)
- Koala (*Phascolarctos cinereus*) – Vulnerable (EPBC Act) and Special Least Concern (NC Act)
- Australian Painted Snipe (*Rostratula australis*) – Endangered (EPBC Act), Vulnerable (NC Act)
- Ornamental Snake (*Denisonia maculata*) – Vulnerable (EPBC Act and NC Act)
- Glossy Black-cockatoo (*Calyptorhynchus lathami*) – Vulnerable (NC Act)
- Short-beaked Echidna (*Tachyglossus aculeatus*) – Special Least Concern (NC Act).

Eleven migratory species protected under the EPBC Act and NC Act were also identified to occur or considered likely to occur in the Project Area, although it is considered unlikely that significant impacts would occur to these species as a result of the Project.

Impact Avoidance, Mitigation and Offsets

Development of surfacing mining and infrastructure will require clearing of approximately 3,911.0ha of remnant vegetation. Longwall mining is likely to cause subsidence effects in the form of trough-like depressions at the surface that occur sequentially as the longwall progresses. This would occur gradually during the life of the underground mining, which for this Project are estimated over approximately 30 years. These ponds would gradually fill with water and or sediment, which is likely to cause localised changes in the structure and condition of vegetation/habitat over the medium term. The area of remnant REs proposed to be impacted by subsidence ponding, outside the clearing proposed for surface activities, is approximately 33.0ha.

Design of the surface impact areas of the open cut pits and stockpiles has been undertaken to avoid key matters of SES and NES where possible, including:

- Brigalow TEC (RE 11.9.5)
- Natural Grassland TEC (RE 11.3.21)
- SEVT (REs 11.3.11 and 11.9.4)
- Ecosystem values of the primary watercourses in the Study Area, i.e. Hail Creek, Schammer Creek, Middle Creek and Absent Creek (REs 11.3.4, 11.3.25 and 11.3.25a), with direct impacts being restricted to ephemeral drainage lines associated with these watercourses that provide marginal aquatic habitat.

A minimum 30m buffer would be retained around remnant Endangered REs (REs 11.3.1, 11.3.21 and 11.9.5) and Brigalow TEC (RE 11.9.5) and a 30m buffer is proposed adjacent the Natural Grassland TEC (RE 11.3.21) to minimise the edge effects of vegetation clearing on these communities.

A range of management plans exists for the Hail Creek Mine and these will continue to be used for the Project, including the EHP approved species management plan (SMP) that will aim to minimise impacts to species, particularly breeding places, of conservation significant species.

Table ES2 provides a summary of the potential residual impacts to matters of NES and SES as a result of the Project. A total of 2,120.5ha of Of Concern and 1,823.5ha of Least Concern remnant REs will be impacted and including 23.5ha and 9.5ha respectively from subsidence ponding in the Project Area. No remnant Endangered REs are proposed to be impacted by the Project. Significant residual impacts are considered likely for the Koala, Australian Painted Snipe, Regulated Vegetation and Connectivity Areas.

An offset strategy has been prepared by RTCA to compensate for the Stage 1 residual impact in accordance with the Commonwealth EPBC Act Environmental Offsets Policy (SEWPaC 2012) and the Queensland *Environmental Offsets Act 2014*.

Table ES2: Proposed residual impacts to matters of NES and SES

	Area of habitat within the Study Area (high value only) (ha)	Potential Habitat in the Indicative Extent of Project Open Cut Components (high value only) (ha)	Additional Potential Habitat in the Indicative Extent of Underground Mining i.e. subsidence ponding (high value only) (ha)	Total Potential Habitat in the Project Area (high value only) (ha)
Brigalow	3.0	0	0	0
Natural Grassland	42.0	0	0	0
SEVT	11.0	0	0	0
Black Ironbox	193.0	22.0	9.5	31.5
Siah's Backbone	1.5	0	0	0
Squatter Pigeon	6,328.5	3,903.0	33.0	3,936.0
Koala	6,328.5	3,903.0	33.0	3,936.0
Australian Painted Snipe	75.0	24.5	0	24.5
Ornamental Snake	105.5	0.5	0	0.5
Glossy Black-cockatoo	244.0	25.0	9.5	34.5
Short-beaked Echidna	6,500.0	3,945.5	33.0	3,978.5
Migratory species	6,608.5	3,911.0	33.0	3,944.0
Regulated Vegetation[1]	3,734.5	2,348.0	39.0	2,387.0
Connectivity Area	6,608.5	N/A		3,944.0
Protected Areas	N/A	N/A		24.0 (edge effects)

Shading = Significant Residual Impacts

[1] Totals equate to the sum of all asepcts of regulated vegetation, i.e. Endangered, Of Concern, Wetland and Watercourse REs.

1 Introduction

1.1 Overview

Ecological Survey & Management were engaged by Rio Tinto Coal Australia (RTCA) to undertake terrestrial flora and fauna surveys and assessment as part of the Hail Creek Transition Project (the Project).

1.2 Description of the Project

The Hail Creek Mine is an open cut coal mine, located approximately 120km south-west of Mackay in Queensland (Figure 1). RTCA will request an amendment of the Hail Creek Mine Environmental Authority (EA) EPML00661913 in accordance with Section 224 of the Queensland *Environmental Protection Act 1994* (EP Act) to approve the Project.

The Project would involve the extension of open cut operations and development of an underground mining operation, entirely contained within the existing Surface Rights Area of ML 4738. The Project includes the following activities (Figure 2):

- Continuation of mining operations at the Hail Creek Mine, producing up to 20 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal
- Continuation of open cut mining west of Hail Creek, and transition of open cut mining operations to the east of Hail Creek, including:
    - extension of open cut mining areas to the north and south of the existing open cut with associated in-pit and out-of-pit waste rock emplacements; and
    - an open cut mining area to the east of Hail Creek with associated out-of-pit waste rock emplacements
- Underground mining activities using a combination of both development and longwall top coal caving mining methodologies for coal seam extraction of both the Elphinstone and Hynds coal seams
- Access to the underground operations from the highwall of the western open cut
- Construction of underground coal clearance infrastructure including in-pit ROM stockpiles
- Construction and operation of infrastructure to remove gas from the coal seam for flaring or beneficial use within the Surface Rights Area for mining purposes in accordance with the *Mineral Resources Act 1989* (MR Act)
- Construction of a gas fired power plant (supplied with gas from the coal seam) to supply electricity to the Hail Creek Mine (i.e. not distributed off-lease)
- Extension of on-site electricity distribution infrastructure
- Processing of ROM coal to produce up to approximately 15.5 Mtpa of product coal at the existing coal handling and preparation plant (CHPP) with augmentation to the plant where required such as the addition of second stage thermal processing

- Extension of product stockpiles and upgrade of coal handling and train load out infrastructure
- Construction of an additional infrastructure area to the east of Hail Creek, including ROM coal stockpiles, a water transfer dam and associated infrastructure, workshops, fuel storage and refuelling area, hazardous goods storage, equipment hardstands, bath house, offices, vehicle washdown, laydown, storage and parking areas
- Construction of access and haul roads including crossings of Hail Creek, Schammer Creek and Middle Creek
- Continued backfilling of open pit voids and waste rock emplacements with waste rock and CHPP coarse rejects
- Final voids within the western and eastern open cut pits
- Excavation and reprocessing of coal rejects from the existing co-disposal facility
- Construction and use of rejects management facilities, including development of a new fines emplacement facility between Middle Creek and Absent Creek, upgrading the existing fines emplacement facility to increase its capacity, and/or disposal of fine rejects within open pit voids
- Construction of new coarse rejects emplacement areas within final voids, within waste rock emplacements and/or an out of pit emplacement area
- Construction and use of a new water transfer dam, sediment basins, open pits/voids, upslope diversion and drainage channels, dewatering bores and other control measures to manage groundwater and surface water within the Project Area
- Construction of new flood levees
- Upgrade of the existing sewage treatment facility and/or construction of a new facility
- Construction and use of a new water treatment facility (potable water)
- Continued diversion of surface water via the approved Brumby Creek diversion
- Continued transport of product coal via the existing train load out facilities and Hail Creek Branch Railway
- Ongoing exploration activities within ML 4738
- Surface monitoring, rehabilitation, and remediation of subsidence effects
- Other associated minor infrastructure, plant, equipment and activities.

The Project shown in Figure 2 represents the potential full mine plan, which would be developed in stages. Stage 1 reflects development up to the end of Year 2 of the Project, as shown on Figure 3. Stage 1 will involve open cut mining within the eastern part of the Project Area, and clearing of the majority of the infrastructure areas including the primary access/haul corridors between the existing Hail Creek Mine and the Project Area. Initial offsets will be secured for Stage 1 with the balance of offsets in subsequent stages.

1.3 Assessment Objectives

The objective of the terrestrial flora and fauna assessment was to undertake terrestrial flora and fauna surveys and assess the potential impacts of the Project on the flora and fauna. This included:

- Undertaking seasonal terrestrial flora and fauna surveys, including targeted searches for conservation significant species
- Validating and mapping remnant vegetation
- Identifying, describing and mapping conservation significant flora and fauna and other relevant matters, listed under Queensland and Commonwealth biodiversity legislation and policy
- Assessing the likelihood of conservation significant terrestrial flora and fauna to use the Study Area
- Describing the likely direct, indirect and cumulative impacts of the Project (at full development and at Stage 1) on the terrestrial biodiversity values
- Describing the likely direct, indirect and cumulative impacts of the Project (at full development and at Stage 1) on threatened species and communities listed as matters of national environmental significance (NES) under the Commonwealth EPBC Act
- Describing the likely direct, indirect and cumulative impacts of the Project (at full development and at Stage 1) on matters of State environment significance (SES) under the Queensland *Nature Conservation Act 1992* (NC Act) and *Environmental Offsets Act 2014* (EO Act)
- Describing proposed impact avoidance and mitigation measures aimed at reducing the impacts of the Project
- Identifying likely significant residual impacts on matters of SES and NES and the potential offset liability of the Project under the Queensland EO Act and Commonwealth EPBC Act.

This assessment was prepared in consideration of the following:

- *EHP Information request for an amendment application for an environmental authority (reference 173053)* (EHP 2014a)
- *EIS Information Guideline – Flora and Fauna* ((EHP 2015a) Date accessed 24 March 2015).

On 11 June 2014, the Project was referred under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). On 9 July 2014, a delegate of the Commonwealth Minister for the Environment declared the Project to be a 'controlled' action for the purpose of the EPBC Act due to potential impacts on the following controlling provisions under Part 3 of the EPBC Act:

- Sections 18 and 18A of the EPBC Act (listed threatened species and communities)
- Sections 24D and 24E of the EPBC Act (a water resource, in relation to coal seam gas development and large coal mining development).

The level of assessment was set at Preliminary Documentation.

1.4 Regional Context

The Study Area (Figure 1) is located west of the Britton and Denham Ranges, approximately 120km south-west of Mackay (Figure 1). It is situated within the Northern Bowen Basin Sub-region of the Brigalow Belt Bioregion. This sub-region occupies 1,316,960ha of Queensland (0.8%) (EHP 2013a).

1.5 Description of the Study Area

The Study Area is located immediately adjacent to the east of the operating Hail Creek Mine, within ML 4738. The Study Area abuts the existing and authorised extent of operations at Hail Creek Mine and extends to the north, east and south of existing operations (Figure 2). The proposed project will be located within the Study Area and will allow continuation and extension of open cut mining and commencement of underground mining immediately east of the existing open cut pit at Hail Creek Mine.

Development of the Study Area was largely based on the boundaries of ML 4738 and has been used to gain an understanding of the vegetation and habitat in the Project Area and immediately surrounding areas. Ecological constraint mapping within the Study Area has been used to inform Project design. Sections 1.5.1 to 1.5.6 provides a description of the physical characteristics of the Study Area and surrounding landscape.

1.5.1 *Climate*

The region in which the Study Area is located is characterised by sub-tropical conditions, whereby there is generally a dry season between June and August, with maximum temperatures between 25.1°C and 28.3°C and a hot and humid wet season between October and March, with maximum temperatures ranging from 34.6°C and 36.0°C as recorded at the Mornabah Airport weather station ((BoM 2015) Date accessed 17 March 2015). Average annual rainfall recorded at the Nebo weather station is 755.4mm, with more than 64% falling between December and March ((BoM 2015) Date accessed 17 March 2015).

1.5.2 *Topography*

The Study Area is dissected by numerous, broad drainage corridors, which generally flow in a south-easterly direction towards Bee Creek which is located outside of the Study Area and runs parallel to the Suttor Development Road (Figure 1). Broad floodplains are associated with the major watercourses of Absent, Hail and Middle Creeks (Figure 1). Terrain in the central and northern portions of the Study Area consist of low undulating slopes and spurs of generally less than 5% gradient. The topography of the Study Area becomes steeper in the north as the landform slopes up to the foothills of a broad ridge linking the Mount Gotthardt and Denham Ranges.

The Denham and Britton Ranges occur approximately 16km to the east of the Study Area at elevations of 649m and 385m respectively. The Carborough and Kerlong Ranges occur approximately 13km to the south-west of the Study Area at elevations of 282m and 339m respectively. The Mount Gotthardt Range occurs

approximately 8km to the west of the Study Area reaching elevations of up to 565m and includes Mt Yuckawaw, Mt Hess, Mt Cristoe and Mt Lookout.

1.5.3 *Soils*

Three major soil units have been identified within the Study Area (GSS Environmental 2007). These include:

1. *Red Shallow Rocky Clay*

   This soil unit dominates the upper and mid slopes of the various spur-lines throughout the Study Area. The unit generally consists of shallow red to reddish brown clays, which exhibit a high stone content in the surface horizons. Weathered bedrock has been observed at a depth of less than one metre and outcropping recorded on steeper slopes.

2. *Black Uniform Clay*

   This soil unit is characterised by a medium to heavy black clay that exhibits little to no textural change through the profile and is prevalent on the low flat plains adjacent to Schammer and Hail Creeks.

3. *Alluvial Soils*

   These soils occur in the creek beds, banks and immediate flood levees within the study area and display high variability. In general this unit consists of brown to pale brown sands and sandy loams through to dark brown sandy clay loams.

Small patches of grey brown clay have been recorded in association with the black uniform clays. Duplex intergrades of alluvial soils and red shallow rocky clays occur on the majority of the lower slopes adjacent to the various drainage lines. These intergrades display a high variability in colour, texture and structure but general consist of sands and sandy loams overlying lower clay horizons.

1.5.4 *Surface Water*

A number of 1st, 2nd, 3rd and 4th order ephemeral streams occur in the Study Area. Brumby, Middle and Absent Creeks occur in the west and are formed a short distance outside the Study Area on the slopes of Mt Hess. Schammer Creek is located in the north and flows into Hail Creek, which is a 4th order stream flowing in a southerly direction in the centre of the Study Area and joining Bee Creek just south of the Study Area (Figures 1 and 7).

Hail Creek is in the Isaac River sub-basin, which is at the headwaters of the northern Fitzroy River catchment (EHP 2013a).

1.5.5 *Current Land Use*

The current and historical land use for the Study Area is cattle grazing with open cut coal mining immediately adjacent, to the west of the Study Area (Figure 1). The majority of the Study Area supports remnant woodland vegetation communities.

1.5.6 ***Protected Areas***

Homevale National Park is located immediately adjacent to the east of the proposed Project. Homevale National Park is located 50km north of Nebo and includes within its boundaries cliffs, peaks and spires such as Diamond Cliffs, Marling Spikes and Sydney Heads. The park straddles two Interim Biogeographic Regionalisation for Australia (IBRA) bio-regions (Brigalow Belt North and Central Queensland Coast), which incorporates three sub-regions (Northern Bowen Basin, Bogie River Hills and Clarke-Connors Ranges).

A diverse range of vegetation communities occur within the park, which includes open grassy woodlands, notophyll vine forests, dry softwood scrub, montane shrublands and heaths, eucalypt woodlands to open forests and brigalow-belah communities. To date, a total of 377 wildlife species have been recorded within the park. These include four conservation significant fauna species (Northern Quoll, Red Goshawk, Squatter Pigeon, Common Death Adder) and seven conservation significant flora species (*Bertya sharpeana, Dichanthium setosum, Melaleuca pearsonii, Omphalea celata, Ozothamnus eriocephalus, Plectranthus graniticola, Sannantha papillosa*) ((EHP 2014b) Date accessed 17 March 2015). It is understood that the western section of the park, to the west of Tullawarra Road, has been significantly impacted by frequent and moderate to high intensity fires over the past few years. The greatest impacts have been observed in a significant decline in the structure and composition of the softwood scrub and brigalow-belah communities in this part of the park (Pers. Comms., Darcy O'Laughlin (Local Fire Warden and landowner), 13 January 2015).

Important fossil localities are also present with fossils dating from the Permian period (280-225 million years ago).

2 Methodology

2.1 Nomenclature and Taxonomy

2.1.1 *Flora*

Application of flora scientific names in this report follows Bostock and Holland (2010). In the first occurrence in the text, common names (if one exists) will be followed by its scientific name. Common names were derived from Harden et al. (2006; 2007), Brooker and Kleinig (2008), Maslin (2001), Hacker (1990), Tothill and Hacker (1996), Sharp and Simon (2002), and Auld and Medd (2002). Use of an asterisk (*) indicates the species is not native to Queensland, e.g. Common Lantana (**Lantana camara var. camara*). Following the first in-text reference, flora species will be referred to by common name only (where one exists or if used in tables or bullet points).

2.1.2 *Fauna*

Taxonomy and nomenclature for fauna species within this report follows the following references:

- Amphibians – Tyler and Knight (2011)
- Reptiles – Wilson (Wilson and Swann 2013)
- Birds – Pizzey et. al. (2012)
- Mammals (except bats) – Menkhorst and Knight (2011)
- Bats – Churchill (2009).

Common names are used where a species has an accepted common name with the scientific name provided at the first instance of the name appearing in the text. Common names are sourced from the references listed above or where no common name is provided, searches are made for other widely accepted common names. Use of an asterisk (*) indicates the species is not native to Australia, e.g. *Pig (*Sus scrofa*). Following the first in-text reference, fauna species will be referred to by common name only (where one exists or if used in tables or bullet points).

2.2 Review of Existing Information

2.2.1 *Database Searches*

State and Commonwealth database searches were undertaken for the Study Area to identify records or potential occurrences of conservation significant flora and fauna species and ecological communities. Database searches were undertaken within a rectangular search area, which encompassed the Study Area and an approximate 20km buffer area. The north-west corner of the search area was located at -21.3073, 148.2045 and the south-east corner was located at -21.671, 148.5958. The search area is considered to be representative of the broader region.

Desktop searches covered the following databases and mapping sources:

- EPBC Act Protected Matters Search Tool (DotE 2014a)
- Queensland Herbarium databases – HERBRECS (Queensland Herbarium 2013a)
- Queensland Museum Database (Queensland Museum 2013)
- Regulated Vegetation Management Map, Supporting Maps Version 8 and Essential Habitat Maps Version 4 (NRM 2014)
- Protected Plants Flora Survey Trigger Map (EHP 2014c)
- Wildlife Online database (EHP 2013b)
- BirdLife Australia Atlas (BirdLife Australia 2014)
- Orthorectified imagery (resolution 50cm) – flown October 2010 and 2014 (provided by RTCA)
- Biodiversity Planning Assessments – Brigalow Belt Version 1.3 (EPA 2008)
- Geology mapping - 1:100,000 Hillalong and Harrybrandt Mapsheet (NRM 2011)
- Atlas of Groundwater Dependent Ecosystems ((National Water Commission 2013) Date accessed 12 February 2013).

2.2.2 *Literature and Reports of Previous Studies*

The biodiversity values of the Study Area and adjoining areas, i.e. within ML 4738, have been investigated through multiple studies between 1995 and 2013 and a significant volume of data has been collected over this time for the site. Key drivers for these studies has generally been associated with development of the Hail Creek Mine, much of which formed part of conditions and strategies relating to nature conservation in the Plan of Operations for the existing Hail Creek Mine. These studies include:

- ***Pre-mining studies***
  - *Hail Creek Coal Project: Fauna Survey* (Environmental Research and Education 1996).
  - *Hail Creek Project Vegetation Study* (Elsol 1996).
  - *Results of survey of potential roosting sites of little pied bats (*Chalinolobus picatus*) on Brumby Creek, Hail Creek Mine proposed pit area* (Paterson 1998).
  - *Studies of the Little Pied Bat, Ornamental Snake and the Frog Fauna, Hail Creek Mining Lease and Surrounds* (Pavey and Blomberg 1997).
  - *An assessment of Nature Conservation Values contained by Lot 13, Hail Creek* (Ball et al. 2001).
- ***HCM Expansion Studies***
  - *Nature Conservation Survey and Potential Impacts – Hail Creek Further Development Project* (URS 2005).

- *Hail Creek Further Development Project Environmental Assessment Report* (URS 2006).

- ***Post Development Studies***
  - *Assessment of Regional Ecosystem Mapping and Eucalyptus raveretiana for a proposed Co-disposal area at the Hail Creek Mine, Central Queensland* (Ecotone 2008).
  - *First Monitoring Survey Event for the Ornamental Snake (*Denisonia maculata*) and Little Pied Bat (*Chalinolobus picatus*) on Hail Creek Mine* (Footprints Environmental Consultants 2009a).
  - *Biodiversity Values Assessment of Remnant Habitats supported within the Hail Creek Mining Lease* (Footprints Environmental Consultants 2009b).
  - *Biodiversity Values Assessment of the Lot 13 Property, WHS 466* (Footprints Environmental Consultants 2009c).
  - *Hail Creek Mine, 2009 Biodiversity Monitoring* (SKM 2010a).
  - *RTCA Hail Creek Mine – Annual Threatened Fauna Monitoring, 2010* (JKR Ecological 2010).
  - *Annual Threatened Fauna Monitoring* (Ecological Survey & Management 2012).
  - *Hail Creek Mine Rehabilitation BioCondition Monitoring Report 2011* (Ecological Survey & Management 2011a).
  - *Targeted threatened flora surveys in semi-evergreen vine thicket communities in Lot 13* (Ecological Survey & Management 2011b).
  - Eucalyptus raveretiana *(Black Ironbox) Monitoring Program, 2011 Draft Report* (Ecological Survey & Management 2011c).
  - Eucalyptus raveretiana *(Black Ironbox) Monitoring Program, 2010 Final Report* (Ecological Survey & Management 2010).

These studies range from largely anecdotal assessment, prior to development of standard survey guidelines, through to detailed seasonal flora and fauna surveys using a suite of survey and trapping techniques in accordance with Queensland and Commonwealth guidelines. The most current field survey was undertaken by Ecological Survey & Management, predominately in March and November 2013 as part of investigations for the proposed Project.

2.3 Field Survey

Post wet and dry season flora and fauna surveys were undertaken for the Study Area as outlined in Table 1. These surveys aimed to field-validate the type, distribution and remnant status of vegetation communities throughout the Study Area and develop an inventory of flora and fauna species. Targeted searches for conservation significant flora and fauna were also undertaken.

Table 1: Flora and fauna survey program

	Wet Season (Autumn)	Dry Season (Spring)	Total Survey Period
Fauna	▪ 4 to 18 March 2013	▪ 10 to 21 November 2013	27 days
Flora	▪ 9 to 14 February 2012 (bio-condition sites) ▪ 26 February to 8 March 2013 ▪ 18 to 21 March 2013 ▪ 28 March 2013 ▪ 31 January to 1 February 2015 ▪ 16 to 20 February 2015	▪ 9 to 12 November 2013	33 days

The south-western portion of the Study Area was excluded from the dry season fauna surveys (identified in Figure 2 as the approximate extent of fines reject emplacement). However, this is not considered to be a limitation because the area was surveyed during the wet season and nearby sites with similar vegetation and habitat characteristics were surveyed during the dry season.

Surveys were undertaken under the following permits and approvals:

- Scientific Purposes Permit: WISP06300809 (Valid from 25 October 2009 to 24 October 2014)
- Scientific Purposes Permit: WISP06352009 (valid from 23 Oct 2009 to 22 October 2014)
- Animal Ethics Committee Approval: CA2012/09/630 (valid from 1 October 2012 to 30 September 2015).

A suitably qualified and experienced team of ecologists completed the field surveys and preparation of this report as outlined in Appendix A.

2.3.1 *Flora Field Survey Methods*

Survey Timing and Climatic Conditions

Field flora surveys were undertaken over a combined period of 33 days, predominantly in March and November 2013 (Table 1). Monthly rainfall leading up to the March 2013 survey period was moderate (Table 2), providing reasonable conditions for the detection of most grasses and annual herbs. Typically, the November survey was preceded by dry conditions, with no rainfall in the two months prior (Table 2).

Table 2: Monthly rainfall (mm) for Nebo (approx. 30km south-east of the Study Area)

	Jan	Feb	March	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	142.1	135.3	109.2	47.3	34.9	39.1	28.2	18.6	19.9	30.7	54.6	98.6
Actual Rainfall Total 2013	252.7	122.4	No data	73.2	62.3	No data	No data	3.5	0.0	No data	No data	No data

Source: Nebo Weather Station (No. 33054) ((BoM 2015) Date accessed 17 March 2015)

Site Selection

The field flora survey methods were developed in order to:

- Validate existing EHP produced Regional Ecosystem (RE) vegetation mapping, and better define the distribution and proportionate composition of REs within mixed polygons of more than one RE type
- Target conservation significant flora species and communities (listed under Commonwealth and State legislation) and their habitats, which were identified from database searches
- Produce a comprehensive floral inventory for each vegetation type and the Study Area as a whole.

The Study Area was surveyed in compliance with the Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 3.2 (Neldner et al. 2012). Assessment sites were performed throughout the Study Area so as to thoroughly assess Queensland Government mapped remnant vegetation.

The validation and mapping of remnant vegetation was undertaken at a total of 432 vegetation assessment sites. Figure 4 shows the distribution of vegetation survey sites across the Study Area. Detailed flora species lists were collated at all secondary, bio-condition and Ecological Equivalence Methodology (EEM) sites. This includes 332 vegetation assessment sites undertaken during the 2013 post wet season survey and 29 vegetation assessment sites undertaken during the 2013 dry season survey. Multiple sites were conducted within each RE type and included, 32 EEM sites (8 during the 2013 wet season and 24 during the 2013 dry season), 21 detailed secondary sites, 118 tertiary sites and 190 modified quaternary sites. The less detailed sampling (quaternary assessment sites) was conducted to provide additional information relating to the vegetative structure and to assist in mapping the distribution of the identified REs within the Study Area.

In January 2015, an additional 18 EEM sites were undertaken in areas of non-remnant vegetation in the southern portion of the study area. An additional secondary site and 51 Tertiary sites (34 of which upgraded previous Quaternary sites) were also installed at this time to provide further information to the Queensland Herbarium as part of a RE map amendment process.

A total of 35 bio-condition monitoring sites (Eyre et al. 2011) that were conducted by the team during the wet season of 2012 were also referenced.

Secondary Assessment Sites

Data at these sites was collected in compliance with the Queensland Herbarium's secondary site assessment methodology (Neldner et al. 2012). Data recorded at each secondary site included:

- Date and precise location (with reference to handheld GPS)
- Soils, slope, aspect and landform observations
- Ground-layer, mid-stratum and canopy species composition and abundance
- Structural characteristics
- Condition and disturbance of existing vegetation communities (including distribution of weed species)
- Quantitative and qualitative species composition within a 1000m^2 quadrat, and documentation of ancillary species identified within the immediate area or during foot traverse
- Basal area of vegetation (Bitterlich Stick methodology)
- Photographs of the community (north, east, south, west, groundcover and soils).

Tertiary Assessment Sites

Data recorded at each tertiary site included:

- Date and precise location (with reference to handheld GPS)
- Soils, slope, aspect and landform observations
- Ground-layer, mid-stratum and canopy species composition and abundance
- Structural characteristics
- Basal area of vegetation (Bitterlich Stick methodology)
- Condition and disturbance of existing vegetation communities (including distribution of weed species)
- Photographs of the community.

Quaternary Assessment Sites

Data recorded at each quaternary site included:

- Precise location (with reference to handheld GPS)
- Ground-cover, mid-stratum and canopy species composition and abundance
- Structural characteristics of the ecologically dominant layer (EDL)
- Condition
- Limited photographs of the community.

Vegetation Condition Assessment

Field surveys were undertaken prior to the release of the *Guide to determining terrestrial habitat quality* (EHP 2014d) under the Queensland environmental offsets framework. Therefore, the flora field survey was not undertaken in accordance with the 'Species Habitat Index' component of the assessment methodology outlined in this guide. However, the 'Site Condition' and 'Site Context' components that are required as part of this guide, were assessed as part of EMM Assessment sites undertaken in the Study Area, under the previous *Queensland Biodiversity Offset Policy* requirements (DERM 2011). Indicators assessed included but were not limited to; recruitment, canopy height and cover, shrub cover, native grass cover, organic litter cover, weed cover, patch size, connectivity and species richness (EHP 2014d).

Vegetation condition was also assessed at each site through observations of:

- Tree health
- Canopy dieback
- Insect predation
- Fire and/or storm damage
- Clearing
- Thinning
- Grazing intensity
- Weed infiltration.

The collated condition data is then used to calculate an ecological equivalence score for the vegetation communities impacted by the Project. This process also involves comparison of the measured vegetation indicators to the 'benchmark' attributes for each RE. Benchmark data is data describing the standard or typical condition of a particular RE in an undisturbed condition and is determined from an average value from mature and long undisturbed reference of 'Best on Offer' sites (Eyre et al. 2008). Benchmarks for various vegetation communities are developed by the EHP but not all are available at this stage. Reference to data collated by the author during optimal conditions in similar habitats, or relevant information provided by EHP was used as a comparison base for REs for which a benchmark does not currently exist.

The field surveys were conducted prior to the finalisation of a detailed mine plan and therefore, EEM sites were only undertaken where surface disturbance areas were known at the time of survey. Additional vegetation condition assessments would be required in areas proposed to be impacted by the Project and where offsets are required.

Natural Grassland Assessment Quadrats

The Natural Grasslands TEC, listed under the EPBC Act, was identified as potentially occurring in the Study Area from database searches. In line with the Natural Grasslands TEC listing advice ((TSSC 2008a) Date accessed 11 November 2013), field verification aimed to assess all grassland areas against specific diagnostic criteria to determine whether grasslands within the Study Area satisfied the minimum requirements of the "good quality" condition class described in the listing advice. A total of five transects were undertaken in the field-validated natural grassland community.

Brigalow Assessment

Previous surveys, outlined in Section 2.2.2, have identified the Brigalow TEC, listed under the EPBC Act, in the study area, which corresponds with RE 11.9.5. Detailed bio-condition assessments were undertaken within all of the remnant patches of Brigalow and quaternary, tertiary and secondary assessments sites, as detailed above, were used to supplement the knowledge of the non-remnant patches.

In all potential patches of the Brigalow TEC, the composition of the groundcover layer was determined by measuring the composite percentages of groundcover parameters within a series of nested quadrats of $1m^2$ in area. The nested quadrats were measured every 10m after starting at the 5m mark on a 100m long measuring tape. Groundcover parameters included: native grasses, aquatic vegetation, cryptograms, non-native grasses, non-native herbs, shrubs less than one metre, bare ground, litter, rocks and timber. These transects were used to determine whether the sampled vegetation communities satisfied the condition thresholds of the conservation advice for the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC (TSSC 2013).

Gilgai was present throughout Brigalow communities, particularly in the Brigalow TEC. Gilgai formation became shallower and less defined to the south of the TEC in regrowth Brigalow that does not form TEC (Figure 9).

Semi-evergreen Vine Thicket Assessment

The SEVT TEC, listed under the EPBC Act, was identified as potentially occurring in the study area. Detailed bio-condition assessments were not conducted within the various patches of SEVT (REs 11.3.11 and 11.9.4) due to their small size and density of vegetation. Quaternary, tertiary and secondary assessments sites as detailed above were used to validate the composition, structure and condition of the smaller patches. Diagnostic criteria and condition thresholds for determining whether a patch is a component of the SEVT TEC is not included in the listing advice or SPRAT profile pertaining to this TEC (TSSC 2001o). However, the SPRAT

profile indicates that in order to determine whether a patch located within Queensland is a component of the SEVT TEC it must satisfy the:

- Criteria for remnant status as defined under the VM Act
- Minimum patch size to be a mappable entity for coastal and non-coastal bio-regions, unless site-specific, property-scale mapping has been undertaken (minimum mappable entity is greater than 1 hectare)
- Structural composition requirements of the corresponding RE that is considered a component of the SEVT TEC (i.e. 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.7.1x1, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.8, 11.11.18).

Targeted Species Surveys

Conservation significant flora returned from database searches were reviewed and where relevant formed the focus of targeted flora species surveys. A list of these species is provided in Appendix F.

Detailed traverses of specific habitat types were undertaken. All areas of Natural Grassland, Brigalow, SEVT and riparian communities and their immediate edges were surveyed in detail for the presence of conservation significant flora species that are known to occur in the region and/or these particular vegetation types.

Quantification surveys were conducted for one conservation significant species previously identified in the Study Area; Black Ironbox (*Eucalyptus raveretiana*).

Black Ironbox Quantification

Methods to develop a population estimate for Black Ironbox involved undertaking 500m transects regularly along each of the creeks that were found to support Black Ironbox (RE 11.3.25a). A range of stream morphologies were sampled, i.e. bends where densities of Black Ironbox were observed to be greater and narrow linear sections of watercourses where Black Ironbox was not as abundant. A total of 13 transects were undertaken during the dry season survey in November 2013, with each individual Black Ironbox marked with a GPS and the height, diameter at breast height (DBH) and health of each tree recorded.

Vegetation Mapping

Department of Natural Resources and Mines (NRM) mapped remnant vegetation was validated in the field using the survey data described in the preceding sections and referencing the latest geology mapping (NRM 2011). The boundaries of vegetation types were mapped in the field using a GPS and/or aerial photograph interpretation. An RE Map Amendment Application Kit was prepared for ML 4738 and submitted to the Queensland Herbarium, via EHP (Mackay Office), in February 2014. This Map Amendment Application Kit reflected the ground-truthed mapping undertaken as part of the terrestrial ecology field surveys and shown on Figure 10.

The majority of the Map Amendment Kit was accepted by the Queensland Herbarium and EHP in January 2015, however, further information was requested to enable a final determination to be made in relation to several large polygons in the north of the mine lease and numerous small polygons scattered throughout

the mine lease. The additional information was sent to the Queensland Herbarium, via EHP (Emerald Office), in March 2015 and is still being assessed.

Random Traverses

In addition to EEM, Secondary, Tertiary and Quaternary assessment sites, large portions for the Study Area were traversed on foot and the random meander technique applied (Cropper 1993). The purpose of random traverses was to ensure adequate site coverage and to establish a comprehensive floral species list for the Study Area. This method is also essential for the detection of cryptic, pest and conservation significant species.

Flora Inventory and Abundance

A comprehensive flora species list, including native and introduced species, was compiled for the Study Area. Relative abundance of flora species was assessed on a site-by-site basis, with detailed inventories compiled at all EEM, bio-condition and Secondary assessment sites.

In relation to vegetation structure, abundance estimates were determined for species within each stratum of the community, with particular focus on the ecologically dominant layer (EDL) as it is by these species that the community is defined and from this the RE determined (Neldner et al. 2012).

The status (remnant/non-remnant) of existing vegetation was determined by comparing the existing predominant canopy with the undisturbed predominant canopy. The Queensland Herbarium defines the predominant canopy under the VM Act, as the EDL, namely, that stratum of the vegetation which contains the most above ground biomass. The EDL can be defined in terms of growth form, height, cover density and species. In the majority of cases, the EDL is equivalent to the upper stratum (Walker and Hopkins 1990).

The crown cover definitions and associated crown separation descriptions (e.g. sparse) were also applied to the lower strata to allow a consistent description of the spatial distribution of the respective vegetation layers.

The landform description upon which the field validated vegetation communities occurred was based on simple erosional landform patterns characterised by relief and modal slope as described by Speight (1990).

For compilation of detailed floristic inventories at all secondary level assessment sites, the relative abundance of species was based on the Braun-Blanquet technique, as per the notes in Appendix I (Mueller-Dombois and Ellenberg 2003 Whittaker 1975).

Coordinate System and Map Datum

Positional data was collected a using a GPS, with an accuracy of 3 to 5m. Positional locations were recorded using the Latitude and Longitude coordinate system. All locations presented in this report are within zone 55K. The map datum used was WGS84.

Ancillary Information

Other field characteristics such as areas of weed infestation, habitat areas for conservation significant species and regional connectivity were recorded and described as part of the field survey. Photographic records were taken throughout the Study Area, capturing each community type, habitat type and the broader landscape.

2.3.2 *Fauna Field Survey Techniques*

Survey Timing and Climatic Conditions

The post wet season fauna survey was undertaken between 4 and 18 March, inclusive and weather conditions during this period and preceding this period were relatively dry for the time of year, with some rain experienced immediately prior and at the commencement of the survey period. The minimum temperature experienced during the survey was 14.7°C and maximum 34.4°C. Conditions were reasonably mild for the time of year.

The dry season fauna survey was undertaken between 10 and 21 November, inclusive and conditions were characteristic of this time of year, with relatively dry conditions compared with average monthly rainfall (refer Table 3). Temperatures ranged from 13.2°C to 36.9°C during the dry season survey.

The nearest weather stations best representing a similar landscape to the Study Area, are Nebo and Moranbah Airport stations ((BoM 2015) Date accessed 17 March 2015). The temperature and rainfall data for the survey periods and weeks preceding these survey periods is presented in Table 3.

Table 3: Indicative weather conditions for the Study Area

Date	Temperature (°C)		Rainfall (mm)
	Min	Max	
Post Wet Season Survey			
25/02/2013	19.6	30.8	24.0
26/02/2013	20.9	29.7	0.2
27/02/2013	21.4	29.5	34.0
28/02/2013	21.9	29.8	11.0
1/03/2013	22.0	32.4	♦
2/03/2013	22.1	31.1	♦
3/03/2013	21.1	28.2	♦
4/03/2013*	22.6	28.4	♦
5/03/2013*	21.9	25.7	♦

Date	Temperature (°C)		Rainfall (mm)
	Min	Max	
6/03/2013*	21.3	27.3	50.0
7/03/2013*	18.8	29.1	0.7
8/03/2013*	19.6	28.8	0.0
9/03/2013*	18.5	30.2	0.0
10/03/2013*	19.0	30.0	1.0
11/03/2013*	18.9	28.9	0.0
12/03/2013*	16.8	28.8	0.0
13/03/2013*	15.3	29.9	0.0
14/03/2013*	16.0	31.1	No data
15/03/2013*	14.7	31.9	No data
16/03/2013*	16.5	31.6	No data
17/03/2013*	16.8	34.4	0.0
18/03/2013*	20.2	32.8	0.0
Dry Season Survey			
3/11/2013	15.0	34.4	0.0
4/11/2013	13.4	37.0	0.0
5/11/2013	18.3	33.4	0.0
6/11/2013	18.1	31.3	3.0
7/11/2013	15.7	33.0	0.0
8/11/0213	15.2	34.3	0.0
9/11/2013	11.6	35.5	0.0
10/11/2013*	13.2	36.2	0.0
11/11/2013*	16.9	35.1	0.0
12/11/2013*	19.5	35.9	0.0
13/11/2013*	19.5	33.3	7.8
14/11/2013*	21.1	35.6	0.0
15/11/2013*	20.7	35.6	9.6

Date	Temperature (°C)		Rainfall (mm)
	Min	Max	
16/11/2013*	19.7	35.9	0.0
17/11/2013*	16.3	29.0	1.4
18/11/2013*	18.0	30.4	19.4
19/11/2013*	18.7	33.4	0.0
20/11/2013*	20.9	34.2	0.0
21/11/2013*	21.1	36.9	0.0

Source: Post wet season rainfall data = Nebo weather station (No. 33054), all other data = Moranbah Airport weather station (No. 34035)
* Survey dates
♦ Totals accumulated into next figure

Overview of Survey Effort

A variety of faunal survey methods were used, including systematic trap sites, spotlighting, call playback, infrared cameras, active searching, supplementary survey sites, harp traps, Anabat survey sites, Koala transects and observation (e.g. bird surveys and opportunistic observations). In total, 11 systematic trap sites, 29 supplementary sites, 10 harp trap sites and 18 Anabat Sites were employed across the Study Area during post wet season and dry season surveys (Figure 5).

Sites selected for each of the survey techniques was determined through desktop review of aerial photography, RE mapping and database search results in order to stratify survey effort across major habitat types for species likely to occur in the Study Area. Major habitat types were identified through broad vegetation groups (BVGs) mapped for the Study Area. BVGs are developed by the Queensland Herbarium to group vegetation communities at a high level and are included in the RE spatial dataset (EHP 2013c). Desktop review indicated that BVGs for the Study Area could be divided into six major habitat types:

- Eucalypt woodlands to open forests on floodplains
- Eucalypt woodlands on inland depositional plains
- Palustrine wetlands
- Tussock grasslands
- Scrub
- Other Acacia dominated open forests, woodlands and shrublands.

These major habitat types were used to design the survey, which was then refined where necessary in the field, once an on-ground appreciation for the REs and habitat could be obtained. Site layout and effort in each habitat type was also influenced by site access constraints, condition of communities and habitat and other physical conditions, such as flooding and fire.

Table 4 outlines the survey effort conducted for each type of technique during the survey. The following sections describe techniques used and where they were conducted.

Table 4: Dry season fauna survey effort for the Study Area

Survey Technique	Trap nights/Person hours	Target Fauna
Elliot Traps	1100 trap nights	Small mammals
Pitfall Traps	176 trap nights	Small mammals, reptiles and frogs
Funnel Traps	264 trap nights	Small mammals, reptiles and frogs
Spotlighting (including by vehicle)	25 person hours on foot and 12 from slow moving vehicle	Mammals, reptiles, nocturnal birds
Call Playback	11 person hours	Owls, arboreal mammals
Infrared Camera	52 trap nights	Medium to large mammals and reptiles
Bird Survey	52 person hours in addition to recording birds opportunistically while on site approximately 270 person hours	Birds
Anabat	18 nights	Bats
Harp Trap	20 trap nights	Bats
Active Searching	25 person hours	Small mammals and reptiles
Koala Transects	64 person hours	Koala

Systematic Trap Sites

A total of 11 systematic trap sites (TS1 – TS11) were established in areas of native vegetation throughout the Study Area during the survey (Figure 5). Each systematic trap site consisted of:

- 4 pitfall traps
- 3 pairs of funnel traps
- 25 small Elliot A traps
- 1 infrared camera.

All traps were open for four nights except the infrared cameras were in place for a total of six nights at sites TS8 – TS11. The survey comprised a total of 1,592 trap nights (trap nights refers to the total number of traps that were open for a total number of nights e.g. 4 traps open for 5 nights equates to 20 trap nights). Elliot traps were baited with a mixture of rolled oats, honey, peanut butter and bacon pieces. Traps were located 5 to 10m apart and positioned close to suitable microhabitat features such as fallen logs, dense grass tussocks or areas of surface

rock. Traps were checked early in the morning and any animals captured were identified and immediately released. Pitfall and funnel traps were also checked in the afternoon and opportunistically during the day.

Pitfall traps comprised four 20L buckets dug into the ground to rim level, with a drift fence that intersected the mouth of each bucket and extended beyond the line of buckets to guide fauna towards the buckets. A water soaked sponge, leaf litter and a small piece of polystyrene foam was placed in each bucket to provide moisture and shelter for animals captured. The polystyrene foam is able to be used as a flotation device for captured animals so that they do not drown in the event of heavy rain. An insecticide powder was also sprinkled in and around the lip of pitfall traps to reduce the incidence of ant related trap deaths. Three sets of two funnel traps were also located along the drift fence to capture larger lizards and snakes that could escape or avoid the buckets. Funnel traps were covered with a towel to provide shelter for captured animals.

A minimum of one person hour of spotlighting and active searching was conducted at each systematic trap site, as well as a minimum one person hour of bird surveys at each trap site, each morning, while traps were being checked.

A brief description of the location and habitat attributes of each of the systematic trap sites is provided in Table 5.

Table 5: Description of habitat of systematic fauna trap sites

Survey Site ID	Site Location	Vegetation Description	Representative Photograph
TS1	South-western portion of Study Area, Middle Creek	Remnant RE 11.3.25a dominated by Queensland Blue Gum, Carbeen and Narrow-leaved Red Ironbark with moderate numbers of mature trees, low levels of fallen timber and deep leaf litter and a moderate cover of exotic species	

Survey Site ID	Site Location	Vegetation Description	Representative Photograph
TS2	Central southern portion of the Study Area, Brigalow	Brigalow (RE 11.9.5) forest with most trees having a diameter of <20cm, extensive gilgai areas, a high cover of fallen timber but mostly with a diameter of <20cm, some areas of deep leaf litter and a moderate cover of exotic species	
TS3	Central portion of the Study Area	Poplar Box woodland (RE 11.9.7) with few mature hollow bearing trees, low levels of fallen timber, no areas of deep leaf litter and a high cover of the exotic Buffel Grass	
TS4	Central portion of the Study Area, Hail Creek	Narrow band of Queensland Blue Gum, Carbeen and Black Ironbox fringing Hail Creek (RE 11.3.25a). A high number of mature hollow bearing trees with moderate levels of fallen timber, few areas of deep leaf litter and moderate cover of exotic species	

Survey Site ID	Site Location	Vegetation Description	Representative Photograph
TS5	Central portion of the Study Area	Poplar Box woodland (RE 11.9.7) with mid dense mid storey of False Sandalwood and Yellowwood. Some mature hollow bearing trees, a good cover of fallen timber, some areas of deep leaf litter and a low cover of exotic species	
TS6	Northern portion of the Study Area	Open woodland of Narrow-leaved Red Ironbark (RE 11.9.9) with some hollow bearing trees and some fallen timber, no areas of deep leaf litter and low cover of exotic species	
TS7	North-eastern portion of the Study Area, SEVT	SEVT (RE 11.3.11) with some hollow bearing trees, abundant areas of deep leaf litter, moderate levels of fallen timber and low cover of exotic species	

Survey Site ID	Site Location	Vegetation Description	Representative Photograph
TS8	Central portion of the Study Area	Queensland Blue Gum woodland with Carbeen (RE 11.3.4), some very large hollow bearing trees present with other areas dominated by regrowth, some fallen timber present, no areas of deep leaf litter and moderate cover of exotic species	
TS9	Central eastern portion of the Study Area	Mountain Coolabah open woodland (RE 11.9.2) with abundant hollow bearing trees, low levels of fallen timber, no areas of deep leaf litter and a high cover of exotic species	
TS10	Central portion of the Study Area	Narrow-leaved Red Ironbark woodland (RE 11.9.9) with few hollow bearing trees, little fallen timber or areas of deep leaf litter and low cover of exotic species	

Survey Site ID	Site Location	Vegetation Description	Representative Photograph
TS11	South-eastern portion of the Study Area, Brigalow	Small patch of Brigalow mid-mature forest (RE 11.9.5), no mature trees, abundant fallen timber but small diameter (<20cm), some areas of deep leaf litter, no gilgai, low cover of exotic species	

Supplementary Survey Sites

A total of 29 supplementary survey sites (S1-S29) were conducted across the Study Area, using spotlighting and call playback, infrared cameras, bird survey and/or active searching.

A description of the location, survey techniques and vegetation types of the supplementary survey sites is provided in Table 6.

Table 6: Description of supplementary survey sites

Survey Site ID	Site Location	Survey Techniques	Vegetation Description
S1	Central portion of the Study Area	Bird Survey	Wetland with isolated Queensland Blue Gum (RE 11.3.2b)
S2	Southern portion of the Study Area	Active Search	Poplar Box woodland with False Sandalwood and Yellowwood (RE 11.9.5)
S3	Central portion of the Study Area	Active Search	Queensland Blue Gum, Poplar Box, Narrow-leaved Red Ironbark woodland (RE 11.3.4)
S4	North-eastern portion of the Study Area	Active Search	Narrow-leaved Red Ironbark woodland (RE 11.9.9)
S5	Western portion, just outside the Study Area	Active Search and Bird Survey	Mountain Coolabah with some surface rock grassy woodland (RE 11.9.2)
S6	Central portion of the Study Area	Active Search and Bird Survey	Poplar Box woodland (RE 11.3.2)
S7	North-eastern portion of the Study Area	Active Search	Narrow-leaved Red Ironbark woodland (RE 11.9.9)
S8	South-eastern portion of the Study Area	Active Search	Mountain Coolabah grassy woodland (RE 11.9.2)
S9	Western portion, just outside the Study Area	Spotlight	Mountain Coolabah grassy woodland (RE 11.9.2)
S10	Central eastern portion of the Study Area	Spotlight	Poplar Box woodland (RE 11.9.7)
S11	Southern portion of the Study Area	Spotlight	Freshwater wetland with fringing mature Queensland Blue Gum (RE 11.3.27)

Survey Site ID	Site Location	Survey Techniques	Vegetation Description
S12	Northern portion of the Study Area	Spotlight	Queensland Blue Gum, Carbeen, Poplar Box and Narrow-leaved Red Ironbark woodland (RE 11.3.4)
S13	Northern portion of the Study Area	Spotlight	Queensland Blue Gum, Poplar Box, Narrow-leaved Red Ironbark woodland (RE 11.3.4)
S14	North-western portion of the Study Area	Spotlight	Queensland Blue Gum, Carbeen and River Oak riparian woodland (RE 11.3.25) along Schammer Creek
S15	Central eastern portion of the Study Area	Spotlight	Black Ironbox riparian woodland, with occasional Queensland Blue Gum, Carbeen, River Oak and Weeping Paperbark (RE 11.3.25a) along Hail Creek
S16	Northern portion of the Study Area	Spotlight	Queensland Blue Gum, Carbeen, River Oak and Weeping Paperbark (RE 11.3.25a) at Brumby Waterhole
S17	Southern portion of the Study Area	Spotlight	Natural grassland with occasional stunted Poplar Box and Prickly Acacia (RE 11.3.21)
S18	Central portion of the Study Area	Spotlight	Queensland Blue Gum and Poplar Box woodland (RE 11.3.4) along a small drainage line
S19	Southern portion of the Study Area	Spotlight	Poplar Box and Silver-leaved Ironbark woodland (RE 11.9.7)
S20	South-eastern portion of the Study Area	Active Search and Bird Survey	Poplar Box woodland (RE 11.9.7)
S21	Central eastern portion of the Study Area	Active Search and Bird Survey	Poplar Box and Mountain Coolabah woodland (RE 11.9.7)
S22	Central portion of the Study Area	Active Search and Bird Survey	Poplar Box woodland, with some Queensland Blue Gum (RE 11.3.2)
S23	Central eastern portion of the Study Area	Active Search and Bird Survey	SEVT with Belah, Mountain Coolabah, Yellowwood and False Sandalwood (RE 11.9.4)
S24	Central portion of the Study Area	Spotlight	Poplar Box and Narrow-leaved Red Ironbark woodland (RE 11.9.7)
S25	Central northern portion of the Study Area	Spotlight	Poplar Box and Queensland Blue Gum woodland (RE 11.3.2)
S26	Northern portion of the Study Area	Active Search and Bird Survey	Carbeen and Narrow-leaved Red Ironbark woodland (RE 11.4.2)
S27	Central western portion of the Study Area	Active Search and Bird Survey	Poplar Box woodland (RE 11.3.2)
S28	Southern portion of the Study Area	Spotlight	Brigalow and Belah open forest (RE 11.9.5)
S29	Southern portion of the Study Area	Active Search and Bird Survey	Poplar Box and Silver-leaved Ironbark woodland (RE 11.9.7)

Spotlighting

A total of 25 person hours of spotlighting was undertaken on foot in the Study Area. This included in the vicinity of each systematic trap sites and nine supplementary survey site, for one person hour per site (Table 4). An additional 12 person hours of slow vehicle based spotlighting was conducted along various tracks within the Study Area, where it was safe to do so. This is an ideal method for detecting nocturnal reptiles and amphibians. Fauna were located from eye

shine or direct observation and identified. The distinctive calls of some fauna were also used to identify their presence.

Call Playback

Call playback involved broadcasting recorded calls of owls or arboreal mammals through a megaphone in an effort to elicit a territorial response from any animals that hear the call. Animals either call in response to the recording and/or move in to the location that the call was played from. The call is played and then approximately 2 to 3 minutes are spent listening for a response and looking for animals that have moved into the area without calling. Call playback was undertaken in the vicinity of each systematic trap site totalling 11 hours for the survey period. Following the call playback session, spotlighting was conducted of the immediate area to locate any owls that had flown into the area without calling and had not been seen during the call playback. The calls of the following species were played:

- Barking Owl (*Ninox connivens*)
- Masked Owl (*Tyto novaehollandiae*)
- Southern Boobook (*Ninox novaeseelandiae*)
- Barn Owl (*Tyto alba*)
- Koala (*Phascolarctos cinereus*).

Infrared Cameras

An infrared camera was set up at each of the systematic trap sites, for four nights at TS1 to TS7 and six nights at TS8 to TS11, totalling 52 trap nights. The cameras were set on a bait station of a chicken frame, apple and sweet potato with bait stations re-baited each week.

Bird Surveys

During the checking of traps at each systematic trap site, bird surveys were conducted along the trap transect, with all birds seen and heard recorded. The order in which systematic trap sites were checked was varied each morning to ensure that sites were surveyed for birds at slightly different times each day. A total of 44 person hours were spent in total at the 11 systematic survey sites and eight person hours were spent conducting bird surveys at eight additional sites resulting in a total survey time of 52 person hours. Opportunistic records of birds were also made while undertaking other activities throughout the Study Area. Approximately 270 person hours were spent undertaking opportunistic bird observations during the field survey.

Anabat

The Anabat surveys involved the use of an SD1 Anabat detector to record the echolocation calls of micro-bats as they forage. A sonogram was then produced suing software that allows for comparison against reference calls for identified. Unfortunately, some species of bat have very similar and/or quiet calls and cannot be positively distinguished via Anabat (e.g. *Nyctophilus* species). Therefore, a

probability rating is provided for calls identified. All Anabat calls were analysed by Greg Ford, a specialist in analysing Anabat recordings.

Anabat units were deployed for one night from dusk until dawn at 18 locations across the Study Area (Figure 5). Anabat survey sites were selected on the basis of having suitable flyways, flowering trees that attract insects or water that attracts insects and bats.

Harp Trap

Harp Traps were used to capture bats during the survey and were set at 10 locations, each for 2 nights resulting in a total of 20 harp trap nights. Harp traps were located in suitable flyways such as small waterways or tracks. Harp traps comprise two banks of vertical microfilament line offset from one another. Bats fly into one of these wires and drop into a bag beneath the trap where they can be collected for identification. Captured bats were kept in a quiet cool location and released on the night following their capture.

Active Searches

Active searching was conducted to detect reptiles, frogs and small ground dwelling mammals. It involved the searching of suitable microhabitat such as logs, bark, deep leaf litter, surface rocks and shedding bark. Active searching was undertaken for 25 person hours across the site, including 1 person hour at each systematic trap site and 14 supplementary sites (Table 4).

Koala Line Transects

The EPBC Act Protected Matters Search Report for the Study Area and surrounding areas, indicates the Koala and/or its habitat is known from the search area. Additionally, anecdotal sightings of Koalas have been recorded at Hail Creek Mine in the north near Hail Creek and to the west in close proximity to the current mining area (Figure 14). Therefore, targeted line transects were conducted in the Study Area during the dry season survey to provide information in relation to the use of the Study Area by this species. In line with the *Draft EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory* (DotE 2013a), line transects were stratified across the Study Area to establish an estimate of population density, distribution and habitat preferences (Figure 5).

The methodology employed for the line transects involved two ecologists walking a distance of 25m apart for a length of 500m on one side of a centreline and then returning along the other side of the 500m centreline also remaining a distance of 25m apart, while inspecting each tree along this transect. This approach results in a search area of 5ha (500m x 100m search area) for each transect. In total, 32 line transects were conducted, with 160ha of potential habitat actively searched for this species in the Study Area. Results of these transects are provided in Section 5.5.1.

Opportunistic Observations

Records of fauna in the Study Area were also made opportunistically while undertaking other activities, such as moving between trap sites, throughout the survey periods.

Habitat Assessment

The quality of fauna habitat in the Study Area was assessed on the basis of several criteria. These criteria are adapted for treeless habitat types such as grasslands or wetlands as appropriate, and include:

- **Low:** Many fauna habitat elements in low quality areas have been removed or altered such as mature, hollow-bearing trees, fallen timber and deep leaf litter. Remnants are often small in size, support substantial weed infestations of high or moderate threat weeds (e.g. Mother of Millions (**Bryophyllum delagoense*) and are poorly connected to other areas of remnant vegetation).
- **Moderate:** Some habitat components are present but others are lacking. For example a remnant may have a reasonably intact understorey but lack mature canopy species and fallen timber. Some weed infestations are present but are relatively small in size or comprise species of low to moderate threat. Linkages with other remnant habitats in the landscape may be lacking or somewhat tenuous.
- **High:** most habitat components are present (e.g. old-growth trees, fallen timber, lack of weeds and deep leaf litter), the remnant is large enough to support species that are typically associated with large intact areas of habitat (e.g. Powerful Owl [*Ninox strenua*] and Greater Glider [*Petauroides volans*]) and it is well connected or contiguous with others of native vegetation.

Fauna Field Survey Standards

A number of guidelines have been considered in development of survey methods for this Project, particularly with regard to survey timing and techniques employed to target conservation significant species most likely to occur in the Study Area.

Table 7 provides a comparison of the survey guidelines listed below, along with the survey effort undertaken for this current survey of the Study Area:

- *Survey guidelines for Australia's threatened birds* (DEWHA 2010a)
- *Survey guidelines for Australia's threatened bats* (DEWHA 2010b)
- *Survey guidelines for Australia's threatened mammals* (SEWPaC 2011a)
- *EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (DotE 2014b)
- *Survey guidelines for Australia's threatened reptiles* (SEWPaC 2011b)
- *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (SEWPaC 2011c)

- *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (Eyre et al. 2014)
- *Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006 – 2016* (EPA 2006).

The Queensland survey guidelines provide general survey methodology and minimum effort advice for detection of all species, and do not provide specific methods for conservation significant species. However, recommended methods are provided for each class of animal and these have been used in Table 7 for each species. Where available, and listed above, Queensland targeted species survey guidelines have been included in Table 7.

Table 7 includes only those species for which a moderate or higher likelihood of occurrence was determined through this assessment (see Section 5.5 and Appendix G).

For all target species, a combination of two or more recommended techniques have been employed. For all species the minimum survey effort described in the above guidelines has been met or exceeded by this current survey with multiple techniques employed across the Study Area for each group of species.

Table 7: Survey effort for each conservation significant species targeted during the field survey

Species Name	Common Name	Commonwealth Government Survey Techniques[1]	Commonwealth Government Survey Effort[2]	Queensland Government Survey Techniques	Queensland Government Survey Effort[3]	Current Survey Effort for the Study Area
Birds						
Australian Painted Snipe	*Rostratula australis*	• Targeted stationary observations • Land-based area searches or line transects	• 10 hours/ 5 days • 10 hours/ 3 days	• Diurnal bird survey • Spotlighting • Incidental observations	• Diurnal search: 6 x 5-10 minute area searches of each systematic site • Spotlighting: 2 x 30 person minute search per site	• Diurnal survey (52 hours): 4 person hours x 11 systematic sites and 8 person hours at supplementary sites • Spotlighting (37 hours): 1 person hour x 11 systematic sites, 14 person hours at supplementary sites and 12 person hours from a vehicle • Incidental observations: Approx. 270 person hours
Glossy Black-cockatoo	*Calyptorhynchus lathami*	Not applicable	Not applicable	• Diurnal bird survey • Incidental observations	• Diurnal search: 6 x 5-10 minute area searches of each systematic site	• Diurnal survey (52 hours): 4 person hours x 11 systematic sites and 8 person hours at supplementary sites • Incidental observations: Approx. 270 person hours
Squatter Pigeon (southern)	*Geophaps scripta scripta*	• Area searches or transect surveys in suitable habitat • Flushing surveys	• 15 hours/3 days 10 hours/3 days			
Mammals						
Koala	*Phascolarctos cinereus*	• Faecal pellet searches using Spot Assessment Technique	• Not specified	• Line transects • Call playback • Spotlighting • Scat and sign searches	• Line transects: (no minimum number stipulated for large sites)	• Line transects (64 hours): 32 transects/160ha

Species Name	Common Name	Commonwealth Government Survey Techniques[1]	Commonwealth Government Survey Effort[2]	Queensland Government Survey Techniques	Queensland Government Survey Effort[3]	Current Survey Effort for the Study Area
		(SAT), particularly for drier sites • Diurnal strip transect searches (<30ha) • Nocturnal spotlighting • Call playback • Remote sensor activated cameras • Optimal survey period between August and January		• Incidental observations	• Call playback: 2 sessions at each systematic site • Spotlight: 2 x 30 minute search per site • Sign searches: search each systematic site and incidentally	• Call playback (11 hours): 1 person hour x 11 systematic sites • Spotlighting (37 hours): 1 person hour x 11 systematic sites, 14 person hours at supplementary sites and 12 person hours from a vehicle • Active searches (25 hours): 1 person hour x 11 systematic sites and 14 person hours at supplementary sites
Reptiles						
Ornamental Snake	*Denisonia maculata*	• Diurnal searches • Spotlighting • Driving roads at night • Pitfall and funnel trap transects could be trialled • All methods likely to yield low returns. • Optimal survey period	• Diurnal searches: 1.5 person hours/ ha of habitat over ≥ 3 days • Spotlighting: 1.5 person hours/ ha of habitat over ≥ 3 days • Driving: opportunistically • Transects: 2 replicates/ habitat type	• Nocturnal active search • Camera trapping • Scat and sign searches • Incidental observations	• Nocturnal searches: 2 x 30 person minute search per site • Camera: 1 camera/ site x 4 nights • Sign searches: Search each systematic site and incidentally	• Infrared cameras (52 trap nights): 11 systematic sites x 4 nights, 4 supplementary sites x 2 nights • Spotlighting (37 hours): 1 person hour x 11 systematic sites, 14 person hours at supplementary sites and 12 person hours from a vehicle • Active searches (25 hours): 1 person hour

Species Name	Common Name	Commonwealth Government Survey Techniques[1]	Commonwealth Government Survey Effort[2]	Queensland Government Survey Techniques	Queensland Government Survey Effort[3]	Current Survey Effort for the Study Area
		between September to late March				x 11 systematic sites and 14 person hours at supplementary sites

Notes:
1. Recommended survey techniques can be used individually or in combination for each species
2. Minimum survey effort is not defined for very large sites, i.e. survey effort is based on 5ha sites for Quolls and 50ha sites for birds
3. A minimum of three replicate generic survey sites is recommended per assessment unit and surveys should be undertaken during optimal seasons, Spring (mid-September to mid-December) and Autumn (late February to April)

2.3.3 *Likelihood of Occurrence*

Threatened Ecological Community Assessment

Flora surveys were conducted across the Study Area at a scale and intensity to sufficiently identify whether any Commonwealth threatened ecological communities (TECs) were present. TECs not recorded during the field surveys were therefore, considered not to occur within the Study Area.

Conservation Significant Species Assessment

Database searches identified conservation significant species that potentially occur in the Study Area. The likelihood of such species occurring was then assessed based on the results of the field surveys.

The likelihood of conservation significant species occurring in the Study Area was classified using the criteria presented in Table 8. The assessment was based on the species' known ranges and habitat preferences, which were evaluated based on characteristics of the Study Area observed during field surveys.

Table 8: Criteria to assess potential for species to occur in the Study Area

Likelihood to Occur	Definition
Present	The species was recorded in the Study Area during the field surveys.
High	The species was not recorded within the Study Area during the field surveys but is known to occur within the surrounding area, and habitat of suitable quality exists within the Study Area.
Moderate	The species was not recorded in the Study Area during the field surveys, although it is known to occur in the wider region. Habitat was identified for the species in the Study Area during the field surveys; however, it is marginal, fragmented and/or small in size, or degraded.
Low	The species was not recorded in the Study Area during the field surveys. The species is either: a) Unlikely to occur in the wider region and due to the lack of, or extremely poor quality habitat in the Study Area, the species is not expected to occur in the Study Area; or b) May forage periodically in the wider region and may overfly the Study Area, but the habitat in the Study Area is generally not suitable.

Conservation Significant Species Habitat Mapping

In addition to the survey effort detailed above, habitat mapping of high value and low value habitat was also conducted for conservation significant species identified or considered likely to occur in the Study Area.

The mapping of this habitat is based on detailed field-validated RE mapping to accurately identify areas of habitat for conservation significant species based on known habitat preferences, field observations from the Study Area and previous experience, where applicable.

The habitat for species recorded or considered to have a moderate or higher likelihood to occur in the Study Area was broadly divided into three categories:

High Value Habitat

- Habitat that comprises vegetation types or contains other habitat attributes reported in literature sources as known or likely to support the species or provide breeding and foraging resources for the species
- Habitat that may provide connectivity between two areas of habitat and therefore play a role in facilitating genetic exchange and/or dispersal is also considered to comprise high value habitat.

Low Value Habitat

- Habitat that comprises vegetation types that could potentially be used by the species for foraging at times, but is considered unlikely to be of importance for the breeding of the species
- Habitat types that the species has been recorded in but that are not considered to be habitat of importance for the species. This habitat type may also be potentially used for dispersal (as even unsuitable habitat can potentially be used for dispersal) but is not important in maintaining connectivity between areas of high value habitat.

Unsuitable Habitat

- All other vegetation types not included in high value or low value habitat.

2.3.4 *Assessment of Significance of Impacts*

For matters of NES, the significance of impacts was assessed in accordance with the *EPBC Act Significant Impact Guidelines 1.1: Matters of national environmental significance* (*EPBC Act Significant Impact Guidelines*) (DotE 2013b).

For matters of SES listed under the EO Act, the *Queensland Environmental Offsets Policy Significant Residual Impact Guideline* (*Queensland Residual Impact Guideline*) (EHP 2014e) was used to assess significance of impacts. Matters of local environmental significance (LES) are not defined for the region in which the Study Area is located.

A conservative, risk-based approach was adopted to determine the need for a significance assessment of species and communities under the EPBC Act or EO Act. This approach considers both the likelihood of occurrence of the species within the Study Area and the potential for habitat loss or disturbance (directly or indirectly) resulting from the Project's impacts. This approach ensures that potential project-related impacts on threatened, migratory or special least concern species and communities, which were recorded within the Study Area or have a moderate or higher likelihood to occur in the Study Area are considered. The criteria for determining if a significance assessment is required is presented in Table 9.

Table 9: Criteria to determine if assessment of significance of impacts from the Project is required for the species or community

Likelihood to occur	No potential for habitat loss or disturbance from the Project	Potential for habitat loss or disturbance from the Project
Present	No	Yes
High	No	Yes
Moderate	No	Yes
Low	No	No

Note: Although some migratory species are listed as Special Least Concern under the NC Act and are matters of SES, the Queensland Residual Impact Guideline (EHP 2014e)does not consider significance of impacts to migratory species.

2.3.5 *Limitations*

Seasonal surveys conducted in the Study Area are considered to have enabled broad site coverage and have resulted in a comprehensive species list, which is reflective of the species assemblages and habitat types occurring in the local area.

Nonetheless, ecological surveys often do not record all species of flora and fauna present on a site for a variety of reasons such as seasonal absence or reduced activity during certain seasons. For example, reptiles are less active during winter and can be difficult to detect during these months.

This report overcomes these limitations by assessing impacts not only on species recorded during the field survey, but on species that are potentially present (based on known distribution and habitat availability).

3 Desktop Results

3.1 Geology of the Study Area

Geology mapping was obtained from the 1:100,000 Hillalong and Harrybrandt Mapsheet of the *Queensland Geological Mapping Dataset* (NRM 2011). Seven geological units are mapped across the Study Area (Figure 6), as follows:

- Qa – Clay, silt, sand, gravel; flood-plain alluvium – equivalent to Land Zone 3
- Qpa – Clay, silt, sand, gravel; flood-plain alluvium on high terraces – equivalent to Land Zone 4 in the Study Area
- Pwb – Labile sandstone, siltstone, mudstone, coal, conglomerate in the east – equivalent to Land Zone 9 in the Study Area
- Pwj – Calcareous sandstone, calcareous shale, mudstone, coal, concretionary limestone – equivalent to Land Zone 9 in the Study Area
- Pwt – Lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff, tuffaceous (cherty) mudstone – equivalent to Land Zone 9 in the Study Area
- Rr – Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base) – equivalent to Land Zone 9 in the Study Area
- Ki – Gabbro, leuco-diorite, quartz hornblende diorite, biotite hornblende granodiorite – equivalent to Land Zone 12 in the Study Area.

Equivalent Land Zones (as defined under the Queensland *Vegetation Management Act 1999* (VM Act) and in Wilson and Taylor (Wilson and Taylor 2012)) are provided as these are relevant to assigning field-validated vegetation communities to REs within the Study Area.

3.2 EPBC Act Listed Threatened Ecological Communities

The EPBC Act Protected Matters Search Report (Appendix B) lists three Endangered TECs, as defined under the EPBC Act, as known to occur within the 20km buffer search area around the Study Area (refer to Section 2.2.1):

- Brigalow (*Acacia harpophylla* dominant and co-dominant) (Brigalow)
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (Natural Grasslands)
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT).

NRM regulated vegetation mapping indicates REs 11.9.3 and 11.9.5, representative of Natural Grassland and Brigalow TECs, respectively, occur in the Study Area (Figure 7). Field validation of NRM vegetation mapping is discussed in Section 4.2.

3.3 Queensland Regulated Vegetation Mapping

The Study Area is currently mapped by the NRM as supporting regulated vegetation throughout the majority of the Study Area. Upper reaches of Hail Creek in the north of the Study Area are not mapped as remnant and are therefore, unregulated (Figure 7). Nine remnant REs have been mapped by NRM for the Study Area, of which one is Endangered, three are Of Concern and five are Least Concern (Table 10).

Table 10: Queensland Regional Ecosystem Mapping for the Study Area

RE Code	Vegetation Management Status	Biodiversity Status	EPBC Act Status	Short Description (Queensland Herbarium 2013b)	BVG1M
11.3.4	Of Concern	Of Concern	Not listed	*Eucalyptus tereticornis* and/or *Eucalyptus spp.* woodland on alluvial plains	16c
11.3.25	Least Concern	Of Concern	Not listed	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	16a
11.3.27f	Least Concern	Of Concern	Not listed	Palustrine wetland (e.g. vegetated swamp)	34d
11.4.2	Of Concern	Of Concern	Not listed	*Eucalyptus spp*. and/or *Corymbia spp*. Grassy or shrubby woodland on Cainozoic clay plains	17a
11.9.2	Least Concern	No concern at present	Not listed	*Eucalyptus melanophloia +/- E. orgadophila* woodland on fine-grained sedimentary rocks	17b
11.9.3	Least Concern	No concern at present	Endangered	*Dichanthium spp., Astrebla spp.* grassland on fine-grained sedimentary rocks	30b
11.9.5	Endangered	Endangered	Endangered	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	25a
11.9.7a	Of Concern	Of Concern	Not listed	*Eucalyptus populnea, Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks. *Eucalyptus populnea* predominates forming a distinct but discontinuous canopy (1-015m high)	17a
11.9.9	Least Concern	No concern at present	Not listed	*Eucalyptus crebra* woodland on fine-grained sedimentary rocks	13c

3.4 Conservation Significant Flora

3.4.1 *EPBC Act Listed Flora*

Database searches identified four Endangered and four Vulnerable flora species listed under the EPBC Act as potentially occurring in the 20km buffer search area around the Study Area, as follows (Appendices B-D[1]):

- *Cycas ophiolitica* (a cycad) – Endangered (EPBC Act and NC Act)
- King Bluegrass (*Dichanthium queenslandicum*) – Endangered (EPBC Act), Vulnerable (NC Act)
- Native Moth Orchid (*Phalaenopsis rosenstromii*) – Endangered (EPBC Act and NC Act)
- Siah's Backbone (*Streblus pendulinus*) – Endangered (EPBC Act), Least Concern (NC Act)
- *Dichanthium setosum* (no common name) – Vulnerable (EPBC Act) Least Concern (NC Act).
- Black Ironbox (*Eucalyptus raveretiana*) – Vulnerable (EPBC Act), Least Concern (NC Act)
- *Omphalea celata* (no common name) – Vulnerable (EPBC Act and NC Act)
- *Ozothamnus eriocephalus* (no common name) – Vulnerable (EPBC Act and NC Act).

Only the Black Ironbox is known to occur within the Hail Creek ML.

These species, along with a description of preferred habitat, and likelihood of occurrence within the Study Area are outlined in Appendix F.

3.4.2 *NC Act Listed Flora*

In addition to the NC Act species also listed under the EPBC Act and which are identified in Section 3.4.1, database search results for the 20km buffer search area around the Study Area included one Endangered and five Near Threatened flora species listed under the NC Act, as follows (Appendices B-D):

- *Sannantha papillosa* (no common name) – Endangered (NC Act)
- *Bertya sharpeana* (no common name) – Near Threatened (NC Act)
- *Lobelia membranacea* (no common name) – Near Threatened (NC Act)
- Southern Bonewood (*Macropteranthes leiocaulis*) – Near Threatened (NC Act)
- *Melaleuca pearsonii* (no common name) – Near Threatened (NC Act)

- [1] Wildlife Online and Queensland Herbarium database search results have not been provided in this report due to a large number of records returned. These results can be provided on request.

- *Sarcotoechia heterophylla* (no common name) – Near Threatened (NC Act).

No records of any NC Act listed species are known from within the Hail Creek ML.

The Protected Plants Flora Survey Trigger Map shows the centre of the Study Area as being high risk areas for plants listed under the NC Act (EHP 2015b) (Appendix E). These high risk areas are most likely indicating the presence of the EPBC Act listed Vulnerable Black Ironbox as records of this species have been lodged with the Queensland Herbarium and this species was previously listed as Vulnerable under the NC Act up until December 2014. Although, the Black Ironbox is now listed as Least Concern under the NC Act, the EHP advises on their website that the Flora Survey Trigger Map may take up to 12 months to reflect the NC Act classification amendments that occurred in December 2014.

3.4.3 *Essential Habitat*

No essential habitat for conservation significant plant species has been mapped for the Study Area or immediate surrounding areas.

3.5 Conservation Significant and Migratory Fauna

3.5.1 *EPBC Act Listed Fauna*

Database searches for the 20km buffer search area around the Study Area identified six Endangered and eight Vulnerable fauna species listed under the EPBC Act as potentially occurring in the search area, as follows (Appendices B-D)[2]:

- Eungella Day Frog (*Taudactylus eungellensis*) – Endangered (EPBC Act and NC Act)
- Australian Painted Snipe (*Rostratula australis*) – Endangered (EPBC Act), Vulnerable (NC Act)
- Black-throated Finch (*Poephila cincta cincta*) – Endangered (EPBC Act and NC Act)
- Start Finch (*Neochmia ruficauda ruficauda*) – Endangered (EPBC Act and NC Act)
- Northern Quoll (*Dasyurus hallucatus*) – Endangered (EPBC Act), Least Concern (NC Act)
- Allan's Lerista (*Lerista allanae*) – Endangered (EPBC Act and NC Act)
- Masked Owl (northern) (*Tyto novaehollandiae kimberli*) – Vulnerable (EPBC Act and NC Act)
- Red Goshawk (*Erythrotriorchis radiatus*) – Vulnerable (EPBC Act), Endangered (NC Act)
- Squatter Pigeon (southern) (*Geophaps scripta scripta*) – Vulnerable (EPBC Act and NC Act)

[2] Wildlife Online database search results have not been provided in this report due to a large number of records returned. These results can be provided on request.

- Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable (EPBC Act), Least Concern (NC Act)
- Koala (*Phascolarctos cinereus*) – Vulnerable (EPBC Act) and Special Least Concern (NC Act)
- South-eastern Long-eared Bat (*Nyctophilus corbeni*) – Vulnerable (EPBC Act and NC Act)
- Ornamental Snake (*Denisonia maculata*) – Vulnerable (EPBC Act and NC Act)
- Yakka Skink (*Egernia rugosa*) – Vulnerable (EPBC Act and NC Act).

Four species listed above, the Koala, Squatter Pigeon, Australian Painted Snipe and Ornamental Snake, have known records from within the Hail Creek ML.

These species are listed in Table G1 of Appendix G, along with a description of preferred habitat and an assessment of the likelihood of each species to occur in the Study Area.

Migratory Species

Database searches also identified 14 birds listed under the migratory provisions of the EPBC Act as potentially occurring in the search area (Appendix B and C). A number of these species are also listed as Special Least Concern under the NC Regulation. These species, preferred habitat and an assessment about the likelihood of each to occur in the Study Area, are listed in Table G2 of Appendix G.

Register of Critical Habitat

No species identified in database searches for the search area are listed under the Register of Critical Habitat under the EPBC Act.

3.5.2 *NC Act Listed Fauna*

In addition to the NC Act fauna species also listed under the EPBC Act and which are identified in Section 3.5.1, database search results for the 20km buffer search area around the Study Area included three Vulnerable and two Near Threatened fauna species listed under the NC Act as potentially occurring in the search area, as follows:

- Tusked Frog (*Adelotus brevis*) – Vulnerable
- Glossy Black-cockatoo (*Calyptorhynchus lathami*) – Vulnerable
- Ghost Bat (*Macroderma gigas*) – Vulnerable
- Eungella Honeyeater (*Bolemoreus hindwoodi*) – Near Threatened
- Common Death Adder (*Acanthophis antarcticus*) – Near Threatened.

There are known records of three NC Act listed species in the Hail Creek ML, being the Koala, Squatter Pigeon and Ornamental Snake.

A number of EPBC Act listed Migratory species are also listed as Special Least Concern migratory species under the NC Act. In additional to those species listed in Table G2 of Appendix G, two Special Least Concern migratory species listed

under the NC Act were returned from database searches. These species, preferred habitat and an assessment about the likelihood of each to occur in the Study Area, are also listed in Table G2 of Appendix G.

These conservation significant species and an assessment about their likelihood to occur in the Study Area is provided in Table G1 of Appendix G.

3.5.3 *Essential Habitat*

Essential habitat for the Squatter Pigeon and Ornamental Snake is mapped in the Study Area in close proximity to Hail Creek (Figure 7).

Habitat factors listed by the NRM for each of these species is shown in Table 11 (NRM 2014).

Table 11: Extract from the essential habitat database version 4.0

Species	Vegetation Community	Regional Ecosystems	Altitude	Soil	Position in the Landscape
Squatter Pigeon (southern subsp.)	Dry eucalypt woodland (including Poplar Box, Spotted Gum, Yellow Box, Acacia and Callitris), with sparse short grass, often on sandy areas near to permanent water; grassy eucalypt woodlands. Next on ground near or under grass tussock, log or low bush.	Various on Land Zones 2, 3, 4, 5, 7, 8, 9, 10, 11 and 12	None	No soils information	Gravelly ridges, traprock and river flats.
Ornamental Snake	Under litter/fallen timber and in wide soil cracks, in riparian woodland/open forest and shrub/woodland including Brigalow (*Acacia harpophylla*).	11.3.5, 11.3.25, 11.4.2, 11.4.3, 11.4.5, 11.4.6, 11.4.7, 11.4.8, 11.4.9, 11.9.1, 11.9.5, 11.11.19	100-450m	Deep cracking clay and sandy loam substrates.	Near freshwater waterholes/creeks.

3.6 Critical Habitat and Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are defined under Part 3, Division 1, Sections 25 and 26 of the Environmental Protection Regulation 2008 as well as in the Code of Environmental Compliance for Exploration and Mineral Development Projects (EHP 2001) and include three environmental constraint Categories A, B and C, which broadly encompass:

- Protected areas listed under the NC Act
- Areas subject to International Conventions, including Wetlands of International Importance, Conservation of Migratory Species and Wild Animals and Protection of the World Cultural and Natural Heritage
- REs and areas of high nature conservation value
- Areas listed under the *Forestry Act 1959* (Forestry Act)
- Areas subject to a State Planning Policy that the policy declares is in need of environmental protection.

The Queensland Government produces Environmentally Sensitive Area mapping, which shows only Category B ESAs within the Study Area, in the form of Endangered REs (Figure 8). The adjacent Homevale National Park is mapped as a Category A ESA and a nature refuge to the west of the Study Area at Mt Hess, is mapped as a Category C ESA (Figure 8).

The Study Area is not within an area identified as Critical Habitat under the NC Act.

3.7 Watercourses and Wetlands

Watercourse and wetland values and functions are discussed in detail in the Aquatic Ecology Impact Assessment (DPM Enviroscienses 2015) that has been prepared for the Project. Some aspects of terrestrial and aquatic ecology inherently overlap and as such, wetland and watercourse values and functions relevant to this terrestrial ecology assessment are discussed in sections 3.7.1 to 3.7.4 below.

3.7.1 *Referable Wetlands*

As part of the Queensland Government's management of wetlands, the EHP has prepared a map of referable wetlands which includes:

- Wetland protection areas (WPAs) within the Great Barrier Reef catchments, comprising;
    - Wetlands of high ecological significant (HES) wetlands
    - Trigger areas that represent the area of hydrological influence of HES wetlands.
- Wetlands of General Ecological Significance (GES).

A search of the Referable Wetlands map shows there are no high ecological significance wetlands or trigger areas in the Study Area. However, the Study Area is identified as supporting GES wetlands that encompass areas of riverine and the palustrine wetland associated with Hail Creek and Middle Creek.

3.7.2 *Vegetation Management Wetlands*

Vegetation Management Wetland mapping is produced by the Queensland Government to regulate vegetation clearing in areas mapped as wetlands. Vegetation Management Wetlands are identified as matters of SES under the EO Regulation. These wetlands are defined under the VM Act and shown on a Regulated Vegetation Management Supporting Map.

Two general areas within the Study Area are located on this Map as shown on Figure 7 and equate to approximately 22.0ha. These occur in the centre of the Study Area, associated with a modified impoundment known as the central wetland and in the south of the Study Area associated with a small patch of mapped RE 11.3.27.

3.7.3 *Vegetation Management Watercourses*

Vegetation Management Watercourse mapping is produced by the Queensland Government to regulate vegetation clearing along watercourses. Vegetation Management Watercourses are identified as matters of SES under the EO Regulation. These watercourses are defined under the VM Act and shown on a Regulated Vegetation Management Supporting Map.

In accordance with the EO Regulation, a prescribed RE is a matter of SES to the extent that the ecosystem is located within a defined distance from the banks of a relevant watercourse. The defined distance is determined by the stream order, with different stream orders requiring larger buffers of vegetation from the bank of the stream. Defined distances are outlined in the Queensland Environmental Offsets Policy and for non-coastal bioregions are:

- Stream Order 1 or 2 – 25m distance from the defining bank
- Stream Order 3 or 4 – 50m distance from the defining bank
- Stream Order 5 or greater – 100m distance from the defining bank (EHP 2014f).

Vegetation Management Watercourses are shown on Figure 7, which shows numerous 1st, 2nd and 3rd order streams that flow into Hail Creek, which commences as a 4th order stream in the north of the Study Area and flows out of the Study Area as a 5th order stream in the south of the Study Area. Approximately 768.0ha of regulated vegetation associated with watercourses occurs in the Study Area based on the defined distances above.

3.7.4 *Groundwater Dependent Ecosystems*

Review of the National Atlas of Groundwater Dependent Ecosystems (GDEs) indicates the majority of the vegetation in the Study Area has no potential for groundwater interaction. Vegetation on Hail and Middle Creeks have a moderate to high potential of interaction with surface expression of groundwater, whereas a small section of Hail Creek in the south of the Study Area has a high potential of groundwater interaction (Appendix H).

Queensland Wetland Data Springs

The Queensland Government has prepared the Queensland Wetland Data Springs mapping, which show the location of springs in Queensland. These springs are dependent on the surface expression of groundwater and their locations are used to identify the location of potential GDEs.

No springs are mapped within or adjacent the Study Area.

3.8 Biodiversity Planning Assessment Mapping

The Biodiversity Assessment Mapping Methodology (BAMM) has been developed to provide a consistent approach for assessing biodiversity values at the landscape scale in Queensland. The BAMM is based on vegetation mapping from the Queensland Herbarium and incorporates a range of biodiversity related data. The BAMM is focused primarily on assessing terrestrial values and is used by the EHP to generate Biodiversity Planning Assessments (BPAs) for each of the Queensland's bioregions. The BPAs are used by EHP staff, other government departments or local governments to assist with a range of planning or decision making processes.

The BAMM is applied in two stages; the first stage uses existing data to assess ecological concepts such as rarity, diversity, fragmentation, habitat condition, resilience, threats, and ecosystem processes in a uniform and reliable way across a bioregion. These criteria are used to filter available data and provide an initial determination of significance. The second stage relies upon expert opinion to refine the results of the first stage. It uses expert knowledge to identify features such as wildlife corridors and areas with species biodiversity value (e.g. centres of endemism or wildlife refugia), and includes data that may not be available uniformly across the bioregion.

A state ecological corridor is located along the northern edge of the Study Area and stretches in a west to north-east direction connecting the Carborough and Kerlong Ranges to the south-west of the Study Area with Homevale National Park and the Britton and Denham Ranges to the east of the Study Area. Bee Creek forms a regionally significant ecological corridor to the south of the Study Area (Figure 8).

4 Field Flora Results

4.1 EPBC Act Listed Threatened Ecological Communities

REs representing three TECs listed under the EPBC Act were identified in the Study Area, predominantly in the south of the Study Area (Figure 9). These are:

- Brigalow
- Natural Grassland
- SEVT.

A description of each of these TECs is provided in Sections 4.1.1 – 4.1.3 and shown on Figure 9. The location of the TECs outside the approximately surface extent is discussed in Section 7.3.

4.1.1 *Brigalow TEC*

Six polygons of Brigalow dominated vegetation occur in the south of the Study Area, all formed by remnant and regrowth RE 11.9.5. Although some patches have not been cleared within the last 15 years, only one patch meets the condition threshold criteria of the listed advice (TSSC 2013). The results of bio-condition monitoring plots that were undertaken in 2009, 2011 and 2012 validate that all but one of the patches of RE 11.9.5 fail to satisfy the condition thresholds of the Brigalow TEC listed under the EPBC Act (TSSC 2013a) Specifically, field surveys found that the cover of exotic perennial species within three of these four polygons was greater than 50% based on information recorded from four bio-condition plots (comprising 100 x 50m transects), which were conducted throughout the Study Area. According to the Brigalow Listing Advice (TSSC 2013), Brigalow communities that have greater than 50% perennial weed cover in any particular stratum do not meet the condition thresholds that are required for it to form part of the TEC and are therefore not considered to comprise the Brigalow TEC under the EPBC Act. Table 12 demonstrates the condition of the field-validated patches of Brigalow TEC using information from the four bio-condition plots.

Table 12: Condition and status of field-validated Brigalow TEC

Vegetative Cover (%)	BC_004	BC_013	BC_023	BC033	Q186
Woody					
T1	53.97	45.91	71.19	58.0	~40.0
T2	-	2.39	-	-	<5.0
S1	-	-	-	-	
Non-woody (relative vegetative cover)					
Groundcover - native	21.5	6.5	98.0	2.9	~5.0
Groundcover - exotic	78.5	93.5	2.0	97.1	~95.0
TEC Condition	n/a	n/a	**TEC**	n/a	n/a

In accordance with Table 12, one patch of Brigalow in the south-eastern portion of the Study Area meets the condition criteria, is greater than 0.5 ha in area and does not appear to have been cleared in the last 15 years. Therefore, this patch is considered to be a component of the Brigalow TEC (Figure 9). This patch accounts for 3.0 ha in the Study Area and is represented by RE 11.9.5.

Several other patches of regrowth RE 11.9.5 were mapped within the Study Area but were not considered a component of the Brigalow TEC because they were dominated by Belah (*Casuarina cristata*) and did not support Brigalow.

The predominant threatening processes acting on this TEC are thinning, inappropriate fire regimes, cattle grazing and competition of exotic pastoral grasses outcompeting native recruitment.

4.1.2 ***Natural Grassland TEC***

Field validated RE 11.3.21 is considered a component of the Natural Grasslands TEC, which is listed as Endangered under the EPBC Act (TSSC 2008d).

One patch of this TEC occurs in the Study Area, along the southern boundary on the eastern side of Hail Creek. The community was dominated by Spring Grass (*Eriochloa crebra*) and Native Millet (*Panicum decompositum*), with a moderate diversity of native herbs and other grasses. Although relative abundance of native species was generally low, a total of 57 native grassland species was identified. This community also exhibited gilgai-like depressions, although it was shallow and not well formed. A full description of RE 11.3.21 is provided in Table 13. It is worth noting that the NRM mapped distribution of RE 11.9.3 (also a component of the Natural Grasslands TEC) in the centre of the Study Area was found to be dominated by *Eleocharis* species and was representative of a large palustrine wetland (RE 11.3.27).

Approximately 42.0ha of Natural Grassland TEC occurs in the Study Area (Figure 9).

Several exotic species were commonly encountered in this community, but were not dominant. A large area of improved pasture occurs off-lease and to the south of this TEC and the TEC is currently grazed by cattle.

4.1.3 ***SEVT TEC***

The SEVT TEC was identified in the Study Area, along the eastern boundary, in the form of RE 11.3.11 and 11.9.4 (Figure 9).

One small patch of RE 11.3.11 was identified in the far north-eastern corner of the Study Area, in association with a sinuous oxbow/overflow channel on the upper reaches of Hail Creek. The patch was dominated by Burdekin Plum (*Pleiogynum timorense*), Ribbonwood (*Euroschinus falcatus var. angustifolius*), White Fig (*Ficus virens var. sublanceolata*) and Black Ironbox and had a median height of 21 m.

RE 11.9.4 occurs as three small patches of remnant vegetation and is dominated by Scrub Wilga (*Geijera salicifolia*), Yellowwood (*Terminalia oblongata*) and Cocaine Bush (*Erythroxylum australe*), with emergent Belah, Mountain Coolabah (*Eucalyptus orgadophila*), Yellowwood and False Sandalwood (*Eremophila mitchellii*). Remnant examples of this RE generally formed dense thickets and in most cases excluded weed infiltration, except in more fragmented areas.

Areas of regrowth RE 11.9.4 identified in the Study Area, contained fewer SEVT TEC species and were degraded to the extent that they are not considered to represent the SEVT TEC.

Approximately 11.0ha of SEVT TEC occurs in the Study Area. Weed infiltration is the predominant threat to this TEC as described in Table 13.

4.2 Queensland Remnant Vegetation

Field validation of vegetation communities confirmed the presence of remnant vegetation throughout the Study Area (Figure 10). Vegetation was mapped as remnant if it met the criteria defined under the VM Act and described in Section 2.3.1. Approximately 6,608.5ha of remnant and 956.5ha of non-remnant (regrowth and cleared areas) has been mapped for the Study Area.

The overall distribution of NRM mapped and field-validated remnant vegetation was found to be fairly consistent throughout the majority of the Study Area. However, several broad floodplain basins, most notably the basin associated with Absent Creek, the floodplains in the vicinity of the confluence of Schammer and Hail Creeks and two broad drainage basins flowing from the eastern boundary toward Hail Creek, were found to be representative of non-remnant RE 11.3.4. Improved pasture and stags (dead trees) were prevalent in these areas. Several areas of NRM mapped non-remnant vegetation within the northern and south-eastern portions of the Study Area were found to satisfy the criteria defined under the VM Act and as such were mapped as remnant vegetation.

The composition of the field-validated remnant vegetation, however, was found to be moderately different to the NRM mapping. An increased number of RE types were identified in the Study Area compared with the NRM mapping (12 REs including 3 associations versus 9) as well as a greater distribution of vegetation on alluvium (land zone 3). REs 11.3.2 (and 11.3.2b), 11.3.11, 11.3.21, 11.3.25a, 11.9.4 and 11.12.1 were the additional REs that were field-validated as present but not identified in the current NRM mapping. REs 11.3.4, 11.4.2, 11.9.2, 11.9.5, 11.9.7a and 11.9.9 were confirmed as present.

REs 11.9.2 and 11.9.9 were found to be more widely distributed than currently mapped. The NRM mapped distributions of RE 11.9.7a were found to have a variable distribution of a scrubby mid-stratum and difficult to differentiate from the parent RE 11.9.7. As such RE 11.9.7a was applied to all field-validated patches of Poplar Box on fine-grained sedimentary rocks.

RE 11.3.2 was identified as covering a significant proportion of the floodplain distribution currently attributed to RE 11.3.4 on NRM mapping. The NRM prescribed association of 11.3.2b was also recorded at two locations in the central portion of the Study Area within a broader distribution of RE 11.3.2. The patch of NRM mapped RE 11.9.3 in this area was found to be representative of a perennial sedgeland on alluvium and as such was representative of RE 11.3.27. Several smaller patches of this RE type were identified on the floodplains adjacent to the lower reaches of Hail and Middle Creeks. A considerable proportion of the NRM mapped RE 11.3.25 on these two creeks was found to be more representative of RE 11.3.25a due to the presence and dominance of Black Ironbox within the upper

strata. Several small patches of REs 11.9.4 and 11.9.5 were identified within the Study Area, however many of these failed to satisfy remnant status as per the criteria defined under the VM Act. One small, disjunct patch of RE 11.3.11 was identified on the north-eastern boundary of the Study Area. One small patch of RE 11.12.1 was identified in the north-western portion of the Study Area on a small intrusion of igneous rocks. A patch of NRM mapped RE 11.9.2 in the southern portion of the Study Area was found to be more representative of a natural grassland on alluvium and was mapped as remnant RE 11.3.21.

A total of 93.5ha Endangered, 3,641.0ha Of Concern and 2,874.0ha Least Concern remnant REs listed under the VM Act occur in the Study Area. Of this 103.0ha has an Endangered and 3,875.0ha has an Of Concern biodiversity status. None of the REs identified in the Study Area are listed as Critically Limited or Threshold REs (DERM 2011). REs 11.9.7 and 11.9.9 account for the greatest remnant coverage in the Study Area, with extensive areas of REs 11.3.4 (844.0) and 11.9.2 (831.0ha) also present.

Table 13 provides a description of the vegetation communities recorded in the Study Area. Figure 10 maps the distribution of these vegetation communities. Table 14 outlines the extent of remnant and regrowth REs in the Study Area.

4.2.1 *Ecological condition*

It is considered that while the sclerophyll woodland communities, i.e. REs 11.3.2, 11.3.4, 11.9.2, 11.9.7 and 11.9.9, would meet benchmark condition in relation to species diversity and structure, these would tend to fail to satisfy benchmark criteria in relation to large trees and fallen woody debris, i.e. large trees due to thinning and logs due to an increased fire frequency. Similarly, thinning, low species diversity and a moderate abundance of exotic flora species in REs 11.9.4 and 11.9.5 means these communities would fail to meet benchmark conditions. REs 11.3.25, 11.3.25a, 11.4.2 and 11.12.1 were found to be moderately fragmented and generally had low species diversity within the groundcover layer and would also fail to meet benchmark condition. REs 11.3.11, 11.3.21 and 11.3.27 would satisfy benchmark condition.

Overall, while some patches would be close to benchmark condition, many of the vegetation communities have suffered from historic thinning and timber harvesting, overgrazing, detrimental fire frequency and invasion by exotic species in the ground layer.

Table 13: Regional Ecosystems identified in the Study Area during the field surveys

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
11.3.2 Poplar Box woodland on alluvial plains VM Act Status – Of Concern Biodiversity Status – Of Concern EPBC Act Status – *not applicable*	Remnant	The canopy layer was dominated by Poplar Box (*Eucalyptus populnea*). The canopy height ranged from 13 to 21m (median 16m). The canopy cover intercept was typically 30%. Queensland Blue Gum (*Eucalyptus tereticornis*), Carbeen (*Corymbia tessellaris*) and/or Dallachy's Gum (*Corymbia dallachiana*) were infrequently recorded within the canopy layer, but most commonly at the edge of the community. A very sparse sub-canopy layer was also present and dominated by Poplar Box. Other infrequently occurring species included Western Rosewood (*Alectryon oleifolius ssp. Elongatus*), Sally Wattle (*Acacia salicina*) and Yellowwood. The very sparse tall shrub layer was generally dominated by Sally Wattle. Other species included Whitewood (*Atalaya hemiglauca*), Poplar Box, Myrtle Tree (*Psydrax oleifolium*), Pegunny and Western Rosewood. Where present, the low shrub layer was generally	The community as a whole was found to be relatively intact with a consistent distribution of species across all strata. Occasional minor canopy holes were encountered but these appeared to be mostly attributable to natural attrition. The groundcover was primarily dominated by native grasses with only minor occurrences of exotic species such as Parthenium Weed (*Parthenium hysterophorus*), Sabi Grass (*Urochloa mosambicensis*) and Green Panic (**Megathyrsus maximus var. pubiglume*). The predominant threatening processes currently include thinning, inappropriate fire regimes (Pers Comms Martine	This community was commonly recorded on the various broad floodplains associated with Bee, Hail, Middle and Schammer Creeks and their minor tributaries. This vegetation type is also prevalent on the eastern side of a large wetland located approximately 500mm to the north-east of the confluence of Brumby and Hail Creeks.	 S013: looking south  EEM03a: looking south

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
		dominated by Whitewood, Myrtle Tree and Sally Wattle. The groundcover was generally dominated by Forest Bluegrass (*Bothriochloa bladhii ssp. bladhii*), Tall Chloris (*Chloris ventricosa*), Pitted Bluegrass (*Bothriochloa decipiens var. decipiens*) and Desert Bluegrass (*Bothriochloa ewartiana*). Other commonly recorded species included Three-awn Speargrass (*Aristida vagans*), Kangaroo Grass (*Themeda triandra*), Dark Wiregrass (*Aristida calycina var. calycina*), Hairy Panic (*Panicum effusum*) and Black Speargrass (*Heteropogon contortus*). An association of this RE, which is specifically described as RE 11.3.2b and recognised in the REDD, was identified in two locations to the south-east of the large wetland in the centre of the Study Area. This community represents two small wetlands within a broader distribution of Poplar Box woodland. Isolated specimens of Queensland Blue Gum were recorded within the centre of these wetland patches. The groundcover represents the	Goldner (RTCA), 6 February 2012), drought, cattle utilisation and suppression of natural regeneration or recruitment due to cattle grazing and/or increased frequency of fires.		 T062: looking west  Q066 (RE 11.3.2b): looking west

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
		ecologically dominant layer and was dominated by *Eleocharis philippensis* and *Eleocharis equisetina*. Other commonly recorded species included Brown Beetle Grass (*Diplachne fusca ssp. fusca*), Wavy Marshwort (*Nymphoides crenata*), *Cyperus spp.,* Monochoria (*Monochoria cyanea*) and Nardoo (*Marsilea drummondii*). Exotic species were limited to the edge of the community and included Awnless Barnyard Grass (**Echinochloa colonum*) and Buddha Pea (**Aeschynomene indica*).			
11.3.4 Queensland Blue Gum and/or *Eucalyptus spp.* tall woodland on alluvial plains VM Act Status – Of Concern	Remnant	The composition of the canopy layer was variable with dominant species including Carbeen, Queensland Blue Gum, Poplar Box, Narrow-leaved Red Ironbark (*Eucalyptus crebra*), and Clarkson's Bloodwood (*Corymbia clarksoniana*). Poplar Gum (*Eucalyptus platyphylla*) and Mountain Coolabah were infrequently recorded within this layer. The height of the canopy ranged from 18 to 30m (median 21m) and the crown	The community as a whole was found to be relatively intact with a consistent distribution of species across all strata. Occasional minor canopy holes were encountered but these appeared to be mostly attributable to natural attrition. The composition of the groundcover was variable, with some areas dominated by	This community was commonly recorded on the various broad floodplains associated with Bee, Brumby, Hail, Middle and Schammer Creeks and their minor tributaries. An unusual thicket of Pegunny was identified within and immediately fringing a series of sinuous	 S005 (Middle Creek): looking east

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
Biodiversity status – Of Concern EPBC Act status – *not applicable*		intercept ranged from 15 to 40% (average ~30%). The very sparse to sparse sub-canopy layers were equally as variable and composed of the same species to those present within the canopy layer. The isolated to sparse tall shrub layer was dominated Sally Wattle and/or juvenile canopy species with Pegunny, Myrtle Tree and Whitewood. Less frequently encountered species included Black Tea Tree (*Melaleuca bracteata*), Creek Sandpaper Fig (*Ficus opposita*), Prickly Pine (*Bursaria incana*) and Bat's Wing Coral Tree (*Erythrina vespertilio*). The composition of the groundcover was similarly variable with some areas heavily degraded and dominated by exotic species such as Indian Bluegrass (**Bothriochloa pertusa*) or Angleton Grass (**Dichanthium aristatum*) while other more intact areas were dominated by native species including Forest Bluegrass, Black Speargrass, Silky Browntop (*Eulalia aurea*), Queensland Blue Grass	native grasses while others with exotic species (Parthenium Weed, Angleton Grass, Indian Bluegrass). The predominant threatening processes currently include thinning, inappropriate fire regimes, drought, cattle utilisation and suppression of natural regeneration or recruitment due to cattle grazing and/or increased frequency of fires.	braided channels in Absent Creek in the vicinity of the rail loop. This community was not readily associated with a prescribed RE, and has been included as part of the broader polygon of RE 11.3.4 in which it was identified.	 T070 (Brumby Creek): looking south  T114 (Hail Creek): looking north

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
		(*Dichanthium sericeum*), *Aristida personata,* Kangaroo Grass and Desert Bluegrass. The canopy layer of a small thicket on Absent Creek was dominated by Pegunny and associated Black Tea Tree, Blind-your-eye (*Excoecaria dallachiana*) and Yellowwood and had a median height of 14m and cover intercept of 80%. The sub-canopy had a similar composition, median height of 7m and cover ranging from 30 to 50%. The shrub layer was dominated by Soft Acalypha (*Acalypha eremorum*) and associated Blind-your-eye, Creek Sandpaper Fig, Yellowwood and Wallaby Apple (*Pittosporum spinescens*). Less frequently recorded species included Small-leaved Ebony (*Diospyros humilis*), Cluster Fig (*Ficus racemosa*) and Narrow-leaved Red Olive Plum (*Elaeodendron australe var. integrifolium*). The groundcover layer was dominated by Green Panic.			 S007 (Pegunny thicket, Absent Creek): looking north

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
11.3.11 Semi-evergreen vine thicket on alluvium. VM Act Status – Endangered Biodiversity status – Endangered EPBC Act status – Endangered	Remnant	The canopy of this atypical community was dominated by Burdekin Plum (*Pleiogynium timorense*). Associated species included Ribbonwood, White Fig and Black Ironbox. The height of the canopy ranged from 15 to 24m (median 21m) and the crown intercept ranged from 30 to 40%. The sub-canopy, and potentially the ecologically dominant layer, was dominated by Burdekin Plum. Associated species included Foambark (*Jagera pseudorhus*), Scrub Wilga, Celerywood (*Polyscias elegans*), Red Kamala (*Red Kamala*), Yellow Tulip (*Drypetes deplanchei*), Peach Bush (*Ehretia membranifolia*), Stiff Denhamia (*Denhamia oleaster*), Wonga Vine , Cockspur Vine (*Maclura cochinchinensis*) and Smooth Water Vine (*Cissus oblonga*). The sparse to mid-dense shrub layers were dominated by a diverse variety of vine forest species which included upper strata species, Currant Bush (*Carissa ovata*), Chain Fruit (*Alyxia ruscifolia*), Broad-leaved Native Cherry (*Exocarpos latifolius*) and Muttonwood (*Myrsine variabilis*). Groundcover species were limited to a very sparse cover of juvenile upper strata species and Whisker Grass (*Cyperus gracilis*). Weed infiltration within this community was generally limited to thickets of Common Lantana on the outside edges of the community.		The patch was associated with a sinuous oxbow/overflow channel on the upper reaches of Hail Creek, upstream of Brumby Waterhole on the north-eastern boundary of the Study Area.	 S001a: looking north  S001a: looking south

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
11.3.21 *Dichanthium spp., Astrebla spp*. grassland on alluvial plains, Cracking clay soils. VM Act Status – Endangered Biodiversity status – Endangered EPBC Act status – Endangered	Remnant	Woody vegetation was limited to isolated, mostly stunted, Poplar Box and Prickly Acacia. The ecologically dominant layer of this community was the groundcover layer which was dominated by Spring Grass and Native Millet. A moderate diversity of native herbs and grasses were identified within this community (total of 57 species) although the relative abundance of these was generally low. The soak areas were generally dominated by *Eleocharis pallens*, *Cyperus spp.* and Nardoo.	The composition of the community was variable throughout due to the occasional presence of low points and/or soaks, proximity to a large area of improved pasture to the south and utilisation by cattle. Several exotic species were commonly encountered but never found to be dominant. These included Buddha Pea, Angleton Grass, Indian Bluegrass and Awnless Barnyard Grass.	This community was limited to the far southern portion of Study Area on the eastern side of Hail Creek.	 BC021: looking south  BC022 (soak area): looking north

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
11.3.25 Queensland Blue Gum woodland fringing drainage lines VM Act Status – Least Concern Biodiversity status – Of Concern EPBC status – *not applicable*	Remnant	Queensland Blue Gum frequently dominated the canopy of this community with other commonly recorded species including Carbeen, River Oak (*Casuarina cunninghamiana*), Clarkson's Bloodwood, Narrow-leaved Red Ironbark and Mountain Coolabah. The height of the canopy ranged from 17 to 31m (median 23m) while the crown intercept ranged from 15 to 60% (average 40%). The composition of the very sparse to sparse sub-canopy was generally dominated by River Oak. Associated species included juvenile canopy species. Additional species included *Lagunaria queenslandica*, Black Tea-tree, Sally Wattle, Weeping Paperbark (*Melaleuca fluviatilis*), Burdekin Plum and Ribbonwood. The low tree layer was dominated by River Oak and Pegunny. Other species included Red Kamala, Creek Sandpaper Fig and juvenile canopy species.	The condition of this community was found to be quite variable with the canopy in some areas found to be fragmented and discontinuous. Most areas however were relatively to moderately intact with numerous large, mature and hollow bearing canopy trees present. The shrub layers were also mostly intact and dominated by native species, however Common Lantana was occasionally prevalent within the lower shrub layer. The condition of the groundcover was variable with most patches dominated by exotic grass species. The distribution of this community within Brumby Creek on the western side of the mine was heavily degraded by exotic grasses and weeds and negatively	This community was commonly recorded fringing the upper reaches of Brumby, Hail, Middle and Schammer Creeks and their minor tributaries. An association of this RE, which is specifically described as RE 11.3.25a and recognised in the REDD, was more commonly recorded fringing the major drainage lines within the Study Area.	 T111 (Schammer Creek): looking east  T113 (upper Hail Creek): looking north

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
		The tall shrub layer was generally dominated by Pegunny or White Currant Bush (*Flueggea leucopyrus*) with other commonly recorded species including Coffee Bush (*Breynia oblongifolia*), Creek Sandpaper Fig, Sally Wattle, Yellowwood and juvenile canopy and sub-canopy species. Where present, the low shrub layer was variously composed of similar species to the tall shrub layer. The composition of the groundcover was variable with most areas heavily degraded and dominated by exotic species including Green Panic, Indian Bluegrass or Angleton Grass.	impacted by impounded water. The predominant threatening processes currently include thinning, impounded or impeded hydrological flows, bank shear, , inappropriate fire regimes, cattle utilisation and suppression of natural regeneration or recruitment due to competition of exotic pastoral grasses.		 T116 (upper Brumby): looking north

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
11.3.25a Black Ironbox woodland to open forest fringing drainage lines VM Act Status – Least Concern Biodiversity status – Of Concern EPBC Act status – *not applicable*	Remnant	The canopy layer was generally dominated by Black Ironbox. Other species included Queensland Blue Gum, Carbeen, River Oak and Weeping Paperbark. The height of the canopy ranged from 16 to 34m (median 23m) with a crown intercept that ranged from 20 to 60% (average ~40%). The sub-canopy was dominated by either Black Ironbox or River Oak. Associated species were similar to those recorded in the canopy layer. The low tree layer, where present, was variously dominated by River Oak, Pegunny, Red Kamala, Black Tea Tree and/or *Lagunaria queenslandica*. Other species less frequently recorded within this layer included Sally Wattle, Ribbonwood and Burdekin Plum. Two shrub layers were often present with the very sparse to sparse tall shrub layer dominated by Pegunny or occasionally Creek Sandpaper Fig, Burdekin Plum or Red Kamala. Other tall shrub species included Wallaby Apple	Mostly intact community although narrow sections of Hail Creek were often found to support a fragmented and discontinuous canopy, primarily due to the prevalence of steep, sheared banks or clearing of the adjacent floodplains. Very large, hollow-bearing trees in excess of 30m in height and possessing diameters in excess of 1000mm were prevalent throughout. The shrub layers were mostly intact with only minor infiltration of Lantana. In some locations Cockspur Vine was prevalent in the shrub layer and on occasion extended into the upper strata. The groundcover was heavily degraded and dominated by exotic grasses.	This community was commonly recorded fringing Bee, Brumby, Hail and Middle Creeks and their minor tributaries.	 T105 (Hail Creek): looking south  S017 (Bee Creek): looking east

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
		and Ribbonwood. The low shrub layer, where present, was variously dominated by Creek Sandpaper Fig, Pegunny, Common Lantana, Sally Wattle and Gunn's Phyllanthus (*Phyllanthus gunnii*). The heavily degraded groundcover was most commonly dominated by Green Panic. Other frequently recorded species including Couch (**Cynodon dactylon*), Parthenium Weed, Sabi Grass, Angleton Grass, Indian Bluegrass, Black Speargrass and *Pratia concolor*. Species such as Curly Bluegrass (*Dichanthium fecundum*), Wild Sorghum (*Sarga leiocladum*), Spiny-headed Mat Rush (*Lomandra longifolia*) and River Grass (*Chionachne cyathophora*) were commonly encountered in some areas.	The bank structure of the various creeks supporting this community, Hail Creek in particular, was found to be markedly affected by high volume flow events. Bank shear resulting in cliffs in excess of 5m in height and fallen trees were frequently encountered.		 T023 (Middle Creek): looking south

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
11.3.27 Freshwater wetlands VM Act Status – Least Concern Biodiversity status – Of Concern EPBC Act status – *not applicable*	Remnant	The community was primarily representative of broad wetlands lacking woody vegetation Sparse to isolated specimens of Queensland Blue Gum, Carbeen and/or Poplar Box were commonly recorded on the fringes of the wetlands. The height of these trees ranged from 18 to 36m (median approximately 25m). The shrub layer, where present, was similarly limited to the fringes and dominated by isolated specimens or small clumps of Queensland Blue Gum and/or Sally Wattle. Associated species included Carbeen, Whitewood and Prickly Acacia (**Vachellia farnesiana*). The composition and cover of the groundcover layer was variable due to the amount of standing water present within the community. Commonly recorded species included *Eleocharis spp.* (*E. equisetin*a, *E. philippensis, E. plana, E. pallens, E. dulcis*), Spiny Mud Grass (*Pseudoraphis spinescens*), Swamp Lily (*Ottelia ovalifolia*), *Caldesia oligococca*, Tall Flat Sedge	Mostly intact community with a naturally very sparse canopy layer. Most patches of this community were holding water at the time of the survey and within the water bodies themselves were dominated by native aquatic vegetation. The composition of the groundcover fringing the wetlands were variable with some patches being degraded by exotic species such as Parthenium Weed, Awnless Barnyard Grass, Buddha Pea and Couch. The predominant threatening processes currently include fire threat, altered hydrological regimes, grazing and compaction by cattle, pigs and brumbies (particularly during the dry season) and	These wetlands were limited to broad depressions and old oxbows associated with Hail and Middle Creeks. A large wetland is also located approximately 500m north-east of the confluence of Brumby and Hail Creeks. The size of this wetland may have been increased by the construction of a low dam wall in its south-eastern extent.	 S012 (north-east of Hail Creek): looking south  S016 (Hail Creek): looking west

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
		(*Cyperus exaltatus*), Brown Beetle Grass, Monochoria, Wavy Marshwort, Creeping Water Primrose (*Ludwigia peploides ssp. montevidensis*), Nardoo, Curly Pondweed (*Potamogeton tricarinatus*), Water Couch (*Paspalum distichum*) and *Polygonum plebeium*.	suppression of natural regeneration or recruitment due to competition of exotic pastoral grasses and herbs.		
11.4.2 *Eucalyptus spp.* and/or *Corymbia spp.* grassy or shrubby woodland on Cainozoic clay plains VM Act Status – Of Concern Biodiversity status – Of Concern EPBC Act status – *not applicable*	Remnant	The canopy was dominated by Carbeen and Narrow-leaved Red Ironbark. Clarkson's Bloodwood, Poplar Box and Queensland Blue Gum were also common components of the canopy. The height of this layer ranged from 16 to 24m (median 18m) and had a crown intercept of 10 to 30%. The sub-canopy was dominated by Narrow-leaved Ironbark and Variable-barked Bloodwood (*Corymbia erythrophloia*) with Carbeen, Clarkson's Bloodwood, Poplar Box and Dallachy's Gum other commonly recorded species. The shrub layer was dominated by Variable-barked Bloodwood with juvenile canopy species, Sally Wattle and Corkwood	The cover of the canopy layer was highly variable with some large holes prevalent. The cue for these holes was not readily evident. The groundcover was primarily dominated by native species, although Parthenium Weed was frequently recorded in the vicinity of stock watering points and associated farm tracks in the north-eastern portion of the patch.	This community was limited to a gently-undulated low rise on the southern side of Hail Creek in the north-eastern portion of the Study Area.	 BC015: looking north

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
		Wattle (*Vachellia bidwillii*) occurring occasionally. The groundcover was found to be relatively intact and dominated by Black Speargrass, with associated Forest Bluegrass, Desert Bluegrass, Wiregrasses (*Aristida spp.*) and Cup Grass (*Eriochloa crebra*).			 T053: looking west
11.9.2 Mountain Coolabah grassy woodland to open-woodland. VM Act Status – Least Concern Biodiversity status – No Concern at Present	Remnant	The canopy layer was exclusively dominated by Mountain Coolabah and ranged in height from 11 to 23m (median height 15m) and possessed a crown intercept of between 10 to 30% (average 15%). The very sparse sub-canopy layer was also dominated by Mountain Coolabah but included a number of additional species such as Dallachy's Gum, Variable-barked Bloodwood and Poplar Box. The tall and low shrub layers displayed some variability in	Although naturally sparse the condition of this community ranged from moderately fragmented to moderately intact with most areas tending towards relatively intact. In heavily fragmented areas canopy dieback was prevalent with the underlying cause unknown. The groundcover throughout was mostly dominated by native	This vegetation type was recorded throughout the Study Area, but was most prevalent along the south-eastern boundary and within the south-western portion of the Study Area.	 BC015: looking north

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
EPBC Act status – *not applicable*		terms of dominance but were usually dominated by Whitewood with other prominent species including Dead Finish (*Archidendropsis basaltica*), juvenile upper strata species, Wallaby Apple, Sally Wattle, Emu Apple (*Owenia acidula*) and Currant Bush. The groundcover was generally dominated by native grasses, which included Forest Bluegrass, Black Speargrass, Desert Bluegrass, Kangaroo Grass, Golden Beard Grass (*Chrysopogon fallax*) and Queensland Bluegrass. Small groves of vine thicket generalists growing on small rocky outcrops were recorded throughout the broad distribution of Mountain Coolabah between Absent and Middle Creeks as well as the patches along the central portion of the eastern boundary of the Study Area. These groves, which were mostly less than 100m^2 in area were dominated by stunted Burdekin Plum. Other commonly occurring species included Yellow Tulip, Stiff Denhamia,	grasses. Indian Bluegrass and Buffel Grass (**Pennisetum ciliare*) were recorded in some areas but never as the dominant cover. The predominant threatening processes currently include thinning, inappropriate fire regimes and weed infiltration from tracks and drill-pads.		 T053: looking west  vicinity of S006: small grove of vine thicket

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
		Scrub Wilga, Muttonwood, Sandalwood, Scrub Boonaree, Narrow-leaved Croton (*Croton phebalioides*) and Small-leaved Ebony.			
11.9.4 Semi-evergreen vine thicket, generally dominated by a low tree layer (5-10m high) which is floristically diverse and variable. VM Act Status – Of Concern Biodiversity status – Endangered EPBC Act status – Endangered	Remnant	The ecologically dominant layer of the various distributions of this vegetation type was generally dominated by the shrub layer. The emergent layer, where present, supported species such as Belah, Mountain Coolabah, Yellowwood and False Sandalwood. The canopy layer of this community was dominated by Yellowwood and False Sandalwood. The height of the canopy layer ranged from 5 to 9m (median 8m) and a crown intercept of 20 to 40%. The mid-dense shrub layer was dominated by Scrub Wilga, Yellowwood and Cocaine Bush (*Erythroxylum australe*). The shrub layer ranged in height from 1 to 5m (median height 3m) and had a cover intercept ranging from 70 to 80%. Other shrub species included Scrub Boonaree, Wallaby Apple, Peach Bush, Yellow Aspen Read Ash, Stiff Denhamia, Currant Bush, Stiff Jasmine (*Jasmine*	The remnant distributions of these patches were generally representative of dense thickets and in most cases excluded weed infiltration. Species such as Buffel Grass, Green Panic and Blue Billygoat Weed (**Ageratum houstonianum*) were occasionally recorded in the more intact patches, but dominated the more fragmented areas of regrowth thicket. The predominant threatening processes currently include further clearing, inappropriate fire regimes, cattle utilisation and suppression of natural regeneration or	This vegetation type was limited to the eastern portions of the Study Area where they occur as small patches. Two patches were recorded on the northern and eastern side of a small grove of remnant Brigalow.	 S020: looking south

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
		volubile), Small-fruited Mock Olive and Corky Milk Vine (*Secamone elliptica*). The mid-dense groundcover was dominated by *Aristida gracilipes* and Brigalow Grass (*Paspalidium caespitosum*). Other commonly recorded species included Whisker Grass, *Dichanthium tenue* and Tall Chloris.	recruitment due to competition of exotic pastoral grasses.		 Q125 (regrowth): looking north
11.9.5 Brigalow and/or Belah open forest on fine-grained sedimentary rocks VM Act Status – Endangered Biodiversity status – Endangered EPBC Act status –	Remnant	The canopy layer within this community was dominated by either Brigalow or Belah and had a height that ranged from 12 to 21m (median 16m) and a crown cover intercept ranging from less than 2 – 80%. Regrowth and degraded areas tended to have a crown intercept at the lower end of this range while within more intact areas the crown intercept averaged approximately 70%. The only other species recorded within the canopy layer was Poplar Box, which was recorded infrequently. The very sparse to sparse sub-canopy, where present, was dominated by	Highly variable community with a canopy ranging from intact to fragmented. Most areas tending toward relatively intact but still with large canopy holes throughout and most patches small and fragmented. There was evidence of historical clearing within many areas. In addition, the land surface was heavily eroded within some patches. Many areas heavily utilised by	The main distribution of this vegetation type is located on the eastern side of Hail Creek, approximately 1000m south-east of the Rocky Bar crossing. This distribution included Belah and Brigalow dominant remnant and regrowth vegetation. Small groves of remnant Brigalow were recorded in	 S018 (regrowth Belah): looking north

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
Endangered		upper strata species with Yellowwood, False Sandalwood and Queensland Bottle Tree (*Brachychiton rupestris*) occurring occasionally. Two shrub layers were usually present with the very sparse to sparse tall shrub layer being variably dominated by upper strata species and associated species such as Cocaine Bush, Soft Acalypha, Scrub Wilga, Scrub Boonaree, Scrub Leopardwood, Yellowwood and False Sandalwood. The isolated to mid-dense low shrub layer (where present) was usually dominated by Soft Acalypha or Currant Bush. The groundcover was also variously composed due to numerous factors such as over-utilisation by cattle, presence of gilgai, density of crown cover and size of the patch. Commonly encountered species within fragmented and/or degraded patches included Buffel Grass, Indian Bluegrass, Brigalow Grass, Wiregrasses (*Aristida spp.*), Forest Bluegrass, and/or Green Panic. More intact areas were usually	cattle and as such the groundcover at times displayed high levels of degradation. Groundcover health was equally variable with some areas dominated by native grasses and others by exotic species. The predominant threatening processes currently include thinning, inappropriate fire regimes (Pers Comms Martine Goldner (RTCA), 6 February 2012), cattle utilisation and suppression of natural regeneration or recruitment due to competition of exotic pastoral grasses.	the south-eastern corner of the Study Area and on the western side of the operational mining area.	 BC004 (Brigalow): looking west  BC023 (Brigalow): looking south

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
		dominated by Brigalow Grass with other dominant species including Curly Windmill Grass, Whisker Grass, Mulga Fern, Purple Lovegrass (*Eragrostis lacunaria*), Tall Windmill Grass and Slender Canegrass (*Dinebra decipiens*). The gilgai areas commonly supported species such as Native Thyme (*Ocimum tenuiflorum*), *Cyperus spp*., Brown Beetle Grass, Lesser Joyweed, Monochoria, *Cyanotis axillaris* and Nardoo.			 T083 (Brigalow regrowth): looking north
11.9.7 Poplar Box, False Sandalwood shrubby woodland on fine-grained sedimentary rocks VM Act Status – Of Concern Biodiversity status – Of Concern	Remnant	This canopy layer of this community was dominated by Poplar Box and had a height range from 10 to 17m (median 15m) and crown intercept ranging from 10 to 40% (average 20%). Infrequently recorded species within the canopy layer included Narrow-leaved Red Ironbark, Carbeen and Clarkson's Bloodwood. The sub-canopy was also dominated by Poplar Box. Species such as Narrow-leaved Ironbark, Sally Wattle and Brush Myrtle were infrequently recorded within this layer.	The canopy layer within this community was found to be mostly intact although occasional canopy holes were recorded in some areas, the cause of which is unknown. The groundcover layer was generally dominated by native grasses. Species such as Buffel Grass, Indian Bluegrass and Sabi Grass were occasionally dominant.	This vegetation type was commonly encountered within the eastern half of the Study Area. Smaller distributions were recorded on the western side of the mine and south of Middle of Creek.	 S010: looking south

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
EPBC Act status – *not applicable*		The very sparse shrub layer, where present, was variously dominated by Whitewood, Poplar Box, False Sandalwood and Sally Wattle. Other species recorded within the shrub layer include Dead Finish, Brush Myrtle, Beefwood, Western Rosewood, Vine Tree (*Ventilago viminalis*) and Coffee Bush. The groundcover was generally dominated by Forest Bluegrass, Desert Bluegrass or Black Speargrass. Other species included Pitted Bluegrass, Kangaroo Grass, Wiregrasses, Golden Beard Grass, Tall Chloris, Hairy Panic and Silky Browntop.	threatening processes currently include thinning, inappropriate fire regimes, overgrazing and suppression of natural regeneration or recruitment due to competition of exotic pastoral grasses.		 T091: looking east
11.9.9 Narrow-leaved Red Ironbark woodland on fine-grained sedimentary rocks VM Act Status – Least Concern Biodiversity	Remnant	The height of canopy layer, which was dominated by Narrow-leaved Red Ironbark, ranged from 12 to 20m (median 15m), The cover intercept ranged from 15 to 40% (average 20%). Other canopy species included Poplar Box, Variable-barked Bloodwood, Ironwood (*Acacia excelsa ssp. excelsa*) and Dallachy's Gum. The very sparse to sparse sub-canopy was dominated by Narrow-leaved Red Ironbark	Overall the canopy layer was relatively to moderately intact with only small areas fragmented by various causes. Erosion associated with gullies appeared to be one such cause of this fragmentation with canopy dieback another. The cause of the observed dieback is unknown. Historical clearing was evident in	This vegetation type was commonly recorded throughout the Study Area.	 S011: looking south

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
status – No concern at present EPBC Act status – *not applicable*		and/or Variable-barked Bloodwood. Other species included Dallachy's Gum, Ironwood, Poplar Box, Brigalow and Corkwood Wattle. The composition of the tall shrub layer found to be relatively variable. Dominant species included juvenile canopy species, Whitewood, Beefwood, Prickly Pine, Quinine Bush, Scrub Myrtle and Showy Wattle (*Acacia decora*). The low shrub layer (where present) was equally variable but mostly dominated by Whitewood. The groundcover layer was most often dominated by Black Speargrass or Kangaroo Grass. However some areas were dominated by the exotic Indian Bluegrass. Other frequently recorded groundcover species included Hairy Panic, Barbed Wire Grass and Desert Bluegrass.	some areas. The groundcover was mostly intact with only small areas dominated by exotic grass species. The predominant threatening processes currently include thinning, fire threat, overgrazing and suppression of natural regeneration or recruitment due to competition of exotic pastoral grasses.		 T111: looking east

Regional Ecosystem	Remnant Status	Species and Structural Composition	Condition	Location	Representative Photograph
11.12.1 Narrow-leaved Red Ironbark woodland on igneous rocks VM Act Status – Least Concern Biodiversity status – No concern at present EPBC Act status – *not applicable*	Remnant	The canopy of this community was dominated by Narrow-leaved Red Ironbark and had a height that ranged from 12 to 17m (median 15m) and a crown intercept ranging from 10 – 15%. Other canopy species present included Dallachy's Gum and Variable-barked Bloodwood. The sub-canopy, and potentially the ecologically dominant layer, was dominated by Variable-barked Bloodwood and Narrow-leaved Red Ironbark and had a median height of 9m and cover intercept of 25%. The very sparse shrub layer was dominated by juvenile canopy species with Wallaby Apple occurring infrequently. The groundcover layer was dominated by Kangaroo Grass and Black Speargrass. Other commonly recorded species included India Bluegrass, Cockatoo Grass (*Alloteropsis semialata*), Hairy Panic, Queensland Bluegrass and Barbed Wire Grass.	Relatively intact community with consistent canopy distribution. Although exotic species were present the groundcover was most often dominated by native grasses. The predominant threatening processes currently include thinning, fire threat, cattle utilisation and suppression of natural regeneration or recruitment due to competition of exotic pastoral grasses.	This community is widespread on the property to immediate north, which is referred to as "Lot 13". However, within the Study Area this community was limited to a small knoll in the far north-western corner.	 T112: looking north

Table 14: Area of field-validated vegetation in the Study Area

RE Code	Short Description	Remnant Vegetation (ha)
11.3.2	Poplar Box (*Eucalyptus populnea*) woodland on alluvial plains	580.5
11.3.2b	Palustrine wetland within Poplar Box woodland (e.g. vegetated swamp).	3.0
11.3.4	Queensland Blue Gum (*Eucalyptus tereticornis*) and/or *Eucalyptus spp*. woodland on alluvial plains.	844.0
11.3.11	Semi-evergreen vine thicket on alluvial plains	1.5
11.3.21	*Dichanthium spp., Astrebla spp*. grassland on alluvial plains, Cracking clay soils.	42.0
11.3.25	Queensland Blue Gum woodland fringing drainage lines.	21.5
11.3.25a	Riverine wetland or fringing riverine wetland. Black Ironbox (sometimes emergent), Weeping Paperbark (*Melaleuca fluviatilis*) woodland.	192.0
11.3.27	Freshwater wetlands.	30.0
11.4.2	*Eucalyptus spp*. and/or *Corymbia spp*. grassy or shrubby woodland on Cainozoic clay plains	95.0
11.9.2	Silver-leaved Ironbark (*Eucalyptus melanophloia*) ± Mountain Coolabah (*E. orgadophila*) woodland on fine-grained sedimentary rocks.	831.0
11.9.4	Semi-evergreen vine thicket or Brigalow (*Acacia harpophylla*) with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks.	10.0
11.9.5	Brigalow and/or Belah (*Casuarina cristata*) open forest on fine-grained sedimentary rocks.	50.0
11.9.7	Poplar Box, False Sandalwood (*Eremophila mitchellii*) shrubby woodland on fine-grained sedimentary rocks.	2,108.5
11.9.9	Narrow-leaved Red Ironbark (*Eucalyptus crebra*) woodland on fine-grained sedimentary rocks.	1,792.5
11.12.1	Narrow-leaved Red Ironbark woodland on igneous rocks.	7.0
Totals		**6,608.5**

Table 15 compares the extent of each remnant RE within the Study Area against that remaining in the in the Brigalow Belt Bioregion and the Northern Bowen Basin Sub-region. The vegetation in the Study Area accounts for a small amount of the sub-region. The large areas of REs 11.9.7 and 11.9.9 account for 2% and 1.4% of each of these REs, respectively, in the Bioregion and the Study Area accounts for 7.9% of RE 11.3.11 and 7% of RE11.9.7 in the sub-region. This data has been derived from a metadata supplement which has been produced in conjunction with a report detailing the current extent of remnant vegetation in Queensland (Accad et al. 2012). This report and the associated metadata provide a comprehensive analysis of the amount of pre-clearing (the predicted extent of each vegetation type prior to European settlement and clearing practices) and remnant vegetation in Queensland and the extent of clearing of remnant vegetation, based on individual REs.

Of note, is the limited distribution of RE 11.3.11 in the sub-region, this RE is Endangered, although, the majority of this RE occurs in other sub-regions within the Brigalow Belt Bioregion. The patch of RE 11.3.11 in the Study Area is quite small (less than 2ha) and would fail to be a mapable entity at a scale of 1:100,000, which is the scale applied to the State's regulated vegetation mapping. It is likely that these REs may, under broad mapping datasets such as the NRM mapping, be

incorporated into the surrounding RE (e.g. REs 11.3.4 or 11.3.25). The primary reason for mapping these units at the property scale was driven by the criteria for assessing the compliance of these areas with the condition thresholds of the TECs listed under the EPBC Act. The distribution of RE 11.3.11 accounts for 7.9% of the RE in the sub-region, which could be considered regionally significant or an indication of the typical size of these vegetation types, which are unlikely to be captured and therefore underrepresented in regional scale mapping.

Table 15: Comparison of Remnant Regional Ecosystems remaining in the Northern Bowen Basin Subregion and Brigalow Belt Bioregion

RE Code	Remnant Vegetation Remaining (ha) (Accad et al. 2012)			Remnant vegetation in the Study Area		
	Northern Bowen Basin	Brigalow Belt Bioregion	Brigalow Belt Protected Areas	Area (ha)	% of Sub-region	% of Bioregion
11.3.2	31495	514464	10178	583.5	1.9	0.1
11.3.4	18111	182982	3806	844.0	4.7	0.5
11.3.11	19	2367	573	1.5	7.9	0.1
11.3.21	2383	52497	196	42.0	1.8	0.1
11.3.25	35119	513144	8437	213.5	0.6	<0.1
11.3.27	760	48991	2098	30.0	3.9	0.1
11.4.2	6067	34923	488	95.0	1.6	0.3
11.9.2	40434	146508	16522	831.0	2.1	0.6
11.9.4	2800	33505	7120	10.0	0.4	<0.1
11.9.5	10549	165734	21158	50.0	0.5	<0.1
11.9.7	30219	106955	1066	2,108.5	7.0	2.0
11.9.9	61917	123870	4089	1,792.5	2.9	1.4
11.12.1	2739	846633	24213	7.0	0.3	<0.1

4.2.2 *Groundwater Dependent Ecosystems*

Field surveys confirmed that the majority of vegetation communities within the Study Area are largely dependent on rainfall and surface water flow regimes. Hydrobiology identifies the potential for groundwater intrusions to surface waters (Hydrobiology 2015). DPM Enviroscience's' (2015a), review of the GDE Atlas (Appendix H) suggests that within the Study Area and surrounds the following GDEs potentially occur:

- GDEs reliant on surface expression of groundwater, including:
  - Areas of high potential for groundwater interaction along Hail Creek and Middle Creek
  - Areas of moderate potential for groundwater interaction in palustrine wetlands
  - Areas of low potential for groundwater interaction.
- GDEs reliant on subsurface groundwater (vegetation), including:
  - Areas with high potential for groundwater interaction, comprising riparian vegetation fringing higher order streams.
- Inflow dependent ecosystems are:
  - Highly likely to be represented by the southern-most palustrine wetland

- Likely to be represented by riverine wetlands and the northern-most palustrine waterbody (Figure 10).

4.3 Floristic Diversity

A total of 515 flora species representing 97 families and 304 genera were recorded from the Study Area. The dominant family group in the Study Area is Poaceae, with Asteraceae, Fabaceae, Cyperaceae and Myrtaceae also prominent. The dominant family groups exemplify the overall type, composition and condition of vegetation in the Study Area, with the groundcover layer being the most diverse. The species inventory included 73 (14%) exotic species, four of which are listed as Class 2 pests and one as a Class 3 pest under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act). A list of the flora species recorded from the Study Area is presented in Table I1 of Appendix I in their respective RE type.

The various woodland communities were found to have relatively high species diversity, although this may also be a function of the application of a significantly greater number of survey sites within these communities due to a greater overall presence within the Study Area. Low species diversity was observed within the wetlands, natural grassland, SEVT and woodlands on Cainozoic clay plains.

The species richness was greatest within Narrow-leaved Red Ironbark woodland (RE 11.9.9), Poplar Box Woodland (RE 11.9.7) Mountain Coolabah woodland (RE 11.9.2), Poplar Box woodland on alluvium (RE 11.3.2), mixed complex woodland on alluvial plains (RE 11.3.4) and Brigalow open forest (RE 11.9.5) communities.

4.4 Conservation Significant Flora Species

4.4.1 *EPBC Act Listed Flora*

One flora species, Black Ironbox, listed as Vulnerable under the EPBC Act, was identified within the Study Area during field surveys. One other EPBC Act listed flora species, Siah's Backbone (*Streblus pendulinus*), was recorded in the Study Area in RE 11.3.11 in the far north-east of the Study Area.

Based on review of database search results and habitat identified in the Study Area, no other EPBC Act listed flora species are considered to potentially occur in the Study Area. The likelihood of all other species, returned from database search results, occurring in the Study Area is presented in Appendix F.

Black Ironbox

Black Ironbox is a medium-sized tree to 25m, with rough, box-type bark on the trunk and base of largest branches. The bark is grey over brown, thick and longitudinally fissured. Adult leaves are strongly discolorous. The fruit is very shallowly hemispherical, to 0.2 x 0.2cm, and 3 or 4 valves are present and strongly exerted (Brooker & Kleinig 2008; SEWPaC 2013, Accessed 28 August 2013). There are two distinguishing features unique to this species; branchlets have a glandular pith and this species has the smallest fruit of any eucalypt (SEWPaC 2013, accessed 28 August 2013).

Black Ironbox occurs as scattered and disjunct populations in central coastal and sub-coastal Queensland, from Dipperu National Park south-west of Mackay, north to Charters Towers, Bowen and Ayr, in and 100km around Rockhampton and near the Mackenzie River north of Duaringa. It has been recorded from approximately 23 locations, in two main areas; Nebo to Ayr and Aps Creek to Rockhampton (Brooker & Kleinig 2008; SEWPaC 2013, Accessed 28 August 2013).

Population estimates in the Hail Creek ML have been undertaken using November 2013 survey data, provided in Table I2 of Appendix I, and previous survey information collected by SKM in 2009 (SKM 2010b). The 2009 SKM survey comprised 12 transects. Analysis of both sets of data revealed some discrepancies, although in general the average number of Black Ironbox recorded per lineal kilometre was very similar.

Based on the combination of survey data, densities of this species were found to range from an average of 54 individuals per lineal kilometre along Brumby and Middle Creeks and 105, 124 and 87 individuals per lineal kilometre along Hail Creek lower, middle and upper, respectively. Therefore, approximately 4,570 individuals (between 4080 and 5065 individuals) are estimated to occur in the wider Hail Creek Mine in areas mapped as RE 11.3.25a. This range represents the multiplication of the average number of specimens per lineal kilometre by the total length of RE 11.3.25a within the broader Hail Creek Mine surface rights boundary (Figure 11). A 95% confidence interval using T tables was applied to the standard error of these averages to produce the range.

Low value habitat is considered to be all of those areas in the Study Area characterised by RE 11.3.25 upstream of where Black Ironbox has been recorded, but which does not currently support Black Ironbox as these areas potentially provide suitable habitat for colonisation by Black Ironbox. A small pocket of monsoon SEVT with emergent Burdekin Plum and Black Ironbox (RE 11.3.11) was recorded in the far north-east boundary of the Study Area. Black Ironbox was recorded in the lower reaches of Schammer Creek within both remnant and non-remnant RE 11.3.25a, while a single mature individual was recorded in the upstream reaches of Schammer Creek. Outlying specimens of Black Ironbox were also recorded in the western portion of Brumby Creek that terminates at the western boundary of Hail Creek ML (outside the Study Area) (Figure 11). These outliers were not factored into the estimated range of specimens within the Study Area due to their low numbers and inability to significantly affect the standard error of the quantification methodology. The Study Area supports 193.0ha of high value and 17.0ha of low value habitat for this species (Figure 11).

The population of Black Ironbox occurring in the Study Area could be considered an important population as it potentially occurs at the western limit of this species' range. This is discussed in Appendix K.

Siah's Backbone

On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. This species occurs in the altitudinal range from near sea level to 800m above sea level. The species grows in well developed rainforest,

gallery forest and drier, more seasonal rainforest ((DotE 2015a) Date accessed 26 March 2015).

Although this species is listed as Endangered under the EPBC Act, the listing of Siah's Backbone was originally in relation to the Norfolk Island population, where less than 200 individuals persist. Since the EPBC Act listing, a taxonomic variation occurred and the species now includes the mainland populations that were previously included with *Streblus brunonianus* ((DotE 2015a) Date accessed 26 March 2015). The mainland variant is considered fairly common and widespread, occurring between Cape York Peninsula to Milton in south-east New South Wales ((DotE 2015a) Date accessed 26 March 2015).

Within the Study Area approximately 50 individuals occur within RE 11.3.11 only, in the north-east of the Study Area. This patch of SEVT provides the only viable habitat for the species in the Study Area and accounts for 1.5ha. This species is listed as Least Concern under the NC Act. The location of this species outside the approximate surface disturbance extent is discussed in Section 7.3.5.

*King Bluegrass (*Dichanthium queenslandicum*)*

Field surveys undertaken in 2012 indicated the presence of the EPBC Act listed Endangered, King Bluegrass (*Dichanthium queenslandicum*) in the Study Area and which was included in the Referral of the Project under the EPBC Act in mid-2014. However, the true identification of this grass species has since been resolved in late 2014 through a series of voucher specimens sent to the Queensland Herbarium. The grass species was confirmed by the Queensland Herbarium as, Rat's Tail Grass (*Sehima nervosum*), rather than King Bluegrass. Rat's Tail Grass is not conservation significant under the EPBC Act or NC Act.

King Bluegrass is considered unlikely to occur in the Study Area as extensive seasonal field surveys have not located this species and habitat in the Study Area is not preferred by this species.

4.4.2 *NC Act Listed Flora*

No NC Act listed flora species are considered likely to occur in the Study Area due to a lack of suitable habitat and no known nearby records.

4.4.3 *Exotic Flora*

Field surveys recorded five exotic flora species listed under the Queensland LP Act throughout the Study Area. Four of these species are also Commonwealth listed Weeds of National Significance (WoNS). An additional exotic plant, Prickly Acacia (**Vachellia farnesiana*) is noted due to its particularly invasive nature. Table 16 lists each of these exotic species.

Table 16: Exotic flora in the Study Area

Species	WoNS	LP Regulation	Regional Ecosystems Supporting Species
Prickly Acacia (**Vachellia farnesiana*)	Not listed	Not listed	Recorded infrequently, in non-remnant areas nearby watercourses and REs 11.3.2, 11.3.4, 11.3.21 and 11.9.7.
Harrisia Cactus (**Eriocereus martinii*)	Not listed	Class 2	Recorded infrequently, predominantly in Brigalow and SEVT (REs 11.9.2, 11.9.4, 11.9.5 and 11.3.11).
Common Lantana (**Lantana camara var. camara*)	Yes	Class 3	Recorded occasionally along watercourses in remnant and non-remnant areas (REs 11.3.4, 11.3.25 and 11.3.25a, with a single specimen recorded in RE 11.9.9).
Common Prickly Pear (**Opuntia stricta*)	Yes	Class 2	Recorded infrequently in remnant REs 11.9.2 and 11.9.9.
Velvet Prickly Pear (**Opuntia tomentosa*)	Yes	Class 2	Recorded frequently in remnant areas (REs 11.9.2, 11.9.7, 11.9.5, 11.3.11, 11.3.4).
Parthenium Weed (**Parthenium hysterophorus*)	Yes	Class 2	Recorded commonly throughout the Study Area in remnant and non-remnant areas, including two large infestations (REs 11.3.2, 11.3.4, 11.3.21, 11.3.25, 11.3.25a, 11.4.2, 11.9.2, 11.9.4, 11.9.5, 11.9.7, 11.9.9).

5 Field Fauna Results

5.1 Habitat and Landscape Connectivity

The maintenance of landscape connectivity between patches of habitat is a fundamental aspect of conservation ecology (Endler 1977 Forman 1995). Habitat corridors are often recommended to maintain and/or enhance landscape connectivity (Bennett et al. 1999).

The majority of the Study Area supports remnant vegetation, and although the entire Study Area is subject to current and historical disturbance in the form of thinning, frequent fire regime and grazing, connectivity throughout the Study Area and with the adjacent landscape is maintained. The Study Area forms part of a broader landscape corridor network. This is recognised through the Biodiversity Planning Assessment Mapping (Figure 8), with state and regionally significant corridors to the north and south of the Study Area.

The Creeks throughout the Study Area also provide further linkage between drainage basins and ranges to the north, for species with smaller home ranges, such as amphibians and reptiles.

5.2 Habitat Assessment

The habitat in the Study Area has been disturbed in the form of past thinning, grazing and a frequent fire regime. However, habitats in the Study Area are of moderate to high value due to connectivity to other intact and diverse areas in the landscape (e.g. Homevale National Park), and general low exotic species cover in most habitat types. Six broad habitat types were identified in the Study Area, with Eucalypt Woodlands and Open Forests accounting for largest area habitat in the Study Area (Figure 13). These habitats are formed by both remnant and non-remnant vegetation.

Eucalypt Woodlands and Open Forests

The Study Area supports large areas of eucalypt woodlands and open forests, which are primarily dominated by Poplar Box, Mountain Coolabah, Queensland Blue Gum, Carbeen and/or Narrow-leaved Ironbark. These areas of vegetation are considered to be of moderate habitat value. They have low to moderate numbers of mature hollow bearing trees, a low cover of deep leaf litter and fallen timber and a variable groundcover from being dominated by native species in some areas, to dominated by exotic species in other areas. However, these areas of vegetation are well connected to other areas of native vegetation.

Riparian vegetation

The areas of riparian vegetation that fringe the waterways within the Study Area are considered to be of moderate habitat value. These areas of vegetation generally have a greater number of mature hollow bearing trees but these are often limited to a narrow band along the banks of the waterways. The riparian vegetation has few areas of deep leaf litter, moderate cover of fallen timber and a moderate cover of exotic species. Due to the majority of the Study Area

supporting remnant vegetation, these areas of vegetation are well connected to other areas of native vegetation.

Brigalow

The Brigalow vegetation within the Study Area is considered to be of moderate habitat value. It supports mid-mature Brigalow vegetation with most trees having a DBH of less than 20cm, has abundant fallen timber although most fallen timber is also less than 20cm in diameter and some limited areas of deep leaf litter and some surface rock in the north. The understorey is a mix of native and exotic species. The Brigalow has well developed, extensive gilgai, particularly in the north that tend to become less extensive and shallow towards the south. The isolated patches of Brigalow tend to have very limited and/or shallow gilgai.

Natural Grasslands

The area of natural grassland in the south of the Study Area is considered to be of moderate habitat value. The vegetation type naturally lacks the structural habitat elements such as hollow bearing trees, fallen timber and leaf litter that provide micro-habitat features for a variety of fauna species. However, the natural grassland area within the Study Area is considered to be of moderate habitat value as it is dominated by native species with a low cover of exotic weeds.

Wetlands

The wetlands within the Study Area are considered to be of moderate habitat quality. Wetlands are largely restricted to the large wetland in the centre of the Study Area and smaller wetlands close to Hail Creek in the south of the Study Area. The large central wetland is likely to have been a natural feature but a constructed earthen wall has augmented this wetland area. This wetland supports a good cover of native aquatic and emergent plants with fringing mature trees providing roosting and nesting opportunities and occur within an area of remnant vegetation (Figures 10 and 13).

Another more permanent waterhole is located in the far north-eastern corner of the Study Area and is known locally as Brumby Waterhole (Figure 9). This waterhole is characterised by steep rocky sides and is likely to be used regularly as a watering point for wildlife within the Study Area and the adjacent Homevale National Park. The waterhole was found to support fringing vegetation, but aquatic and emergent flora was generally absent (DPM Envirosciences 2015). Nonetheless, the Brumby Waterhole complex may represent valuable dry season refuge and plays a role in sustaining local biotic diversity (DPM Envirosciences 2015).

All identified wetland areas are regularly utilised by cattle, wild horses and pigs, resulting in varying levels of degradation of wetland values

Vine Thicket

This community is limited to some small patches in the north-east and south-east of the Study Area and were considered to be high quality fauna habitat. These patches had a good cover of deep leaf litter with some mature hollow bearing trees as well as a moderate cover of fallen timber and a low cover of exotic species. These patches of vegetation were also well connected to other areas of remnant vegetation.

Cleared Areas

The relatively small areas that do not support remnant or substantial regrowth vegetation within the Study Area are considered to be of low habitat value. These areas lack most habitat elements such as hollow bearing trees, deep leaf litter and fallen timber and tend to support a high cover of exotic species.

5.3 Fauna Diversity

A total of 203 species of terrestrial vertebrate fauna were recorded during the fauna surveys, including 5 introduced species. Species included 119 birds, 38 mammals, 28 reptiles and 18 amphibians. A complete list of species recorded in the Study Area is provided in Tables J1 and J2 of Appendix J.

Species diversity was similar at most trap sites, with Trap Sites 2, 4, 8 and 11 exhibiting greatest diversity. Trap Sites 2 and 11 were located in Brigalow habitat (RE 11.9.5), whereas Trap Site 4 was in Riparian habitat (RE 11.3.25a) and 8 in Eucalypt Woodland (RE 11.3.4). Trap Sites 5 and 6 had lowest diversity, with 19 species recorded at each. These Trap Sites occurs in Eucalypt Woodlands (REs 11.9.7 and 11.9.9 respectively).

5.3.1 *Birds*

A total of 119 birds were identified in the Study Area during field surveys (Appendix J). Most commonly recorded species were; Black-faced Cuckoo-shrike (*Coracina novaehollandiae*), Torresian Crow (*Corvus orru*), followed by Noisy Friarbird (*Philemon corniculatus*), Blue-winged Kookaburra (*Dacelo leachii*), Little Friarbird (*Philemon citreogularis*), Pied Butcherbird (*Cracticus nigrogularis*), Rainbow Lorikeet (*Trichoglossus haematodus*) and Southern Boobook (*Ninox novaeseelandiae*). Supplementary Site 1 provided the greatest diversity of birds in the Study Area, with 27 species recorded at this central dam/wetland.

Two conservation significant bird species listed under the Queensland NC Act and/or the Commonwealth EPBC Act were recorded in the Study Area:

- Australian Painted Snipe.
- Squatter Pigeon

Another five bird species listed under the Migratory provisions of the EPBC Act were also recorded:

- Cattle Egret (*Ardea ibis*)
- Eastern Great Egret (*Ardea modesta*)

- Rainbow Bee-eater
- White-bellied Sea-eagle
- White-throated Needle-tail.

Further discussion about these species and their habitat in the Study Area is provided in Sections 5.5.1 and 5.5.2.

5.3.2 *Amphibians*

Field surveys recorded 18 amphibians in the Study Area, including the introduced Cane Toad (**Rhinella marinus*). This introduced species was recorded at 7 of the 11 Trap Sites as well as at 9 of the supplementary sites (Appendix J). The majority of species were recorded at Trap Site 2 in Brigalow (RE 11.9.5).

The most commonly occurring native amphibians recorded were the Green Tree Frog (*Litoria caerulea*), Spotted Marsh Frog (*Limnodynastes tasmaniensis*), Broad-palmed Rocket Frog (*Litoria latopalmata*) and Ornate Burrowing Frog (*Platyplectrum ornatum*). No conservation significant amphibian species were recorded in the Study Area and are considered unlikely to occur.

5.3.3 *Reptiles*

Habitat quality for reptiles is strongly influenced by attributes such as leaf litter, fallen logs and debris. The loss of these habitat elements very often occurs in disturbed environments and often leads to reductions in both diversity and abundance of reptiles. The majority of the Study Area has moderate habitat quality for reptiles, with low to moderate numbers of mature hollow bearing trees, a low cover of deep leaf litter and fallen timber and a variable groundcover. Field surveys recorded 28 reptile species in the Study Area, with Bynoe's Gecko (*Heteronotia binoei*), Iridescent Litter-skink (*Lygisaurus foliorum*), Ragged Snake-eyed Skink (*Cryptoblepharus pannosus*) and Open-litter Rainbow-skink (*Carlia pectoralis*) most commonly recorded (Appendix J).

One conservation significant reptile, the Ornamental Snake was recorded in the Study Area, at Trap Site 2 (TS2) in Brigalow habitat (RE 11.9.5). No other conservation significant reptiles are considered likely to occur in the Study Area. Further discussion about the Ornamental Snake and its preferred habitat in the Study Area is provided in Sections 5.5.1 and 5.5.2.

5.3.4 *Mammals*

A total of 38 mammal species were recorded in the Study Area during field surveys, including 20 species of microchiropteran bat. The most commonly recorded mammals were bats, i.e. Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*) and Hoary Wattled Bat (*Chalinolobus nigrogriseus*). Eastern Grey Kangaroo (*Macropus giganteus*) and Greater Glider (*Petauroides volans*) were also common.

Two conservation significant species were identified in the Study Area during field surveys. The Koala was identified at one location during vehicle based spotlighting in an ecotonal area between Poplar Box and Mountain Coolabah habitat, and has

been recorded by others at two other locations in the Study Area following spotter/catcher activities at Hail Creek Mine. This species is discussed further in Section 5.5.1.

The following five feral mammals were recorded:

- Wild Dog/Dingo *(*Canis lupus*)
- Feral Cat *(*Felis catus*)
- European Rabbit *(*Oryctolagus cuniculus*)
- Pig (*Sus scrofa*)
- Brumby (*Equus caballus*).

Feral animals are discussed further in Section 5.5.3.

5.4 Important Fauna Sites or Occurrences

While the Study Area doesn't support particularly important fauna sites, it has a reasonably high diversity and supports a substantial number of the conservation significant fauna species. This is most likely a result of its varied habitat and proximity to state and regionally significant areas such as Homevale National Park.

Although there are no large or regionally important wetland habitats in the Study Area, compared with the nearby Lake Elphinstone, which is located approximately 10km west of the Study Area, there are a number of smaller wetlands that are considered to provide stepping stones and supplementary habitat to Lake Elphinstone, being the central wetland, smaller areas of RE 11.3.27 in the south and various shallow ponded areas associated with alluvial plains that become waterlogged during seasonal rainfall. Also of note is a permanent waterhole along an upper tributary of Hail Creek in the far north-east of the Study Area, near RE 11.3.11. This waterhole is known as Brumby Waterhole and is very small waterhole located within a deep gorge.

5.5 Conservation Significant Fauna Species

5.5.1 *EPBC Act Listed Fauna*

Four EPBC Act listed fauna species were identified in or immediately adjacent the Study Area during field surveys. The identified species were:

- Squatter Pigeon (Southern) - Vulnerable (EPBC Act and NC Act)
- Koala - Vulnerable (EPBC Act, Special Least Concern (NC Act)
- Australian Painted Snipe - Endangered, also Migratory (EPBC Act and NC Act)
- Ornamental Snake - Vulnerable (EPBC Act and NC Act).

A further five fauna species listed as Migratory under the EPBC Act were also identified in the Study Area during the field survey. These species were:

- Cattle Egret
- Eastern Great Egret

- Rainbow Bee-eater
- White-bellied Sea-eagle
- White-throated Needle-tail.

Based on a review of database search results and habitat identified in the Study Area, an additional three fauna species listed as Migratory under the EPBC Act are considered highly or moderately likely to occur in the Study Area. These species are:

- Caspian Tern
- Fork-tailed Swift
- Latham's Snipe.

Each of the EPBC Act species listed above are discussed further below.

The likelihood of all species, returned from database searches, occurring in the Study Area is presented in Appendix G. Impacts to these species are discussed in Section 7.3 and 7.4.

Squatter Pigeon (Southern)

This species is known to inhabit tropical dry, open sclerophyll woodlands and occasionally open savannah. It appears to favour sandy soil dissected with low gravelly ridges and is less common on heavy soils with dense grass cover. It is nearly always found in close association with permanent water (Higgins and Davies 1996). This species is also often recorded from areas that do not support remnant vegetation, but in these areas it seems to be associated with clear, disturbed sites such as tracks and stockyards ((DotE 2014c) Date accessed 21 February 2014; S. Marston pers. obs.).

The Squatter Pigeon (southern) was recorded at a number of locations in the study Area during past and recent field surveys (Figure 14). The species was typically observed on tracks, cattle camps and water points. A total of 6,328.5ha of high value habitat occurs in the Study Area and is associated with all remnant and some areas of substantial regrowth vegetation communities, except REs 11.3.11, 11.3.27, 11.9.4 and 11.9.5, as these REs are considered too dense or waterlogged and less likely to be used by this species. A total of 721.5ha of low value habitat also occurs in the Study Area where there are scattered trees within 100m of high value habitat and in vegetation represented by RE 11.9.5 as Squatter Pigeons potentially move through this type of non-alluvial clay habitat as groundcover is typically more sparse this type of RE and cattle grazing throughout the Study Area as thinned the ground and mid-layers of these communities. The vegetation and habitat within the Study Area is commonly found throughout the surrounding region and is not considered to be unique or particularly significant for the Squatter Pigeon. It is estimated that at least 20,332ha of similar remnant habitat occurs within 5km of the Study Area based on remnant vegetation mapping for the region.

Koala

The Koala is listed as Vulnerable under the EPBC Act. It is widespread in sclerophyll forest and woodland on foothills and plains on both sides of the Great Dividing Range from about Chillagoe, Queensland to Mt Lofty Ranges in South Australia (Menkhorst and Knight 2011). The Koala inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by species from the genus *Eucalyptus* (Martin and Handrasyde 1999).

Essentially any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees provides potential Koala habitat. Koalas are known to occur in modified or regenerating native vegetation communities ((DotE 2014d) Date accessed 7 October 2014). The South East Queensland Koala Conservation State Planning Regulatory Provisions define Koala food trees as species of the Corymbia, Melaleuca, Lophostemon or Eucalyptus genera (DotE 2013a ERM 2010).

This species has been recorded at eight locations in the Study Area and one location within the operational mining area to the west of the Study Area (Figure 14). The most recent Koala sightings were in August 2014 in Queensland Blue Gum tall woodland on alluvial plains in the upper reaches of Hail Creek. The Koala is also likely to occur in the broader landscape in low densities. A total of 6,328.5ha of high value habitat occurs within the Study Area in the form of eucalypt open woodland, woodland and open forest, and riparian woodland. REs 11.3.11, 11.3.27, 11.9.4 and 11.9.5 do not form habitat for this species as these communities lack preferred feed and habitat trees, or in the case of REs 11.3.11, 11.9.4 and 11.3.27, are too difficult to move through. At least 20,332ha of similar remnant Koala habitat occurs within 5km of the Study Area in the broader landscape.

A number of known and potential feed tree species of the Koala were recorded throughout the Study Area, including:

- Narrow-leaved Red Ironbark (*Eucalyptus crebra*)
- Silver-leaved Ironbark (*Eucalyptus melanophloia*)
- Mountain Coolabah (*Eucalyptus orgadophila*)
- Poplar Box (*Eucalyptus populnea*)
- Black Ironbox (*Eucalyptus raveretiana*)
- Queensland Blue Gum (*Eucalyptus tereticornis ssp. tereticornis*)
- Long-fruited Bloodwood (*Corymbia clarksoniana*)
- Dallachy's Gum (*Corymbia dallachiana*)
- Carbeen (*Corymbia tessellaris*)
- Variable-barked Bloodwood (*Corymbia erythrophloia*).

In accordance with the Koala Habitat Assessment Tool in the *EPBC Act referral guidelines for the Vulnerable Koala* (DotE 2014b), the Study Area is considered to support habitat critical to the survival of the Koala, as outlined in Table 17, as:

- Koalas are known to use habitat in the Study Area
- The Study Area supports 6,328.5ha of Koala habitat that is connected with another 21,800ha of contiguous vegetation in Homevale National Park
- Hail Creek is likely to provide refuge habitat for this species during adverse climatic conditions.

Table 17: EPBC Act Koala habitat assessment

Attribute	**Inland Distribution**[3] (DotE 2014b)	**Score**	**Discussion**
Koala occurrence	Evidence of one or more Koalas within the last 5 years	+2	Koalas have been recorded at Hail Creek, the most recent being in August 2014.
Vegetation composition	Has forest, woodland or shrubland with emerging trees with 2 or more known Koala food tree species.	+2	Ten potential Koala feed trees were identified in the Study Area as outlined above. The Study Area contains habitat comprising two or more of these species. There is no evidence to suggest that Koalas don't feed from all of these species at some stage and/or in some areas.
Habitat connectivity	Area is part of a contiguous landscape ≥1000ha.	+2	6,328.5ha of Koala habitat occurs in the Study Area. The Study Area forms contiguous habitat with adjacent vegetated areas of the Homevale National park, which combined are greater than 28,000ha.
Key existing threats	Evidence of infrequent or irregular Koala mortality from vehicle strike or dog attack present in the Study Area.	+1	Historical records indicate that Koalas have been struck by vehicles at Hail Creek Mine in the past.
Recovery value	Habitat is likely to be important for achieving the interim recovery objectives for the inland context.	+2	The Koala habitat in the Study Area forms part of a large contiguous habitat area and the vegetation along Hail Creek is likely to provide refuge for Koalas during periods of drought and extreme heat. Therefore, the habitat in the Study Area is likely to be important for achieving the interim recovery objectives for the Koala.
Total Score		**9**	**Koala habitat in the Study Area, Figure 14, is considered to represent critical habitat under the EPBC Act referral guidelines for the vulnerable Koala.**

[3] The Study Area is considered to occur within the inland geographic contexts of the Koala, as the average annual rainfall for the nearest weather stations, being Nebo (033054) and Moranbah Airport (034035), is less than 800mm. It is noted that the Study Area is located close to the 800mm isohyet.

Australian Painted Snipe

The Australian Painted Snipe is a secretive, cryptic, crepuscular species that occurs in terrestrial shallow wetlands, both ephemeral and permanent. The species also utilises inundated grasslands, gilgai, saltmarsh, dams, rice crops, sewage farms and bore drains.

This species was recorded in a broad drainage line at the far southern end of the Study Area during the field survey (Figure 15). A total of 75.0ha of potential high value habitat occurs in the Study Area associated with the central wetland (RE 11.3.2b) and a number of small patches of REs 11.3.21 and 11.3.27 at the southern end of the Study Area (Figure 15). These areas form relatively permanent wetland habitat in the Study Area. A total of 1,336.5ha of potential low value habitat also occurs in the Study Area and is restricted to floodplain and wetland areas in REs 11.3.2 and 11.3.4 that become waterlogged during high rainfall (Figure 15) and therefore, potentially provide temporary habitat for this species.

Ornamental Snake

The Ornamental Snake is found in close association with frogs, which form the majority of its prey. It is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions with clay soils but is also known from lake margins, wetlands and waterways ((DotE 2014e) Date accessed 21 February 2014).

This species was recorded in the Study Area in Brigalow habitat to the east of Hail Creek during field surveys (Figure 15). A total of 105.5ha of high value habitat occurs in south of the Study Area in the form of remnant and regrowth RE 11.9.5 on the eastern side of Hail Creek. Only those areas of gilgai and particularly with Brigalow overstorey are considered habitat for this species in the Study Area and in close proximity to where the species has been recorded. Deep well formed gilgai is present throughout the remnant patch of Brigalow (RE 11.9.5), with gilgai in the southern regrowth patches of habitat being less defined and shallower. Gilgai habitat does not occur elsewhere in the Study Area.

The remnant polygon of RE 11.9.5 in the far east of the Study Area is substantially removed from all other habitat areas and it is considered unlikely the species would disperse the distance to the eastern patch. Potential impacts to the Ornamental Snake are discussed in Section 7.3.9.

Migratory Species

Cattle Egret

The Cattle Egret is found in tropical and temperate grasslands, wooded lands and terrestrial wetlands ((DotE 2014f) Date accessed 21 February 2014). Habitat for the Cattle Egret includes tropical and temperate grasslands, wooded lands and terrestrial wetlands. Predominantly shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora are used by this species ((DotE 2014f) Date accessed 21 February 2014). The species also occurs in moist poorly drained pastures, stock paddocks, croplands,

garbage dumps, and drains (Pizzey et al. 2012). The Cattle Egret is a colonial breeder and nests in the branches of inundated trees or on small islands ((DotE 2014f) Date accessed 21 February 2014).

One individual of this species was recorded in open grassy woodland habitat, RE 11.9.7 near the central wetland. The Cattle Egret could use habitat throughout the Study Area for foraging, particularly open or disturbed grazing areas near cattle. However, there is no important habitat for the Cattle Egret, in the form of nest sites or colonial roosts, within the Study Area.

Eastern Great Egret

This species occurs throughout Australia in wetland habitat, including; inland and coastal freshwater and saline, permanent and ephemeral, open and vegetation, large and small, natural and artificial swamps, marshes, rivers lakes, damp or flooded grasslands, pastures, reservoirs, drainage channels, salt pans, salt marshes, mudflats, mangrove swamps and lagoons, although it does not occur in the driest areas of Australia. Major breeding colonies occur in northern Australia, with minor colonies scattered through the species' distribution.

One individual of this species was recorded near a small pond outside to the west of the Study Area. This species is closely associated with water and will be confined to wetland areas in the Study Area. There is no important foraging or breeding habitat in the Study Area.

Rainbow Bee-eater

The Rainbow Bee-eater is found in a wide variety of habitats including open woodlands with sandy or loamy soil, sand ridges, sand banks, river banks, beaches, Mangroves and Rainforests (Pizzey et al. 2012). This species nests in burrows excavated in sandy ground, bank or cutting (Pizzey et al. 2012).

This species has been recorded in the far north-east corner of the Study Area in the vicinity of SEVT. The Rainbow Bee-eater is likely to overfly the Study Area. However, there is no important habitat for the species within the Study Area and no nest burrows were identified during field surveys.

White-bellied Sea-eagle

The White-bellied Sea-eagle is typically found in coastal areas particularly around islands, reefs, bays, headlands, beaches, estuaries, mangroves, swamps, lagoons and floodplains but will venture far inland along major rivers (Pizzey et al. 2012). The White-bellied Sea-eagle prefers large expanses of open water for foraging however, the species will also use nearby open grasslands ((DotE 2014g) Date accessed 21 February 2014).

This species has been recorded immediately adjacent the Study Area at the Hail Creek Mine polishing pond outflow. However, the Study Area does not contain any suitable habitat for the White-bellied Sea-eagle, in the form of large waterbodies or watercourses. The species' presence in the broader area is likely to be associated with significant rainfall events.

White-throated Needle-tail

In Australia, the White-throated Needletail is almost exclusively aerial ((DotE 2014h) Date accessed 21 February 2014), foraging in and over a variety of habitats including woodlands, open forest, rainforest, plains, lakes and towns (Pizzey et al. 2012). The species has been recorded roosting in trees in woodlands and forests amongst thick foliage and in hollows ((DotE 2014h) Date accessed 21 February 2015).

This species has been recorded over a partially cleared area towards the centre of the Study Area. The White-throated Needletail is likely to overfly the Study Area. However, there is no important habitat for the species within the Study Area as this bird does not breed while in Australia ((DotE 2014h) Date accessed 21 February 2015).

Caspian Tern

This species is widespread in Queensland, in coastal and inland environments. In addition to coastal environments, it occurs in fresh or saline lakes, wetlands, waterholes, artificial ponds, reservoirs, rivers and creeks. Breeding occurs most in coastal or island environments as well as inland on Lake Bindegolly and Lake Moondarra ((DotE 2015b) Date accessed 12 March 2015).

This species may use the Study Area infrequently during periods of high rainfall, particularly in open paddocks and around small dams and wetlands.

Fork-tailed Swift

The Fork-tailed Swift is a non-breeding visitor to Australia and is almost exclusively aerial ((DotE 2014i) Date accessed 21 February 2014). The species is an aerial forager typically over open habitats however, sometimes occurs above rainforests, wet sclerophyll forest or pine plantations and cities (Pizzey et al. 2012) ((DotE 2014i) Date accessed 21 February 2014).

This species was not recorded in the Study Area during field surveys. However, there is a moderate likelihood that the Fork-tailed Swift could overfly the Study Area as part of a wider foraging range.

Latham's Snipe

The Latham's Snipe is found across much of eastern Australia in areas of soft wet ground or shallow water with tussocks, wet paddocks, seepage below dams, irrigated areas, scrub or open woodland (Pizzey et al. 2012). The species can also occur coincidentally with the Painted Snipe (i.e. both species occupy similar habitats) (DotE 2014a) .

This species was not recorded in the Study Area during field surveys. However, there is a moderate likelihood that habitat for Latham's Snipe may occur in the Study Area during periods of high rainfall, particularly in open paddocks and around small dams and wetlands.

5.5.2 *NC Act Listed Fauna*

One NC Act listed Special Least Concern animal, the Short-beaked Echidna, was identified in the Study Area during field survey. No additional fauna species listed under the NC Act, other than those discussed in Section 5.5.1 were identified in or immediately adjacent the Study Area during field surveys.

Based on a review of database search results and habitat identified in the Study Area, the Glossy Black-cockatoo (Vulnerable) is considered highly likely to occur in the Study Area. This species and the Short-beaked Echidna is discussed further below. The likelihood of all species, returned from database searches, occurring in the Study Area is presented in Appendix G.

Glossy Black-cockatoo

The Glossy Black-cockatoo occurs in eucalypt woodlands with an understorey or sub-canopy of She-oaks (species of the *Casuarina or Allocasuarina* genus) on the seeds of which its diet is based (Garnett et al. 2011). This species nests in hollows, typically in Eucalypt trees that can be alive or dead (Garnett and Crowley 2000).

This species has been recorded at one location outside the Study Area as part of surveys in 2012 (Figure 16). A total of 244.0ha of potential high value habitat for the Glossy Back-cockatoo occurs in the Study Area in the form of remnant vegetation communities containing Casuarina and Allocasuarina species. This includes REs 11.3.25 and 11.3.25a fringing Hail and Middle Creeks and which contain River Oak (*Casuarina cunninghamiana*) and patches of remnant RE 11.9.5 in the south of the Study Area that contain Belah (*Casuarina cristata*). Some patches of substantial regrowth that represent RE 11.9.5 also in the south of the Study Area provide high value habitat (Figure 16). A total of 6,084.0ha of low value habitat for this species also occurs in the Study Area in the form of all remnant vegetation communities except REs 11.3.11, 11.3.27, 11.9.4 and 11.9.5 (Figure 16). The Study Area contains few stands of *Allocasuarina* or *Casuarina* trees, therefore, it is likely the Glossy Black-cockatoo occurs in the Study Area on rare occasions and is unlikely to breed in the Study Area.

Notable Species

The NC Act lists the following Special Least Concern animals as being of Special Cultural Significance:

- Koala
- Short-beaked Echidna (*Tachyglossus aculeatus*)
- Platypus (*Ornithorhynchus anatinus*)
- Migratory birds listed under the JAMBA, CAMBA or Bonn Convention.

The Koala was identified in the Study Area during field surveys as discussed in Section 5.5.1.

The Short-beaked Echidna occupies a wide range of habitats including cleared areas and scats of this species were identified at Supplementary Site 6 in the Study Area. It is likely to use all areas of the Study Area as habitat. With vegetated

areas forming higher value habitat (Figure 16). Approximately 6,500.0ha of high value and 699.0ha of low value habitat occurs in the Study Area.

Waterways within the Study Area are ephemeral and contain very little or no water during the dry season, therefore, they are not considered to provide suitable habitat for the Platypus. There is a permanent waterhole in a high order tributary of Hail Creek, known as Brumby Waterhole. However, this is located in a steep sided gorge, with no vegetated soil bank habitat in which the Platypus would shelter.

A number of migratory birds species were recorded in the Study Area, associated with permanent and temporary wetlands and which are listed as Special Least Concern species under the NC Act. These are discussed in Section 5.5.2.

Colonial breeders occurring in the Study Area include, all frog species recorded, all species of microchiropteran bats recorded, and all glider species.

5.5.3 *Feral Animals*

Six feral animals were recorded in the Study Area during the field surveys (Appendix J). Four of these species are declared Class 2 feral animals under the Queensland LP Act. Table 18 provides a description of the presence of feral animals in the Study Area.

Table 18: Feral Animals in the Study Area

Species	LP Regulation	Abundance and occurrence in the Study Area
Dingo, Domestic Dog (**Canis familiaris dingo, *Canis familiaris*)	Class 2	This species was identified at Trap Site 2 from a camera trap and opportunistically in the Study Area.
Feral Cat (**Felis catus*)	Class 2	One individual was recorded at Trap Site 4 during spotlighting activities.
European Rabbit (**Oryctolagus cuniculus*)	Class 2	Rabbits were identified opportunistically during drive transects throughout the Study Area and during spotlighting activities at Trap Site 3.
Pig (**Sus scrofa*)	Class 2	Individuals or scats of this species were identified at four trap sites and one supplementary site.
Cane Toad (**Rhinella marina*)	Not listed	The Cane Toad was recorded at 7 of the 11 trap sites, as well as at 9 supplementary sites and opportunistically throughout the Study Area.
Horse, Brumby (**Equus caballus*)	Not declared	Two mobs of this species were observed regularly throughout the Study Area.

6 Landscape Values

6.1 Protected Areas

Areas protected under the Queensland NC Act occur adjacent to the Study Area, in the form of:

- Homevale National Park
- Kemmis Creek Nature Refuge (Figure 8).

No protected areas occur in the Study Area. A number of the conservation significant species records returned from database search results are located in these protected areas.

6.2 Corridors and Connectivity

As described in Sections 4.2 and 5.1, the Study Area supports 6,608.5ha of remnant vegetation, which contributes to the regional connectivity of the area. In particular, this vegetation reinforces and buffers state and regionally significant corridors to the north and south of the Study Area (Figure 8).

The remnant areas and varied habitat types in the Study Area provide solid linkages for fauna species moving across the landscape potentially between Bee Creeks and Homevale National Park, and to the Carborough and Kerlong Ranges further south. The Study Area is located in what appears to be a diverse landscape of ranges and lowlands, with a large waterbody in Lake Elphinstone situated 15km south west of the Study Area and major waterways of Bee Creek and Cooper Creek further to the east (Figure 8).

6.3 Wetlands and waterways

Drainage across the Study Area is generally in a south-easterly direction through a series of 1st, 2nd, 3rd and 4th order ephemeral streams. 1st, 2nd and 3rd orders streams are at the headwaters of Hail Creek, and include Schammer, Brumby, Middle and Absent Creeks. Hail Creek, a 4th and 5th order stream, dissects the Study Area in a north-south direction in the centre and joins Bee Creek, another 4th order stream, immediately south of the Study Area (Figure 7). Bee Creek meanders just within the far southern corner of the Study Area.

Another more permanent waterhole is located in the far north-eastern corner of the Study Area and is known locally as Brumby Waterhole (Figure 9). This waterhole is characterised by steep rocky sides and is likely to be used regularly as a watering point for wildlife within the Study Area and the adjacent Homevale National Park.

A section of Brumby Creek in the Study Area has been severed from the headwaters of Brumby Creek, which has been diverted into Middle Creek. This in combination with development of the adjacent Hail Creek Mine, has altered hydrological regimes in the eastern portion of the Study Area.

A number of wetland areas occur in the Study Area, with most occurring as small oxbows on floodplains adjacent to Hail and Middle Creeks. The central wetland is

the largest feature, with a small, formalised dam located in the south-west corner. It appears that a low bund has led to the prolonged retention of water in the south-western corner of this feature. However the low bund is not considered to be responsible for the formation of the wetland but it may influence the dominance and persistence of some flora species. A number of small ponded remnant areas exist (i.e. REs 11.3.2b and 11.3.27) and many low-lying areas of RE 11.3.2 and 11.3.4 would form broad shallow ponds during seasonal rainfall events.

DPM Envirosciences note that all watercourses in the Study Area are ephemeral, with some pools expected to hold water for extended periods. Waterways in the Study Area and surrounds are considered to be of generally good quality (rating B), which is reflected in the report card prepared for the Connors River catchment by the Fitzroy Partnership for River Health 2014 (2015).

The Study Area is located within the Isaac River drainage sub-basin of the Fitzroy River basin. This drainage sub-basin accounts for 1.3% of Queensland and is 22,364.5km^2 in area and is within the Great Barrier Reef catchment ((EHP 2014g) Date accessed 25 February 2014).

7 Potential Impacts

This section describes the potential and likely impacts on terrestrial ecology from the construction, operation and eventual decommissioning of the Project. The following potential impacts and aspects are discussed in this section:

- Land clearance (Section 7.1)
- Indirect impacts (Section 7.2)
- Matters of National Environmental Significance (Section 7.3)
- Wildlife of State Environmental Significance (Section 7.4)
- Cumulative impacts (Section 7.5).

7.1 Land Clearance

7.1.1 *Vegetation Clearing*

The Project layout is shown on Figure 2 and would involve underground longwall mining and open cut pits and surface infrastructure. While the location, depth and quality of the coal resource largely dictates the primary disturbance areas of the Project, spoil dumps and particularly infrastructure planning allows some flexibility in location and layout and as such disturbance areas have been designed, where possible, to reduce the surface area of infrastructure or condense impact areas. For example, a large component of the proposed infrastructure area is co-located within the area proposed for long-wall mining. Also, the major waterways of Hail Creek, Schammer Creek and Middle Creek have been avoided for surface mining activities and infrastructure where possible. EPBC Act listed Brigalow communities in the Study Area have been avoided.

The proposed open cut pits and associated spoil dumps and surface infrastructure would involve a land disturbance area of approximately 4,319.5ha (Figure 2). Vegetation clearing would be required for a large proportion of mine activities and would account for approximately 3,911.0ha of remnant vegetation (Figures 2 and 17) the remaining 408.5ha comprises cleared or regrowth areas.

During the life of the Project, additional surface infrastructure, or changes to the location of gas infrastructure would be considered. Given the variable gas quantities and the wide range of topography and vegetation cover across the Project Area, the specific locations of additional, or changes to proposed, surface gas drainage boreholes and associated temporary surface infrastructure would be defined as a component of future detailed mine planning, engineering and feasibility studies and described in future revisions of the Plan of Operations.The proposed gas drainage corridors are shown on Figure 2 and would be developed and remediated progressively in reponse to underground mining activities.

Table 19 outlines the proposed extent of clearing of each remnant RE over the life of the Project. In many areas the open cut components will encompass the areas subject to permanent subsidence ponding (Figure 2), whereby vegetation will have already been cleared. The vegetation communities that are likely to be affected by subsidence ponding outside the open cut components of the Project will be mainly along Hail Creek and adjacent alluvial plains, i.e. REs 11.3.4 and 11.3.25a,

where Project design has aimed to keep open cut components away from this watercourse. In these areas, vegetation is likely to be affected in the medium term through inundation and sedimentation, whereby some dieback of vegetation within the ponded area is likely to take place, particularly where inundation is sustained for greater than several days. Natural regeneration may occur in the long-term as the soil seedbank should be largely retained or replenished from unaffected remnant vegetation adjacent to the ponded areas. Monitoring and remediation of subsidence ponding will occur where there is risk of erosion or bank instability. In addition to the areas proposed to be impacted by open cut and infrastructure components of the Project, approximately 33.0ha of remnant vegetation and 1.5ha of cleared/regrowth areas are likely to be affected by subsidence ponding.

Underground mining will extend beyond the approximate surface disturbance extent, including under Hail Creek and adjacent alluvial plains. Vegetation in these areas may be affected by underground activities, in the form of tension cracking, which will be monitored and remediated where necessary. Tension cracking is likely to have minimal effects on vegetation composition, structure and condition in the long-term.

Vegetation communities proposed to be impacted by Stage 1 of the Project are listed in Table 20. The Stage 1 Project Area will comprise surface mining and infrastructure areas within the approximate surface disturbance extent (Figures 2 and 3). No subsidence ponding or tension cracking will occur as part of Stage 1, as no underground mining will have commenced at this stage. Similar to the overall clearing footprint over the life of the Project, REs 11.9.9 and 11.9.7 account for the largest areas of clearing during Stage 1. The Stage 1 Project Area would account for approximately 49% of the approximate surface disturbance extent of the Project (Figure 18).

Table 19: Vegetation Communities proposed to be impacted by the Project

RE	Vegetation Type	VM Act Status	Bio-diversity Status	Area of remnant REs in the Approximate Surface Disturbance Extent (ha)		Additional area of REs in the Indicative Extent of Underground Mining (ha)	Total Area of Remnant REs within the Northern Bowen Basin Sub-region (ha)
				Indicative Extent of Project Open Cut Components (ha)	Additional Predicted Subsidence Pond Areas (ha)		
11.3.2	Poplar Box (*Eucalyptus populnea*) woodland on alluvial plains	Of Concern	Of Concern	350.0	2.0	23.0	31,495
11.3.2b	Palustrine wetland within Poplar Box woodland (e.g. vegetated swamp).	Of Concern	Of Concern	3.0	0	0.0	
11.3.4	Queensland Blue Gum (*Eucalyptus tereticornis*) and/or *Eucalyptus spp*. woodland on alluvial plains.	Of Concern	Of Concern	224.0	18.0	102.0	18,111
11.3.11*	Semi-evergreen vine thicket on alluvial plains	Endangered	Endangered	0	0	0	19
11.3.21*	*Dichanthium spp., Astrebla spp*. grassland on alluvial plains	Endangered	Endangered	0	0	0	2,383
11.3.25	Queensland Blue Gum woodland fringing drainage lines.	Least Concern	Of Concern	2.50	0	0	35,119
11.3.25a	Riverine wetland or fringing riverine wetland. Black Ironbox (sometimes emergent), Weeping Paperbark (*Melaleuca fluviatilis*) woodland.	Least Concern	Of Concern	22.0	9.5	44.5	
11.3.27	Freshwater wetlands.	Least Concern	Of Concern	22.0	0	0.0	760
11.4.2	*Eucalyptus spp*. and/or *Corymbia spp*. grassy or shrubby woodland on Cainozoic clay plains	Of Concern	Of Concern	0	0	4.5	6,067
11.9.2	Silver-leaved Ironbark (*Eucalyptus melanophloia*) ± Mountain Coolabah (*E. orgadophila*) woodland on fine-grained sedimentary rocks.	Least Concern	No Concern at Present	436.0	0	2.5	40,434
11.9.4*	Semi-evergreen vine thicket or Brigalow (*Acacia harpophylla*) with a semi-evergreen vine thicket	Of Concern	Endangered	0	0	0	2,800

RE	Vegetation Type	VM Act Status	Bio-diversity Status	Area of remnant REs in the Approximate Surface Disturbance Extent (ha)		Additional area of REs in the Indicative Extent of Underground Mining (ha)	Total Area of Remnant REs within the Northern Bowen Basin Sub-region (ha)
				Indicative Extent of Project Open Cut Components (ha)	Additional Predicted Subsidence Pond Areas (ha)		
	understorey on fine-grained sedimentary rocks.						
11.9.5*	Brigalow and/or Belah (*Casuarina cristata*) open forest on fine-grained sedimentary rocks.	Endangered	Endangered	0	0	0	10,549
11.9.7	Poplar Box, False Sandalwood (*Eremophila mitchellii*) shrubby woodland on fine-grained sedimentary rocks.	Of Concern	Of Concern	1520.0	3.5	60.5	30,219
11.9.9	Narrow-leaved Red Ironbark (*Eucalyptus crebra*) woodland on fine-grained sedimentary rocks.	Least Concern	No Concern at Present	1324.5	0	17.5	61,917
11.12.1	Narrow-leaved Red Ironbark woodland on igneous rocks.	Least Concern	No Concern at Present	7.0	0	0	2,739
			TOTAL	**3,911.0**	**33.0**	**254.5**	**242,612**

* REs that represent TECs under the EPBC Act

Table 20: Vegetation Communities proposed to be impacted by Stage 1 of the Project

RE	Vegetation Type	VM Act Status	Bio-diversity Status	Area of REs in the Approximate Surface Disturbance Extent (ha)	Total Area of Remnant REs within the Northern Bowen Basin Sub-region (ha)
11.3.2	Poplar Box (*Eucalyptus populnea*) woodland on alluvial plains	Of Concern	Of Concern	161.5	31,495
11.3.2b	Palustrine wetland within Poplar Box woodland (e.g. vegetated swamp).	Of Concern	Of Concern	0	
11.3.4	Queensland Blue Gum (*Eucalyptus tereticornis*) and/or *Eucalyptus spp*. woodland on alluvial plains.	Of Concern	Of Concern	65.0	18,111
11.3.11*	Semi-evergreen vine thicket on alluvial plains	Endangered	Endangered	0	19
11.3.21*	*Dichanthium spp., Astrebla spp*. grassland on alluvial plains	Endangered	Endangered	0	2,383
11.3.25	Queensland Blue Gum woodland fringing drainage lines.	Least Concern	Of Concern	2.5	35,119
11.3.25a	Riverine wetland or fringing riverine wetland. Black Ironbox (sometimes emergent), Weeping Paperbark (*Melaleuca fluviatilis*) woodland.	Least Concern	Of Concern	2.0	
11.3.27	Freshwater wetlands.	Least Concern	Of Concern	9.5	760
11.4.2	*Eucalyptus spp*. and/or *Corymbia spp*. grassy or shrubby woodland on Cainozoic clay plains	Of Concern	Of Concern	0	6,067
11.9.2	Silver-leaved Ironbark (*Eucalyptus melanophloia*) ± Mountain Coolabah (*E. orgadophila*) woodland on fine-grained sedimentary rocks.	Least Concern	No Concern at Present	167.0	40,434
11.9.4*	Semi-evergreen vine thicket or Brigalow (*Acacia harpophylla*) with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks.	Of Concern	Endangered	0	2,800
11.9.5*	Brigalow and/or Belah (*Casuarina cristata*) open forest on fine-grained sedimentary rocks.	Endangered	Endangered	0	10,549
11.9.7	Poplar Box, False Sandalwood (*Eremophila mitchellii*) shrubby woodland on fine-grained sedimentary rocks.	Of Concern	Of Concern	661.0	30,219
11.9.9	Narrow-leaved Red Ironbark (*Eucalyptus crebra*) woodland on fine-grained sedimentary rocks.	Least Concern	No Concern at Present	855.5	61,917
11.12.1	Narrow-leaved Red Ironbark woodland on igneous rocks.	Least Concern	No Concern at Present	1.5	2,739
			TOTAL	**1,925.5**	**242,612**

* REs that represent TECs under the EPBC Act

7.1.2 *Habitat Removal*

The area proposed to be cleared comprises habitat for native fauna, including matters of NES and SES protected under Commonwealth and State legislation (see Sections 5.5.1 and 5.5.2). Figures 23 and 24 show the extent of broad habitats within the Project Area and Stage 1 Project Area.

Fauna displaced by habitat clearing may move into areas of undisturbed habitat remaining within the immediately surrounding areas. The increased fauna load has the potential to place pressure on these communities and displace resident animals.

Riparian areas of Hail, Schammer and Middle Creeks would largely be retained. Impacts to these areas would be in the form of clearing of up to 70m in width for each of the three infrastructure corridors connecting the existing Hail Creek Mine west of Hail Creek with the new mining and infrastructure areas east of Hail Creek (Figure 2).

Food resources and other habitat features, such as fallen logs and hollow bearing trees would be largely lost from the clearance area, however hollow bearing trees would be salvaged for use in rehabilitation. There is potential for specific habitat features, such as habitat trees and nests to be avoided for some elements of the Project that are not fixed in location, such as access roads and through sensitive vegetation clearing practices in the vicinity of Hail Creek (see Section 8).

7.2 Indirect Impacts

7.2.1 *Subsidence*

Longwall mining is likely to cause subsidence effects in the form of trough-like depressions at the surface that occur sequentially as the longwall progresses. Subsidence results as the mining creates a void underground and the overlaying strata drops to fill the void. This would occur gradually during the life of the underground mining, which for this Project would be approximately 30 years. Modelling predicts that subsidence troughs of up to 6.9m in depth (after extraction of two seams [Elphinstone and Hynds Seams]) may occur in shallower mined areas and up to 2.5m where only the Hynds Seam is extracted at the southern end of the underground mining area. The depth of the these subsidence troughs would be related to the depth of cover, height of extraction and panel width (Gordon Geotechniques 2015). Subsidence impacts are most likely to be greatest in the northern third of the underground mining area where both seams would be extracted and the depth of cover is shallower.

Similarly, surface cracking and buckling may occur along panel edges due to the higher tensile strain on the ground surface. This tensile strain is most likely to result in permanent cracking in the zone around the perimeter of each of the longwall panels (Gordon Geotechniques 2015). Surface cracking is predicted to be no deeper than 10m and up to 200mm in width above dual seam extraction areas in shallower parts of the mining area. Cracks of up to 50mm are predicted for deeper single seam extraction areas. However, during the life of the longwall mining, cracking is likely to affect only small areas at any one time (Gordon

Geotechniques 2015). Tension cracking is unlikely to create adverse effects to remnant vegetation and habitat over the long term, particularly where remediation takes place.

Figures 17, 19, 21, 23, 25, 27 and 29 show the extent of the longwall mining area in relation to remnant vegetation, TECs and habitat for conservation significant flora and fauna. Subsidence effects (surface cracking) are likely to occur throughout this area (Figure 17), accounting for 23.5ha of Of Concern and 9.5ha of Least Concern remnant vegetation outside the open cut components of the Project. This impact would also involve approximately 2km of Hail Creek and the lower reaches of Schammer Creek (Figure 19). Effects on vegetation within this area are likely to be in the form of:

- Artificial ponding or draining away from normally inundated areas during and after rainfall, potentially causing dieback
- Sediment loading within the subsided areas, potentially causing gradual dieback
- Cracking causing erosion and scouring, particularly of creek banks if left unmanaged (Hydrobiology 2015).

Remediation of ponding and cracking created by subsidence is discussed in Sections 8.3.1 to 8.3.3. It is not feasible to remediate all areas of ponding and these areas are shown on Figure 2 and Figure 17 in relation remnant vegetation. Where permanent ponds are formed there is likely to be a gradual change in vegetation condition, particularly where inundation has occurred. Over the long term these ponded areas, will naturally fill with sediment and natural regeneration is likely to take place.

Indirect subsidence related impacts are not expected to impact areas beyond the extent of the Mining Lease, including the National Park.

7.2.2 *Hydrological changes*

Open cut mining and out of pit waste emplacement is not proposed within or immediately adjacent to Hail Creek. For the majority of the main channel of Hail Creek, a vegetated buffer of varying widths (ranging from 80m to 120m) would be maintained between the Creek and surface open pit and waste emplacement activities. However, three infrastructure crossings and a series of surface gas infrastructure corridors are proposed across Hail Creek and which will require riparian vegetation clearing and bank disturbance (Figures 2 and 17).

Additionally, underground longwall mining beneath Hail and Schammer Creeks would take place. Subsidence troughs and cracking caused by the underground mining can alter surface drainage paths and create ponding (Hatch 2015a). While tension cracking will be remediated where necessary, not all areas of subsidence ponding will be able to be remediated as discussed in Section 8.3.1. Subsidence ponding that occurs within or on the banks of Hail Creek has the potential to cause erosion and impact bank stability. Management of these impacts is discussed in Section 8.3.

Surface mining and associated activities would directly impact 1st and 2nd order streams flowing into Hail Creek (Figures 2 and 20). Consistent with the current water management system at the Hail Creek Mine, runoff from undisturbed catchments would be diverted around mining operations, while runoff from disturbed catchments would be captured in the mine water management system and stored and treated for release in accordance with EA conditions, used within the CHPP or used for dust suppression. Levees would also be constructed adjacent to parts of Hail, Schammer and Middle Creeks to manage flooding throughout the Project Area and open cut voids.

Water modelling indicates a potential 5-11% reduction in flows within the Hail Creek catchment in the Study Area. This is predicted due to an approximate 11% reduction in the Hail Creek contributing catchment area as a result of the Project, i.e. subsidence ponding. Overall, Hatch (Hatch 2015b) found that the Project, including subsidence ponding, will impact on the localised flow characteristics within the ML boundary, but, will have minimal impact on the downstream off-lease environment. However, overall Hatch (Hatch 2015a, 2015b) describes that despite the subsidence, the Project is unlikely to result in a measureable reduction to the extent, frequency and duration of flows encountered in the waterways in the Study Area.In some areas upstream of subsidence impacts, a small increase in flows (<5%) may be experienced due to a slight increase in catchment area (Hatch 2015b Hydrobiology 2015). Impacts to daily and annual local flows are likely to be greatest during low flow dry conditions reducing to minimal impacts during high flow wet climatic conditions (Hatch 2015b). It should be noted that a conservative approach to modelling was undertaken, whereby the worst case subsidence scenario was used to quantify the potential impacts to surface flows. However, in reality subsidence ponding will occur gradually over the life of the underground mining, i.e. approximately 20 years, and during this time subsidence ponds will be subject to infilling from sediment movements along Hail Creek and its tributaries (Hatch 2015b) reversing the subsidence effects to flow rate to some extent.

During normal climatic conditions where moderate and high flows are experienced in the catchment on an annual basis, impacts to riparian vegetation should not be significant. It is expected that riparian ecosystems occurring within Hail Creek, and Schammer Creek, including habitat for Black Ironbox, would be maintained despite the disturbances caused by the Project. There is potential for localised impacts to riparian vegetation during sustained dry periods, where annual rainfall totals are well below average. However, predicted changes to stream flows are unlikely to substantially impact riparian vegetation.

With regard to GDEs, (DPM Envirosciences 2015) recognise there are two potential impacts on groundwater associated with the Project:

- Groundwater drawdown
- Groundwater coming into contact with coal and potentially coal seam gas before it is pumped out of the mine.

GDEs in the vicinity of the Project are considered to be reliant on the shallow alluvial groundwater systems given their proximity in relation to

watercourses(DPM Envirosciences 2015). Beyond the extent of the underground mining area, groundwater depressurisation within the coal seam due to the Project is not expected to significantly impact alluvial aquifers. Accordingly, no impact to GDEs beyond the extent of underground mining is expected (Douglas Partners 2015 in (DPM Envirosciences 2015)).

Within the underground mining area, contamination of alluviaum near Hail Creek and its tributaries is expected to be low based on modelling and the depth of the underground activities (DPM Envirosciences 2015).

Geochemical characterisation studies have concluded that waste rock and coal reject material that would be generated by the Project would generally be low risk and non-acid forming (Golder Associates 2015).

7.2.3 *Edge Effects*

Edge effects, in the form of species and structure modification through increased light, wind sheer, weed invasion or changed species composition is unlikely to substantially alter the structure and composition of communities as a result of this Project. Given the open structure of the woodland and open forest habitat in the Study Area coupled with the depauperate nature of the soils, edge effects resulting from vegetation clearing and land disturbance would not be as pronounced as if dense intact communities were present.

Edge effects would be most pronounced around the edges of the Study Area where intact remnant communities would remain and abut the proposed mining activities. Edge effects would be greatest where a number of narrow infrastructure corridors up to 70m wide are proposed to dissect remnant communities, particularly as these are more dense riparian communities of Hail, Schammer and Middle Creeks and tributaries (Figure 19) compared with surrounding woodland and open forest communities. Measures outlined in Section 8 would be implemented to minimise the extent of edge effects in vegetation to be retained.

7.2.4 *Fragmentation*

The Project would not isolate habitats within the Study Area or sever connectivity with areas outside the Study Area. Connectivity of areas to the north of the Study Area and with Hail Creek to the south of the Study Area would remain. A large tract of remnant vegetation would link these areas west of the Study Area in the vicinity of Mt Hess.

However, the Project would result in fragmentation of the remnant vegetation to be retained within the Study Area and in the broader landscape context. The major habitat corridor of Hail Creek would be retained, although it would be dissected by three infrastructure corridors and a series of surface gas drainage infrastructure corridors (Figures 2 and 17). The three infrastructure corridors, proposed for co-locating haul roads and other infrastructure, will be up to 70m in width.

Connectivity will be retained along the balance of riparian areas of Hail Creek and Middle Creek to primary linkages between large tracts of remnant vegetation in ranges to the north of ML 4738 with lowland habitats and catchments to the south of the Study Area in what would be an otherwise highly disturbed landscape.

Connectivity Areas are a prescribed matter of SES under the EO Regulation. A Landscape Fragmentation and Connectivity (LFC) Tool has been developed by the EHP as a support tool to quantify significance of impacts on connectivity. Section 7.4.2 outlines the results of LFC Tool significance assessment for the Project.

7.2.5 *Exotic Flora and Pest Animals*

The Project has the capacity to result in the introduction and spread of weed species and to facilitate the establishment and expansion of existing populations of pest animals and plants into adjacent intact areas, including the Homevale National Park. The invasion of pest plants could degrade the quality of remnant communities and fauna habitats, and increased pest animals could result in direct predation of native fauna species. These types of impacts are most likely to occur during and immediately after vegetation clearing and through transport of weed seed on vehicles and machinery during construction and operation of the Project.

At the time of the field surveys in 2013, six declared pest plants were detected within the Study Area, with Parthenium Weed and Velvet Prickly Pear being most common. Parthenium Weed in particular is widespread and abundant across the Study Area particularly in disturbed areas. The risk of spread of these species and the other four weeds to other areas is moderate and weed spread would need to be specifically managed as part of the Project, particularly along riparian areas and into remnant vegetation adjacent ML 4738.

Evidence of pest animals was not common in the Study Area, however, the pest animals observed have the ability to move freely and in some cases long distances throughout the landscape and/or readily colonise new areas. It is unlikely this Project would introduce new species, but rather attract some feral animal species during periods of disturbance, for example Wild Dogs during vegetation clearing activities. Two mobs of wild horses were observed frequently in the Study Area during field surveys. As the Project would involve large areas of vegetation clearing, these animals are likely to move more permanently into adjacent areas, including Homevale National Park, as the Study Area becomes less suitable for them. Though some fencing exists in and around the Study Area, some of the pest animals identified in the Study Area currently have access to adjacent areas, including Homevale National Park.

The Hail Creek Mine Pest Animal and Weed Management Plan would be amended to incorporate pest plant and animal management as part of the Project as described in Section 8.

7.2.6 *Dust*

Dust deposition as a result of mining activities has the potential to have an adverse effect on vegetation. Various studies have been undertaken that can be used to develop a threshold dust deposition level below which adverse impacts are unlikely to occur to vegetation. Review of the research undertaken by Doley (2003) suggests that a depositional load threshold of $7g/m^2$ could be used when assessing potential mineral dust impacts to vegetation. However, dust characteristics, vegetation density, plant leaf size and environmental conditions will affect the impacts of dust deposition on individual species. The potential physical effects of

dust on vegetation relate to the reactivity of the dust with leaf tissue, alteration of energy exchange between the plant and the environment, e.g. heat, light absorption affecting photosynthesis of the plant, and water vapour exchange of the plant (Doley 2003).

An air quality impact assessment has been undertaken for the Project, which modelled potential dust deposition in and around the Project. The model found that based on the activities proposed as part of the Project and dust management measures to be implemented, the dust deposition rates for the maximum production stage of the Project are below 4g/m^2/month (Todoroski Air Sciences 2015), which is well below the depositional threshold suggested by Doley (2003).

Therefore, dust deposition is considered to be relatively low with regard to vegetative impacts and unlikely to adversely impact vegetation adjacent to the proposed mining and infrastructure activities of the Project.

7.2.7 *Noise and Vibration*

Ongoing noise and vibration emissions associated with the Project would result from vegetation clearing, blasting in the open cut pit, operation of conveyors and other surface infrastructure and vehicle movements, including trucks, dozers, drills and graders. Temporary or intermittent noise and vibration emissions would be associated with machinery and activity associated with construction of surface infrastructure.

Most fauna species exhibit a high degree of adaptability to the noise from machinery. Noise from mining activities may cause some behavioural modification by birds, potentially altering feeding activity, and sudden loud noises may also startle bird and mammals species. Consequently, depending on the magnitude of construction and operational noise, there may be some species that would be affected by noise and therefore, would forego utilisation of habitat within the noise disturbance zones. The size of the zone would likely be different for individual species and depend on the intensity and nature of the noise sources. It is not possible to quantify the proportion of the local fauna community that would be adversely affected by this issue but it is expected to be a minority of species, and noise impacts to fauna unlikely to occur over a significant distance from the noise source. In the case of temporary noise associated with construction or clearing activities, native fauna are likely to return to affected habitat areas within a short period of the noise emissions ceasing.

Impacts on fauna from ground vibration (e.g. from blasting and the operation of some equipment) would be similar to noise disturbance. It is possible that some species would forego the utilisation of areas close to the vibration source, where the intensity of the vibration exceeds the tolerance of the species. This is likely to be greatest in the vicinity of the open cut pits.

7.2.8 *Lighting*

Potential impacts of light spill from lighting associated with the Project is likely to be limited and restricted to infrastructure areas, around the EIA and ROM. The types of common and adaptable species identified in the Study Area during the

field survey, are generally able to adapt to environmental conditions over small areas.

7.2.9 *Traffic*

Development of access roads and haul roads for the Project is likely to impact fauna through vehicle strike of animals crossing these roads, causing injury and mortality. Ground-dwelling fauna are most susceptible to vehicle strike, although birds and micro-bats may also be impacted. Up to three haul road crossings of Hail Creek, one crossing of Middle Creek and one crossing of Schammer Creek is proposed. Additional light vehicle crossings of Hail Creek may also be constructed. Figure 2 and Figures 25–30 show vegetation and habitat areas proposed to be impacted by infrastructure including roads.

All trafficable areas would be subject to speed limits that would reduce the risk of animal strikes. Relevant signage, safe driving procedures and staff inductions addressing this risk would increase awareness and contribute to reducing the risk of this impact.

7.2.10 *Final Landform*

During operations, continued backfilling of open pit voids with waste rock would take place. Final voids would also be used to increase water storage capacity for the Project.

At the completion of mining activities, final landform earthworks and revegetation would be undertaken over a period of approximately 5 years. The final landform and rehabilitation concept for the end of the Project life and progressive rehabilitation is described in Section 4 of the *Hail Creek Transition Project Environmental Assessment Report* (Rio Tinto Coal Australia 2015).

7.3 Matters of National Environmental Significance

A number of matters of NES occur within the Study Area and will potentially be impacted by the Project. These are discussed in Table 21, along with the predicted area of impacts from approximate surface disturbance extent, including subsidence ponding.

Table 21: Approximate surface disturbance extent to matters of NES

Matter of NES	Open Cut Components of Mining Activities (ha)		Approximately Area of Subsidence Ponding outside the Open Cut Components (ha)		Total Approximate Surface Disturbance Extent (ha) (high value habitat)
Brigalow TEC	0		0		0
Natural Grassland TEC	0		0		0
SEVT TEC	0		0		0
	High Value Habitat	**Low Value Habitat**	**High Value Habitat**	**Low Value Habitat**	
Black Ironbox	22.0	2.5	9.5	0	31.5
Siah's Backbone	0	0	0	0	0
Squatter Pigeon	3,903.0	386.0	33.0	1.5	3,936.0
Koala	3,903.0	N/A	33.0	N/A	3,936.0
Australian Painted Snipe	24.5	573.5	0	20.0	24.5
Ornamental Snake	0.5	0	0	0	0.5

A full assessment of the significance of impacts, in accordance with the *EPBC Act Significant Impact Guidelines* (DotE 2013b), for those species that are likely to be directly or indirectly impacted by the Project has been undertaken in Appendix K.

7.3.1 *Brigalow TEC*

The patch of Brigalow TEC (RE11.9.5) consisting of 3.0ha within the Study Area (Figure 9) is exposed to current and potential threats, including:

- Encroachment of exotic grasses and forbs, particularly Buffel Grass, Parthenium Weed and Prickly Pear species, and potential for the introduction of new exotic species
- Increased susceptibility to fire due to the elevated fuel loads associated with exotic pasture grass infiltration.

The Project has been designed to avoid 3.0ha of Brigalow TEC in the Study Area (Figures 19 and 20). This community would not be subject to impacts as a result of surface or underground mining activities and an approximate 30m buffer will be retained around this TEC (see Section 8.4).

Therefore, the Project is unlikely to cause direct or indirect adverse impacts to the Brigalow TEC in the Study Area and this community has not been assessed further.

7.3.2 *Natural Grassland TEC*

The patch of Natural Grassland TEC (RE 11.3.21) within the Study Area (Figures 19 and 20) is exposed to current and potential threats, including:

- Encroachment of exotic grasses and forbs, particularly Buffel Grass and Parthenium Weed, and potential for the introduction of new exotic species
- Degradation by pest fauna such as pigs foraging within the community.

The Project has been designed to avoid direct impacts to the patch of Natural Grassland TEC in the Study Area and maintain a minimum 30m buffer around this community (Figure 19). This community would not be subject to impacts as a result of subsidence from underground activities. Consistent with the current water management system at the Hail Creek Mine, runoff from undisturbed catchments would be diverted around mining operations, while runoff from disturbed catchments would be captured in the mine water management system and stored and treated for release in accordance with EA conditions. Therefore, there is not likely to be contamination of surface water potentially draining into the Natural Grassland area (see Sections 7.2.1 and 8.4). No access roads or other infrastructure would be located within this TEC.

Therefore, the Project is unlikely to cause direct or indirect impacts to the Natural Grassland TEC in the Study Area and this community has not been assessed further.

7.3.3 *SEVT TEC*

The patches of SEVT TEC (REs 11.3.11 and 11.9.4) within the Study Area (Figures 19 and 20) are exposed to current and potential threats, including:

- Encroachment of exotic grasses and forbs, particularly Buffel Grass, Parthenium Weed and Prickly Pear species, and potential for the introduction of new exotic species
- Increased susceptibility to fire due to the elevated fuel loads associated with exotic pasture grass infiltration
- Further fragmentation through development of fire breaks and boundary fences.

The Project has been designed to avoid all patches of SEVT TEC with provision of a 30m buffer to each patch (Figures 2 and 19).

Therefore, the Project is unlikely to cause direct or indirect impacts to the SEVT TEC in the Study Area and this community has not been assessed further.

7.3.4 *Black Ironbox*

A total of 193.0ha of high value and 17.0ha of low value Black Ironbox habitat was identified in the Study Area along Hail Creek and its tributaries. Habitat supported more than 4,570 individuals.

Threats to Black Ironbox posed by the Project include:

- Clearing of some individuals to facilitate watercourse crossings
- Indirect impacts from subsidence ponding and tension cracking that may cause localised dieback from subsidence ponding and erosion and slight reduction in stream flows during low flow periods (refer section 7.2.2)
- Sediment and mine water releases.

Consistent with the current water management system at the Hail Creek Mine, runoff from undisturbed catchments would be diverted around mining operations, while runoff from disturbed catchments would be captured in the mine water

management system and stored and treated for release in accordance with EA conditions. The Subsidence Management Plan prepared for the Project provides for the remediation of stream bed cracks, degraded sections of stream bed and banks, and surface cracks, buckling and heaving, in situations where there is a risk of increased erosion. Remediation measures will be monitored for effectiveness and additional measures implemented as required.

During normal climatic conditions where moderate and high flows are experienced in the catchment on an annual basis, impacts to riparian vegetation should not be significant. It is expected that riparian ecosystems occurring within Hail Creek, and Schammer Creek, including habitat for Black Ironbox, would be maintained despite the disturbances caused by the Project. There is potential for localised impacts to riparian vegetation during sustained dry periods, where annual rainfall totals are well below average. However, predicted changes to stream flows are unlikely to substantially impact riparian vegetation.

An assessment of impacts against the *EPBC Act Significant Impact Guidelines* (DotE 2013b) in Appendix K2, found that the population of Black Ironbox occurring in the Study Area is likely to be considered an important population due to it's location at the western limit of this species' range. The Project would involve clearing and subsidence effects to approximately 31.5ha of high value habitat and 2.5ha of low value habitat for this species (including approximately 650 individuals (based on average tree counts along Hail Creek) for open cut mining and gas drainage infrastructure (Figures 21 and 22). An additional 54.0ha of high value habitat would be potentially subject to tension cracking from underground mining activities, although this type of impact is unlikely to substantially impact habitat provided remediation to manage the risk of erosion, is undertaken.

However, the majority of the population would remain (i.e. more than 85% of the estimated population in the Study Area), and would continue to provide recruitment within and downstream of the Study Area. Therefore, the Project is considered unlikely to cause a significant impact to the national distribution and recovery of Black Ironbox. A full assessment of the significance of impacts of the Project to the Black Ironbox in accordance with the EPBC Act Significant Impact Guidelines (DotE 2013b) is provided in Appendix K1.

7.3.5 ***Siah's Backbone***

Siah's Backbone occurs at one location in the Study Area within a small pocket of SEVT TEC (RE 11.3.11) in the north-east of the Study Area. This population falls outside the Project Area and will not be impacted directly or indirectly by the Project (Figures 17 and 19). Therefore, this species has not been considered further. It should also be noted that the mainland variant of this species is relatively commonly occurring.

7.3.6 ***Squatter Pigeon***

This species was recorded at a number of locations in the Study Area during field surveys (Figure 14). The Project presents three main threats to the Squatter Pigeon (southern), as follows:

- Loss of habitat due to clearing for surface infrastructure and mining activities
- Degradation of habitat by invasion of exotic grasses.

A total of 3,903.0ha of high value and 386.0ha of low value habitat is proposed to be cleared for open cut mining and gas drainage infrastructure (Figures 25 and 26). An additional 33.0ha of high value and 1.5ha of low value habitat would be subject to subsidence ponding impacts from underground operations. Extensive areas of similar habitat occurs in the local region, in the form of remnant, regrowth and disturbed areas. It is estimated that at least 20,332ha of similar remnant habitat occurs within 5km of the Study Area based on remnant vegetation mapping for the region.

The sub-population of Squatter Pigeon that occurs in the Study Area is not considered to represent an important population of the species. This species is regularly recorded in the region and is noted as 'remaining common north of the Carnarvon Ranges in Central Queensland' ((DotE 2015c) Date accessed 20 March 2015).

An assessment of the significance of impacts against the *EPBC Act Significant Impact Guidelines* (DotE 2013b) was undertaken in Appendix K2 and found that the sub-population that occurs in the Study Area is unlikely to be an important population and substantial areas of suitable habitat would remain unaltered within the local landscape. Therefore, it is considered unlikely that the Project would have a significant impact on the Squatter Pigeon.

7.3.7 ***Koala***

Primary threats to this species as a result of the Project include:

- Habitat loss and fragmentation, particularly narrowed and fragmented connectivity along Hail Creek
- Increased risk of predation, particularly just after clearing activities
- Vehicle strike, particularly by haul trucks, which cannot slow or break quickly.

Approximately 3,903.0ha of habitat critical[4] for the survival of the Koala would be removed as part of the Project. While this clearing would fragment the habitat, this is localised and is unlikely to isolate any habitat or populations to the extent that the Koala is likely to decline. An additional 33.0ha of critical habitat would be potentially subject to subsidence ponding impacts from underground mining activities. However, due to the extensive habitat areas that would remain in the surrounding landscape (i.e. at least 20,332ha of similar remnant Koala habitat occurs within 5km of the Study Area in the broader landscape) it is expected that the species would persist in the broader area and therefore, not substantially interfere with the recovery of the species.

[4] In accordance with the EPBC Act Referral Guidelines for the Vulnerable Koala (DotE 2014b) and outlined in Section 5.5.1.

Nonetheless, the Project is considered likely to cause a significant impact to the Koala according to the *EPBC Act Significant Impact Guidelines* (DotE 2013b), due to the large area of critical habitat that is proposed to be cleared. It is described in the *EPBC Act Referral Guidelines For The Vulnerable Koala* (DotE 2014b) that referral is recommended for impacts equal to or greater than 20ha, where known Koala food trees are present and in areas with a habitat score equal to or greater than 8 (DotE 2014b). An assessment of the significance of impacts to the Koala was undertaken against the *EPBC Act Significant Impact Guidelines* (DotE 2013b) in Appendix K3.

7.3.8 ***Australian Painted Snipe***

Removal of habitat and degradation of water quality of the wetland habitat in the Study Area is a threat to the Australian Painted Snipe as a result of this Project. The central wetland habitat is proposed to be directly impacted by the Project (Figures 25 ad 26). Remaining habitat areas are considered to be sufficiently far away from the Project Area to be protected from indirect impacts of the Project.

Approximately 24.5ha of high value and 573.5ha of low value habitat for this species will be directly impacted by the Project as part of surface mining activities and surface gas drainage infrastructure predominantly in the central wetland habitat area. An additional 20.0ha of low value habitat would be potentially subject to subsidence ponding impacts from underground mining activities.

Indirect impacts to water quality of wetland areas is unlikely, as consistent with the current water management system at the Hail Creek Mine, runoff from undisturbed catchments would be diverted around mining operations, while runoff from disturbed catchments would be captured in the mine water management system and stored and treated for release in accordance with EA conditions. Additionally, subsidence monitoring would take place to identify areas that may require remediation to minimise ponding or erosion from tension cracking or to ensure surface water flow to the remaining wetland areas is not permanently or significant interrupted.

In accordance with the *EPBC Act Significant Impact Guidelines* (DotE 2013b), the Project is considered to have the potential to result in a significant impact to the Australian Painted Snipe, as 24.5ha of high value wetland habitat is proposed to be cleared. There is potential for this area of impact to be offset within the Project Area, whereby subsidence ponding may form wetland habitat for this species over the short to medium term. An assessment of the significance of impacts to the Australian Painted Snipe was undertaken against the *EPBC Act Significant Impact Guidelines* (DotE 2013b) in Appendix K4.

7.3.9 ***Ornamental Snake***

The Project has been designed so that it largely avoids Ornamental Snake habitat and maintains a minimum 30m buffer around the majority of this habitat. However, a small section of habitat in the north-eastern corner will be impacted. Approximately 0.5ha of high value habitat for the Ornamental Snake is proposed to be cleared for surface infrastructure.

Indirect impacts including dust, noise and lighting created by adjacent activities and vehicle strike may also impact Ornamental Snakes or habitat for this species. A number of measures would be implemented to minimise the extent of potential indirect impacts as outlined in Section 8.4 and in the EPBC Act Significance Assessment (DotE 2013b) in Appendix K5.

In accordance with the significance assessment undertaken in Appendix K6, the population of Ornamental Snake that occurs within the Study Area is considered to comprise an important population.

As outlined in the Draft Referral guidelines for the nationally listed Brigalow Belt reptiles (SEWPaC 2011c), clearing of less than 1.0ha of important habitat is unlikely to have a significant impact, provided connectivity is not compromised. Habitat will not be fragmented in the Study Area as no other Project activities are proposed to impact this habitat. Therefore, the Ornamental Snake population in the Study Area is expected to persist. Therefore, the Project is considered unlikely to interfere and in turn will support the recovery of the Ornamental Snake.

7.3.10 ***Migratory Birds***

A number of terrestrial migratory birds are considered to potentially occur in the Study Area as listed in Table G2 in Appendix G. Foraging habitat, in the form of Eucalypt woodland and riparian habitat is proposed to be cleared as part of the Project.

In accordance with the *EPBC Act Significant Impact Guidelines* (DotE 2013b) an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it would:

- Substantially modify, destroy or isolate an area of important habitat for a migratory species
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

It is considered unlikely the Project Area provides important habitat for any migratory species as the habitat is homogenous in the surrounding landscape and would be unlikely to form important breeding habitat for any migratory species. As such the Project Area is unlikely to support an ecologically significant proportion of the population of a migratory species, and this would have been evident as a result of seasonal surveys undertaken in the Study Area. The Natural Grassland TEC, which were observed to support wetland and migratory species would be retained and managed as part of the Project.

Therefore, the Project is considered unlikely to result in a significant impact to a migratory species.

7.4 Matters of State Environmental Significance

Potential impacts to the following terrestrial matters of SES have been identified in accordance with the EO Act:

- Regulated Vegetation, including Endangered, Of Concern, Wetland and Watercourse Vegetation
- Connectivity Area
- Watercourses and Wetlands
- Protected Wildlife Habitat
- Protected Areas.

A number of these matters of SES are also matters of NES and this is explained in Sections 7.4.1 to 7.4.5.

7.4.1 ***Regulated Vegetation***

Regulated vegetation, specifically Endangered, Of Concern, wetland and watercourse vegetation, is listed as a matter of SES under the EO Act.

In accordance with the *Queensland Residual Impact Guideline* (EHP 2014e) a number of remnant REs within the Project Area will require clearing with likely impacts from subsidence ponding. These impacts trigger the significant residual impact criteria for regulated vegetation in Table 1 of the *Queensland Residual Impact Guideline* (EHP 2014e). In total, 2,120.5ha of Of Concern REs, 19.0ha of wetland REs and 247.0ha of watercourse REs will be impacted and that triggers the threshold for significant impacts under this guideline. Table 22 outlines those REs and the extent of clearing of each. It should be noted that areas calculated in Table 22 may overlap where watercourse or wetland REs are also Endangered or Of Concern REs.

The total area of regulated vegetation required to be offset in Stage 1 is 966.5ha and the total area of regulated vegetation required to be offset overall is 2,262.5ha. These totals are less than the sum of all aspects of regulated vegetation proposed to be impacted, i.e. Of Concern, Wetland and Waterway regional ecosystems, as some of these aspects overlap.

Residual impacts and potential offset liability for regulated vegetation is discussed in Section 9.2.

Some of the regulated vegetation in Table 22 also forms TECs and is therefore a matter of NES, i.e. REs 11.3.11, 11.3.21, 11.9.4 and 11.9.5. These communities are discussed in Sections 7.3.1 to 7.3.3 in relation to the EPBC Act.

Table 22: Assessment of clearing and subsidence impacts to regulated vegetation against the significant residual impact criteria of the *Queensland Residual Impact Guideline* (VM Act status)

For clearing other than clearing for linear infrastructure criteria	Clearing/Impacting Endangered and Of Concern REs		Clearing/Impacting wetland REs[2]		Clearing/Impacting watercourse REs within a defined distance of a watercourse[3]		Is the clearing/ Impact likely to be significant?
	RE[1]	Indicative Surface Disturbance Extent (ha)	RE	Indicative Surface Disturbance Extent (ha)	RE	Indicative Surface Disturbance Extent (ha)	
Area greater than 5ha where in a grassland RE	11.3.21	0	11.3.21	0	11.3.21	0	No
Area greater than 2ha where in a sparse RE	11.3.2/b 11.3.4 11.9.7	355.0 242.0 1,523.5	11.3.2/b 11.3.4 11.3.27 11.4.2 11.9.2 11.9.7 11.9.9 11.12.1	0.5 0 18.5 0 0 0 0 0	11.3.2/b 11.3.4 11.3.27 11.4.2 11.9.2 11.9.7 11.9.9 11.12.1	30.0 33.5 2.5 0 9.0 59.0 81.5 0	Yes
Area greater than 0.5ha where in a dense to mid-dense RE	11.3.11 11.9.4 11.9.5	0 0 0	11.3.11 11.3.25/a 11.9.4 11.9.5	0 0 0 0	11.3.11 11.3.25/a 11.9.4 11.9.5	0 31.5 0 0	Yes
Clearing within 50m of the defining bank	N/A		Yes		N/A		Yes
Clearing within 5m of the defining bank	N/A		N/A		Yes		Yes
Total Residual Impact (ha)	**2,120.5**		**19.0**		**247.0**		

[1] Structural category obtained from the Regional Ecosystem Description Database (Queensland Herbarium 2014)

[2] Wetland REs discussed in Section 3.7.2

[3] Watercourse REs and defined distances discussed in Section 3.7.3

7.4.2 *Connectivity Areas*

The proposed impacts to 3,944.0ha of remnant REs 11.3.2/b, 11.3.4, 11.3.25/a, 11.3.27, 11.4.2, 11.9.2, 11.9.4, 11.9.7, 11.9.9 and 11.12.1 as part of the Project will not sever connectivity between remnant areas or habitats within the Project Area or with adjacent areas outside the Project Area. Some fragmentation may occur along the western boundary of the Project Area, where pockets of subsidence ponding is likely to occur (Figure 17).

An assessment of the significance of impacts to connectivity areas has been undertaken in accordance with the *Queensland Residual Impact Guideline* (EHP 2014e). The LFC Tool has been used to determine the extent of impacts to connectivity areas. The LFC Tool determines the significance of a development impact on connectivity areas by assessing:

- Test 1: Whether the change in the core ecosystem extent at the local scale (post impact) is greater than a threshold determined by the level of fragmentation at the regional scale; or
- Test 2: If any core area (greater than or equal to 1ha) is lost or reduced to patch fragments (core to non-core) (EHP 2014e).

The EHP was requested to run the LFC Tool for the Project on, 24 March 2015, using the Project Area shown in Figure 2 and based on the current Version 8.0 Regulated Vegetation mapping (NRM 2015).

The LFC Tool determined that Test 2 of the significance assessment is triggered by the Project, whereby two small core areas <100ha adjacent Hail Creek will be fragmented into patches (Plate 1) and this is considered a significant impact according to the *Queensland Residual Impact Guideline* (EHP 2014e).

In line with the *Queensland Environmental Offsets Policy* (EHP 2014f), the full extent of potential impacts on connectivity areas from the entire Project is to be considered in applying the significant residual impact test (EHP 2014e) even though offsets are proposed to be delivered in a staged manner.

It should be noted that EHP have approved some aspects and are still assessing other components of field-validated amendments to the remnant RE mapping for the Study Area (refer Section 2.3.1). However, these amendments were not yet reflected in the Queensland Government regulation vegetation mapping (i.e. Version 8.0), which is updated periodically, at the time the LFC Tool was applied. There is potential for the final approved field-validated mapping to alter the results of the LFC Tool assessment slightly.

7.4.3 *Wetlands and Watercourses*

As outlined in the *Queensland Residual Impact Guideline* (EHP 2014h) a significant residual impact to wetlands and watercourses (separate from vegetation management wetlands and watercourses) could require offsetting under the EO Act. As discussed in Section 3.7, no high ecologically significant wetlands, trigger areas orsprings occur in the Project Area. Therefore, none of these types of wetlands are proposed to be impacted by the Project. While there will be impacts

to and removal of wetlands of GES within the Study Area, these types of wetlands are not recognised as matters of SES.

As discussed in Section 7.2.2, there is a low risk of impacts to GDEs within the extent of underground mining through groundwater draw down or contamination (DPM Envirosciences 2015).

7.4.4 *Protected Wildlife Habitat*

In addition to essential habitat (Figure 7) and protected flora survey trigger areas mapped for the Study Area (Appendix E), vegetation within the Project Area was found to provide habitat for Endangered and Vulnerable wildlife (flora and fauna), which are matters of SES under the EO Act.

Habitat for the following protected wildlife would require clearing and be subject to potential impacts from open cut and infrastructure activities and subsidence ponding as follows:

- 3,936.0ha of high value and 387.5ha of low value Squatter Pigeon habitat
- 0.5ha of high value Ornamental Snake habitat
- 24.5ha of high value and 593.5ha of low value Australian Painted Snipe habitat
- 3,936.0ha of high value Koala habitat
- 34.5ha of high value and 3,888.5ha of low value Glossy-black Cockatoo habitat
- 3,978.5ha of high value and 365.5ha of low value Short-beaked Echidna habitat.

The following sections provide an assessment of the likely impacts and significance of impacts to these protected wildlife.

Squatter Pigeon

The Squatter Pigeon is a matter of SES and NES and impacts to this species are also discussed in Section 7.3.6. An assessment of the significance of impacts to the Squatter Pigeon against the Queensland Residual Impact Guideline (EHP 2014e) has been undertaken in Appendix K2.

It is estimated that 3,936.0ha of high value and 387.5ha of low value habitat is proposed to be impacted by the Project (Figures 25 and 26). However, in line with the assessment of significance of impacts to this species under the EPBC Act, the assessment of significance under the EO Act found that there is unlikely to be a significant residual impact to the Squatter Pigeon (Appendix K2). Extensive areas of similar habitat occur in the landscape and given the mobility of the species, fragmentation of the Study Area is unlikely to disrupt mobility of the species. It is estimated that at least 20,332ha of similar remnant habitat occurs within 5km of the Study Area based on remnant vegetation mapping for the region.

Koala

The Koala is a matter of SES and NES and impacts to this species are also discussed in Section 7.3.7. An assessment of the significance of impacts to the Koala against the *Queensland Residual Impact Guideline* (EHP 2014e) has been undertaken in Appendix K3.

In line with the assessment of significance of impacts to this species under the EPBC Act, the assessment of significance under the EO Act found that there is potential for a significant residual impact to the Koala as a result of the Project due to the large area of high value habitat proposed to be impacted by the Project, i.e. 3,936.0ha (Figures 25 and 26). However, the Koala is likely to persist in the medium-long term as there is extensive habitat in the surrounding landscape, including to be retained in the Study Area. At least 20,332ha of similar remnant Koala habitat occurs within 5km of the Study Area in the broader landscape.

Australian Painted Snipe

The Australian Painted Snipe is a matter of SES and NES and impacts to this species are also discussed in Section 7.3.8. An assessment of the significance of impacts to the Australian Painted Snipe against the Queensland Residual Impact Guideline (EHP 2014e) has been undertaken in Appendix K4.

The Project is proposed to impact 24.5ha of high value and 593.5ha of potential low value habitat in the Study Area (Figures 27 and 28). In line with the assessment of significance of impacts to this species under the EPBC Act, the assessment of significance under the EO Act found that there is potential for a significant residual impact to the Australian Painted Snipe from the Project due to the area of high value habitat that is proposed to be cleared.

Ornamental Snake

The Ornamental Snake is a matter of SES and NES and impacts to this species are also discussed in Section 7.3.9. An assessment of the significance of impacts to the Ornamental Snake against the Queensland Residual Impact Guideline (EHP 2014e) has been undertaken in Appendix K5.

Approximately 0.5ha of high value habitat is proposed to be cleared for the Project (Figures 27 and 28). In line with the assessment of significance of impacts to this species under the EPBC Act, the assessment of significance under the EO Act found that due to the relatively small area of habitat clearing, there is unlikely to be a significant residual impact to the Ornamental Snake.

Glossy-black Cockatoo

The Glossy Black-cockatoo was not identified in the Study Area, but is known from the local area. 244.0ha of potential high value habitat and 6,084.0ha of low value habitat occurs in the Study Area. Potential impacts of the Project include:

- Disturbance or removal of feed trees
- Loss of tree hollows in which to nest

- Indirect impacts from adjacent infrastructure areas, i.e. dust, noise and light impacts on foraging individuals and potential nest sites.

Approximately 25.0ha of high value and 3,864.5ha of low value habitat is proposed to be impacted through vegetation clearing for surface mining and infrastructure (Figures 29 and 30). An additional, 9.5ha of high value habitat and 24.0ha of low value habitat would be potentially impacted by subsidence impacts from underground activities. However, due to the relatively low number of feed trees in the Study Area, this habitat is unlikely to be ecologically significant. Feed trees would remain in the Study Area and habitat would remain elsewhere in the landscape, particularly in the adjacent Homevale National Park. It is estimated that at least 1,667ha of similar remnant habitat occurs within 5km of the Study Area based on remnant vegetation mapping for the region. Therefore, the Project is considered unlikely to significantly impact the Glossy Black-cockatoo. An assessment of the significance of impacts of the Project on the Glossy Black-cockatoo against the *Queensland Residual Impact Guideline* (EHP 2014h) is provided in Appendix K6.

Short-beaked Echidna

The Short-beaked Echidna is listed as Special Least Concern under the NC Act. Approximately 3,945.5ha of high value and 364.0ha of low value habitat for the Short-beaked Echidna would be impacted by the Project through development of open cut pits, waste rock emplacement and infrastructure areas. This habitat is connected with similar large habitat areas to the north-west, north and east-west of the Study Area, including Homevale National Park. An additional 33.0ha of high value habitat and 1.5ha of low value habitat would be impacted gradually, i.e. over 30 years, by subsidence ponding from underground operations (Figures 29 and 30).

Habitat for this species would remain in the local landscape, including in the northern and southern portions of the Study Area and along Hail Creek, and in the west along Middle and Absent Creeks. It is estimated that at least 21,487ha of similar remnant habitat occurs within 5km of the Study Area. Vegetation clearing measures would be implemented to minimise impacts to breeding places of this species, including pre-clearance surveys and the presence of spotter/catchers during clearing (see Section 8). These measures are included in the Hail Creek SMP, which would be updated to incorporate the Project and sent to EHP for approval.

Appendix K7 provides an assessment of the significance of impacts to the Short-beaked Echidna in accordance with the *Queensland Residual Impact Guideline* (EHP 2014e). This assessment found that the Project is unlikely to cause a significant impact to the Short-beaked Echidna due to the widespread non-specific habitat requirements of this species, the unlikely presence of ecologically significant habitat in the Study Area and the extent of this habitat remaining in the landscape.

Impacts to migratory species are addressed in Section 7.3.10.

7.4.5 *Protected Areas - Homevale National Park*

Homevale National Park is located immediately adjacent the Study Area and waste rock emplacement is proposed immediately adjacent Homevale National Park. The boxcut will be progressively rehabilitated and form a bund between the National Park and active mining operations. While no clearing of vegetation or habitat in Homevale National Park is proposed as part of the Project, potential indirect impacts from dust, noise, light and vegetation clearing may affect vegetation and habitat within Homevale National Park within close proximity of the boundary of the Project. These are likely to be temporary for dust and noise impacts, however edge effects within a short distance of the boundary, in the form of weed invasion are likely to be more permanent. A relatively narrow cleared fence line currently exists along the Study Area and Homevale National Park boundary. Therefore, these edge effects are potentially already occurring to some extent.

Protected Areas are matters of SES under the EO Regulation. In accordance with the *Queensland Residual Impact Guideline* (EHP 2014e) an impact to a protected area is significant if it will or is likely to result in one or more of the following:

- The authorised clearing or inundation of all or part of the protected area for the construction of private or publically owned infrastructure on the area
- The exclusion of, or reduction in, the public use or enjoyment of all or part of the protected area
- A reduction in the natural or cultural values of all or part of the protected area.

The Project is not proposed to directly impact the adjacent Homevale National Park, i.e. no clearing is proposed within the National Park and the Project would not reduce or exclude the public use or enjoyment of the Homevale National Park as access to the National Park is remote from the Project.

The Project is likely to reduce the natural or cultural values of part of Homevale National Park in a small area where the Project Area abuts the western boundary of this National Park. This would occur through indirect impacts causing edge effects into the national park, such as noise, dust and light impacts and weed invasion. The extent of these impacts into the Homevale National Park is likely to extend for a distance of approximately 8km along its western boundary adjacent where the Project Area is proposed. The most permanent potential edge effect is considered likely to be weed impacts. Weed infiltration has the potential to extend for a distance of approximately 30m into the National Park given the open woodland structure of the vegetation along its western boundary (equating to a linear area of approximately 24ha). Although this is likely to vary to some extent along the boundary.

Taking into consideration the severity of impacts, it is considered that the residual impacts are unlikely to extend far into the vegetation (approximately 30m) and will not degrade vegetation and habitat to the extent that natural or cultural values will be substantially reduced or compromised.

7.4.6 *Legally Secured Offset Areas*

Legally secured offset areas are recognised as matters of SES under the EO Act. A section of the Study Area is proposed as a legally secured offset area to offset other activities at Hail Creek Mine, separate to this Project. This proposed offset area is shown on Figures 21 and 22 and encompasses the following matters of NES and SES:

- Of Concern REs (refer Sections 7.1.1 and 7.4.1 and Figure 17)
- Endangered REs (refer Sections 7.1.1 and 7.4.1 and Figure 17)
- Black Ironbox and habitat (refer Section 7.3.4 and Figure 21)
- Squatter Pigeon habitat (refer Section 7.3.6 and Figure 25)
- Koala habitat (refer Section 7.3.6 and Figure 25)
- Australian Painted Snipe habitat (refer Section 7.3.7 and Figure 27)
- Glossy Black-cockatoo habitat (refer Section 7.4.4 and Figure 29
- Short-beaked Echidna habitat (refer Section 7.4.4 and Figure 29).

The proposed legally secured offset was conditionally approved in March 2015 and a management plan is being prepared for the area.

The Queensland Residual Impact Guideline (EHP 2014e) considers that an action is likely to have a significant residual impact to a legally secured offset area or matters within the legally secured offset area where one or both of the following occurs:

- For the prescribed environmental matter, or matters, for which the area was set aside for the purposes of an environmental offset – a use of the area that is inconsistent with how the environmental offset was or is required to be undertaken to achieve a conservation outcome for the prescribed environmental matter under a delivery or management plan or agreement
- For any other prescribed environmental matter in the area – a significant residual impact as mentioned elsewhere in the Queensland Residual Impact Guideline (EHP 2014e).

The Project has been designed to avoid this proposed legally secured offset area (refer Figure 21) and therefore, there will be no significant impact to this area in accordance with the Guideline.

7.5 Cumulative Impacts

The Project will add to the existing mine open cut disturbance footprint and combined with subsidence ponding from underground mining, would cover an area of approximately 7,272.0ha compared with the existing and authorised extent of operations of 2,917.0ha (Figure 1). This ultimate disturbance area would not occur immediately but would grow over approximately 32 years and therefore the accumulation of impacts would be gradual within the Study Area.

Coal mine development in the Bowen Basin and specifically in the Moranbah region has grown substantially in the last five years. More than a dozen mine projects

are being developed or operating within 60km of the Study Area (Broadmeadow, Broughton, Burton, Carborough Downs, Coppabella, Daunia, Eaglefield, Goonyella Riverside, Isaac Plains, Miller, Moorvale, Newlands, Eastern Creek, Suttor Creek, Woolombi, Northern Goonyella, South Walker). The closest mines (South Walker Mine and Coppabella) are approximately 20km to the south and south-west of the Study Area. This extent of development combined with broadscale cattle grazing in the region has resulted in a fragmented landscape between intact remnant areas of the Blue Mountains to the east, Carborough and Kerlong Ranges to the south-west within the Denham Range and the Denham and Leichhardt Ranges to the north and further north-west.

Matters of SES and NES that are potentially impacted by the Project are likely to occur elsewhere in the region and some of the other mining projects within the region may also be impacting some of these matters, particularly the Squatter Pigeon and Brigalow communities (Ecotone Environmental Services 2006, 2005 SKM 2009).

This Project would contribute in the short to medium term to the overall reduction in habitat for some species in this region. The extent of this contribution is unknown as the extent of development to be approved in this region cannot be accurately predicted. However, the Project will not impact more than approximately 5% of any given remnant RE within the subregion and generally less than 1.5%. The Project will not impact more than 1.5% of any given remnant RE in the bioregion and generally less than 0.3%. This is based on remnant vegetation remaining in the region and listed in Table 15.

It is proposed that significant residual impacts to matters of SES and NES would be offset to reduce the impact of the Project including the cumulative impact of this Project in the region.

8 Impact Avoidance and Mitigation Measures

Based on this assessment of potential impacts to terrestrial ecology of the Study Area, the following measures outlined in Sections 8.1 to 8.4 are proposed to avoid, minimise and manage impacts of the Project.

- Refinement of the mine design to avoid land clearance (Section 8.1)
- Vegetation clearance procedures (Section 8.2)
- Subsidence management (Section 8.3.1)
- Surface water management (Section 8.3.3)
- Pest animal and weed management (Section 8.3.4)
- Dust management (Section 8.3.5)
- Lighting management (Section 8.3.6)
- Vehicle strike (Section 8.3.7)
- Rehabilitation management of matters of NES (Section 8.3.8).

8.1 Refinement of the Mine Design to Avoid Land Clearance

Design of the surface impact areas of the open cut pits and stockpiles has been undertaken to avoid key matters of SES and NES where possible, including:

- Brigalow TEC (Re 11.9.5)
- Natural Grassland TEC (RE 11.3.21)
- SEVT (REs 11.3.11 and 11.9.4)
- Ecosystem values of the primary watercourses in the Study Area, i.e. Hail Creek, Schammer Creek, Middle Creek and Absent Creek (REs 11.3.4, 11.3.25 and 11.3.25a)

A minimum 30m buffer would be retained around remnant Endangered REs (REs 11.3.1, 11.3.21 and 11.9.5) and Brigalow TEC (RE 11.9.5) and a 30m buffer is proposed adjacent the Natural Grassland TEC (RE 11.3.21) to minimise the edge effects of vegetation clearing on these communities. The total area of Endangered remnant REs and TECs to be avoided equates to 96.0ha.

To reduce the number of dissections of Hail Creek, the existing cleared Hail Creek crossing point, known as 'rock bar crossing', would be used as one of the infrastructure corridors between the existing Hail Creek Mine and the new Project Area (Figure 2).

8.2 Vegetation Clearance Procedures

A number of controls on the clearing methods are proposed in order to minimise impact on habitat and areas of vegetation to be retained. These controls include:

- Clearing would be undertaken sequentially and in accordance with the 'Ground Disturbance Permit' process, whereby all disturbance that involves individual trees (dead or alive), vegetation and soil disturbance requires approval from the Environmental Officer. This would confirm the area of

remnant vegetation to be cleared is that which is required for the safe construction and operation of the Project

- Particular care would be taken in relation to any work in or adjacent to watercourses, particularly in high flow or prolonged rainfall periods. Any necessary sediment control works would be implemented, particularly if remnant pools are located adjacent to construction activities. Any necessary rehabilitation of riparian areas would be undertaken using native flora species. A pre-clearing inspection would be undertaken ahead of construction of powerlines, roads or other linear infrastructure across watercourses to determine which individual trees can be retained during construction works
- The *Hail Creek Mine Species Management Plan* (SMP) (Ecological Survey & Management 2013) would be updated (where necessary) and implemented for all clearing activities as part of the development and operation of the Project. This SMP would be updated to accommodate the Project, including permits and conditions and measures outlined as part of this assessment, where necessary. The SMP includes specifically, the following measures:
    - Work areas in the vicinity of remnant vegetation would be clearly delineated during construction to prevent unnecessary encroachment of disturbance into remnant vegetation
    - A pre-clearing inspection would be undertaken by a spotter/catcher within 48 hours of clearing and would include identifying and marking habitat trees and providing advice on the way to fell trees
    - The vegetation surrounding all identified habitat trees would be cleared first and the habitat tree left for a period of at least one night to allow fauna to vacate of their own volition. At the spotter/catchers discretion, hollows are to be inspected using an elevated work platform (EWP) with any fauna encountered captured and relocated prior to the habitat tree being felled
    - A spotter/catcher would be present during all clearing activities to shadow machinery, rescue animals and relocate these where necessary
- Where practicable, large tree hollows or hollow logs would be retained and relocated to nearby rehabilitation areas
- Dust suppression techniques, i.e. use of water trucks, would be employed where necessary
- Topsoil would be retained and reused as part of rehabilitation and remediation activities to encourage natural regeneration of native species where possible.

8.3 Management of Indirect Impacts

8.3.1 *Subsidence Management*

Approximately 33.0ha of remnant vegetation, outside the footprint of open cut mining, is likely to be impacted progressively by subsidence and likely permanent ponding as the longwall progresses underground (Figure 2). This area would involve 2km of Hail Creek and adjacent alluvial plains.

The Subsidence Management Plan specifies that remediation of areas of subsidence will be undertaken where practicable, particularly within and along creek banks where an increased risk of erosion and instability have been identified. Where necessary, erosion control and stabilisation earthworks will be undertaken to minimise the extent of ponding and scouring of creek banks. The Subsidence Management Plan provides a subsidence monitoring, evaluation and monitoring program to facilitate identification of subsidence impacts, trigger implementation of remediation measures and monitor the effectiveness of remediation works.

Further discussion about subsidence ponding and monitoring is provided in Section 4 of the the *Hail Creek Transition Project Environmental Assessment Report* (Rio Tinto Coal Australia 2015) and the *Subsidence Prediction Report for the Hail Creek Transition Project* (Gordon Geotechniques 2015).

8.3.2 ***Tension Crack Remediation***

Ongoing monitoring and targeted remediation of subsidence cracking is required as part of underground mining operations. As stated in the Subsidence Management Plan, where assessed as necessary, rehabilitation of tension cracking will be undertaken and ongoing maintenance applied if required. In line with the Subsidence Management Plan, remediation will be undertaken sensitively with disturbance and vegetation clearing limited to a narrow strip (2-3m) along the length of the crack and in the immediate vicinity of observed buckling and heaving. Erosion and sediment controls may also be required until groundcover has re-established. This may include the installation of minor diversion drains, hay bales and/or silt fences.Tension crack remediation will be particularly important along the banks of Hail Creek, to maintain creek bank integrity and habitat for Black Ironbox. Weed management will be required in remediated areas to optimise the chance of natural regeneration.

Further detailed discussion about tension crack remediation is provided in Section 4 of the *Hail Creek Transition Project Environmental Assessment Report* (Rio Tinto Coal Australia 2015) and the *Subsidence Prediction Report for the Hail Creek Transition Project* (Gordon Geotechniques 2015).

8.3.3 ***Surface Water Management***

Consistent with the current water management system at the Hail Creek Mine, runoff from undisturbed catchments would be diverted around mining operations, while runoff from disturbed catchments would be captured in the mine water management system and stored and treated for release in accordance with EA conditions. This surface water management minimises the risk of adjacent and downstream vegetation and habitat areas from becoming contaminated and ensures hydrological regimes are maintained as far as practical.

Waste rock would be subject to geochemical investigations to inform emplacement management strategies consistent with the existing *Hail Creek Mine Mineral Waste Management Plan*. This management plan would be revised to incorporate waste rock management for the Project.

8.3.4 *Pest Animal and Weed Management*

Pest animal and weed management measures would be conducted in accordance with the Hail Creek Mine Land Use Stewardship Mangement Plan to minimise the risk of impacts to vegetation and habitats adjacent ML 4738 and areas to be retained in the Study Area.

Pest animal and weed management would include measures such as:

- Weed audits and mapping to be undertaken through the Project Area for declared pest species listed under the LP Regulation and listed as WoNS, to determine distribution and density of declared weeds on site
- Designing and implementing appropriate treatment control programs to contain and reduce the extent of declared pest weed species in the Project Area and prevent introduction of new pest species
- Weed hygiene procedures
- Passive monitoring of pest animals and control options to be implemented when population sizes are considered to require management.

8.3.5 *Dust Management*

Dust suppression measures, such as haul road watering, would be implemented for the Project.

8.3.6 *Vehicle Strike*

Traffic management would include signage to make road users aware of the risk of striking fauna crossing roads.

To minimise vehicle strike to snakes dispersing from Ornamental Snake habitat, a barrier fence will be located at the northern edge of the Ornamental Snake habitat adjacent the haul road that abuts the edge of this habitat area.

8.3.7 *Rehabilitation*

A *Mine Rehabilitation Guidance Note* has been prepared to specifically describe a minimum standard for the planning, implementation and review of rehabilitation of specific land use domains at Hail Creek Mine (Ecological Survey & Management 2014). The four general goals for rehabilitation at HCM require rehabilitation of areas disturbed by mining to result in sites that are:

- Safe to humans and wildlife
- Non-polluting
- Stable
- Able to sustain an agreed post-mining land use of either grazing and/or native ecosystems.

A Rehabilitation Management Plan would be applied to the Project with reference to the existing *Hail Creek Mine Rehabilitation Guidance Note* (Ecological Survey & Management 2014) to document monitoring actions to assess the success of natural regeneration of disturbance from surveys and tension crack remediation

within areas of natural vegetation. It would also address the rehabilitation of Black Ironbox in subsided riparian habitat areas. The monitoring would be undertaken on a regular basis and include techniques such as photographic reference points, ground cover transects along seismic lines and rehabilitation tension cracks to quantify and cover levels of exotic and native groundcover species. This would enable appropriate weed control actions to be determined and areas requiring weed control to be prioritised.

If monitoring indicates that natural regeneration is slow, then additional measures such as seeding or planting of native species would be undertaken to ensure a return to the pre-disturbance vegetation.

8.4 Management of matters of NES and SES

Table 23 outlines the maximum disturbance limits to matters of NES and SES proposed for the Project. Table 24 outlines the measures that are proposed to be employed throughout the Project to ensure disturbance limits are adhered to and impacts to matters of NES and SES are minimised where possible.

Table 23: Matters of NES and SES Disturbance limits

Scientific Name	Common Name	Conservation Status[1]		High Value Habitat Clearance Limits (including subsidence impacts) (ha)
		NC Act	EPBC Act	
N/A	Brigalow TEC	N/A	Endangered	0
N/A	Natural Grassland TEC	N/A	Endangered	0
N/A	SEVT TEC	N/A	Endangered	0
Eucalyptus raveretiana	Black Ironbox	Least Concern	Vulnerable	31.5
Steblus pendulinus	Siah's Backbone	Least Concern	Endangered	0
Geophaps scripta scripta	Squatter Pigeon	Vulnerable	Vulnerable	3,936.0
Phascolarctos cinereus	Koala	Special Least Concern	Vulnerable	3,936.0
Rostratula australis	Australian Painted Snipe	Vulnerable	Vulnerable	24.5
Denisonia maculata	Ornamental Snake	Vulnerable	Vulnerable	0.5
Calyptorhynchus lathami	Glossy Black-cockatoo	Vulnerable	Not Listed	34.5
Tachyglossus aculeatus	Short-beaked Echidna	Special Least Concern	Not Listed	3,978.5
Various	Migratory bird species	Special Least Concern	Migratory	Not specified

Table 24: Mitigation measures to minimise impacts to matters of NES and SES

Common Name	Management Measures
Brigalow TEC	▪ Provision of a minimum 30m buffer around this TEC. ▪ Surface water will managed to maintain surface water quality and flow feeding into Brigalow, by diverting runoff from undisturbed catchments around mining operations, and capturing, storing and treating runoff from disturbed catchments, for release under controlled circumstances and in accordance with EA conditions.
Natural Grassland TEC	▪ Provision of a minimum 30m buffer around this TEC. ▪ Surface water will managed to maintain surface water quality and flow feeding into the Natural Grassland community, by diverting runoff from undisturbed catchments around mining operations, and capturing, storing and treating runoff from disturbed catchments, for release under controlled circumstances and in accordance with EA conditions.
SEVT TEC	▪ Provision of a minimum 30m buffer around this TEC.
Black Ironbox	▪ Areas of disturbance within 50m of Hail, Schammer and Middle Creeks would be designed to avoid large Black Ironbox trees, i.e. avoidance of trees greater than 60cm DBH where possible. ▪ Linear infrastructure will be co-located within cleared corridors where possible.
Squatter Pigeon	▪ Impacts to the Squatter Pigeon will be managed during vegetation clearing through implementation of the SMP that will include measures such as: o Progressive clearing o Pre-clearance surveys to identify breeding places o Presence of a spotter/catcher to supervise clearing o Avoiding nests and young during clearing activities where possible, or removing to a wildlife carer.
Koala	▪ Impacts to the Koala will be managed during vegetation clearing through implementation of the SMP that will include measures such as: o Progressive clearing o Pre-clearance surveys o Presence of a spotter/catcher to supervise clearing ▪ Where Koalas are located during clearing activities, a 20m buffer and connectivity with other vegetated areas would be retained around the tree in which the Koala is located, and left until the Koala moves away of its own accord.
Australian Painted Snipe	▪ Surface water will managed to maintain surface water quality and flow feeding into retained wetland habitat, by diverting runoff from undisturbed catchments around mining operations, and capturing, storing and treating runoff from disturbed catchments, for release under controlled circumstances and in accordance with EA conditions. .Subsidence monitoring will take place, to identify areas that may require remediation to minimise ponding, erosion from tension cracking or to ensure stream bank stabilisation ▪ Implement SMP to minimise impacts on breeding places and individuals.
Ornamental Snake	▪ A fence will be located between the section of high value habitat and the haul road that will impact the habitat to minimise impacts to dispersing snakes. ▪ Occurrences of this habitat in Mining Lease 4738 would be managed to eliminate exotic grasses and declared weed species, particularly Parthenium Weed, Velvet Prickly Pear and Harrisia Cactus.

Common	Management Measures
	▪ Surface water will managed to maintain surface water quality and flow feeding into gilgai habitat, by diverting runoff from undisturbed catchments around mining operations, and capturing, storing and treating runoff from disturbed catchments, for release under controlled circumstances and in accordance with EA conditions.
Migratory bird species	▪ Impacts to migratory birds will be managed during vegetation clearing through implementation of an EHP approved SMP that will include measures such as: o Progressive clearing o Pre-clearance surveys to identify breeding places o Presence of a spotter/catcher to supervise clearing o Avoiding nests and young during clearing activities where possible, or removing to a wildlife carer.
Glossy Black-cockatoo	▪ Impacts to the Glossy Black-cockatoo will be managed during vegetation clearing through implementation of an EHP approved SMP that will include measures such as: o Progressive clearing o Pre-clearance surveys to identify breeding places o Presence of a spotter/catcher to supervise clearing o Avoiding nests and young during clearing activities where possible, or removing to a wildlife carer.
Short-beaked Echidna	▪ Impacts to the Short-beaked Echidna will be managed during vegetation clearing through implementation of an EHP approved SMP that will include measures such as: o Progressive clearing o Pre-clearance surveys to identify breeding places o Presence of a spotter/catcher to supervise clearing

9 Residual Impacts and Offset Liability

An assessment of residual impacts and the resulting offset liability has been undertaken for matters of SES, NES and local environmental significance (LES) after all mitigation measures could be implemented.

The environmental offsets framework in Queensland has recently been amended and in July 2014 the EO Act, along with the EO Regulation was passed and the *Queensland Environmental Offsets Policy* (QEOP) (EHP 2014f) was released.

The EO Regulation prescribes a number of matters of NES, SES and LES. Under the EO Act, matters of NES, SES or LES may require offsetting if a prescribed activity is likely to cause a significant residual impact to these matters. The *Queensland Environmental Offsets Policy Significant Residual Impact Guideline* (EHP 2014e) is used to assess the potential for significant residual impacts to occur.

The assessment of EPBC Act listed MNES that may need to be assessed as part of a project and the assessment of significance of impacts is to be undertaken in accordance with the *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DotE 2013b). The *EPBC Act Environmental Offsets Policy* (SEWPaC 2012) is used to determine the offset requirements of a project. Sections 4 and 5.2 of the Offsets Policy states that offsets under the EPBC Act are only required if residual impacts are 'significant'.

For this Project some matters of NES are also matters of SES, i.e. the vegetation forming the Brigalow, Natural Grassland and SEVT TECs, Squatter Pigeon, Koala, Australian Painted Snipe and Ornamental Snake. Matters that are prescribed NES and SES are required to be assessed under both the Commonwealth *EPBC Act Significant Impact Guidelines* (DotE 2013b) and the *Queensland Residual Impact Guideline* (EHP 2014e).

Sections 9.1 and 9.2 outline the potential significant residual impacts to specific matters of NES and SES as a result of the Project and provide areas of impact from which offset liability may be predicted. Table 25 provides an overall summary of land area that may require offsetting as part of the Project, i.e. including matters of NES and SES. These totals include areas of habitat and vegetation for which a significant residual impact is proposed, i.e. Regulated Vegetation, Koala and Australian Painted Snipe habitat and Connectivity Areas. The total area of vegetation and habitat that will likely require offsetting under Queensland and Commonwealth legislation is not an accumulated total, but accounts for the overlap of impact area that is the same for each environmental matter.

Table 25: Total land area potentially requiring offsetting (all matters of NES and SES combined)

	Total Footprint Size[1] (ha)	Land Area to be Offset[2] (ha)
Stage 1	2,110.5ha	1,934.0
Subsequent Stages	2,244.5	2,026.5
Total	4,355.0	3,960.5

[1] Including remnant vegetation, regrowth and cleared land in indicative extent of open cut components and subsidence ponding.
[2] Matters of NES and matters of SES in indicative extent of open cut components and subsidence ponding.

9.1 Significant Residual Impacts on Matters of NES

Assessment of the Project's full development extent impacts was undertaken for each of the following matters of NES identified in the Study Area:

- Black Ironbox
- Squatter Pigeon
- Koala
- Australian Painted Snipe
- Ornamental Snake.

Matters of NES have been discussed throughout this assessment report in Sections 4.4.1, 5.5.1, 7.3, 8.4 and Appendix K. Some of the matters of NES listed above are also matters of SES and discussed in Section 9.2 in relation to the EO Act.

It was found that for all matters of NES, except the Koala and the Australian Painted Snipe, impacts could be avoided or minimised sufficiently to reduce the likelihood of significant residual impacts occurring as a result of the Project – that is, there will be no residual impact to matters of NES, with the exception of the Koala and the Australian Painted Snipe (refer Appendix K). It is noted that while large areas of Squatter Pigeon habitat will be impacted by the Project, the species is considered to remain common north of the Canarvon Ranges, occurring as a continuous, single, sub-population. Also, the region in which the Study Area is located is not recognised as supporting an Important Population (discussed in Section 7.3.6 and Appendix K2) and therefore, the impact to this species is unlikely to be significant.

The impacts to 3,936.0ha of critical habitat for potentially an important population of the Koala is considered likely to be significant in accordance with the EPBC Act referral guidelines for the vulnerable Koala (DotE 2014b), whereby greater than 20ha of critical habitat is proposed to be cleared (Figure 25). Therefore, offsets are proposed for the Koala. Stage 1 of the Project will involve clearing of 1,924.5ha of high value habitat for the Koala (Figure 26).

The Project will impact 24.5ha of high value Australian Painted Snipe habitat mostly associated with the central wetland within the Study Area (Figure 27). While the habitat in which the species was recorded in the Study Area, i.e. Natural

Grassland RE 11.3.21, will not be impacted by the Project, approximately 24.5ha of potential high value habitat will be impacted, which is considered to be potentially significant under the EPBC Act (Figure 27).

It should be noted that in many cases area calculations may overlap where more than one species occupies the same habitat, for example 3,936.0ha of high value Koala and Squatter Pigeon habitat is formed by the same mapped habitat type within the Study Area (Figure 25). Similarly, an area of TEC which on its own is a matter of NES may also form habitat for another matter of NES, for example Brigalow TEC forms habitat for the Ornamental Snake. Therefore, the areas of matters of NES to be offset would not necessarily be an accumulated total of the areas provided in Table 26. For matters of NES, under the EPBC Act, significant residual impacts of 3,936.0ha of Koala habitat and 24.5ha of Australian Painted Snipe habitat will potentially require offsetting.

Table 26: Matters of NES potentially requiring offsets under the EPBC Act

Matters of National Environmental Significance	Stage 1	Full Development Extent (including Stage 1)			Significant Residual Impacts Likely?
	Potential Habitat in the Stage 1 Project Area (high value only) (ha)	Potential Habitat in the Indicative Extent of Project Open Cut Components (high value only) (ha)	Additional Potential Habitat in the Indicative Extent of Underground Mining i.e. subsidence ponding (high value only) (ha)	Total Potential Habitat in the Project Area (high value only) (ha)	
Threatened Ecological Communities*					
Brigalow TEC	0	0	0	0	No
Natural Grassland TEC	0	0	0	0	No
SEVT TEC	0	0	0	0	No
Threatened Species					
Black Ironbox	2.0	22.0	9.5	31.5	No
Siah's Backbone	0	0	0	0	No
Squatter Pigeon*	1,924.5	3,903.0	33.0	3,936.0	No
Koala*	1,924.5	3,903.0	33.0	3,936.0	Yes
Australian Painted Snipe*	9.5	24.5	0	24.5	Yes
Ornamental Snake*	0.5	0.5	0	0.5	No
Migratory Species[1]	1,925.5	3,911.0	33.0	3,944.0	No

Note: Only impacts to high value habitat areas have been used in calculations to determine potential offset liability.

[1] All remnant REs potentially provide habitat for one or more migratory species, therefore, this has been used to calculate migratory bird habitat proposed to be impacted.

* Indicates the Matter of NES is also a matter of SES

9.2 Significant Residual Impacts on Matters of SES

Matters of SES have been discussed throughout this assessment report in Sections 4.4.2, 5.5.2, 7.4, 8.4 and Appendix K. Matters of LES for the Project and surrounding areas are not prescribed.

Table 27 outlines the likely impacts to matters of SES from the Project at Stage 1 and the full development extent and identifies which matters of SES are likely to require offsetting under the EO Act. Table 27 identifies that a significant residual impact is likely for Regulated Vegetation and Protected Wildlife Habitat as a result of the Project due to the extent of high value habitat that is proposed to be cleared. This high value habitat encompasses essential habitat for the Squatter Pigeon and Ornamental Snake, which is mapped by the Queensland Government within the Project Area, and is therefore not assessed separately. It should be noted that in many cases area calculations may overlap where more than one species occupies the same habitat, for example 3,936.0ha of high value Koala and Squatter Pigeon habitat is formed by the same mapped habitat type within the Study Area (Figure 25). Similarly, an area of Endangered RE which on its own is a matter of SES may also form habitat for another matter of SES, for example Endangered RE 11.3.21 forms habitat for the Australian Painted Snipe. Therefore, the areas of matters of SES to be offset would not necessarily be an accumulated total of the areas provided in Table 27. For matters of SES under the EO Act, regulated vegetation, connectivity areas, protected wildlife and protected areas totals identified in column 5 of Table 27 will potentially require offseting.

Table 27: Matters of SES potentially requiring offsets under the EO Act

Matters of State Environmental Significance	Stage 1		Full Development Extent (including Stage 1)				Significant Residual Impacts likely?
	Potential Habitat in the Stage 1 Project Area (high value only) (ha)		Potential Habitat in the Indicative Extent of Project Open Cut Components (high value only) (ha)	Additional Potential Habitat in the Indicative Extent of Underground Mining i.e. subsidence ponding (high value only) (ha)	Total Indicative Extent of the Project (high value habitat only) (ha)		
Regulated Vegetation (total area)							Yes
'Endangered' or 'of concern' regional ecosystems*; or	RE11.3.2 RE11.3.4 RE11.9.7	161.5 65.0 661.0	2,097.0	23.5	RE11.3.2/b RE11.3.4 RE11.9.7	355.0 242.0 1,523.5	Yes
	887.5				2,120.5		
Regional ecosystems within mapped vegetation management wetlands	RE11.3.2 RE11.3.27	0.5 8.0	19.0	0	RE11.3.2/b RE11.3.27	0.5 18.5	Yes
	8.5				19.0		
Regional ecosystems within the defined distance of a vegetation management watercourse	RE11.3.2 RE11.3.25/a RE11.3.27 RE11.3.4 RE11.9.2 RE11.9.7 RE11.9.9	18.5 4.0 1.0 15.5 8.0 19.0 58.5	232.0	15.0	RE11.3.2/b RE11.3.4 RE11.3.25/a RE11.3.27 RE11.9.2 RE11.9.7 RE11.9.9	30.0 33.5 31.5 2.5 9.0 59.0 81.5	Yes
	124.5				247.0		
Connectivity Areas[1]	1,925.5		N/A		3,944.0		Yes

Matters of State Environmental Significance	Stage 1	Full Development Extent			Significant Residual Impacts likely?
	Potential Habitat in the Stage 1 Project Area (high value only) (ha)	Potential Habitat in the Indicative Extent of Project Open Cut Components (high value only) (ha)	Additional Potential Habitat in the Indicative Extent of Underground Mining i.e. subsidence ponding (high value only) (ha)	Total Potential Habitat in the Project Area (high value only) (ha)	
Wetlands and Watercourses	N/A				
Protected Wildlife Habitat (total area)					Yes
Squatter Pigeon*	1,924.5	3,903.0	33.0	3,936.0	No
Koala*	1,924.5	3,903.0	33.0	3,936.0	Yes
Australian Painted Snipe*	9.5	24.5	0	24.5	Yes
Ornamental Snake*	0.5	0.5	0	0.5	No
Glossy Black-cockatoo	5.0	25.0	9.5	34.5	No
Short-beaked Echidna	1,946.0	3,945.5	33.0	3,978.5	No
Koala habitat in south-east Queensland	N/A				
Protected Areas	24.0	N/A		24.0	Refer Section 7.4.5
Fish Habitat Areas and highly Protected Zones of State Marine Parks	Refer to (DPM Enviroscienses 2015)				
Waterways Providing for Fish Passage	Refer to (DPM Enviroscienses 2015)				
Marine Plants	N/A				
Legally Secured Offset Areas	0	0	0	0	No

Note: Only impacts to high value habitat areas have been used in calculations to determine potential offset liability.

[1] Connectivity Area is represented by remnant vegetation, therefore the extent of remnant REs has been used to calculate Connectivity Areas proposed to be impacted.

* Indicates the Matter of SES is also a matter of NES

9.3 Offset Strategy

An environmental offset is required under the Commonwealth EPBC Act and the Queensland EO Act to address the residual significant impacts on matters of NES and matters of SES that are likely as a result of the Project. In late 2014 and early 2015, RTCA met with representatives from the Queensland EHP and the Commonwealth DotE to discuss the offset for the Project and the offset strategy described below is based on the outcome of those discussions.

RTCA proposes to provide a staged offset in accordance with the *Queensland Environmental Offsets Policy* (EHP 2014f) for both matters of NES and SES whereby the initial offsets will be secured for Stage 1 with the balance of offsets in subsequent stages. Stage 1 is proposed to cover clearing of the footprint from construction to the end of Year 2 (i.e. approximately 1,925.5ha of remnant regional ecosystems). In accordance with the *Queensland Environmental Offsets Policy* (EHP 2014f), a detailed assessment of the impact of each stage of the Project and the offset requirement for each stage would be conducted prior to providing the notice of election to EHP for that stage. The offset would be provided before the commencement of each stage. As described in the *Queensland Environmental Offsets Policy* (EHP 2014f), offset staging will provide RTCA with flexibility to adapt the offset provisions to operational changes that may occur over time.

RTCA proposes to offset Stage 1 of the Project using the financial settlement offset calculated in accordance with the Queensland *Financial Settlement Offset Calculator* ((EHP 2015c) Date accessed March 2015) for matters of NES and SES. The *Financial Settlement Offset Calculator* includes all relevant matters of SES (i.e. Connectivity Areas, Regulated Vegetation [including Endangered, Of Concern, wetland vegetation and watercourse vegetation], and Protected Wildlife [Koala and Australian Painted Snipe]) as well as all relevant matters of NES (i.e. Koala and Australian Painted Snipe). The financial settlement offset fund is managed by EHP who will be responsible for ensuring delivery of conservation outcomes for the particular impacted matters. The impacts from subsequent stages would be offset in accordance with the *Queensland Environmental Offsets Policy* (EHP 2014f) prior to clearing above the allowances in Stage 1 Subsequent stages may be offset via a financial settlement offset, land-based offset or a direct-benefit offset.

The Queensland Government's Environmental Offsets Framework ((EHP 2015d) Date accessed March 2015) indicates that the approach for financial settlement offsets are aligned with the Commonwealth's approach under the EPBC Act Offset Assessment Guide (SEWPaC 2012). The Commonwealth *EPBC Act Environmental Offsets Policy* (SEWPaC 2012) describes that a state offset will count toward an offset under the EPBC Act to the extent that it compensates for the residual impact to the protected matter identified under the EPBC Act. Therefore, the Queensland calculator will account for impacts on all relevant matters of NES, namely, the Koala and Australian Painted Snipe. The Queensland Government's Environmental Offsets Framework ((EHP 2015d) Date Accessed March 2015) caps the maximum offset requirement at a ratio of 1:4 (area cleared to area offset). RTCA would work with EHP to enable it to spend the fund amount in the same region as the Project.

10 References

Accad, A., Neldner, V.J., Wilson, B.A., Niehus, R.E., 2012. *Remnant Vegetation in Queensland. Analysis of remnant vegetation 1997-2009, including regional ecosystem inforamtion*. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.

Auld, B.A., Medd, W., 2002. *Weeds: An illustrated botanical guide to the weeds of Australia*. Inkata Press, Melbourne.

Ball, D., Kitchener, T., Champion, I., 2001. *An assessment of Nature Conservation Values contained by Lot 13, Hail Creek*. Queensland Parks and Wildlife Service, prepared for Hail Creek Coal P/L, Brisbane.

Batianoff, G.N., Pearson, S.G., 1990. *Further Notes on Bertya-sharpeana Guymer Euphorbianceae a Significant Extension of Its Range in Queensland Australia*. Austrobaileya 3, 327–328.

Bennett, A.F., Resources, I.U. for C. of N. and N., Programme, I.F.C., 1999. *Linkages in the Landscape: The Role of Corridors and Connectivity in Wildlife Conservation*, The IUCN Forest Conservation Programme Series. International Union for the Conservation of Nature, Gland, Switzerland.

BirdLife Australia, 2014. *The Atlas of Australian Birds*. Date accessed 7 February 2014, BirdLife Australia and WildlifeLink, Queensland.

BoM, 2015. *Climate Statistics for Australian Locations*. Australian Government, Canberra.

Bostock, P.D., Holland, A.E. (Eds.), 2010. *Census of the Queensland FLora 2010*. Queensland Herbarimu, Biodiversity and Ecosystem Sciences, Department of Environment and Resource Management, Queensland Government, Brisbane.

Brooker, M.I.A., Kleinig, D.A., 2008. *Field Guide to Eucalypts: Northern Australia*, Field Guide to Eucalypts. Bloomings Books, Melbourne.

Chapple, D.G., 2003. *Ecology, life-history, and behavior in the Australian scincid genus Egernia, with comments on the evolution of complex sociality in lizards*. Herpetol. Monogr. 17, 145–180.

Churchill, S., 2009. *Australian Bats*. Allen & Unwin, Crows Nest.

Cogger, H.G., 2014. *Reptiles and Amphibians of Australia*, 7th ed. CSIRO Publishing, Collingwood.

Cooper, W., 2004. *Fruits of the Australian Tropical Rainforest*. Nokomis Editions Pty Ltd, Melbourne.

Cropper, S.C., 1993. *Management of endangered plants*. CSIRO Publishing, Collingwood, Victoria.

CSIRO, 2013. *Atlas of Living Australia, Melaleuca pearsonii*. Global Biodiversity Information Facility, Canberra.

DEH, 2014. *Native animal facts - Glossy black-cockatoo*. Date accessed 26 November 2014, Department of Environment and Heritage, NSW Government, Sydney.

DERM, 2011. *Queensland Biodiversity Offset Policy (version 1)*. Department of Environment and Resource Management, Queensland Government, Brisbane.

DEWHA, 2010a. *Survey guidelines for Australia's threatened birds*. Department of the Environment, Water, Heritage and the Arts, Australian Government, Canberra.

DEWHA, 2010b. *Survey guidelines for Australia's threatened bats*. Department of the Environment, Water, Heritage and the Arts, Australian Government, Canberra.

DNR, 1999. *Species management maunal: information to assist Queensland's foresters and forest resource managers in management of flora and fauna that are endangered, vulnerable or rare, and for other species requiring special management - Volume 3 (Flora)*. Department of Natural Resources, Queensland Government, Brisbane.

Doley, D., 2003. *Effects of minderal dusts on vegetation a review of literature and model calculations*. Report to Sinclair Kinght Merz, Brisbane.

DotE, 2015a. *Streblus pendulinus - Siah's Backbone SPRAT Profile*. Department of the Environment, Commonwealth Government, Canberra.

DotE, 2015b. *Hydroprogne caspia - Caspian Tern SPRAT Profile*. Department of the Environment, Australian Government, Canberra.

DotE, 2015c. *Geophaps scripta scripta - Squatter Pigeon (southern) SPRAT Profile*. Date accessed 19 February 2015, Department of the Environment, Commonwealth Government, Canberra.

DotE, 2014a. *EPBC Act Protected Matters Search Report*. Date accessed 10 December 2014, Department of the Environment, Australian Government, Canberra.

DotE, 2014b. *EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)*. Department of the Environment, Australian Government, Canberra. Available at: http://www.environment.gov.au/system/files/resources/dc2ae592-ff25-4e2c-ada3-843e4dea1dae/files/koala-referral-guidelines.pdf.

DotE, 2014c. *Geophaps scripta scripta - Squatter Pigeon (southern) SPRAT Profile*. Date accessed 17 July 2014; Department of the Environment, Australian Government, Canberra.

DotE, 2014d. *Phascolarctos cinereus Koala SPRAT Profile*. Department of the Environment, Australian Government, Canberra.

DotE, 2014e. *Denisonia maculata - Ornamental Snake SPRAT Profile*. Department of the Environment, Canberra.

DotE, 2014f. *Ardea ibis - Cattle Egret SPRAT Profile*. Department of the Environment, Australian Government, Canberra.

DotE, 2014g. *Haliaeetus leucogaster - White-bellied Sea-Eagle SPRAT Profile*. Department of the Environment, Canberra.

DotE, 2014h. *Hirundapus caudacutus - White-throated Needletail SPRAT Profile*. Department of the Environment, Canberra.

DotE, 2014i. *Apus pacificus - Fork-tailed Swift SPRAT Profile*. Date accessed 13 February 2014, Department of the Environment, Australian Government, Canberra.

DotE, 2014j. *Denisonia maculata in Species Profile and Threats Database*. Department of the Environment, Canberra.

DotE, 2014k. *Hirundo rustica - Barn Swallow*. Date accessed 13 February 2014, Department of the Environment, Australian Government, Canberra.

DotE, 2014l. *Monarcha melanopsis - Black-faced Monarch*. Date accessed 13 February 2014, Department of the Environment, Australian Government, Canberra.

DotE, 2014m. *Gallinago hardwickii in Species Profile and Threats Database*. Date accessed 13 February 2014, Department of the Environment, Australian Government, Canberra.

DotE, 2014n. *Eucalyptus raveretiana - Black Ironbox SPRAT Profile*. Date accessed 26 November 2014, Department of the Environment, Commonwealth Government, Canberra.

DotE, 2014o. *Rostratula australis - Australian Painted Snipe SPRAT Profile*.

DotE, 2013a. *Draft EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)*. Department of the Environment, Australian Government, Canberra.

DotE, 2013b. *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*. Department of the Environment, Australian Government, Canberra.

DotE, 2013c. *Lerista allanae - Allan's Lerista, Retro Slider SPRAT PRofil*. Department of the Environment, Australian Government, Canberra.

DotE, 2008. *Approved Conservation Advice for Ozothamnus eriocephalus*. Department of the Environment, Australian Government, Canberra.

DPM Envirosciences, 2015. *Draft Hail Creek Transition Project - Aquatic Ecology Impact Assessment*. Prepared for Rio Tinto Coal Australia (Hail Creek Mine), Mountain Creek.

Ecological Survey & Management, 2014. *Hail Creek Coal Mine Rehabilitation Guidance Note*. Prepared for Rio Tinto Coal Australia (Hail Creek Mine), Brisbne.

Ecological Survey & Management, 2013. *Hail Creek Mine Species Management Program*. Prepared for Rio Tinto Coal Australia (Hail Creek Mine), Brisbane.

Ecological Survey & Management, 2012. *Annual Threatened Fauna Monitoring*. Ecological Survey & Management, prepared for RTCA Hail Creek Coal, Brisbane.

Ecological Survey & Management, 2011a. *Hail Creek Mine Rehabilitation BioCondition Monitoring Report 2011*. Ecological Survey & Management, prepared for RTCA Hail Creek Coal, Brisbane.

Ecological Survey & Management, 2011b. *Targeted threatened flora surveys in semi-evergreen vine thicket communities in Lot 13*. Ecological Survey & Management, prepared for RTCA Hail Creek Coal, Brisbane.

Ecological Survey & Management, 2011c. *Eucalyptus raveretiana (Black Ironbox) Monitoring Program, 2011 Draft Report*. Ecological Survey & Management, prepared for RTCA Hail Creek Coal, Brisbane.

Ecological Survey & Management, 2010. *Eucalyptus raveretiana (Black Ironbox) Monitoring Program, 2010 Final Report*. Ecological Survey & Management, prepared for RTCA Hail Creek Coal, Brisbane.

Ecotone, 2008. *Assessment of Regional Ecosystem Mapping and Eucalyptus raveretiana for a proposed Co-disposal area at the Hail Creek Mine, Central Queensland*. Ecotone Ecological Consultants, Waratah, New South Wales.

Ecotone Environmental Services, 2006. *Carborough Extension Report - Flora and Fauna*. Prepared for Matrix Consulting, Brisbane.

Ecotone Environmental Services, 2005. *Isaac Plains Project Flora and Fauna Assessment*. Prepared for Matrix Consulting, Brisbane.

EHP, 2015a. *EIS information guideline - Flora and fauna*. Department of the Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2015b. *Protected Plants Flora Survey Trigger Map*. Date accessed 12 March 2015, Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2015c. *Financial Settlement Offset Calculator*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2015d. *Environmental Offsets Framework*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2014a. *Environmental Protection Act 1994 Notice: Information request for an amendment application for an environmental authority (reference 173053)*. Department of the Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2014b. *Rare or threatened plants of Homevale National Park, Wetland Info*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2014c. *Protected Plants Flora Survey Trigger Map*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2014d. *Guide to determining terrestrial habitat quality - A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2014e. *Queensland Environmental Offsets Policy Significant Residual Impact Guideline*. Department of the Environment and Heritage Protection, Queensland Government, Brisbane. [http://www.ehp.qld.gov.au/assets/documents/pollution/management/offsets/significant-residual-impact-guide.pdf; Date accessed 26 March 2015].

EHP, 2014f. *Queensland Environmental Offsets Policy (Version 1.1)*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2014g. *Isaac River drainage sub-basin - facts and maps, WetlandInfo*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2014h. *Queensland Environmental Offsets Policy Draft Significant Residual Impact Guidelines*. Unpublished Report Prepared by the Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2013a. *Northern Bowen Basin bioregion province - facts and maps, WetlandInfo*. Date accessed 12 February 2013, Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2013b. *Wildlife Online Extract*. Date Accessed 20 August 2013, Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2013c. *Broad Vegetation Groups*. Date accessed 23 January 2014, Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2013d. *Mt. Coolum bertya - Bertya sharpeana, WetlandInfo*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EHP, 2001. *Code of Environmental Compliance for Exploration and Mineral Development Projects*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

Elsol, J., 1996. *Hail Creek Project Vegetation Study*. Rio Tinto Coal, Brisbane.

Endler, J.A., 1977. *Geographical Variation, Speciation, and Clines*. Princeton University Press, New Jersey, USA.

Environment Australia, 2001. *Threat Abatement Plan for Diback caused by the root-rot fungus Phytophthora cinnamomi*. Natural Heritage Trust, Enviornment Australia, Commonwealth Government, Canberra. Available at: http://www.environment.gov.au/biodiversity/threatened/publications/tap/pubs/phytophthora.pdf.

Environmental Research and Education, 1996. *Hail Creek Coal Project: Fauna Survey*. Environmental Research and Education, prepared for Minenco, Brisbane.

EPA, 2008. *Biodiversity Planning Assessment, Brigalow Belt (Version 1.3)*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

EPA, 2006. *Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016*. Environmental Protection Agency, Queensland Government, Brisbane.

ERM, 2010. *South East Queensland Koala Conservation State Planning Regulatory Provisions*. Department of Environment and Resource Management, Queensland Government, Brisbane.

Eyre, T.J., Ferguson, D.J., Hourigan, C.L., Smith, G.C., Mathieson, M.T., Kelly, A.L., Venz, M.F., Hogan, L.D., Rowland, J., 2014. *Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland Version 2.0*. Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.

Eyre, T.J., Kelly, A.L., Neldner, V.J., 2011. *Biocondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland, Assessment Manual, Version 2.1*. Department of Environment and Resource Management, Queensland Government, Brisbane.

Eyre, T.J., Kelly, A.L., Neldner, V.J. et al., 2008. *Biocondition: A terrestrial Condition Assessment Tool for Biodiversity in Queensland. Field Assessment*

Manual Version 1.6. Biodiversity Sciences Unit, Environmental Protection Agency, Queensland Government, Brisbane.

Fletcher, M., 2001. *Rare and threatened plants of the Central Highlands*. Queensland Parks and Wildlife Service, Emerald.

Footprints Environmental Consultants, 2009a. *First Monitoring Survey Event for the Ornamental Snake (Denisonia maculata) and Little Pied Bat (Chalinolobus picatus) on Hail Creek Mine*. Footprints Environmental Consultants, prepared for RTCA Hail Creek Coal, Brisbane.

Footprints Environmental Consultants, 2009b. *Biodiversity Values Assessment of Remnant Habitats supported within the Hail Creek Mining Lease*. Footprints Environmental Consultants, prepared for RTCA Hail Creek Coal, Brisbane.

Footprints Environmental Consultants, 2009c. *Biodiversity Values Assessment of the Lot 13 Property, WHS 466*. Footprints Environmental Consultants, prepared for RTCA Hail Creek Coal, Brisbane.

Forman, R.T.T., 1995. *Some general principles of landscape and regional ecology*. Landsc. Ecol. 10, 133–142.

Forster, P.I., 1994. *Notes on Dansiea Byrnes and Macropteranthes*. Austrobaileya 4, 149–153.

Garnett, S.T., Crowley, G.M., 2000. *The Action Plan for Australian Birds*. Natural Heritage Trust, Enviornment Australia, Commonwealth Government, Canberra.

Garnett, S.T., Szabó, J., Dutson, G., 2011. *The Action Plan for Australian Birds 2010*. CSIRO Publishing, Collingwood, Victoria.

Golder Associates, 2015. *Hail Creek Transition Project Geochemical Assessment*. Prepared for Rio Tinto Coal Australia, Brisbane.

Gordon Geotechniques, 2015. *Subsidence Prediction Report for the Hail Creek Transition Project*. Prepared for Rio Tinto Coal Australia, Brisbane.

GSS Environmental, 2007. *Soil Survey and Land Resource Assessment - Hail Creek*. Global Soil Systems Environmental, Brisbane.

Guymer, G.P., 1988. *Notes on Bertya Planchon (Euphorbiaceae)*. Austrobaileya 2, 427–431.

Hacker, J.B., 1990. *A Guide to Herbaceous and Shrub Legumes of Queensland*. University of Queensland Press, Brisbane.

Halford, D.A., Henderson, R.J.F., 2002. *Studies in Euphorbiaceae A.L.Juss. sens. lat. 3. A revision of Bertya Planch. (Ricinocarpeae Müll.Arg., Bertyinae Müll.Arg.)*. Austrobaileya 6, 187–245.

Hanger, J., Loader, J., 2009. *Infectious disease in koalas: Implications for conservation. In: Koala Conservation Conference.* Friends of the Koala, Lismore.

Harden, G., McDonald, W.J.F., McDonald, B., Williams, J., 2007. *Rainforest Climbing Plants: A Field Guide to Their Identification*. Gwen Harden Publishing, Nambucca Heads, New South Wales.

Harden, G.J., McDonald, B., McDonald, W.J., Williams, J.B., 2006. *Rainforest Trees and Shrubs: A Field Guide to Their Identification in Victoria, New South Wales and Subtropical Queensland Using Vegetative Features*. Gwen Harden Publishing, Nambucca Heads, New South Wales.

Hatch, 2015a. *Hail Creek Transition Project Surface Water Assessment*. Prepared for Rio Tinto Coal Australia, Brisbane.

Hatch, 2015b. *Waterway Flow Impact Assessment Hail Creek Transition Project*. Prepared for Resource Strategies, Brisbane.

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

Higgins, P., Davies, S.J.J.F., 1996. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 3 Snipe to Pigeons*. Oxford University Press, Melbourne.

Higgins, P.J., Peter, J.M., Cowling, S.J., 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., 2001. *Handbook of Australian, New Zealand & Antarctic Birds, Volume 5, Tyrant-flycatchers to Chats*. Oxford University Press, Melbourne.

Hydrobiology, 2015. *Fluvial Geomorphology & Surface Water Quality Assessment (Draft) Hail Creek Transition Project*. Prepared for Rio Tinto Coal Australia (Hail Creek Mine), Brisbane.

JKR Ecological, 2010. *RTCA Hail Creek Mine - Annual Threatened Fauna Monitoring, 2010*. JKR Ecological, prepared for RTCA Hail Creek Coal, Brisbane.

Jones, D.L., 2006. *A Complete Guide to Native Orchids of Australia Including Island Territories*. Reed New Holland, Sydney.

Marchant, S., Higgins, P. (Eds.), 1994. *The Handbook of Australian, New Zealand and Antarctic Birds: Volumes 1 & 2*. Oxford University Press, Melbourne.

Martin, R., Handrasyde, K., 1999. *The Koala: Natural History, Conservation and Management*. UNSW Press Australian Natural History Series, University of New South Wales Press Ltd, Sydney.

Maslin, B.R., 2001. *WATTLE: Acacias of Australia, Version 1.0 CD ROM*.

McDonald, K., Dennis, A., Kyne, P., Debus, S., Curtis, L., 2012. *Queensland's Threatened Animals*. CSIRO Publishing, Collingwood, Victoria.

Melzer, A., Carrick, F., Menkhorst, P., Lunney, D., John, B.S., 2000. *Overview, critical assessment, and conservation implications of koala distribution and abundance*. Conserv. Biol. 619–628.

Menkhorst, P., Knight, F., 2011. *Field Guide to Mammals of Australia*. Oxford University Press, Melbourne.

Mueller-Dombois, D., Ellenberg, H., 2003. *Aims and methods of vegetation ecology*. Blackburn Press, New Jersey, USA.

National Water Commission, 2013. *National Atlas of Groundwater Dependent Ecosystems*. Bureau of Meteorology, Commonwealth Government, Canberra.

Neldner, V.J., Wilson, B.A., Thompson, E.J., Dillewaard, H.A., 2012. *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 3.2*. Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.

NRM, 2015. *Regulated Vegetation Management Map, Vegetation Management Supporting Map Version 8.0 and Essential Habitat Database Version 4.0*. Date accessed 24 February 2015, Department of Natural Resources and Mines, Queensland Government, Brisbane.

NRM, 2014. *Regulated Vegetation Management Map, Vegetation Management Supporting Map Version 8.0 and Essential Habitat Database version 4.0*. Date accessed 11 February 2014, Department of Natural Resources and Mines, Queensland Government, Brisbane.

NRM, 2011. *Geological Survey of Queensland*. Department of Natural Resources and Mines, Brisbane, Queensland.

Paterson, G., 1998. *Results of survey of potential roosting sites of little pied bats (Chalinolobus picatus) on Brumby Creek, Hail Creek Mine proposed pit area*. HLA Environsciences, on behalf of Pacific Coal, Brisbane.

Pavey, C., Blomberg, S.P., 1997. *Studies of the Little Pied Bat (Chalinolobus picatus) the Ornamental Snake (Denisonia maculata) and the Frog Fauna, Hail Creek Mining Lease and Surrounds*. Environmental Research and Education, prepared for RTZ-CRA Technical Services, Brisbane.

Pizzey, G., Knight, F., Pizzey, S., 2012. *The Field Guide to the Birds of Australia*, 9th ed. HarperCollins Publishers, Sydney.

Queensland Herbarium, 2014. *Regional Ecosystem Description Database (REDD). Version 8.1 (April 2014)*. Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.

Queensland Herbarium, 2013a. *HERBRECS Reference 1213_128*. Date Accessed 22 April 2013, Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.

Queensland Herbarium, 2013b. *Regional Ecosystem Description Database (REDD). Version 6.1 (February 2013)*. Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.

Queensland Herbarium, 2012. *Specimen label information - Bertya sharpeana, Accessed 19 January 2012*. Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.

Queensland Herbarium, 2007. *National Multi-species Recovery Plan for the cycads, Cycas megacarpa, Cycas ophiolitica, Macrozamia cranei, Macrozamia lomandroides, Macrozamia pauli-guilielmi and Macrozamia platyrachis*. Prepared for the Department of Environment and Water Resources, Canberra, Queensland Parks and Wildlife Service, Brisbane.

Queensland Museum, 2013. *Zoological Data Search*. Date Accessed 11 September 2013, Queensland Museum, Queensland Government, Brisbane.

Rio Tinto Coal Australia, 2015. *Hail Creek Transition Project Environmental Assessment Report*. Prepared by Resource Strategies for Rio Tinto Coal Australia, Brisbane, Queensland.

Robinson, M., 1995. *A Field Guide to Frogs of Australia*. Australian Museum/ Reed New Holland, Chatswood, New South Wales.

SEWPaC, 2013a. *Eucalyptus raveretiana - Black Ironbox in Species Profile and Threats Database*. Department of Sustainability, Environment, Water, Population and Communities, Canberra.

SEWPaC, 2013b. *Taudactylus eungellensis - Eungella Day Frog in Species Profile and Threats Database*. Department of Sustainability, Envirnoment, Water, Population and Communities, Commonwealth Government, Canberra.

SEWPaC, 2013c. *Nyctophilus corbeni - South-eastern Long-eared Bat SPRAT Profile*. Department of Sustainability, Environment, Water, Population and Communities, Commonwealth Government, Canberra.

SEWPaC, 2012. *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (October 2012)*. Department of Sustainability, Environment, Water, Population and Communities, Commonwealth Government, Canberra.

SEWPaC, 2011a. *Survey guidelines for Australia's threatened mammals*. Department of Sustainability, Environment, Water, Population and Communities, Australian Government, Canberra.

SEWPaC, 2011b. *Survey guidelines for Australia's threatened reptiles*. Department of Sustainability, Environment, Water, Population and Communities, Australian Government, Canberra.

SEWPaC, 2011c. *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles*. Department of Sustainability, Environment, Water, Population and Communities, Australian Government, Canberra.

Sharp, D., Simon, B.K., 2002. *AusGrass: Grasses of Australia*. Australian Biological Resources Study, Department of Sustainability, Environment, Water, Population and Communities, Commonwealth Government, Canberra.

Simpson, K., Trusler, P., Day, N., 2010. *Field Guide to the Birds of Australia*. Penguin Group Australia, Melbourne.

SKM, 2010a. *Hail Creek Mine, 2009 Biodiversity Monitoring*. SKM, prepared for RTCA Hail Creek Coal, Brisbane.

SKM, 2010b. *Black Ironbox (Eucalyptus raveretiana) 2009 Monitoring Report*. Report prepared for Rio Tinto Coal Australia, Sinclair Knight Mertz, Brisbane.

SKM, 2009. *Daunia Coal Mine Project Flora and Fauna Survey 2008*. Prepared for BMA, Brisbane.

Speight, J.G., 1990. *Landform*, in: McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J., Hopkins, M.S. (Eds.), Australian Soil and Land Survey Field Handbook. Inkata Press, Melbourne.

Stanley, T.D., Ross, E.M., 1986. *Flora of south-eastern Queensland, Volume 1*. Department of Primary Industries, Queensland Government, Brisbane.

Todoroski Air Sciences, 2015. *Hail Creek Transition Project Air Quality and Greenhouse Gas Assessment*. Prepared for Rio Tinto Coal Australia, Brisbane.

Tothill, J.C., Hacker, J.B., 1996. *The Grasses of Southern Queensland*. University of Queensland Press, Brisbane.

TSSC, 2013. *Commonwealth Conservation Advice for Brigalow Ecological Community*. Department of the Environment, Canberra.

TSSC, 2008a. *Commonwealth Listing Advice on Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin*. Department of the Environment, Australian Government, Canberra.

TSSC, 2008b. *Commonwealth Conservation Advice on Dichanthium setosum*. Department of Sustainability, Envirnoment, Water, Population and Communities, Commonwealth Government, Canberra.

TSSC, 2008c. *Approved Conservation Advice for Eucalyptus raveretiana (Black Ironbox)*. Department of the Environment, Australian Government, Canberra.

TSSC, 2008d. *Commonwealth Conservation Advice on Omphalea celata*. Department of Sustainability, Envirnoment, Water, Population and Communities, Commonwealth Government, Canberra.

Tyler, M., Knight, F., 2011. *Field Guide to the Frogs of Australia: Revised Edition*. CSIRO Publishing, Collingwood, Victoria.

URS, 2006. *Hail Creek Further Development Project Environmental Assessment Report*. URS, Brisbane.

URS, 2005. *Nature Conservation Survey and Potential Impacts - Hail Creek Further Development Project*. URS, Brisbane.

VanDyck, S., Strahan, R., 2008. *The Mammals of Australia*. New Holland Publishers, Sydney.

Veary, A., 2011. *Assessment of Seasonal Habitat Characteristics as Predictors of Habitat Suitability for the Threatened Ornamental Snake (Denisonia maculata)*. Report prepared for the Australian Coal Association Research Program (ACARP), Brisbane.

Walker, J., Hopkins, M.S., 1990. *Vegetation*, in: McDonald, R.C., Isbel, R.F., Speight, J.G., Walker, J., Hopkins, M.S. (Eds.), Australian Soil and Land Survey Field Handbook. Inkata Press, Melbourne, pp. 58–86.

Whittaker, R.H., 1975. *Communities and ecosystems*, Current concepts in biology. Macmillan Publishing, New York, USA.

Wilson, P.G., Heslewood, M.M., Quinn, C.J., 2007. *Re-evaluation of the genus Babingtonia (Myrtaceae) in eastern Australia and New Caledonia*. Aust. Syst. Bot. 20, 315.

Wilson, P.R., Taylor, P.M., 2012. *Land Zones of Queensland*. Queensland Herbariu, Queensland Department of Science, Information Technology, Innovation and the Arts, Brisbane.

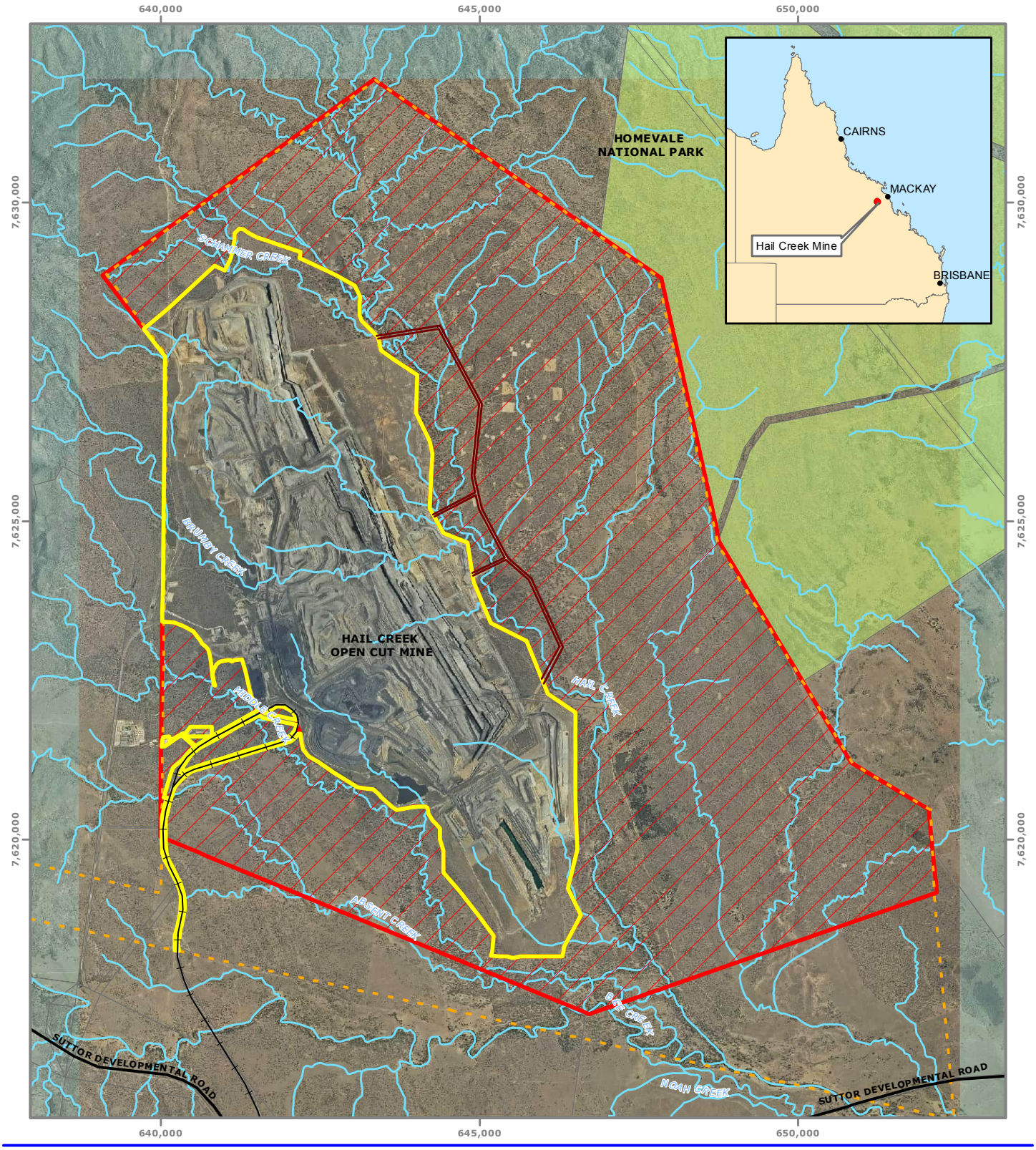
Wilson, S., 2005. *A Field Guide to Reptiles of Queensland*. New Holland, Sydney.

Wilson, S., Swann, G., 2013. *The complete guide to reptiles of Australia - 4th edition*. New Holland Publishers (Australia), Sydney.

Woinarski, J.C.Z., Oakwood, M., Winter, J., Burnett, S., Milne, D., Foster, P., Myles, H., B, H., 2008. *Surviving the toads: patterns of persistence of the*

northern quoll Dasyurus hallucatus in Queensland. Report to the Australian Government's Natural Heritage Trust, Australian Government, Northern Territory Government.

Figures



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Road
- Railway
- Powerline Easement
- Vegetation Management Act Watercourse
- Cadastral Boundary
- National Park

Figure 1 : Location of the Study Area

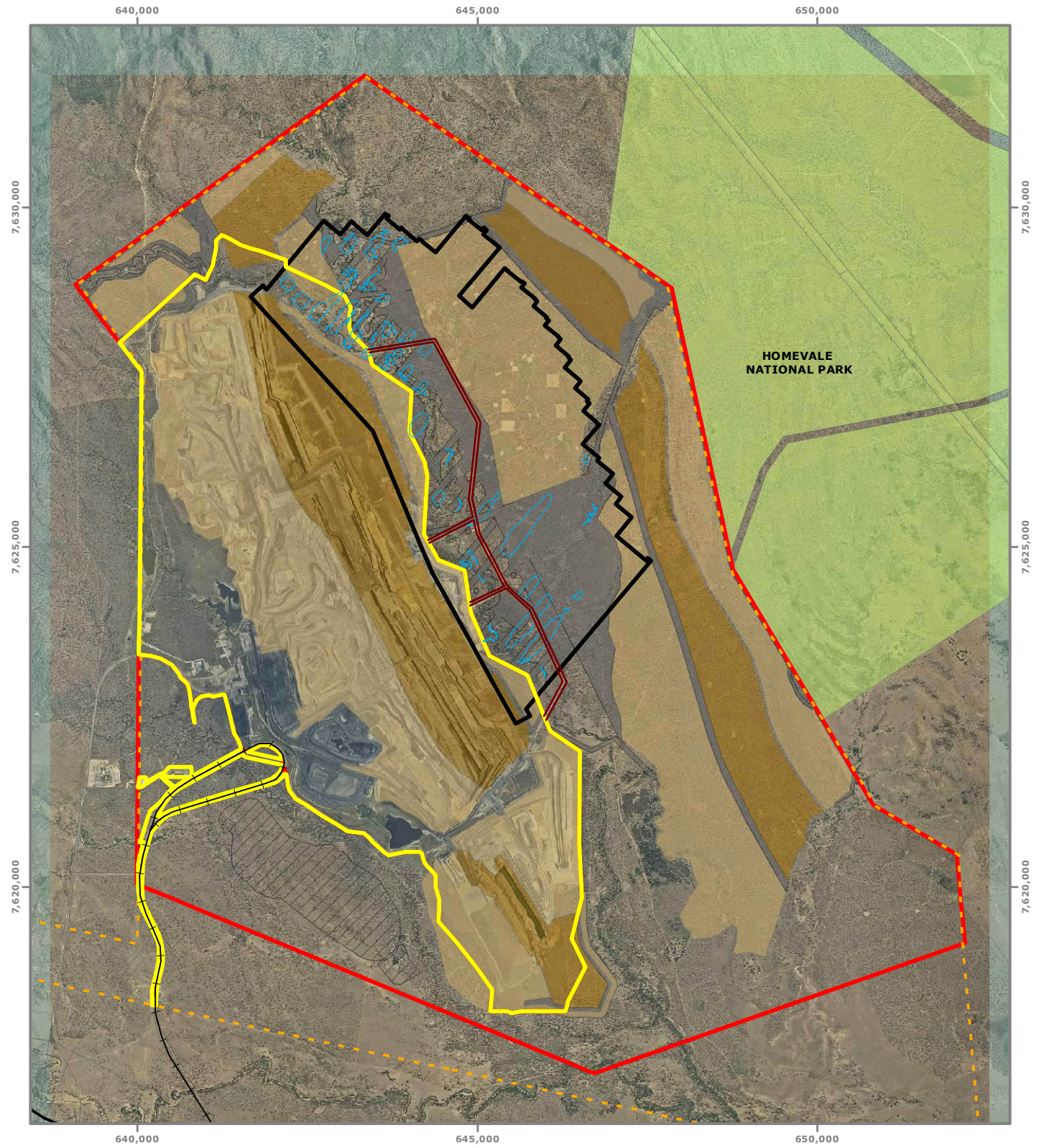
Hail Creek Transition Project -
Terrestrial Ecology Assessment

Map Number: 13003_TEC_01_j
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, Watercourse - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Powerline Easement
- Cadastral Boundary
- National Park
- Existing and Authorised Extent of Operations

Hail Creek Transition Project

- Approximate Extent of Longwall Mining Area
- Approximate Extent of Open Cut
- Approximate Extent of Out of Pit Waste Rock Emplacement
- Approximate Extent of Fines Reject Emplacement
- Approximate Extent of Project Infrastructure
- Predicted Subsidence Pond Areas

Figure 2 : Project Layout

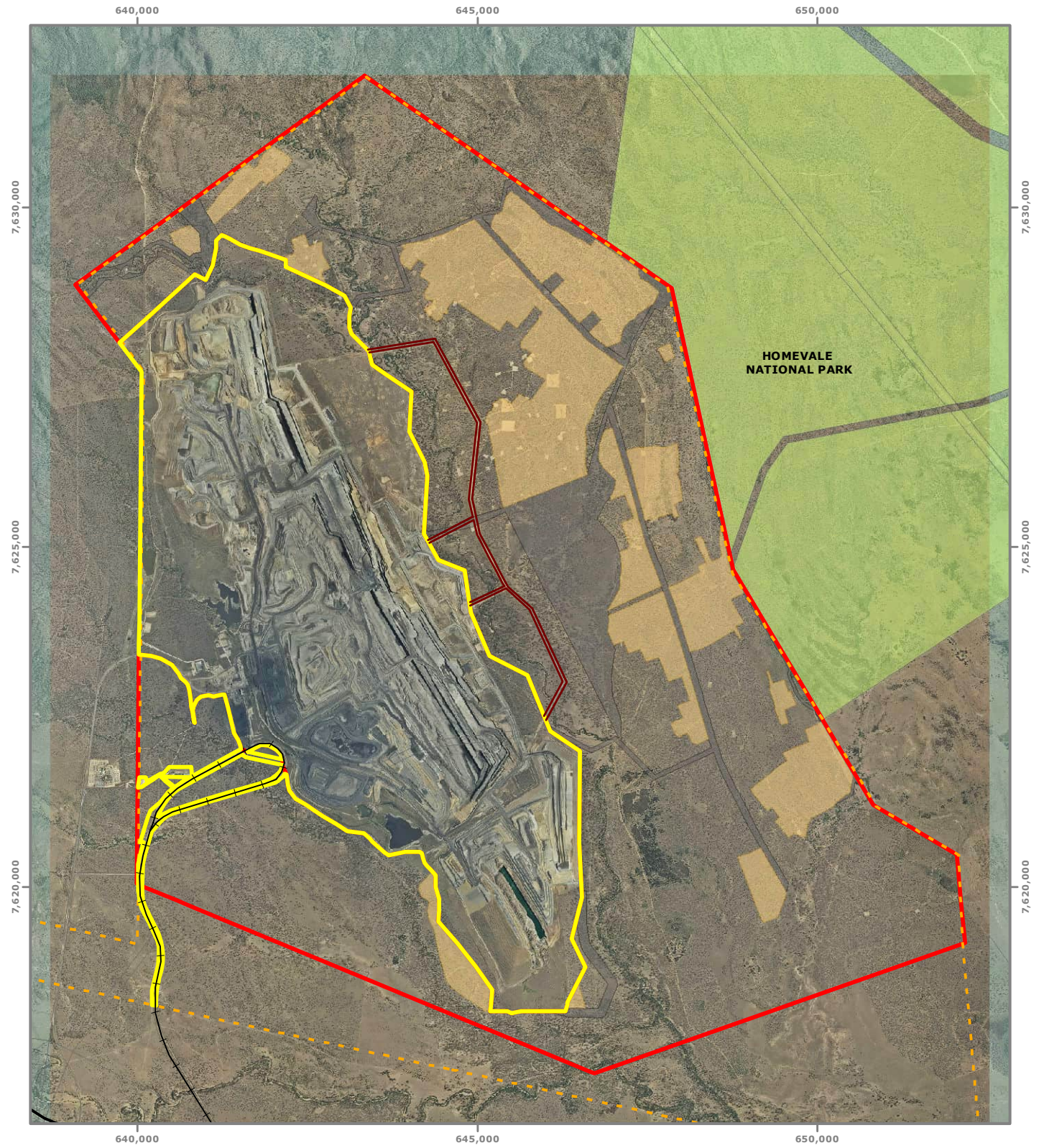
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_02_m
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Powerline Easement
- Cadastral Boundary
- National Park
- Existing and Authorised Extent of Operations

Hail Creek Transition Project

- Year 2018 Approximate Extent of Mining Landform
- Year 2018 Approximate Extent of Project Infrastructure

Figure 3 : Stage 1 Project Layout

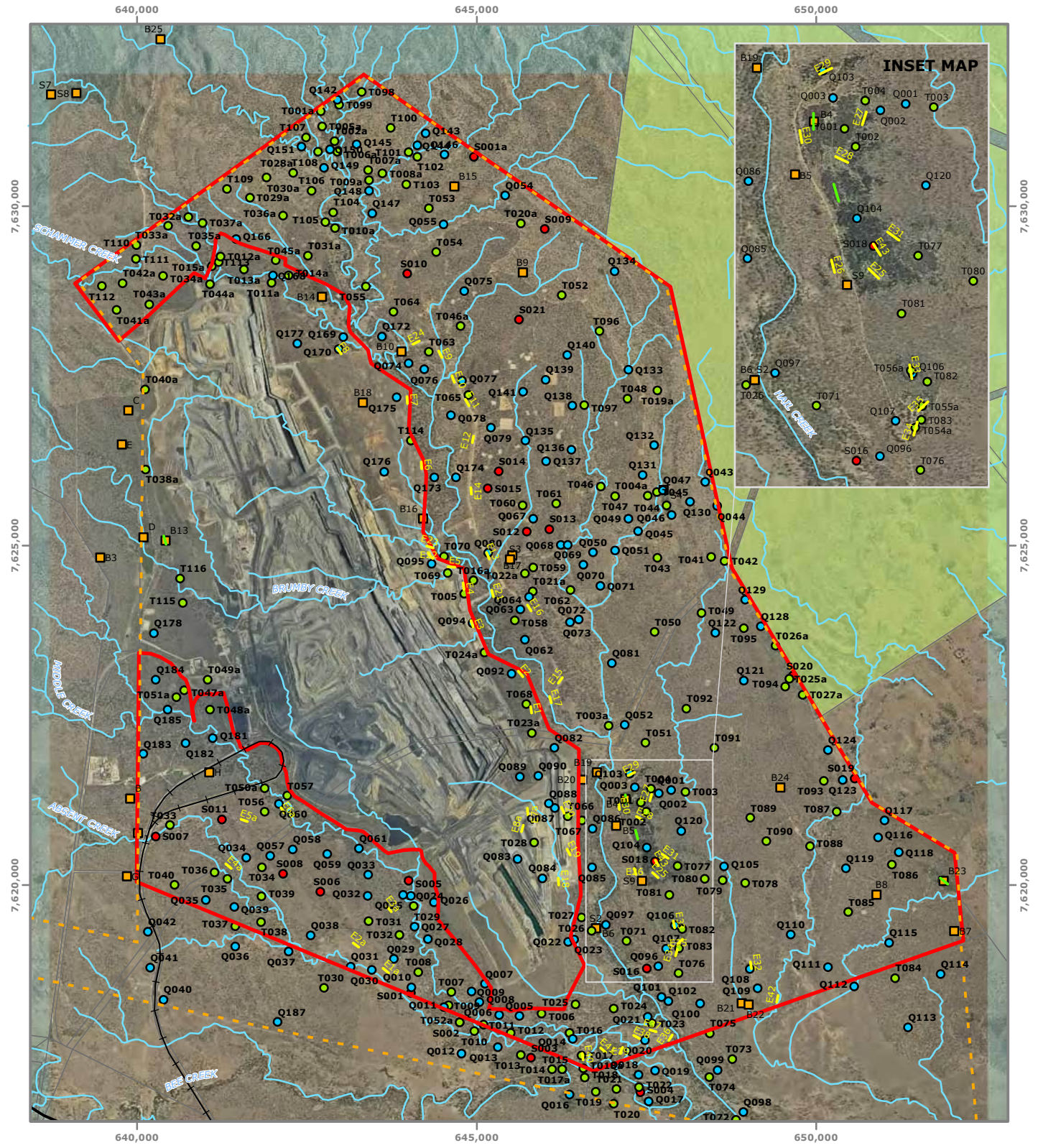
Hail Creek Transition Project -
Terrestrial Ecology Assessment

Map Number: 13003_TEC_03_I
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary
- National Park

Vegetation Assessment Sites

- Secondary Assessment Site
- Tertiary Assessment Site
- Quaternary Assessment Site
- BioCondition Site
- Threatened Ecological Community (TEC) bio-condition transect
- Ecological Equivalence Methodology (EEM) Site

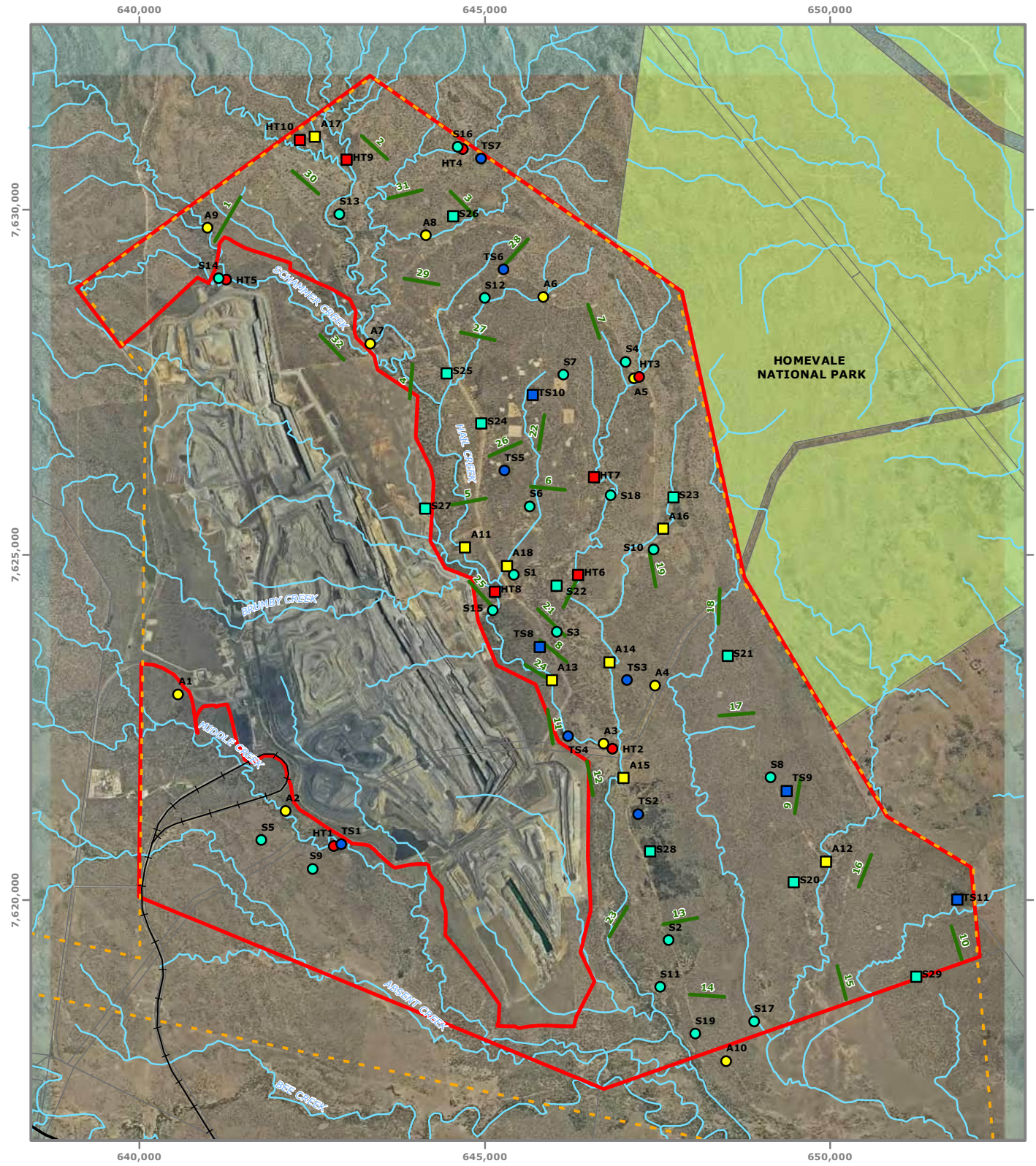
Figure 4 : Flora survey site locations

Hail Creek Transition Project -
Terrestrial Ecology Assessment

Map Number: 13003_TEC_04_i
Date: 21 March 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, Watercourse - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary
- National Park

Post Wet Season Survey Sites

- Anabat Site
- Harp Trap Site
- Supplimentary Site
- Trap Site

Dry Season Survey Sites

- Anabat Site
- Harp Trap Site
- Supplimentary Site
- Trap Site
- Koala Transects

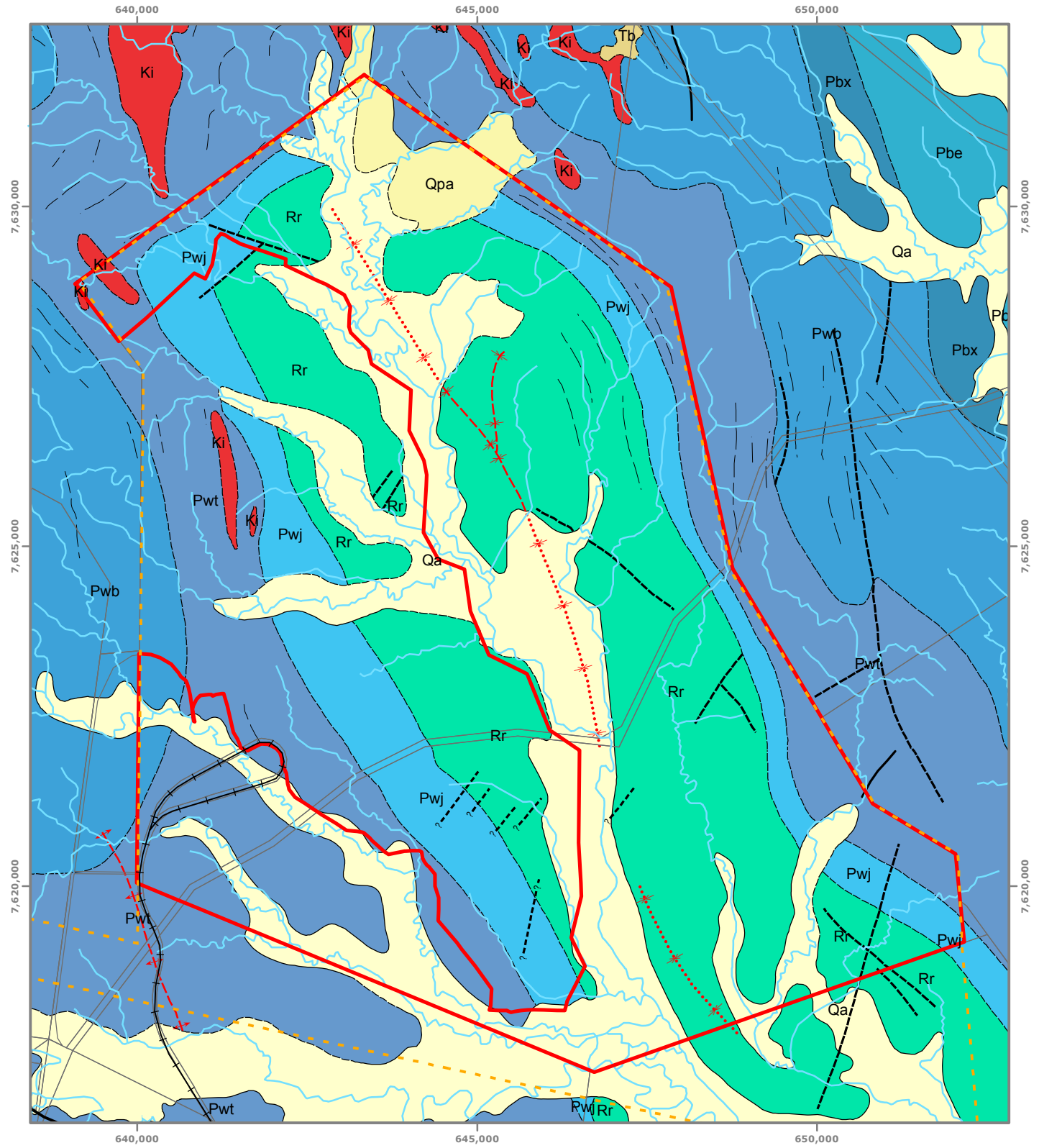
Figure 5 : Fauna survey site locations

Hail Creek Transition Project -
Terrestrial Ecology Assessment

Map Number: 13003_TEC_05_i
Date: 24 March 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, Watercourse - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

GEOLOGICAL BOUNDARIES

- Geological Boundary Accurate
- Geological Boundary Approximate

FAULTS AND SHEAR ZONES

- Fault Accurate
- Fault Approximate
- Fault Inferred/Concealed

FOLDS

- Anticline Approximate
- Syncline Approximate
- Syncline Concealed

DYKES, VEINS OR SILLS

- Sill

TRENDS AND DIPS

- Trend Line

MAP SYMBOL	LITHOLOGY	DOMINANT ROCK	AGE
Pwt	Lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff, tuffaceous (cherty) mudstone	SEDS	LATE PERMIAN
Pwb	Labile sandstone, siltstone, mudstone, coal, conglomerate in the east	ARMU	LATE PERMIAN
Pwj	Calcareous sandstone, calcareous shale, mudstone, coal, concretionary limestone	ARMU	LATE PERMIAN
Qpa	Clay, silt, sand, gravel; flood-plain alluvium on high terraces	ALLV	PLEISTOCENE
Qa	Clay, silt, sand, gravel; flood-plain alluvium	ALLV	QUATERNARY
Ki	Gabbro, leuco-diorite, quartz hornblende diorite, biotite hornblende granodiorite	GRTD	CRETACEOUS
Rr	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base)	ARMU	EARLY TRIASSIC

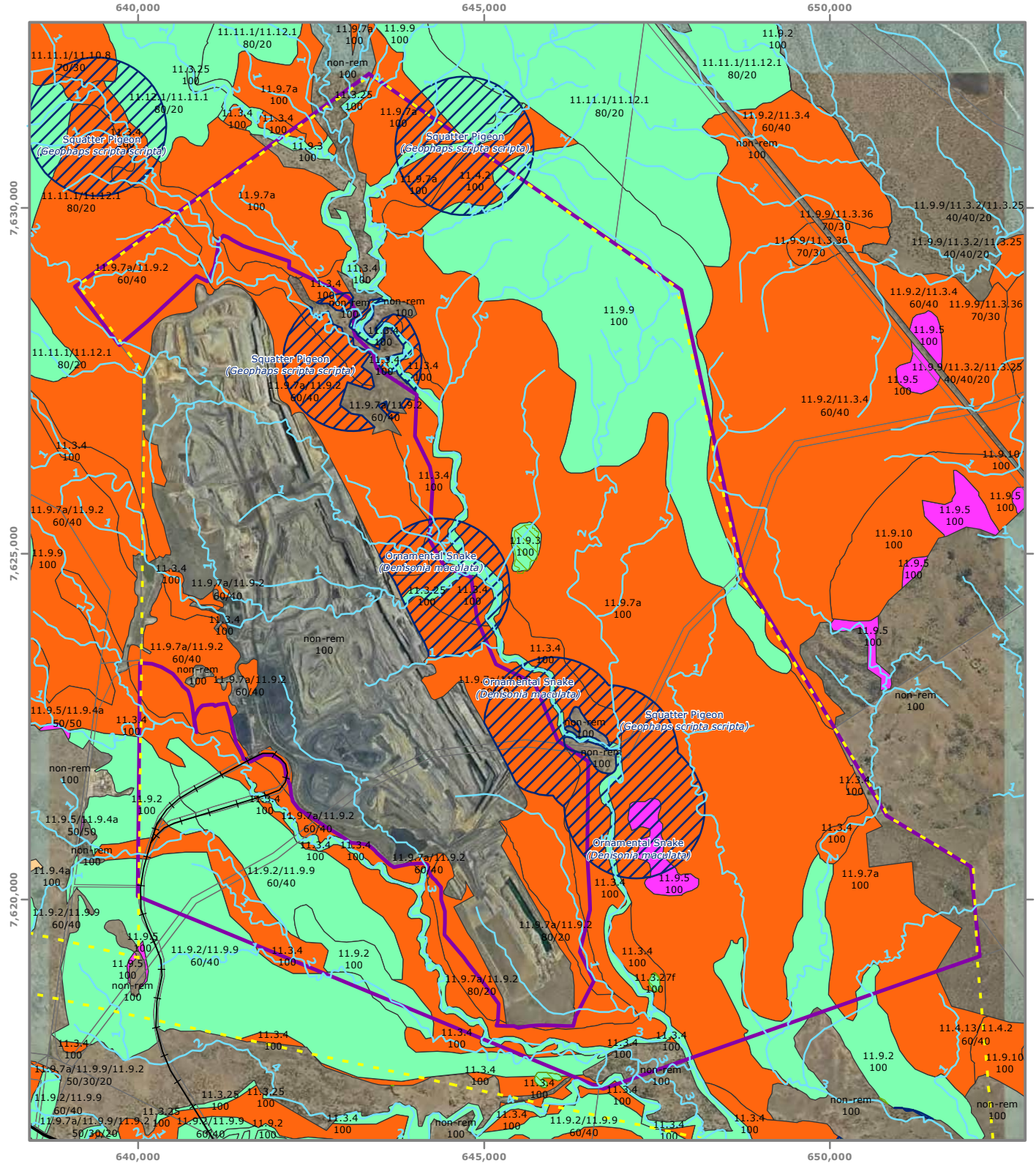
Figure 6 : Geology mapping for the Study Area

Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_06_h
Date: 17 March 2015
Map Projection: GDA 1994 MGA Zone 55
Data: DCDB, Watercourse, Geology - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Cadastral Boundary
- Vegetation Management Act Essential Habitat V4.0
- Vegetation Management Act Wetland
- Vegetation Management Act Watercourse and Stream Order

Remnant Regional Ecosystems 8.0

Vegetation Management Act Status

- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystems
- Category C area containing of concern regional ecosystems
- Category C area that is a least concern regional ecosystems

Figure 7 : NRM Regional Ecosystem mapping for the Study Area

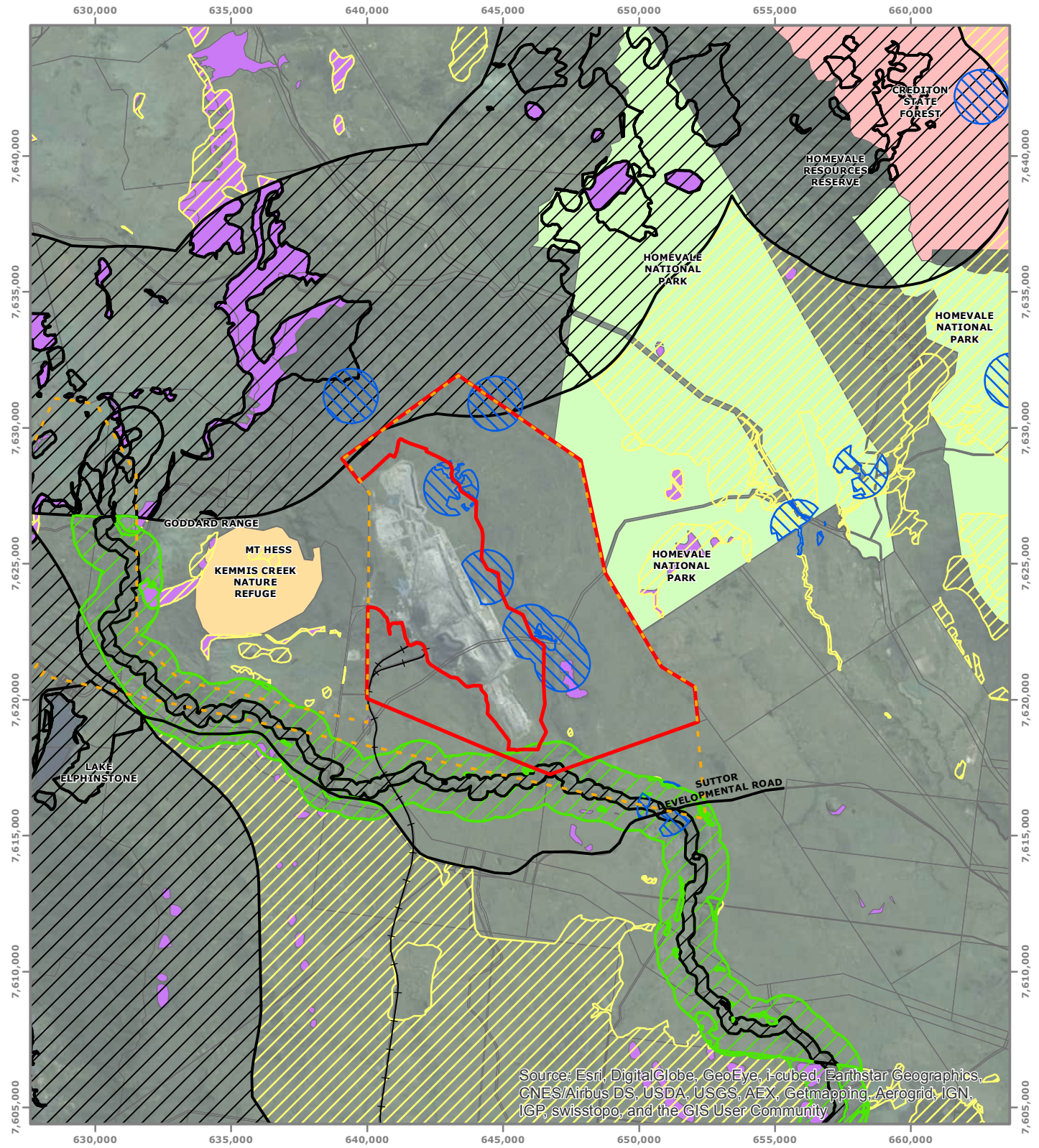
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_07_i
Date: 17 March 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, RE, Essential Habitat, Rem Drainage - (C) State of Queensland (DNRM) 2015
Road, Rail: Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Cadastral Boundary
- Road
- Railway
- Vegetation Management Act Essential Habitat V4.0

Biodiversity Planning Assessment Mapping

- Biodiversity Planning Assessment Vegetation

Ecological Corridors

- Regional Ecological Corridors
- State Ecological Corridors

Environmentally Sensity Areas (ESAs)

- National Park - Category A
- Endangered Regional Ecosystems - Category B
- Nature Refuges - Category C
- State Forest - Category C

Figure 8 : Environmentally Sensitive Areas and Biodiversity Planning Assessment mapping for the Study Area

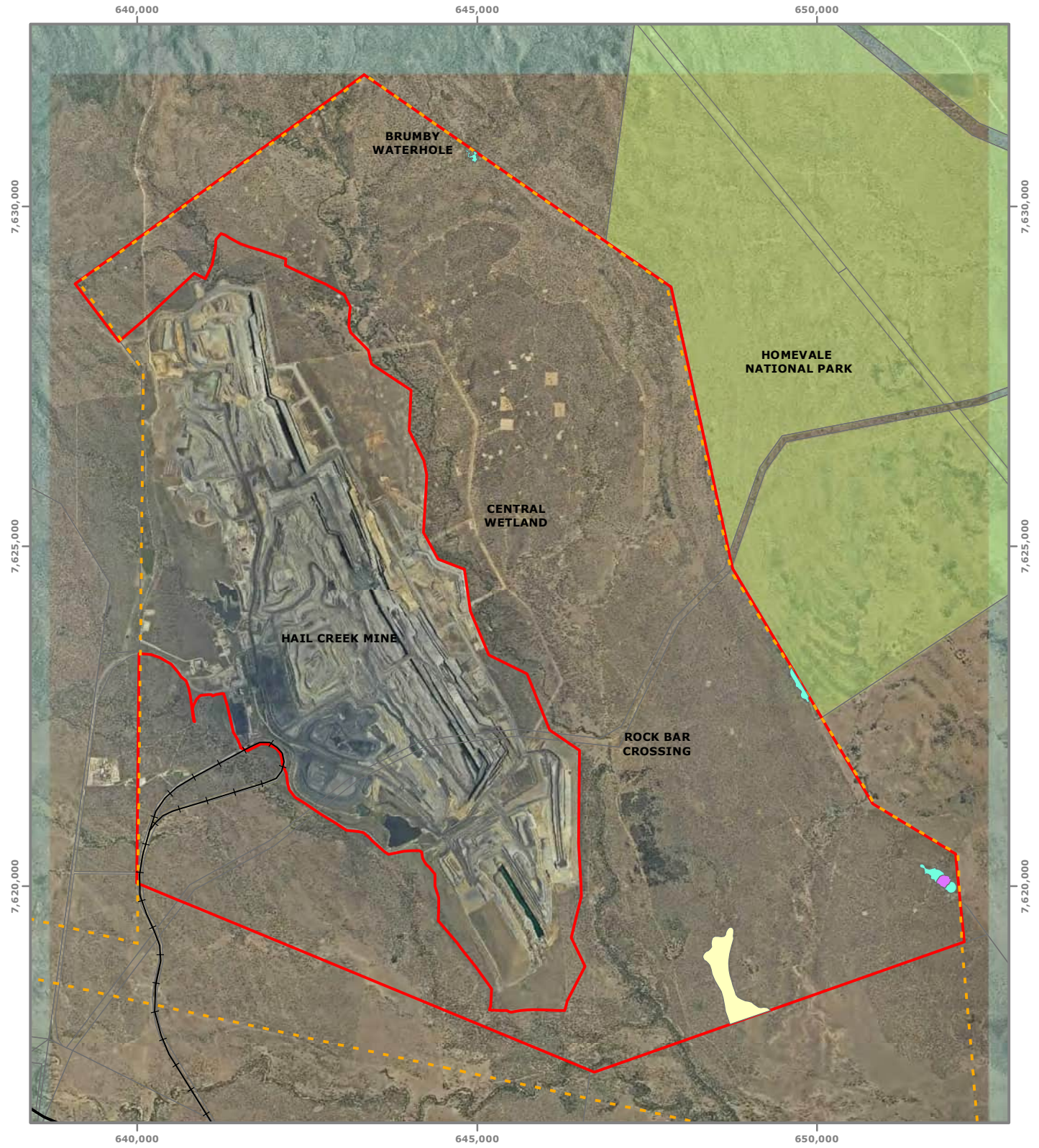
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_08_j
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Data: DCDB, BPA, ESA, Essential Habitat, Remnant Drainage - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail: Geoscience Australia 2014

0 1 2 4 6 8 10
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Cadastral Boundary
- National Park

EPBC Act Threatened Ecological Communities (TEC)

- Brigalow (*Acacia harpophylla* dominant and co-dominant)
- Natural Grassland
- Semi-evergreen Vine Thicket (SEVT)

Figure 9 : Field-validated Commonwealth threatened ecological community mapping for the Study Area

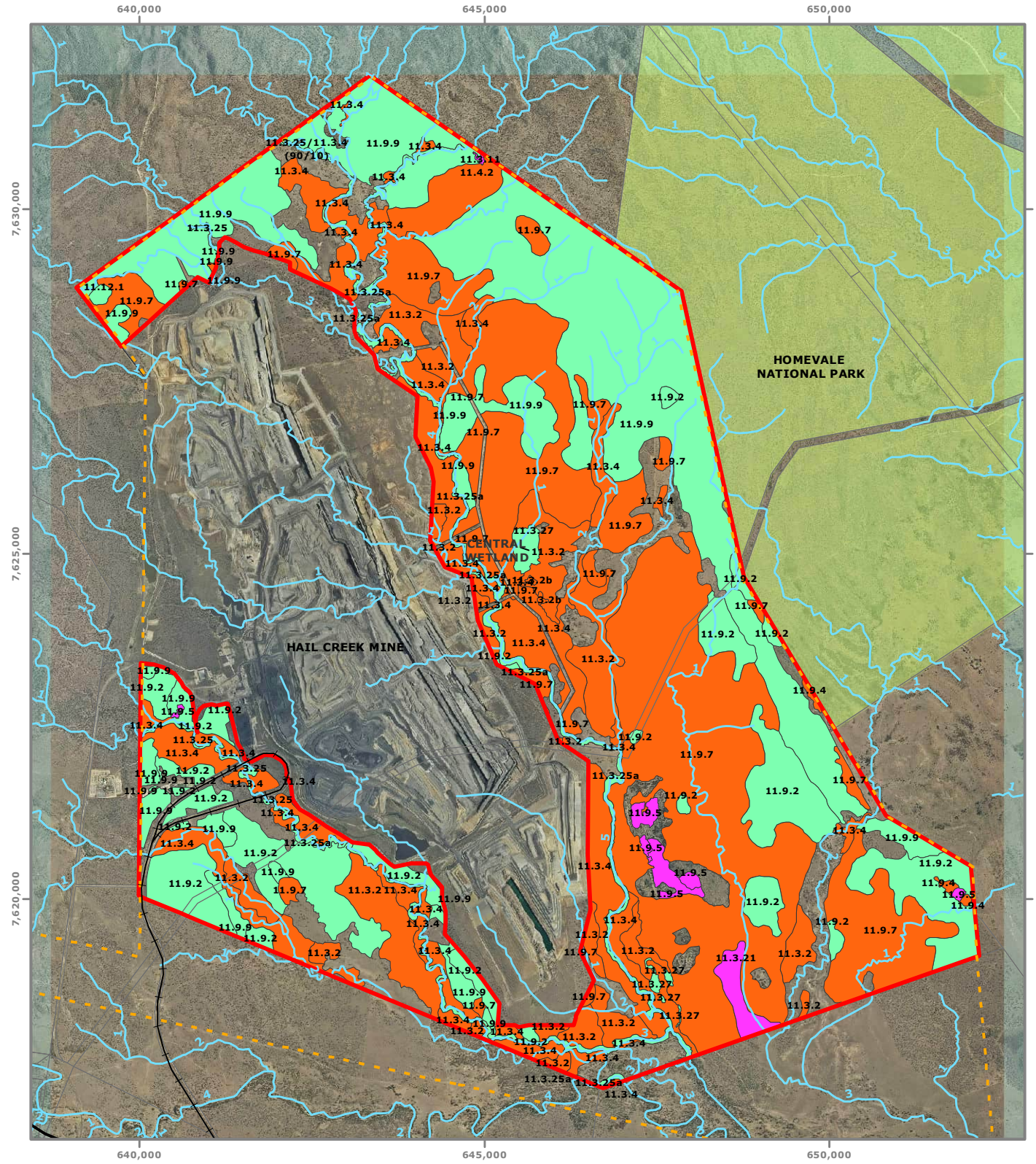
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_09_I
Date: 25 March 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road,Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Cadastral Boundary
- National Park

Remnant Vegetation

Vegetation Management Act Status

- Endangered
- Of concern
- Least concern
- Vegetation Management Act Watercourse and Stream Order

Figure 10 : Field-validated Regional Ecosystem mapping for the Study Area

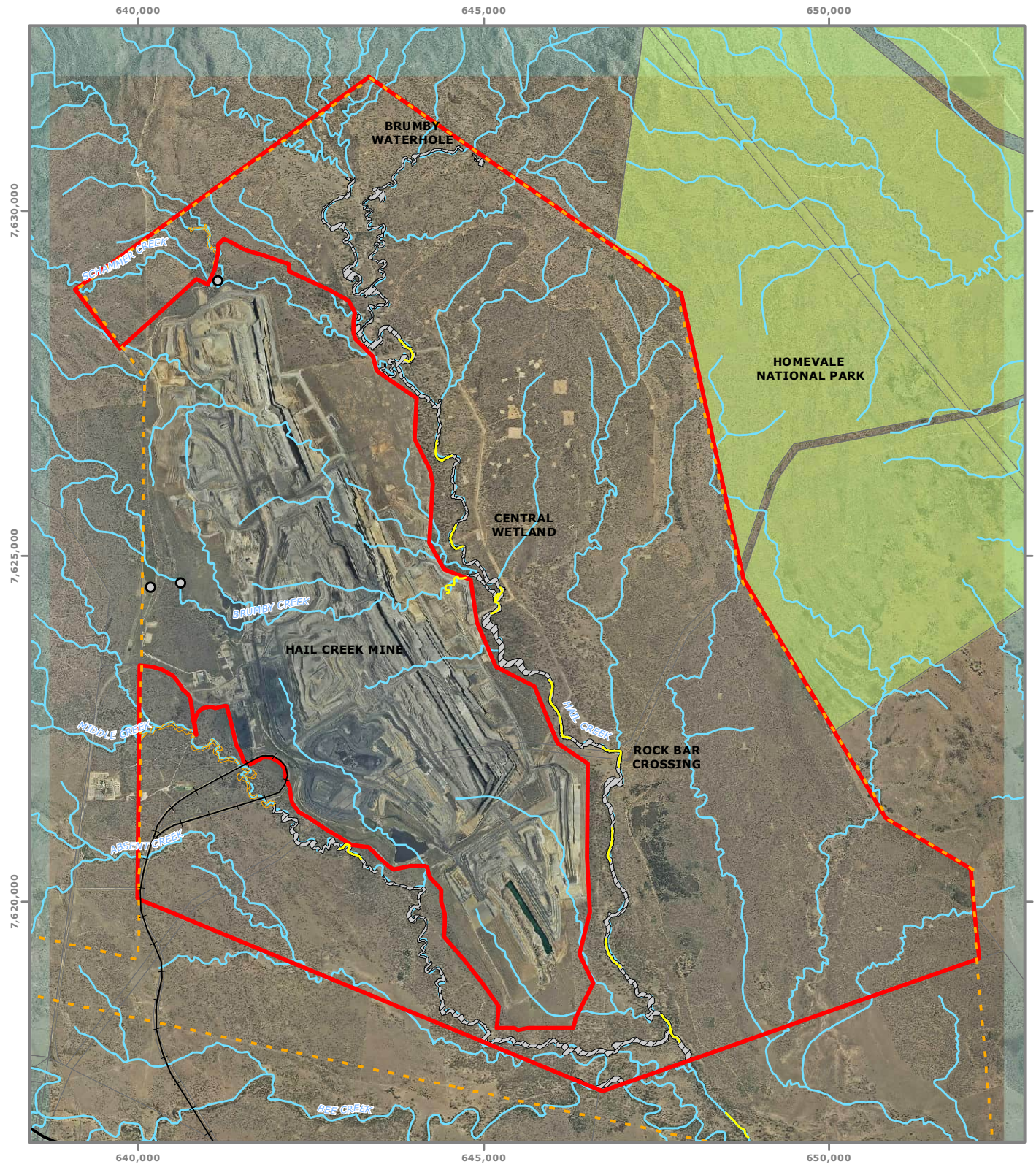
Hail Creek Transition Project -
Terrestrial Ecology Assessment

Map Number: 13003_TEC_10_I
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, Watercourse - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary
- National Park

Conservation Significant Flora Species Records

- Black Ironbox *(Eucalyptus raveretiana)* – V – EPBC Act
- Black Ironbox (*Eucalyptus raveretiana*) – V – EPBC Act

Potential Habitat Mapping

- High Value Habitat - Black Ironbox *(Eucalyptus raveretiana)* – V – EPBC Act
- Low Value Habitat - Black Ironbox *(Eucalyptus raveretiana)* – V – EPBC Act
- Quantification Transects

Figure 11 : Conservation significant flora species records and potential habitat mapping for the Study Area

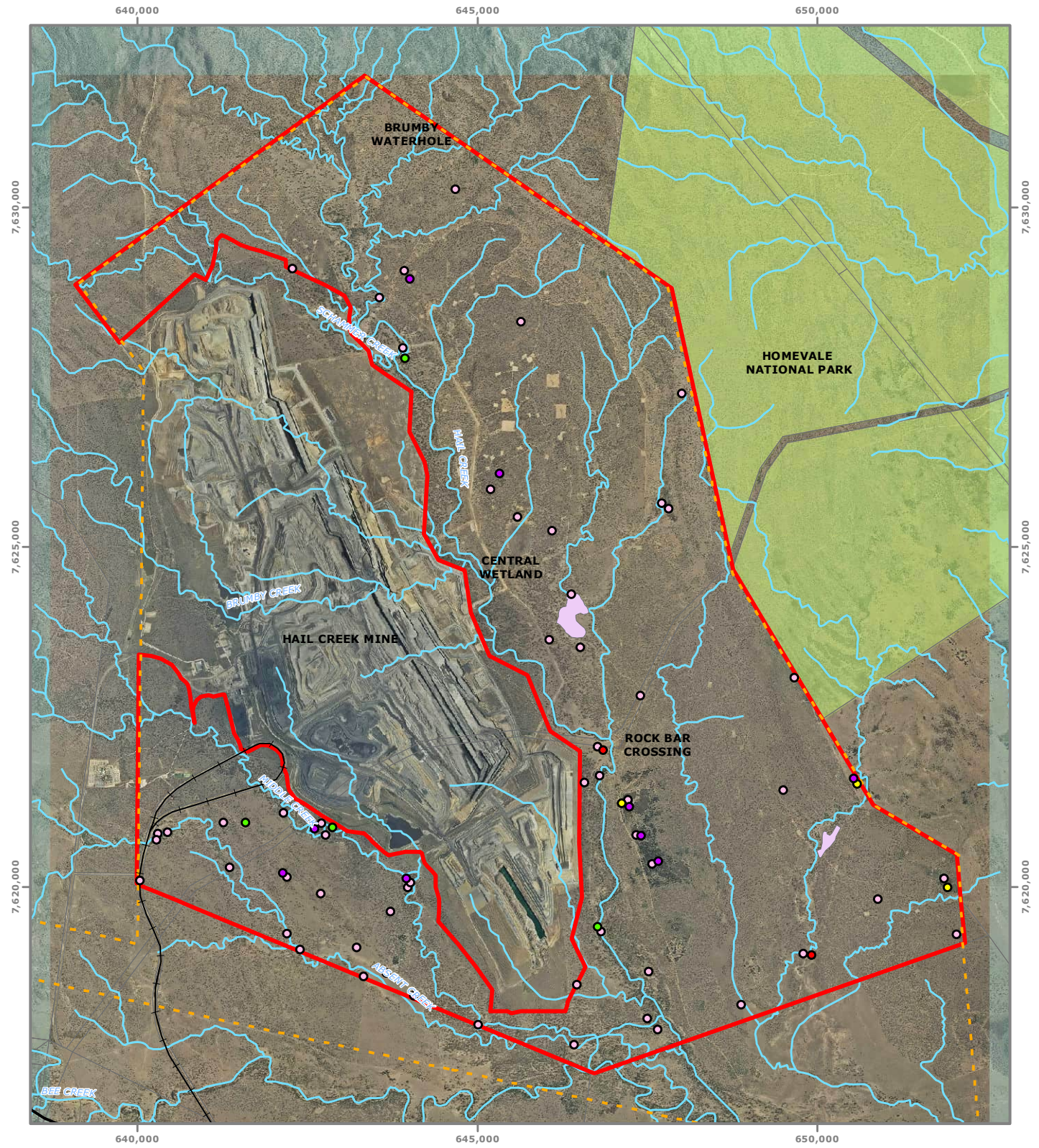
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_11_p
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, Watercourse - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary
- National Park

Exotic Flora

- Prickly Acacia *(*Vachellia farnesiana)*
- Harrissia Cactus *(*Eriocereus martinii)*
- Common Lantana *(*Lantana camara var. camara)*
- Velvet Prickly Pear *(*Opuntia tomentosa)*
- Parthenium Weed *(*Parthenium hysterophorus)*
- Parthenium Weed Infestation *(*Parthenium hysterophorus)*

Figure 12 : Declared exotic flora records for the Study Area

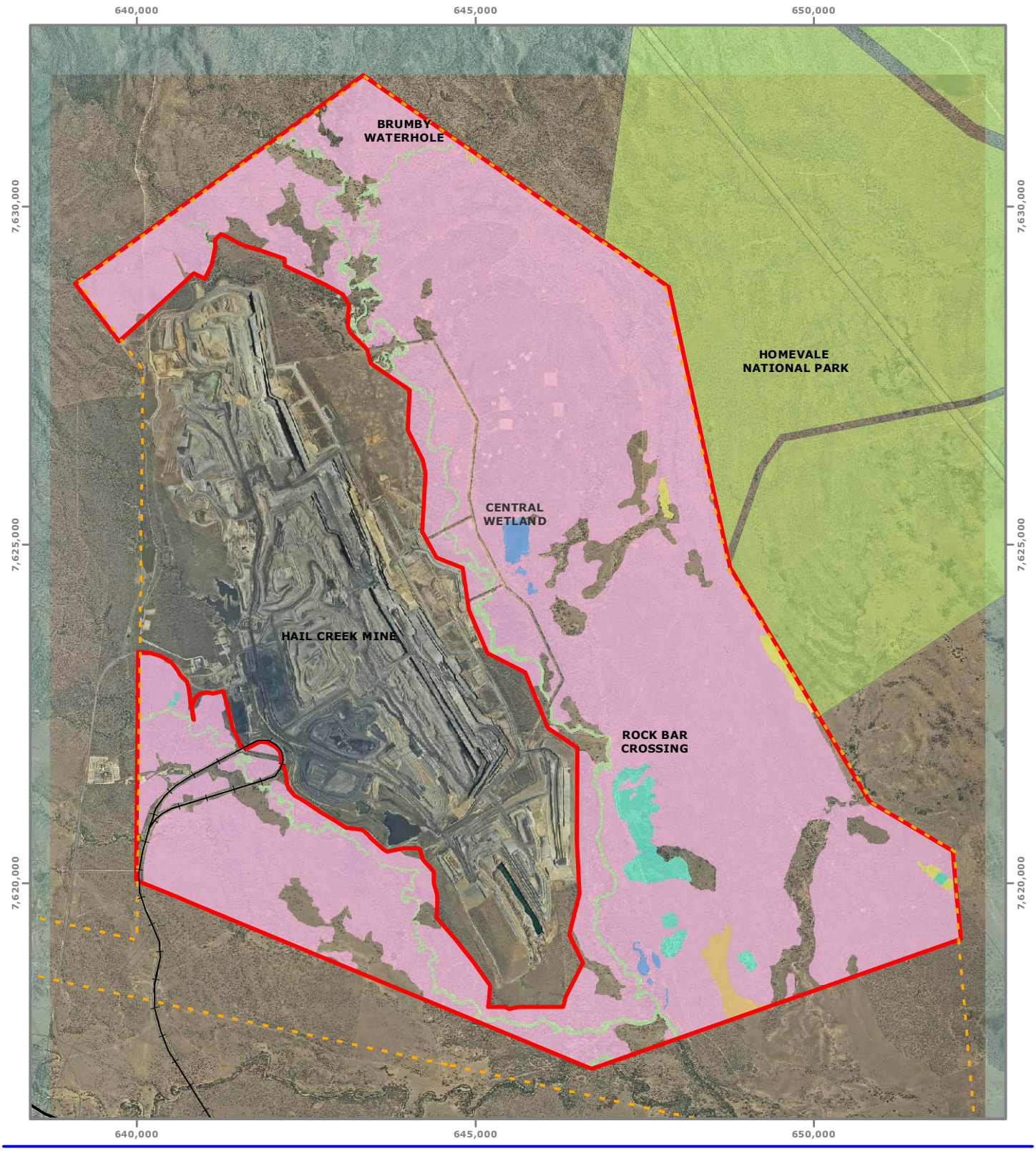
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_12_I
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, Watercourse - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Cadastral Boundary
- National Park

Broad Habitat Types – (remnant and non-remnant vegetation)

- Eucalypt Woodlands and Open Forests
- Riparian Vegetation
- Brigalow
- Natural Grasslands
- Wetlands
- Vine Thicket

Figure 13 : Broad habitat types within the Study Area

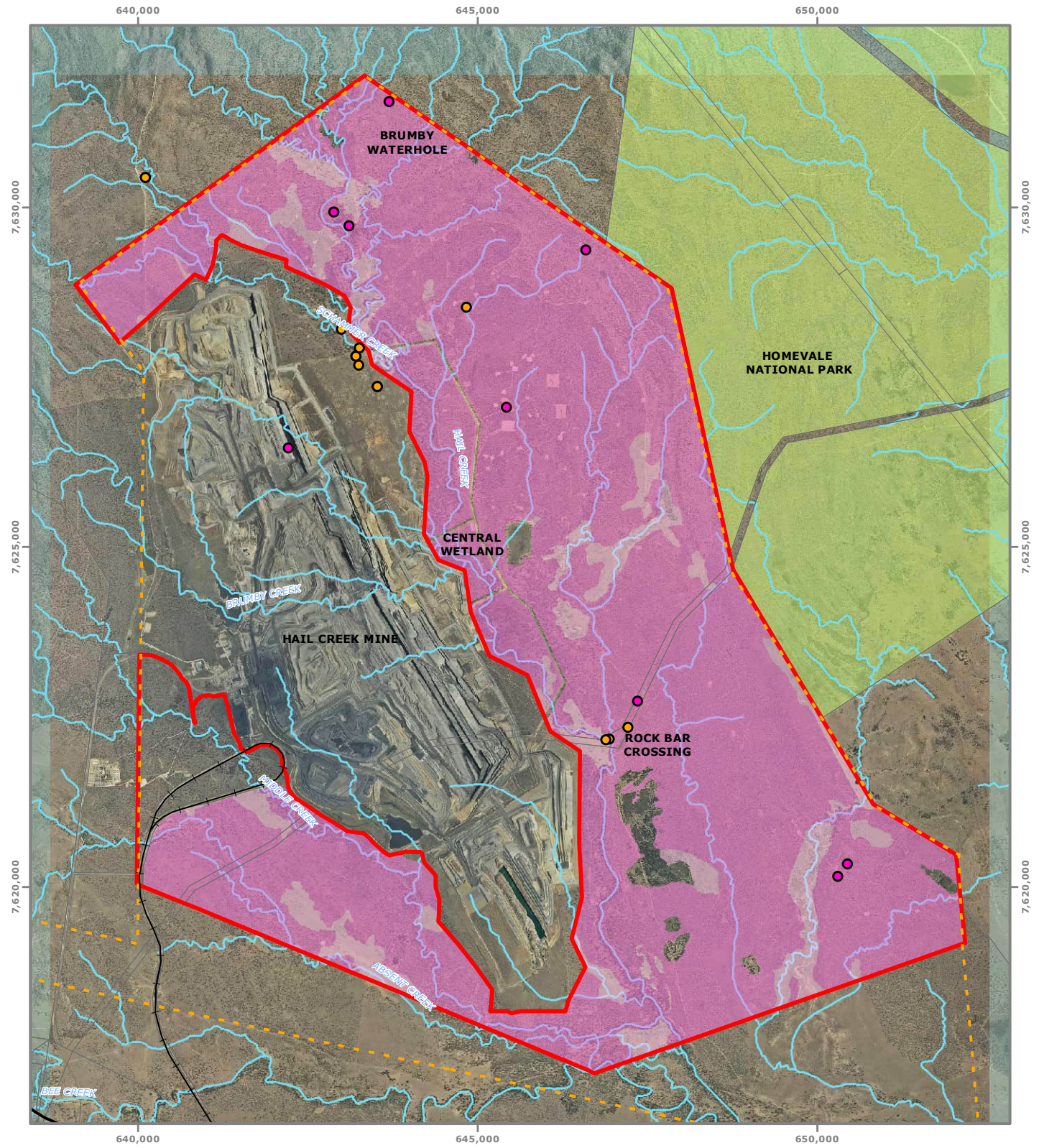
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_13_m
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary
- National Park

Conservation Significant Fauna Species Records

- Squatter Pigeon *(Geophaps scripta scripta)* – V/V (EPBC Act/NC Act)
- Koala *(Phascolarctos cinereus)* – V/SLC (EPBC Act/NC Act)

Potential Habitat Mapping

- High Value Habitat - Squatter Pigeon *(Geophaps scripta scripta)* – V/V (EPBC Act/NC Act), Koala *(Phascolarctos cinereus)* – V/SLC (EPBC Act/NC Act)
- Low Value Habitat - Squatter Pigeon *(Geophaps scripta scripta)* – V/V (EPBC Act/NC Act)

Figure 14 : Conservation significant fauna mapping for the Study Area - Koala and Squatter Pigeon

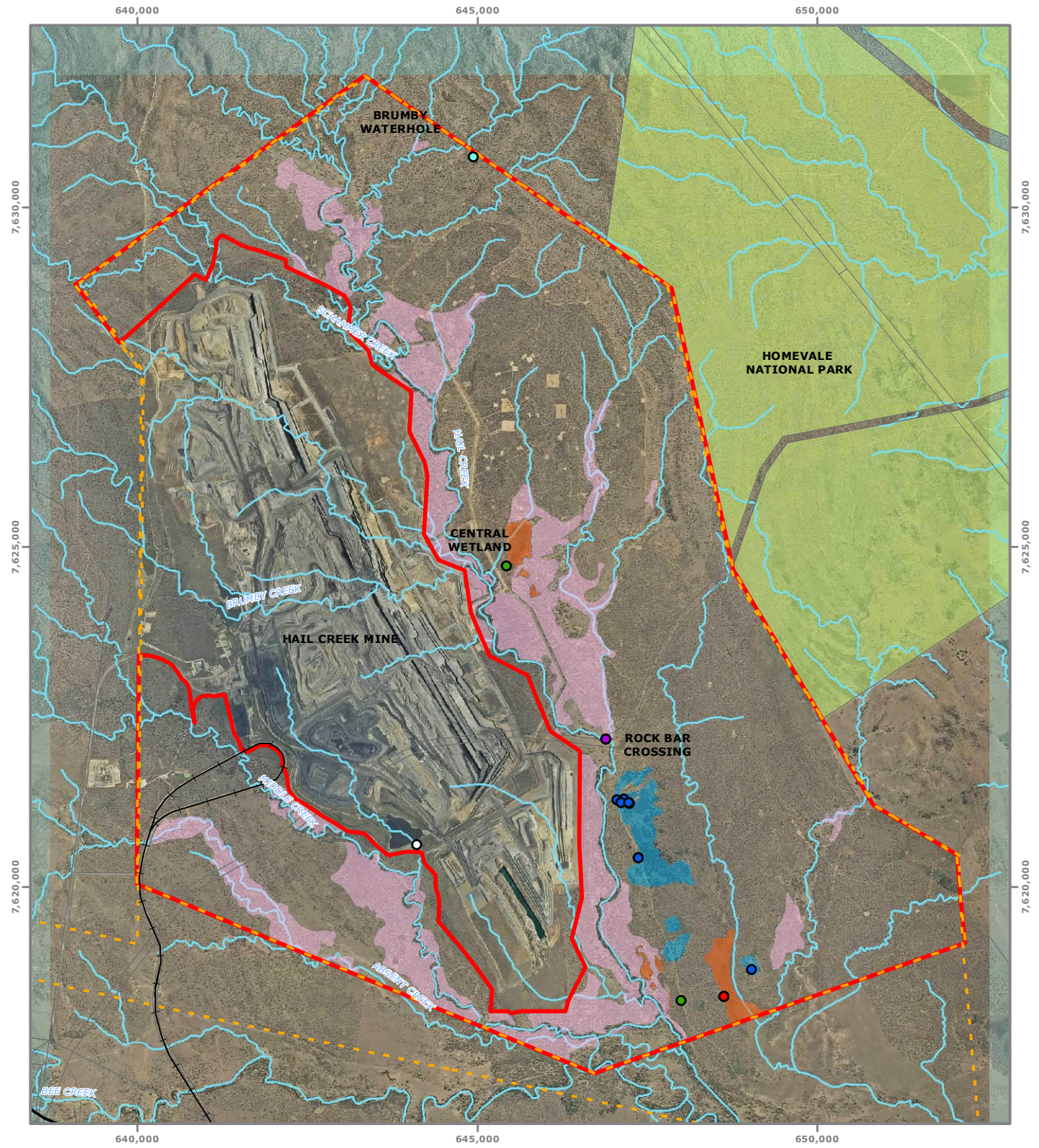
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_14_i
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, Watercourse - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary
- National Park

Conservation Significant Fauna Species

- Australian Painted Snipe *(Rostratula australis)* – E/V (EPBC Act/NC Act)
- Ornamental Snake *(Denisonia maculata)* – V/V (EPBC Act/NC Act)

Potential Habitat Mapping

- High Value Habitat - Australian Painted Snipe *(Rostratula australis)* – E/V (EPBC Act/NC Act)
- Low Value Habitat - Australian Painted Snipe *(Rostratula australis)* – E/V (EPBC Act/NC Act)
- High Value Habitat - Ornamental Snake *(Denisonia maculata)* – V/V (EPBC Act/NC Act)

Migratory Bird Records

- Magpie Goose *(Anseranas semipalmata)* – (EPBC Act/NC Act)
- White-throated Needletail *(Hirundapus caudacutus)* – (EPBC Act/NC Act)
- Rainbow Bee-eater *(Merops ornatus)* – (EPBC Act/NC Act)
- White-bellied Sea-Eagle *(Haliaeetus leucogaster)* – (EPBC Act/NC Act)

Figure 15 : Conservation significant fauna mapping for the Study Area - Australian Painted Snipe and Ornamental Snake

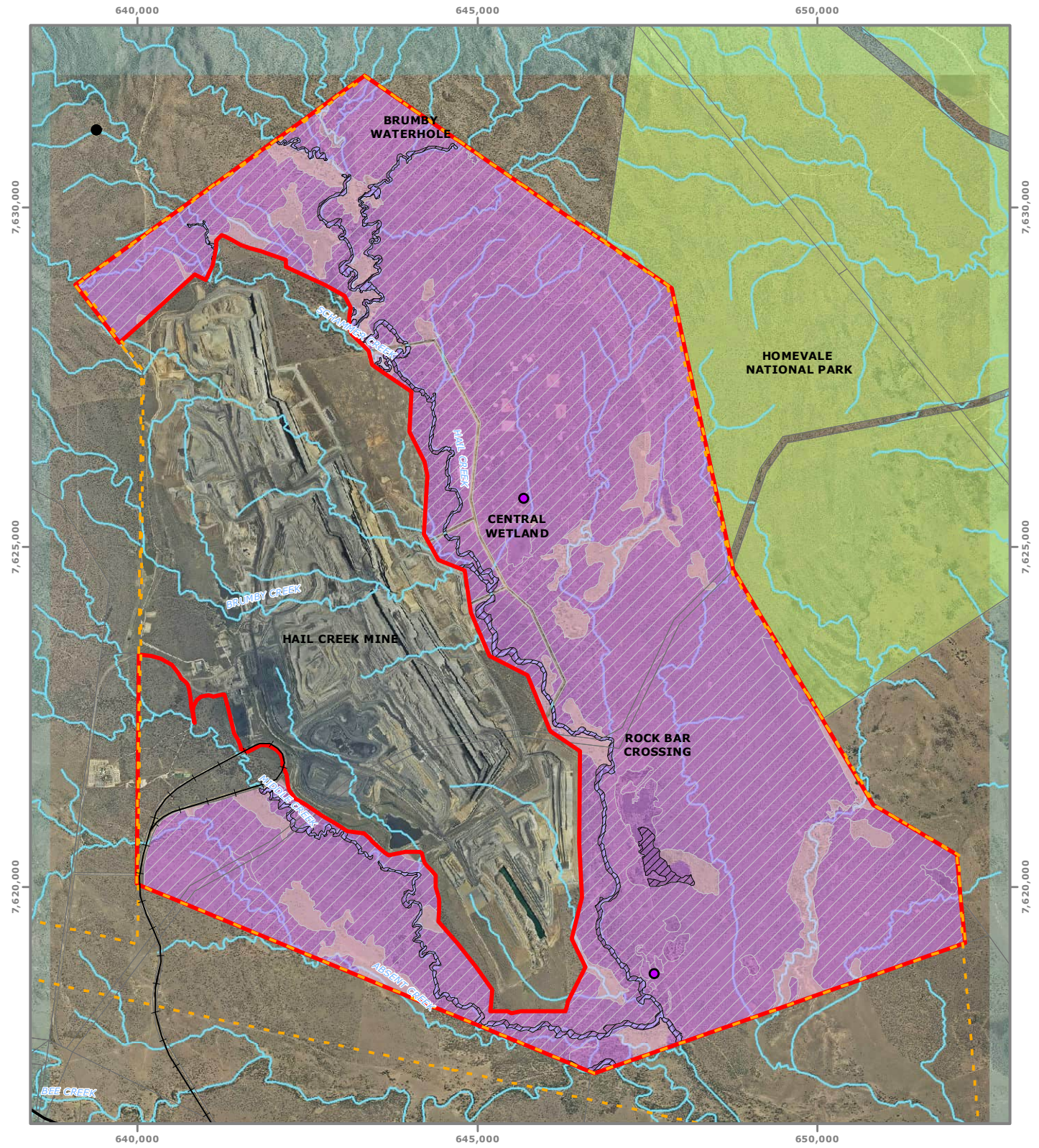
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_15_i
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, Watercourse - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Road
- Railway
- Watercourse
- Cadastral Boundary
- National Park

Conservation Significant Fauna Species Records

- Glossy Black-cockatoo *(Calyptorhynchus lathami)* – V (NC Act)
- Short-beaked Echidna *(Tachyglossus aculeatus)* – SLC (NC Act)

Potential Habitat Mapping

- High Value Habitat - Glossy Black-cockatoo *(Calyptorhynchus lathami)* – V (NC Act)
- Low Value Habitat - Glossy Black-cockatoo *(Calyptorhynchus lathami)* – V (NC Act)
- High Value Habitat - Short-beaked Echidna *(Tachyglossus aculeatus)* – SLC (NC Act)
- Low Value Habitat - Short-beaked Echidna *(Tachyglossus aculeatus)* – SLC (NC Act)

Figure 16 : Conservation significant fauna mapping for the Study Area - Glossy Black-cockatoo and Short-beaked Echidna

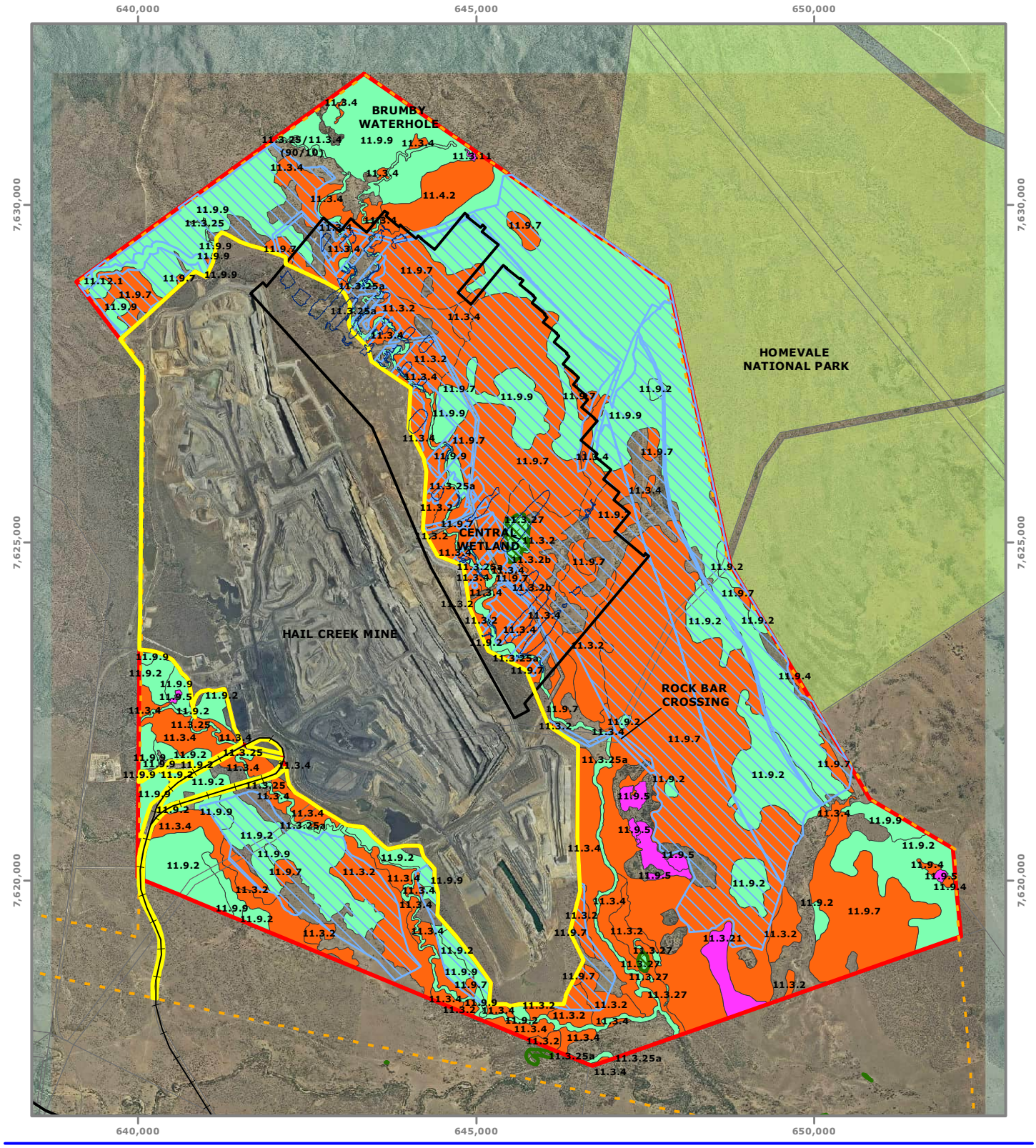
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_16_k
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, Watercourse - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Approximate Surface Disturbance Extent
- Approximate Extent of Longwall Mining Area
- Predicted Subsidence Pond Areas
- Road
- Railway
- Cadastral Boundary
- National Park
- Vegetation Management Act Wetland

Remnant Vegetation

Vegetation Management Act Status

- Endangered
- Of concern
- Least concern

Figure 17 : Field-validated Regional Ecosystems in the Project Area

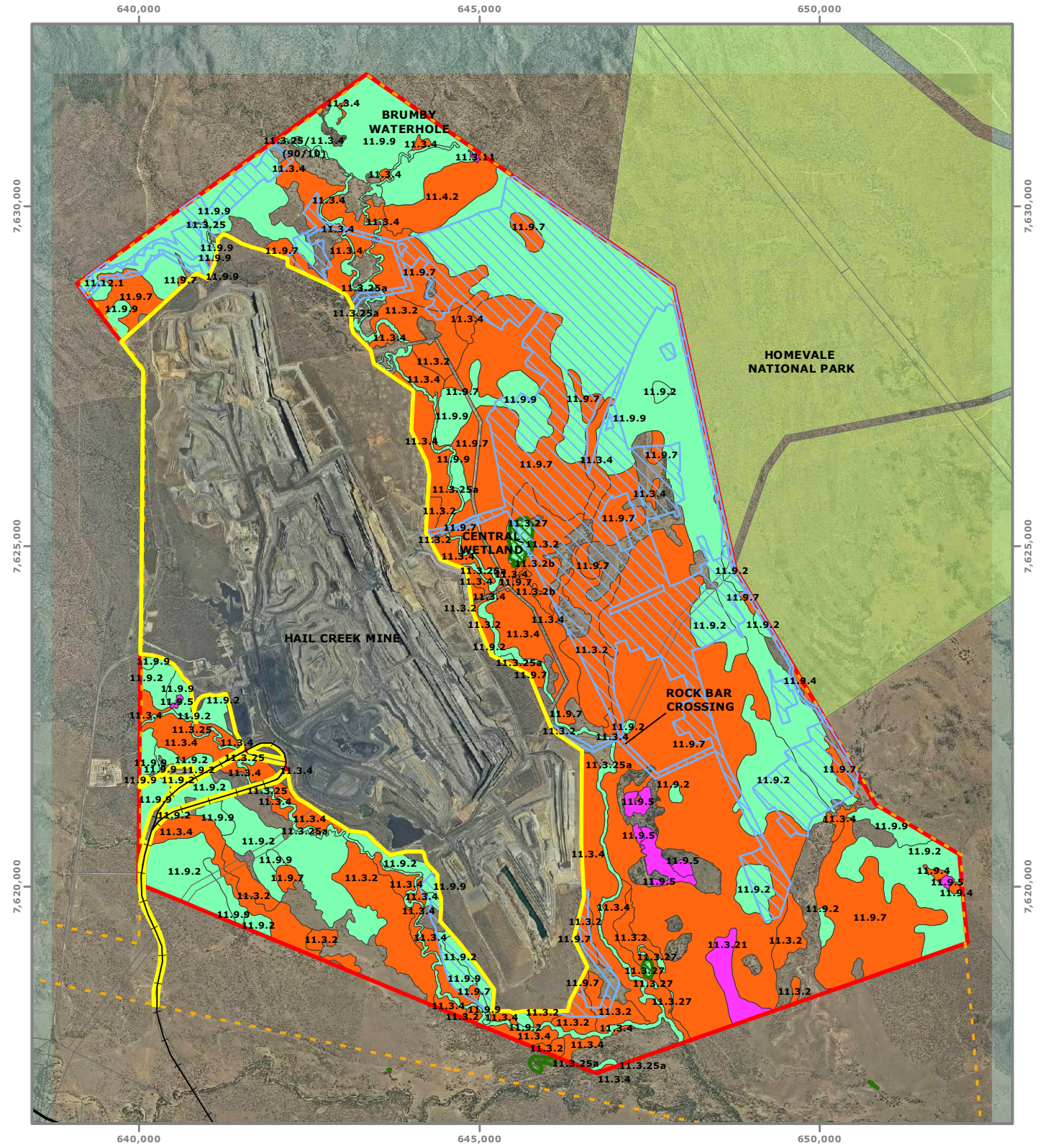
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_17_k
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Stage 1 Approximate Surface Disturbance Extent
- Road
- Railway
- Cadastral Boundary
- National Park
- Vegetation Management Act Wetland

Remnant Vegetation

Vegetation Management Act Status

- Endangered
- Of concern
- Least concern

Figure 18 : Field-validated Regional Ecosystems in the Stage 1 Project Area

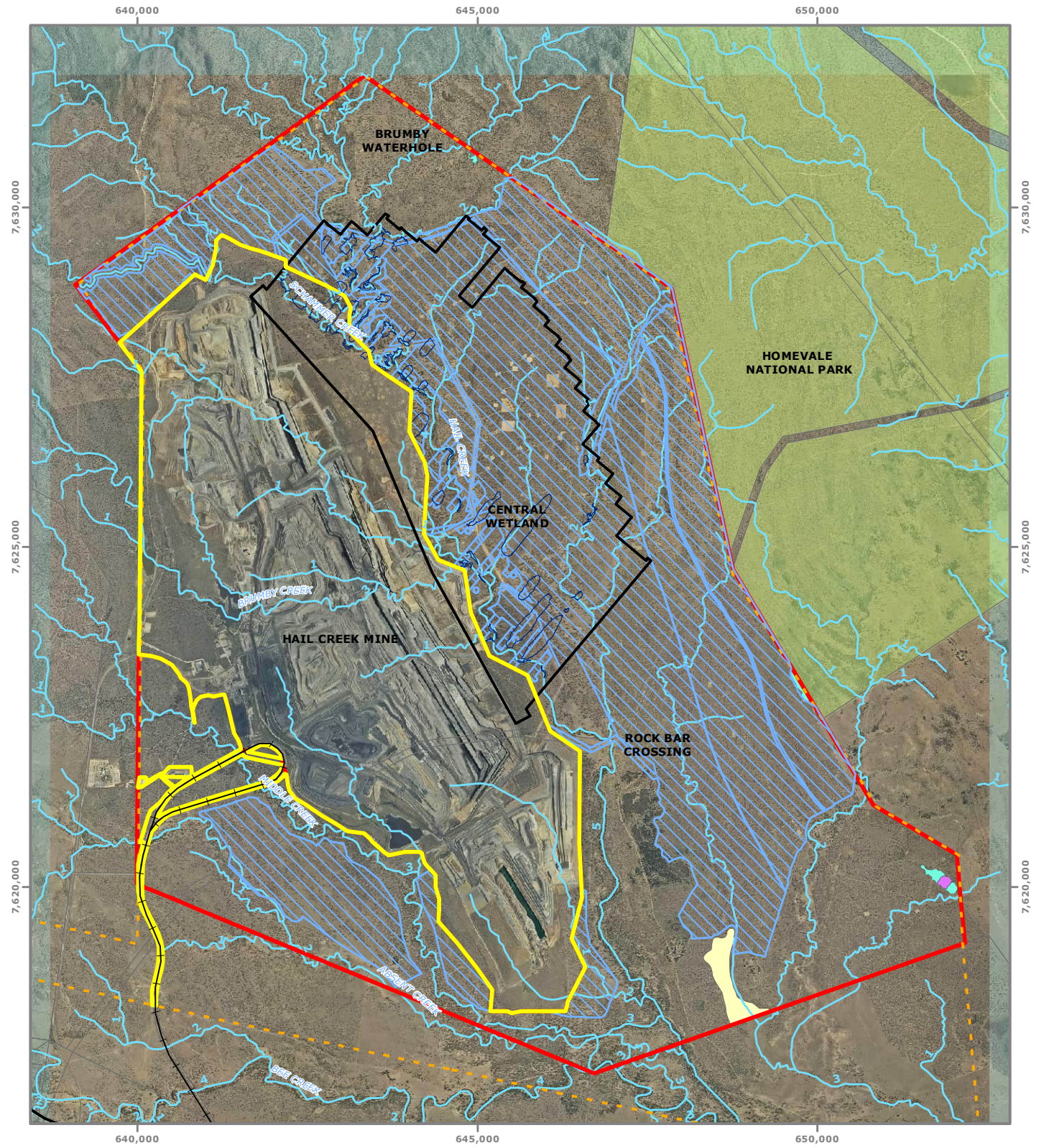
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_18_I
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Approximate Surface Disturbance Extent
- Approximate Extent of Longwall Mining Area
- Predicted Subsidence Pond Areas
- Road
- Railway
- Vegetation Management Act Watercourse and Stream Order
- Cadastral Boundary
- National Park

EPBC Act Threatened Ecological Communities (TEC)

- Brigalow (*Acacia harpophylla* dominant and co-dominant)
- Natural Grassland
- Semi-evergreen Vine Thicket (SEVT)

Figure 19 : Commonwealth threatened ecological communities relative to the Project Area

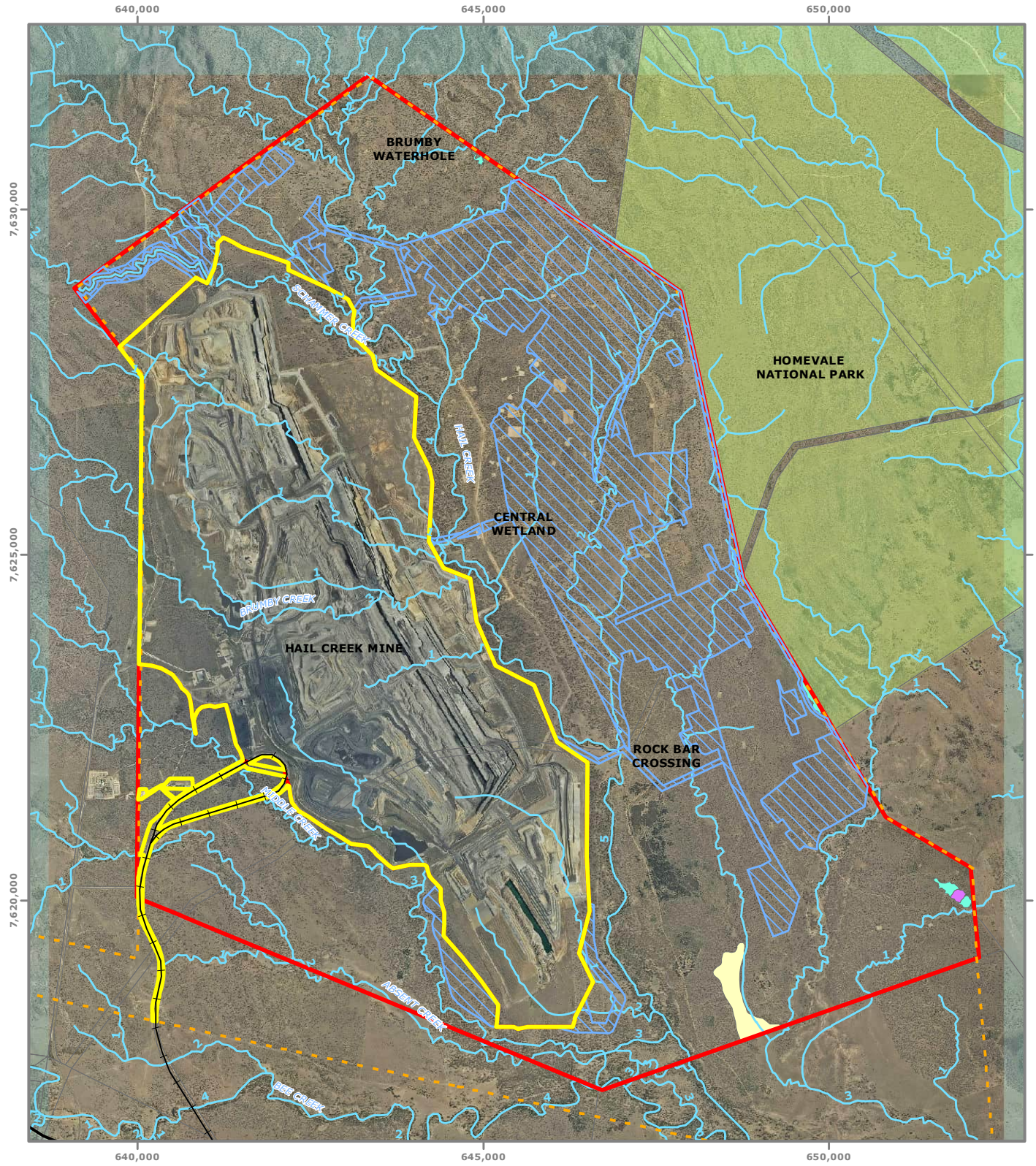
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_19_h
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Stage 1 Approximate Surface Disturbance Extent
- Road
- Railway
- Vegetation Management Act Watercourse and Stream Order
- Cadastral Boundary
- National Park

EPBC Act Threatened Ecological Communities (TEC)

- Brigalow (*Acacia harpophylla* dominant and co-dominant)
- Natural Grassland
- Semi-evergreen Vine Thicket (SEVT)

Figure 20 : Commonwealth threatened ecological communities relative to the Stage 1 Project area

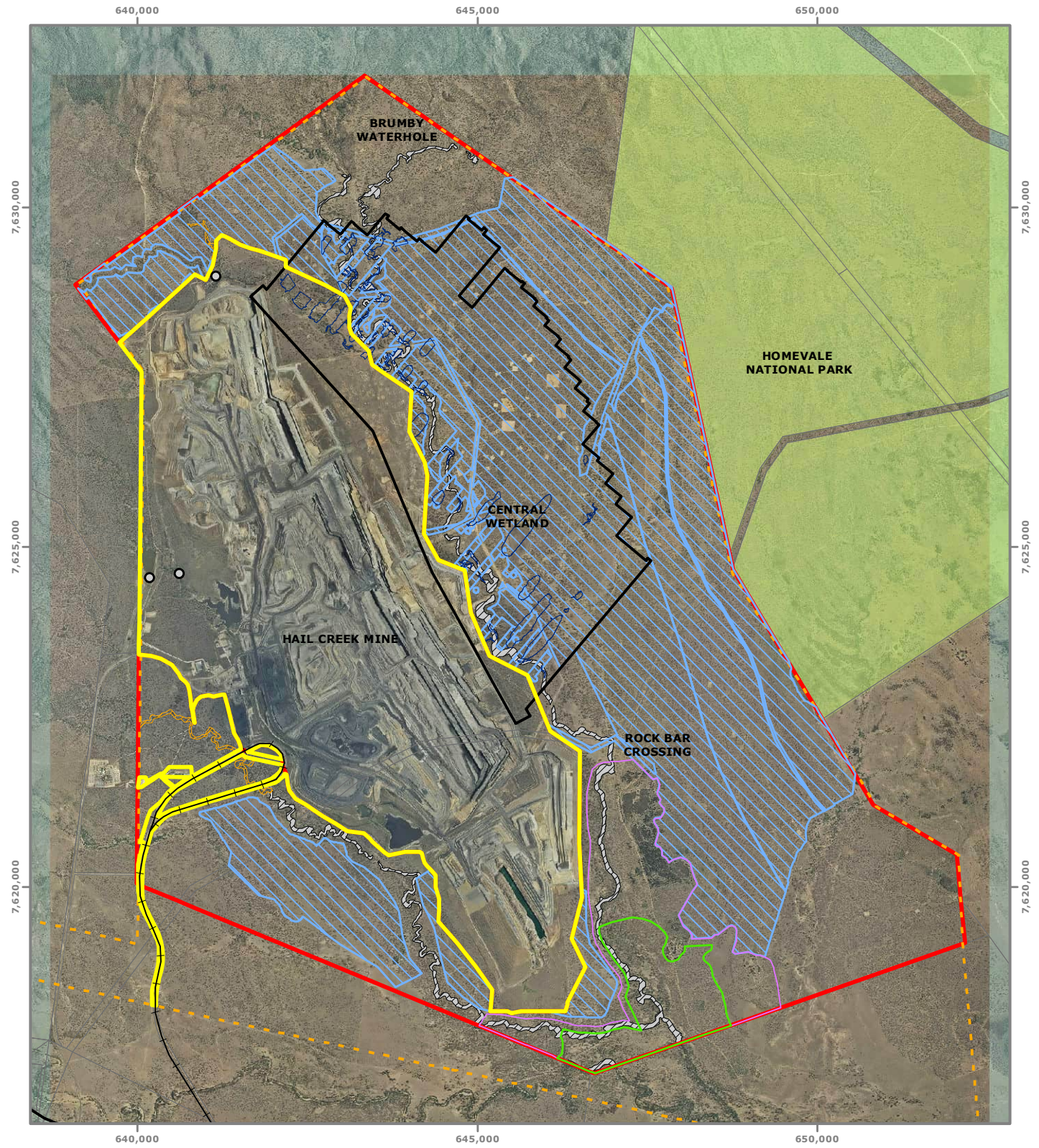
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_20_h
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Approximate Surface Disturbance Extent
- Approximate Extent of Longwall Mining Area
- Predicted Subsidence Pond Areas
- Legally Secured Offset Area – Proposed
- Environmental Management Zone
- Road
- Railway
- Cadastral Boundary
- National Park

Conservation Significant Flora Species Records

- Black Ironbox *(Eucalyptus raveretiana)* – V – EPBC Act
- Black Ironbox *(Eucalyptus raveretiana)* – V – EPBC Act

Potential Habitat Mapping

- High Value Habitat - Black Ironbox *(Eucalyptus raveretiana)* – V – EPBC Act
- Low Value Habitat - Black Ironbox *(Eucalyptus raveretiana)* – V – EPBC Act

Figure 21 : Conservation significant flora in the Project Area

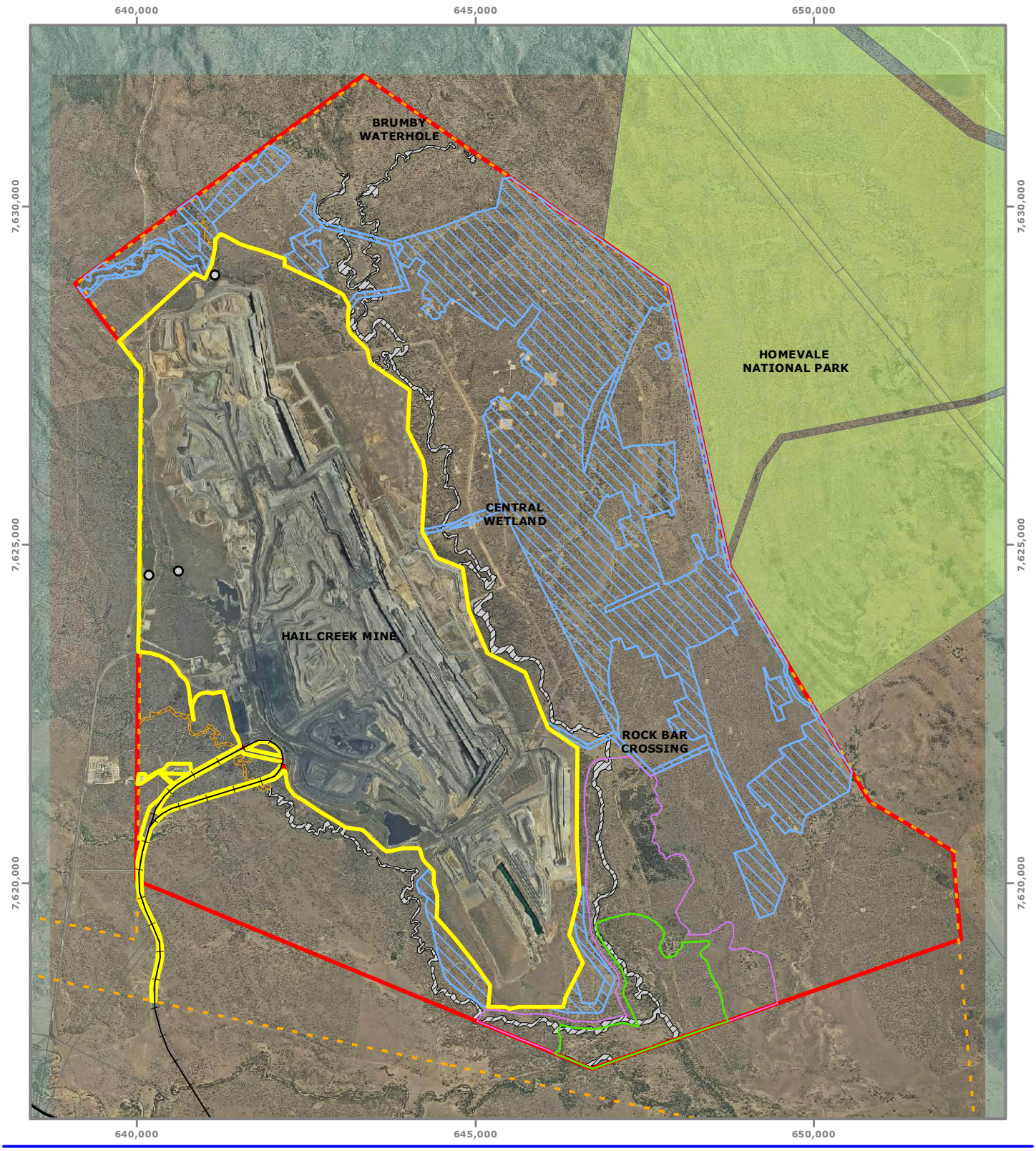
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_21_k
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Stage 1 Approximate Surface Disturbance Extent
- Legally Secured Offset Area – Proposed
- Environmental Management Zone
- Road
- Railway
- Cadastral Boundary
- National Park

Conservation Significant Flora Species Records

- Black Ironbox *(Eucalyptus raveretiana)* – V – EPBC Act
- Black Ironbox *(Eucalyptus raveretiana)* – V – EPBC Act

Potential Habitat Mapping

- High Value Habitat - Black Ironbox *(Eucalyptus raveretiana)* – V – EPBC Act
- Low Value Habitat - Black Ironbox *(Eucalyptus raveretiana)* – V – EPBC Act

Figure 22 : Conservation significant flora in the Stage 1 Project Area

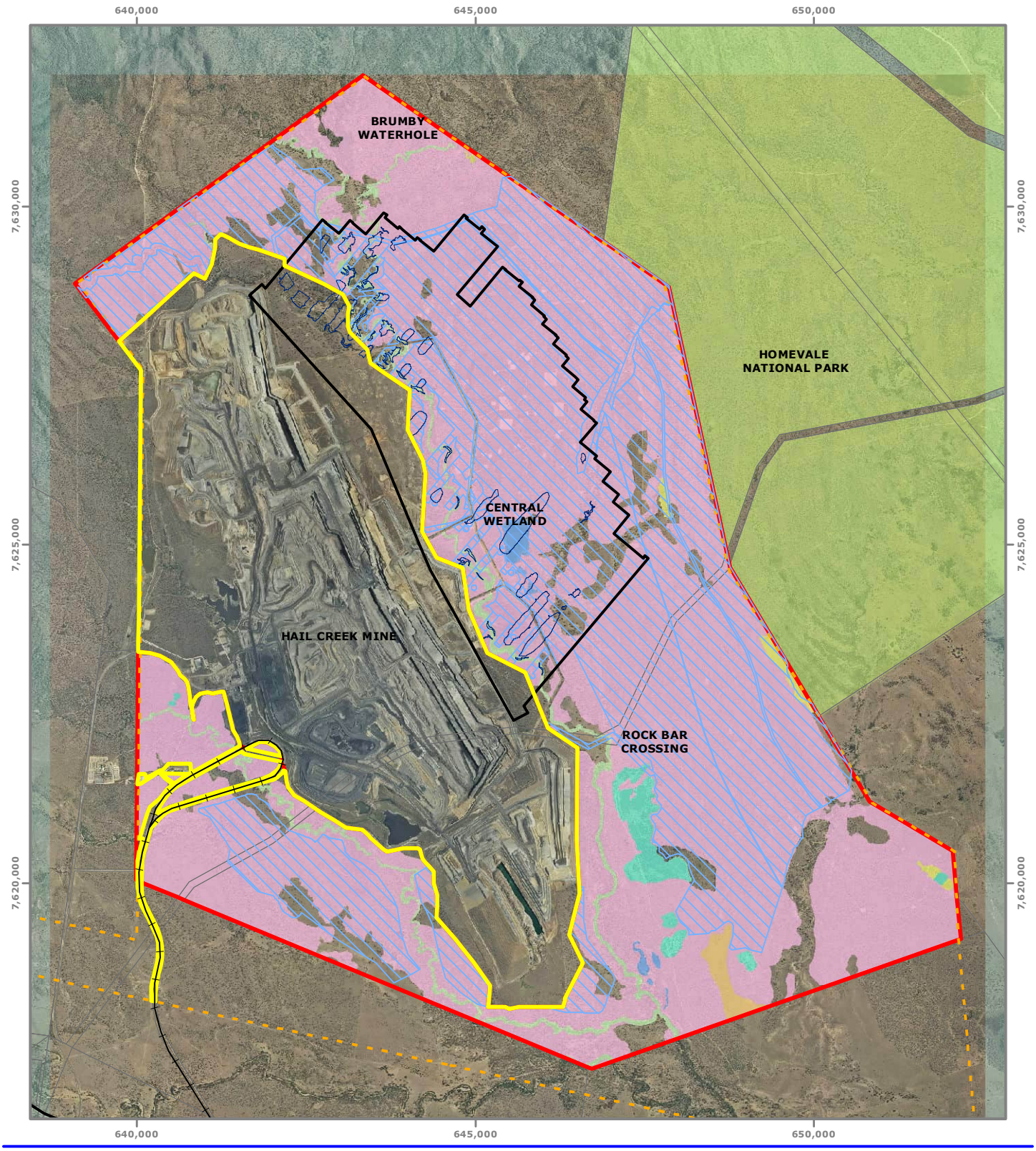
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_22_e
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Approximate Surface Disturbance Extent
- Approximate Extent of Longwall Mining Area
- Predicted Subsidence Pond Areas
- Road
- Railway
- Cadastral Boundary
- National Park

Broad Habitat Types – (remnant and non-remnant vegetation)

- Eucalypt Woodlands and Open Forests
- Riparian Vegetation
- Brigalow
- Natural Grasslands
- Wetlands
- Vine Thicket

Figure 23 : Broad habitat types in the Project Area

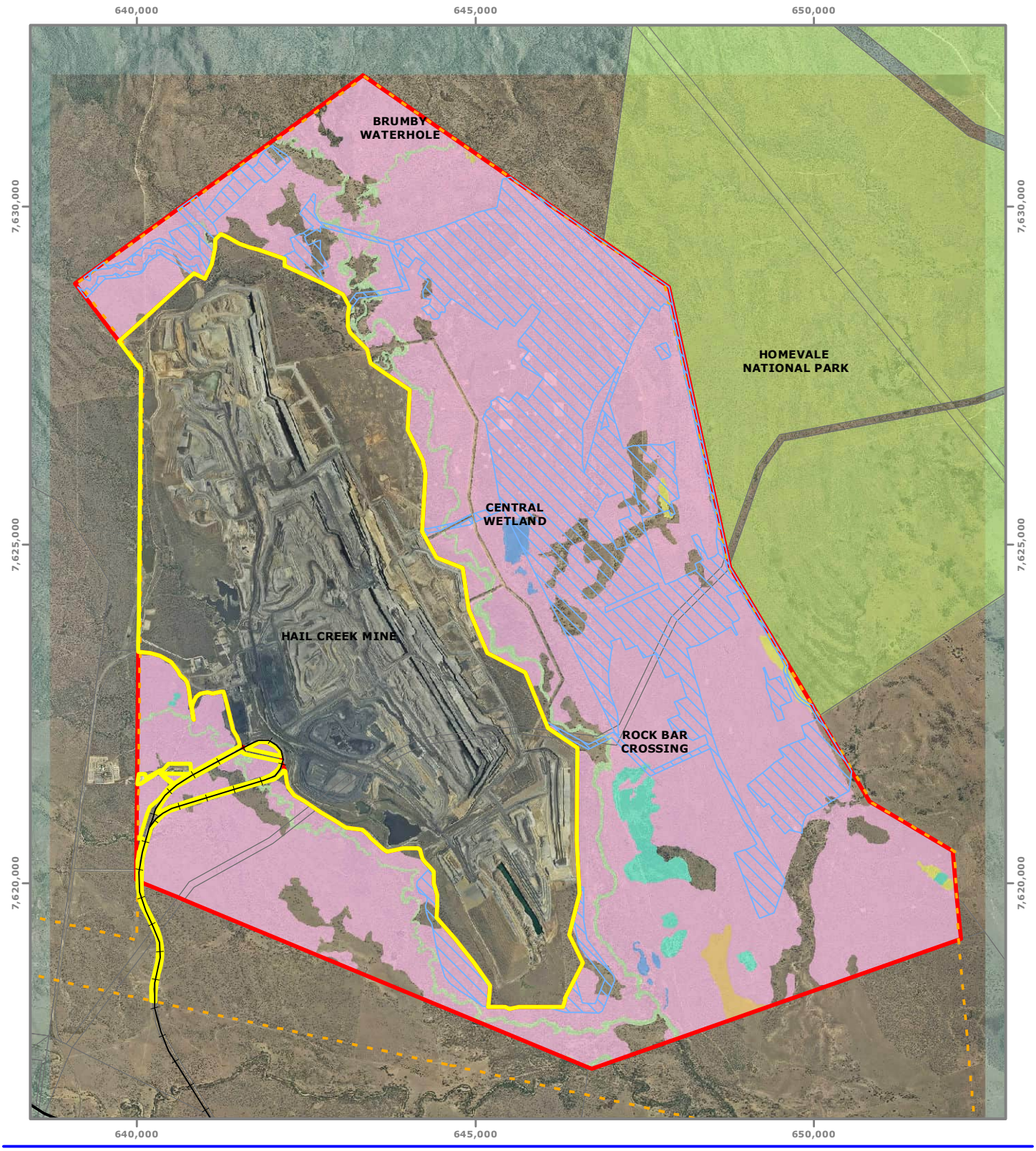
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_23_d
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Stage 1 Approximate Surface Disturbance Extent
- Road
- Railway
- Cadastral Boundary
- National Park

Broad Habitat Types

- Eucalypt Woodlands and Open Forests
- Riparian Vegetation
- Brigalow
- Natural Grasslands
- Wetlands
- SEVT

Figure 24 : Broad habitat types in the Stage 1 Project Area

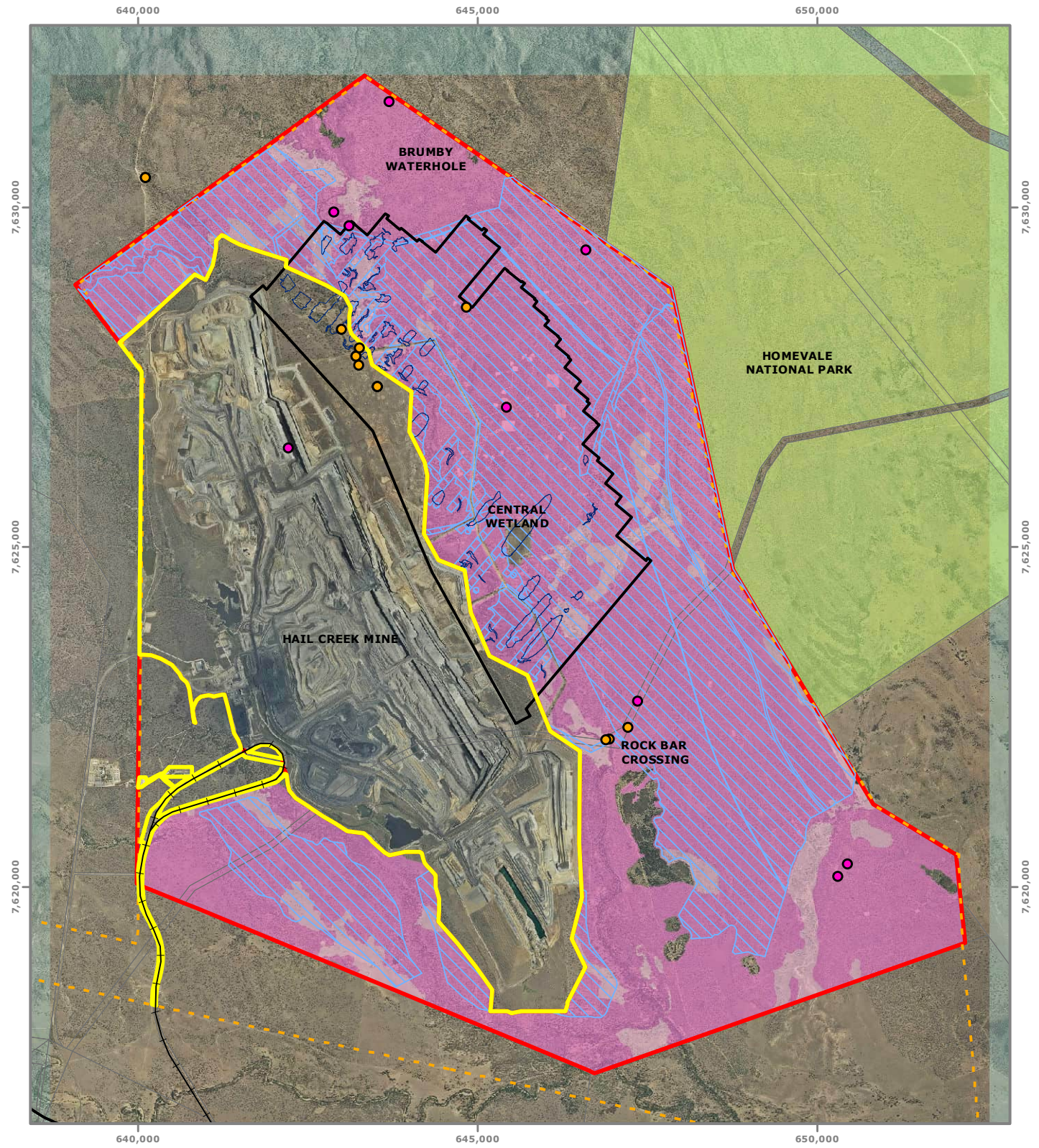
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_24_c
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Approximate Surface Disturbance Extent
- Approximate Extent of Longwall Mining Area
- Predicted Subsidence Pond Areas
- Road
- Railway
- Cadastral Boundary
- National Park

Conservation Significant Fauna Species

- Squatter Pigeon *(Geophaps scripta scripta)*) – V/V (EPBC Act/NC Act)
- Koala *(Phascolarctos cinereus)* – V/SLC (EPBC Act/NC Act)

Potential Habitat Mapping

- High Value Habitat - Squatter Pigeon *(Geophaps scripta scripta)* – V/V (EPBC Act/NC Act), Koala *(Phascolarctos cinereus)* – V/SLC (EPBC Act/NC Act)
- Low Value Habitat - Squatter Pigeon *(Geophaps scripta scripta)*) – V/V (EPBC Act/NC Act)

Figure 25 : Conservation significant fauna habitat in the Project Area – Koala and Squatter Pigeon

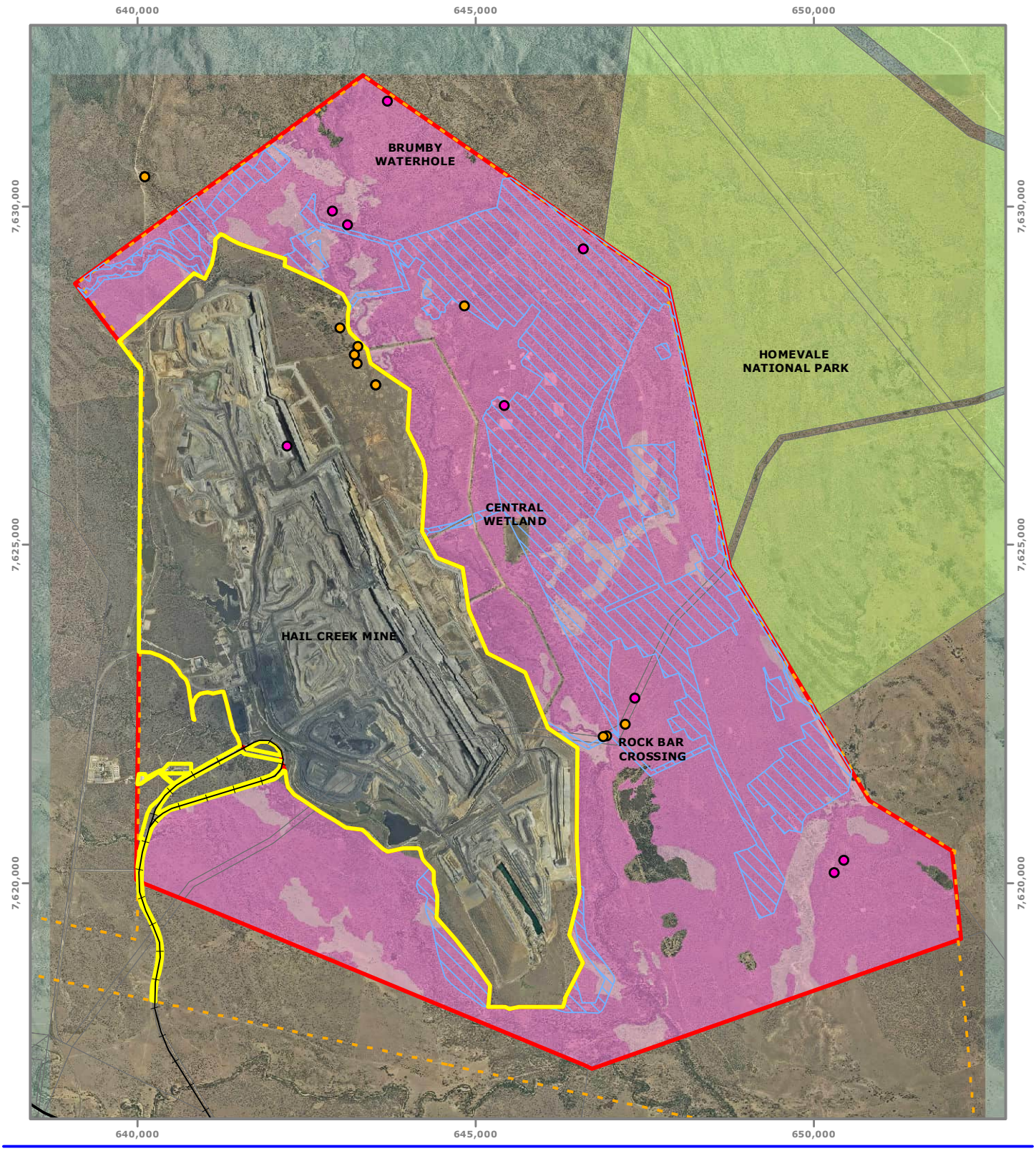
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_25_c
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Stage 2 Approximate Surface Disturbance Extent
- Road
- Railway
- Cadastral Boundary
- National Park

Conservation Significant Fauna Species

- Squatter Pigeon *(Geophaps scripta scripta)*) – V/V (EPBC Act/NC Act)
- Koala *(Phascolarctos cinereus)* – V/SLC (EPBC Act/NC Act)

Potential Habitat Mapping

- High Value Habitat - Squatter Pigeon *(Geophaps scripta scripta)* – V/V (EPBC Act/NC Act), Koala *(Phascolarctos cinereus)* – V/SLC (EPBC Act/NC Act)
- Low Value Habitat - Squatter Pigeon *(Geophaps scripta scripta)*) – V/V (EPBC Act/NC Act)

Figure 26 : Conservation significant fauna habitat in the Stage 1 Project Area – Koala and Squatter Pigeon

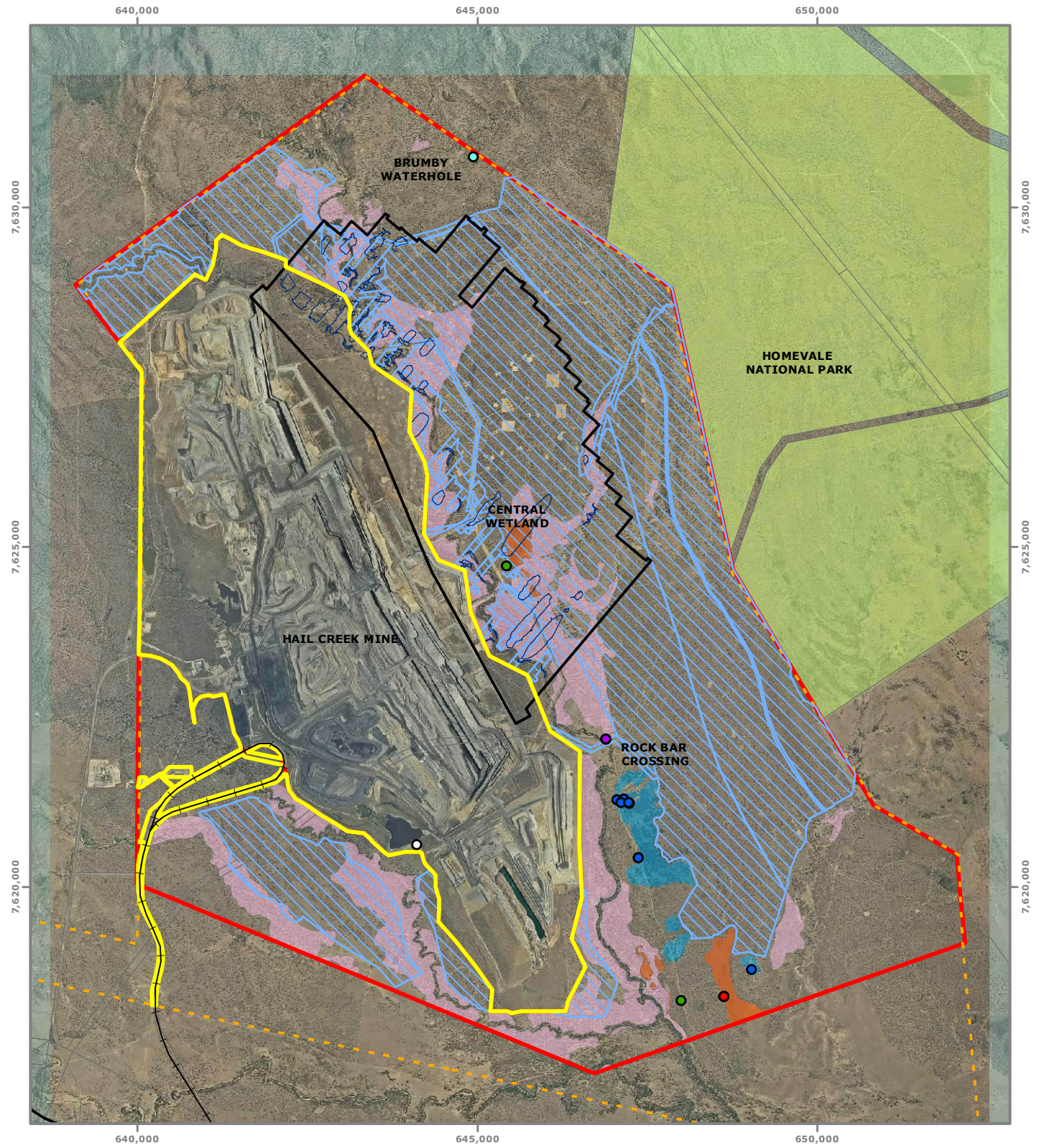
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_26_c
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Approximate Surface Disturbance Extent
- Approximate Extent of Longwall Mining Area
- Predicted Subsidence Pond Areas
- Road
- Railway
- Cadastral Boundary
- National Park

Conservation Significant Fauna Species

- Australian Painted Snipe *(Rostratula australis)* – E/V (EPBC Act/NC Act)
- Ornamental Snake *(Denisonia maculata)* – V/V (EPBC Act/NC Act)

Potential Habitat Mapping

- High Value Habitat - Australian Painted Snipe *(Rostratula australis)* – E/V (EPBC Act/NC Act)
- Low Value Habitat - Australian Painted Snipe *(Rostratula australis)* – E/V (EPBC Act/NC Act)
- High Value Habitat - Ornamental Snake *(Denisonia maculata)* – V/V (EPBC Act/NC Act)

Migratory Bird Records

- Magpie Goose *(Anseranas semipalmata)* – (EPBC Act/NC Act)
- White-throated Needletail *(Hirundapus caudacutus)* – (EPBC Act/NC Act)
- Rainbow Bee-eater *(Merops ornatus)* – (EPBC Act/NC Act)
- White-bellied Sea-Eagle *(Haliaeetus leucogaster)* – (EPBC Act/NC Act)

Figure 27 : Conservation significant fauna habitat in the Project Area - Australian Painted Snipe and Ornamental Snake

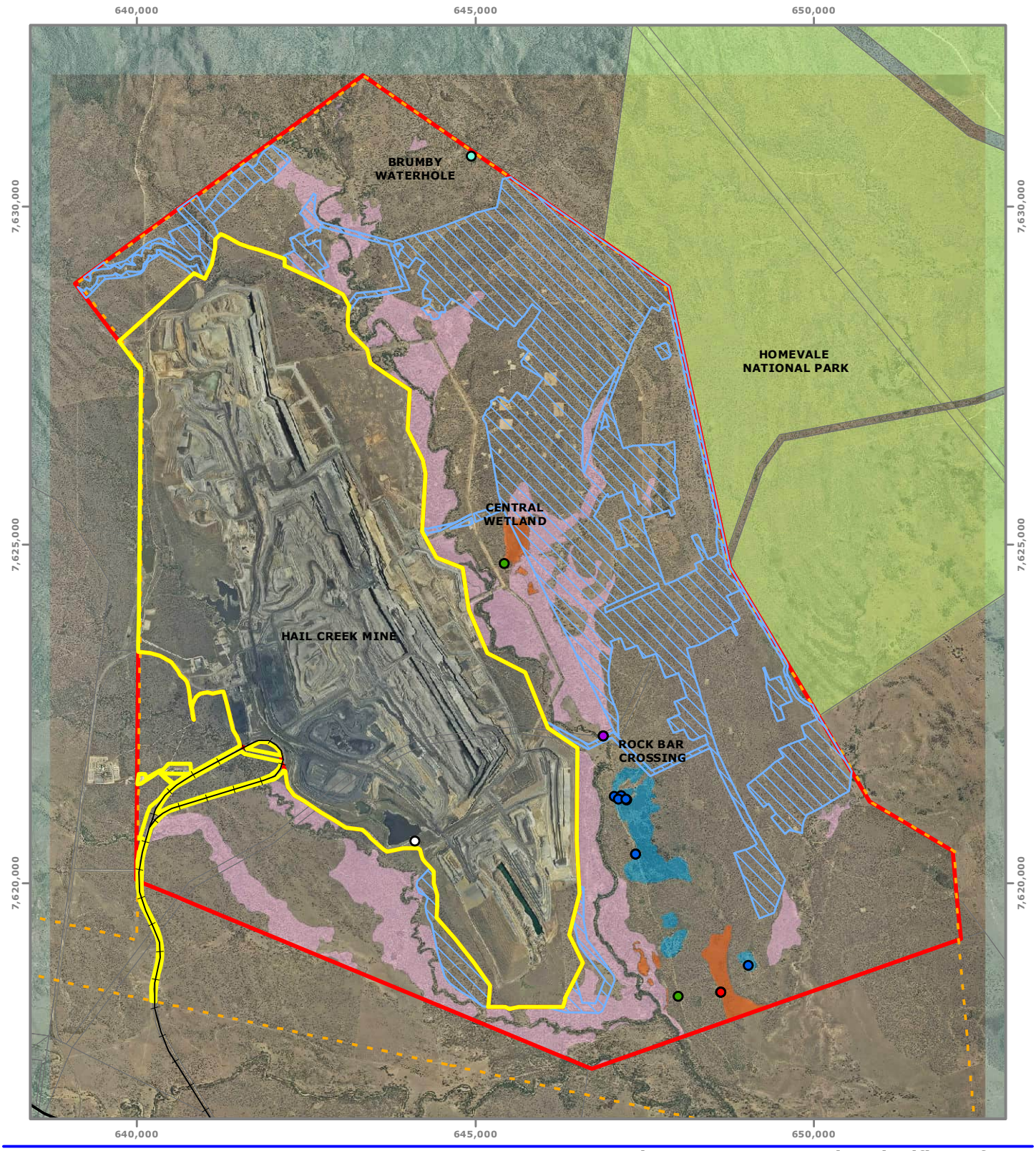
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_27_c
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Stage 1 Approximate Surface Disturbance Extent
- Road
- Railway
- Cadastral Boundary
- National Park

Conservation Significant Fauna Species

- Australian Painted Snipe *(Rostratula australis)* – E/V (EPBC Act/NC Act)
- Ornamental Snake *(Denisonia maculata)* – V/V (EPBC Act/NC Act)

Potential Habitat Mapping

- High Value Habitat - Australian Painted Snipe *(Rostratula australis)* – E/V (EPBC Act/NC Act)
- Low Value Habitat - Australian Painted Snipe *(Rostratula australis)* – E/V (EPBC Act/NC Act)
- High Value Habitat - Ornamental Snake *(Denisonia maculata)* – V/V (EPBC Act/NC Act)

Migratory Bird Records

- Magpie Goose *(Anseranas semipalmata)* – (EPBC Act/NC Act)
- White-throated Needletail *(Hirundapus caudacutus)* – (EPBC Act/NC Act)
- Rainbow Bee-eater *(Merops ornatus)* – (EPBC Act/NC Act)
- White-bellied Sea-Eagle *(Haliaeetus leucogaster)* – (EPBC Act/NC Act)

Figure 28 : Conservation significant fauna habitat in the Stage 1 Project Area - Australian Painted Snipe and Ornamental Snake

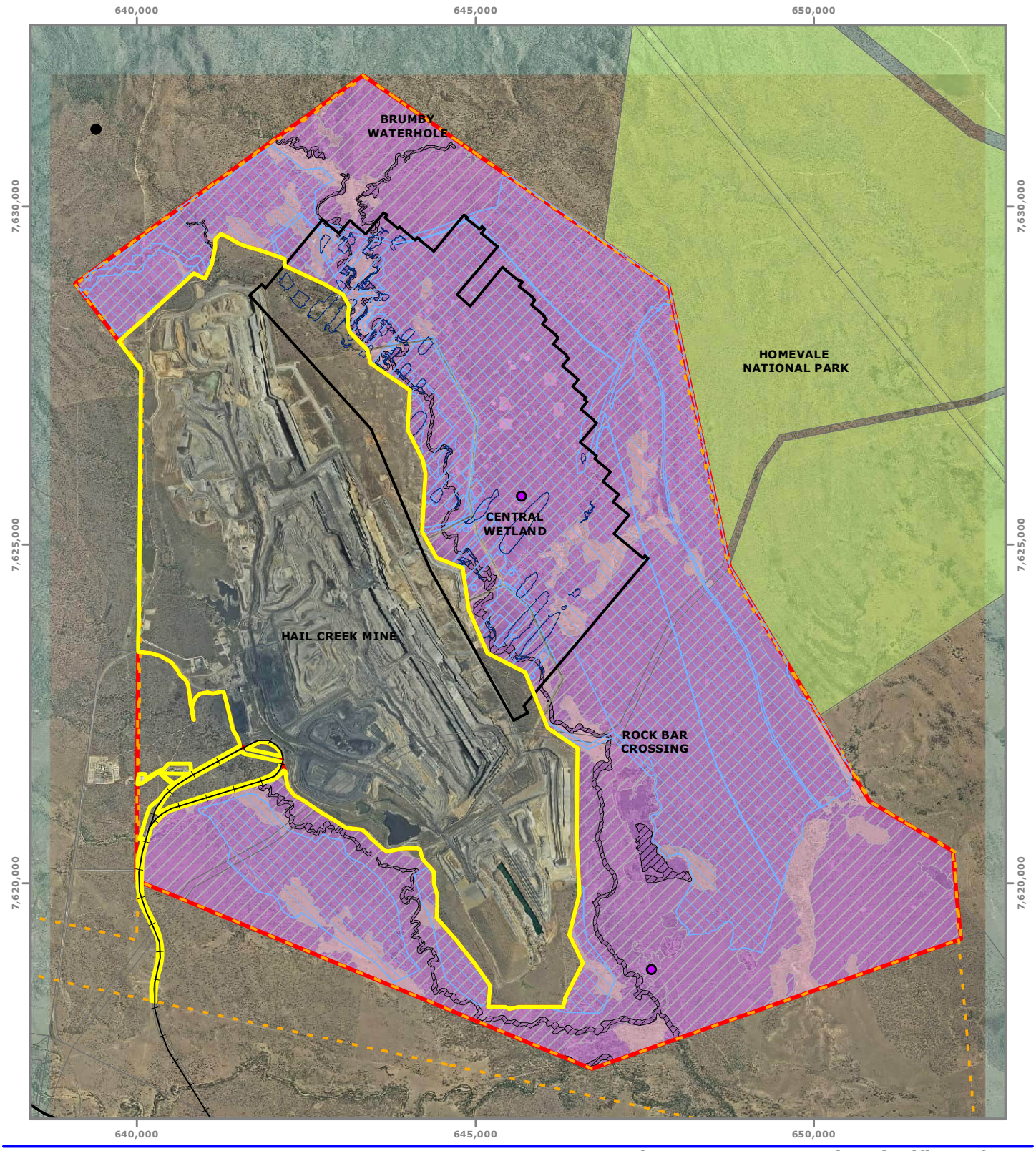
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_28_c
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Approximate Extent of Longwall Mining Area
- Approximate Surface Disturbance Extent
- Predicted Subsidence Pond Areas
- Road
- Railway
- Cadastral Boundary
- National Park

Conservation Significant Fauna Species Records

- Glossy Black-cockatoo *(Calyptorhynchus lathami)* – V (NC Act)
- Short-beaked Echidna *(Tachyglossus aculeatus)* – SLC (NC Act)

Potential Habitat Mapping

- High Value Habitat - Glossy Black-cockatoo *(Calyptorhynchus lathami)* – V (NC Act)
- Low Value Habitat - Glossy Black-cockatoo *(Calyptorhynchus lathami)* – V (NC Act)
- High Value Habitat - Short-beaked Echidna *(Tachyglossus aculeatus)* – SLC (NC Act)
- Low Value Habitat - Short-beaked Echidna *(Tachyglossus aculeatus)* – SLC (NC Act)

Figure 29 : Conservation significant fauna habitat in the Project Area - Glossy Black-cockatoo and Short-beaked Echidna

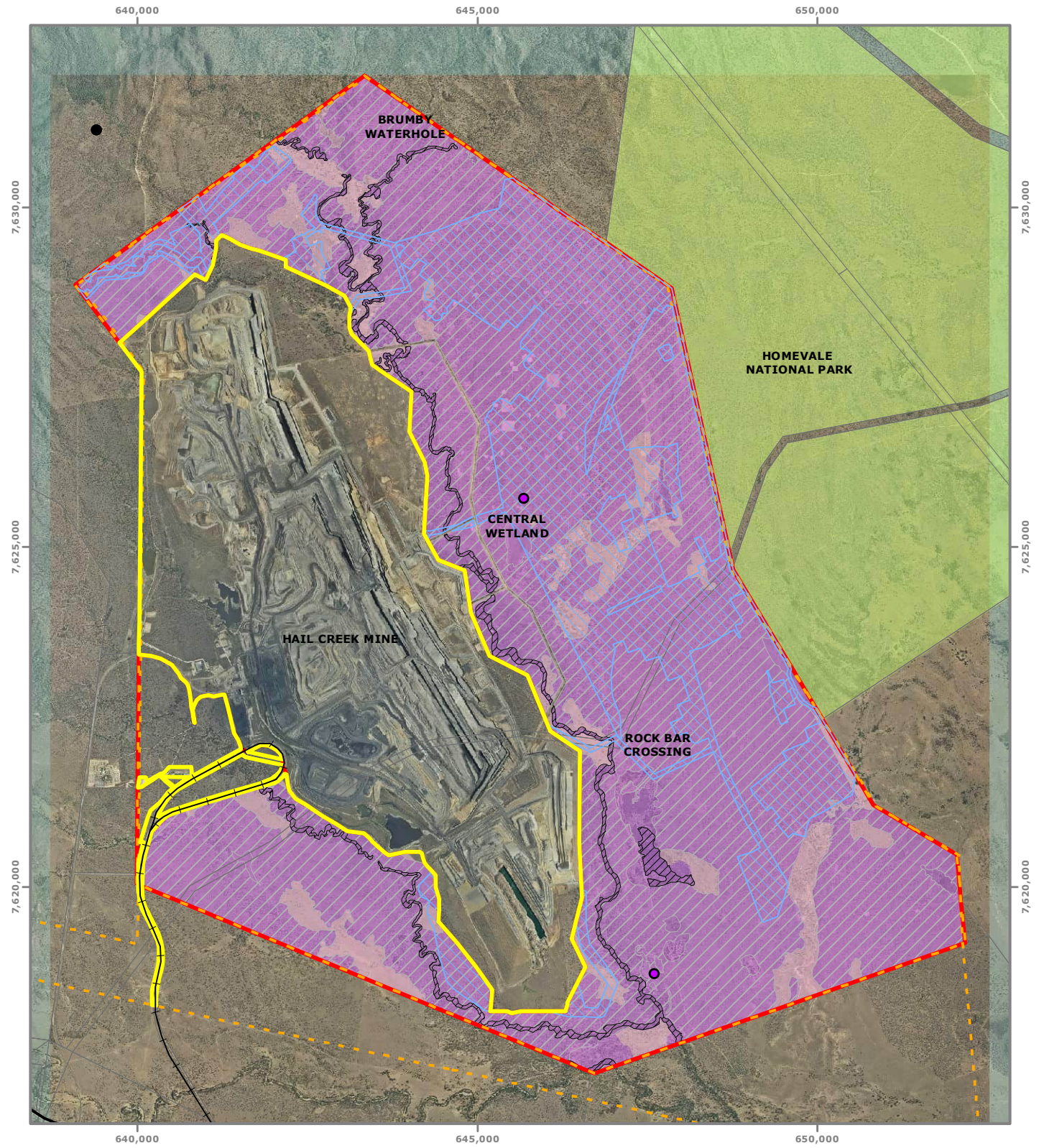
Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_29_c
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, Watercourse - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management



Legend

- Study Area
- Mining Lease 4738
- Existing and Authorised Extent of Operations
- Stage 1 Approximate Surface Disturbance Extent
- Road
- Railway
- Cadastral Boundary
- National Park

Conservation Significant Fauna Species Records

- Glossy Black-cockatoo *(Calyptorhynchus lathami)* – V (NC Act)
- Short-beaked Echidna *(Tachyglossus aculeatus)* – SLC (NC Act)

Potential Habitat Mapping

- High Value Habitat - Glossy Black-cockatoo *(Calyptorhynchus lathami)* – V (NC Act)
- Low Value Habitat - Glossy Black-cockatoo *(Calyptorhynchus lathami)* – V (NC Act)
- High Value Habitat - Short-beaked Echidna *(Tachyglossus aculeatus)* – SLC (NC Act)
- Low Value Habitat - Short-beaked Echidna *(Tachyglossus aculeatus)* – SLC (NC Act)

Figure 30 : Conservation significant fauna habitat in the Stage 1 Project Area - Glossy Black-cockatoo and Short-beaked Echidna

Hail Creek Transition Project - Terrestrial Ecology Assessment

Map Number: 13003_TEC_30_c
Date: 08 May 2015
Map Projection: GDA 1994 MGA Zone 55
Imagery: Oct 2014
Data: DCDB, Watercourse - (C) State of Queensland (Department of Natural Resources and Mines) 2015
Road, Rail - Geoscience Australia 2014

0 0.5 1 2 3 4
Kilometers

N

ecological survey & management

Appendix A

Study Team

Team Member	Title	Years of Experience	Qualifications	Role
Steve Marston	Principal Ecologist	18	BEnvEng (Hons)	Fauna field survey, reporting and review
Ben Nottidge	Senior Ecologist	9	BAppSc (Hons)	Fauna field survey
Dave Hannah	Principal Ecologist	20	BAppSc, PGDip	Fauna field survey
Jason Richard	Principal Ecologist	16	BAppSc MWildlifeMgt	Fauna field survey
Chris Hansen	Principal Botanist	12	BSc(Hons)	Flora field survey, reporting and review
Craig Marston	Ecologist	4	BAppSc (Hons)	Flora field survey
Meredith Watherston	Principal Ecologist	12	BSc (Env)	Reporting and technical review

Appendix B

EPBC Act Protected Matters Search Report for the Search Area

Australian Government
Department of the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

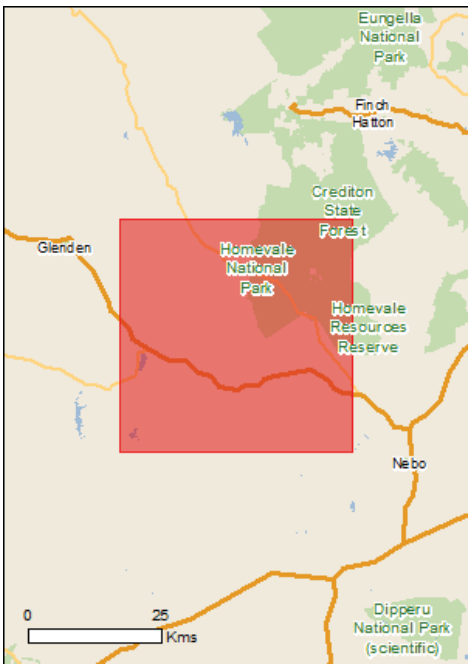
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 12/03/15 11:58:00

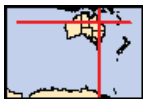
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



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

Coordinates
Buffer: 0.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	24
Listed Migratory Species:	14

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

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

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

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

Place on the RNE:	None
State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	28
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

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

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
Poephila cincta cincta Black-throated Finch (southern) [64447]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area
Frogs		

Name	Status	Type of Presence
Taudactylus eungellensis		
Eungella Day Frog [1887]	Endangered	Species or species habitat likely to occur within area
Mammals		
Dasyurus hallucatus		
Northern Quoll [331]	Endangered	Species or species habitat known to occur within area
Nyctophilus corbeni		
South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Species or species habitat may occur within area
Other		
Cycas ophiolitica		
[55797]	Endangered	Species or species habitat likely to occur within area
Plants		
Dichanthium queenslandicum		
King Blue-grass [5481]	Endangered	Species or species habitat likely to occur within area
Dichanthium setosum		
bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus raveretiana		
Black Ironbox [16344]	Vulnerable	Species or species habitat known to occur within area
Omphalea celata		
[64586]	Vulnerable	Species or species habitat known to occur within area
Ozothamnus eriocephalus		
[56133]	Vulnerable	Species or species habitat likely to occur within area
Phalaenopsis rosenstromii		
Native Moth Orchid [15984]	Endangered	Species or species habitat may occur within area
Streblus pendulinus		
Siah's Backbone, Sia's Backbone, Isaac Wood [21618]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Denisonia maculata		
Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area
Egernia rugosa		
Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
Elseya albagula		
Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur within area
Lerista allanae		
Allan's Lerista, Retro Slider [1378]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Rheodytes leukops		
Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Marine Species		
Crocodylus porosus		
Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat likely to occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Reptiles		

Name	Threatened	Type of Presence
Crocodylus porosus		
Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Homevale	QLD
Homevale 1	QLD
Homevale 2	QLD

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata		
Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina		
Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus		
Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat may occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Vachellia nilotica		
Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Lake Elphinstone	QLD

Coordinates

-21.3073 148.2045,-21.671 148.2045,-21.671 148.5958,-21.3073 148.5958,-21.3073 148.2045

Caveat

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

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

© Commonwealth of Australia
Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix C

BirdLife Australia Atlas Search Results for the Search Area

Scientific Name	Common Name	NC Regulation Status[1]	EPBC Act Status[2]
Acanthiza nana	Yellow Thornbill	LC	NL
Acanthiza pusilla	Brown Thornbill	LC	NL
Accipiter fasciatus	Brown Goshawk	LC	NL
Acrocephalus australis	Australian Reed-Warbler	LC	NL
Aegotheles cristatus	Australian Owlet-nightjar	LC	NL
Aerodramus terrareginae	Australian Swiftlet	LC	NL
Alectura lathami	Australian Brush-turkey	LC	NL
Anas gracilis	Grey Teal	LC	NL
Anas rhynchotis	Australasian Shoveler	LC	NL
Anas superciliosa	Pacific Black Duck	LC	NL
Anhinga novaehollandiae	Australasian Darter	LC	NL
Aprosmictus erythropterus	Red-winged Parrot	LC	NL
Aquila audax	Wedge-tailed Eagle	LC	NL
Ardea modesta	Eastern Great Egret	LC	NL
Ardea pacifica	White-necked Heron	LC	NL
Ardeotis australis	Australian Bustard	LC	NL
Artamus leucorynchus	White-breasted Woodswallow	LC	NL
Aythya australis	Hardhead	LC	NL
Burhinus grallarius	Bush Stone-curlew	LC	NL
Cacatua galerita	Sulphur-crested Cockatoo	LC	NL
Cacomantis flabelliformis	Fan-tailed Cuckoo	LC	NL
Cacomantis pallidus	Pallid Cuckoo	LC	NL
Cacomantis variolosus	Brush Cuckoo	LC	NL
Calyptorhynchus banksii	Red-tailed Black-Cockatoo	LC	NL
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	NL
Caprimulgus macrurus	Large-tailed Nightjar	LC	NL
Centropus phasianinus	Pheasant Coucal	LC	NL
Ceyx azureus	Azure Kingfisher	LC	NL
Chalcites basalis	Horsfield's Bronze-Cuckoo	LC	NL
Chalcites lucidus	Shining Bronze-Cuckoo	LC	NL
Chenonetta jubata	Australian Wood Duck	LC	NL
Cincloramphus mathewsi	Rufous Songlark	LC	NL
Cisticola exilis	Golden-headed Cisticola	LC	NL
Colluricincla harmonica	Grey Shrike-thrush	LC	NL
Colluricincla megarhyncha	Little Shrike-thrush	LC	NL
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC	NL
Coracina papuensis	White-bellied Cuckoo-shrike	LC	NL
Coracina tenuirostris	Cicadabird	LC	NL
Corcorax melanorhamphos	White-winged Chough	LC	NL

Scientific Name	Common Name	NC Regulation Status[1]	EPBC Act Status[2]
Cormobates leucophaea	White-throated Treecreeper	LC	NL
Corvus coronoides	Australian Raven	LC	NL
Corvus orru	Torresian Crow	LC	NL
Coturnix ypsilophora	Brown Quail	LC	NL
Cracticus nigrogularis	Pied Butcherbird	LC	NL
Cracticus tibicen	Australian Magpie	LC	NL
Cracticus torquatus	Grey Butcherbird	LC	NL
Cygnus atratus	Black Swan	LC	NL
Dacelo leachii	Blue-winged Kookaburra	LC	NL
Dacelo novaeguineae	Laughing Kookaburra	LC	NL
Daphoenositta chrysoptera	Varied Sittella	LC	NL
Dendrocygna eytoni	Plumed Whistling-Duck	LC	NL
Dicaeum hirundinaceum	Mistletoebird	LC	NL
Dicrurus bracteatus	Spangled Drongo	LC	NL
Dromaius novaehollandiae	Emu	LC	NL
Egretta novaehollandiae	White-faced Heron	LC	NL
Elanus axillaris	Black-shouldered Kite	LC	NL
Elseyornis melanops	Black-fronted Dotterel	LC	NL
Entomyzon cyanotis	Blue-faced Honeyeater	LC	NL
Eolophus roseicapillus	Galah	LC	NL
Eudynamys orientalis	Eastern Koel	LC	NL
Eurystomus orientalis	Dollarbird	LC	NL
Falco berigora	Brown Falcon	LC	NL
Falco cenchroides	Nankeen Kestrel	LC	NL
Falco longipennis	Australian Hobby	LC	NL
Fulica atra	Eurasian Coot	LC	NL
Gallinula tenebrosa	Dusky Moorhen	LC	NL
Gallirallus philippensis	Buff-banded Rail	LC	NL
Gelochelidon nilotica	Gull-billed Tern	LC	NL
Geopelia striata	Peaceful Dove	LC	NL
Geophaps scripta	Squatter Pigeon	V	V
Gerygone albogularis	White-throated Gerygone	LC	NL
Glossopsitta pusilla	Little Lorikeet	LC	NL
Grallina cyanoleuca	Magpie-lark	LC	NL
Grus rubicunda	Brolga	LC	NL
Haliastur sphenurus	Whistling Kite	LC	NL
Hydroprogne caspia	Caspian Tern	LC	NL
Lalage leucomela	Varied Triller	LC	NL
Leucosarcia picata	Wonga Pigeon	LC	NL
Lichenostomus chrysops	Yellow-faced Honeyeater	LC	NL
Lichenostomus flavus	Yellow Honeyeater	LC	NL
Lichmera indistincta	Brown Honeyeater	LC	NL

Scientific Name	Common Name	NC Regulation Status[1]	EPBC Act Status[2]
Lopholaimus antarcticus	Topknot Pigeon	LC	NL
Malurus melanocephalus	Red-backed Fairy-wren	LC	NL
Manorina flavigula	Yellow-throated Miner	LC	NL
Manorina melanocephala	Noisy Miner	LC	NL
Megalurus gramineus	Little Grassbird	LC	NL
Meliphaga lewinii	Lewin's Honeyeater	LC	NL
Melithreptus albogularis	White-throated Honeyeater	LC	NL
Melithreptus gularis	Black-chinned Honeyeater	LC	NL
Melithreptus lunatus	White-naped Honeyeater	LC	NL
Merops ornatus	Rainbow Bee-eater	LC	M
Microcarbo melanoleucos	Little Pied Cormorant	LC	NL
Microeca fascinans	Jacky Winter	LC	NL
Myiagra inquieta	Restless Flycatcher	LC	NL
Myiagra rubecula	Leaden Flycatcher	LC	NL
Myzomela sanguinolenta	Scarlet Honeyeater	LC	NL
Neochmia temporalis	Red-browed Finch	LC	NL
Nettapus coromandelianus	Cotton Pygmy-goose	LC	NL
Nettapus pulchellus	Green Pygmy-goose	LC	NL
Ninox novaeseelandiae	Southern Boobook	LC	NL
Nymphicus hollandicus	Cockatiel	LC	NL
Ocyphaps lophotes	Crested Pigeon	LC	NL
Oriolus sagittatus	Olive-backed Oriole	LC	NL
Pachycephala pectoralis	Golden Whistler	LC	NL
Pachycephala rufiventris	Rufous Whistler	LC	NL
Pardalotus punctatus	Spotted Pardalote	LC	NL
Pardalotus striatus	Striated Pardalote	LC	NL
Pelecanus conspicillatus	Australian Pelican	LC	NL
Petrochelidon ariel	Fairy Martin	LC	NL
Petrochelidon nigricans	Tree Martin	LC	NL
Phalacrocorax carbo	Great Cormorant	LC	NL
Phalacrocorax sulcirostris	Little Black Cormorant	LC	NL
Philemon buceroides	Helmeted Friarbird	LC	NL
Philemon citreogularis	Little Friarbird	LC	NL
Philemon corniculatus	Noisy Friarbird	LC	NL
Platycercus adscitus	Pale-headed Rosella	LC	NL
Podiceps cristatus	Great Crested Grebe	LC	NL
Pomatostomus temporalis	Grey-crowned Babbler	LC	NL
Porphyrio porphyrio	Purple Swamphen	LC	NL
Ptilonorhynchus maculatus	Spotted Bowerbird	LC	NL
Ptilonorhynchus nuchalis	Great Bowerbird	LC	NL
Rhipidura albiscapa	Grey Fantail	LC	NL
Rhipidura leucophrys	Willie Wagtail	LC	NL
Scythrops novaehollandiae	Channel-billed Cuckoo	LC	NL

Scientific Name	Common Name	NC Regulation Status[1]	EPBC Act Status[2]
Sericornis frontalis	White-browed Scrubwren	LC	NL
Smicrornis brevirostris	Weebill	LC	NL
Sphecotheres vieilloti	Australasian Figbird	LC	NL
Strepera graculina	Pied Currawong	LC	NL
Struthidea cinerea	Apostlebird	LC	NL
Tachybaptus novaehollandiae	Australasian Grebe	LC	NL
Taeniopygia bichenovii	Double-barred Finch	LC	NL
Threskiornis molucca	Australian White Ibis	LC	NL
Threskiornis spinicollis	Straw-necked Ibis	LC	NL
Todiramphus macleayii	Forest Kingfisher	LC	NL
Todiramphus pyrrhopygius	Red-backed Kingfisher	LC	NL
Todiramphus sanctus	Sacred Kingfisher	LC	NL
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	LC	NL
Trichoglossus haematodus	Rainbow Lorikeet	LC	NL
Vanellus miles	Masked Lapwing	LC	NL
Vanellus tricolor	Banded Lapwing	LC	NL
Zosterops lateralis	Silvereye	LC	NL

1. Indicates the Queensland conservation status of each taxon under the NC Regulation. The codes are Least Common (LC), Special Least Concern (SLC), Near Threatened (NT), Vulnerable (V), Endangered (E) fauna species.

2. Indicates the Commonwealth conservation status of each taxon under the EPBC Act. The codes are Marine (MAR), Migratory (MIG), Not Listed (NL), Vulnerable (V), Endangered (E) fauna species.

Appendix D

Queensland Museum Database

Search Results for the Search Area

Family	Scientific Name	Common Name	NC Regulation Status[1]	EPBC Act Status[2]
Amphibians				
Limnodynastidae	*Adelotus brevis*	Tusked Frog	V	NL
Limnodynastidae	*Limnodynastes peronii*	Striped Marsh Frog	LC	NL
Limnodynastidae	*Limnodynastes tasmaniensis*	Spotted Marshfrog	LC	NL
Limnodynastidae	*Limnodynastes terraereginae*	Scarlet-sided Pobblebonk	LC	NL
Limnodynastidae	*Platyplectrum ornatum*	Ornate Burrowing Frog	LC	NL
Myobatrachidae	*Mixophyes fasciolatus*	Great Barred-frog	LC	NL
Myobatrachidae	*Pseudophryne major*	Great Brown Broodfrog	LC	NL
Hylidae	*Cyclorana alboguttata*	Green-stripe Frog	LC	NL
Hylidae	*Cyclorana novaehollandiae*	New Holland Frog	LC	NL
Hylidae	*Litoria caerulea*	Green Treefrog	LC	NL
Hylidae	*Litoria chloris*	Southern Orange-eyed Treefrog	LC	NL
Hylidae	*Litoria inermis*	Peters' Frog	LC	NL
Hylidae	*Litoria latopalmata*	Broad-palmed Rocketfrog	LC	NL
Hylidae	*Litoria rubella*	Naked Treefrog	LC	NL
Hylidae	*Litoria wilcoxii*	Stony-creek Frog	LC	NL
Bufonidae	*Rhinella marina*	Cane Toad	*	*
Reptiles				
Carphodactylidae	*Phyllurus nephthys*	Peppered-belly Leaf-tail Gecko	LC	NL
Diplodactylidae	*Amalosia rhombifer*	ZigZag Velvet Gecko	LC	NL
Diplodactylidae	*Diplodactylus conspicillatus*	Fat-tailed Gecko	LC	NL
Diplodactylidae	*Lucasium steindachneri*	Box-patterned Gecko	LC	NL
Diplodactylidae	*Oedura*			NL
Diplodactylidae	*Oedura ocellata*	Ocellated Velvet Gecko	LC	NL
Gekkonidae	*Gehyra dubia*	Dubious Dtella	LC	NL
Gekkonidae	*Gehyra variegata*	Variegated Dtella	LC	NL
Gekkonidae	*Heteronotia binoei*	Bynoe's Gecko	LC	NL
Pygopodidae	*Delma labialis*	Single-striped Delma	LC	NL
Scincidae	*Anomalopus brevicollis*	Short-necked Worm-skink	LC	NL
Scincidae	*Calyptotis temporalis*	Broad-templed Calyptotis	LC	NL
Scincidae	*Carlia*	4 fingered skink		NL
Scincidae	*Carlia pectoralis*	Open-litter Rainbow-skink	LC	NL
Scincidae	*Carlia rhomboidalis*	Blue-throated Rainbow-skink	LC	NL
Scincidae	*Carlia schmeltzii*	Robust Rainbow-skink	LC	NL
Scincidae	*Carlia vivax*	Lively Skink	LC	NL
Scincidae	*Cryptoblepharus pannosus*	Ragged Snake-eyed Skink	LC	NL

Family	Scientific Name	Common Name	NC Regulation Status[1]	EPBC Act Status[2]
Scincidae	*Cryptoblepharus virgatus*	Wall Skink	LC	NL
Scincidae	*Ctenotus arcanus*	Arcane Ctenotus	LC	NL
Scincidae	*Ctenotus taeniolatus*	Copper-tailed Skink	LC	NL
Scincidae	*Eulamprus amplus*	Lemon-barred Forest-skink	NT	NL
Scincidae	*Eulamprus brachysoma*	Northern Barsided Skink	LC	NL
Scincidae	*Eulamprus martini*	Martin's Skink	LC	NL
Scincidae	*Eulamprus tenuis*	Bar-sided Skink	LC	NL
Scincidae	*Lampropholis adonis*	Diamond Shielded Sunskink	LC	NL
Scincidae	*Lampropholis delicata*	Garden Skink	LC	NL
Scincidae	*Lerista fragilis*	Eastern Mulch-slider	LC	NL
Scincidae	*Liburnascincus mundivensis*	Outcrop Rainbow-skink	LC	NL
Scincidae	*Lygisaurus foliorum*	Burnett's Skink	LC	NL
Scincidae	*Lygisaurus zuma*	Sun-loving Litter-skink	LC	NL
Scincidae	*Menetia greyii*	Common Dwarf Skink	LC	NL
Scincidae	*Menetia timlowi*	Dwarf Litter-skink	LC	NL
Scincidae	*Morethia taeniopleura*	North-eastern Firetail Skink	LC	NL
Scincidae	*Saproscincus hannahae*	Hannah's Shadeskink	LC	NL
Agamidae	*Diporiphora australis*	Tommy Round-head	LC	NL
Agamidae	*Diporiphora nobbi*	Nobbi Dragon	LC	NL
Typhlopidae	*Ramphotyphlops unguirostris*	Claw-snouted Blind Snake	LC	NL
Pythonidae	*Morelia spilota*	Carpet Python	LC	NL
Colubridae	*Dendrelaphis punctulata*	Green Tree Snake	LC	NL
Elapidae	*Acanthophis praelongus*	Northern Death Adder	LC	NL
Elapidae	*Cacophis harriettae*	White-crowned Snake	LC	NL
Elapidae	*Cacophis squamulosus*	Golden-crowned Snake	LC	NL
Elapidae	*Cryptophis boschmai*	Carpentaria Snake	LC	NL
Elapidae	*Cryptophis nigrescens*	Small-eyed Snake	LC	NL
Elapidae	*Demansia psammophis*	Yellow-faced Whip Snake	LC	NL
Elapidae	*Demansia torquata*	Collared Whipsnake	LC	NL
Elapidae	*Denisonia maculata*	Ornamental Snake	V	NL
Elapidae	*Furina diadema*	Red-naped Snake	LC	NL
Elapidae	*Pseudonaja textilis*	Eastern Brown Snake	LC	NL
Birds				
Loriidae	*Trichoglossus haematodus*	Rainbow Lorikeet	LC	NL
Cuculidae	*Chrysococcyx lucidus*	Shining Bronze Cuckoo	LC	NL
Camperphagidae	*Lalage leucomela*	Varied Triller	LC	NL
Acanthizidae	*Gerygone palpebrosa*	Fairy Gerygone	LC	NL
Monarchidae	*Monarcha melanopsis*	Black-faced Monarch	LC	NL
Monarchidae	*Rhipidura fuliginosa*	Grey Fantail	LC	NL

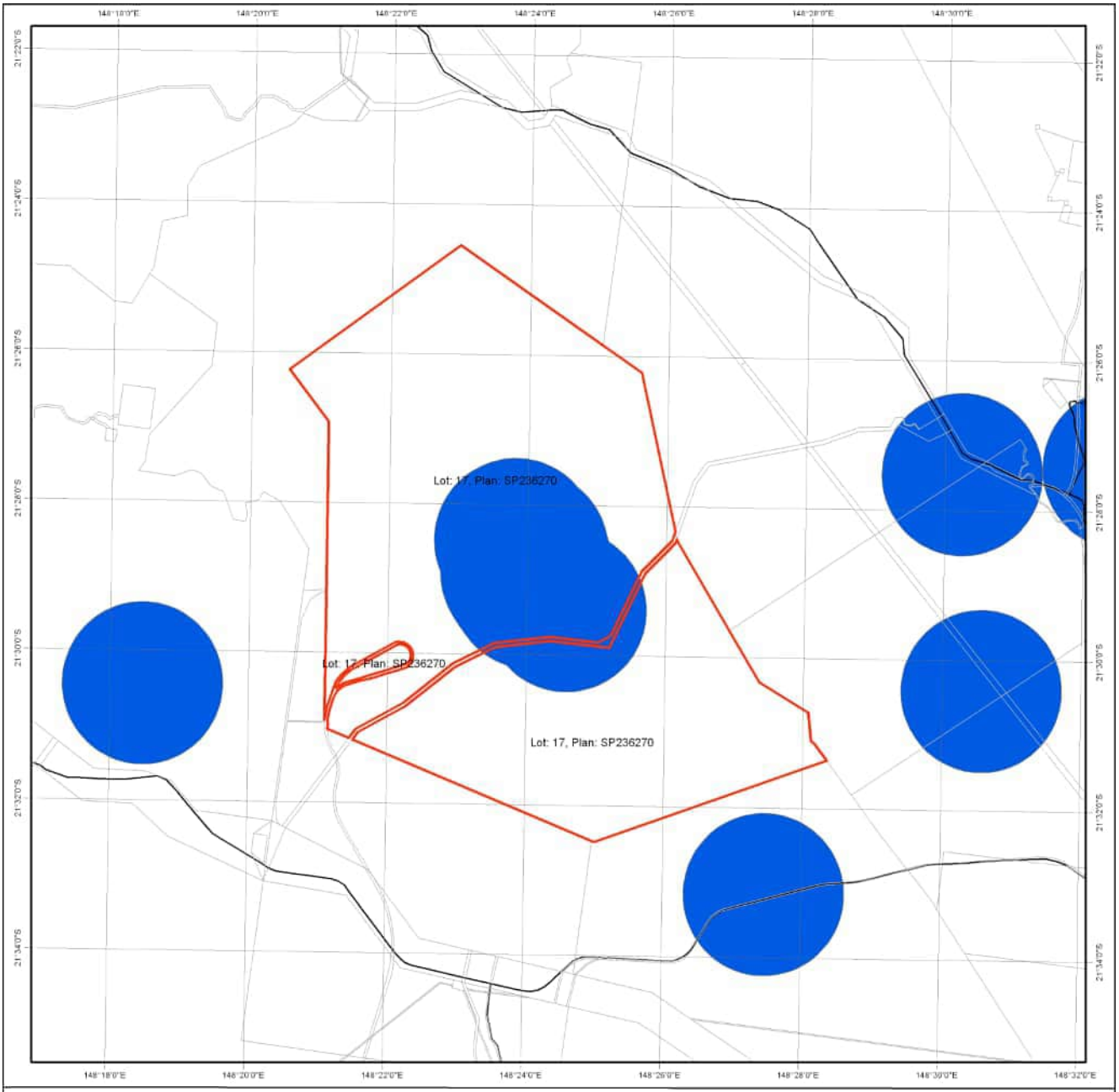
Family	Scientific Name	Common Name	NC Regulation Status[1]	EPBC Act Status[2]
Monarchidae	*Rhipidura rufifrons*	Rufus Fantail	LC	NL
Pachycephalidae	*Colluricincla megarhyncha*	Little Shrike-thrush	LC	NL
Zosteropidae	*Zosterops lateralis*	Silvereye	LC	NL
Meliphagidae	*Myzomela obscura*	Dusky Honeyeater	LC	NL
Mammals				
Dasyuridae	*Dasyurus hallucatus*	Northern quoll	LC	E
Dasyuridae	*Planigale ingrami*	Long-tailed planigale	LC	NL
Peramelidae	*Isoodon macrourus*	Northern brown bandicoot	LC	NL
Macropodidae	*Macropus dorsalis*	Black-striped wallaby	LC	NL
Macropodidae	*Thylogale stigmatica*	Red-legged pademelon	LC	NL
Pteropodidae	*Nyctimene robinsoni*	Queensland tube-nosed bat	LC	NL
Muridae	*Hydromys chrysogaster*	Water rat	LC	NL
Muridae	*Pseudomys patrius*	Pebble- mound mouse	LC	NL
Leporidae	*Oryctolagus cuniculus*	Rabbit	*	*

1. Indicates the Queensland conservation status of each taxon under the NC Regulation. The codes are Least Common (LC), Special Least Concern (SLC), Near Threatened (NT), Vulnerable (V), Endangered (E) fauna species.

2. Indicates the Commonwealth conservation status of each taxon under the EPBC Act. The codes are Marine (MAR), Migratory (MIG), Not Listed (NL), Vulnerable (V), Endangered (E) fauna species.

Appendix E

Protected Plants Flora Survey Trigger Map for the Study Area



Protected Plants Flora Survey Trigger Map

Legend

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

Queensland Government

LOCALITY DIAGRAM



N

0 980 1,960 2,940 3,920 4,900 m

This product is projected into:
GDA 1994 Queensland Albers

This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Heritage Protection at palm@ehp.qld.gov.au

Disclaimer:
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

© The State of Queensland (Department of Environment and Heritage Protection), 2015

Appendix F

Conservation Significant Flora Returned from Database Searches for the Search Area

Scientific Name	Common Name	NC Reg. [1]	EPBC Act [2]	Source	Preferred habitat	Potential to occur in the Monitoring area? [4]
Bertya sharpeana	ncn	NT	NL	Wildlife Online	*Bertya sharpeana* is an extensively branched shrub growing up to 4m tall and has been recorded from a number of structural vegetation formations on Mt Coolum, including heath, open forest and woodland and the margins of rainforest. In other locations the species occurs mostly in heath but occasionally in open forest or woodland communities or on rainforest margins (Halford and Henderson 2002). The species occurs on dark brown, skeletal organic loams. Around Mt Coolum the species is found approximately 150m above sea level, while around Sydney Head (75km south-west of Mackay and 5km north of Mt Britton), the species is located approximately 920m above sea level and most commonly in low open-heath vegetation consisting of *Acacia* spp., *Astroloma sp*., *Leucopogon neo-anglicus*, *Leptospermum neglectum*, *Melaleuca pearsonii*, *Pultenaea retusa* and *Banksia spinulosa* (Batianoff and Pearson 1990 EHP 2013d Guymer 1988 Queensland Herbarium 2012).	Low: Underlying geology and preferred habitat not present.

Scientific Name	Common Name	NC Reg. [1]	EPBC Act [2]	Source	Preferred habitat	Potential to occur in the Monitoring area? [4]
Cycas ophiolitica	a cycad	E	E	EPBC Act Protected Matters Search Tool	Trunked cycad to 2m in height (rarely to 4m) and with trunk diameter ranging from 4 to 20cm. Endemic to central Queensland in two localities around Marlborough and Rockhampton. Occurs in woodland to open woodland dominated by eucalypts, often on serpentinite substrates (Queensland Herbarium 2007).	Low: Underlying geology and preferred vegetative habitat not present.
Dichanthium queenslandicum	King Blue Grass	V	E	HERBRECS, EPBC Act Protected Matters Search Tool	Perennial tufted grass to 80cm in height. Confined to natural grassland areas on heavy black clay soils of the Central Highlands and, to a lesser extent, the Darling Downs and Burke pastoral districts. Recorded only from well-managed and conservatively grazed properties (Fletcher 2001 Sharp and Simon 2002).	Low: Potentially suitable habitat occurs in the south of the Study Area on heavy clay soils as part of the natural grassland community (RE 11.3.21). However, extensive surveys failed to locate this species in the Study Area despite searches of the natural grassland habitat. Initial field survey sampling included a grass species thought to be *D. queenslandicum*, however, identification of voucher specimens by the Queensland Herbarium confirmed these samples as another Least Concern grass species.
Dichanthium setosum	ncn	LC	V	HERBRECS, Wildlife Online, EPBC Act Protected Matters Search Tool	Upright perennial grass to 1m in height. Can form pure swards or occur as scattered clumps in association with heavy basaltic soils and stony red-brown hard-setting loam on clay subsoil. Found in woodlands through to disturbed sites such as roadsides (TSSC 2008b; Sharp & Simon 2002).	Low: Extensive surveys have failed to locate this species in the Study Area. This species potentially occurs to the north of the Study Area in habitats such as Mountain Coolabah (*Eucalyptus coolabah*) woodland on basalt (RE 11.8.5. Heavy basaltic soils are not present in the Study Area.

Scientific Name	Common Name	NC Reg. [1]	EPBC Act [2]	Source	Preferred habitat	Potential to occur in the Monitoring area? [4]
Eucalyptus raveretiana	Black Ironbox	LC	V	HERBRECS, Wildlife Online, EPBC Act Protected Matters Search Tool	Medium-sized tree shrub to 25m in height, with slightly furrowed hard and dark grey bark on trunk and lowest branches. Occurs on the banks of rivers, creeks and moderate sized watercourses on clayey or sandy loam and is often associated with White Paperbark (*Melaleuca leucadendra*) and/or Weeping Paperbark (*Melaleuca fluviatilis*) fringing open forest in coastal streams where it tends to displace Queensland Blue Gum (*Eucalyptus tereticornis*) as the emergent eucalypt species. Species dominant on lower banks and in channels of Schammer, Hail, Middle and Bee Creeks which are located within or adjacent the Study Area (Ecological Survey & Management 2011a SKM 2010b TSSC 2008c).	**Present:** This species has been recorded as a dominant canopy and sub-canopy species on the lower banks and in the channels of Schammer, Hail, Middle and Bee Creeks, in the Study Area. This species, where dominant, is classified by a specific vegetation community association, that of RE 11.3.25a (Figure 11).
Lobelia membranacea	ncn	NT	NL	HERBRECS	Prostrate herb with stems often rooting at nodes. Grows in moist or swampy situations in sandy soils or coastal wallum areas (Stanley and Ross 1986). Local record in Teemburra Creek to the north-east of Homevale National Park.	Low: Underlying geology and preferred habitat not present.

Scientific Name	Common Name	NC Reg. [1]	EPBC Act [2]	Source	Preferred habitat	Potential to occur in the Monitoring area? [4]
Macropteranthes leiocaulis	Southern Bonewood	NT	NL	HERBRECS, Wildlife Online	Shrub to medium-sized seasonally deciduous tree to 25m in height. Grows in deciduous and semi-evergreen vine thickets and Araucarian microphyll vine forests north from the Binjour Plateau, northwest of Gayndah to Mingela Bluff near Townsville (DNR 1999 Forster 1994 Harden et al. 2006).	Low: This species has been recorded adjacent the Study Area in SEVT (RE 11.12.4) and on Absent Creek immediately outside the Study Area. However, this is a distinctive species and it was not identified in SEVT in the Study Area (i.e. RE 11.9.4).
Melaleuca pearsonii	ncn	NT	NL	Wildlife Online	Small shrub to 80cm, previously known to only occur on the Blackdown Tableland, west of Rockhampton. Further studies have found that this species is an occasional to common component of shrubland to heathland on exposed rhyolitic outcrops in Sydney Heads (75km south-west of Mackay and 5km north of Mt Britton) (CSIRO 2013).	Low: Underlying geology and preferred habitat not present.

Scientific Name	Common Name	NC Reg. [1]	EPBC Act [2]	Source	Preferred habitat	Potential to occur in the Monitoring area? [4]
Omphalea celata	ncn	V	V	HERBRECS, Wildlife Online, EPBC Act Protected Matters Search Tool	Small tree to 12m in height with glossy, cream-coloured bark. Occurs in fragmented semi-evergreen vine thicket or araucarian microphyll vine forest. Three populations are known: recorded as common on metamorphic substrates in a steep-sided gorge (Hazelwood Gorge) near Eungella; as a small population of less than 12 plants on Gloucester Island east of Bowen and as scarce individuals in Cooper Creek within Homevale National Park (TSSC 2008c).	Low: This species has been recorded within Cooper Creek, approximately 10km east of the Study Area in Homevale National Park and it may occur in semi evergreen vine thicket habitat north of the Study Area. However, habitat in the Study Area is not preferred and extensive field surveys of riparian habitat has failed to locate this distinct tree species.
Ozothamnus eriocephalus	ncn	V	V	HERBRECS, EPBC Act Protected Matters Search Tool	Weakly woody shrub with fine white hairs forming a mat over the branches. Known from the Bowen and Mackay area of central Queensland with specimens recorded at Peases Lookout and Dick's Tableland in the Eungella National Park, Sydney Heads in Homevale National Park, Finch Hatton Gorge, Lake Elphinstone, Mt Abbot (two small populations), Gloucester Island and Redcliffe Vale. Known from a range of habitat types, including the margins of disturbed notophyll vine forest, margins of gallery forest, microphyll vine forest, tall open New England Blackbutt (*Eucalyptus andrewsii*) – Red Mahogany (*E. resinifera*) forest with an understorey of Black Sheoak	Low: Underlying geology and preferred habitat not present.

Scientific Name	Common Name	NC Reg. [1]	EPBC Act [2]	Source	Preferred habitat	Potential to occur in the Monitoring area? [4]
					(*Allocasuarina littoralis*), in open eucalypt forest and on rocky ridges with *Eucalyptus* spp. - *Acacia* spp. scrub. It is also known from the edge of creek banks and in crevices on steep granite slopes, often in sunny situations. It is known from moderate to high elevations ranging from 380 to 950 m. It occurs on skeletal sandy or gravelly soils or occasionally deeper red-brown clay loams derived from granites and sandstones (DotE 2008).	
Phalaenopsis rosenstromii	Native Moth Orchid	E	E	EPBC Act Protected Matters Search Tool	Highly localised growing on trees, rarely rocks, in humid airy situations on sheltered slopes and in gullies in deep gorges and close to waterfalls and streams. Usually in rainforest. Distribution is Iron Range to Mt Spec (North of Paluma), within an altitudinal range of 200-500m (Jones 2006).	Low: Underlying geology and preferred habitat no present.

Scientific Name	Common Name	NC Reg. [1]	EPBC Act [2]	Source	Preferred habitat	Potential to occur in the Monitoring area? [4]
Sannantha papillosa	ncn	E	NL	Wildlife Online	Small shrub to 1.5m in height. Previously known to occur on Mt. Elliot and Cape Cleveland within the Bowling Green Bay National Park growing on skeletal soils overlaying granite in *Leptospermum* dominated heathland (RE 11.12.18). More recently, specimens of this species were recorded on the south-eastern edge of Sydney Heads in the Britton Range, which is located approximately 6.3km north-east of the Homevale homestead, in heathland on exposed rocky plateaus (Wilson et al. 2007 Wilson 2005).	Low: Underlying geology and preferred habitat not present.
Sarcotoechia heterophylla	ncn	NT	NL	HERBRECS	Small tree to 12m in height growing in rainforest from the Bowen region south to Eungella at altitudes ranging from 200 to 900m (Cooper 2004).	Low: Preferred vegetative habitat not present.

Scientific Name	Common Name	NC Reg. [1]	EPBC Act [2]	Source	Preferred habitat	Potential to occur in the Monitoring area? [4]
Streblus pendulinus	Siah's Backbone	LC	E	EPBC Act Protected Matters Search Tool	Occurs from Cape York Peninsula to Milton, south-east New South Wales and on Norfolk Island. On the Australian mainland, it is found in warmer rainforests, mainly along watercourses. Grows in an altitudinal range between near sea level and 800m above sea level. Grows in well-developed rainforest, gallery forest and drier, more seasonal rainforest. On Norfolk Island, the species is found in a variety of forest types ((DotE 2015a) Date accessed 26 March 2015).	**Present:** This species was recorded in vine thicket in the north-east of the Study Area in RE 11.3.11. No other patches of vine thicket within the Study Area form habitat for this species.

1. Indicates the Queensland conservation status of each taxon under the NC Regulation. The codes are Least Common (LC), Special Least Concern (SLC), Near Threatened (NT), Vulnerable (V), Endangered (E) flora species.

2. Indicates the Commonwealth conservation status of each taxon under the EPBC Act. The codes are Not Listed (NL), Vulnerable (V), Endangered (E) flora species.

Note: ncn = no common name.

Appendix G

Conservation Significant Fauna Returned from Database Searches for the Search Area

Table G1: Preferred habitat of conservation significant fauna and likelihood to occur in the Study Area

Common Name	Scientific Name	NC Reg[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
Amphibians						
Eungella Day Frog	*Taudactylus eungellensis*	E	E	EPBC Act Protected Matters Search Tool	Restricted to the ranges west of Mackay, from Clarke Range in the north to Finch Hatton Gorge and Crediton in the South. Occurs along small creeks in rainforest as well as wet sclerophyll forest, with streamside habitat comprising dense rainforest with ferns, vines, palms and epiphytes in the understorey. Uses exposed steep, rocky sections of streams within splash zones of waterfalls and cascades ((SEWPaC 2013b) Date accessed 3 September 2013).	Low: Suitable rainforest habitat is not present in the Study Area.
Tusked Frog	*Adelotus brevis*	V	NL	Queensland Museum, Wildlife Online	Usually associated with water in rainforest, wet sclerophyll forest or grassland which is sometimes inundated (Robinson 1995).	Low: Suitable rainforest or wet sclerophyll forest is not present in the Study Area.
Birds						
Australian Painted Snipe	*Rostratula australis*	V	E	EPBC Act Protected Matters Search Tool	This is a secretive, cryptic, crepuscular species that occurs in terrestrial shallow wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, salt-marsh, dams, rice crops, sewage farms and bore drains. The species feeds on vegetation, seeds, and invertebrates including crustaceans and molluscs (Marchant and Higgins 1994).	**Present:** This species has been recorded in the Study Area in a broad drainage line in the south (Figure 14). Suitable habitat for this species occurs in wetlands and areas on land zone 3 that become waterlogged during high rainfall periods.
Black-throated Finch (southern)	*Poephila cincta cincta*	E	E	EPBC Act Protected	This species is known from dry, open grassy woodlands and forests and grasslands of the sub-tropics and tropics	Low: There are a lack of records of this species from the region and the

Common Name	Scientific Name	NC Reg[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
				Matters Search Tool	with seeding grasses and ready access to water (Higgins et al. 2006). Also thought to probably require a mosaic of different habitat in the wet season to find seed (Garnett et al. 2011). Mainly inhabit dry open to very open eucalypt woodlands with dense grassy ground cover and often along watercourses (Higgins et al. 2006). This species has undergone a significant range contraction from the southern parts of its former distribution. It has not been recorded in south-east Queensland since the early 80s and is now thought to be extinct in NSW. It is noted as being mostly absent from the coastal plain but occasionally recorded from the area around Townsville and Ingham (Higgins et al. 2006).	species has not been recorded in the Study Area, despite considerable survey effort.
Eungella Honeyeater	*Bolemoreus hindwoodi*	NT	NL	Wildlife Online	This species is usually confined to the rainforest canopy, sometimes occurs at the edge of rainforest and visits lowland eucalypt and casuarina forests and woodland, as well as gardens. Occurs at higher altitudes of Clarke Range, usually above 900m above sea level, however, has been recorded at 150m at Finch Hatton Gorge (Higgins et al. 2001).	Low: Rainforest habitat does not occur in the Study Area and is some distance to the north-east of the Study Area in Homevale National Park.
Glossy Black-cockatoo	*Calyptorhynchus lathami*	V	NL	Wildlife Online, BirdLife Atlas	This species occurs in eucalypt woodlands with an understorey or sub-canopy of She-oaks (*Casuarina or Allocasuarina*) on the seeds of which its diet is based. It nests in tree hollows(Garnett et al. 2011).	**High:** This species has been identified at one location, just north (outside) of the Study Area, as part of surveys in 2012 (Figure 16). The Study Area contains few stands of Allocasuarina

Common Name	Scientific Name	NC Reg[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
						or Casuarina, it is likely this species occurs in the Study Area on rare occasions and is unlikely to breed in the Study Area.
Masked Owl (northern)	*Tyto novaehollandiae kimberli*	V	V	EPBC Act Protected Matters Search Tool	Forests, woodlands, caves along the entire east coast of Australia (Simpson et al. 2010).	Low: While this species may use habitat in the Study Area for foraging. There are no known records of this species in close proximity to the Study Area and no breeding habitat.
Red Goshawk	*Erythrotriorchis radiatus*	E	V	Wildlife Online, EPBC Act Protected Matters Search Tool	This species occurs in woodlands and forests, ideally with a mosaic of vegetation types and permanent water, particularly riverine forests. The species avoids both very dense and very open habitats. They are solitary and secretive birds and hunt mainly from ambush. Their prey is mostly birds, but also mammals, reptiles and insects (Marchant and Higgins 1994). Nests are restricted to trees taller than 20m and within 1km of a watercourse or wetland. It is thought to rarely breed in areas with fragmented native vegetation (Garnett et al. 2011). Home ranges of 120km^2 and 200km^2 for females and males, respectively have been recorded (Marchant and Higgins 1994).	Low: The open and relatively uniform nature of habitats in the Study Area make habitat suboptimal for this species.
Squatter Pigeon (southern)	*Geophaps scripta scripta*	V	V	Wildlife Online, BirdLife Atlas, EPBC Act Protected	This species is known from tropical dry, open sclerophyll woodlands and sometimes savannah. It appears to favour sandy soil dissected with low gravely	**Present:** This species has been recorded at a number of locations in the Study Area during

Common Name	Scientific Name	NC Reg[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
				Matters Search Tool	ridges and is less common on heavier soils with dense grass cover. It is nearly always found in close association with permanent water. The southern sub-species for the Squatter Pigeon (southern) is described as occurring south of the Burdekin River (Higgins and Davies 1996).	past and recent field survey programs (Figure 14). It occurs generally in disturbed areas such as tracks, cattle camps and watering points. This species is most likely to breed within areas of remnant *Eucalyptus* woodland in the Study Area.
Star Finch	*Neochmia ruficauda ruficauda*	E	E	EPBC Act Protected Matters Search Tool	The Star Finch usually inhabits low dense damp grasslands bordering wetlands and waterways and also open savannah woodlands near water or subject to inundation but is absent from expanses of open country and uplands usually occurring in valleys (Higgins et. al. 2006). In Queensland this species' range has largely contracted to southern Cape York. There have not been any confirmed records from the Cairns to Townsville region for some time and none were recorded during the Birds Australia Atlas project (Higgins et al. 2006). Recent records around Rockhampton are thought likely to be aviary escapees (Higgins et al. 2006).	Low: There are no known records of this species in the region and the distribution of this species is thought to have contracted further north. The Study Area does not provide optimal habitat conditions for this species.
Mammals						
Ghost Bat	*Macroderma gigas*	V	NL	Wildlife Online	The Ghost Bats roosts in shallow caves along cliff lines, boulder piles and deep limestone caves. They occur in a broad range of habitats including arid spinifex hill sides, grasslands, monsoon forest,	Low: Preferred habitat of this species does not occur in the Study Area, but is likely to occur

Common Name	Scientific Name	NC Reg[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
					savannah woodlands, tall open forest, deciduous vine forest and tropical rainforest (Churchill 2009).	further east in Homevale National Park
Grey-headed Flying-fox	*Pteropus poliocephalus*	LC	V	EPBC Act Protected Matters Search Tool	It occurs in a coastal belt from Rockhampton to Melbourne roosting in camps commonly formed in gullies, typically not far from water and usually in vegetation with dense canopy. Various habitats that include eucalyptus, *Angophora spp*., tea-trees and banksias (VanDyck and Strahan 2008).	Low: This species is more likely to occur closer to the coast and there are no particular habitat features that would attract this species to the Study Area. This species may occur further east in Homevale National Park
Koala	*Phascolarctos cinereus*	SLC	V	EPBC Act Protected Matters Search Tool	This species is widespread in sclerophyll forest and woodlands on foothills and plains on both sides of the Great Dividing Range from about Chillagoe, Queensland to Mt Lofty Ranges in South Australia (Menkhorst and Knight 2011).	**Present:** This species has been recorded at eight locations in the Study Area and one location within the operational mining area to the west of the Study Area (Figure 14). The most recent Koala sightings were in August 2014 in Queensland Blue Gum tall woodland on alluvial plains in the upper reaches of Hail Creek. Preferred habitat in the Study Area is in the form of Eucalyptus open woodland and forest and riparian woodland.
Northern Quoll	*Dasyurus hallucatus*	LC	E	Queensland Museum, Wildlife	The Northern Quoll was once widespread in Queensland but has undergone a severe	Low: Preferred habitat is not present in the

Common Name	Scientific Name	NC Reg[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
				Online, EPBC Act Protected Matters Search Tool	range contraction and is now absent from much of its former range. It is usually associated with dissected rocky escarpments but also known from Eucalypt forest and woodlands, around human settlement and occasionally rainforest. In the Northern Territory Northern Quoll populations are becoming extinct within one year of the arrival of the Can Toad (**Rhinella marina*), although in Queensland some remnant quoll populations persist in areas where Can Toad have long been present (VanDyck and Strahan 2008). The areas where the quoll persists in Queensland tend to be steep, rocky areas close to water that have not been recently burnt and appear to have become extinct in many lowland habitats formerly occupied (Woinarski et al. 2008).	Study Area, although this species is known from the steeper more remote sections of Homevale National Park
South-eastern Long-eared Bat	*Nyctophilus corbeni*	V	V	EPBC Act Protected Matters Search Tool	The South-eastern Long-eared Bat occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodlands. In Queensland, this species is mainly recorded in the Brigalow Belt South Bioregion, extending eastwards to the Bunya Mountains National Park, as far north as the Expedition Range and Dawson River areas and west into the Mulga Lands Bioregion ((SEWPaC 2013c) Date accessed 3 September 2013).	Low: The habitat in the Study Area could be used as foraging habitat for this species, however, there have been no records of this species in the vicinity of the Study Area or surrounding landscape and the Study Area is beyond the known northern range limit of this species.
Reptiles						

Common Name	Scientific Name	NC Reg[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
Allan's Lerista	*Lerista allanae*	E	E	EPBC Act Protected Matters Search Tool	This species is restricted to the area between Clermont and Capella where it is known only from black soil downs. Early specimens were found several centimetres under the surface of black-red soil, under tussocks of grass on farmland in association with Mountain Coolabah/Red Bloodwood open woodlands and Black Tea-tree closed scrub to low closed-forest gravely hills, ridges and gullies and scattered *Bauhinia spp*. on plains (DotE 2013c).	Low: Preferred habitat does not occur the Study Area and there are no known records of this species in close proximity to the Study Area. This species is known only from the Capella – Clermont area.
Common Death Adder	*Acanthophis antarcticus*	NT	NL	Wildlife Online	During the day usually found half buried in sand, soil or litter often at the bases of trees and shrubs (Cogger 2014). Widespread where shrub and leaf litter layers remain intact (Wilson 2005).	Low: Habitats with suitable leaf litter are small and sparsely scattered in the Study Area.
Ornamental Snake	*Denisonia maculata*	V	V	Queensland Museum, Wildlife Online, EPBC Act Protected Matters Search Tool	The Ornamental Snake is found in close association with frogs which form the majority of its prey. It is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions with clay soils but is also known from lake margins, wetlands and waterways (DotE 2014j).	**Present:** This snake has been recorded in the Study Area in Brigalow habitat to the east of Hail Creek (Figure 15).
Yakka Skink	*Egernia rugosa*	V	V	EPBC Act Protected Matters Search Tool	The Yakka Skink is commonly found in cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows. The species often takes refuge in large hollow logs and has been known to excavate deep burrow systems, sometimes under dense ground vegetation (Cogger 2014 Wilson 2005). In cleared habitat, this species can	Low: There are no known records of this species in close proximity to the Study Area. Habitat in the Study Area is sub-optimal

Common Name	Scientific Name	NC Reg[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
					persist where there are shelter sites such as raked log piles, deep gullies, tunnel erosion/sinkholes and rabbit warrens. The species has also been found sheltering under sheds and loading ramps. This species is not generally found in trees or rocky habitats (Chapple 2003).	

1. Indicates the Queensland conservation status of each taxon under the NC Regulation. The codes are Least Common (LC), Special Least Concern (SLC), Near Threatened (NT), Vulnerable (V), Endangered (E) fauna species.

2. Indicates the Commonwealth conservation status of each taxon under the EPBC Act. The codes are Not Listed (NL), Vulnerable (V), Endangered (E) fauna species.

Table G2: Preferred habitat of migratory fauna and likelihood to occur in the Study Area

Common Name	Scientific Name	NC Reg'n[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
Barn Swallow	*Hirundo rustica*	LC	M	EPBC Act Protected Matters Search Tool	Occurs in open country in coastal lowlands, often near water, towns and cities. Also in or over freshwater wetlands, paperbark Melaleuca woodland, mesophyll shrub thickets and tussock grassland. Prefers areas with accessible artificial structures for perching (DotE 2014k).	Low: This species is unlikely to occur as far inland as the Study Area and there are no suitable perching structures within the Study Area.
Black-faced Monarch	*Monarcha melanopsis*	SLC	M	Wildlife Online, EPBC Act Protected Matters Search Tool	Rainforest, eucalypt woodlands and forest (mainly wet sclerophyll), coastal scrubs, rainforest gullies (DotE 2014l Pizzey et al. 2012). In Queensland occurs on the eastern slows of the Great Divide. Also occasionally occurs further inland (DotE 2014l).	Low: Species may occur in more intact, denser remnant within the Study Area, however, is more likely to occur in rainforest habitats within nearby Homevale National Park.
Caspian Tern	*Hydroprogne caspia*	SLC	M	Wildlife Online	This species is widespread in Queensland, in coastal and inland environments. In addition to coastal environments, it occurs in fresh or saline lakes, wetlands, waterholes, artificial ponds, reservoirs, rivers and creeks. Breeding occurs most in coastal or island environments as	**High:** This species has previously been recorded incidentally on Brumby Waterhole within the Study Area in 2012. It is likely to use all wetland (temporary or permanent, natural or artificial) within the Study Area and adjacent

Common Name	Scientific Name	NC Reg'n[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
					well as inland on Lake Bindegolly and Lake Moondarra ((DotE 2015b) Date accessed 12 March 2015).	Hail Creek Mine, e.g. polishing ponds.
Cattle Egret	*Ardea ibis*	LC	M	EPBC Act Protected Matters Search Tool	Stock paddocks, pastures, croplands, garbage dumps, wetlands, tidal mudflats and drains (Pizzey et al. 2012).	**Present:** A small group of this species was recorded amongst cattle in the central portion of the Study Area. This species may occur throughout the Study Area and more likely in low lying areas, particularly in open or disturbed grazing areas, nearby cattle.
Cicadabird	*Coracina tenuirostris*	SLC	NL	Wildlife Online	In northern Australia, the Cicadabird is mainly found in rainforests, paperbark woodlands and forests and mangroves, and it is occasionally found in open eucalypt forests adjacent to these habitats (Higgins et al. 2006)	**Moderate:** This species may occur in the Study Area periodically.
Fork-tailed Swift	*Apus pacificus*	LC	M	EPBC Act Protected Matters Search Tool	Aerial over open habitat sometimes over forests and cities (Pizzey et al. 2012). Sometimes occur above rainforests, wet sclerophyll forest or pine plantations (DotE 2014i).	**Moderate:** This species may overfly the Study Area as part of a wider foraging range.
Eastern Great Egret	*Ardea modesta*	SLC	M	Wildlife Online, EPBC Act Protected	Shallows of rivers, estuaries, tidal mudflats, freshwater	**Present:** This species is likely to occur in wetland

Common Name	Scientific Name	NC Reg'n[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
				Matters Search Tool	wetlands, sewage ponds, larger dams (Pizzey et al. 2012).	habitats similar to the Australian Painted Snipe.
Latham's Snipe	*Gallinago hardwickii*	LC	M	EPBC Act Protected Matters Search Tool	Soft wet ground or shallow water with tussocks, wet paddocks, seepage below dams, irrigated areas, scrub or open woodland (Pizzey et al. 2012). Can occur coincidentally with the Painted Snipe (i.e. both species occupy similar habitats) (DotE 2014m).	**Moderate:** Preferred habitat may occur in the Study Area during periods of high rainfall, particularly in open paddocks and around small dams and wetlands.
Oriental Cuckoo	*Cuculus optatus*	SLC	NL	Wildlife Online	This is a non-breeding migrant to northern Australia. It occurs in monsoon rainforest, vine thickets, wet sclerophyll forests, and open wattle and Eucalypt forests and woodlands, sometimes in mangroves. It has also been found in gardens and plantations (Higgins 1999).	**Moderate:** This species may occur in the Study Area periodically.
Painted Snipe	*Rostratula benghalensis*	V	M, E	EPBC Act Protected Matters Search Tool	Refer Table G1	**Present:** Refer Table I1
Rainbow Bee-eater	*Merops ornatus*	SLC	M	Wildlife Online, EPBC Act Protected Matters Search Tool	Woodlands, beaches, rainforest and mangroves (Pizzey et al. 2012).	**Present:** This species has been recorded in the far north-east corner of the Study Area in the vicinity of SEVT.
Rufous Fantail	*Rhipidura rufifrons*	SLC	M	Wildlife Online, EPBC Act Protected	Rainforest, wet eucalypt forests, monsoon forests, paperbarks, sub-	Low: Dense wet forest habitat is not present in the Study Area.

Common Name	Scientific Name	NC Reg'n[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
				Matters Search Tool	inland and coastal scrubs, mangroves, watercourses, parks (Pizzey et al. 2012).	Preferred habitats are likely to occur in nearby Homevale National Park.
Satin Flycatcher	*Myiagra cyanoleuca*	SLC	M	Wildlife Online, EPBC Act Protected Matters Search Tool	Heavily vegetated gullies in forests and taller woodlands and during migration coastal forests, woodlands, mangroves, gardens and open country (Pizzey et al. 2012).	Low: Dense gully habitat not present in the Study Area.
Spectacled Monarch	*Monarcha trivirgatus*	SLC	M	Wildlife Online, EPBC Act Protected Matters Search Tool	Rainforest, thickly wooded gullies, waterside vegetation (Pizzey et al. 2012).	Low: Dense rainforest habitat not present in the Study Area.
White-bellied Sea-eagle	*Haliaeetus leucogaster*	SLC	M	Wildlife Online, EPBC Act Protected Matters Search Tool	Coasts, islands, estuaries, large rivers, lakes and reservoirs (Pizzey et al. 2012).	**Present:** Suitable habitat for this species, in the form or large waterbodies or watercourses is not present in the Study Area, although it has been recorded immediately adjacent the Study Area at the Hail Creek Mine polishing pond outflow.
White-throated Needletail	*Hirundapus caudacutus*	SLC	M	Wildlife Online, EPBC Act Protected Matters Search Tool	Aerial over forests, woodlands, farmlands, plains, lakes and towns (Pizzey et al. 2012).	**Present:** This species has been recorded over a partially cleared area towards the centre of the Study Area. It is likely to overfly the Study Area, although there is no important habitat for the

Common Name	Scientific Name	NC Reg'n[1]	EPBC Act[2]	Source	Preferred Habitat	Potential to occur in the Study Area?
						species within the Study Area.

1. Indicates the Queensland conservation status of each taxon under the NC Regulation. The codes are Least Common (LC), Special Least Concern (SLC), Near Threatened (NT), Vulnerable (V), Endangered (E) fauna species.

2. Indicates the Commonwealth conservation status of each taxon under the EPBC Act. The codes are Migratory (M), Not Listed (NL), Vulnerable (V), Endangered (E) fauna species. Note: Aquatic reptiles returned from database searches have not been considered in this report.

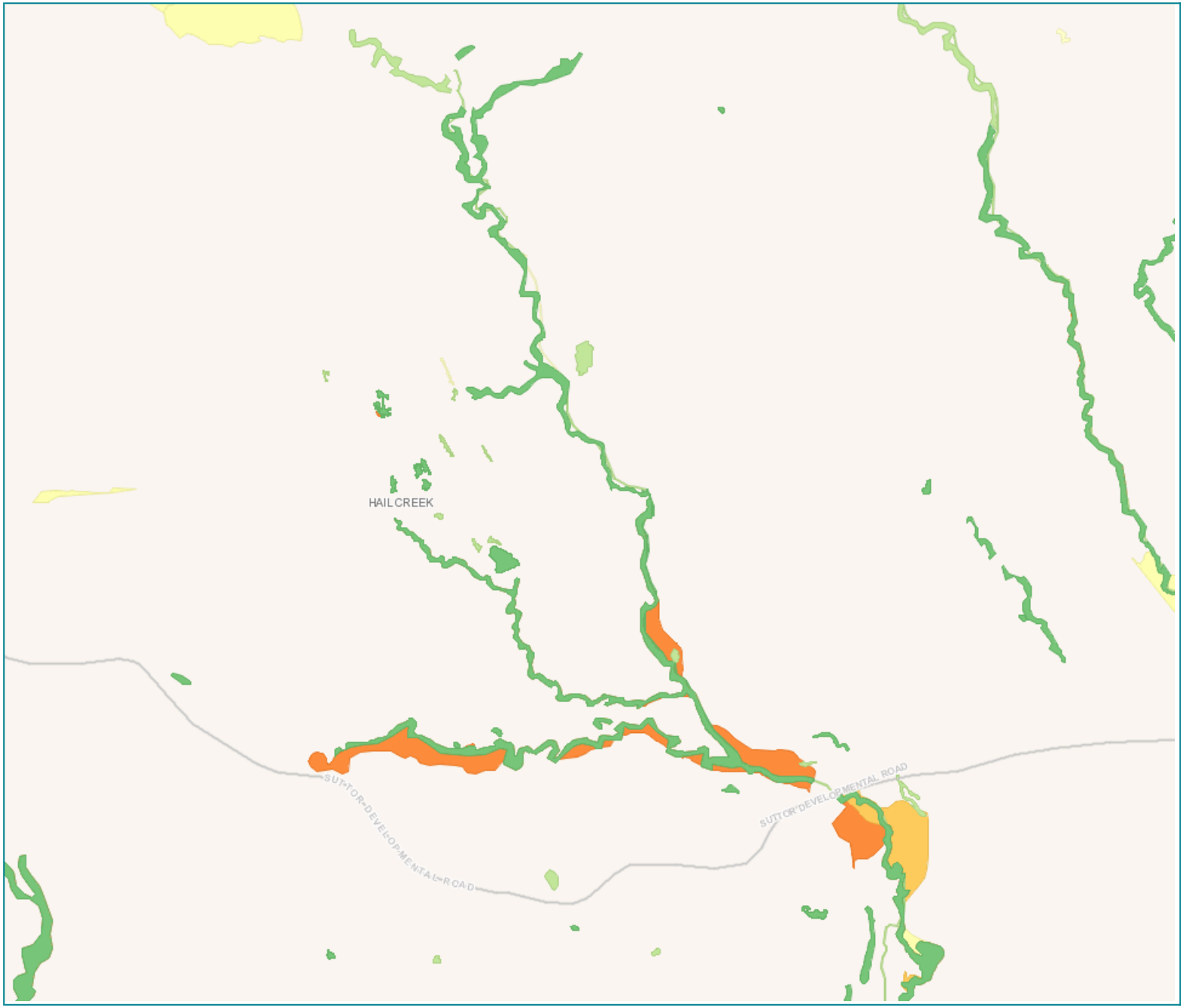
Appendix H

National Atlas of Groundwater Dependent Ecosystems

Mapping for the Study Area

Australian Government
Bureau of Meteorology

Groundwater Dependent Ecosystem Map Report



N

Hail Creek Study Area

GDE, Reliant on surface expression of groundwater (rivers, springs, wetlands)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- High potential for groundwater interaction
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction

GDE, Reliant on subsurface groundwater (vegetation)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- High potential for groundwater interaction
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction
- No Ecosystems analysed

GDE, Subterranean (Cave & Aquifers)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- No Ecosystems analysed

1:130,181

Metres 2,000 4,000 6,000 8,000 10,000

Data source - Data are assumed to be correct as supplied from Commonwealth, State and Territory data suppliers or referenced projects.

Disclaimer - Use of the information and data contained within this document is at your sole risk. Neither the Bureau nor its agents make any warranties or representations regarding the quality, accuracy, merchantability or fitness for purpose of any material in this document.

Date: 12 February, 2014

Appendix I

Flora Field Records for the Study Area

Table I1: Field flora records for the Study Area

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
CYPERACEAE	*Abildgaardia vaginalis*	*ncn*	LC		+											+	
MALVACEAE	*Abutilon fraseri*	Dwarf Lantern-flower	LC		+									+			
MALVACEAE	*Abutilon malvifolium*	Mallow-leaf Lantern Flower	LC	+										2			
MALVACEAE	*Abutilon micropetalum*	Small-flowered Lantern Flower	LC			+								2			
MALVACEAE	*Abutilon oxycarpum var. subsagittatum*	Straggly Lantern Bush	LC			+							1	+-3		+	
MIMOSACEAE	*Acacia decora*	Pretty Wattle	LC														
MIMOSACEAE	*Acacia excelsa ssp. excelsa*	Ironwood	LC									+					
MIMOSACEAE	*Acacia harpophylla*	Brigalow	LC											5-6			
MIMOSACEAE	*Acacia salicina*	Sally wattle	LC	3	1-4			+-1	+-2	4(e)		+-2			+-2	+-2	
EUPHORBIACEAE	*Acalypha eremorum*	Soft Acalypha	LC									-5		+			
ASTERACEAE	*Acanthospermum hispidum*	Star Burr	*		+												
ASTERACEAE	*Achyranthes aspera*	Chaff Flower	LC	1	+			+	+			+		+-2	+-1	+	
ADIANTACEAE	*Adiantum atroviride*	Maidenhair Fern	LC														
ADIANTACEAE	*Adiantum hispidulum var. hispidulum*	Rough Maidenhair Fern	LC														
ASTERACEAE	*Adriana urticoides var. urticoides*	Eastern Bitter-bush	LC	+	+												
FABACEAE	*Aeschynomene brevifolia*	*ncn*	LC													+	
ASTERACEAE	*Aeschynomene indica*	Buddha Pea	*	1	+		2			1-3(e)					+		
ASTERACEAE	*Ageratum houstonianum*	Blue Billygoat Weed	*					+-2	2-3				2	+(-3)			

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
ACANTHACEAE	*Ajuga australis*	Australian Bugle	LC		+												
MIMOSACEAE	*Albizia procera*	White Siris	LC		+												
SAPINDACEAE	*Alectryon connatus*	Grey Birdseye	LC		+	+						+-(3)					
SAPINDACEAE	*Alectryon diversifolius*	Scrub Boonaree	LC		+	2			+			+-(3)	4	+		+(-3)	
SAPINDACEAE	*Alectryon oleifolius ssp. elongatus*	Western Rosewood	LC	2	+								2	+	+	+	
SAPINDACEAE	*Alectryon subdentatus*	Hard Alectryon	LC			+											
POACEAE	*Alloteropsis cimicina*	Small Cockatoo Grass	LC												+		
POACEAE	*Alloteropsis semialata*	Cockatoo Grass	LC		+-2										+		2
RHAMNACEAE	*Alphitonia excelsa*	Red Ash	LC									+-(3)	4			+-2	
APOCYNACEAE	*Alstonia constricta*	Bitter Bark	LC					+	+(-2)			+				+(-4)	
AMARANTHACEAE	*Alternanthera denticulata*	Lesser joyweed	LC	+	+		1	+-2	+-2	1-2		+		+-4	+	+	
AMARANTHACEAE	*Alternanthera nana*	*ncn*	LC	1	+						1	+		+-1	1-2		
AMARANTHACEAE	*Alternanthera pungens*	Khaki Weed	*														
FABACEAE	*Alysicarpus rugosus*	*ncn*	*	1	+												
FABACEAE	*Alysicarpus vaginalis*	*ncn*	*	+	+		1					+			+		
APOCYNACEAE	*Alyxia ruscifolia*	Chain Fruit	LC			2-3						+					
AMARANTHACEAE	*Amaranthus viridis*	Green Amaranth	*						+								
LYTHRACEAE	*Ammannia multiflora*	*ncn*	LC	1	+-3		+					+		+			
LORANTHACEAE	*Amyema biniflorum*	Bloodwood Mistletoe	LC												+		
POACEAE	*Ancistrachne uncinulata*	Hooky Grass	LC											+	+		
RUBIACEAE	*Antirhea putaminosa*	*ncn*	LC			+											

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
MIMOSACEAE	*Archidendropsis basaltica*	Dead Finish	LC									+-2			+-4	+(-4)	
PAPERAVACEAE	*Argemone ochroleuca*	Mexican Poppy	*					+-2	+-2								
POACEAE	*Aristida benthamii*	*ncn*	LC													+	
POACEAE	*Aristida calycina var. calycina*	Dark Wiregrass	LC	1	+-2							+-2			+-5	+-2	
POACEAE	*Aristida gracilipes*	*ncn*	LC										5			+(-2)	
POACEAE	*Aristida latifolia*	Kerosene Grass	LC		+-2				+						+		
POACEAE	*Aristida leptopoda*	White Speargrass	LC		+							+				+	
POACEAE	*Aristida personata*	*ncn*	LC		+-4												
POACEAE	*Aristida ramosa*	Purple Wiregrass	LC	+	+-2							+					
POACEAE	*Aristida vagans*	*ncn*	LC	2-5								+			+	+	1
APOCYNACEAE	*Asclepias curassavica*	Red-flowered Balloon Cotton	*					+-2	+-2								
ASTERACEAE	*Aster subulatus*	Wild Aster	*					+-1	+-1	1(e)				+			
SAPINDACEAE	*Atalaya hemiglauca*	Whitewood	LC	3	+-2				+			+-4	2	+-1	2-5	+-4	
PITTOSPORACEAE	*Auranticarpa rhombifolia*	Diamond-leaved Pittosporum	LC			1											
MYRTACEAE	*Backhousia angustifolia*	Narrow-leaved Myrtle	LC			+											
LAMIACEAE	*Basilicum sp.*	*ncn*	LC									+			+	+	
ASTERACEAE	*Bidens bipinnata*	Cobbler's Pegs	*	+	1-2			+-2	+-1	+(e)		+-1	2	+-1	+	+	
ASTERACEAE	*Blumea diffusa*	*ncn*	LC		+												
ASTERACEAE	*Blumea mollis*	*ncn*	LC						+								
NYCTAGINACEAE	*Boerhavia dominii*	Tar vine	LC	+								+-1		+-1	+	+	
NYCTAGINACEAE	*Boerhavia sp. (St. George A. Hill AQ3992991)*	*ncn*	LC														
POACEAE	*Bothriochloa bladhii spp. bladhii*	Forest Bluegrass	LC	3	3-4		+				3	1-4		+	1-3	+(-5)	

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
POACEAE	*Bothriochloa decipiens var. cloncurrensis*	*ncn*	LC					+-1	+								
POACEAE	*Bothriochloa decipiens var. decipiens*	Pitted Bluegrass	LC	+	+										1-3		
POACEAE	*Bothriochloa ewartiana*	Desert Bluegrass	LC	3	+-2		3				2	+-4		+	1-4	+-3	
POACEAE	*Bothriochloa pertusa*	Indian Bluegrass	*	2	+-4			+-2	+		3	+-4		+-5	2-5	+-4	1
POACEAE	*Brachyachne tenella*	Native Couch	LC				+							+			
STERCULIACEAE	*Brachychiton australis*	Broad-leaved Bottle Tree	LC		+	+											
STERCULIACEAE	*Brachychiton rupestris*	Queensland Bottle Tree	LC											+			
PHYLLANTHACEAE	*Breynia oblongifolia*	Coffee Bush	LC	+	+-3	1							2	+	+	+-2	
PHYLLANTHACEAE	*Bridelia leichhardtii*	Small-leaved Scrub Ironbark	LC			3						+					
ACANTHACEAE	*Brunoniella australis*	Blue Trumpet	LC	2	1-2				+		2	2		+-2	1-2	1-2	
PITTOSPORACEAE	*Bursaria incana*	Prickly Pine	LC		+												
ALISMATACEAE	*Caldesia oligococca*	*ncn*	LC							+-4(e)							
ASTERACEAE	*Calotis dentex*	White Burr Daisy	LC												+		
ASTERACEAE	*Calotis scabiosifolia var. scabiosifolia*	Rough Burr Daisy	LC	+			1					+-2		+	+		
POACEAE	*Calyptochloa gracillima*	*ncn*	LC													+	
ASTERACEAE	*Camptacra barbata*	*ncn*	LC				2				1	+-1			+	+	
POACEAE	*Capillipedium spicigerum*	Scented Top	LC		+											+-2	
CAPPARACEAE	*Capparis canescens*	Wild Orange	LC	+								+			+	+-2	
CAPPARACEAE	*Capparis lasiantha*	Nipan	LC	+								+-2	2	+-2	+-2	+	

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
CAPPARACEAE	*Capparis loranthifolia*	Narrow-leaved Bumble Tree	LC												+	+	
CAPPARACEAE	*Capparis ornans*	Climbing Caper	LC		+												
CYPERACEAE	*Carex inversa*	*ncn*	LC			3-4											
APOCYNACEAE	*Carissa ovata*	Currant Bush	LC	+	+	3-4						+(-4)	4	+-2	+-3	+(-3)	
CASUARINACEAE	*Casuarina cristata*	Belah	LC										5	+-6			
CASUARINACEAE	*Casuarina cunninghamiana*	River Oak	LC					2-3	+-4								
VITACEAE	*Cayratia clematidea*	Forest Grape	LC														
ASTERACEAE	*Centella asiatica*	Pennywort	LC	+													
ASTERACEAE	*Centipeda minima*	*ncn*	LC	1	+		+							+-1			
CAESALPINIACEAE	*Chamaecrista absus*	*ncn*	LC		+				+						+		
CAESALPINIACEAE	*Chamaecrista mimosoides*	*ncn*	LC		+-1							+			+-2	+-1	
CAESALPINIACEAE	*Chamaecrista nomame var. nomame*	*ncn*	LC													+	
EUPHORBIACEAE	*Chamaesyce dallachiana*	*ncn*	LC		+-1							+			+	+	
EUPHORBIACEAE	*Chamaesyce drummondii*	Caustic Vine	LC	+	+						1	+-2		+	+-2	+	
EUPHORBIACEAE	*Chamaesyce hirsuta*	Asthma Weed	*		+-2				+			+					
CHARACEAE	*Chara sp.*	*ncn*	LC											+(-4)			
ADIANTACEAE	*Cheilanthes sieberi ssp. sieberi*	Mulga Fern	LC	+					+				2	+	+	+	
CHENOPODIACEAE	*Chenopodium carinatum*	Keeled Goosefoot	LC	+		+											
ASTERACEAE	*Chenopodium desertorum ssp. microphyllum*	Frosted Goosefoot	LC							+(e)							
POACEAE	*Chionachne cyathophora*	River Grass	LC		+			1	+								
POACEAE	*Chloris divaricata*	Slender Chloris	LC											+(-3)			

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
POACEAE	*Chloris inflata*	Purple Rhodes Grass	*	+											+		
POACEAE	*Chloris ventricosa*	Tall Chloris	LC	3	+-1							+	3		1-4	+	
POACEAE	*Chloris virgata*	Feathertop Rhodes Grass	*														
ASTERACEAE	*Chrysocephalum apiculatum*	Golden Yellowbells	LC		+												
POACEAE	*Chrysopogon fallax*	Golden Beard Grass	LC	1								+-1		+	+-3	+-2	
POACEAE	*Chrysopogon sylvaticus*	*ncn*	LC													+	
ASTERACEAE	*Cirsium vulgare*	Scotch Thistle	*		+				+								
VITACEAE	*Cissus oblonga*	Soft Water Vine	LC			2											
VITACEAE	*Clematocissus opaca*	Forest Grape	LC		+-2	2						+(-2)		+			
VERBENACEAE	*Clerodendrum floribundum*	Lolly Bush	LC		+-2	+					+		2		+	+-1	
COMMELINACEAE	*Commelina cyanea*	*ncn*	LC		+-2	2-3		+	+-1			+		+	+		
COMMELINACEAE	*Commelina ensifolia*	*ncn*	LC				1					+			+		
CONVOLVULACEAE	*Convolvulus erubescens*	Climbing Bindweed	LC		+		+					+				+	
ASTERACEAE	*Conyza sumatrensis*	Fleabane	*		+-1			+	+-1	+(e)		+		+-1	+	+-1	
TILIACEAE	*Corchorus tomentellus*	*ncn*	LC					+									
TILIACEAE	*Corchorus trilocularis*	*ncn*	LC	+	+				+			+1		+	+	+-2	
BORAGINACEAE	*Cordia dichotoma*	Snotty-gobble	LC														
MYRTACEAE	*Corymbia clarksoniana*	Long-fruited Bloodwood	LC		2-5												
MYRTACEAE	*Corymbia dallachiana*	Dallachy's Gum	LC		+-3						2	+				+	1
MYRTACEAE	*Corymbia erythrophloia*	Variable-barked Bloodwood	LC		+-2						5	+-2				+-4	4

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
MYRTACEAE	*Corymbia tessellaris*	Carbeen	LC		3-5			2-4	+-4		6						
ASTERACEAE	*Crassocephalum crepidioides*	Thickhead	*					+						+		+	
AMARYLLIDACEAE	*Crinum flaccidum*	Field Lily	LC	1	+-1				+								
AMARYLLIDACEAE	*Crinum pedunculatum*	River Lily	LC					+									
FABACEAE	*Crotalaria incana*	*ncn*	*	+	+					+(e)		+		+	+	+	
FABACEAE	*Crotalaria mitchellii ssp. mitchellii*	*ncn*	LC		+-1												
FABACEAE	*Crotalaria montanum*	*ncn*	LC	+	+		1				+	+-1			+	+	
FABACEAE	*Crotalaria sessiliflora*	*ncn*	LC												+		
EUPHORBIACEAE	*Croton insularis*	Silver Croton	LC			1											
EUPHORBIACEAE	*Croton phebalioides*	Narrow-leaved Croton	LC														
LAURACEAE	*Cryptocarya triplinervis var. pubens*	Hairy Three-veined Laurel	LC					+									
CUCURBITACEAE	*Cucumis althaeoides*	*ncn*	*						+								
CUCURBITACEAE	*Cucumis anguria*	*ncn*	*						+					+			
CURCURBITACEAE	*Cucumis melo ssp. agrestis*	Paddock Melon	LC	1	+-2				+	+(e)					+		
FABACEAE	*Cullen tenax*	Emu Foot	LC		+												
SAPINDACEAE	*Cupaniopsis simulata*	Northern Tuckeroo	LC		+	1						+(-3)					
COMMELINACEAE	*Cyanotus axillaris*	*ncn*	LC											+-2			
ASTERACEAE	*Cyanthillium cinereum*	Veronia	LC	2	+-2				+			1-2	1	+	+-2	1-2	
ORCHIDACEAE	*Cymbidium canaliculatum*	Black Orchid	LC		+-2			+	+			+			+	+	
POACEAE	*Cymbopogon obtectus*	Silkyheads	LC													+	

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
POACEAE	*Cymbopogon refractus*	Barbed Wire Grass	LC	+	+-3							+	2	+	+-3	+3	2
POACEAE	*Cynodon dactylon var. dactylon*	Couch Grass	*		+-2		2	1-4	2-3	+-3(e)					+		
CYPERACEAE	*Cyperus bifax*	*ncn*	LC							+-2				+	+-3	+	
CYPERACEAE	*Cyperus bowmanii*	*ncn*	LC														
CYPERACEAE	*Cyperus concinnus*	*ncn*	LC	2	+-4		3			+-2		+-1	1	+-3	+		
CYPERACEAE	*Cyperus cristulatus*	*ncn*	LC		+										+	+	
CYPERACEAE	*Cyperus difformis*	Dirty Dora	LC	1	+		2			1		+		+			
CYPERACEAE	*Cyperus esculentus*	*ncn*	LC	1	1-3		3			+-3	2	1-2			+	+	
CYPERACEAE	*Cyperus exaltatus*	*ncn*	LC		+					+-5							
CYPERACEAE	*Cyperus fulvus*	*ncn*	LC	1-2	1-2							1-(4)	1	+	1-2	+-2	
CYPERACEAE	*Cyperus gilesi*	*ncn*	LC									+				+	
CYPERACEAE	*Cyperus gracilis*	Whisker Grass	LC	2	1-2	3			+-2			+	3	1-3	1	+-2	
CYPERACEAE	*Cyperus holoschoenus*	*ncn*	LC							+							
CYPERACEAE	*Cyperus iria*	*ncn*	LC							+-3							
CYPERACEAE	*Cyperus nervulosus*	*ncn*	LC									+(-2)		+	+		
CYPERACEAE	*Cyperus scarious*	*ncn*	LC					+-2	+-3								
CYPERACEAE	*Cyperus squarrosus*	*ncn*	LC									-2					
CYPERACEAE	*Cyperus squarrosus*	*ncn*	LC												+		
CYPERACEAE	*Cyperus victoriensis*	*ncn*	LC	+-3				+									
POACEAE	*Dactyloctenium radulans*	Button Grass	LC	1				+						+	+-2	+	
LORANTHACEAE	*Dendrophthoe homoplastica*	*ncn*	LC													+	
CELASTRACEAE	*Denhamia oleaster*	Stiff Denhamia	LC									+(-3)	3		+		
RUBIACEAE	*Dentella repens*	*ncn*	LC														
FABACEAE	*Desmodium brachypodum*	*ncn*	LC		+											+-1	
FABACEAE	*Desmodium campylocaulon*	*ncn*	LC				+										

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
FABACEAE	*Desmodium filiforme*	*ncn*	LC												+	+	
FABACEAE	*Desmodium gangeticum*	*ncn*	LC		+-2		2		+							+	
FABACEAE	*Desmodium rhytidophyllum*	Hairy Tre-foil	LC		+-2										+	+-2	
FABACEAE	*Desmodium triflorum*	*ncn*	LC		+							+					
FABACEAE	*Desmodium varians*	Variable tre-foil	LC		+				+(-2)			+				+	
HEMERO-CALLIDACEAE	*Dianella caerulea*	Blueberry Flax Lily	LC									+					
HEMERO-CALLIDACEAE	*Dianella revoluta*	*ncn*	LC		+										+	+	
HEMERO-CALLIDACEAE	*Dianella sp. (n-r)*	*ncn*	LC		+										+		
POACEAE	*Dichanthium aristatum*	Angleton Grass	*		+-5		2	+	+	+-3(e)	3	+(-3)		+	+(-4)		
POACEAE	*Dichanthium fecundum*	*ncn*	LC		+-2			+-3	+	+-2(e)					+(-3)	+	
POACEAE	*Dichanthium sericeum ssp. sericeum*	Queensland Bluegrass	LC	2	+-2		2	+	+		1	+-2		+	+-2	+-2	2
POACEAE	*Dichanthium tenue*	*ncn*	LC		+						1		2				
POACEAE	*Digitaria ammophila*	*ncn*	LC		+						+	+-2				+	
POACEAE	*Digitaria brownii*	Cotton Fingergrass	LC										1				
POACEAE	*Digitaria coenicola*	*ncn*	LC		+										+-2	+	
POACEAE	*Digitaria eriantha*	Pangola Grass	*						+(-2)								
POACEAE	*Dinebra decipiens ssp. decipiens*	*ncn*	LC							+(e)				+-2			
EBENACEAE	*Diospyros geminata*	Scaly Ebony	LC		+-2	3-4											
EBENACEAE	*Diospyros humilis*	Small-leaved Ebony	LC		+-2	1						+(-2)	3		+	+	

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
POACEAE	*Diplachne fusca ssp. fusca*	Small-flowered Beetle Grass	LC		+		2										
ACANTHACEAE	*Dipteracanthus australasicus ssp. corynothecus*	*ncn*	LC										2	+			
SAPINDACEAE	*Dodonaea stenophylla*	*ncn*	LC										3			+	
SAPINDACEAE	*Dodonaea viscosa*	Sticky Hopbush	LC													+	
SINOPTERIDACEAE	*Doryopteris concolor*	Resurrection Fern	LC														
PUTRANJIVACEAE	*Drypetes deplanchei*	Yellow Tulip	LC			3-4						+(-4)					
CHENOPODIACEAE	*Dysphania ambrosioides*	*ncn*	*														
POACEAE	*Echinochloa colonum*	Awnless Barnyard Grass	*	+	+-3		+	+-3	+-3	1-3				1-3	+		
ASTERACEAE	*Eclipta prostrata*	White Eclipta	LC		+		1	+	+	+-3				+			
BORAGINACEAE	*Ehretia membranifolia*	Peach Bush	LC	+-3	+-2	1			+			+(-2)		+-2	+-3	+	
CHENOPODIACEAE	*Einadia hastata*	*ncn*	LC											+	+		
CHENOPODIACEAE	*Einadia nutans*	*ncn*	LC												+		
CHENOPODIACEAE	*Einadia polygonoides*	*ncn*	LC	1										+-2	+		
CELASTRACEAE	*Elaeodendron australe var. integrifolium*	Narrow-leaved Red Olive Plum	LC		+-4							+					
SAPINDACEAE	*Elattostachys xylocarpa*	White Tamarind	LC			1											
CELASTRACEAE	*Elaeodendron australe var. integrifolium*	Narrow-leaved Red Olive Plum	LC			2-3											
CYPERACEAE	*Eleocharis cylindrostachys*	*ncn*	LC											+			
CYPERACEAE	*Eleocharis dulcis*	Water Chestnut	LC							+-6							
CYPERACEAE	*Eleocharis pallens*	*ncn*	LC	+-3	+		3			+-3							

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
CYPERACEAE	*Eleocharis philippensis*	*ncn*	LC		+-2							+					
CYPERACEAE	*Eleocharis plana*	Flat-stemmed Bogrush	LC							+-3							
ASTERACEAE	*Emilia sonchifolia*	Emilia	*	+	1-2			+	+-2		1	+-1	0.5	+-1	-1	+-2	
CHENOPODIACEAE	*Enchylaena tomentosa*	Ruby Saltbush	LC	+										+-1			
POACEAE	*Enneapogon gracilis*	Slender Bottle-washer	LC	+	+							+(-2)			+	+	
POACEAE	*Enneapogon intermedius*	Tall Bottlewasher	LC		+												
POACEAE	*Enneapogon lindleyanus*	Conetop Nineawn	LC										3			+	
POACEAE	*Enneapogon purpurascens*	Purple Nineawn	LC									+				+	
POACEAE	*Enteropogon acicularis*	Curly Windmill Grass	LC	2	+-1		+				2	+-1		+	+-3		
POACEAE	*Enteropogon ramosus*	Twirly Windmill Grass	LC	2	+							+					
ASTERACEAE	*Epaltes australis*	*ncn*	LC	1				+-1	+			+		+	+-1		
POACEAE	*Eragrostis elongata*	Clustered Lovegrass	LC	+	+		1	+	+					+	+-2		
POACEAE	*Eragrostis lacunaria*	Purple Lovegrass	LC											1-3			
POACEAE	*Eragrostis leptostachya*	Paddock Lovegrass	LC	1	+			+				+(-2)	2		+		
POACEAE	*Eragrostis parviflora*	Weeping Lovegrass	LC	+			2			+-2(e)					+		
POACEAE	*Eragrostis sororia*	*ncn*	LC									+-3			+-3	+-2	
POACEAE	*Eragrostis spartinoides*	*ncn*	LC													+	
POACEAE	*Eragrostis tenellula*	*ncn*	LC	1										+	+		
MYOPORACEAE	*Eremophila debile*	Winter Apple	LC	1	+-1						1	+-2		+-1	+-2	+	
MYOPORACEAE	*Eremophila mitchellii*	False Sandalwood	LC	2									5	+-4		+	

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
CACTACEAE	*Eriocereus martinii*	Harrisia Cactus	*(C2)									+		+-1			
POACEAE	*Eriochloa crebra*	Cup Grass	LC	+-3	1-3		4			+-3	3	+-3		+-2	+-2	+	
POACEAE	*Eriochloa procera*	Early Spring Grass	LC	+	+			+		+-2		1-3		+-2	+-2	+	
APIACEAE	*Eryngium plantagineum*	*ncn*	LC				+-1										
FABACEAE	*Erythrina vespertilio*	Bat's wing Coral Tree	LC		+-3			+									
ERYTHROXYLACEAE	*Erythroxylum australe*	Southern Erythroxylum	LC										4		+		
MYRTACEAE	*Eucalyptus crebra*	Narrow-leaved Red Ironbark	LC	+	+(-4)							+				5-6	5-6
MYRTACEAE	*Eucalyptus melanophloia*	Silver-leaved Ironbark	LC									+(-6)					
MYRTACEAE	*Eucalyptus orgadophila*	Mountain Coolabah	LC		+-2					+-2(e)		6					
MYRTACEAE	*Eucalyptus populnea*	Poplar Box	LC	6	+-2					+(e)				+	6		
MYRTACEAE	*Eucalyptus raveretiana*	Black Ironbox	LC			4			5-6								
MYRTACEAE	*Eucalyptus tereticornis ssp. tereticornis*	Queensland Blue Gum	LC		2-5			5-6	+-5	5-6(e)							
POACEAE	*Eulalia aurea*	Satin Brown-top	LC	+	+-2		2					+-2		+	+-4	+-2	
LAXMANNIACEAE	*Eustrephus latifolius*	Wombat Berry	LC		1-2	+		+	1		2	+	1			+-1	
CONVOLVULACEAE	*Evolvulus alsinoides ssp. sericea*	Creeping Speedwell	LC	1	+							+-1		+-1	+-2	+-2	
EUPHORBIACEAE	*Excoecaria dallachiana*	Blind-your-eye	LC		+-5				+								
SANTALACEAE	*Exocarpos latifolius*	Broad-leaved Native Cherry	LC			3						+(-2)	1				
MORACEAE	*Ficus opposita*	Creek Sandpaper Fig	LC		+-4	2		1-4	+-5	+(e)							

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
MORACEAE	*Ficus platypoda*	Rock Fig	LC			+											
MORACEAE	*Ficus racemosa*	Cluster Fig	LC		+	+		+									
MORACEAE	*Ficus virens var. sublanceolata*	White Fig	LC			1											
CYPERACEAE	*Fimbristylis bisumbellata*	*ncn*	LC	1	+							+(-3)				+	
CYPERACEAE	*Fimbristylis dichotoma*	*ncn*	LC	1	+										+	+	
CYPERACEAE	*Fimbristylis velata*	*ncn*	LC									+					
RUTACEAE	*Flindersia australis*	Crow's Ash	LC			2											
RUTACEAE	*Flindersia dissosperma*	Scrub Leopardwood	LC											+	+		
PHYLLANTHACEAE	*Flueggea leucopyrus*	White Currant	LC	+	+-4				+-2	+(e)		+(-2)			+	+-2	
CYPERACEAE	*Fuirena ciliaris*	*ncn*	LC							+(e)							
FABACEAE	*Galactia tenuiflora*	*ncn*	LC	+-2	1-2						+	2				1-3	
RUTACEAE	*Geijera salicifolia*	Broad-leaved Wilga	LC			1						+(-3)	5	+-3	+(-3)	+	
ORCHIDACEAE	*Geodorum densiflorum*	Pink Nodding Orchid	LC												+		
EUPHORBIACEAE	*Glochidion apodogynum*	(a) Cheese Tree	LC			1			+								
LAMIACEAE	*Glossocarya hemiderma*	Glossocarya	LC														
FABACEAE	*Glycine clandestina*	Glycine Pea	LC	+											+	+	
FABACEAE	*Glycine falcata*	*ncn*	LC		+												
FABACEAE	*Glycine latifolia*	*ncn*	LC	'+-2													
FABACEAE	*Glycine tabacina*	Twining Glycine	LC	+	+-1	1	1				+	+-1			+	+-1	
FABACEAE	*Glycine tomentella*	Hairy glycine	LC		+-1				+						+	+	
ASTEARCAEAE	*Gnaphalium luteo-album*	*ncn*	*									+		+			
APOCYNACEAE	*Gomphocarpus physocarpus*	Balloon Cotton	*		+							+					

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
AMARANTHACEAE	*Gomphrena celosioides*	Gomphrena Weed	*	1						+(e)		+			+		
GOODENIACEAE	*Goodenia fasicularis*	*ncn*	LC	+													
FABACEAE	*Goodenia hirsuta*	*ncn*	LC													+	
GOODENIACEAE	*Goodenia rotundifolia*	Trailing Guinea Flower	LC													+	
SCROPHULARIACEAE	*Gratiola pedunculata*	*ncn*	LC	+										+	+		
PROTEACEAE	*Grevillea helmsiae*	Helm's Grevillea	LC			+											
PROTEACEAE	*Grevillea parallela*	Silver Oak	LC												+		
PROTEACEAE	*Grevillea striata*	Beefwood	LC													+	
TILIACEAE	*Grewia latifolia*	Dysentery Bush	LC	2	!-3				+		1	2	2	+-2	1-2	1-3	
TILIACEAE	*Grewia scabrella*	Rough Grewia	LC		+			+									
ASTERACEAE	*Gynura drymophila*	*ncn*	LC	1	+				+(-3)			+-2			+	+	
HALORAGACEAE	*Haloragis aspera*	*ncn*	LC				1									+	
BORAGINACEAE	*Heliotropium indicum*	*ncn*	*							+-2(e)							
POACEAE	*Heteropogon contortus*	Bunched Speargrass	LC	3	!-4				+		4	3-4		+	1-4	1-4	4-5
POACEAE	*Heteropogon triticeus*	Giant Speargrass	LC		+-1				+							+-4	1-2
MALVACEAE	*Hibiscus meraukensis*	*ncn*	LC														
MALVACEAE	*Hibiscus sp. (Emerald S.L Everist 2124)*	*ncn*	LC						+								
MALVACEAE	*Hibiscus sturtii var. sturtii*	Hill's Hibiscus	LC	+-2										+			
POACEAE	*Holcolemma dispar*	*ncn*	LC	+-2	!-3				+		+	+-1			+-3	+	
VIOLACEAE	*Hybanthus enneaspermus*	Mauve Spade Flower	LC	1	+							1-2		+	+-2	+-2	
VIOLACEAE	*Hybanthus stellarioides*	Orange Spade Flower	LC		+-2				+		+	+				+	
POACEAE	*Hyparrhenia rufa*	Thatch Grass	*														

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
CLUSIACEAE	*Hypericum gramineum*	Native St. John's Wort	LC					+				+					
JOHNSONIACEAE	*Hypoxis arillacea*	*ncn*	LC		+							+					
POACEAE	*Imperata cylindrica*	Blady Grass	LC		+-4												
FABACEAE	*Indigofera australis var. australis*	Native Indigo	LC		+											+	
FABACEAE	*Indigofera brevidens*	*ncn*	LC										1				
FABACEAE	*Indigofera colutea*	*ncn*	LC	+	+							+-2			+-2	+-2	
FABACEAE	*Indigofera hirsuta*	*ncn*	LC	+	+												
FABACEAE	*Indigofera linifolia*	*ncn*	LC		+						+	+-1			+-1	1-2	
FABACEAE	*Indigofera linnaei*	*ncn*	LC	+											+-2		
FABACEAE	*Indigofera suffruticosa*	*ncn*	LC									+			+-2	1-2	
FABACEAE	*Indigofera trita*	*ncn*	LC									+					
COLCHICACEAE	*Iphigenia indica*	*ncn*	LC												+		
CONVOLVULACEAE	*Ipomoea brownii*	*ncn*	LC									+		+		+	
CONVOLVULACEAE	*Ipomoea lonchophylla*	*ncn*	LC				1										
CONVOLVULACEAE	*Ipomoea plebeia*	Bell Vine	LC	+	+-2			+	+		+	+			+	+	
CONVOLVULACEAE	*Ipomoea sp. (n-r)*	*ncn*	LC												+		
POACEAE	*Iseilema vaginiflorum*	Red Flinder's Grass	LC				2										
CONVOLVULACEAE	*Jacquemontia paniculata var. tomentosa*	*ncn*	LC	+								+			+-1	+-1	
SAPINDACEAE	*Jagera psuedorhus var. psuedorhus*	Foambark	LC			1											
OLEACEAE	*Jasminum didymum var. racemosum*	Slender Jasmine	LC			+-2											
OLEACEAE	*Jasminum lineare*	Desert Jasmine	LC	+	+	1		+	+			+-2			+-2	+-2	
OLEACEAE	*Jasminum volubile*	Stiff Jasmine	LC			2											
ASTERACEAE	*Lactuca saligna*	Prickly Lettuce	*													+	

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
ASTERACEAE	*Lagenophora gracilis*	*ncn*	LC													+	
MALVACEAE	*Lagunaria queenslandica*	*ncn*	LC			+		1-3	+-5								
VERBENACEAE	*Lantana camara var. camara*	Common Lantana	*(C3)		+	+-2		+-2	+-3							+	
RUBIACEAE	*Larsenaikia ochreata*	Native Garden	LC												+	+	
POACEAE	*Leptochloa digitata*	Umbrella Canegrass	LC				+										
SCROPHULARIACEAE	*Leucas lavandulifolia*	*ncn*	*		+			+	+								
CAMPANULACEAE	*Lobelia purpurascens*	Whiteroot	LC														
LAXMANNIACEAE	*Lomandra filiformis ssp. filiformis*	*ncn*	LC		+							+			+	+	
LAXMANNIACEAE	*Lomandra longifolia*	Spiny-headed Matrush	LC		+				+								
LAXMANNIACEAE	*Lomandra multiflora ssp. multiflora*	Many-flowererd Matrush	LC		+							+					
ONAGRACEAE	*Ludwigia affinis*	*ncn*	LC							+							
ONAGRACEAE	*Ludwigia octovalvis*	Native Willow Primrose	LC	+	+		2							+	+		
ONAGRACEAE	*Ludwigia peploides ssp. montevidensis*	Creeping Water Primrose	*							3							
ONAGRACEAE	*Ludwigia perennis*	*ncn*	LC				+										
CAESALPINIACEAE	*Lysiphyllum hookeri*	Pegunny	LC	+	+-5	+		2-5	2-5								
MORACEAE	*Maclura cochinchinensis*	Cockspur Vine	LC			2		+-2	+								
FABACEAE	*Macroptilium atropurpureum*	Siratro	*						+								
FABACEAE	*Macroptilium lathyroides*	Phasey Bean	*						+	+(e)						+	

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
CHENOPODIACEAE	*Maireana microphylla*	Blue Saltbush	LC												+	+	
EUPHORBIACEAE	*Mallotus philippensis*	Red Kamala	LC		+	4-5		+									
MALVACEAE	*Malvastrum americanum*	Spiked Malvastrum	*	+-2	1			+		+(e)		+		+-3	+	+	
MALVACEAE	*Malvastrum coromandelianum*	Red-flowered Mallow	*	+	1		+(e)	+-2	+-2			+		+-2	+	+	
APOCYNACEAE	*Marsdenia microlepis*	Northern Milkvine	LC													+	
APOCYNACEAE	*Marsdenia viridiflora ssp. viridiflora*	Native Pear	LC									+		+-1	+	+	
MARSILEACEAE	*Marsilea drummondii*	Nardoo	LC	+	+-2		2			2-3							
MARSILEACEAE	*Marsilea mutica*	(a) Nardoo	LC							+-2							
CELASTRACEAE	*Maytenus cunninghamii*	Yellowberry Bush	LC									+			+	+-3	
CELASTRACEAE	*Maytenus disperma*	Orangebark	LC			1											
SCROPHULARIACEAE	*Mecardonia procumbens*	*ncn*	*	+			+-1	+-2	+-2	+				+			
POACEAE	*Megathyrsus maximus var. pubiglumis*	Green Panic	*	+	+(-6)			5-6	5-6	+(e)		+	1.75	1-5	+	+	
MYRTACEAE	*Melaleuca bracteata*	Black Teatree	LC		+(-5)			+-3	+-3								
MYRTACEAE	*Melaleuca fluviatilis*	Weeping Teatree	LC					+(-3)	+(-3)								
MYRTACEAE	*Melaleuca trichostachya*	Creek Paperbark	LC						+								
STERCULIACEAE	*Melhania oblongifolia*	Velvet Hibiscus	LC	+	+							+-2		+	+	+-2	
MELIACEAE	*Melia azedarach var. azedarach*	White Cedar	LC		+												
POACEAE	*Melinis repens*	Red Natal Grass	*		+				+		+	+-2		+	+	1-3	

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
STERCULIACEAE	*Melochia pyramidata*	*ncn*	*	+	+							+		+			
ANNONACEAE	*Melodorum leichhardtii*	Zig-zag Vine	LC			1											
RUTACEAE	*Micromelum minutum*	Cluster Berry	LC			+-2											
SCROPHULARIACEAE	*Mimulus gracilis*	*ncn*	LC				1										
LOGANIACEAE	*Mitrasacme alsinoides*	*ncn*	LC	+			1				+	+				+	
PONTERIDACEAE	*Monochoria cyanea*	Monochoria	LC							1-2							
FABACEAE	*Mucuna gigantea*	Burny Bean	LC						+								
CURCUBITACEAE	*Mukia maderaspatana*	*ncn*	LC	+	+-2			+	+		1			+		+	
COMMELINACEAE	*Murdannia graminea*	Slugherb	LC	+								+			+-2	+	
RUTACEAE	*Murraya ovatifoliolata*	Native Orange Jessamine	LC			1											
HALORAGACEAE	*Myriophyllum verrucosum*	Red Water Milfoil	LC							1							
MYRSINACEAE	*Myrsine variabilis*	Muttonwood	LC			2-3						+(-3)	1				
HYDROCHARITACEAE	*Najas tenuifolia*	Waternymph	LC							+-2(e)							
FABACEAE	*Neptunia gracilis*	Native Sensitive Plant	LC	1-2	+-2		2				2	1-2		+	+-2	+-2	
OLEACEAE	*Notelaea microcarpa var. microcarpa*	Small-fruited Mock Olive	LC			2						+	2				
MENYANTHACEAE	*Nymphoides crenata*	Wavy Marshwort	LC							+-2							
MENYANTHACEAE	*Nymphoides indica*	Water Snowflake	LC							+-3							
CHENOPODIACEAE	*Nyssanthes erecta*	*ncn*	LC	1										1	+		
LAMIACEAE	*Ocimum tenuiflorum*	Native Thyme	LC	+			1	+		+-2				+-3			

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
RUBIACEAE	*Opercularia hispida*	*ncn*	LC												1		
POACEAE	*Oplismenus aemulus*	Basket Grass	LC										+				
CACTACEAE	*Opuntia aurantiaca*	Tiger Pear	LC													+	
CACTACEAE	*Opuntia stricta*	Common Prickly Pear	*(C2)									+				+	
CACTACEAE	*Opuntia tomentosa*	Velvet Prickly Pear	*(C2)	+	+							+		+-1	+	+	
HYDROCHARITACEAE	*Ottelia ovatifolia*	Swamp Lily	LC							+-3							
MELIACEAE	*Owenia acidula*	Emu Apple	LC									+(-2)				+	
OXALIDACEAE	*Oxalis perennans*	*ncn*	LC		+												
OXALIDACEAE	*Oxalis radicosa*	*ncn*	LC											+			
ASTERACEAE	*Ozothamnus cassinioides*	*ncn*	LC													+	
BIGNONIACEAE	*Pandorea pandorana*	Wonga Vine	LC			2								+		+	
POACEAE	*Panicum buncei*	Native Panic	LC							+(e)							
POACEAE	*Panicum decompositum var. tenuis*	Native Millet	LC	+	+-2		2				+	+(-2)		+	+	+-2	
POACEAE	*Panicum effusum*	Hairy Panic	LC	2	+-2				+			+-2			+-2	1-3	2
POACEAE	*Panicum queenslandicum*	Yabilla Grass	LC		+												
POACEAE	*Panicum simile*	Two-coloured Panic	LC	2	+							+-2			+	+-2	
MIMOSACEAE	*Paraserianthes toona*	Mackay Cedar	LC						+								
APOCYNACEAE	*Parsonsia lanceolata var. lanceolata*	Rough Silkpod	LC	+	+-1	+								+-2	+-2	+-1	
ASTERACEAE	*Parthenium hysterophorus*	Parthenium Weed	*(C2)	2	1-2		1	+	+-3	+-2	1	1-2	1	+-3	+-1	+	
POACEAE	*Paspalidium caespitosum*	Brigalow Grass	LC										4	2-5			

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
POACEAE	*Paspalidium constrictum*	*ncn*	LC	+									1	+	+	+-2	
POACEAE	*Paspalidium disjunctum*	Shot Grass	LC	1										+	+		
POACEAE	*Paspalidium distans*	Shot Grass	LC	+											+		
POACEAE	*Paspalidium jubiflorum*	Warrego Grass	LC				+										
POACEAE	*Paspalum distichum*	Water Couch	LC	+						+-5							
PASSIFLORACEAE	*Passiflora aurantia*	Native Passionflower	LC			+											
PASSIFLORACEAE	*Passiflora foetida*	Stinking Passionflower	*		+									+		+	
PASSIFLORACEAE	*Passiflora suberosa*	Corky Passionvine	*		+								1				
RUBIACEAE	*Pavetta australiensis*	Butterfly Bush	LC			2											
POACEAE	*Pennisetum ciliare*	Buffel Grass	*		+-4				+		+	+-3	1	+-4	+-3	1-3	
ASTERACEAE	*Peripleura diffusa*	*ncn*	LC											+	+		
ASTERACEAE	*Peripleura hispidula var. setosa*	*ncn*	LC	+	+-1						+	+-1				+-2	
POLYGONACEAE	*Persicaria attenuata*	Smartweed	LC							1							
POLYGONACEAE	*Persicaria orientalis*	Prince's Feather	LC							+(e)							
PICDRODENDRACEAE	*Petalostigma pubescens*	Quinine Bush	LC	+								+				+	
PHYLLANTHACEAE	*Phyllanthus fuernrohrii*	*ncn*	LC													+	
PHYLLANTHACEAE	*Phyllanthus gunnii*	*ncn*	LC											+			
PHYLLANTHACEAE	*Phyllanthus maderaspatensis*	*ncn*	LC	+								+		+-2	+-2	+	
PHYLLANTHACEAE	*Phyllanthus virgatus*	*ncn*	LC	1	+-2		+				+	+		+	+-2	12	
ASTERACEAE	*Picris angustifolia subsp. carolorum-henricorum*	*ncn*	LC		+												
THYMELEACACEAE	*Pimelea neo-anglica*	Poison Pimelea	LC		+-3												

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
PITTOSPORACEAE	*Pittosporum spinescens*	Wallaby Apple	LC		+(-3)	+							2	+		+	+
LAMIACEAE	*Plectranthus parviflorus*	*ncn*	LC														
ANACARDIACEAE	*Pleiogynium timorense*	Burdekin Plum	LC		+	5						+(-3)					
PLUMBAGINACEAE	*Plumbago zeylanica*	Native Plumbago	LC	+		1						+(-2)		+			
CARYOPHYLLACEAE	*Polycarpaea corymbosa var. minor*	*ncn*	LC													+	
POLYGALACEAE	*Polygala linariifolia*	Native Milkwort	LC						+							+	
POLYGONACEAE	*Polygonum plebeium*	Small Knotweed	LC							+-2(e)							
COMVOLVULACEAE	*Polymeria ambigua*	Tangled Morning Glory	LC	+	+												
CONVOLVULACEAE	*Polymeria longifolia*	Peak Downs Curse	LC	+			1					+		+	+		
CONVOLVULACEAE	*Polymeria pusilla*	Annual Polymeria	LC	+-2	+		2				1	+		+		+	
ARALIACEAE	*Polyscias elegans*	Celerywood	LC			1											
RUBIACEAE	*Pomax umbellata*	Pomax	LC										+				
PORTULACACEAE	*Portulaca filifolia*	*ncn*	LC	1											+		
PORTULACACEAE	*Portulaca oleracea*	Pigweed	*	1										+-1			
PORTULACACEAE	*Portulaca pilosa*	Hairy Pigweed	*	+										+	+		
POTAMOGETONACEAE	*Potamogeton crispus*	Crisped Pondweed	LC							+							
POTAMOGETONACEAE	*Potamogeton tricarinatus*	Curly Pondweed	LC							+-3(e)							
SAPOTACEAE	*Pouteria cotinifolia var. pubescens*	Lemon Aspen	LC		+								2	+			
CAMPANULACEAE	*Pratia concolor*	*ncn*	LC		+			1-2	1-2								
ACANTHACEAE	*Pseuderanthemum tenellum*	*ncn*	LC		+									+			

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
POACEAE	*Pseudoraphis spinescens*	Spiny Mud-grass	LC							1-5							
RUBIACEAE	*Psydrax attenuatum*	*ncn*	LC													+	
RUBIACEAE	*Psydrax odorata*	Shiny-leaved Canthium	LC									+(-2)	3				
RUBIACEAE	*Psydrax oleifolium*	Myrtle Tree	LC	1								+			1-4	+	
ASTERACEAE	*Pterocaulon redolens*	*ncn*	LC	+	+				+			+		+	+	+-1	
ASTERACEAE	*Pterocaulon serrulatum*	Pineapple Bush	LC									+		+		+-2	
FABACEAE	*Rhynchosia minima ssp. australis*	Rhyncho	LC	2	+-3		+-1		+	2(e)	2	2	2	+	1-2	1-2	
BRASICACEAE	*Rorippa eustylis*	*ncn*	LC							+			0.5				
ACANTHACEAE	*Rostellularia adscendens*	Pink Tongues	LC	2	+-2		2					1-2		+-2	1-2	+-2	
CHENOODIACEAE	*Salsola kali*	Soft Roly-poly	LC											+			
SANTALACEAE	*Santalum lanceolatum*	Sandalwood	LC	+-4	+					+(e)		+(-3)	1	+	+	+	
APOCYNACEAE	*Sarcostemma viminale ssp. brunonianum*	Caustic Vine	LC												+		
POACEAE	*Sarga leiocladum*	Wild Sorghum	LC		+-4			+								+	
CYPERACEAE	*Scleria mackaviensis*	*ncn*	LC		+-1						+	1-2	0.5			1-3	
SCROPHULARIACEAE	*Scoparia dulcis*	Scoparia	LC					+	+			+			+		
APOCYNACEAE	*Secamone elliptica*	Corky Milk Vine	LC										3				
POACEAE	*Sehima nervosum*	*ncn*	LC													+	
CAESALPINIACEAE	*Senna barclayana*	Pepper-leaved Senna	*	+	+				+						+		
CAESALPINIACEAE	*Senna coronilloides*	Brigalow Senna	LC											+	+		
CAESALPINIACEAE	*Senna gaudichaudii*	*ncn*	LC			+-2							0.5				
CAESALPINIACEAE	*Senna occidentalis*	Sicklepod	*		+												

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
CAESALPINIACEAE	*Senna surattensis*	Singapore Shower	LC										2				
FABACEAE	*Sesbania cannabina*	Sesbania Pea	LC	1	+		+			+(e)				+	+	+	
POACEAE	*Setaria pumila ssp. subtessellata*	*ncn*	*														
POACEAE	*Setaria surgens*	*ncn*	LC			+											
MALVACEAE	*Sida cordifolia*	Flannel Weed	LC		+-1				+						+		
MALVACEAE	*Sida corrugata*	Corrugated Sida	LC											+			
MALVACEAE	*Sida rhombifolia*	Paddy's Lucerne	*	+-1	1		+	1-2	1-4		1	+-1		+	+-2	+-1	
MALVACEAE	*Sida rohlenae*	*ncn*	LC	+-2	+-1							+(-2)		+			
MALVACEAE	*Sida spinosa*	Spiny Sida	*	1						+(e)			0.5	+	+-2	+	
MALVACEAE	*Sida subspicata*	Shrubby Sida	LC	2	1-4			+	+		1	+-4	2	+	+-2	+-2	3
MALVACEAE	*Sida trichopoda*	Pin Sida	LC	+	+											+	
ASTERACEAE	*Sigesbeckia orientalis*	Indian Head	*											+			
SOLANACEAE	*Solanum ellipticum*	Potato Weed	LC		+							+		+	+	+	
SOLANACEAE	*Solanum esuriale*	*ncn*	LC	+-1											+		
SOLANACEAE	*Solanum furfuraceum*	Corky Nightshade	LC										0.5				
SOLANACEAE	*Solanum nigrum*	Blackberry Nightshade	*		+			+	+-1					+			
SOLANACEAE	*Solanum parvifolium*	*ncn*	LC			+							2	+			
SOLANACEAE	*Solanum seaforthianum*	Brazilian Nightshade	*		+							+	1	+			
ASTERACEAE	*Sonchus oleraceus*	Milk Thistle	*		+				+-1					+			
RUBIACEAE	*Spermacoce brachystema*	*ncn*	LC		+-1				+			+-2			+-2	1-2	
RUBIACEAE	*Spermacoce multicaulis*	*ncn*	LC												+	+	
LEMNACEAE	*Spirodela punctata*	Duckweed	LC							+-2(e)							
POACEAE	*Sporobolus caroli*	Fairy Grass	LC	1										+-2	+-2		

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
POACEAE	*Sporobolus elongatus*	Slender Rat's Tail Grass	LC	+	+												
POACEAE	*Sporobolus mitchellii*	*ncn*	LC							+-3							
SCROPHULARIACEAE	*Stemodia glabella*	*ncn*	LC				+(e)										
MENISPERMACEAE	*Stephania japonica var. discolor*	Tape Vine	LC			+			+								
MORACEAE	*Streblus pendulinus*	Whalebone Tree	LC, E			+-2											
FABACEAE	*Stylosanthes hamata*	Seca	*												+		
FABACEAE	*Stylosanthes scabra*	Shrubby Stylo	*	+					+		+	+-1		+	+-1	+	
ASTERACEAE	*Tagetes minima*	Stinking Roger	*						+				5				
FABACEAE	*Tephrosia filipes*	*ncn*	LC								+	+			+	+	
FABACEAE	*Tephrosia purpurea*	*ncn*	LC												+		
COMBRETACEAE	*Terminalia oblongata*	Yellowwood	LC		+(-4)				+(-3)				4	1-4	+		
LAMIACEAE	*Teucrium argutum*	*ncn*	LC													+	
POACEAE	*Themeda avenacea*	Native Oatgrass	LC	+-2	+-2		+								+(-4)		
POACEAE	*Themeda triandra*	Kangaroo Grass	LC	2-4	1-3				+(2)		4	+-4		+	+-3	3-5	5
ASTERACEAE	*Thymophylla tenuiloba var. tenuiloba*	Dahlberg Daisy	*	+													
POACEAE	*Tragus australianus*	Burr Grass	LC												+-2		
AIZOACEAE	*Trianthema portulacastrum*	*ncn*	*											+			
AIZOACEAE	*Trianthema triquetra*	Red Spinach	LC												+		
BORAGINACEAE	*Trichodesma zeylanica*	Camel Bush	LC		+-2												
ASTERACEAE	*Tridax procumbens*	Tridax Daisy	*						+					+		+	
RUBIACEAE	*Triflorensia ixoroides*	Shiny-leaved Tarenna	LC			2							2				
MORACEAE	*Trophis scandens*	Burney Vine	LC		+	+							+				

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
MELIACEAE	*Turraea pubescens*	Native Witch-hazel	LC			2											
APOCYNACEAE	*Tylophora erecta*	*ncn*	LC		+												
POACEAE	*Urochloa gilesi var. gilesi*	*ncn*	LC												+		
POACEAE	*Urochloa mosambicensis*	Sabi Grass	*	1	+				+-3			+-1			+-4	+	
POACEAE	*Urochloa piligera*	*ncn*	LC		+												
MIMOSACEAE	*Vachellia bidwillii*	Corkwood Wattle	LC								1	+				+	
MIMOSACEAE	*Vachellia farnesiana*	Prickly Acacia	*	+	+		+								+		
RHAMNACEAE	*Ventilago viminalis*	Vine Tree	LC			+						+	1	+	+-3	+	
VERBENACEAE	*Verbena officinalis*	Common Verbena	*						+-2								
ASTERACEAE	*Verbesina encelioides*	Crownbeard	*		+												
FABACEAE	*Vigna lanceolata var. lanceolata*	Maloga Bean	LC		+							+			+		
FABACEAE	*Vigna radiata var. sublobata*	Green Gram	LC												+		
FABACEAE	*Vigna vexillata var. angustifolia*	Wild Cowpea	LC						+			+					
LAMIACEAE	*Vitex melicopea*	Northern Vitex	LC						+								
ASTERACEAE	*Vittadinia hispidula*	*ncn*	LC												+	+	
ASTERACEAE	*Vittadinia pustulata*	*ncn*	LC	1			1										
CAMPANULACEAE	*Wahlenbergia gracilis*	Blue Bells	LC		+							+			+	+	
CAMPANULACEAE	*Wahlenbergia sp.*	*ncn*	LC								+					+	
STERCULIACEAE	*Waltheria indica*	*ncn*	LC	+	+						+	+			+-2	+-1	
ASTERACEAE	*Wedelia spilanthoides*	*ncn*	LC	+								+			+-2	+-3	
ASTERACEAE	*Xanthium pungens*	Noogera Burr	*				+		+					+			
FABACEAE	*Zornia dyctiocarpa var. filifolia*	*ncn*	LC	+												+	

FAMILY	Botanical Name	Common Name	NC Reg	11.3.2	11.3.4	11.3.11	11.3.21	11.3.25	11.3.25a	11.3.27	11.4.2	11.9.2	11.9.4	11.9.5	11.9.7	11.9.9	11.12.1
FABACEAE	*Zornia muelleriana ssp. muelleriana*	*ncn*	LC												+		
FABACEAE	*Zornia muriculata*	*ncn*	LC									+			+-2	1-2	

1. Indicates the Queensland conservation status of each taxon under the NC Regulation. The codes are Least Common (LC), Special Least Concern (SLC), Near Threatened (NT), Vulnerable (V), Endangered (E) flora species.

2. Indicates the Commonwealth conservation status of each taxon under the EPBC Act. The codes are Not Listed (NL), Vulnerable (V), Endangered (E) flora species.

3. Relative abundance of species was based on the Braun-Blanquet technique cover-abundance scale (Mueller-Dombois & Ellenberg 1974, Whittaker 1975) as follows:

   - **+** = individual specimen recorded
   - **1** = sparse, <5%;
   - **2** = any number, <5%;
   - **3** = 5 – 24%;
   - **4** = 25 – 49%;
   - **5** = 50 – 74%; and,
   - **6** = 75 – 100%.*ncn* indicates the species is not known by a common name.

Table I2: Summary of Black Ironbox recorded in each transect (refer (SKM 2010b) for upper Hail Creek data)

Transect	DBH (mm)								Height (m)								
	<100	100-200	200-300	300-400	400-500	500-600	>600	Total	0-2	2-5	5-10	10-15	15-20	20-25	25-30	>30	Total
Middle Hail Creek																	
1	3	5	7	11	10	15	12	**63**		1	5	11	25	20	1	0	**63**
2	0	4	8	3	4	2	11	**32**	0	0	2	10	14	5	1	0	**32**
3	8	2	2	1	3	4	19	**39**	1	3	5	2	12	13	3	0	**39**
4	2	0	3	4	5	12	17	**43**	0	0	4	4	22	12	1	0	**43**
5	4	2	3	8	4	4	4	**29**	3	0	5	12	7	1	1	0	**29**
11	2	3	5	2	5	8	4	**29**	0	1	6	6	11	5	0	0	**29**
Average	3.2	2.7	4.7	4.8	5.2	7.5	11.2	39.2	0.8	0.8	4.5	7.5	15.2	9.3	1.2	0.0	39.2
SE	-2.7	-1.8	-2.4	-3.9	-2.5	-5.1	-6.3	-13.0	-1.3	-1.2	-1.4	-4.1	-6.9	-6.9	-1.0	0.0	-13.0
95% CI	-2.2	-1.4	-2.0	-3.2	-2.0	-4.2	-5.2	-10.7	-1.1	-1.0	-1.1	-3.4	-5.7	-5.7	-0.8	0.0	-10.7
Lower Hail Creek																	
6	0	6	11	6	10	8	22	**63**	0	0	6	12	24	20	1	0	**63**
7	18	11	14	6	8	10	22	**89**	7	7	6	27	16	21	5	0	**89**
8	6	1	5	4	9	4	17	**46**	0	1	5	3	17	15	5	0	**46**
9	4	6	6	5	7	10	19	**57**	1	2	2	9	17	17	9	0	**57**
10	0	1	1	2	5	8	7	**24**	0	0	1	2	11	9	1	0	**24**
Average	5.6	5.0	7.4	4.6	7.8	8.0	17.4	55.8	1.6	2.0	4.0	10.6	17.0	16.4	4.2	0.0	55.8
SE	-7.4	-4.2	-5.1	-1.7	-1.9	-2.4	-6.2	-23.8	-3.0	-2.9	-2.3	-10.1	-4.6	-4.8	-3.3	0.0	-23.8
95% CI	-7.1	-4.0	-4.9	-1.6	-1.8	-2.3	-5.9	-22.7	-2.9	-2.8	-2.2	-9.6	-4.4	-4.5	-3.2	0.0	-22.7
Middle Creek																	
12	11	3	8	4	2	3	6	**37**	4	3	4	7	12	7	0	0	**37**
Brumby Creek																	
13	0	3	8	2	2	3	3	**21**	0	0	0	9	9	3	0	0	**21**

Appendix J

Fauna Field Records for the Study Area

Table J1: Field fauna records for the Study area excluding micro-bats

Common Name	Scientific Name	Status		Survey Sites																																													
				Trap Sites											Supplementary Sites																																			Opp.
		NC Act	EPBC Act	TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	TS9	TS10	TS11	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	
Amphibians																																																
Broad-palmed Rocket Frog	*Litoria latopalmata*	LC	NL	H	H Pf AS		X	H																H	H		H	H	X																	
Bumpy Rocket Frog	*Litoria inermis*	LC	NL																																													H
Cane Toad	*Rhinella marina*	*	*	AS	Sp H	Sp H	Fu AS Sp		Sp	Sp AS Pf				Sp			X							X	H	X	X	X	H		H		H													
Desert Froglet	*Crinia deserticola*	LC	NL		Sp		H Sp	H Sp																	H																						X
Desert Tree Frog	*Litoria rubella*	LC	NL	H	Sp	X					H			Sp			X																														
Eastern Sedge Frog	*Litoria fallax*	LC	NL																																												Sp
Eastern Snapping Frog	*Cyclorana novaehollandiae*	LC	NL																																												X
Eastern Stony Creek Frog	*Litoria wilcoxii*	LC	NL																									X		X		X														X
Emerald-spotted Tree Frog	*Litoria peronii*	LC	NL		X																				X																					
Green-striped Burrowing Frog	*Cyclorana alboguttata*	LC	NL		Sp	AS	Sp									X								X	X						X														
Green Tree Frog	*Litoria caerulea*	LC	NL		X	Sp	Sp	Sp El Fu	Sp		Sp	Sp	Sp	Sp											X	X		X	X	X		X						X							
Knife-footed Frog	*Cyclorana cultripes*	LC	NL																																											Sp
Ornate Burrowing Frog	*Platyplectrum ornatum*	LC	NL	Pf	AS Pf	Pf Sp	Pf	Pf																						X		X	X												
Roth's Tree Frog	*Litoria rothii*	LC	NL																																											Sp
Salmon-striped Frog	*Limnodynastes salmini*	LC	NL	Pf																																									X
Spotted Marsh Frog	*Limnodynastes tasmaniensis*	LC	NL	Pf Sp	Pf P Fu	Pf Fu	Pf	Pf			Sp Pf Fu	Fu P Sp El																			X		H					Sp			Sp			
Striped Marsh Frog	*Limnodynastes peronii*	LC	NL																									H																	X
Striped Rocket Frog	*Litoria nasuta*	LC	NL								Sp																																			
Birds																																															
Apostlebird	*Struthidea cinerea*	LC	NL																																												X
Australasian Darter	*Anhinga novaehollandiae*	LC	NL												X																															
Australasian Figbird	*Sphecotheres vieilloti*	LC	NL																																											X
Australasian Grebe	*Tachybaptus novaehollandiae*	LC	NL												X X																															
Australian Bustard	*Ardeotis australis*	LC	NL										X																													X				X DT

Common Name	Scientific Name	Status		Survey Sites																																								
				Trap Sites											Supplementary Sites																													Opp.
		NC Act	EPBC Act	TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	TS9	TS10	TS11	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	
Australian Hobby	*Falco longipennis*	LC	NL																																									X X
Australian Magpie	*Cracticus tibicen*	LC	NL		Ir		X		X																												X			X				X
Australian Owlet-nightjar	*Aegotheles cristatus*	LC	NL						H			H																				H												
Australian Painted Snipe	*Rostratula australis*	V	E,M																																									X
Australian Pelican	*Pelecanus conspicillatus*	LC	NL																																									X
Australian Wood Duck	*Chenonetta jubata*	LC	NL												X																													X
Azure Kingfisher	*Ceyx azureus*	LC	NL																											X														
Black Bittern	*Ixobrychus flavicollis*	LC	NL																																									X
Black Kite	*Milvus migrans*	LC	NL				X																																					X
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	LC	NL			X		X	X	X	X	X	X	X																										X	X		X	
Black-fronted Dotterel	*Elseyornis melanops*	LC	NL																																									X
Black-necked Stork	*Ephippiorhynchu s asiaticus*	LC	NL																																									X
Black-shouldered Kite	*Elanus axillaris*	LC	NL																																									X
Black-winged Stilt	*Himantopus himantopus*	LC	NL																																									X
Black Swan	*Cygnus atratus*	LC	NL																																									X
Blue-faced Honeyeater	*Entomyzon cyanotis*	LC	NL			X	X					X																												X				
Blue-winged Kookaburra	*Dacelo leachii*	LC	NL	X				X	X	X		X		X																				X										
Brolga	*Grus rubicunda*	LC	NL		X																																							X X
Brown Falcon	*Falco berigora*	LC	NL																																									X X
Brown Quail	*Coturnix ypsilophora*	LC	NL					X	X																																			X
Brown Treecreeper	*Climacteris picumnus*	LC	NL																																									X
Brush Cuckoo	*Cacomantis variolosus*	LC	NL																																									X
Bush Stone-curlew	*Burhinus grallarius*	LC	NL								H																												Sp H					
Cattle Egret	*Ardea ibis*	LC	NL																																									X
Cicadabird	*Coracina tenuirostris*	LC	NL																																									X X
Channel-billed Cuckoo	*Scythrops novaehollandiae*	LC	NL		X						X		X																															
Collared Sparrowhawk	*Accipiter cirrocephalus*	LC	NL												X																													
Comb-crested Jacana	*Irediparra gallinacea*	LC	NL												X X																													
Common Bronzewing	*Phaps chalcoptera*	LC	NL																																	X								
Cotton Pygmy-goose	*Nettapus coromandelianus*	LC	NL												X X																													

Common Name	Scientific Name	Status		Survey Sites																																								
		NC Act	EPBC Act	Trap Sites											Supplementary Sites																													Opp.
				TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	TS9	TS10	TS11	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	
Crested Pigeon	*Ocyphaps lophotes*	LC	NL				X																																					X
Dollarbird	*Eurystomus orientalis*	LC	NL	X			X			X	X																																	X
Double-barred Finch	*Taeniopygia bichenovii*	LC	NL											X			X																				X							
Dusky Moorhen	*Gallinula tenebrosa*	LC	NL												X																													
Eastern Barn Owl	*Tyto javanica*	LC	NL			CP	CP		CP																		X																	DT
Eastern Great Egret	*Ardea modesta*	LC	M																																									X
Eastern Koel	*Eudynamys orientalis*	LC	NL									X																										H						X
Emu	*Dromaius novaehollandiae*	LC	NL																																									X
Eurasian Coot	*Fulica atra*	LC	NL												X																													
Forest Kingfisher	*Todiramphus macleayii*	LC	NL				X				X				X																					X					X			X
Galah	*Eolophus roseicapillus*	LC	NL			X	X				X																																	X
Glossy Ibis	*Plegadis falcinellus*	LC	NL												X																													X
Golden-headed Cisticola	*Cisticola exilis*	LC	NL	X																																								
Great Crested Grebe	*Podiceps cristatus*	LC	NL																																									X
Grey Butcherbird	*Cracticus torquatus*	LC	NL											X																														X
Grey Teal	*Anas gracilis*	LC	NL												X																													X
Grey-crowned Babbler	*Pomatostomus temporalis*	LC	NL								X		X				X																											
Ground Cuckoo-shrike	*Coracina maxima*	LC	NL																																									X
Hardhead	*Aythya australis*	LC	NL												X																													X
Intermediate Egret	*Ardea intermedia*	LC	NL												X																													X
Jacky Winter	*Microeca fascinans*	LC	NL			X																																						X
Laughing Kookaburra	*Dacelo novaeguineae*	LC	NL	X	X				X		X																													X				
Leaden Flycatcher	*Myiagra rubecula*	LC	NL				X			X																															X			X
Lewin's Honeyeater	*Meliphaga lewinii*	LC	NL							X																																		
Little Black Cormorant	*Phalacrocorax sulcirostris*	LC	NL												X																													X
Little Bronze Cuckoo	*Chalcites minutillus*	LC	NL																																									X
Little Friarbird	*Philemon citreogularis*	LC	NL		X	X		X			X	X	X																												X			
Little Lorikeet	*Glossopsitta pusilla*	LC	NL																																									X
Little Pied Cormorant	*Microcarbo melanoleucos*	LC	NL												X																													
Little Shrike-thrush	*Colluricincla megarhyncha*	LC	NL							X																																		

Common Name	Scientific Name	Status		Survey Sites																																								
		NC Act	EPBC Act	Trap Sites											Supplementary Sites																													Opp.
				TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	TS9	TS10	TS11	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	
Magpie Goose	*Anseranas semipalmata*	LC	NL												X																		H											
Magpie-lark	*Grallina cyanoleuca*	LC	NL																																	X								X X
Masked Lapwing	*Vanellus miles*	LC	NL												X																													X X
Mistletoebird	*Dicaeum hirundinaceum*	LC	NL																																									X X
Nankeen Kestrel	*Falco cenchroides*	LC	NL												X																													X
Nankeen Night-heron	*Nycticorax caledonicus*	LC	NL				Sp																				X																	
Noisy Friarbird	*Philemon corniculatus*	LC	NL		X				X	X			X				X																			X				X				X
Olive-backed Oriole	*Oriolus sagittatus*	LC	NL																																									X
Pacific Baza	*Aviceda subcristata*	LC	NL			X		X					X																															X
Pacific Black Duck	*Anas superciliosa*	LC	NL		X										X																		H											X
Painted Button-quail	*Turnix varius*	LC	NL																				X																					
Pale-headed Rosella	*Platycercus adscitus*	LC	NL		X	X					X																													X				
Pallid Cuckoo	*Cacomantis pallidus*	LC	NL																																									X
Peaceful Dove	*Geopelia striata*	LC	NL				X																																					X
Peregrine Falcon	*Falco peregrinus*	LC	NL					X																																				
Pheasant Coucal	*Centropus phasianinus*	LC	NL	X																																								X
Pied Butcherbird	*Cracticus nigrogularis*	LC	NL			X			X			X	X	X																						X					X			
Pied Currawong	*Strepera graculina*	LC	NL		X					X																																		X
Pink-eared Duck	*Malacorhynchus membranaceus*	LC	NL												X																													
Plumed Whistling-duck	*Dendrocygna eytoni*	LC	NL												X																													
Purple Swamphen	*Porphyrio porphyrio*	LC	NL												X																													
Rainbow Bee-eater	*Merops ornatus*	LC	M				X			X																																		X
Rainbow Lorikeet	*Trichoglossus haematodus*	LC	NL								X	X	X	X																						X				X				X
Red-backed Fairy-wren	*Malurus melanocephalus*	LC	NL	X					X			X	X																					X										
Red-winged Parrot	*Aprosmictus erythropterus*	LC	NL		X						X			X			X																											X
Royal Spoonbill	*Platalea regia*	LC	NL												X																													
Rufous Whistler	*Pachycephala rufiventris*	LC	NL											X																							X						X	X
Sacred Kingfisher	*Todiramphus sanctus*	LC	NL	X	X		X										X																											
Southern Boobook	*Ninox novaeseelandiae*	LC	NL	H	H					X		H		Sp																								H	H Sp					
Spangled Drongo	*Dicrurus bracteatus*	LC	NL							X	X																																	

Common Name	Scientific Name	Status		Survey Sites																																								
		NC Act	EPBC Act	Trap Sites											Supplementary Sites																													Opp.
				TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	TS9	TS10	TS11	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	
Spotted Bowerbird	*Ptilonorhynchus maculatus*	LC	NL							X																											X							X
Square-tailed Kite	*Lophoictinia isura*	LC	NL																																									X
Squatter Pigeon	*Geophaps scripta*	V	V																																									X X
Straw-necked Ibis	*Threskiornis spinicollis*	LC	NL												X																													X
Striated Pardalote	*Pardalotus striatus*	LC	NL			X	X		X	X	X			X																														
Striped Honeyeater	*Plectorhyncha lanceolata*	LC	NL		X									X			X																											
Sulphur-crested Cockatoo	*Cacatua galerita*	LC	NL		X									X																														X
Tawny Frogmouth	*Podargus strigoides*	LC	NL				Sp					Sp		Sp										X								X												
Torresian Crow	*Corvus orru*	LC	NL	X	Ir	X	X		X		X	X	X																							X	X				X			
Wedge-tailed Eagle	*Aquila audax*	LC	NL																																									X X
Weebill	*Smicrornis brevirostris*	LC	NL					X	X		X			X																													X	
Welcome Swallow	*Hirundo neoxena*	LC	NL																																									X
Whistling Kite	*Haliastur sphenurus*	LC	NL			X									X																													X
White-bellied Cuckoo-shrike	*Coracina papuensis*	LC	NL											X																							X							
White-bellied Sea-eagle	*Haliaeetus leucogaster*	LC	M																																									X
White-browed Scrubwren	*Sericornis frontalis*	LC	NL							X																																		
White-faced Heron	*Egretta novaehollandiae*	LC	NL				X								X																													
White-necked Heron	*Ardea pacifica*	LC	NL												X																													X
White-throated Gerygone	*Gerygone albogularis*	LC	NL			X				X			X																												X			X
White-throated Honeyeater	*Melithreptus albogularis*	LC	NL				X	X		X																											X							X
White-throated Needletail	*Hirundapus caudacutus*	LC	M																																									X X
White-winged Triller	*Lalage sueurii*	LC	NL																																									X
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	LC	NL																																									X
Yellow-throated Miner	*Manorina flavigula*	LC	NL			X					X	X																						X		X				X				
Mammals																																												
Common Brushtail Possum	*Trichosurus vulpecula*	LC	NL							Sp																																		
Common Planigale	*Planigale maculata*	LC	NL								Pf																																	
Dingo, Domestic Dog	*Canis lupus*	*	*		Ir																										X	X												X
Eastern Grey Kangaroo	*Macropus giganteus*	LC	NL	X		Ir		X				X																								Sp				Sp		X			

Common Name	Scientific Name	Status		Survey Sites																																								
		NC Act	EPBC Act	Trap Sites											Supplementary Sites																													Opp.
				TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	TS9	TS10	TS11	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	
Feral Cat	*Felis catus*	*	*				Sp																																					
Greater Glider	*Petauroides volans*	LC	NL	Sp							Sp						X									X			X			X							Sp					
Horse, Brumby	*Equus caballus*	*	*																																									X
Koala	*Phascolarctos cinereus*	LC	V																																									X
Little Red Flying-fox	*Pteropus scapulatus*	LC	NL								Sp			Ro																														
Pig	*Sus scrofa*	*	*	Di						X				Di Sc																							Sc							
Rabbit	*Oryctolagus cuniculus*	*	*			Sp																																						DT
Rufous Bettong	*Aepyprymnus rufescens*	LC	NL											Sp																														
Short-beaked Echidna	*Tachyglossus aculeatus*	SLC	NL																	S c																								X
Squirrel Glider	*Petaurus norfolcensis*	LC	NL								Sp																	X																
Sugar Glider	*Petaurus breviceps*	LC	NL						Sp								X									X																		
Water-rat	*Hydromys chrysogaster*	LC	NL				Tr																																					
Reptiles																																												
Black-headed Monitor	*Varanus tristis*	LC	NL																																									X
Brown Tree Snake	*Boiga irregularis*	LC	NL											X											X																			X DT
Bynoe's Gecko	*Heteronotia binoei*	LC	NL	AS	AS	AS	AS				Pf Sp AS	AS	Fu	Sp Fu Pf AS			X		X	X	X	X												X	AS			X	Sp	AS	AS	Sp	AS	
Chain-backed Dtella	*Gehyra catenata*	LC	NL		AS	AS								Sp AS			X																X				AS	X					AS	
Claw-snouted Blind Snake	*Ramphotyphlops unguirostris*	LC	NL																																									X
Common Tree Snake	*Dendrelaphis punctulatus*	LC	NL								AS																																	
Curl Snake	*Suta suta*	LC	NL											Sp																														DT
Dubious Dtella	*Gehyra dubia*	LC	NL								Sp		Sp										X																					
Eastern Bearded Dragon	*Pogona barbata*	LC	NL																																									X
Eastern Striped Skink	*Ctenotus robustus*	LC	NL					Fu							X				X																								AS	
Fine-spotted Mulch-skink	*Glaphyromorphus punctulatus*	LC	NL							Fu									X																									
Fire-tailed Skink	*Morethia taeniopleura*	LC	NL						Fu AS			Fu	Pf	Fu Pf			X																										AS	
Frill-necked Dragon	*Chlamydosaurus kingii*	LC	NL																																									X
Iridescent Litter-skink	*Lygisaurus foliorum*	LC	NL		Fu	Pf	AS		Fu		Pf	Pf Fu	Fu	Pf		X	X	X		X																								
Lesser Black Whipsnake	*Demansia vestigiata*	LC	NL					X																																				
Lively Rainbow Skink	*Carlia vivax*	LC	NL	Pf Fu																																								

Common Name	Scientific Name	Status		Survey Sites																																								
		NC Act	EPBC Act	Trap Sites											Supplementary Sites																													Opp.
				TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	TS9	TS10	TS11	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	
Keelback	*Tropidonophis mairii*	LC	NL		Sp					Sp	Sp																X	X		X														
Ocellated Velvet Gecko	*Oedura monilis*	LC	NL							AS				Sp																														
Open-litter Rainbow-skink	*Carlia pectoralis*	LC	NL	Pf	AS		AS	Pf			Fu	Pf AS		Fu Pf AS																				X	AS					AS			AS	
Ornamental Snake	*Denisonia maculata*	V	V		AS Pf Sp																																							X
Pale-headed Snake	*Hoplocephalus bitorquatus*	LC	NL	Sp																												X												
Ragged Snake-eyed Skink	*Cryptoblepharus pannosus*	LC	NL	AS					AS Pf		AS	AS	AS				X	X	X	X																X				AS				
Red-naped Snake	*Furina diadema*	LC	NL																																									Sp
Robust Rainbow-skink	*Carlia schmeltzii*	LC	NL										Pf																											AS				
Shaded-litter Rainbow-skink	*Carlia munda*	LC	NL					Pf		Pf			Pf Fu																						AS									
Short-necked Worm-skink	*Anomalopus brevicollis*	LC	NL	AS																																								
Yellow-faced Whipsnake	*Demansia psammophis*	LC	NL	Fu																																								
Tree Skink	*Egernia striolata*	LC	NL	AS		El											X	X			X															X							AS	

Survey Sites

AS	*Active Search*	DT	*Drive Transect*	H	*Heard*	Ro	*Roosting*	X	*Opportunistic*
CP	*Call Playback*	El	*Elliot Trap*	Ir	*Infrared Camera*	Sc	*Scat*		
Di	*Diggings*	Fu	*Funnel Trap*	Pf	*Pitfall Trap*	Tr	*Track*		

Table J2: Field micro-bat records for the Study area

Common Name	Scientific Name	Status		Harp Trap Sites										Anabat Sites															
		NC Act	EPBC Act	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
Beccari's Free-tailed Bat	*Mormopterus beccarii*	LC	NL											A		A			A	A	A	A	A		A	A	A	A	A		A
Chocolate Wattled Bat	*Chalinolobus morio*	LC	NL											A	A				A	A	A	A	B			A		A			
Eastern Bent-winged Bat	*Miniopterus orianae oceanensis*	LC	NL											B	B	B	B		B	B	B	B	B			A	B				B
Eastern Cave Bat	*Vespadelus troughtoni*	LC	NL											A	A							B	B			B					
Gould's Long-eared Bat	*Nyctophilus gouldii*	LC	NL					X																							
Gould's Wattled Bat	*Chalinolobus gouldii*	LC	NL			X		X						A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A
Greater Glider	*Petauroides volans*	LC	NL																												
Hoary Wattled Bat	*Chalinolobus nigrogriseus*	LC	NL			X		X			X	X		A	B	A	A		B	A	A	B	A	B	B	B	B	A	A	B	A
Inland Broad-nosed Bat	*Scotorepens balstoni*	LC	NL					X						A	A	B		B		A		A	A			A		A			A
Inland Forest Bat	*Vespadelus baverstocki*	LC	NL											A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	B	A	A
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	LC	NL						X		X		X																		
Little Bent-winged Bat	*Miniopterus australis*	LC	NL					X						A	A	A		A	A	A	A	A	A			A	A	A	A		A
Little Broad-nosed Bat	*Scotorepens greyii*	LC	NL																												
Little Pied Bat	*Chalinolobus picatus*	LC	NL													A			B	B			B			B		B	A		A
Little Red Flying-fox	*Pteropus scapulatus*	LC	NL																												
Northern Broad-nosed Bat	*Scotorepens sanborni*	LC	NL			X	X			X	X																				
Northern Freetail Bat	*Chaerephon jobensis*	LC	NL											A		A	A	A	A	A	A	A	A			A	A	A	A		A
Troughton's Sheath-tail Bat	*Taphozous troughtoni*	LC	NL													B			B	A	A	A	A			A	A	B			
Water-rat	*Hydromys chrysogaster*	LC	NL																												
White-striped Free-tailed Bat	*Austronomus australis*	LC	NL																								A				A
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	LC	NL											A	A	A	A	A	A	A	A	A	A			A	A	A	A		A
ncn	*Mormopterus ridei*	LC	NL											A		B	B	B		B	B	B	A	A			B	A	A	B	A

Common Name	Scientific Name	Status		Harp Trap Sites										Anabat Sites															
		NC Act	EPBC Act	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
ncn	*Nyctophilus sp.*	LC	NL											A		A		A		A		A	A			A		A			A
ncn	*Scotorepens greyii/S. sanborni*	LC	NL											A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Survey Sites					
A	*Call positively identified*	B	*Call could not be confirmed*	X	*Opportunistic*

Appendix K

Significance Assessments for Conservation Significant Species

This appendix provides an assessment of the significance of impacts to the matters of NES and SES species and communities that were identified in the Study Area as potentially being impacted by the Project, either directly or indirectly. Table K1 identifies the matters which have been assessed, the relevant legislation and assessment guidelines and the likely significance of residual impacts determined from the assessment.

Table K1: Matters of NES and SES for which an assessment of significance of impacts has been undertaken

Protected Matter	**NC Act/EO Act (Matter of SES)**	**EPBC Act (Matter of NES)**	**Assessed under the EPBC Act Significant Impact Guidelines** (DotE 2013b)	**Assessed under the Queensland Residual Impact Guideline** (EHP 2014e)	**Is there potential for a significant residual impact?**
Black Ironbox (*Eucalyptus raveretiana*)	Least Concern	Vulnerable	✓	X	No
Squatter Pigeon (*Geophaps scripta scripta*)	Vulnerable	Vulnerable	✓	✓	No
Koala (*Phascolarctos cinereus*)	Special Least Concern	Vulnerable	✓	✓	Yes
Australian Painted Snipe (*Rostratula australis*)	Vulnerable	Vulnerable	✓	✓	Yes
Ornamental Snake (*Denisonia maculata*)	Vulnerable	Vulnerable	✓	✓	No
Glossy Black-cockatoo (*Calyptorhynchus lathami*)	Vulnerable	Not Listed	X	✓	No
Short-beaked Echidna (*Tachyglossus aculeatus*)	Special Least Concern	Not Listed	X	✓	No

K1: Black Ironbox (*Eucalyptus raveretiana*)

Description

This is a medium-sized tree growing to 25m, with rough, box-type bark on the trunk and base of largest branches. The bark is grey over brown, thick and longitudinally fissured. Adult leaves are strongly discolorous. The fruit is very shallowly hemispherical, to 0.2 x 0.2cm, and 3 or 4 valves are present and strongly exerted (Brooker & Kleinig 2008; SEWPaC 2013c, Accessed 28 August 2013). There are two distinguishing features unique to this species; branchlets have a glandular pith and this species has the smallest fruit of any eucalypt (SEWPaC 2013c, Accessed 28 August 2013).

Distribution

Black Ironbox occurs as scattered and disjunct populations in central coastal and sub-coastal Queensland, from Dipperu National Park southwest of Mackay, north to Charters Towers, Bowen and Ayr, in and 100km around Rockhampton and near the Mackenzie River north of Duaringa. It has been recorded from approximately 23 locations, in two main areas; Nebo to Ayr and Aps Creek to Rockhampton (Brooker & Kleinig 2008; SEWPaC 2013c, Accessed 28 August 2013).

It is protected in Dipperu National Park, Eungella National Park, Homevale National Park and Goodedulla National Park. The extent of occurrence is approximately 124,000km^2 (SEWPaC 2013c, Accessed 28 August 2013).

Habitat Preference

This species always grows along creek beds and river banks in sandy through to heavy clay soils. Altitudinal range is 1-300m and Black Ironbox grows in sub-tropical areas with an annual rainfall of 650-1100m (SEWPaC 2013a).

Threats

Known threats to this species include:

- Invasive weeds, particularly Rubber Vine (**Cryptostegia grandiflora*), which can smother large trees; exotic grasses such as Green Panic (**Megathyrsus maximus ssp. publiglume*) and some other weeds, including Lantana, which inhibit regeneration on creek banks and increase fuel loads and fire frequency
- Water resource development, resulting in habitat loss or degradation and stream flow modification
- Accidental harvesting as a result of timber harvesting operations (SEWPaC 2013c, Accessed 28 August 2013).

Threats posed by the Project include, increased dust deposition, clearing, habitat loss and degradation of watercourses (from effects of subsidence) supporting high value habitat for the species adjacent and downstream of the Study Area. The Project is likely to result in the loss of approximately 14% of the local population through clearing and ponding from subsidence.

Table K2 provides a summary of impacts and an assessment against the *EPBC Act Significant Impact Guidelines* (DotE 2013b) criteria.

Table K2: Significance Assessment for the Black Ironbox

Occurrence within the Study Area
Black Ironbox is abundant along watercourses in the Study Area, numbering approximately 4,570 individuals, where it dominates the T1 and T2 tree layers along some sections of Hail, Schammer, Brumby, Middle and Bee Creeks. The dominance of this species increases, almost to the exclusion of other canopy species, downstream of the confluence of Middle and Hail Creeks. The area of occupancy in the Study Area equates to 193.0ha of RE 11.3.25a and this is considered high value habitat for the species (Figure 11). An additional 17.0ha of low value habitat (i.e. where the species wasn't recorded but could potentially grow) occurs in the upper reaches of Middle and Schammer Creeks (Figure 11).
Important population
The concept of an 'important population' is central to assessing the potential for an action to have a significant impact on a species listed as Vulnerable under the EPBC Act. Each of the key 'important population' aspects is addressed below. *a) Key Source population for breeding or dispersal* Hail Creek is at the headwaters of the Fitzroy River catchment. Therefore, the individuals that occur in the Study Area are likely to contribute substantially to dispersal of this species downstream into the catchment. *b) Populations that are necessary for maintaining genetic diversity* The Black Ironbox in the Study Area is likely to be necessary for contributing genetic diversity of the species in the Fitzroy River catchment. However, this species has been recorded in a number of catchments including but not limited to the Mackenzie, Isaac, Connors, Funnel, Boothill, Nebo and Denison Creek catchments (DotE 2014n) and are all likely to contribute to maintaining genetic diversity. It is unknown as to whether the population in the Study Area is necessary for maintaining genetic diversity. *c) Populations that are near the limit of the species' range* The Black Ironbox located in the Study Area is potentially at the western limit of this species' range, as it tends to be located in coastal and sub-coastal areas (DotE 2014n). *Conclusion:* The population of Black Ironbox that occurs in the Study Area is considered likely to constitute an important population as a result of the large size of the population and the location being at the western limit of this species' range.
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
a) Lead to a long-term decrease in the size of an important population of a species The Black Ironbox population in the Study Area is likely to be an important population. The Project would result in: ▪ Clearing of approximately 22.0ha of Black Ironbox high value habitat and approximately 2.5ha of potential low value habitat for the species in the Study Area for infrastructure (e.g. surface gas drainage pipelines, haul roads and other access roads); ▪ Subsidence ponding in 9.5ha of Black Ironbox high value habitat for the species in the Study Area; and ▪ Potential subsidence surface cracking in 54.0ha of Black Ironbox (high value habitat) habitat in the Study Area.

The number of individuals that are ultimately removed is part of infrastructure development, such as haul roads, powerlines and light vehicle roads, is estimated to be in the order of 650 individuals, i.e. approximately 14% of the estimated population in the Study Area.
Impacts from potential subsidence surface cracking are likely to be minimal as these impacts will be long term, i.e. over approximately 30 years, and the structure, composition and area of vegetation/habitat is unlikely to be substantially altered. It is expected that riparian ecosystems occurring within Hail Creek, and Schammer Creek, including habitat for Black Ironbox, would be maintained despite the disturbances caused by the Project as predicted changes to stream flows are unlikely to be substantial.

The following mitigation is proposed to manage impacts to this species:

- As part of detailed design, infrastructure will be located to avoid individuals where possible and particularly large individuals of greater than 60cm DBH as recruitment from these individuals is likely to be greater
- Some trees may be lopped rather than felled, where individuals occur on the edge of corridor clearing
- Surface water will be managed to maintain surface water quality and flow, by diverting runoff from undisturbed catchments around mining operations, and capturing, storing and treating runoff from disturbed catchments, for release under controlled circumstances and in accordance with EA conditions.
- Subsidence monitoring will take place, along Creeks and streams, including Hail Creek, to facilitate identification of subsidence impacts, trigger implementation of remediation measures and monitor the effectiveness of remediation works.

The size of the population is unlikely to be significantly impacted in the long-term because thousands of mature trees will be retained (161.5ha [or more than 85% of Black Ironbox in the Study Area]) to enable recruitment of this population and populations downstream.

b) Reduce the area of occupancy of an important population

The Black Ironbox population in the Study Area is likely to be an important population. Approximately 31.5ha of high value habitat that this species occupies will be impacted along Hail Creek and Middle Creek and 2.5ha of low value habitat in the upper reaches of Schammer Creek. Black Ironbox are most dense along Hail Creek in the southern portion of the Study Area and avoiding individuals for construction of a light vehicle access road and powerline across this habitat will be more difficult. Avoiding individuals to locate infrastructure corridors will become more achievable further north as densities of this species decrease the further upstream the impact. Therefore, the area of occupancy of Black Ironbox within the Study Area is expected to be reduced through development of the Project because direct clearing of the population will occur.

c) Fragment an existing important population into two or more populations

A number of infrastructure corridors and gas drainage corridors are proposed to be located across Hail Creek, which will involve clearing of some vegetation of up to 70m for haul roads for example. This will cause fragmentation of the Black Ironbox population in the Study Area. However, connectivity of watercourses and therefore flow of genetic material will not be severed as a result of the Project. Additionally, as the population in the Study Area is so large and the species takes the form of a robust large tree, the proposed clearing would not isolate parts of the population to the extent that a new sub-population would be created.
Therefore, the Project is not considered to fragment an existing important population of Black Ironbox into two or more populations.

d) Adversely affect habitat critical to the survival of a species

The high value habitat in the Study Area, i.e. RE 11.3.25a, proposed to be cleared is not considered critical to the survival of the species as individuals of Black Ironbox and other suitable habitat occurs throughout the primary watercourses of the Study Area and a substantially greater population density occurs in the south of the Study Area, at the confluence of Hail and Middle Creeks and further downstream of the Study Area on Bee Creek and other downstream creeks.
Impacts to vegetation and habitat associated with subsidence effects are likely to be gradual, i.e. over approximately 30 years, and subsidence impacts along Hail Creek will be managed to minimise the risk or erosion and bank destabilisation. Nonetheless some areas of ponding is likely to affect structure, composition and area of vegetation/habitat to some extent. The large proportion of the population of Black Ironbox and its habitat in the Study Area will be retained. Therefore, the Project is considered unlikely to adversely affect habitat critical to the survival of the Black Ironbox.

e) Disrupt the breeding cycle of an important population

Approximately 31.5ha of high value habitat will be impacted by the Project for construction of infrastructure corridors, gas drainage corridors and as a result of subsidence ponding. Habitat impacts will include the likely removal or disturbance to approximately 650 individuals of this species, i.e. approximately 14% of the estimated population in the Study Area. Surface water studies have found that impacts to stream flows in the Hail Creek catchment is unlikely to be more than 5-11% of the current flow (Hatch 2015b).
Downstream impacts to high value habitat is unlikely as surface water will managed to maintain surface water quality and flow, by diverting runoff from undisturbed catchments around mining operations, and capturing, storing and treating runoff from disturbed catchments, for release under controlled circumstances and in accordance with EA conditions. Additionally, subsidence monitoring will take place to identify areas that may require remediation along Hail Creek to minimise erosion and bank destabilisation.
Therefore, the breeding cycle of the overall population in the Study Area or downstream of the Study Area is unlikely to be significantly impacted by the Project because thousands of mature trees will be retained and the population is unlikely to be fragmented.

f) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The extent of potential habitat removal is not considered to cause the species to decline as 161.5ha of high value habitat will remain in the Study Area.

g) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

Weed invasion is a known threat to the Black Ironbox, particularly by exotic grasses and other invasive species such as *Lantana, Bellyache Bush (**Jatropha gossypiifolia*) and Chinee Apple (**Ziziphus mauritiana*) (DotE 2014n). There are numerous weeds in the Study area, including Green Panic, which was recorded regularly along watercourses in the Study Area during field surveys in 2013 and presents a potential existing threat to Black Ironbox recruitment. Access by cattle to watercourses is causing some bank destabilisation, erosion and compaction of the root zone of large trees in some areas. Lantana has been recorded in the Study Area, but not in high abundance. It does not appear to be currently threatening the habitat of this species.
These are all current threats to this species in the Study Area and in the broader region, and it is not expected that this Project would introduce new or exacerbate impacts of existing invasive species to the habitat of Black Ironbox because a weed and feral animal program will be implemented for the Project to minimise this risk.

h) Introduce disease that may cause the species to decline, or The root-rot fungus (*Phytophthora cinnamomi*) is known to affect susceptible plants in areas of higher annual rainfall, i.e. mean annual rainfall greater than 600mm, which potentially encompasses the Study Area (Environment Australia 2001). For example the mean annual rainfall between 1871 and 2013, for Nebo weather station, approximately 31km south-east of the Project Area, is approximately 755mm (BoM 2015). This disease is not known to occur in the Study Area and the Project is considered unlikely to increase the likelihood of this disease being introduced as no new types of activities are proposed.
i) Interfere substantially with the recovery of the species. Approximately 31.5ha of high value habitat for Black Ironbox will be impacted by the Project. The number of individuals that will require clearing is likely to be in the order of 650 individuals. However, this proportion is not considered substantial enough to interfere with the recovery of the species, i.e. more than 85% of the estimated population in the Study Area will be retained. The larger population of Black Ironbox will remain in the Study Area and will continue to be a source of dispersal and genetic diversity for the Fitzroy River catchment as thousands of trees will remain unaffected by the Project.
Conclusion: The population of Black Ironbox occurring in the Study Area is considered likely to constitute an important population and the Project will impact 31.5ha of high value habitat for this species. However, a large portion of the population, i.e. at least 85%, will remain and continue to provide recruitment within and downstream of the Study Area. Therefore, the Project is considered unlikely to significantly impact the Black Ironbox.

K2: Squatter Pigeon (*Geophaps scripta scripta*)

Description

The Squatter Pigeon (southern) is a medium-sized, ground-dwelling pigeon that measures approximately 30cm in length and weighs about 190 to 205g. the adults are predominantly grey-brown, but have black and white stripes on the face and throat, blue-grey skin around the eyes, dark brown (and some patches of iridescent green or violet) on the upper surfaces of the wings, blue-grey o the lower breast and belly, white on the lower region and flanks of the belly and extending onto the under surfaces of the wings, and a blackish-brown band along the trailing edge of the tail. They have black bills, dark brown irises, and dull purple legs and feet. The sexes are similar in appearance ((DotE 2015c) Date accessed 20 March 2015).

Distribution

The Squatter Pigeon (southern) occurs on the inland slopes of the Great Dividing Range. Its distribution extends from the Burdekin-Lynd divide in central Queensland, west to Charleville and Longreach, north-east to the coastline between Proserpine and Port Curtis (near Gladstone), and south to scattered sites throughout south-eastern Queensland ((DotE 2015c) Date accessed 20 March 2015).

The distribution of the southern subspecies overlaps with the distribution of the northern subspecies around the Burdekin-Lynd divide. Hybrid birds (or what appear to be hybrid birds) have been recorded within this zone of overlap. The species is noted as remaining common north of the Carnarvon Ranges in central Queensland, i.e. in the area in which the Study Area is located and in this region is it considered to occur as a continuous, single, sub-population ((DotE 2015c) Date accessed 20 March 2015).

Habitat Preference

This species is known to inhabit tropical dry, open sclerophyll woodlands and occasionally open savannah. It appears to favour sandy soil dissected with low gravelly ridges and is less common on heavy soils with dense grass cover. It is nearly always found in close association with permanent water (Higgins and Davies 1996). This species is often recorded from areas that do not support remnant vegetation, but in these areas it seems to be associated with clear, disturbed sites such as tracks and stockyards ((DotE 2015c) Date accessed 20 March 2015; S. Marston pers. obs.).

Foraging and breeding habitat in Queensland generally occurs in well-draining, gravelly, sandy or loamy soils on low, gently sloping, flat to undulating plains and foothills and lateritic duplex soils on low ‘jump-ups’ and escarpments i.e. Land Zones 5 and 7. These underlying geologies and soils support open forest to woodland communities with patchy, tussock-grassy understoreys. Foraging habitat also occurs on any remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species,

on sandy or gravelly soils within 3km of a suitable, permanent waterbody ((DotE 2015c) Date accessed 20 March 2015).

Dispersal habitat includes any forest or woodland occurring between patches of foraging or breeding habitat. The sub-species is unlikely to move far from woodland trees which provide cover. Where scattered trees still occur, and the distance of cleared land between remnant trees or patches of habitat does not exceed 100m, i.e. degraded environments, individuals may forage or disperse ((DotE 2015c) Date accessed 20 March 2015).

Threats

Three main threats to the Squatter Pigeon (southern) have been identified:

- Loss of habitat due to clearing for agricultural or (in more recent years) industrial purposes
- Degradation of habitat by grazing herbivores, i.e. sheep, cattle and rabbits
- Excessive predation. Known predators include cats, foxes, birds of prey, dingos and snakes, but cats and foxes are likely to be having the greatest impact upon Squatter Pigeon (southern) populations.

It is, however, noted that this species is common in the region and the 2010 Action Plan for Australian Birds no longer lists it as Near Threatened under the IUNC Red List Guidelines (Garnett et al. 2011).

Table K3 provides a summary of impacts and an assessment against the *EPBC Act Significant Impact Guidelines* (DotE 2013b) and *Queensland Residual Impact Guideline* (EHP 2014h) criteria.

Table K3: Significance Assessment for the Squatter Pigeon

Occurrence within the Study Area
The Squatter Pigeon (southern) was recorded at a number of locations in the Study Area during past and recent field surveys (Figure 14). The species was typically observed on tracks, cattle camps and water points. A total of 6,328.5ha of potential high value habitat occurs in the Study Area and is associated with all remnant and some areas of substantial regrowth vegetation communities, except REs 11.3.11, 11.3.27, 11.9.4 and 11.9.5, as these REs are considered too dense or waterlogged and less likely to be used by this species. A total of 721.5ha of potential low value habitat also occurs in the Study Area where there are scattered trees within 100m of high value habitat and in vegetation represented by RE 11.9.5 as Squatter Pigeons potentially move through this type of non-alluvial clay habitat as groundcover is typically more sparse this type of RE and cattle grazing throughout the Study Area as thinned the ground and mid-layers of these communities.
Important population under the EPBC Act
The concept of an 'important population' is central to assessing the potential for an action to have a significant impact on a species listed as Vulnerable under the EPBC Act. Each of the key 'important population' aspects is addressed below. *a) Key Source population for breeding or dispersal* This species is regularly recorded in the central Queensland region and remains common north of the Carnarvon Ranges ((DotE 2015c) Date accessed 20 March 2015). All sub-populations of this species occurring south of the Carnarvon Ranges in Central Queensland are considered to be important sub-populations ((DotE 2015c) Date accessed 20 March 2015). The habitat types of the Project Area remain common throughout the region and the population of this species within the Project Area is therefore considered unlikely to be of particularly significance for breeding or dispersal. *b) Populations that are necessary for maintaining genetic diversity* The inherent mobility of a bird species is likely to increase genetic exchange between individuals in comparison to less mobile species whose access to potential mates may be limited. The species is noted as being likely to comprise a single contiguous breeding population ((DotE 2015c) Date accessed 20 March 2015). It is therefore considered unlikely that the population of this species that occurs within the Study Area is important in maintaining genetic diversity of the species. *c) Populations that are near the limit of the species' range* The range of the Squatter Pigeon (Southern) extends north to the Burdekin region and the species once occurred in southern New South Wales, although it has not been recorded in New South Wales for some time ((DotE 2015c) Date accessed 20 March 2015). The area surrounding the Study Area is within the known distribution of this species. *Conclusion:* The population of the Squatter Pigeon (southern) within the Study Area is considered unlikely to be a key source population for breeding or dispersal or for maintaining genetic diversity and the species is not at or near the species' range limit. Therefore, the population of this species that uses the Study Area is considered unlikely to be an important population.

EPBC Act Significant Impact Guideline (DotE 2013b)	***Queensland Residual Impact Guideline*** (EHP 2014h)	***Response***
An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:	*An action is likely to have a significant impact on endangered and vulnerable wildlife if the impact on the habitat will:*	
Lead to a long-term decrease in the size of an important population of a species	Lead to a long-term decrease in the size of a local population; or	The Squatter Pigeon is considered to remain common north of the Carnarvon Ranges as a continuous, single, sub-population ((DotE 2015c) Date accessed 20 March 2015). The population of the Squatter Pigeon in the Study Area is not regarded as an important population under the EPBC Act. A total of 3,903.0ha of the high value and 386.0ha of low value habitat is proposed to be cleared for the Project (Figure 25). An additional 33.0ha of high value and 1.5ha of low value habitat will be impacted through subsidence ponding. Extensive areas of similar habitat occur in the local region, in the form of remnant and disturbed areas. The Hail Creek Mine SMP will be updated to include the Project and will include measures to minimise impacts to the Squatter Pigeon during habitat clearing activities, including: ▪ Progressive clearing ▪ Pre-clearance surveys to identify breeding places ▪ Supervision by a spotter/catcher during all clearing activities ▪ Avoiding nests and young during clearing activities where possible, or removing to a wildlife carer. Therefore, the Project is not predicted to lead to a long-term decrease in the sub-population that occurs north of the Canarvon Ranges.
Reduce the area of occupancy of an important population	Reduce the area of occupancy of the species; or	The population of Squatter Pigeon that occurs in the Study Area is not anticipated to represent an important population of the species. The species is recognised as remaining common in its northern distribution. The Squatter Pigeon is known to occur in Homevale National Park ((DotE 2015c) Date accessed 20 March 2015). Therefore, the Project is not likely to reduce the area of occupancy of the species. A total of 3,936.0ha of high value and 387.5ha of low value habitat is proposed to be impacted for the Project through vegetation clearing and gradual subsidence ponding

		(Figure 25). The vegetation within the Study Area is commonly found throughout the surrounding region and is not considered to be unique or particularly significant for the Squatter Pigeon. It is estimated that at least 20,332ha of similar remnant habitat occurs within 5km of the Study Area based on remnant vegetation mapping for the region. Therefore, the area that is occupied by this species in the Study Area is not considered to be significant to the extent that this clearing would cause a significant impact to this species. This in combination with the availability of similar habitat within the broader region and the mobility of this species, indicate this Project is unlikely to substantially reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	Fragment an existing population; or	The population of Squatter Pigeon that occurs in the Study Area is not considered to represent an important population of the species. Therefore, the Project is not likely to fragment an important population. The disturbance of remnant and non-remnant habitat that occurs in the Study Area is not anticipated to fragment the population of Squatter Pigeon that occur within the Study Area as the species is known to occupy and utilise cleared areas for feeding habitat. Furthermore, the inherent mobility of avian species further reduces the potential for the Project to fragment sub-populations of this species.
Adversely affect habitat critical to the survival of a species	N/A	The Project will involve impacts to a total of 3,936.0ha of high value and 387.5ha of low value habitat for the Squatter Pigeon (Figure 25). However, the Study Area does not contain habitat critical to the survival of the Squatter Pigeon that is listed under the EPBC Act or identified in Recovery Plans. The habitat that would be disturbed within the Study Area is not regarded as particularly significant or indicative of critical habitat due to the large amount of potential Squatter Pigeon habitat that will remain within the broader landscape. Substantial habitat will continue to be available to the population of the Squatter Pigeon. Therefore, the Project is considered unlikely to adversely affect habitat critical to the survival of the Squatter Pigeon.
Disrupt the breeding cycle of an important population	N/A	The population of Squatter Pigeon that occurs within the Study Area is not considered to represent an important population of the species. Therefore, the Project is not likely to disrupt the breeding cycle of an important population. It is possible during vegetation clearing activities that breeding pairs of the Squatter Pigeon are disrupted, however, management measures will be implemented to minimise disruption to breeding animals, through use of a spotter/catcher and SMP that will involve searching the area immediately prior to clearing to identify any active nests.
Modify, destroy, remove or isolate or	N/A	Sub-populations in this region have not been identified as being of particular importance for the long term survival or recovery of this species ((DotE 2015c) Date

decrease the availability or quality of habitat to the extent that the species is likely to decline		accessed 20 March 2015). This species is regularly recorded as part of environmental impact studies in the region. A total of 3,903.0ha of high value habitat and 386.0 of low value habitat is proposed to be cleared for the Project (Figure 25). An additional 33.0ha of high value habitat and 1.5ha of low value habitat may be impacted by gradual subsidence from underground operations. However, impacts to vegetation and habitat associated with subsidence effects are likely to be minimal as these impacts will be progressive, i.e. over approximately 30 years, gradually affected condition and structure of the vegetation within subsidence areas. Subsidence and tension crack monitoring will take place to identify areas that may require remediation to minimise erosion or creek bank destabilisation. These impacts are not considered unlikely to cause the species to decline given the extent of similar habitat occurring in the local landscape and broader sub-region.
N/A	Reduce gene flow among populations	The disturbance of remnant and non-remnant habitat that occurs in the Study Area is not anticipated to sever the population or habitat of Squatter Pigeon that occurs within the Study Area as the species is known to occupy and utilise cleared areas for feeding habitat. Furthermore, the inherent mobility of avian species further reduces the potential for the Project to fragment sub-populations of this species. Therefore, the gene flow among populations is unlikely to be reduced as a result of the Project.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	The Study Area is located within a modified grazing landscape where introduced plants and feral predators are present. Activities associated with the Project are not anticipated to result in the introduction of any new invasive species to those already present or increase the density of feral predators. A Pest Animal and Weed Management Plan will be implemented for the Project to reduce the potential for introduction and spread of weeds to the Study Area. Therefore, the Project is considered unlikely to result in invasive species that are harmful to the Squatter Pigeon becoming established in the species' habitat.
Introduce disease that may cause the species to decline, or	Introduce disease that may cause the population to decline	Disease is not a known threat to this species. Therefore, the Project is unlikely to introduce any disease that may cause the Squatter Pigeon to decline.
Interfere substantially with the recovery of the species.	Interfere with the recovery of the species	This species is regularly recorded in the region and is noted as 'remaining common north of the Carnarvon Ranges in Central Queensland' ((DotE 2015c) Date accessed 20 March 2015). Substantial areas of suitable habitat will remain unaltered within the local landscape, as at least 20,332ha of similar remnant habitat occurs within 5km of the Study Area based on remnant vegetation mapping for the region. Therefore, it is considered

		unlikely the Project will interfere substantially with the recovery of the Squatter Pigeon species.
N/A	Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	The Study Area is likely to form breeding, feeding, nesting and resting habitat for the Squatter Pigeon. However, the Study Area is unlikely to be more ecological significant than other habitat areas to be retained in the Study Area or surrounding landscape.
Conclusion: The Project is considered unlikely to result in a significant impact to the Squatter Pigeon as the species remains common in its northern distribution, the Study Area is considered unlikely to support an important population, and extensive habitat occurs elsewhere in the region.		

K3: Koala (*Phascolarctos cinereus*)

Description

The Koala is a tree-dwelling, medium-sized marsupial with a stocky body, large rounded ears, sharp claws and variable but predominantly grey-coloured fur. Males generally are larger than females and there is a gradient in body weight from north to south across their range, with larger individuals in the south and smaller individuals in the north. The average weight of males is 6.5kg in Queensland, compared with 12kg in Victoria. In the north of its range, the Koala tends to have shorter, silver-grey fur, whereas in the south it has longer, thicker, brown-grey fur ((DotE 2014d) Date accessed 7 October 2014).

Distribution

The Koala is endemic to Australia, and is widespread in coastal and inland areas from north-east Queensland to Eyre Peninsula, South Australia. The range extends over 22° of latitude and 18° of longitude, or about one million square kilometres. The Koala's distribution is not continuous across this range and it occurs in a number of populations that are separated by cleared land or unsuitable habitat.

In Queensland the Koala has scattered populations throughout Queensland, in moist forests along the coast, sub-humid woodlands in southern and central Queensland, and in some eucalypt woodlands along watercourses in the semi-arid environments of the western part of the State. The Koala has also been found to occur in non-riverine communities in semi-arid areas.

The greatest density of the Koala in the State occurs in south-east Queensland, and lower densities occur through central and eastern areas. For example, population densities range from moderately high in south-east Queensland and some parts of central Queensland (e.g. 1–3 koalas/ha) to low in other parts of central Queensland (e.g. 0.01 koalas/ha) ((DotE 2014d) Date accessed 7 October 2014).

Habitat Preference

Koalas inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by species from the genus Eucalyptus. The distribution of Koalas is also affected by altitude (limited to <800m ASL), temperature and, at the western and northern ends of the range, leaf moisture ((DotE 2014d) Date accessed 7 October 2014).

Threats

The main identified threats to the Koala are loss and fragmentation of habitat, vehicle strike, disease, and predation by the Dog (*Canis lupus familiaris*). Drought and incidences of extreme heat are also known to cause very significant mortality, and post-drought recovery may be substantially impaired by the range of other threatening factors ((DotE 2014d) Date accessed 7 October 2015).

Within the Project Area, primary threats are:

- Habitat loss and fragmentation, particularly narrowed connectivity with Hail Creek
- Increased risk of predation
- Vehicle strike, particularly by haul trucks, which cannot slow or break quickly.

Habitat Assessment – Critical Habitat

In accordance with the Koala Habitat Assessment Tool in the *EPBC Act referral guidelines for the Vulnerable Koala* (DotE 2014b), the Study Area is considered to support habitat critical to the survival of the Koala, as outlined in Table K4, as:

- Koalas are known to use habitat in the Study Area
- The Study Area supports 6,328.5ha of Koala habitat that is connected with another 21,800ha of contiguous vegetation in Homevale National Park
- Hail Creek is likely to provide refuge habitat for this species during adverse climatic conditions.

Table K4: EPBC Act Koala habitat assessment

Attribute	Inland Distribution[5] (DotE 2014b)	Score	Discussion
Koala occurrence	Evidence of one or more Koalas within the last 5 years	+2	Koalas have been recorded at Hail Creek, the most recent being in August 2014.
Vegetation composition	Has forest, woodland or shrubland with emerging trees with 2 or more known Koala food tree species.	+2	Ten potential Koala feed trees were identified in the Study Area as outlined above. The Study Area contains habitat comprising two or more of these species. There is no evidence to suggest that Koalas don't feed from all of these species at some stage and/or in some areas.
Habitat connectivity	Area is part of a contiguous landscape ≥1000ha.	+2	6,328.5ha of Koala habitat occurs in the Study Area. The Study Area forms contiguous habitat with adjacent vegetated areas of the Homevale National park, which combined are greater than 28,000ha.
Key existing threats	Evidence of infrequent or irregular Koala mortality from vehicle strike or dog attack present in the Study Area.	+1	Historical records indicate that Koalas have been struck by vehicles at Hail Creek Mine in the past.
Recovery value	Habitat is likely to be important for achieving the interim recovery objectives for the inland context.	+2	The Koala habitat in the Study Area forms part of a large contiguous habitat area and the vegetation along Hail Creek is likely to provide

[5] The Study Area is considered to occur within the inland geographic contexts of the Koala, as the average annual rainfall for the nearest weather stations, being Nebo (033054) and Moranbah Airport (034035), is less than 800mm. It is noted that the Study Area is located close to the 800mm isohyet.

Attribute	Inland Distribution[5] (DotE 2014b)	Score	Discussion
			refuge for Koalas during periods of drought and extreme heat. Therefore, the habitat in the Study Area is likely to be important for achieving the interim recovery objectives for the Koala.
Total Score		**9**	**Koala habitat in the Study Area, Figure 14, is considered to represent critical habitat under the EPBC Act referral guidelines for the vulnerable Koala.**

Table K5 provides a summary of impacts and an assessment against the *EPBC Act Significant Impact Guidelines* (DotE 2013b) and *Queensland Residual Impact Guideline* (EHP 2014h) criteria.

Table K5: Significance Assessment for the Koala

Occurrence within the Study Area		
This species has been recorded at eight locations in the Study Area and one location within the operational mining area to the west of the Study Area (Figure 14). The most recent Koala sightings were in August 2014 in Queensland Blue Gum tall woodland on alluvial plains in the upper reaches of Hail Creek. The Koala is also likely to occur in the broader landscape in low densities. A total of 6,328.5ha of potential high value habitat occurs within the Study Area in the form of eucalypt open woodland, woodland and open forest, and riparian woodland. REs 11.3.11, 11.3.27, 11.9.4 and 11.9.5 do not form habitat for this species as these communities lack preferred feed and habitat trees, or in the case of REs 11.3.11, 11.9.4 and 11.3.27, are considered too difficult to move through and have a low abundance of suitable feed trees. A number of known and potential feed tree species of the Koala were recorded throughout the Study Area.		
Important population under the EPBC Act		
The concept of an 'important population' is central to assessing the potential for an action to have a significant impact on a species listed as Vulnerable under the EPBC Act. Each of the key 'important population' aspects is addressed below. *a) Key Source population for breeding or dispersal* The SPRAT profile cites research (Melzer et al. 2000) indicating that the Koala population density in the Brigalow Belt in Central Queensland varies from moderately high (e.g. 1-3 koalas/ha) in some parts of Central Queensland to low (e.g. 0.01 koalas/ha) in other parts of Central Queensland. Sightings of a number of Koalas in the Study Area and adjacent areas suggests that the site supports a reasonable abundance of this species and in combination with the habitat in the broader area, the population of the Koala that occurs on the site and nearby areas is likely to be quite large and therefore potentially a key source population. *b) Populations that are necessary for maintaining genetic diversity* The Study Area is bordered to the east by habitat for the species in Homevale National Park and to the north by extensive areas of habitat in the form of remnant vegetation, therefore, the Koala population in the Study Area is likely to be a small part of a larger population that is distributed across the remnant vegetation in the broader landscape. As the population in the Study Area is likely to be a key source population it is also likely to be necessary for maintaining genetic diversity. *c) Populations that are near the limit of the species' range* The Koala is known to occur from north-east Queensland to South Australia. Therefore, the Koalas in the Study area are not near the limit of the species' range. *Conclusion:* The Koalas that occur in the Study Area are likely to be part of a key source population and important for maintaining genetic diversity. Therefore, the population that occurs in the Study Area is likely to be part of an important population.		
EPBC Act Significant Impact Guideline (DotE 2013b)	***Queensland Residual Impact Guideline*** (EHP 2014h)	***Response***

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:	*An action is likely to have a significant impact on endangered and vulnerable wildlife if the impact on the habitat will:*	
Lead to a long-term decrease in the size of an important population of a species	Lead to a long-term decrease in the size of a local population; or	Koalas in the Study Area are considered to potentially constitute part of an important population. The Project will result in: ▪ Clearing of approximately 3,903.0ha of high value habitat ▪ Subsidence ponding in an additional 33.0ha of high value habitat ▪ Potential subsidence surface cracking in another 288.0ha of high value habitat. At least 20,332ha of similar remnant Koala habitat occurs within 5km of the Study Area in the broader landscape and the Koalas that occupy the Study Area are expected to remain in the landscape. There is potential for a small decrease in the size of the population in the short-term however, it is considered unlikely that the Project will lead to a long-term decrease in the size of an important population of this species in the long-term because of the extensive areas of connective habitat that will remain in the landscape. Management of vegetation and habitat clearing will be undertaken through implementation of an SMP, whereby clearing will be undertaken progressively and under the supervision of a spotter/catcher. Where Koalas are located during clearing activities, a 20m buffer and connectivity with other vegetated areas would be retained around the tree in which the Koala is located, and the Koala left to move away of its own accord. Clearing would only resume in the area once the Koala has moved away.
Reduce the area of occupancy of an important population	Reduce the area of occupancy of the species; or	Koalas in the Study Area are considered to potentially constitute part of an important population. Approximately 3,936.0ha of critical habitat for the Koala will be impacted as part of the Project, therefore, the area of occupancy will be reduced as part of the Project (Figure 25). However, more than 20,332ha of similar remnant habitat for the Koala is considered to occur within 5km of the Study Area based on remnant vegetation mapping for the region.
Fragment an existing important population into two or more populations	Fragment an existing population; or	Koalas in the Study Area are considered to potentially constitute part of an important population. Impacts to approximately 3,936.0ha of critical habitat will occur as a result of the Project (Figure 25). Clearing of corridors of between 30m and 70m is required for haul roads, powerlines, light vehicle access roads and gas

		drainage corridors and this will fragment habitat to be retained, particularly at four locations along Hail Creek. Vehicle strike is also possible for animals moving along riparian areas of Hail Creek. However, these cleared corridors are unlikely to sever connectivity entirely and individuals will still be able to move through the landscape. Therefore, it is considered unlikely the Project will fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	NA	The Project will involve impacts to 3,903.0ha of critical habitat for this species in the form of vegetation clearing. The remaining 2,425.5ha of habitat to be retained in the Study Area will be fragmented to some extent, although connectivity will generally remain with extensive areas surrounding the Study Area. Therefore, the Project is considered to potentially adversely affect habitat critical to the survival of the species. An additional 33.0ha of high value habitat may be impacted by subsidence from underground operations. Impacts to vegetation and feed trees associated with subsidence effects are likely to be progressive, i.e. over approximately 30 years, and the structure, composition and area of vegetation/habitat is likely to become degraded over the long term. Subsidence and tension crack monitoring will take place to identify areas that may require remediation to minimise erosion or creek bank destabilisation.
Disrupt the breeding cycle of an important population	N/A	Koalas in the Study Area are considered to potentially constitute part of an important population. Impacts to 3,936.0ha of critical habitat has the potential to impact the breeding cycle of this population if individuals are stressed as a result of clearing activities. However, clearing of this area will be gradual and an SMP will be implemented that includes measures such as pre-clearance surveys and the presence of a spotter/catchers during clearing activities to minimise impacts to individuals and breeding places of this species. Therefore, it is considered unlikely that the breeding cycle of the population will be disrupted.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	N/A	The extent of habitat proposed to be impacted as part of this Project, through clearing and subsidence ponding, is approximately 3,936.0ha, which is critical habitat for the Koala. The clearing will not isolate any areas of critical Koala habitat as connectivity will largely remain along Hail Creek, although it will be fragmented. Habitat clearing and fragmentation of habitat to be retained has the potential to result in increased pressure on remaining habitat and the population may slightly decrease in size in the short term. However, habitat remains throughout the landscape including in the adjacent Homevale National Park and the Koala is considered likely to persist in the landscape due to this large amount

		of available habitat. It is estimated that at least 20,332ha of similar remnant habitat occurs within 5km of the Study Area. Therefore, the habitat clearing is considered unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
N/A	Reduce the gene flow among populations	Although habitat within the Study Area will be fragmented by Project, connectivity large intact habitat areas outside the Study Area will not be severed. It is expected that animals will still be able to move around in the landscape and therefore the gene flow of the population is unlikely to be affected.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	N/A	Invasive species, including feral animals such as the *Fox (*Vulpes vulpes*) and *Dog have been identified as part of recent field surveys throughout the Study Area. These threats are currently present within the Study Area and will continue to be during future mining activities in the Study Area. They will continue to be managed as part of a Pest Animal and Weed Management Plan for the Project. These types of predatory species are drawn to areas of disturbance to prey upon mammals and reptiles that are moving away from the disturbance area. Therefore, predation by feral animals is a risk to this species during and immediately after clearing activities. Predatory species are also attracted to the prey opportunities presented by cleared linear corridors, i.e. exposure of prey moving across easements. However, this Project will not result in invasive species becoming established in potential habitat in the Project Area, as these invasive and predatory species are already established throughout the Study Area and the wider landscape.
Introduce disease that may cause the species to decline, or	N/A	Three viruses are known to affect Koalas in the wild, Chlamydia and Koala Retrovirus (KoRV-A and KoRV-B). It is known that Chlamydia is a sexually transmitted disease in Koalas, however, how the Retrovirus is spread contagiously is unknown. Studies have shown that 100% of Koalas in the wild have the Retrovirus, and the majority of Queensland and New South Wales populations are infected with Chlamydia (Hanger and Loader 2009). Stress has been suggested to exacerbate the effects of disease on Koala populations in more populated areas. However, the Project does not present a significant mechanism, whereby the gradual clearing of habitat would result in the introduction or increase the prevalence of these diseases in the local Koala population, due to the extensive area of habitat in the landscape. Therefore, the Project is considered unlikely to introduce disease that may cause the species to decline.

Interfere substantially with the recovery of the species.	N/A	A total of 3,936.0ha of critical habitat is proposed to be impacted as a result of the Project. Due to the extensive habitat areas that will remain in the landscape it is expected that the species will persist in the landscape and therefore, the Project is considered unlikely to substantially interfere with the recovery of the species within the broader area.
N/A	Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	Habitat in the Study Area is considered to be important as the species has been recorded in the Study Area on a number of occasions. Hail Creek is likely to provide important refuge habitat particularly in drought conditions as described in the Commonwealth EPBC Act Referral guidelines for the Vulnerable koala (DotE 2014b). The whole Study Area is considered to provide important feeding, breeding and resting habitat for the Koala. The Project will involve clearing and fragmentation of breeding, feeding and resting habitat, including along Hail Creek.
Conclusion: The Project has the potential to cause a significant impact to the Koala due to the large area of critical habitat that is proposed to be cleared and the potential for the local population to constitute part of an important population. However, it is considered unlikely that there will be a decrease in the local population in the long term due to the extensive habitat that occurs in the region. The impacts to the Koala can be offset by an appropriate offset strategy.		

K4: Australian Painted Snipe

Description

The Australian Painted Snipe is a stocky wading bird around 220–250mm in length with a long pinkish bill. The adult female, more colourful than the male, has a chestnut-coloured head, with white around the eye and a white crown stripe, and metallic green back and wings, barred with black and chestnut. There is a pale stripe extending from the shoulder into a V down its upper back. The adult male is similar to the female, but is smaller and duller with buff spots on the wings and without any chestnut colouring on the head, nape or throat ((DotE 2014o) Date accessed 10 December 2015).

Distribution

The Australian Painted Snipe has been recorded at wetlands in all states of Australia. It is most common in eastern Australia, where it has been recorded at scattered locations throughout much of Queensland, New South Wales, Victoria and south-eastern South Australia ((DotE 2014o) Date accessed 10 December 2014). The population size of the Australian Painted Snipe is unknown but is estimated to be between a few hundred individuals to 5,000 breeding adults. This population is considered to occur as a single, contiguous breeding population ((DotE 2014o) Date accessed 10 December 2014).

Habitat Preference

The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of Lignum (*Muehlenbeckia florulenta*) or canegrass or sometimes Tea-trees. The Australian Painted Snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber ((DotE 2014o) Date accessed 10 December 2014).

Threats

Potential threats to the Australian Painted Snipe include:

- Loss of habitat from proposed surface infrastructure and degradation of habitat through reduced water quality and reduction in the frequency of flooding
- Predation by feral animals ((DotE 2014o) Date accessed 10 December 2014).

Table K6 provides a summary of impacts and an assessment against the *EPBC Act Significant Impact Guidelines* (DotE 2013b) and *Queensland Residual Impact Guideline* (EHP 2014h) criteria.

Table K6: Significance Assessments for the Australian Painted Snipe

Occurrence within the Study Area		
This species was recorded in a broad drainage line at the far southern end of the Study Area during the field survey (Figure 15). A total of 75.0ha of potential high value habitat occurs in the Study Area associated with the central wetland (RE 11.3.2b) and a number of small patches of REs 11.3.21 and 11.3.27 at the southern end of the Study Area (Figure 15). These areas form relatively permanent wetland habitat in the Study Area. A total of 1,336.5ha of potential low value habitat also occurs in the Study Area and is restricted to floodplain and wetland areas in REs 11.3.2 and 11.3.4 that become waterlogged during high rainfall periods (Figure 15) and therefore, potentially provide temporary habitat for this species.		
EPBC Act Significant Impact Guideline (DotE 2013b)	***Queensland Residual Impact Guideline*** (EHP 2014h)	***Response***
An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:	*An action is likely to have a significant impact on endangered and vulnerable wildlife if the impact on the habitat will:*	
Lead to a long-term decrease in the size of a population	Lead to a long-term decrease in the size of a local population	High value wetland habitat for the Australian Painted Snipe will be impacted as part of surface infrastructure and waste rock emplacement activities at the central wetland. Approximately 24.5ha of high value habitat will be removed at the central wetland and 573.5ha of potential low value habitat will also be impacted through surface mining and infrastructure activities and from subsidence ponding (Figure 27). Indirect adverse impacts on breeding places in retained high value habitat areas in the form of noise, dust and runoff from the adjacent waste rock emplacement and infrastructure areas is unlikely to be substantial given the distance between these habitats and the Project Area (Figure 27). The following management strategies will be employed to minimise impacts to Australian Painted Snipe habitat: ▪ Surface water will managed to maintain surface water quality and flow, by diverting runoff from undisturbed catchments around mining operations, and capturing, storing and treating runoff from disturbed catchments, for release under controlled circumstances and in accordance with EA conditions.

		▪ Subsidence monitoring along creeks and streams will take place, to identify areas that may require remediation to minimise ponding, erosion from tension cracking or to ensure stream bank stabilisation ▪ An EHP approved SMP will be implemented to include actions to minimise the risk to breeding places and individuals of this species. The Australian Painted Snipe is considered to be a single contiguous breeding population (Garnett et al. 2011) and is often a solitary breeder. In addition, the species is thought to possibly be migratory or dispersive. Therefore, presence of this species in the Study Area is unlikely to be permanent. However, 24.5ha of high value habitat is proposed to be impacted and habitat loss is a key threat to the Australian Painted Snipe, therefore, the Project has the potential to cause a decline in the population of the Australian Painted Snipe. There is the potential for the subsided areas that will be permanently inundated to provide additional habitat for this species within the Study Area over the medium term.
Reduce the area of occupancy of the species	Reduce the area of occupancy of the species	Although, the habitat in which the Australian Painted Snipe was recorded will not be impacted by the Project, high value and potential low value habitat will be impacted by the Project. Therefore, the area of occupancy of this species on the site will potentially be reduced as a result of the Project. However, the overall area of occupancy for the species within the broader area is unlikely to be affected by the loss of 24.5ha of high value habitat and 593.5ha of potential low value habitat There is the potential for the subsided areas that will be permanently inundated to provide additional habitat for this species within the Study Area over the medium term.
Fragment an existing population into two or more populations	Fragment an existing population	The Australian Painted Snipe is thought to be migratory or dispersive and a single contiguous breeding population. The Project will not fragment the population of Australian Painted Snipe as habitat will be retained as part of the Project.
Adversely affect habitat critical to the survival of a species	N/A	The Study Area does not support habitat critical to the survival of this species that is listed under the EPBC Act or identified in Recovery Plans. The Study Area is not anticipated to represent critical or important habitat for this species due to the relatively small size and temporary nature of much of the wetland habitat in the Study Area and the presence of predatory species such as *Cats, *Foxes, *Pigs and *Dogs. Therefore, the Project is considered unlikely to result in impacts to habitat critical to the survival of the species.

Disrupt the breeding cycle of a population	N/A	It is not known if the species breeds in the Study Area but it is possible. The Project is considered unlikely to disrupt the breeding cycle of a population of Australian Painted Snipe because breeding in high value habitat can be managed during the construction and operation of the proposed Project and large numbers of breeding animals are not expected to be impacted as this type of activity has not been observed in the wetland habitats as part of previous surveys.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	N/A	The Project will involve direct impacts to the central wetland habitat in the Study Area, which accounts for 24.5ha of high value habitat for this species. Loss of habitat is considered a key threat to the Australian Painted Snipe (DotE 2014o). Therefore, the Project is considered to have the potential to decrease the availability of habitat to the extent that the species may slightly decline.
N/A	Reduce gene flow among populations	The Project is unlikely to affect gene flow of the Australian Painted Snipe as this is a mobile species that is recognised as a single population, and the Project will not affect this species' ability to move between habitat areas.
Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat	Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	Invasive species, including feral animals such as the *Fox, *Cat, *Dog and *Feral Pigs have been identified as part of field surveys in the Study Area. This Project is unlikely to result in invasive species becoming established in habitat in the Study Area, as these invasive and predatory species are already established throughout the broader landscape.
Introduce disease that may cause the species to decline, or	Introduce disease that may cause the population to decline	Disease is not a known threat to this species. Therefore, the Project is considered unlikely to introduce disease that may cause the Australian Painted Snipe to decline.
Interfere with the recovery of the species.	Interfere with the recovery of the species	The Project will involve disturbance to 24.5ha of high value habitat for the Australian Painted Snipe and this type of impact is considered a key threat to the species. Therefore, the Project is considered to have the potential to interfere slightly with the recovery of the Australian Painted Snipe.
N/A	Cause disruption to ecologically significant locations (breeding, feeding, nesting,	The habitat in the Study Area is not considered particularly significant for the Australian Painted Snipe as the species does not appear to use the site regularly, i.e. there is only one record of the species in the Study Area despite numerous

	migration or resting sites) of a species.	surveys since 1996 (refer Section 2.2.2). Nonetheless, the central wetland in particular may form breeding habitat for this species.
Conclusion: There is potential for the Project to cause a significant impact to the Australian Painted Snipe to due to the extent of high value habitat proposed to be impacted.		

K5: Ornamental Snake (*Denisonia maculata*)

Description

The Ornamental Snake is a brown, grey-brown or almost black snake growing up to 50cm in length with lighter coloured body scales, often with darker streaks/flecks. The crown of the head is darker brown/black with lighter flecks, it has distinctly barred lips, a white/cream belly with dark spots/flecks on the outer edges, and smooth scales (Cogger 2014). The Ornamental Snake is largely a nocturnal species found in close association with frogs which form the majority of its diet (Cogger 2014). It is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions with clay soils but is also known from lake margins, wetlands and waterways (Cogger 2014 DotE 2014j). The Ornamental Snake shelters during the day in logs, under coarse woody debris, ground litter and deep soil cracks (Cogger 2014 DotE 2014j). During dry times, the species typically seeks refuge within soil cracks on gilgai mounds within the habitat area (DotE 2014j). The species bears live young and typically breeds during the pre-wet season from September to November (McDonald et al. 2012).

Distribution

The species is known only from the Brigalow Belt North and parts of the Brigalow Belt South biogeographical regions (DotE 2014j). The core of the species' distribution occurs within the drainage system of the Fitzroy and Dawson Rivers (DotE 2014j). Known localities occur in the following regions - Blackwater, Dysart, Peak Downs, Moranbah, Coppabella, Rockhampton region, east of Midgee, Yepoon crossing, Emerald, near Moura, the Dawson Valley, Charters Towers, Biloela, Duaringa, St Lawrence, St George, Goondiwindi, Dipperu National Park and near Nebo (DotE 2014j).

Habitat Preference

This species is known to persist in areas that contain gilgai even though they have been cleared of woody vegetation as the snake uses soil cracks for shelter (Veary 2011). Also, habitat that maintains microhabitat features such as leaf litter and woody debris is considered likely to be of higher value for this species. Regional Ecosystems RE 11.9.5 is listed among the most common vegetation communities where this species is recorded (DotE 2014j).

The *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* describes habitat characteristics that constitutes important habitat for the Ornamental Snake, as gilgai depressions and mounds, with connectivity between gilgais and other suitable habitats being important where the Ornamental Snake has been identified (SEWPaC 2011c). Based on this definition, all gilgai areas within the Project Area and adjacent areas are considered important habitat as it is assumed the Ornamental Snake is present within this habitat.

Threats

The abundance of the Ornamental Snake has undergone a decline over the past few decades and the major threats to this species are considered to be:

- Habitat loss through clearing (roads, ploughing, railways, mining-related activities, pipeline constructions)
- Habitat fragmentation
- Habitat degradation by overgrazing by stock, especially cattle, or grazing of gilgais during the wet season leads to soil compaction and compromising of soil structure
- Alteration of landscape hydrology in and around gilgai environments
- Alteration of water quality through chemical and sediment pollution of wet areas
- Contact with the Cane Toad
- Predation by feral species
- Invasive weeds.

Indirect impacts including dust, noise and lighting created by adjacent activities and vehicle strike are the most likely impacts to Ornamental Snake in the Study Area.

Table K7 provides a summary of impacts and an assessment against the *EPBC Act Significant Impact Guideline*s (DotE 2013b) and *Queensland Residual Impact Guideline* (EHP 2014h) criteria.

Table K7: Significance Assessment for the Ornamental Snake

Occurrence within the Study Area		
This species was recorded in the Study Area in Brigalow habitat to the east of Hail Creek during field surveys (Figure 15). A total of 105.5ha of potential high value habitat occurs in the south of the Study Area in the form of remnant and regrowth RE 11.9.5 on the eastern side of Hail Creek. Only those areas of well-formed gilgai are considered habitat for this species in the Study Area, and in close proximity to where the species has been recorded, i.e. within the largest and most intact area of RE 11.9.5. Well-formed gilgai in the Study Area was found to correspond with remnant and regrowth Brigalow, with gilgai becoming smaller, shallower and less extensive in the most southern patches of habitat (Figure 15). The remnant polygon of RE 11.9.5 in the far east of the Study Area is substantially removed from all other habitat areas and it is considered unlikely the species would disperse the distance to the eastern patch.		
Important population		
The concept of an 'important population' is central to assessing the potential for an action to have a significant impact on a species listed as Vulnerable under the EPBC Act. Each of the key 'important population' aspects is addressed below. *a) Key Source population for breeding or dispersal* *b) Populations that are necessary for maintaining genetic diversity; and/or* *c) Populations that are near the limit of the species' range.* However, given the cryptic nature of the Ornamental Snake, the Draft Referral guidelines for the nationally listed Brigalow Belt reptiles (SEWPaC 2011c) recommend using the presence of important habitat as a surrogate for an important population. In accordance with this guideline, the gilgai habitat within the Study Area is considered important habitat. Therefore, the Ornamental Snakes present within the Study Area constitutes an important population.		
EPBC Act Significant Impact Guideline (DotE 2013b)	***Queensland Residual Impact Guideline*** (EHP 2014h)	***Response***
An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:	*An action is likely to have a significant impact on endangered and vulnerable wildlife if the impact on the habitat will:*	
Lead to a long-term decrease in the size of an	Lead to a long-term decrease in the size	The population of Ornamental Snake that occurs in the Study Area is considered to be an important population. Approximately 0.5ha of high value habitat is proposed to be removed in the far north-eastern corner of its habitat (Figure 27).

important population of a species	of a local population; or	The remainder of Ornamental Snake habitat in the Study Area will be retained with a minimum 30m buffer that will minimise indirect impacts to this species. Due to the relatively small area of habitat clearing proposed, it is considered unlikely that the size of the population in the Study Area will decrease as a result of the Project. Additionally, the following mitigation measures will be implemented to manage potential indirect impacts and potentially improve habitat condition in the long term: ▪ Actively manage each patch of habitat to eliminate declared weed species, particularly Parthenium Weed, Velvet Prickly Pear and Harrisia Cactus. ▪ Install exclusion fencing between high value habitat and the proposed adjacent haul road ▪ Manage surface water flow and quality by diverting runoff from undisturbed catchments around mining operations, and capturing, storing and treating runoff from disturbed catchments, for release under controlled circumstance and in accordance with EA conditions.
Reduce the area of occupancy of an important population	Reduce the area of occupancy of the species; or	The population of Ornamental Snake that occurs in the Study Area is considered to be an important population. Approximately 0.5ha of Ornamental Snake habitat will be cleared to accommodate Project infrastructure. Therefore, the Project will result in a very small reduction in the area of available habitat for this species on the site.
Fragment an existing important population into two or more populations	Fragment an existing population; or	Fragmentation of habitat and therefore the population of Ornamental Snake that occurs in the Study Area will not occur as a result of the Project as clearing is proposed on the very north-eastern edge of habitat.
Adversely affect habitat critical to the survival of a species	N/A	The habitat in the Study Area is important habitat for the species and given the relatively large size it could be considered critical for the survival of the population and therefore potentially the species. A small area, 0.5ha, is proposed to be cleared and some edge effects in the form of dust deposition and weed invasion may occur to habitat adjacent the area of clearing. However, habitat in the Study Area is subject to existing weed invasion and as outlined in Section 7.2.6, dust deposition is not expected to be substantial as a result of the Project. Surface water will be managed to maintain surface water quality and flow, by diverting runoff from undisturbed catchments around mining operations, and capturing, storing and treating runoff from disturbed catchments, for release under controlled circumstances and in accordance with EA conditions. Therefore, the Project is considered unlikely to modify or destroy abiotic factors necessary for the

		survival of the areas that will be retained. There will be no effects of underground mining to this species. Additionally, it is proposed weed management be implemented in Brigalow habitat for this species to improve habitat quality. The extent of impacts to Ornamental Snake habitat is therefore, unlikely to be significant.
Disrupt the breeding cycle of an important population	N/A	The removal of 0.5ha of the 105.5ha of high value habitat on the site is considered unlikely to disrupt the breeding cycle of the Ornamental Snake on the site. Maintenance of a 30m buffer around the remainder of Ornamental Snake habitat will be implemented to minimise indirect impacts such as noise and light effects. Although these are anticipated to be minimal as discussed in Sections 7.2.7 and 7.2.8. A barrier fence will also be erected along the north-eastern edge to reduce the risk of snakes, particularly young snakes, traversing infrastructure. Therefore, it is considered unlikely that the breeding cycle of the local population will be impacted.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	N/A	A section of habitat in the north is proposed to be impacted by development of a proposed haul road. 0.5ha of habitat is likely to be removed as part of this haul road development. An approximate 30m buffer will be maintained around the remaining Ornamental Snake habitat in the Study Area and therefore, indirect impacts are not expected to be substantial. Surface water will be managed to maintain surface water quality and flow, by diverting runoff from undisturbed catchments around mining operations, and capturing, storing and treating runoff from disturbed catchments, for release under controlled circumstances and in accordance with EA conditions. Therefore, water quality and flow into gilgai habitat is not expected to be substantially affected. There will be no effects of underground mining to this species. Additionally, it is proposed the weed management be implemented in Brigalow habitat for this species to improve habitat quality. Therefore, direct and indirect impacts that may occur in this habitat is unlikely to be to the extent that the specie is likely to decline.
N/A	Reduce gene flow among populations	No Ornamental Snake habitat will be fragmented or barriers to movement created as a result of the Project. Connectivity between habitat areas will be retained in their current state. Therefore, the Project is unlikely to affect the gene flow among populations.
Result in invasive species that are harmful to a vulnerable species	Result in invasive species that are harmful to an endangered or	Invasive species, including feral animals such as the *Fox, *Dog, *Cat and (Feral Pig have been identified as part of field surveys throughout the Study Area. These predatory species already pose a risk to the Ornamental Snake in the Study Area, and the Project is unlikely to increase this threat. Additionally, the Project is

becoming established in the vulnerable species' habitat	vulnerable species becoming established in the endangered or vulnerable species' habitat	unlikely to introduce new invasive weed species that are not already present and established in habitat in the Study Area and wider landscape. Therefore, the Project is considered unlikely to result in invasive species that are harmful to the Ornamental Snake becoming established in preferred habitat for this species.
Introduce disease that may cause the species to decline, or	Introduce disease that may cause the population to decline; or	Disease is not a known threat to this species. Therefore, the Project is considered unlikely to introduce any disease that may cause the Ornamental Snake to decline.
Interfere substantially with the recovery of the species.	Interfere with the recovery of the species	A small amount of habitat is proposed to be cleared for the Project, i.e. 0.5ha. As outlined in the *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (SEWPaC 2011c), clearing of less than 1.0ha of important habitat is unlikely to have a significant impact, provided connectivity is not compromised. As previously described habitat will not be fragmented in the Study Area. Therefore, the Ornamental Snake population in the Study Area is expected to persist, particularly with the proposed weed management in this Brigalow habitat. Therefore, the Project is considered unlikely to interfere substantially with the recovery of the Ornamental Snake.
N/A	Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	The Ornamental Snake population and habitat in the Study Area is likely to be important. Direct impacts, i.e. clearing of 0.5ha of high value habitat, will be monitored to minimise disruption to breeding individuals. Maintenance of a 30m buffer around the remainder of Ornamental Snake habitat will be implemented to minimise indirect impacts such as noise and light effects. Although these are anticipated to minimal as discussed in Sections 7.2.7 and 7.2.8. Therefore, it is considered unlikely that significant disruption will occur to ecologically significant locations.
Conclusion: The Project is considered unlikely to result in a significant impact to the Ornamental Snake as a small amount of habitat is proposed to be impacted and potential indirect impacts are able to be managed.		

K6: Glossy Black-cockatoo (*Calyptorhynchus lathami*)

Description

The Glossy Black-cockatoo is a brownish-black cockatoo with a small crest. It is approximately 46-50cm long and generally smaller than other black-cockatoos. Males have bright red panels on a black tail and females have a wider tale with red to reddish-yellow patches barred with black and yellow on the head (DEH 2014).

Distribution

This species is distributed along the east coast of Australia from near Eungella in Queensland to Mallacoota in Victoria. An isolated population is also known from Kangaroo Island in South Australia (DEH 2014).

Habitat Preference

The Glossy Black-cockatoo occurs in eucalypt woodlands with an understorey or sub-canopy of She-oaks (species of the *Casuarina or Allocasuarina* genus) on the seeds of which its diet is based (Garnett et al. 2011). This species nests in hollows, typically in Eucalypt trees that can be alive or dead (Garnett and Crowley 2000).

Threats

Potential impacts of the Project to the Glossy Black-cockatoo, include:

- Disturbance and removal of potential feed trees
- Loss of tree hollows in which to nest
- Indirect impacts from adjacent infrastructure areas, including dust, noise and light impacts.

Table K8 provides a summary of impacts and an assessment against the *Queensland Residual Impact Guideline* (EHP 2014h) criteria.

Table K8: Significance Assessment for the Glossy Black-cockatoo

Occurrence within the Study Area
This species has been recorded at one location outside the Study Area as part of surveys in 2012 (Figure 16). A total of 244.0ha of potential high value habitat for the Glossy Back-cockatoo occurs in the Study Area in the form of remnant vegetation communities containing Casuarina and Allocasuarina species. This includes REs 11.3.25 and 11.3.25a fringing Hail and Middle Creeks and which contain River Oak (*Casuarina cunninghamiana*) and patches of remnant RE 11.9.5 in the south of the Study Area that contain Belah (*Casuarina cristata*). Some patches of substantial regrowth that represent RE 11.9.5 also in the south of the Study Area provide high value habitat (Figure 16). A total of 6,084.0ha of potential low value habitat for this species also occurs in the Study Area in the form of all remnant vegetation communities except REs 11.3.11, 11.3.27, 11.9.4 and 11.9.5 (Figure 16). The Study Area contains few stands of *Allocasuarina* or *Casuarina* trees, therefore, it is likely the Glossy Black-cockatoo occurs in the Study Area on rare occasions and is unlikely to breed in the Study Area.
An action is likely to have a significant impact on endangered and vulnerable wildlife if the impact on the habitat will:
a) Lead to a long-term decrease in the size of a local population; or

The Project is unlikely to impact directly on any Glossy Black-cockatoos as part of the construction and operation of the Project as an approved SMP will be implemented for all clearing activities, which includes pre-clearance surveys and the presence of spotter/catchers to minimise impacts to breeding places of significant species. More extensive habitat areas for this species are likely to occur adjacent the Study Area, particularly in the north-east of the Study Area and in Homevale National Park. It is estimated that at least 1,667ha of similar remnant habitat occurs within 5km of the Study Area based on remnant vegetation mapping for the region. Therefore, the Project is unlikely to lead to a long-term decrease in the size of the local population.

b) Reduce the area of occupancy of the species; or

Approximately 25.0ha of high value habitat and 3,864.5ha of low value habitat will be impacted by the Project through vegetation clearing for surface mining and infrastructure (Figure 29). An additional 9.5ha of high value and 24.0ha of low value is likely to be affected by subsidence ponding from underground mining, in the form of progressive, i.e. over 30 years, decline in condition and structure of vegetation within subsidence ponds. However, habitat proposed to be impacted is unlikely to provide important habitat as the presence of preferred feed trees in this habitat area are not abundant.

c) Fragment an existing population; or

The Project will not fragment the local population of Glossy Black-cockatoo as it is a highly mobile species and is likely to move throughout the landscape between preferred foraging areas, potentially including habitat in the Study Area. H

d) Reduce gene flow among populations; or

As no individuals of Glossy Black-cockatoo are proposed to be impacted and the species is highly mobile, the Project is considered unlikely to affect gene flow of the local population.

e) Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat; or

Pest species, including feral animals such as the *Fox and *Cat have been identified as part of recent field surveys throughout the Study Area. These predatory species already pose a risk to Glossy Black-cockatoo in the Study Area, and the Project is unlikely to increase this threat. Additionally, the Project is unlikely to introduce new weed species that are not already present and established in habitat in the Study Area and wider landscape as the Hail Creek Mine Weed and Pest Management Plan will be implemented for the Project.

f) Introduce disease that may cause the population to decline; or

Disease is not a known threat to this species. The Project is unlikely to introduce any disease that may cause the Glossy Black-cockatoo to decline.

g) Interfere with the recovery of the species; or

Habitat in the Study Area is unlikely to form important habitat for the Glossy Black-cockatoo in the landscape due to the relatively low number of feed trees present. A total of 34.5ha of high value habitat is proposed to be impacted and this is considered unlikely to interfere with the recovery of the species.

h) Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.

Due to the relatively small numbers of feed trees in the Study Area, it is unlikely the habitat forms ecologically significant habitat. Nonetheless, an approved SMP will be implemented for the Project, whereby, pre-clearance surveys will be undertaken and

spotter/catchers will be present to minimise impacts to potential breeding places and individuals.
Conclusion: The Glossy Black-cockatoo was not identified in the Study Area, but is known from the local area. Potential habitat occurs in the Study Area, however, due to the relatively low number of feed trees this habitat is unlikely to be ecological significant. Therefore, the Project is considered unlikely to result in a significant impact to the Glossy Black-cockatoo.

K7: Short-beaked Echidna (*Tachyglossus aculeatus*)

Description

The Short-beaked Echidna grows to 30-45cm in length and is covered in long spines with fur between spines. This is a solitary animal with no fixed nest sites. The male has a non-venomous spur on the ankle of its hindleg. Mating occurs in July and August. Young hatch from the egg within the patch approximately 24 days after copulation and remain in the pouch for a further three months. Juveniles start to become independent from September to November (VanDyck and Strahan 2008).

This species is listed as Special Least Concern under the NC Act.

Distribution

The Short-beaked Echidna has been recorded throughout Australia from arid regions to alpine snow covered areas. It occupies cleared habitats and remnant vegetation. However, the distribution of this species is sparse (VanDyck and Strahan 2008).

Habitat Preference

The Short-beaked Echidna has no particular habitat requirements, except supply of ants and termites on which it feeds (VanDyck and Strahan 2008). It seeks shelter under thick bushes, in hollow logs, under piles of debris and occasionally in burrows. This species generally forages at dawn and dusk.

In arid conditions this species avoids temperature extremes by sheltering in caves or crevices and is more active at night during cooler conditions (VanDyck and Strahan 2008).

Threats

The Short-beaked Echidna has few predators, sometimes dingoes/dogs. Potential impacts of the Project to the Echidna, include:

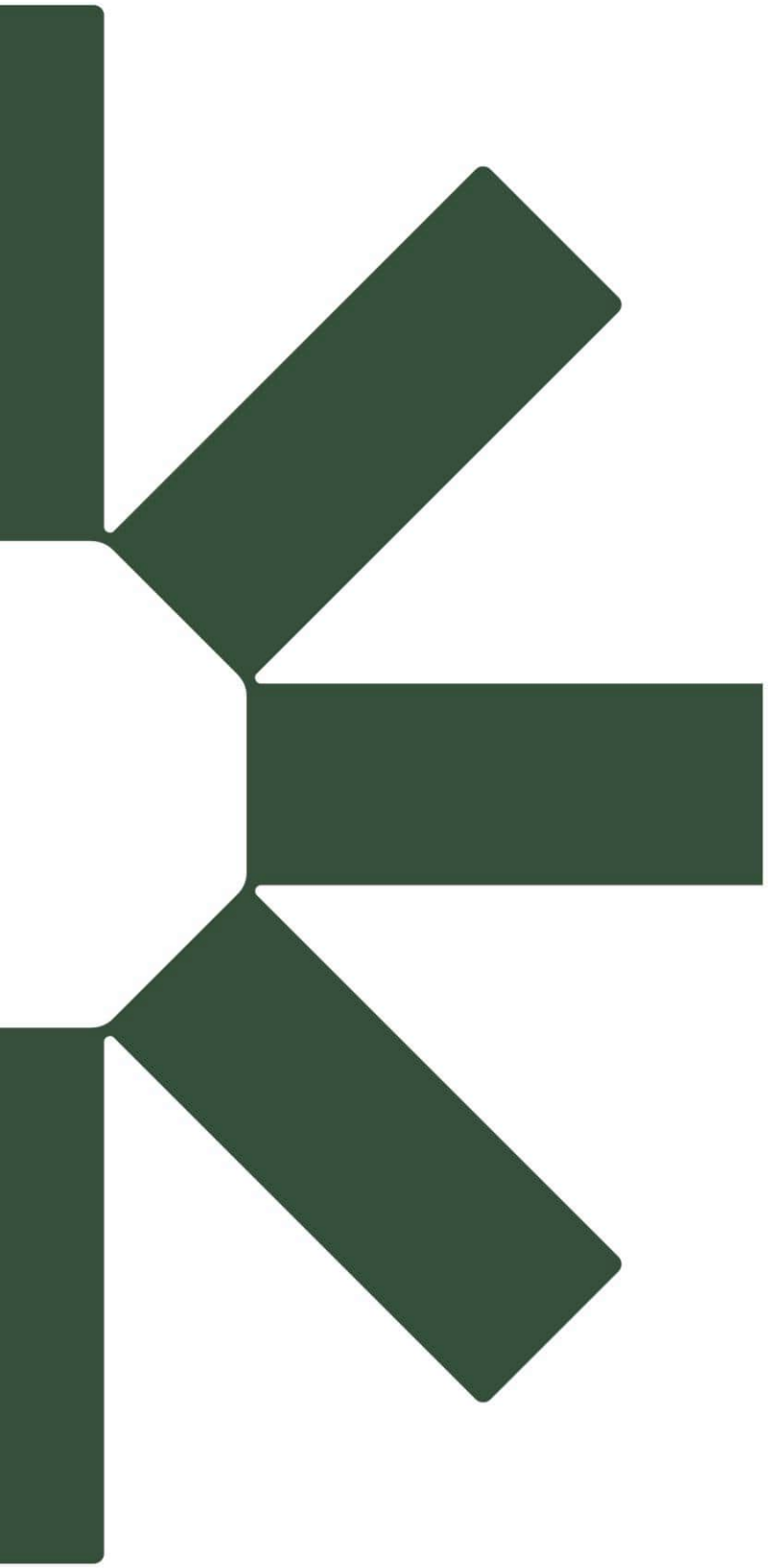
- Disturbance and removal of habitat
- Loss of food source
- Vehicle strike from haul and light vehicles.

Table K9 provides a summary of impacts and an assessment against the *Queensland Residual Impact Guideline* (EHP 2014h) criteria.

Table K9: Significance Assessment for the Short-beaked Echidna

Occurrence within the Study Area
The Short-beaked Echidna was identified in the Study Area at one supplementary site. All areas of the Study Area provide habitat for this species, including cleared areas, although vegetation areas are likely to be more important for this species in providing potential foraging and sheltering resources. Approximately 6,500.0ha of high value and 699.0ha of low value habitat for the Short-beaked Echidna occurs in the Study Area (Figure 16).
An action is likely to have a significant impact on a special least concern (non-migratory) animal wildlife habitat if it is likely that it will result in:

a) A long-term decrease in the size of a local population; or Approximately 3,945.5ha of high value and 364.0ha of low value habitat will be cleared as a result of the Project for surface mining and infrastructure (Figure 29). An additional 33.0ha of high value and 1.5ha of low value habitat is likely to be affected by subsidence ponding from underground mining, in the form of progressive, i.e. over 30 years, decline in condition and structure of vegetation within subsidence ponds. As Short-beaked Echidna habitat is widespread in the region and this species does not have particular habitat requirements, this clearing is unlikely to lead to a long-term decrease in the local population. It is estimated that at least 21,487ha of similar remnant habitat occurs within 5km of the Study Area based on remnant vegetation mapping for the region. Additionally, vegetation clearing will be monitored to minimise disruption to breeding individuals through implementation of an SMP, whereby, pre-clearance surveys will be undertaken prior to vegetation clearing and eggs and young will be relocated or transferred by a spotter/catcher to a wildlife carer and later released back into habitat in the Study Area.
b) A reduced area of occupancy of the species; or A total of 3,978.5ha of high value habitat and 365.5ha of low value habitat will be impacted by the Project (Figure 29). However, the local population of Short-beaked Echidna is considered likely to persist in the landscape as substantial habitat exists throughout the surrounding areas.
c) Fragmentation of an existing population; or Fragmentation of habitat along Hail Creek will occur as a result of clearing for infrastructure corridors. However, overall connectivity with habitat along Hail Creek, remnant areas in the north and south and habitats adjacent the Study Area will not be severed. This is a mobile species and therefore, the local population is unlikely to be permanently fragmented.
d) Reduced gene flow among populations; or As the local population is unlikely to be permanently fragmented, the gene flow among the local population is unlikely to be impacted.
e) Disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species. The Study Area is unlikely to form particularly important habitat for the Short-beaked Echidna in the landscape due to the widespread nature of the species and lack of preferred habitat features. An approved SMP will be implemented for the Project that includes pre-clearance surveys and use of a spotter/catcher during clearing activities to minimise the risk of impacts to nesting, foraging or resting species. Therefore, the Project is unlikely to significantly disrupt ecological significant locations of this species.
Conclusion: The entire Study Area forms habitat for this species and this habitat occurs extensively in the region. This species has no particular habitat requirements and habitat occurs extensively in the broader region. Therefore, the Project is considered unlikely to significantly impact the Short-beaked Echidna.



Making Sustainability Happen